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USACE / NAVFAC / AFCEC / NASA	**UFGS-33 57 55 (November 2018)**
	Change 1 - 11/20

Preparing Activity: NAVFAC	**Superseding**
	UFGS-33 57 00 (August 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

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DIVISION 33 - UTILITIES

SECTION 33 57 55

FUEL SYSTEM COMPONENTS (NON-HYDRANT)

11/18, CHG 1: 11/20

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SECTION 33 57 55

FUEL SYSTEM COMPONENTS (NON-HYDRANT)
11/18, CHG 1: 11/20

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NOTE: This guide specification covers the requirements for general system components for fuel systems (non-hydrant type). Do not use this specification for designs related to pressurized hydrant fueling systems. For such systems, refer to the requirements of the DoD Type III/IV/V, and Cut and 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 item(s) or insert appropriate information.

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

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

PART 1 GENERAL

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NOTE: Use this UFGS in conjunction with UFC 3-460-01 "Design: Petroleum Fuel Facilities". Include in this specification any additional system components/devices necessary to meet state and local regulations.

The specification is written around ASME's standard Class 150 rating. For applications requiring higher pressure ratings (e.g., Class 300), the designer will have to modify this specification appropriately.

Cut and Cover systems must conform to Standard Design AW 078-24-33 UNDERGROUND VERTICAL STORAGE TANKS CUT AND COVER. Field fabricated ASTs must conform to AW 078-24-27 ABOVEGROUND VERTICAL STEEL TANKS WITH FIXED ROOFS. Standards can be found on the Whole Building Design Guide at the following location https://www.wbdg.org/ffc/dod/non-cos-standards.

****

1.1 SUMMARY

This section defines the requirements for system components as related to a non-hydrant fuel distribution system. Provide the entire fuel distribution system as a complete and fully operational system. Size, select, construct, and install equipment and system components to operate together as a complete system. Substitutions of functions specified herein will not be acceptable. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration, and acceptance of the system. System components and piping specified herein must be designed to handle a working pressure of [1900 kPa 275 psig for stainless steel systems][1965 kPa 285 psig for carbon steel systems] at 38 deg C 100 deg F. Components specified herein must be compatible with the fuel to be handled. Components to be suitable for outside, unsheltered location, and to function normally in ambient temperatures between [_____] degrees F and [_____] degrees F.[If gasoline is being handled, refer to 40 CFR Part 60 Subpart Kb and XX, 40 CFR Part 63 Subpart R, BBBBBB, and CCCCCC for design, installation, and testing requirements.]

1.2 REFERENCES

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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 Reference Identifier (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 within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API RP 1004	(2003) Bottom Loading and Vapor Recovery for MC-306 and DOT-406 Tank Motor Vehicles
API RP 1615	(2011) Installation of Underground Petroleum Storage Systems
API RP 2003	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API STD 610	(2010; Errata 2011) Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments
ASME B73.1	(2020) Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM D1655	(2018a) Standard Specification for Aviation Turbine Fuels

ENERGY INSTITUTE (EI)

EI 1529	(2014; 7th Ed) Aviation Fueling Hose and Hose Assemblies

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book
IEEE 1100	(2005) Emerald Book IEEE Recommended Practice for Powering and Grounding Electronic Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2024) Flammable and Combustible Liquids Code
NFPA 70	(2023) National Electrical Code
NFPA 77	(2024) Recommended Practice on Static Electricity
NFPA 407	(2022; TIA 21-1) Standard for Aircraft Fuel Servicing
NFPA 780	(2023) Standard for the Installation of Lightning Protection Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant
SAE AS5877	(2016; Rev B) Detailed Specification for Aircraft Pressure Refueling Nozzle

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-25896	(1983; Rev E; Notice 1 1989; Notice 3 2003) Adapter, Pressure Fuel Servicing, Nominal 2.5 inch diameter
MIL-DTL-5624	(2016; Rev W; Notice 1 2020) Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-83413	(2012; Rev C; AMD 1 2017; AMD 2 2019) Connectors and Assemblies, Electrical, Aircraft Grounding, General Specification for
MIL-DTL-83413/4	(2018; Rev E; AMD 1 2018) Connectors and Assemblies, Electrical, Aircraft Grounding: Plugs, for Types I and II Grounding Assemblies
MIL-DTL-83413/7	(2018; Rev F; AMD 1 2018) Connectors and Assemblies, Electrical, Aircraft Grounding: Clamp Connector for Types I and III Grounding Assemblies, Clip, Electrical
MIL-P-52327C	(1990) Military Specification Pumps, Centrifugal, Electric-Motor-driven, Positive Prime, Petroleum Products, Airfield Defueling and Receiving
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	(2016; Rev D) Reels, Static Discharge, Grounding, 50 and 75 Foot Cable Lengths
CID A-A-59326	(Rev D) General Specification For Coupling Halves, Quick-Disconnect, Cam-Locking Type

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 87	(2016) UL Standard for Safety Power-Operated Dispensing Devices for Petroleum Products
UL 87A	(2015; Reprint Jan 2020) UL Standard for Safety Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85)
UL 330	(2017; Reprint Feb 2019) UL Standard for Safety Hose and Hose Assemblies for Dispensing Flammable Liquids
UL 842	(2015; Reprint Oct 2017) UL Standard for Safety Valves for Flammable Fluids

1.3 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 system components and systems. Provide the drawings as one package with the design analysis. Shop fabrication drawings must include type of material, configuration, thickness, and necessary details of construction of the steel tank and vault. Shop drawings must also show the steel grating and supports. Submit Manufacturer's Catalog Data and Certificates of Compliance. Operation and maintenance information must be submitted for the system components items or systems listed in PART 2. Automatic pump controls must include step-by-step procedures required for system startup, operation, and shutdown.

