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DIVISION 33 - UTILITIES

SECTION 33 52 43.11

AVIATION FUEL MECHANICAL EQUIPMENT

02/10

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USACE / NAVFAC / AFCEC / NASA **UFGS-33 52 43.11 (February 2010)**

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2014
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SECTION 33 52 43.11

AVIATION FUEL MECHANICAL EQUIPMENT
02/10

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

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

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

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR)**.**
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PART 1 GENERAL

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

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

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1615	(2011) Installation of Underground Petroleum Storage Systems

ASME INTERNATIONAL (ASME)

ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM C827/C827M	(2010) Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2012; Errata 2011; Errata 2011) Flammable and Combustible Liquids Code
NFPA 70	(2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3 2014) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant

STEEL TANK INSTITUTE (STI)

STI 010-50-1000	(2011) Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D) Paint, Epoxy-Polyamide, General Specification for
MIL-DTL-38219	(1998; Rev D) Turbine Fuel, Low Volatility, JP-7
MIL-DTL-5624	(2013; Rev V) Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-83133	(2011; Rev H; Am 2 2013) Turbine Fuels, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35 and JP-8 + 100 (NATO F-37)
MIL-DTL-83413	(2012; Rev C) Connectors and Assemblies, Electrical, Aircraft Grounding, General Specification for
MIL-DTL-83413/4	(2013; Rev D) Connectors and Assemblies, Electrical, Aircraft Grounding: Plugs, for Types I and II Grounding Assemblies
MIL-DTL-83413/7	(2012; Rev E; Am 1 2013; Am 2 2014) Connectors and Assemblies, Electrical, Aircraft Grounding Clamp Connector for Types I and III Grounding Assemblies, Clip, Electrical
MIL-PRF-370	(2002; Rev J) Hose And Hose Assemblies, Nonmetallic: Elastomeric, Liquid Fuel
MIL-PRF-4556	(1998; Rev F; Am 1 1999; CANC Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-STD-130	(2007; Rev N; Change 1 2012) Identification Marking of U.S. Military Property
MIL-STD-161	(2005; Rev G; Notice 1 2010) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50696	(Basic) Reels, Static Discharge, Grounding, 50 and 75 Foot Cable Lengths

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 280	Technical Standards and Corrective Action

	Requirements for Owners and Operators of Underground Storage Tanks (UST)

UNDERWRITERS LABORATORIES (UL)

UL 142	(2006; Reprint Jul 2013) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 58	(1996; Reprint Jul 1998) Steel Underground Tanks for Flammable and Combustible Liquids

1.2 ADMINISTRATIVE REQUIREMENTS

Submit detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems. Provide the drawings as one package with the design analysis. Shop fabrication drawings shall include type of material, configuration, thickness, and necessary details of construction of the steel tank and vault. Shop drawings shall also show the steel grating and supports. Submit Manufacturer's Catalog Data and Certificates of Compliance. Operation and maintenance information shall be submitted for the equipment items or systems listed in PART 2. Automatic pump controls shall include step-by-step procedures required for system startup, operation, and shutdown. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted for various types of equipment and systems.

1.3 SUBMITTALS

****

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

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

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force

and NASA projects, or choose the second bracketed item for Army projects.

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

SD-02 Shop Drawings

Meters[; G][; G, [_____]]
Venturi Tubes[; G][; G, [_____]]
Water Draw-off System[; G][; G, [_____]]
Truck Offload System[; G][; G, [_____]]
Operating Tank Vent[; G][; G, [_____]]
Hydrant Outlet Pits and Isolation Valve Pits[; G][; G, [_____]]
High Point Vent and Low Point Drain Pits[; G][; G, [_____]]
Product Recovery Tank and Accessories[; G][; G, [_____]]
Day Tank[; G][; G, [_____]]
Bowser Pumpoff Pump[; G][; G, [_____]]
Truck Fillstand Overfill Protection and Ground Verification Unit[; G][; G, [_____]]
Tightness Monitoring System[; G][; G, [_____]]

SD-03 Product Data

Pressure Gages[; G][; G, [_____]]
Automatic Pump Controls[; G][; G, [_____]]
Meters[; G][; G, [_____]].
Product Recovery Tank and Accessories[; G][; G, [_____]]
Day Tank[; G][; G, [_____]]
Truck Offload System[; G][; G, [_____]].
Operating Tank Vent[; G][; G, [_____]].
Hydrant Outlet Pits and Isolation Valve Pits[; G][; G, [_____]]
High Point Vent and Low Point Drain Pits[; G][; G, [_____]]
Operating Tank Level Indicator[; G][; G, [_____]]
Operating Tank Level Switches[; G][; G, [_____]]
Water Draw-Off System[; G][; G, [_____]]
Venturi Tubes[; G][; G, [_____]].
Bowser Pumpoff Pump[; G][; G, [_____]]
Truck Fillstand Overfill Protection and Ground Verification Unit[; G][; G, [_____]]
Tightness Monitoring System[; G][; G, [_____]]

SD-06 Test Reports

Leak Detection Monitor[; G][; G, [_____]]
Tightness Monitoring System[; G][; G, [_____]]
Coating Testing[; G][; G, [_____]]

SD-07 Certificates

System Supplier[; G][; G, [_____]]
Tightness Monitoring System[; G][; G, [_____]]

SD-10 Operation and Maintenance Data

Automatic Pump Controls[; G][; G, [_____]]
Product Recovery Tank and Accessories[; G][; G, [_____]]
Day Tank[; G][; G, [_____]]
Truck Offload System[; G][; G, [_____]]
Operating Tank Vent[; G][; G, [_____]].
Operating Tank Level Indicator[; G][; G, [_____]]
Water Draw-off System[; G][; G, [_____]].
Truck Fillstand Overfill Protection and Ground Verification Unit[; G][; G, [_____]]
Tightness Monitoring System[; G][; G, [_____]]

1.4 QUALITY ASSURANCE

Submit the following data for approval:

a. Certification stating that the system supplier has provided and installed at least five PLC-based pump control systems in the last five years, for automatic cycling of pumps based upon varying dispensing demands, utilizing multiple pumps. These systems shall be for dispensing jet fuel.

b. Certification that six systems have been successfully operated over the last three years and are currently in service.

c. Project names, locations, system description, and items provided at these installations. Include user point-of-contact and current telephone numbers.

PART 2 PRODUCTS

2.1 MATERIALS

Materials of construction shall be stainless steel, aluminum or nonferrous material except meter case may be steel with electrolyses nickel plated internals coated to 0.075 mm 3 mil thickness. No ferrous or zinc-coated material bronze, brass or other copper bearing alloys shall be used in contact with the fuel.

2.1.1 Types of Fuel

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NOTE: Select type of fuel and insert expected temperature extremes.
****

Components shall be suitable for use with [JP-4 turbine fuel; specific gravity 0.76 at 16 degrees C 60 degrees F; viscosity 0.92 CS at 16 degrees C 60 degrees F; Reid vapor pressure 14 to 21 kPa 2 to 3 psi, MIL-DTL-5624] [JP-5 turbine fuel; specific gravity 0.82 at 16 degrees C 60 degrees F; viscosity 1.62 CS at 16 degrees C 60 degrees F; Reid Vapor pressure less than 0.35 kPa 0.05 psi, MIL-DTL-5624] [JP-7 turbine fuel; specific gravity 0.79 at 16 degrees C 60 degrees F; viscosity 1.95 CS at16 degrees C 60 degrees F; Reid vapor pressure less than 0.35 kPa 0.05 psi, MIL-DTL-38219] [JP-8 turbine fuel; specific gravity 0.81 at 16 degrees C 60 degrees F; viscosity 1.62 CS at 16 degrees C 60 degrees F; Reid vapor pressure less than 0.35 kPa 0.05 psi, MIL-DTL-83133]. Components to be ANSI Class 150 (1920 kPa at 38 degrees C 275 PSIG at 100 degrees F.) unless noted otherwise. Components to be suitable for outside, unsheltered location,

and to function normally in ambient temperatures between [_____] degrees C F and [_____] degrees C F.

2.1.2 Composition of Materials

Materials in contact with the fuel shall be noncorrosive. No zinc-coated metals, brass, bronze, iron, lead or lead alloys, copper or copper alloys, or other light metal alloys containing more than 4 percent copper shall be used in contact with the fuel.

2.1.3 Gaskets

Gaskets shall be in accordance with Section 33 52 43.13 AVIATION FUELING PIPING.

2.1.4 Bolts and Nuts

Bolts and nuts shall be in accordance with Section 33 52 43.13 AVIATION FUELING PIPING.