1.4 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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

Grounding and Bonding; G[, [_____]]

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

][Truck Fillstand Overfill Protection and Ground Verification Unit; G [, [_____]]

][Venturi Tubes; G[, [_____]]

] Meters; G[, [_____]]

[Jockey Pump; G[, [_____]]

] Packaged Truck Offload System; G[, [_____]]

High Point Vent and Low Point Drain Pits; G[, [_____]]

Water Draw-Off System; G[, [_____]]

Operating Tank Vent; G[, [_____]]

SD-03 Product Data

Pressure Gages; G[, [_____]]

Differential Pressure Gauge; G[, [_____]]

Automatic Pump Controls; G[, [_____]]

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

][Truck Fillstand Overfill Protection and Ground Verification Unit; G[, [_____]]

] Flow Switches; G[, [_____]]

[Venturi Tubes; G[, [_____]]

][Differential Pressure Transmitter; G[, [_____]]

] Pressure Sensor; G[, [_____]]

Relaxation Tank; G[, [_____]]

Meters; G[, [_____]]

Submersible Pump; G[, [_____]]

ANSI Type Centrifugal Pump; G[, [_____]]

Sliding Vane Rotary Pump; G[, [_____]]

Self-Priming Centrifugal Pump; G[, [_____]]

[Jockey Pump; G[, [_____]]

] Packaged Truck Offload System; G[, [_____]]

Deaerator Tank; G[, [_____]]

Truck Fillstand Hose; G[, [_____]]

Truck Fillstand Swivel Joints; G[, [_____]]

Tank Truck Bottom Loading Arm; G[, [_____]]

Top Loading Arm; G[, [_____]]

Filter/Separator; G[, [_____]]

High Point Vent and Low Point Drain Pits; G[, [_____]]

FRP Containment Sump; G[, [_____]]

Liquid Level Gauge; G[, [_____]]

Operating Tank Level Indicator; G[, [_____]]

Operating Tank Level Switches; G[, [_____]]

Water Draw-Off System; G[, [_____]]

Operating Tank Vent; G[, [_____]]

Product Dispensing Unit; G[, [_____]]

SD-06 Test Reports

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

] Coating Testing; G[, [_____]]

SD-07 Certificates

System Supplier; G[, [_____]]

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

] SD-10 Operation and Maintenance Data

Automatic Pump Controls; G[, [_____]]

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

][Truck Fillstand Overfill Protection and Ground Verification Unit; G[, [_____]]

] Relaxation Tank; G[, [_____]]

Meters; G[, [_____]]

Submersible Pump; G[, [_____]]

ANSI Type Centrifugal Pump; G[, [_____]]

Sliding Vane Rotary Pump; G[, [_____]]

Self-Priming Centrifugal Pump; G[, [_____]]

[Jockey Pump; G[, [_____]]

] Packaged Truck Offload System; G[, [_____]]

Deaerator Tank; G[, [_____]]

Filter/Separator; G[, [_____]]

Operating Tank Level Indicator; G[, [_____]]

Water Draw-off System; G[, [_____]]

Operating Tank Vent; G[, [_____]]

Product Dispensing Unit; G[, [_____]]

1.5 QUALITY ASSURANCE

Submit the following data for approval:

a. Certification stating that the System Supplier has provided and installed at least five Programmable Logic Control (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 must be for dispensing [jet fuel] [mogas] [avgas] [diesel] [bio-diesel] [E-85] [burner fuel oils] [_____].

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.

1.5.1 Material and Equipment Qualifications

Provide materials and system components that are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship. Materials and system components must have been in satisfactory commercial or industrial use for a minimum two years prior to bid opening. The two year period must include applications of the system components and materials under similar circumstances and of similar size. Materials and system components must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two year period.[Products having less than a two year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours, exclusive of the manufacturer's factory tests, can be shown.]

1.5.2 Nameplates

****

NOTE: In a salt water environment, substitute acceptable non-corroding metal such as, but not limited to, nickel-copper, 304 stainless steel, or monel. Aluminum is unacceptable. Nomenclature (or system identification) should be established by the designer.

Require melamine plastic nameplates for all NAVFAC projects. Also for NAVFAC projects, require nameplates to be associated or keyed to system charts and schedules.

****

Attach nameplates to all specified system components, thermometers, gauges, and valves defined herein. List on each nameplate the manufacturer's name, address, [contract number,] [acceptance date,]

component type or style, model or serial number, catalog number, capacity or size, and the system that is controlled. Construct plates of [anodized aluminum] [stainless steel] [melamine plastic, 3 mm 1/8-inch thick, UV resistant, black with white center core, matte finish surface and square corners] [_____]. Install nameplates in prominent locations with nonferrous screws, nonferrous bolts, or permanent adhesive. Minimum size of nameplates must be 25 by 65 mm 1 by 2-1/2 inches. Lettering must be the normal block style with a minimum 6 mm 1/4-inch height. Accurately align all lettering on nameplates.[For plastic nameplates, engrave lettering into the white core.][Key the nameplates to a chart and schedule for each system. Frame charts and schedule under glass, and locate where directed near each system. Furnish two copies of each chart and schedule. Each nameplate description must identify its function.]

1.6 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect system components and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

PART 2 PRODUCTS

If gasoline is being handled, refer to 40 CFR Part 60 Subpart Kb and XX, 40 CFR Part 63 Subpart R, BBBBBB, and CCCCCC for design, installation, and testing requirements.

2.1 MATERIALS

Materials of construction must be stainless steel, aluminum or nonferrous material except positive displacement meter case may be steel with electroless nickel plated internals coated to 0.075 mm 3 mil thickness, or interior epoxy coating. No ferrous or zinc-coated material bronze, brass or other copper bearing alloys must be used in contact with the fuel. Do not install cast iron bodied valves or system components. Do not use aluminum valves.

2.1.1 Types of Fuel

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NOTE: Select type of fuel and insert expected temperature extremes.
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Components must be suitable for use with [F-24 turbine fuel (Jet-A with additives FSII, CI/LE, and SDA); 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; ASTM D1655] [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]. 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 Fand [_____] degrees C F.

2.1.2 Composition of Materials

Materials in contact with the fuel must 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 must be used in contact with the fuel.

2.1.3 Gaskets

Gaskets must be in accordance with Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

2.1.4 Bolts and Nuts

Bolts and nuts must be in accordance with Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

2.1.5 Flanges

Flanges and flanged end system components must be in accordance with Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT).