2.2 EQUIPMENT AND MATERIAL

2.2.1 General

All items of equipment and material shall be new and of the best quality used for the purpose in commercial practice and shall be products of reputable manufacturers. Each major component of equipment shall have the manufacturer's name, address and catalog number on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable. The gears, couplings, projecting set screws, keys and other rotating parts located so that any person may come in close proximity thereto shall be fully enclosed or properly guarded. Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130 and MIL-STD-161. Pump and filter vessel numbers shall be as indicated on the drawings. In addition, filter vessels shall include element numbers and the date of the next element change. Identification tags made of brass, stainless steel, or engraved anodized aluminum, indicating valve number and normally open (NO) or normally closed (NC) shall be installed on valves. Tags shall be 35 mm 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No 12 AWG, copper wire, stainless or aluminum hanging wires, or chrome-plated beaded chain designed for that purpose.

2.2.2 Supplier

Since the pump control system, including but not limited to pump control panel, venturi tubes, transmitters, flow switches, fueling system pumps, all field instrumentation, tightness monitoring system, and control valves with all hardware and software, is an integrated system it shall be furnished by a single systems supplier regularly engaged in the supplying of this equipment. System Supplier shall be a company whose regular, normal, and primary business is representing manufacturers in the distribution and start-up of aviation fueling facilities, and have no affiliation with the Contractor other than as a seller to the Contractor. Supplier shall provide all equipment and appurtenances regardless of manufacture, be a factory authorized certified representative, and be responsible to the Contractor for satisfactory operation of the entire system, and shall oversee the installation of the equipment. Substitutions

of functions specified will not be acceptable. The Contractor and the System Supplier shall be present at the system commissioning, and shall coordinate and schedule the work during construction, testing, calibration, and acceptance of the system. The System Supplier shall be responsible to the Contractor for scheduling all Contractor, Sub-contractor, and manufacturer's service personnel during system start-up and final commissioning.

2.3 ELECTRICAL EQUIPMENT

Motors, manual or automatic motor control equipment except where installed in motor control centers, and protective or signal devices required for the operation specified herein shall be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.4 PRESSURE GAGES

Pressure gages shall conform to ASME B40.100 with metal cases and 100 mm 4-inch diameter white dials. Gages shall be bottom connected, without back flanges. A pulsation dampener, adjustable to the degree of dampening required, shall be provided for each gage. Range of gages shall be as indicated. A ball valve shall be provided for each pressure gage. Gages shall have all parts immersed in silicone oil. Gages shall be labeled with the calibration date.

2.5 AUTOMATIC PUMP CONTROLS

The pressure and flow transmitters specified in this paragraph shall be obtained from a single supplier of such products. The same supplier shall also furnish the associated venturi tubes and GPM meter. The supplier shall be responsible for furnishing components that are compatible and that operate as a system to perform the required pump control functions. Control tubing between controls/instruments and fuel lines shall be installed to eliminate air entrapment. Control tubing shall be as specified in Section 33 52 43.13 AVIATION FUELING PIPING. Each item of equipment specified hereafter shall have manufacturer's authorized service personnel present to assist in PERFORMANCE TESTING as specified in Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START-UP. Items specified under this paragraph shall be submitted for approval concurrently with items specified in Section 33 09 53 AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM.

2.5.1 Pressure Indicating Transmitters

Pressure indicating transmitters shall consist of a capacitance sensor operating on a differential in pressure of fuel (one side being open to atmospheric pressure). The output shall be a 4 - 20 mA dc, linear signal between 0 - 100 percent of the input. It simultaneously will produce a digital HART (Highway Addressable Remote Transducer) output signal. Loop power shall be provided from remote power supply located in the pump control panel (PCP).

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 13 mm 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be $\pm$ 0.20 percent of calibrated span including combined effects of linearity,

hysteresis and repeatability.

[b. One pressure indicating dial shall be supplied with each pair of transmitters. Pressure indicating dials shall consist of a bellows type pressure sensing element operating on a differential in pressure of fuel (one side being open to atmospheric pressure) and a mechanical indicator (driven by the bellows unit). The bellows shall be dual opposed, liquid filled, rupture-proof type with bellows movement converted to rotation and transmitted by a torque tube. Bellows housing shall be stainless steel and shall have a rated working pressure of not less than 3.MPa 500 psi with a minimum differential pressure range of 0 to 1.5 MPa 0 to 250 psi. Liquid used to fill the bellows shall be suitable for the expected minimum ambient temperature. The indicating dial shall be at least 150 mm 6 inches in diameter with a weatherproof glass cover. The case shall be finished with a weather resistant epoxy resin enamel. The indicating pointer shall traverse a 270 degrees arc. The scales shall be graduated over the selected pressure ranges so that the pressure can be read in kPa psig. Indicator accuracy shall be 0.75 percent of full scale. Pressure indicating dial shall be provided with suitable over-range protection.]

[c. Display at the pressure transmitter shall be LCD, one per each transmitter. The digital scale shall be a 4 digit LCD capable of being read in low light/no light conditions. Indicator scale shall be in kPa psig.]

****

NOTE: Select type of display per directions from COMMAND FUELS FACILITY Engineer.

****

d. Pressure transmitters shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (216 degrees C 419 degrees F). Each transmitter and dial shall be supplied with a factory assembled two valve stainless steel manifold. Vent valves shall be furnished on upper ports of each transmitter and dial. Pressure transmitters and the indicating dial shall be suitable for mounting on a 50 mm 2-inch pipe stand. Complete installation shall be in accordance with manufacturer's recommendations.

e. Provide a HART (Highway Addressable Remote Transducer) protocol interface handheld calibration device. Communicator to be intrinsically safe and have Class 1, Div 1, Group C and D approval. Device to include NIST traceable modules, one 0 to 3.5 MPa 0-500 psig range, one 0-2000 wc, and also one protection module for open sensor bay. Unit shall be furnished in hard carrying case and to include 250 ohm shunt for HART communicator, A900 HART test lead kit, 1 MPa 145 psig pressure pump with variator, low pressure fittings and tubing kit. Hand-held pump capable of producing a minimum of 2 MPa 300 psig pressure.

2.5.2 Flow Switches

Switches shall be actuating vane type flow switch with single adjustable set-point. Switches shall mount on ASME B16.5 Class 150 raised face flange. Flange material shall match the piping material at their connection to the system. Provide snap action switch mechanism U.L. listed

for Class I, Division 1, Group D hazardous locations. Switches to be double pole double throw (DPDT). Switch power shall be 120 volts, single phase, 60 hertz, 10 amps minimum.

2.5.3 Venturi Tubes

a. The venturi tubes shall be provided in conjunction with Section 33 09 53 AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM.

b. Start-up, adjustments and calibration, and instruction of personnel in the operation and maintenance of the venturi tubes shall be considered as a required portion of the controls package.

****
NOTE: Select type of Fuel.
****

c. The venturi tubes shall be low loss differential pressure producers consisting of a short housing piece and a fully machined, contoured throat section providing a restriction at the center, with both inlet approach and exit having geometrically symmetrical curves. They shall be velocity head, impact, differential producing devices designed to measure differential pressure of [JP-4] [JP-5] [JP-7] [JP-8] fuel. They shall be constructed of 304L stainless steel with ANSI Class 150 flanges on each end and be suitable for operation of 2 MPa 275 psig at 212 degrees C 100 degrees F. They shall be of sufficient thickness to with-stand the same stresses as the upstream and downstream piping. Each venturi tube shall have a minimum of four 13 mm 1/2-inch connections. An individual head-capacity curve shall be furnished for each venturi tube.

d. Operating conditions for the venturi tubes shall be as follows:

****
NOTE: Select based on System and PUMP capacity.
****

(1) Issue Venturi Tube. Minimum inlet-to-throat differential pressure at [144] [_____] L/s: 8 mm [2,400] [_____] gpm: 200 in H2O.

(2) Return Venturi Tube. Minimum inlet-to-throat differential pressure at [36] [_____] L/s: 8 mm [600] [_____] gpm: 200 in H2O.

(3) Venturi tubes discharge coefficient "C" to be greater than or equal to 0.97 over pipe Reynolds number range between 200,000 and 1,000,000 and shall be independent of Beta over a Beta range of 0.4 to 0.75. Pressure loss shall be less than 24 percent of differential pressure generated by the venturi tube. Repeatability of the discharge coefficient "C" shall be 2 percent for Reynolds number range of 10,000 to 1,000,000.

(4) Provide two portable GPM Meters, one for each size of venturi. The meters shall be complete with valves, hoses and connecting disconnects, and carrying case. The meters shall have stainless steel bellows, mounting bracket, 3.5 MPa 500 psi swp, 150 mm6-inch dial with 270 degrees arc. Dial shall read GPM Jet Fuel. Range of scale shall match the flow transmitter for issue and return. The venturi manufacturer shall provide the portable meters with

the venturi in order to be compatible. The venturi tubes shall also be provided with a suitable table to convert inches differential pressure to L gallons per minute.

2.5.4 Differential Pressure Transmitter

Differential pressure transmitter shall consist of a capacitance sensor operating on a differential in pressure of fuel. The output shall be a 4 - 20mA dc, square root signal between a minimum of 4 - 100 percent of the input. It may be linear between 0 - 4 percent. It simultaneously will produce a digital HART (Highway Addressable Remote Transducer) output signal. Loop power shall be provided from remote power supply located in the pump control panel (PCP).

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 13 mm 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be ± 0.20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

[b. One differential pressure dial shall be supplied with each pair of transmitters. Differential pressure dial shall consist of a bellows type pressure sensing element, operating on a differential in pressure of fuel, and a mechanical indicator, driven by the bellows unit. The bellows shall be dual opposed, liquid filled, rupture-proof type with bellows movement converted to rotation and transmitted by a torque tube. Displacement of bellows shall be 24,000 cubic mm 1.5 cubic inches for full scale travel. Bellows housing shall be stainless steel and shall have a rated working pressure of not less than 3.5 MPa 500 psi. Liquid used to fill the bellows shall be suitable for the expected minimum ambient temperature. The indicating dial shall be at least 150 mm 6 inches in diameter with a weatherproof glass cover. The case shall be finished with a weather resistant epoxy resin enamel. The indicating pointer shall traverse a 270 degree arc. The scales shall be graduated over the selected pressure ranges so that the flow rate can be accurately read in L gallons per minute. Indicator accuracy shall be 0.5 percent of full scale. Differential pressure indicating dial shall be provided with built-in pulsation damper and suitable over-range protection.]

****

NOTE: Select type of display per directions from COMMAND FUELS FACILITY Engineer.

****

[c. Display at the transmitter shall be LCD, one per each differential pressure transmitter. The digital scale shall be a 4 digit LCD, capable of being read in low light/no light conditions. Indicator scale shall be in L gallons per minute.]

****

NOTE: Select based on System and Pump capacity. Systems greater than 2400 gpm require issue Venturi Tube to have low range (0-1500 gpm) and high range (0- maximum system flow in gpm) transmitters versus one single full range transmitter.

****

d. Each venturi tube shall have two transmitters and one indicating dial

per function and shall be installed as indicated on the drawings. Differential pressure ranges shall be selected as necessary to operate in conjunction with associated venturi tube:

(1) Issue Venturi Tube - 0 to [144] [_____] L/s0 to [2400] [_____] GPM (full range)

(2) Return Venturi Tube - 0 to [36] [_____] L/s0 to [800] [_____] GPM (full range)

[e. Differential pressure transmitters shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (215 degrees C 419 degrees F). Each transmitter and indicating dial shall be supplied with a factory assembled five valve stainless steel manifold. Vent valves shall be furnished on upper ports of each transmitter and indicating dial. Differential pressure transmitters and the indicating dial shall be suitable for mounting on a 50 mm 2-inch pipe stand. Complete installation shall be in accordance with manufacturer's recommendations.]

2.5.5 Pressure Sensor

Sensor shall be UL, FM, or CSA listed for Class 1, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating T2D (215 degrees C 419 degrees F). Excitation voltage shall be 12-28 VDC. Output signal shall be 4-20 mA. Unit shall have 0.25 percent accuracy and have built-in high pressure snubbers, minimum pressure range shall be 0-2.1 MPa 0-300 PSI. Wetted material shall be stainless steel.

2.6 METERS

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NOTE: Select type of fuel.
****

Meter shall be a one-way flow, temperature compensating, positive displacement type meter designed for a continuous flow of 36 L/s 600 GPM at the truck fill stand. Meter shall have ANSI Class 150 flanges and body working pressure of not less than 2 MPa 275 psig and shall be suitable for hydrostatic testing of 2 MPa 275 psig. Meter shall be factory calibrated for [JP-4] [JP-5] [JP-7] [JP-8] jet fuel and capable of being calibrated in the field. The register shall have a non-setback total indicator and a setback type run indicator so that individual runs can be registered without affecting the total of all runs as shown on the indicator. The total indicator shall have a minimum of eight figures and the setback run indicator shall have a minimum of five figures. The register shall read in gallons and the smallest unit of indicated delivery shall be 4 L 1 gallon. Accuracy shall be within +0.3 percent between ten percent and maximum rated flow. Meters shall be provided with a suitable drain at the bottom, equipped with a ball valve. Pressure loss through the meter shall not exceed 20 kPa 3 psi at 36 L/s 600 gpm flow rate.

[2.7 RECEIPT FLOW METER

****
NOTE: Select per COMMAND FUELS FACILITY Engineer direction.

****

Flow meter shall consist of corner tapped orifice flanges, orifice flange plate, differential pressure transducer and flow computer capable of square root extraction for calculating flow rate in gpm. The normal flow range for flow meter is 0-36 L/s 0 to 600 gpm. Orificee flanges shall be ANSI Class 150 and shall be constructed of Type 304 or 304L stainless steel. Beta value shall be 0.70. Maximum pressure loss shall be 20 kPa 3 psi at 36 L/s 600 gpm. Differential pressure transducer shall have a calibrated range of 0-7.5 m 0-300 inch w.c. with a 4-20mA output. Accuracy shall be 0.25 percent of the calibrated range or better. Flow computer shall calculate flow in L/s gpm, from the differential pressure transducer output. Flow computer and pressure transducer shall be located in the pump room and shall be suitable for the installation in Class 1, Division 1, Group D hazardous locations. Flow computer shall have a digital display giving a local readout in L/s gpm, minimum four figures, with a 4-20 mA output to the process control system.

]2.8 PRODUCT RECOVERY TANK AND ACCESSORIES

****

NOTE: Use fiberglass TANK if directed by COMMAND FUELS FACILITY Engineer, reference Section 33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS.

****

2.8.1 Tank Construction

Product recovery tank shall be a U.L. labeled, double wall, steel tank, with interstitial monitor. Tank shall be provided with calibrated gage stick, strapping chart, and a steel vault attached to tank. Vault shall be provided with a rolling pit cover and removable access grating. Minimum inner and outer tank wall thickness shall be 4 mm 0.167 inches.

2.8.1.1 Steel Tank With Vault

a. The design, fabrication, erection, testing, and inspection of the double wall tank shall conform to the requirements of UL 58, Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, Type II. The exterior tank walls shall be separated from the interior walls by standoffs.

b. Material shall be carbon steel plate.

c. Lifting lugs shall be located at the balance points.

d. Provide anchor straps to attach tank to hold down slab. Straps shall be separated from the tank by a pad made of inert insulating material. Number and location of straps shall be as indicated on the drawings. Metal straps, turnbuckles, and anchors shall be coated to resist corrosion.

e. Tank capacity, connections and appurtenance shall be as shown on the drawings and as described under "Monitor."

f. Provide a complete system of cathodic protection for the tank and vault in accordance with Section [26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES].

g. The interior and exterior surfaces of tank and vault shall be coated for corrosion protection. The interior surface shall be coated in accordance with MIL-DTL-24441, Formulas 150, 151, and 152. The exterior surface shall be coated in accordance with STI 010-50-1000 and the tank shall bear the STI 010-50-1000 label.

2.8.1.2 Leak Detection Monitor

a. Provide an annular space between the primary and secondary shells to allow for the free flow and containment of all leaked product from the primary tank.

b. Provide the tank with a leak monitoring system capable of sensing leaks in the secondary containment space and in the vault. The system shall detect a leak of fuel through the inner shell to the area between the inner and outer shells or a leak of ground water through the outer shell into the area between the inner and outer shells. The detector and any equipment in the area of the fuel tanks and valve pits shall be explosion proof. The system shall be a continuous surveillance type. The sensor shall be electronic or hydraulic type and shall be connected to a remote panel. Totally flooded containment space reservoir system shall not be permitted. The panel shall provide an audible and visible alarm if a leak is detected and shall indicate if the leak is fuel or water. The alarm shall be manually reset at the panel. Use an inert gas that is heavier than air in containment space of the tanks to prevent the forming of condensation. The tank monitoring system shall be compatible with the tank furnished and shall be as recommended by the tank manufacturer. Provide instructions and equipment required for calibration of the monitoring system and calibration maintenance schedule. Access shall be provided to the tank sensor for testing and maintenance. The control panel shall be located where shown on the plans. Remote alarm shall be provided at the pump control panel(PCP), see Section 33 09 55 AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (CUT-N-COVER TANKS). This control panel shall have a sign located adjacent to it indicating that the alarm indicates a leak in the fuel tank or the vault. Provide system operating instructions inside of the control panel.

c. Monitoring shall be continuous and shall be remotely indicated. The control console shall generate a visual and audible alarm and shall provide one DPDT contact closure on alarm for remote alarm annunciation.

2.8.1.3 Tank Appurtenances and Fittings

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NOTE: Provide devices in accordance with the recommendation of NFPA 30, Federal, State and Local Codes as applicable in this and following paragraphs.

****

Provide tank appurtenances and fittings as indicated. Nozzles for appurtenances and steel vault shall be as indicated or per manufacturer's recommendations and installed plumb with all above grade flange faces level. Gravity fill line shall be provided with locking cap. The flange on the Fuel Transfer Pump pumpway shall be an ASME Class 150 flange.