2.1.6 Nitrile Butadiene (Buna-N)

Provide Buna-N material that conforms to SAE AMS3275.

2.1.7 Acrylonitrile Butadiene Rubber (NBR)

Provide NBR material that conforms to SAE AMS3275.

2.2 SYSTEM COMPONENTS AND MATERIAL

2.2.1 General

All items of system components and material must be new and of the best quality used for the purpose in commercial practice and must be products of reputable manufacturers. Each major component of the system components must 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 must be fully enclosed or properly guarded. System Components, assemblies and parts must be marked for identification in accordance with MIL-STD-130 and MIL-STD-161. Pump and filter vessel numbers must be as indicated on the drawings. In addition, filter vessels must 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) must be installed on valves. Tags must be 35 mm 1-3/8 inch minimum diameter, and marking must be stamped or engraved. Indentations must be black, for reading clarity. Tags must 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 System 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 must be furnished by a single systems supplier regularly engaged in the supplying of these system components. System Supplier must 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 must provide all system components 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 must oversee the installation of the system components. Substitutions of functions specified will not be acceptable. The Contractor and the System Supplier must be present at the system commissioning, and must coordinate and schedule the work during construction, testing, calibration, and acceptance of the system. The System Supplier must be on-site with their mechanical and control personnel to supervise and assist the contractor during pre-commissioning check-out of the mechanical systems and control systems, initial fuel receipt, initial filing, hydrostatic testing, pigging, flushing, cleaning, system component tests, performance testing and all training for the owner's representatives. The System Supplier must 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

****

NOTE: Show electrical characteristics on the drawings.

Where reduced-voltage motor starters are recommended by the manufacturer or required otherwise, specify and coordinate the type(s) required in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Reduced-voltage starting is required when full voltage starting will interfere with other electrical system components and circuits and when recommended by the manufacturer. Where adjustable speed drives (ASD) are specified, reference Section 26 29 23 ADJUSTABLE SPEED DRIVE (ASD) SYSTEMS UNDER 600 VOLTS. The methods for calculating the economy of using an adjustable speed drive is described in UFC 3-520-01 DESIGN: INTERIOR ELECTRICAL SYSTEMS.

Coordinate the ignition temperature of the fuel(s) to be handled with the electrical design. Ignition temperatures will be as defined in NFPA 497M. Fuel ignition temperatures will dictate the maximum allowable temperature rating of the electrical system components. Coordinate the area classification and the electrical design with UFC 3-460-01.

Coordinate piping, valve, system components and other systems bonding and grounding requirements with UFC 3-460-01. Include also in the design a bonding and grounding plan to relieve and control static electricity buildup as described in UFC 3-460-01.

****

Motors, manual or automatic motor control system components except where installed in motor control centers, and protective or signal devices required for the operation specified herein must 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, must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3.1 Grounding and Bonding

Ground and bond in accordance with NFPA 70, NFPA 77, NFPA 407, NFPA 780, API RP 540, API RP 2003, IEEE 142, and IEEE 1100. Provide jumpers to overcome the insulating effects of gaskets, paints, or nonmetallic components.

2.4 PRESSURE GAGES

****

NOTE: For arctic conditions (less than minus 50 deg F) gauges must be immersed (filled) with silicone. Indicate the scale range for each gauge on the drawings.

****

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

2.4.1 Quick Disconnect

If indicated on drawings provide quick disconnect on pressure gauge. Quick disconnects for pressure gauges must be double shut-off, dry-break design, 316 stainless steel construction, with Fluorocarbon (Viton) seals, minimum working pressure of 6.89 mPa 1000 psig at 38 degrees C 100 degrees F, with 12.7 mm 1/2-inch female NPT threaded connections for both coupler and adapter, manufactured in accordance with ISO 7241, Series B. The quick disconnect assembly must consist of a coupler, half to be connected to the pressure snubber under the pressure gauge, and a nipple/adapter half to be connected above the pressure gauge isolation ball valve. The nipple/adapter is to be provided with an aluminum dust cap to protect the fitting when the gauge is removed.

2.5 DIFFERENTIAL PRESSURE GAUGE

****

NOTE: Piston type differential pressure gauges do not require calibration. Suggest showing on the drawings a pressure gauge installed on the high pressure side of the differential pressure gauge. The pressure gauge should have a scale range from 0 to 2068 kPa (300 psi).

****

The gauge must consist of a spring-supported, corrosion resistant piston moving inside a glass cylinder, with high pressure applied on top of the piston and low pressure applied below it. Under a differential pressure of 206.8 kPa 30 psi, leakage past the piston must not exceed 120 drops per minute. The cylinder and flanges must be stainless steel with Viton O-ring seals. The high pressure inlet of the gauge must have a 10-micron pleated paper filter and the low pressure connection must have a fine mesh stainless steel strainer. The gauge must have an operating pressure of 2068 kPa 300 psi. Differential pressure range of the gauge through approximately 75 mm 3-inches of piston movement must be 0-2068 kPa 0-30 psi with an accuracy of plus 34.5 kPa 0.5 psi, calibrated linearly with one PSI scale graduations. High and low pressure connections must be 1/4-inch NPT female with a stainless steel bar stock valve at each connection. Construction of the gauge must be such that a 3-valve manifold is not necessary. If only one bar stock valve is closed, the gauge must not be damaged by up to 206.8 kPa 300 psi differential pressure in either direction. A pressure gauge must be attached to the differential pressure gauge to indicate the high pressure and have a range of 2068 kPa 300 psi.

2.6 AUTOMATIC PUMP CONTROLS

****

NOTE: Fuel systems that include pumps to receive, transfer, and issue fuel may be provided with an Automatic Pump Control system with a Programmable Logic Controller (PLC) driven Pump Control Panel (PCP) to control the system. The exceptions where a PCP is not required are:

(a) Motive fuel filling stations and that only dispense motive fuel into vehicles.

(b) Motive fuel filling stations that also include attached tactical refueler truck loading station(s) whose flow rate is under 200 gpm for each station.

(c) Pumps serving miscellaneous use tanks.

(d) Isolated miscellaneous pumps that are not part of a larger system. These 5 HP or less size pumps act as sump pumps, pier stripping pumps, etc.