2.8.1.4 Tank Vents

Tank vents shall be standard weight steel pipe with malleable iron fittings. Vent outlets shall be equipped with [flame arresters] [pressure-vacuum vents] [flame arresters and pressure-vacuum vents] [flare stacks].

2.8.1.5 Manway

A 914 mm 36-inch round manway shall have U.L. listed gasket with bolted cover. A fiberglass or stainless steel ladder shall be provided inside the tank at the manway.

2.8.1.6 Sampling and Gauging hatch

A sampling and gauging hatch shall be provided and shall consist of a foot-operated, hinged cover with a flexible sealing ring and provision for padlocking. The hatch shall be non-sparking and shall have a flanged connection for installation on 100 mm 4-inch steel pipe. Provide a datum plate beneath gauge opening, and stencil reference height on gauge/sampling hatch piping.

2.8.1.7 Liquid-level Indicator

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NOTE: Per COMMAND FUELS FACILITY Engineer.
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Liquid-level indicator shall be the mechanically or electronically actuated type that can continuously monitor a tank's usable liquid level storage capacity. The system shall provide a digital readout of a tank's liquid level in terms of mm inches and liters gallons. The system shall be accurate to plus or minus 2 mm 1/16 inch. The system shall measure water accumulation in mm inches from 19 to 125 mm 3/4 to 5 inches off the bottom of a storage tank. Construct system components to be chemically compatible with the fuel to be handled. For each tank monitored, provide a sending unit that transmits the digital readout from a tank to the same electronic monitoring/alarm panel used for the leak detection system. Panel shall be a standard industrial enclosure. Panel doors shall swing left or right. The panel shall display the digital readout of each monitored tank on an LCD mounted exterior to the panel. The panel shall also have external controls to allow operators to toggle between information on the LCD without having to open the panel. Unit shall be Veeder-Root ATG TLS, or Government approved equal and compatable with the Base Fuels Automated System (FAS).

2.8.1.8 Float Switch Assembly

The float switch assembly shall be the top mounted, float operated type with vertical float rod. The switch assembly shall be suitable for flange mounting and float and trim shall be stainless steel. The switch shall be magnetically latching reed or actuated mercury switch suitable for operation on 120 volt, 60 hertz AC power. Rating of the switch contacts shall be adequate for the indicated functions shown on the drawings. This float switch assembly shall be used to start and stop the Fuel Transfer Pump and to indicate a high level and activate an alarm in the PCP.

2.8.1.9 Fuel Transfer Pump (FTP-1)

Refer to Section 33 52 43.23 AVIATION FUEL PUMPS

2.8.1.10 Electric Pump

The electric pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 20 L 5 gal per minute with a differential head of [_____] m feet. The pump and motor shall be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for available electric service, shall be totally enclosed, fan cooled, TEFC, and shall conform to the requirements specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Pump shall be provided with stainless suction screen, foot valve, stainless steel pipe, and aluminum 13 mm 1-1/2-inch cam type quick disconnect with dust cap.

2.8.1.11 Lockable Cap

Provide a lockable cap for the 50 mm 2-inch gravity fill line.

2.8.1.12 Spill Containment Basin

Container shall be constructed of fiberglass reinforced plastic, be compatible with the type of fuel being handled, have a minimum 14 L 3 gal fuel storage capacity, and form a water-tight seal around the fuel piping to prevent spilled fuel from entering the soil. Container shall be provided with a drain and have an easily removable cover constructed of either cast aluminum or cast iron. Covers shall be weather-resistant and shall prevent the influx of water.

2.8.1.13 Overfill Valve (OV-1)

Refer to Section 33 52 43.14 AVIATION FUEL CONTROL VALVES

2.8.1.14 Tank Calibration

Provide a certified tank calibration chart in 2 mm increments reading in L gal. Tank certification shall be done onsite and stamped by a P.E.

[2.9 FUEL SYSTEM WASTE WATER TANK AND ACCESSORIES

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NOTE: Use fiberglass tank if directed by COMMAND FUELS FACILITY Engineer, reference Section 33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS. Use a fuel system waste water tank when designing a cut and cover system if directed by COMMAND FUELS FACILITY Engineer.

****

2.9.1 Tank Construction

Waste water tank shall be a U.L. labeled, double wall, steel tank, with interstitial monitor. Tank shall be provided with calibrated gage stick, strapping chart and a steel vault attached to tank. Vault shall be provided with a rolling pit cover and removable access grating. Minimum

inner and outer tank wall thickness shall be 4 mm 0.167 inches.

2.9.1.1 Steel Tank With Vault

a. The design, fabrication, erection, testing, and inspection of the double wall tank shall conform to the requirements of UL 58, Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, Type II. The exterior tank walls shall be separated from the interior walls by standoffs.

b. Material shall be carbon steel plate.

c. Lifting lugs shall be located at the balance points.

d. Provide anchor straps to attach tank to hold down slab. Straps shall be separated from the tank by a pad made of inert insulating material. Number and location of straps shall be as indicated on the drawings. Metal straps, turnbuckles, and anchors shall be coated to resist corrosion.

e. Tank capacity, connections and appurtenance shall be as shown on the drawings and as described under "Monitor."

f. A complete system of cathodic protection shall be provided for the tank and vault in accordance with Section [26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES].

g. The interior and exterior surfaces of tank and vault shall be coated for corrosion protection. The interior surface shall be coated in accordance with MIL-DTL-24441, Formulas 150, 151, and 152. The exterior surface shall be coated in accordance with STI 010-50-1000 and the tank shall bear the STI 010-50-1000 label.

2.9.1.2 Leak Detection Monitor

a. Provide an annular space between the primary and secondary shells to allow for the free flow and containment of all leaked product from the primary tank.

b. Provide the tank with a leak monitoring system capable of sensing leaks in the secondary containment space and in the vault. The system shall detect a leak of fuel through the inner shell to the area between the inner and outer shells or a leak of ground water through the outer shell into the area between the inner and outer shells. The detector and any equipment in the area of the fuel tanks and valve pits shall be explosion proof. The system shall be a continuous surveillance type. The sensor shall be electronic or hydraulic type and shall be connected to a remote panel. Totally flooded containment space reservoir system will not be permitted. The panel shall provide an audible and visible alarm if a leak is detected and shall indicate if the leak is fuel or water. The alarm shall be manually reset at the panel. Use an inert gas that is heavier than air in containment space of the tanks to prevent the forming of condensation. The tank monitoring system shall be compatible with the tank furnished and shall be as recommended by the tank manufacturer. Submit instructions and equipment required for calibration of the monitoring system, calibration maintenance schedule and access to the tank sensor for testing and maintenance. Locate the control panel where shown on the plans. Remote alarm shall be provided

at the pump control panel (PCP), see Section 33 09 55 AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (CUT-N-COVER TANKS). This control panel shall have a sign located adjacent to it indicating that the alarm indicates a leak in the fuel system waste water tank or the vault. Provide system operating instructions inside of the control panel.

c. Monitoring shall be continuous and shall be remotely indicated. The control console shall generate a visual and audible alarm and shall provide one DPDT contact closure on alarm for remote alarm annunciation.

2.9.1.3 Tank Appurtenances and Fittings

****
NOTE: Provide devices in accordance with the recommendation of NFPA 30, Federal, State and Local Codes as applicable in this and following paragraphs.
****

Provide tank appurtenances and fittings as indicated. Nozzles for appurtenances and steel vault shall be as indicated or per manufacturer's recommendations and installed plumb with all above grade flange faces level.

2.9.1.4 Tank Vents

Tank vents shall be standard weight steel pipe with malleable iron fittings. Vent outlets shall be equipped with pressure-vacuum vents.

2.9.1.5 Manway

A 914 mm 36-inch round manway shall have U.L. listed gasket with bolted cover. A fiberglass or stainless steel ladder shall be provided inside the tank at the manway.

2.9.1.6 Sampling and Gauging hatch

Provide a sampling and gauging hatch consisting of a foot-operated, hinged cover with a flexible sealing ring and provision for padlocking. The hatch shall be non-sparking and shall have a flanged connection for installation on 100 mm 4-inch steel pipe. Provide a datum plate beneath gauge opening, and stencil reference height on gauge/sampling hatch piping.

2.9.1.7 Float Switch Assembly

The float switch assembly shall be the top mounted, float operated type with vertical float rod. The switch assembly shall be suitable for flange mounting and float and trim shall be stainless steel. The switch shall be magnetically latching reed or actuated mercury switch suitable for operation on 120 volt, 60 hertz AC power. Rating of the switch contacts shall be adequate for the indicated functions shown on the drawings. This float switch assembly shall be used to start and stop the Fuel Transfer Pump and to indicate a high level and activate an alarm in the PCP.

2.9.1.8 Electric Pump

The electric pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 200 L 50 gal per minute with a differential head of 8.7 m 57 feet. The pump and motor shall

be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, be of a type approved by the manufacturer of the pump, be suitable for available electric service, be totally enclosed, fan cooled, TEFC, and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Pump shall be provided with stainless suction screen, stainless steel pipe, and aluminum 50 mm 2-inch cam type quick disconnect with dust cap.

2.9.1.9 Overfill Valve (OV-1)

Refer to Section 33 52 43.14 AVIATION FUEL CONTROL VALVES.

2.9.1.10 Tank Calibration

Provide a certified tank calibration chart in 2 mm 1/16 inch increments reading in L gal. Tank certification shall be done onsite and stamped by a P.E.

]2.10 TRUCK OFFLOAD SYSTEM

The truck offload system shall be a factory fabricated and skid mounted unit.

2.10.1 Offload Pump (OP)

Refer to Section 33 52 43.23 AVIATION FUEL PUMPS

2.10.2 Air Eliminator Tank

2.10.2.1 Tank Housing

Each Tank housing shall be fabricated from carbon steel and shall be internally coated with an epoxy coating in accordance with MIL-PRF-4556. Coat the exterior with alkyd resin primer (universal metal primer). Each unit shall be constructed and labeled in accordance with ASME BPVC SEC VIII D1. The housing shall be designed for a working pressure of 600 kPa 90 psig. The inlet and outlet connections shall be provided with raised face flanges faced and drilled in compliance with ASME B16.5, Class 150. The configuration of the air eliminator tanks shall be as shown on the drawings.

2.10.2.2 Sight Gauge

Provide a 125 mm 5-inch armored, clear borosilicate (Pyrex) glass liquid level gauge for observing fuel level in the tank. The gauge shall be equipped with stainless steel ball checks in both the upper and lower fittings, an upper and lower shutoff valve, and a bottom blowoff cock. The gauge will contain a colored density sensitive ball. Glass shall be protected by a minimum of four guard rods.

2.10.2.3 High Level Shutoff

The vent connection shall have a stainless steel high level shutoff mechanism to act as an overfill prevention device to keep fuel from going out the vent.

2.10.2.4 Level Sensors

The level sensors shall be ultrasonic tip sensitive level control switches,

NEMA 7/9, weatherproof, explosion proof for Class I, Div I, Group D, temperature T2D (215 degrees C419 degrees F), 120-volt input power, SPST relay output, 25 mm1-inch flanged mounting.

2.10.2.5 Vent

Tank vent outlet shall be equipped with pressure-vacuum breather vent, aluminum construction with weather hood and with fluoroelastomer pallet seat inserts, high density screens, stainless steel internals, with pressure relief setting at 20 grams 0.5 oz per square mm inch, and vacuum relief set at 1350 grams 32 oz per square mm inch. Pressure venting capacity shall be 151 cubic m 5400 cubic feet per hour, vacuum capacity shall be 136 cubic m 5000 cubic feet per hour.

2.10.3 Non-Surge Check/Air Block Valve

Refer to Section 33 52 43.14 AVIATION FUEL CONTROL VALVES

2.10.4 Offload Fuel Hose

The offload fuel hose shall be 100 mm 4-inch, lightweight, flexible, minimum 200 mm 8-inch bend radius, non-pressurized offloading hose constructed of nitrile rubber, rigid PVC helix, synthetic braiding, smooth bore, corrugated outer diameter, conforming to MIL-PRF-370 (formerly CID A-A-52554), non-collapsible, threaded, male NPT, both ends, and have UV protection.

2.10.5 Offload Sight Flow Indicator

The Truck Offload sight flow indicator shall be 100 mm four inch wafer pattern sight glass, plane indicator aluminum construction.

2.10.6 Flood Lights

Mount three 100 Watt HPS floodlights on the off load skid, approximately 3.66 m 12 foot high, two on one pole, one on another pole to provide light in the off load area. Fixtures shall operate on 277 volts, single phase, 60 Hz. Fixtures shall be rated for installation in wet locations and have narrow vertical and wide horizontal beam spread. Fixtures shall be bronze in color and accept 50 mm 2-inch knuckle mounting.Provide a manual switch for control. See Section 26 56 00 EXTERIOR LIGHTING for applicable requirements.

2.10.7 Flowmeter

Meter shall be a temperature compensating, turbine type meter designed for a continuous flow of [2300] [1150] L [600] [300] GPM. Meter shall have ANSI Class 150 flanges and body working pressure of not less than 2 MPa 275 psig and shall be suitable for hydrostatic testing of 2 MPa 275 psig. Materials of construction shall be stainless steel. Meter shall be factory calibrated and capable of being calibrated for JP-8 jet fuel in the field. Pressure loss through the meter shall not exceed 26 kPa 4 psi at maximum flow rate for water. The register shall be explosion proof and have a total indicator and a rate indicator. The total indicator shall have a minimum of eight figures and the setback rate indicator shall have a minimum of five figures. The register shall read in L gal and the smallest unit of indicated delivery shall be 4 L 1 gal. Accuracy shall be within +0.3 percent between ten percent and maximum rated flow.

[2.10.8 Grounding

****
NOTE: Delete this paragraph if the tank trucks to be loaded/unloaded have a plug-in connection for such a system. Indicate on the drawings the type of connection required for a Grounding Verification Unit. Delete the second paragraph if a grounding cable and clamp connection will be sufficient.
****

The skid shall be equipped with a self winding grounding cable reel. The cable shall be at least 15 m 50 feet long. The cable reel, the grounding cable and the connection clamp shall be in accordance with CID A-A-50696.

][2.10.9 Grounding Verification Unit

****
NOTE: System can connect to a tank truck by using either a grounding clamp or plug. For a grounding plug to work, the tank trucks must have an appropriate receptacle. Coordinate with the Using Agency to determine if plugs are needed and if so what type.

The switch contact in the control module can be used to initiate various interlock functions (e.g., stop pumps, close valves, initiate alarms, etc.). Indicate the desire interlock control functions on the drawings.
****

System shall include grounding [clamp] [plug], grounding cable, and monitoring and control module. System shall automatically and continually monitor and verify a low-resistance static dissipation path (less than [10 Ohms] [_____]) between connecting tanker and the designated ground point. [Grounding clamp shall conform to MIL-DTL-83413 and MIL-DTL-83413/7.] [Grounding plug shall [conform to MIL-DTL-83413 and MIL-DTL-83413/4.] [_____].] Grounding cable shall be corrosion resistant steel strands sheathed in a Hytrel jacket. Cable shall be the spiral, self-retracting type. Cable shall be a minimum 9 m 30 feet in length. Monitoring and control module shall be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations. Module shall include status lights (red for no ground verification and green for positive ground verification) and a lockable bypass switch. Module shall include a switch contact to allow interlock functions.

]2.10.10 Other Offload Equipment

For other equipment shown on the drawings as part of the offload system, refer to this Section and refer to Section 33 52 43.13 AVIATION FUELING PIPING

2.11 HYDRANT OUTLET PITS AND ISOLATION VALVE PITS

Use this paragraph for On-shoulder and On-apron installation. Pantograph and hydrant hose truck hydrant outlet pits and isolation valve pits shall be prefabricated units that are the standard products of a firm regularly engaged in the manufacture of such products and shall essentially duplicate

items that have been in satisfactory use for at least (3) years prior to bid opening. The basic pit shall consist of a 1.25 m 50-inch thick fiberglass walls and floor with main body dimensions as shown on the drawings. The pit shall contain twelve (minimum) integral concrete anchors or two integral anchors that run continuous on three sides of pit. The integral fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the aluminum cover assembly. The manufacturer shall have had a minimum of three years successful experience in the production and usage of their fiberglass service pits and shall supply proof of experience at time of submittals. Pits shall be provided with a 50 mm 2-inch pump-out line terminating with a male cam type bronze connector with female dustcap. Pits shall be provided with removable aluminum grating platform suitable for loading of 150 kg 400 pounds per square foot. The grating shall cover the entire opening when the lid is in the open position. The grating platform shall have outside edges and cut-outs framed. The inside of the lid shall have a 356 by 254 mm 14 by 10 inch permanently attached sign which says "DANGER CONFINED SPACE ENTER BY PERMIT ONLY". The sign shall be white with black letters, made of PVC, completely and permanently encapsulated 1.25 mm 50-mil plastic.