Every fuel system larger than a Filling Station for dispensing motive fuel that includes pumps to receive, transfer, and issue fuel may be provided with an Automatic Pump Control system with a Programmable Logic Controller (PLC) driven Pump Control Panel to control the pumps, run tightness tests, prevent tank overflow, etc. Provide an Automatic Pump Control System when required by Service Headquarters.

Only the most complicated systems use the measurement of pressure and flow to start and stop pumps; this is typically only required for hydrant systems. This specification section assumes that the system for this project uses manually actuated Pump Control Start/Stop Stations to control the pumps. To specify a system that uses an automatic

pump control system that starts and stops the pumps based on flow and/or pressure, use Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT instead and modify accordingly.

****

The control system components specified in this paragraph must be obtained from a single supplier of such products (see the paragraph SYSTEM SUPPLIER in this section for the requirements). The supplier must 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 must be installed to eliminate air entrapment. Control tubing must be as specified in Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT). Each system component specified hereafter must have manufacturer's authorized service personnel present to assist in PERFORMANCE TESTING as specified in Section 33 08 55 FUEL DISTRIBUTION SYSTEM START-UP (NON-HYDRANT). Items specified under this paragraph must be submitted for approval concurrently with items specified in Section 33 09 52 FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (NON-HYDRANT).

Electrical supply and electrical control system components must be suitable for the location and area classification in which they are installed. All mounting hardware must be corrosion resistant.

2.6.1 Pump Control System

****

NOTE: Provide a pump control system with a Programmable Logic Controller (PLC) driven Pump Control Panel on every project larger than a Military Service Station.

NOTE: Delete any of the below listed systems that are inapplicable.

****

Provide a system that is furnished by a Single System supplier. System must include all required hardware and software in an integrated system. System must include the operator's interface computer and all required transmitters. System must monitor and control the following as a minimum:

a. Control valves

b. Refueler truck loading system

c. Over the road tank truck loading system

d. Railcar loading system

e. Over the road tank truck offloading system

f. Railcar offloading system

g. Tank truck overfill protection and ground verification unit

h. Vehicle dispensing system

i. Marine loading system

j. Marine offloading system

k. Transfer pipeline pumping system

2.6.2 Pump Control Panel

****
NOTE: Indicate the control sequences for all equipment and system components on the drawings.
****

See Section 33 09 52 FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (NON-HYDRANT).

2.6.3 Control Stations

****
NOTE: Indicate the location and approximate configuration of each station. Mount all the control system components on a single system component rack next to the corresponding receiving/dispensing system components. Include the sequence of operation for each station on the drawings.
****

Electrical supply and electrical control system components must be suitable for the location and area classification in which they are installed. All mounting hardware must be corrosion resistant.

2.6.3.1 Pump Control Start/Stop Station

****
NOTE: Indicate the sequence of operation for the station on the drawings. Indicate the location of each station on the drawing. Provide a station for each loading or offloading position.
****

Station must consist of an enclosure, start/stop pushbuttons and green indicator lights as required. Enclosure must be corrosion resistant. In hazardous areas, enclosure must be electrogalvanized iron alloy with factory coating or copper-free aluminum. In non-hazardous areas, enclosures must be galvanized steel, stainless steel, electrogalvanized iron alloy with a factory coating or copper-free aluminum. Pushbutton contacts must have a minimum rating of 10 A, 125/250 VAC. Contact configuration must be as required or indicated. Indicator lights must be LED.

2.6.3.2 Emergency Fuel Shut-Off (EFSO) Station

****
NOTE: Indicate on the drawings the sequence of control to occur once an emergency pushbutton is activated. Typically, during activation, power to the entire fueling system is shutdown and an alarm signal is sent to the local fire department.
****

Enclosure must be corrosion resistant. In hazardous areas, enclosure must be electrogalvanized iron alloy with factory coating or copper-free aluminum. In non-hazardous areas, enclosures must be galvanized steel, stainless steel, electrogalvanized iron alloy with a factory coating or copper-free aluminum. All enclosures must be provided with a hinged glass or polycarbonate front and an open bottom. Paint the enclosure red. Mounting hardware must be corrosion resistant. Mount an emergency pushbutton inside the station housing. Pushbutton must be accessible through the hinged front. Pushbutton must be a momentary contact single unit with a jumbo mushroom operator, 1-NC and 1-NO contact. Mount a caution sign beside the emergency shutdown station, with red 50 mm 2-inch letters stating "EMERGENCY SHUTDOWN". The sign must have white background and be of noncorrosive construction.

[2.6.4 Tightness Monitoring System

****

NOTE: These are always provided when required by Regulators. These are almost always provided for Installation Pipeline projects. These are often provided for Interterminal Pipelines projects. These may be provided on large underground receipt or issue pipelines if the pipe volume is large enough to justify it. Contact Service Headquarters or officially designated alternate for guidance on when to provide.

Edit paragraph with location of local controller. If location is not specified, add location of local controller. Location must also be shown on drawings.

****

The system must be a permanent, fully automated, pressure step (no volume measurement) leak detection system, and will be used for tightness testing piping systems. System must have a guaranteed accuracy to detect a leak of less than 0.0004 mL/s 0.0004 gal/h per cubic meter foot at 1 mPa 150 PSI. The system must 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 projects involving quantities and complexities at least equal to those required under this Contract. System components must be compatible with system components furnished and installed under this Section and Section 33 09 52 FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (NON-HYDRANT), where the individual system components are common to both the Tightness Monitoring System functional operation, and the Fuel Control System functional operation. Test results must be unaffected by the temperature change of the fuel, and have a maximum test period of one hour. A local controller must implement and analyze data, store data and be capable of printing results, and be located in the the [pumphouse building] [conditioned enclosure] [_____]. Printer must be provided. Controller must utilize 120V, single phase power. Any additional utilities or system components 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 Supplier. 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 must 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.

][2.6.5 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). Indicate the desired interlock control functions on the drawings.