2.11.1 Pit Cover

The pit cover assembly shall consist of a completely removable one-piece aluminum lid attached to a rigid frame which is an integral part of the fiberglass pit. The lid shall be attached to the frame with hinges which do not carry wheel loads applied to the top surface of the lid in its closed position. The lid shall be equipped with a device to hold the lid in its fully-opened position. This lid-staying device shall automatically engage when the lid is opened to its fully-opened position. The device shall also be provided with a quick-release mechanism designed to be operated with one hand. The lid shall be considered fully-open when it is rotated approximately 90 degrees from its closed position. Each cover lid shall move smoothly through its entire range of motion and shall be counterbalanced sufficiently to require an externally-applied opening force of 35 pounds (maximum) to be applied to the center of the long side of the cover (opposite the hinge side). Similarly, the maximum closing force required to be applied at the same point shall be approximately 18 kg 50 pounds. In addition, the cover shall be counterbalanced in such a fashion that the cover will not close under its own weight if released when open to any angle greater than 70 degrees (from its closed position). Operation of the lid will not have spring assist. Lifting handles (two minimum) shall be provided for each lid. Each handle shall provide comfortable, secure grip for and average adult male's full (gloved) hand. All covers shall be provided with a latch, operable from the exterior of the vault, to securely hold the lid to the frame in the closed position. The latch will be capable of being released from either lifting handle. Tools shall not be required to engage (or disengage) the latch or the lid lifting handles. Latch and handle designs shall be weather-resistant with features to prelude freeze-up and the collection of dirt and precipitation. Projections of the lid's hinges, lifting handles, or latches above the plane of the lid, whether temporary or permanent, shall not be allowed. The weight bearing flange surfaces of both the fiberglass pit liner and the aluminum cover lid shall be machined flat to assure uniform weight distribution. The word FUEL shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 25 mm 1-inch high and 1.6 mm 0.0625-inch deep. [The pantograph pit cover shall include an interior center 457 mm 18-inch diameter (clear opening) twist and turn lid that fully opens and is attached with a stainless steel cable.] [Pit lid shall be designed for resisting debris and water

accumulation at seals, load bearing surfaces, hinges, and handle pockets. Seal shall be an elastomeric perimeter seal, easy to replace, secured to lid by dovetail grooves, no adhesive. Push buttons are not allowed.]

2.11.2 Pit Cover Materials, Design, and Testing

****

NOTE: Provide center opening per Command Fuels Facility Engineer. Provide water resistant lid per Command Service Headquarter Engineer at northern bases.

****

All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 700,000 kg 200,000-pound test-load applied perpendicular to a 129,000 square mm 200-square-inch contact area(254 by 508 mm 10 by 20 inches) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 10 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall model field-installed conditions as nearly as practicable. The 800 kN 200 Kip test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the minimum interior opening dimension of the fiberglass pit body. Maximum deflection of the cover lids, remaining after removal of the test load, shall be + 0.25 mm 0.010-inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of 50 percent of the units.

2.11.3 Pipe Seal

The pipe penetrations through the pit floor or wall shall be sealed by means of a Buna-N boot. The boot shall be secured to the pipe and to a steel sleeve bonded to the pit wall at the pit penetration by stainless steel clamps. Buna-N (Nitrile Butadiene) material shall be in accordance with SAE AMS3275.

2.11.4 Hydrant Outlet Pit Equipment

At the Contractor's option, hydrant pits may be furnished complete with hydrant control valves and shutoff valves assembled in a pipe riser. All valves and piping furnished by the pit manufacturer shall comply with the requirements specified herein. All control valves shall be of the same manufacturer.

2.12 HIGH POINT VENT AND LOW POINT DRAIN PITS

Use for On-Shoulder and On-Apron installations.

2.12.1 Pit Assembly

Each pit shall incorporate the following items built into a self-contained assembly.

2.12.2 Pit

The basic pit shall consist of 6.25 mm 0.25-inch wall fiberglass liner with a main body approximately 575 mm 23-inches in diameter and a minimum of 925 mm 37-inches deep. The pit shall contain two integral concrete anchors. The fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the cast aluminum ring and cover assembly. The pits shall be the standard products of a firm regularly engaged in the manufacture of such product and shall essentially duplicate items that have been in satisfactory use for at least three (3) years prior to bid opening. Proof of experience will be submitted.

2.12.3 Pit Cover, General Requirements

The pit cover shall include a removable outer ring frame and an interior 457 mm 18-inch diameter (clear opening) hinged lid that opens 160 degrees. [The pit shall have a tamperproof cover. The removable outer ring shall have anchors to provide for means to secure the manhole and its moveable cover and lid to the "concrete" fiberglass containment. The inner hinged lid shall have a means of being locked.] Each cover lid shall move smoothly through its entire range of motion and shall require a maximum opening force of 150 N 35 pound-force to be applied at a single lifting handle. Each handle shall provide a comfortable, secure grip for an average adult male's full gloved hand. Tools shall not be required to engage the lifting handle. Projections of the lid's hinges or handles above the plane of the lid, whether temporary or permanent, shall not be allowed. The pit service shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 25 mm 1-inch high and 1.6 mm 0.0625-inch deep. The weight bearing flanges of the fiberglass pit liner and the aluminum cover frame (and lid) shall be machined to assure uniform weight distribution.

2.12.4 Pit Cover Materials, Design, and Testing

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NOTE: Select per COMMAND FUELS FACILITY Engineer direction.
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The cover frames and lids shall be designed and manufactured by a qualified company having a minimum of five years successful experience in the production of similar airport apron slab fixtures. All cover lids and frames shall be designed using an appropriate cast aluminum alloy or rolled aluminum plate to support an aircraft wheel load simulated by a roving 700,000 kg 200,000-pound test-load applied perpendicular to a 129,000 square mm 200-square-inch contact area(254 by 508 mm 10 by 20 inches) of the cover's top surface. The aluminum alloy material selected for design shall be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers shall be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects shall not be allowed. Minor cosmetic welding is acceptable. The cover shall be capable of supporting the test-load without failure regardless of the location or orientation of the load. Localized

yielding or cracking or excessive deformations shall be considered as failure. Actual load-tests shall be performed on a minimum of 10 percent of all the covers supplied. Load-tested units shall be randomly selected. Load-test conditions shall model field-installed conditions as nearly as practicable. The 800 kN 200 Kip test-load shall be applied to the cover for a minimum duration of 5 minutes. Absolute maximum deflection of the cover lid under the test-load shall not exceed 1/180th of the interior diameter of the fiberglass pit body. Maximum deflection of the cover lids, remaining after removal of the test load shall be + 0.25 mm 0.010-inches to assure that no permanent set has taken place. Upon removal of the test-load, the cover lid and frame shall be carefully examined for cracks or localized areas of permanent deformation. All results shall be submitted for review and approval. A single failure to meet any of the stated criteria shall be considered sufficient grounds for the testing of 50 percent of the units.

2.12.5 Pipe Riser Seal

The riser pipe penetration through the pit floor shall be sealed by means of a Buna-N boot. The boot shall be secured to a metal collar welded to the pipe riser and to a flange at the floor opening by stainless steel clamps. Collar shall be fabricated from the same material as the pipe.

2.13 OPERATING TANK LEVEL INDICATOR

The level indicating system must perform tank gauging and have local tank readout. The level indicating system must use a servo to measure all the various locations required for the primary measurement. The level indicating system must be able to measure and compute fuel level, fuel density, fuel actual volume, fuel and water corrected volume, and fuel ambient temperature. The reference point for all level measurements must be from the tank's datum plate. The servo system must attach to the tank's [203] [254] [303] mm [8] [10] [12] inch riser/[254 mm 10-inch] stilling well to minimize the effects of turbulence on the measurements and still allow the government access to take quality control samples. The level indicating system must be able to measure in underground, aboveground and cut and cover tanks with all floor and roof types. The level indicating system must be able to measure multiple tanks with a single field interface unit. The level indicating system must be able to determine whether the tank is issuing or receiving fuel while in the transfer mode and also with the same unit be able to perform leak detection. The level indicating system must require no periodic calibration after installation is complete. The level indicating system must be approved for installation in a hazardous area and certified intrinsically safe by an approved agency and provide lightning protection. The level indicating system must be able to interface with government owned information systems. The level indicating system must provide five sets of alarm outputs; high intermediate high, low, intermediate low and static tank movement alarm.

****

NOTE: Select per COMMAND FUELS FACILITY Engineer direction.

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Level accuracy ± 1.25 mm 0.05 inches
Corrected volume accuracy ± 0.1 percent
Density accuracy ± 1 percent
Temperature accuracy ± -18 degrees C 1 degrees F
Detect water in the tank sump to a level equal to or slightly above the

water draw-off pipe

****
NOTE: This paragraph specifies provision of proprietary products. A J&A must be obtained for these products if the paragraph is included in the project specification.
****

[It will be an ENRAF Servo Gauge Model 854 Automatic Tank Gauging System or approved equal. Equality being determined by compatibility with the Base FAS System.. The system shall include an ENDRESS+HAUSER RTU 8130 and a local display similar or equal to a CP/2500. The RTU shall transmit data to the Base FAS System located in the RCC via telephone lines as shown on the drawings. Base personnel shall coordinate reprogramming of the FAS System to accept this new data.