****

System must include connection plug, control cable, and monitoring and control module. System must be the self-checking type that automatically and continually monitors the liquid-level within a tank truck's storage compartment during fueling.[Connection plug must conform to [_____].][The system must 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 must be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations. Module must include status lights and a switch contact to allow interlock functions. Control cable must be the spiral, self-retracting type. Cable must be a minimum 30 feet in length. The fillstand tank level sensor must signal the fillstand control valves to shutdown and must serve as the primary fill stand overfill system.

]2.6.6 Flow Switches

Switches must be actuating vane type flow switch with single adjustable set-point. Switches must mount on ASME B16.5 Class 150 raised face flange. Flange material must 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 must be 120 volts, single phase, 60 hertz, 10 amps minimum. Units installed on 50 mm 2-inch piping and smaller may be threaded.

[2.6.7 Venturi Tubes

****

NOTE: Venturi tubes and their associated differential pressure transmitters are used in these systems to indicate flow rate on the control panel and not for control of the pumps like in a hydrant system. Seek guidance from the Service Headquarters or officially designated alternate before using.

****

a. The venturi tubes must be provided in conjunction with Section 33 09 52 FUEL PUMP CONTROL AND ANNUNCIATION SYSTEM (NON-HYDRANT).

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

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

c. The venturi tubes must 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 must be velocity head, impact, differential producing devices designed to measure differential pressure of [jet fuel] [mogas] [avgas] [diesel] [bio-diesel] [E-85] [burner fuel oils][_____]. They must be constructed of [304L stainless steel][carbon steel] with ANSI Class 150 flanges on each end and be suitable for operation of [1900 kPa] [1965 kPa] [275 psig] [285 psig] at 37.8 degrees C 100 degrees F. They must be of sufficient thickness to with-stand the same stresses as the upstream and downstream piping. Each venturi tube must have a minimum of four 13 mm 1/2-inch connections. An individual head-capacity curve must be furnished for each venturi tube.

d. Each venturi tube must be specifically custom manufactured for the specific flow conditions. Off the shelf designs are not acceptable. Date of manufacture must be stamped on the tube.

e. Operating conditions for the venturi tubes must 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 must be independent of Beta over a Beta range of 0.4 to 0.75. Pressure loss must be less than 24 percent of differential pressure generated by the venturi tube. Repeatability of the discharge coefficient "C" must 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 must be complete with valves, hoses and connecting disconnects, and carrying case. The meters must have stainless steel bellows, mounting bracket, 3.5 MPa 500 psi swp, 150 mm 6-inch dial with 270 degrees arc. Dial must read GPM Jet Fuel. Range of scale must match the flow transmitter for issue and return. The venturi manufacturer must provide the portable meters with the venturi in order to be compatible. The venturi tubes must also be provided with a suitable table to convert inches differential

pressure to liter gallons per minute.

][2.6.8 Differential Pressure Transmitter

Differential pressure transmitter must consist of a capacitance sensor operating on a differential in pressure of fuel. The output must 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 must be provided from remote power supply located in the pump control panel (PCP).

a. Transmitter body must 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 must be plus/minus 0.20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

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

****

NOTE: Select type of display per directions from Service Headquarters or officially designated alternate.

****

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

****

NOTE: Select based on System and Pump capacity. Systems greater than 150 L/s 2400 gpm require issue Venturi Tube to have low range (0-95 L/s) (0-1500 gpm) and high range (0- maximum system flow in L/s) gpm) transmitters versus one single full range transmitter.

****

d. Each venturi tube must have one transmitter and one indicating dial

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

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

(2) [Return][Bypass] Venturi Tube - 0 to [_____] L/s GPM (full range)

[e. Differential pressure transmitters must 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 must be supplied with a factory assembled five valve stainless steel manifold. Vent valves must be furnished on upper ports of each transmitter and indicating dial. Differential pressure transmitters and the indicating dial must be suitable for mounting on a 50 mm 2-inch pipe stand. Complete installation must be in accordance with manufacturer's recommendations.

]]2.6.9 Pressure Sensor

****

NOTE: Provide on every project that has a Pump Control Panel. It must be ordered with the right range, and is a sensor only. It is used simply to monitor systems, not control them. Indicate their exact installation locations on the drawings.

****

Sensor must 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 must be 12-28 VDC. Output signal must be 4-20 mA. Unit must have 0.25 percent accuracy and have built-in high pressure snubbers, minimum pressure range must be 0-2.1 MPa 0-300 PSI. Wetted material must be stainless steel.

Provide pressure sensors at pump suction header, pump discharge header, [bypass pressure control valve inlet,][bypass pressure control valve outlet,][backpressure control valve inlet,][backpressure control valve outlet,][truck fillstand manifold,][and,][_____].

2.7 RELAXATION TANK

****

NOTE: Include a relaxation tank in a design only when required by UFC 3-460-01. Size each relaxation tank in accordance with UFC 3-460-01. When included in a design, provide a relaxation tank schedule on the drawings to detail the requirements for each tank required (e.g., volume, connection sizes).

****

Tank must conform to API RP 2003 and ASME BPVC SEC VIII D1. Tank housing must be constructed of 3003 or 6061 aluminum alloy. Provide each tank with an ASME pressure vessel seal. Provide tank with internal baffling to prevent flow short-circuiting. Provide tank with an air release tap, a pressure relief tap and a drain tap. Provide flanged end connections on all piping connections (inlet piping, outlet piping, pressure relief piping, vent piping, and drain piping).

2.8 METERS

****

NOTE: Select type of fuel and flow rate. Not all materials are available at all sizes. Aluminum meters for example at a 1900 kPa 275 psig working pressure are only available in 2270 lpm 600 gpm size.

For OCONUS locations, consider meter registers to read in liters.

****

2.8.1 Positive Displacement Meters

Meter must be a one-way flow, temperature compensating, positive displacement type meter designed for a continuous flow of [2270 lpm] [1135 lpm] [600 GPM] [300 GPM] [_____] at the truck fillstand. Meter must have ANSI Class 150 flanges and body working pressure of not less than [1900 kPa] [1965 kPa] [275 psig] [285 psig] and must be suitable for hydrostatic testing of [1900 kPa] [1965 kPa] [275 psig] [285 psig]. Meter must be factory calibrated for [jet fuel] [mogas] [avgas] [diesel] [bio-diesel] [E-85] [burner fuel oils] [_____] and capable of being calibrated in the field. The register must 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 must have a minimum of eight figures and the setback run indicator must have a minimum of five figures. The register must read in liters gallons and the smallest unit of indicated delivery must be one liter one gallon. Accuracy must be within plus/minus 0.3 percent between ten percent and maximum rated flow. Meters must be provided with a suitable drain at the bottom, equipped with a ball valve. Pressure loss through the meter must not exceed 6.9 kPa 3 psi at [2270 lpm] [1135 lpm] [600 GPM] [300 GPM] [_____] flow rate.[Meter must have mechanical head.][Meter must have electronic head with means to remotely transmit the quantities passing through it by electronic pulse transmitters mounted on each meter.][Meter must have card-operated or key-operated data acquisition system to identify the receiver of the fuel and to allow access to the fuel.] Materials of construction must be stainless steel, aluminum, or carbon steel with electroless nickel plated or interior epoxy coated internals. The epoxy coating must be in accordance with MIL-PRF-4556.

[2.8.2 Turbine Meter

****

NOTE: These meters are seldom used as they have several issues (see below). However, they are allowed throughout UFC 3-460-01 at truck, railcar, and marine offloading and loading systems; and at pipeline receipt stations. They are very useful on marine and pipeline receipt applications with flow rates greater than 4540 lpm 1,200 gpm as positive displacement meters are prohibitively expensive over that size. Do not use at truck or railcar loading or offloading, or on any receipt or issue application where the volume to be measured is less than 100,000 gallons without permission of the

Service Headquarters or officially designated alternate. For OCONUS locations, consider meter registers to read in liters. For installations with less than 10 pipe diameters of straight pipe upstream of the meter and 5 pipe diameters downstream of the meter, provide flow straighteners before turbine meters.

****

****

NOTE: Turbine meters have several issues:

a. They cannot be field calibrated using a meter prover. Most are removed and sent back to the factory for calibration.

b. They continue to spin for a few seconds after flow stops, and keep measuring while they spin. They therefore cannot meet the custody transfer requirements for truck or railcar loading and offloading as the quantities are too small.

NOTE: Consider on smaller pumping systems (600 gpm or less) in the pumphouse in lieu of venturi tubes.

****

Volumetric Turbine Flow Meter must be a turbine type meter designed for a continuous flow of [4540] [_____] lpm [1200] [_____] GPM, constructed of 316 stainless steel. The turbine meter must be supplied with Class 150 stainless steel ASME flanges, be capable of [1900] [1965] kPa [275] [285] psig system pressure, and must be suitable for hydrostatic testing of [1900] [1965] kPa [275] [285] psig. Meter must be factory calibrated for [F-24] [JP-4] [JP-5] [JP-7] [JP-8] [jet fuel] [mogas] [avgas] [diesel] [bio-diesel] [E-85] [burner fuel oils] [_____]. The measuring element of the turbine will consist of a straight blade, un-rimmed central rotor, rotating about a central rotor shaft that is supported bilaterally within the inside diameter of the meter body by cylindrical shaped spring clips that maintain the shaft and turbine rotor on the center line of the meter body independent of system pressures and temperatures. The cylindrical shaft clips also will counteract swirl and present a uniform fully turbulent flow profile and uniform boundary layer to the cones and turbine rotor. The turbine meter will have an accuracy of plus/minus 0.5 percent over a 10:1 range and a linearity of up to plus/minus 0.25 percent may be attained with premium calibration. Repeatability of the turbine meter will be 0.1 percent of reading over the entire range of the size of the turbine selected. The turbine meter must be approved by US NIST for solvent, gasoline, diesel fuel, fuel oil, and ethanol for use on custody transfer applications.[Provide turbine meter with flow straightener.]

The turbine meter will be supplied complete with an integrally mounted Multi-Function Microprocessor Based Rate Indicator / Totalizer with Field Programmability and Backlit Display in an Aluminum Enclosure. The enclosure must be rated for explosion proof environments. Input power must be self- contained battery, 10-14 VDC or 20-28 VDC. Outputs must include 4-20mA output and pulse output. A reset magnet, aluminum union, and 2-wire Molex signal cable will also be included with the Indicator/Totalizer. The Indicator/Totalizer must have temperature compensation with a four wire RTD input as well as the ability for RS232

data logging.

][2.9 TANK RECEIPT SLOWFILL FLOWRATE INDICATOR

****

NOTE: Select per Service Headquarters or officially designated alternate. Use to ensure that a fuel storage tank is filled at low velocity until the inlet is covered in order to minimize fuel splashing and static charge buildup.

****

Meter must consist of corner tapped orifice flanges, orifice flange plate, differential pressure gauge, and associated flow chart. The normal flow range is 0 to 36 L/s 600 gpm. Orifice flanges must be ANSI Class 150 and must be constructed of Type 304 or 304L stainless steel. Orifice Beta value must be 0.7, with a maximum pressure loss of no more than 20 kPa at 36 L/s 3 psi at 600 gpm. Differential pressure gauge must have a display of 0-30 meters 0-100 feet water column. A hand chart must be provided which shows the flow (L/s gpm) for the pressure drop indicated on the differential pressure gauge. A note must be added: Tank must not be filled faster than [_____] lpm [_____] gpm (one m/s 3 fps) whenever the fuel is not in contact with the floating pan (tank fuel receipt outlet is covered by one meters 3 feet of fuel when no floating pan is present).

]2.10 MISCELLANEOUS USE PUMPS

****

NOTE: API-610 pumps (refer to Section 33 52 43.23 AVIATION FUEL PUMPS) must be used for the prime movers in systems that load and offload trucks, railcars, ships, barges, and for pipeline transfer. Pumps used here are for miscellaneous use only unless otherwise directed by the Service Headquarters or officially designated alternate. See UFC 3-460-01 for guidance.

Self-priming centrifugal pumps are primarily used for systems that occasionally off-load over the road tank trucks using the direct off-loading type system. See UFC 3-460-01 on the limited times when this type of systems is used.