]2.14 OPERATING TANK LEVEL SWITCHES

****
NOTE: Select per COMMAND FUELS FACILITY Engineer direction.
****

The switches shall be an external mount liquid level switch with a stainless steel float chamber and stainless steel, type 304 or 316, float and trim. Switch contacts shall be two single pole double throw switches factory mutual approved or U.L. listed for use in Class I, Division 1, Group D hazardous location with a maximum temperature rating of T2D (216 degrees C 419 degrees F). Units shall have provisions to check level switch operations without increasing the fuel level in the tanks as shown on the contract drawings.

2.15 OPERATING TANK LEVEL SWITCHES

****
NOTE: Select per COMMAND FUELS FACILITY Engineer direction.
****

a. System shall be designed and installed in such a way that the system shall be continuously and automatically self-checking. Switches shall be an external mount with a stainless steel fluid chamber. Electronic level sensors shall be thermistors or optic type, and be intrinsically safe Class I, Division 1, Group D for hazardous environments, with recognized FM, CSA or UL approval. The sensor holder/junction box shall be accessible from the stairway. Units shall have provisions to check level switch operations without increasing the fuel level in the tanks as shown on the contract drawings.

b. Level alarms shall be mechanically and electrically independent and be totally isolated from the gauging system. The level switches shall receive power and send their signal to the Pump Control Panel. Circuitry and cables from the PCP to the electronic level sensors in the tank shall be intrinsically safe.

[2.16 OPERATING TANK LEVEL SWITCHES

****

NOTE: Select when using a cut and cover Tank.
****

a. System shall be designed and installed in such a way that the system shall be continuously and automatically self-checking. Switches shall be mounted on top of the tank, in the pump house, as indicated. Electronic level sensors shall be thermistors or optic type, and be intrinsically safe Class I, Division 1, Group D for hazardous environments, with recognized FM, CSA or UL approval. The sensor holder/junction box shall be accessible.

b. Level alarms shall be mechanically and electrically independent and be totally isolated from the gauging system. The level switches shall receive power and send their signal to the Pump Control Panel. Circuitry and cables from the PCP to the electronic level sensors in the tank shall be intrinsically safe.

]2.17 WATER DRAW-OFF SYSTEM

****
NOTE: Use a FUEL SYSTEM WASTE WATER TANK when designing a CUT AND COVER SYSTEM if directed by COMMAND FUELS FACILITY Engineer.
****

A water draw-off system shall be provided for each Operating Tank. Water draw-off system shall gravity drain. Each system shall include tank, product return pump and all necessary pipe, pressure relief system, valves, and fittings.

2.17.1 Tank

Water draw-off tank shall be a 210 L 55-gal fabricated stainless steel tank with supporting legs as shown. Tank and support legs shall be fabricated from Type 304 stainless steel.

2.17.2 Sight Glass

Sight glasses for tank shall be standard tubular gages with density ball and shut-off valves on each end. Wetted parts other than sight glass shall be stainless steel. If glass breakage should occur, a stainless steel ball in the valve shall close preventing product loss. Glass shall be protected by minimum of four guard rods.

2.17.3 Return Pump

****
NOTE: Insert site specific Pump requirements.
****

Product return pump (PRP-1 and PRP-2) shall have the capacity of not less than 0.30 L/s 5 gpm against a total head of [_____] mm feet when driven at [_____] rpm. The pump shall have flange connections and shall be constructed of stainless steel or aluminum so as to have no zinc, brass or other copper bearing alloys in contact with the fuel. The unit shall be explosion-proof, Class I, Division 1, Group D with maximum temperature rating of "T2D" (216 degrees C 419 degrees F). The motor shall not be overloading at any point on the pump curve. Contractor has the option of selecting either centrifugal or positive displacement type pump with the

restriction of the positive displacement type pump shall include a pressure relief between the discharge and suction protecting the pump from overloading.

2.17.4 Anchoring

All units of the water draw-off system shall be installed plumb and level and secured in place by anchor bolts.

2.18 BOWSER PUMPOFF PUMP

The pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 0.6 L/s 10 gpm with a differential head of [_____] mm feet when driven at 1800 rpm. The pump and motor shall be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for available electric service, shall be totally enclosed, fan cooled, TEFC, and shall conform to the requirements specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Pump shall be provided with stainless suction side basket strainer.

2.19 TIGHTNESS MONITORING SYSTEM

The system shall be a permanent, fully automated, pressure step (no volume measurement)leak detection system, and will be used for tightness testing the hydrant loop pipeline. System shall have a guaranteed accuracy to detect a leak of less than 0.0004 mL/s 0.0004 gal/h per cubic m foot at 1 MPa 150 PSI. The system shall be US EPA Third Party Certified to the above sensitivity with a Probability of Detection greater than or equal to 95 percent and a Probability of False Alarm of less than or equal to 5 percent. System will have performed satisfactorily on at least five (5) projects involving quantities and complexities at least equal to those required under this Contract. Equipment shall be compatible with equipment furnished and installed under Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT, and Section 33 09 53 AVIATION FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM, where the individual equipment components are common to both the Tightness Monitoring System functional operation, and the Hydrant Fuel Control System functional operation. Test results shall be unaffected by the temperature change of the fuel, and have a maximum test period of one hour. A local controller shall implement and analyze data, store data and be capable of printing results, and be located in the control room of the pumphouse building. Printer shall be provided. Controller shall utilize 120V, single phase power. Any additional utilities or equipment needed to be added to the fuel system in addition to what is shown on the drawings to allow the Tightness Monitoring System to meet the requirements, will be the requirement of the Tightness Monitoring System. Provide calculations, design, and proof of compliance. Upon completion of 72 hours of continuous system operation and before final acceptance of work, test the Tightness Monitoring System in service to demonstrate compliance with contract requirements. Performance verification shall be coordinated with overall fuel system start-up, and commissioning of fueling facilities. Perform performance verification in such a way as to obtain complete tightness information within the required accuracy stated herein and provided Tightness Certification on each pipe section tested.

2.20 TRUCK FILLSTAND OVERFILL PROTECTION AND GROUND VERIFICATION UNIT

****

NOTE: Delete this paragraph if the tank trucks to be loaded do not have an overfill system installed (e.g., liquid level sensors, wiring, and plug receptacle). Indicate the type of plug required for the system.

The switch contact in the control module can be used to initiate various interlock functions (e.g., stop pumps, close valves, initiate alarms, etc.). Indicate the desire interlock control functions on the drawings.

****

System shall include connection plug, control cable, and monitoring and control module. System shall be the self-checking type that automatically and continually monitors the liquid-level within a tank truck's storage compartment during fueling. [Connection plug shall conform to [_____].] [The system shall be compatible with the Scully Duocept w/Truck Identification Module (T.I.M.) P/N 09061 to monitor truck liquid level, provide ground verification and provide a method to electronically prevent product commingling.] System shall be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations. Module shall include status lights and a switch contact to allow interlock functions. Control cable shall be the spiral, self-retracting type. Cable shall be a minimum 9 m 30 feet in length. The fillstand tank level sensor shall signal the fillstand control valves to shutdown and shall serve as the primary fill stand overfill system.

2.21 DAY TANK

A day tank shall be provided in the pumphouse.

2.21.1 Tank

The day tank shall be a 50-gal 190-L fabricated stainless steel tank with supporting legs. Tank and support legs shall be fabricated from Type 304 stainless steel.

2.21.2 Sight Glass

Sight glasses for tank shall be standard tubular gages with density ball and shut-off valves on each end. Wetted parts other than sight glass shall be stainless steel. If glass breakage should occur, a stainless steel ball in the valve shall close preventing product loss. Glass shall be protected by minimum of four guard rods.

2.21.3 Level Sensors

The level sensors shall be ultrasonic tip sensitive level control switches, NEMA 7/9, weatherproof, explosion proof for Class I, Div I, Group D, temperature T2D (419 degrees F215 degrees C), 120-volt input power, SPST relay output, 1-inch 25 mm flanged mounting.

2.21.4 Anchoring

The tank shall be installed plumb and level and secured in place by anchor bolts.

[2.22 JP-8+100 INJECTION SYSTEM AND STORAGE TANK

****

NOTE: Select per COMMAND FUELS FACILITY Engineer direction.

****

The JP-8+100 Injection System shall incorporate and include all components necessary to mechanically inject the JP-8+100 additive into the fuel stream at an adjustable rate of 250 ppm.

2.22.1 Injector Assembly

The injector assembly shall be a completely self contained 100 mm 4-inch flanged unit rated for 150 ANSI service and installed at each truck fill stand. Three units will be government furnished. The main housing shall be constructed of aluminum and contain a "swing vane" positive displacement fluid motor driven by polytetrafluoroethyliene (PTFE) vanes. No externally driven pump shall be accepted. All components shall be compatible with JP-8 and the JP-8+100 additive. The unit shall be passive in operation in that the injection stops when the fuel flow stops. A minimum flow of 4.5 L/s 75 GPM shall be required to start the additive injection. The injector pump shall be adjustable from 0 to 1,000 ppm minimum. The assembly shall include a flow indicator/suction strainer, inlet valve, outlet valve and piping all manufactured from stainless steel materials.