ANSI Type pumps are used for jockey pumps.

Submersible pumps are used at gas stations when the dispenser does not have its own pump. They are also sometimes used as transfer pumps from fuel tanks to day tanks for generators and other similar light duty pumping situations.

Do not use sliding vane rotary pumps to load or offload trucks as they can generate too much pressure and cannot be throttled to limit flow rate.

Indicate the capacity, discharge head pressure, Net positive suction head available, overall efficiency, Voltage, phase, frequency, etc., required for each pump.

Indicate the control sequences for pumps on the drawings.
****

Pumps must be driven by an explosion-proof motor for Class I, Division l, Group D hazardous locations as defined in NFPA 70. Pump assemblies must be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow. Pump motors must be non-overloading throughout their entire pump curve.

2.10.1 Submersible Pump

****
NOTE: Submersible pumps may be used for both above and belowground tanks. Check manufacturer's data since these type pumps may only be capable of handling gasoline or diesel fuels.
****

Pump must be the [single-][multi-]stage, vertical type. Pump and motor combination must operate totally submerged in the product of the storage tank. Pump must extend within 150 mm 6-inches of the storage tank bottom. Pump fuel inlets must be horizontal. Pump mounting must completely support both the weight and vibration of the pump. Pump must include a steel lifting lug capable of supporting the weight of the entire pump and motor assembly. Pump must include a vertical solid shaft motor, base mounting flange, horizontal pump discharge, low net positive suction head (NPSH) first stage impellers, and dynamic and thrust balancing of impellers. Pump must be accessible for servicing without disturbing connecting piping. Pump baseplate, casing, and bearing housing must be of cast iron construction. Pump must be provided with a stainless steel one piece pump shaft. Internal pump components in direct contact with the fuel to be handled must be of compatible construction. Pump bearings must be selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Provide pump with [threaded][flanged] end piping connections.

2.10.2 ANSI Type Centrifugal Pump

a. Overloading, horizontal, centrifugal type. Pump must have a radially split casing with an open impeller and Class 300 flanged connections. The pump suction and discharge flange arrangement must conform to ASME B73.1.

b. Casing discharge must be vertical centerline discharge. Medium and large frame pump casings must incorporate centerline support feet as required by API STD 610. Small frame pumps must not have casing feet. The casing and back cover wall thickness will include 3.2 mm 1/8-inch corrosion allowance. The suction and discharge neck must be drilled and tapped with 6.4 mm 1/4-inch NPT connections, for pressure gauges [and][or] auxiliary piping. A rotation arrow will be cast on the surface of the casing to indicate the proper direction of rotation.

c. Repelling vanes must be cast on the back side of the impeller. The impeller hubs must incorporate a threaded fit to the pump shaft sealed by a Teflon O ring in the hub. The impeller must be balanced to ISO specification G.6.3, with option for G2.5, unless otherwise specified. Balancing must, unless detrimental to the component or its

performance, be attained by the removal of material.

d. The back cover must be fastened to the pump casing with a confined type gasket inert to the fluid being pumped. Seals must be cartridge type end face mechanical seals. The method of lubrication must be oil bath. The thrust bearings must be locked into the cartridge by a bolt-on retainer cover. Snap ring bearing retainers are not acceptable. The radial bearing must be permitted to slide within the inside diameter of the bearing frame to prevent axial load and permit radial load only. Double row filled slot bearings are not acceptable. Bearings must be designed for a minimum L-10 life of 60,000 hours. Angular contact thrust bearings, as required by API STD 610, are required. The pumps must at minimum be fitted with the following bearings:

(1) Small Frame Pumps (ANSI AA through A50):

(a) The thrust bearing: a 5308, AHC3 clearance, double row, deep groove bearing. A pair of 7308 BEGAY, back to back angular contact bearings must be provided as an option when required.

(b) The radial bearing: a 6308, C3 clearance, single row, deep groove.

(2) Medium Frame Pumps (ANSI A60 through A80):

(a) The thrust bearing: a pair of 7310 BEGAY clearance, back to back angular contact bearings.

(b) The radial bearing: a 6310 C3 clearance, single row, deep groove.

(3) Large Frame Pumps (ANSI A90 through A120:

(a) The thrust bearing: a pair of 7314 BEGAY clearance, back to back angular contact bearings.

(b) The radial bearing: a 6314 C3 clearance single row, deep groove.

e. The pump shaft must be of solid construction. Shaft sleeves are not acceptable. In order to establish satisfactory mechanical seal life, the total shaft deflection at the primary seal faces, under the most severe dynamic conditions, must be limited to 0.05 mm 0.002-inch, as required by API STD 610. To achieve this, the stiffness ratios (L3/D4), where L= length of shaft from impeller centerline to nearest bearing in inches and D= shaft diameter under the seal in millimeters inches, must not exceed the following values:

Shaft Size at Seal	L3/D4
Shafts 38 mm 1.5 inch	46
Shafts greater than 38 mm 1.5 inch, 50 mm 2.0 inch	20
Shafts greater than 50 mm 2 inch	19

f. The bearing frame must be cast iron, with radial fins for maximum

cooling. The oil sump must contain a minimum of .23L 8 ounces of oil for small frame pumps, .71 L 24 ounces of oil for mid-frames and .94 L 32 ounces of oil for large. The oil level within the bearing frame must be monitored by an oil sight glass. Two magnetic pipe plugs must be located near the bottom of the bearing frame. The oil fill fitting at the top must be of nylon with an easily removable cap for adding oil. Trico or bottle type constant level oilers are not acceptable. Each end of the bearing frame assembly must incorporate non-contacting labyrinth oil seals. This type of seal is required by API STD 610 to eliminate shaft damage due to fretting and to eliminate the heat generated by the use of contact type lip seals. Other seal systems will be considered only if they are non-fretting. Shaft contacting type lip seals will not be accepted.

g. The thrust bearing end of the bearing frame must be capable of precision impeller adjustments without the need to add or remove shims. The minimum delineation must be .08 mm 0.003-inch and permit impeller clearance settings or readjustments without the need to remove the bearing frame from the volute section and without requiring shims, dial indicators, feeler gauges or disassembly.