2.22.2 Injector Storage Tanks

The injector storage tanks (two each) shall be horizontal double wall steel tanks with a 1500 L 400 gal capacity and a horizontal cylindrical design. The tank shall met all requirements of NFPA 30 and UL 142 for flammable/combustible liquids and shall include a 30 year warranty against defects in material or workmanship. The tank and all components shall be suitable for JP-8+100 additive. The tank shall be equipped with standard accessories including mounting supports, a 606 mm 24-inch manway, normal venting, mechanical level indication, a 50 mm 2-inch NPT plugged drain fitting, primary and secondary containment emergency venting, manual interstitial space monitoring, 50 mm two-inch product drop tube, a manual level sticking port, interior epoxy coating as per Section 09 97 13.17 THREE COAT EPOXY INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS and exterior epoxy coating as per Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES. All materials mounted inside the tank shall be 304 SS minimum. The storage tanks shall be mounted on a 1.5 m 5-foot high steel structural stand. The injector storage tank gauge shall be a vertical direct read with an 200 mm 8 inch minimum dial face calibrated in L gal. The gauge assembly shall mount on a 50 mm 2-inch NPT fitting. The float, float arm and all wetted parts are to be 304 SS minimum.

2.22.3 JP-8+100 Additive Tubing and Conduit

The additive supply header feeding the fuel injection stations shall be manufactured of one 25 mm 1 inch nylon flexible tubing natural colored. The tubing shall have an inner diameter of 21 mm 13/16-inches, a working pressure of 1.4 MPa 205 PSIG and a minimum bend radius of 175 mm 7 inches. All tube fittings shall be of stainless steel ferrule compression design. Support aboveground tubing as required to mount securely.

2.22.4 JP-8+100 Additive Ball Valves and Strainer

The valves and strainer in the tanks supply line shall meet the requirements of Section 33 52 43.13 AVIATION FUELING PIPING plus be equipped with gaskets, seals, seats and packing that are compatible with the JP-8+100 additive. PTFE and fluorocarbon (Viton) -litharge cured are recommended by the additive manufacturer. The strainer shall include a stainless steel 50 mesh screen.

][2.23 OPERATING TANK VENT

****
NOTE: Select when using a cut and cover Tank.
****

a. System shall be designed and installed in such a way that the system shall be continuously and automatically self-checking. Switches shall be mounted on top of the tank, in the pump house, as indicated. Electronic level sensors shall be thermistors or optic type, and be intrinsically safe Class I, Division 1, Group D for hazardous environments, with recognized FM, CSA or UL approval. The sensor holder/junction box shall be accessible.

b. Tank vent outlet shall be equipped with pressure-vacuum breather vent, aluminum construction with weather hood and with fluoroelastomer (FKM, Viton)pallet seat inserts, high density screens, stainless steel internals, with pressure relief setting at 215 Pa 0.5 oz psi, and vacuum relief set at 215 Pa 0.5 oz psi. Pressure venting capacity shall be 75 L/s 9700 cubic feet/hour, vacuum capacity shall be 115 L/s 14500 cubic feet/hour.

]PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

Install equipment and components in position, true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.2 Anchoring

Anchor equipment in place. Check alignment of anchor bolts before installing equipment and clean-out associated sleeves. Do not cut bolts because of misalignment. Notify Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads. Where anchor bolts or like devices have not been installed, provide appropriate self-drilling type anchors for construction condition.

3.1.3 Grouting

Equipment which is anchored to a pad is to be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing

water, debris, oil, rust, and coatings which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide necessary formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting shall be in accordance with ASTM C827/C827M. Perform all grouting in accordance with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

Level and align equipment in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.1.5 Direct Drives

Alignment procedure follows:

3.1.5.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.1.5.2 End Play

Run drive shafts at operational speed. Determine whether axial end play exists. Run drive shaft at operational speed and mark drive shaft axial position when end play exists. Block drive shaft in operating position when aligning drive shaft with driven shaft.

3.1.5.3 Shaft Leveling and Radial Alignment

Pump alignment shall be accomplished by the factory technician or a millwright trained in pump alignment, and with the use of dial gauges or laser alignment equipment.

3.1.5.4 Angular Alignment and End Clearance

Check angular alignment and end clearance by inserting a feeler gage at 4 points, 90 degrees apart around outer edges of coupling halves.

3.1.5.5 Final Recheck

Check adjustments with dial indicator after completing recheck. Align shafts within 0.025 mm 0.001 inch tolerance, except as other-wise required by more stringent requirements of equipment manufacturer.

3.1.6 Precautions

Special care shall be taken to ensure that equipment and materials are

stored properly to prevent damage and maintain cleanliness, and that the completed system is free of rocks, sand, dirt, and foreign objects. Take the following steps to insure these conditions.

a. Equipment brought to the site and not stored inside, shall be stored on blocks or horses at least 450 mm 18 inches above ground.

b. Visual inspection shall be made of each piece of equipment to ensure that it is clean prior to installation.

c. The open ends of equipment shall be closed when work with that piece of equipment is not in progress.

3.2 INSTALLATION OF UNDERGROUND TANKS

Installation shall be per tank manufacturer's recommendations, API RP 1615, NFPA 30, 40 CFR 280, state and local codes and as specified herein. If recommendations require tank to be filled, only fuel will be allowed in tanks. Water filling is not acceptable. Before being placed in service, tank shall be tightness tested in accordance with NFPA 30.

3.2.1 Coating Testing

The coating shall be examined for flaws and tested for thickness. Provide the facilities, personnel, and equipment for testing for flaws and thickness. Thickness shall be measured electronically. Coating shall be tested directly before placement of the tank with an electric flaw detector, equipped with a bell, buzzer, or other type of audible signal that operates when a flaw is detected. The detector for the type of coating used shall have an operating voltage of 10,000 to 35,000 volts. Check of the holiday detector potential may be made by the Contracting Officer at any time to determine the suitability of the detector. Damaged areas shall be repaired with materials identical to those used originally, and after drying, shall be retested electrically. Submit test results.

3.2.2 Steel Tanks

a. Cover the concrete hold down slab with 150 mm 6 inches of tank bedding backfill evenly graded and thoroughly compacted, prior to tank placement.

b. Each tank is to be unloaded and placed on the sand bed using cranes and the rigging procedures provided by the tank manufacturer. Use the tank lifting lugs for lifting the tank into place. The use of slings around the tank is not permitted, nor is the use of chock blocks of any sort. During handling, carefully inspect the tanks for coating damage and repair any damage whatsoever before proceeding. After placement, check each tank to ensure it is sloped as required. The elevation shall be confirmed.

c. Before proceeding with backfill, install the hold down straps and tighten the turnbuckles securely and evenly throughout the length of the tanks. The bottom and sides of the tanks to be fully and evenly supported by hand shoveling and tamping. Use tank bedding backfill up to 303 mm 12 inches above the top of tank. Hand-guided power equipment can be used to place fill in 150 mm 6-inch layers, compacted to a minimum of 95 percent maximum density, after the bottom quadrant is filled. A minimum of four density tests per tank to be performed. Clean, noncorrosive, well tamped gravel to be used for backfill from a

point 303 mm 12 inches above the tanks to finished grade.

d. Do not fill the tank, even partially, before the bottom quadrant is backfilled. The level of fuel product not to exceed the level of compacted backfill at any time.

e. Coordinate tank installation with the installation of cathodic protection.

3.3 INSTALLATION OF FIBERGLASS PITS

Submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided. Follow these recommendations and apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

3.4 POSTED OPERATING INSTRUCTIONS

For each designated system or equipment item, provide instructions for guidance of operating and maintenance personnel. Following approval of content, prepare these instructions in a form and scale that will be readily legible when displayed in appropriate locations, to be designated by the Contracting Officer and meet the following requirements:

3.4.1 Each System

For each system, include diagrams of equipment, piping, wiring and control. Define control sequences.

3.4.2 Each Tank

For each tank provide a P.E. stamped certified tank calibration chart in 1/16-inch increments reading in gallons.

3.4.3 Each Item

For each equipment item, include starting, adjustment, operation, lubrication, safety precautions and shut-down procedures. Identify procedures to be performed in event of equipment failure. Provide other instructions recommended by the manufacturer.

3.4.4 Diagrams

Provide a professionally prepared isometric piping diagram of the fueling system apparatus. Diagram shall be 914 by 1370 mm 36 by 54 inches and shall be color coded to match PCP color diagrams. Diagram shall show the entire facility and shall include all equipment and the operational sequences of all equipment with equipment numbers displayed. Diagram shall show all valves along with the valve numbers shown on the drawings and listed as normally open/closed. It shall be wall mounted under glass.

3.4.5 Volume of Fuel

Provide a certified system inventory of fuel in the pipe, tank, pumphouse, etc. The piping will show length of pipe, size of pipe, L/s gal/foot, and total L gal. Verify during initial fill.

-- End of Section --