h. The pump must be of the back pull-out design to permit the removal of the entire bearing frame assembly, including shaft, mechanical seal, and impeller, without disturbing the pump discharge and suction piping and without disturbing the motor (except for pumps equipped with C-Frame motor adaptors). Small frame and medium frame pumps must have a bearing frame foot that will support the power end in an upright position when removed from the wet end for service. A spacer type coupling must be furnished on non-motor adapter pumps to allow removal of the power end without disturbing the motor.

i. The pump must have the capability of incorporating a C-Frame motor adapter, which permits mounting of motors up to NEMA frame size 256TC for small frame, 405TC (447TSC) for medium frame, and 449T(S)C for large frame, without the need for parallel and angular alignment measurements and adjustments. The motor adapter may be equipped with adjustable feet in order to avoid frame soft foot and eliminate the need to use shims under the adapter assembly.

j. The pump must be constructed of the following materials:

(1) The pump casing and back cover/seal chamber must be constructed of ASTM A743 CF8M.

(2) The impeller must be open type, cast in ASTM A351 CD4MCU.

(3) The pump shaft must be constructed of solid 316SS (ASTM A276 T316) or 17-4PH (ASTM A 564 T630) as required by the application. Bimetallic shafts are acceptable.

2.10.3 Sliding Vane Rotary Pump

Pump must be a sliding vane type rotary pump. The pump construction must permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity must be 189 liters [50][_____] gal per minute with a differential head of 17.4 meters [57][_____] feet. The pump and motor must be mounted on a steel subbase. The motor must 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 must be provided with stainless suction screen.

2.10.4 Self-priming Centrifugal Pump

a. The pump must be a single-stage, horizontal, centrifugal type consisting of a centrifugal impeller combined with a vane-type rotary, positive evacuating, volumetric-displacement priming unit, mounted on a common shaft. Pump must meet MIL-P-52327C.

b. The pump must be such that all rotating parts may be removed without disconnection of the suction or discharge piping.

c. The pump must operate dry for not less than 1-hour without damage or permanent deformation of moving parts after the pump has been operated by the petroleum products.

d. The priming unit must be a vane-type rotary, positive, volumetric-displacement unit mounted on the same shaft as the centrifugal impeller. The priming unit must evacuate air from the suction piping and thereby initially priming the centrifugal impeller and restoring lost prime during the operation of the pump. A stainless steel self-cleaning strainer must be provided in the priming-unit intake line.

e. The motor must 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.

f. Capacity must be [1135] [_____] liters [300][_____] gpm against a total head of [46] [_____] meters [150][_____] feet when driven at 3600 rpm. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump shut-off head must have a 10 to 20 percent head rise to shut off. Pump must be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pumps must not overheat or be damaged in any way while operating continuously at a minimum flow condition of 50 percent of rated flow continuously at a maximum flow condition of 125 percent required capacity. The net positive suction head required at the center of the impeller must not exceed 2 meters 6 feet.

g. Pump must consist of a centrifugal impeller combined with an integral variable-capacity vane type priming unit located within the main centrifugal housing. The vane type positive priming unit must be capable of initially priming the pump and of restoring prime during operation against back pressures to 55 kPa 8 psi. The air release must enable the pump to prime at any discharge head pressure from zero feet to maximum discharge head and must release drip-free to the atmosphere and drain any liquid back into the centrifugal pump.

h. The vane pump must be positively driven by the main pump shaft. No gears or pumps must be required to operate the primary pump. All parts must be factory inspected so that parts are interchangeable. Pumps and motors must be furnished as complete units as herein specified. Pump assembly must be statically and dynamically balanced

for all flow rates from minimum flow to 120 percent of design flow.

i. Pump must include provisions for attaching a vacuum gauge on the suction side and a pressure gauge on the discharge side.

j. The pump must be fitted with a mechanical-type pump shaft seal for closure between the stationary pump case and the pump shaft. The seal must be capable of effectively sealing a pressure equal to 1-1/2 times the pump shut off head. The mechanical-type shaft deal must be a standard product of proven material and design. The sealing surface must be self-aligning and must be readily removable for repair or replacement without removing the electric motor from the base. The sealing surfaces must be constructed of carbon/ni-resist, and the elastomers must be viton. The rotating member must be pin driven by the pump shaft, or must be firmly retained on the pump shaft by a snap ring or other suitable means. Materials used as sealing members or elastomers must be impervious to the deleterious action of the specified product. All parts of the seal must be resistant to corrosion and oxidation.

k. The pump shaft must be fabricated from 410 stainless steel. The shaft must be turned, ground and polished, and hardened to resist wear where the shaft passes through the seal and bearings. The shaft must be supported in the shaft housing by means of heavy duty, anti-friction, sealed type ball bearings.

l. The pump shaft must be coupled to the motor shaft by means of a flexible coupling having sufficient torsional strength to accommodate the rated motor horsepower. The coupling must be capable of handling angular and non-parallel alignment.

m. The pump case must be ductile iron. Flange ratings must be class 105 kg 125-pound per ANSI Standard, and flanges must be faced and drilled.

n. The impeller must be of the closed type, and must be statically and dynamically balanced. The impeller must be constructed of aluminum 356-T6.

[2.10.5 Jockey Pump

The pump must have the capacity of not less than 19 lpm 5 gpm against a total head of 73 meters 240 feet when driven at 3600 rpm and be an ANSI type centrifugal pump.

]2.11 PACKAGED TRUCK OFFLOAD SYSTEM

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

2.11.1 Offload Pump (OP)

Refer to Section 33 52 43.23 AVIATION FUEL PUMPS.

2.11.2 Air Eliminator Tank

2.11.2.1 Tank Housing

Each Tank housing must be fabricated from carbon steel and must 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 must be constructed and labeled in accordance with ASME BPVC SEC VIII D1. The housing must be designed for a working pressure of 600 kPa 90 psig. The inlet and outlet connections must be provided with raised face flanges faced and drilled in compliance with ASME B16.5, Class 150. The configuration of the air eliminator tanks must be as shown on the drawings.

2.11.2.2 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 must 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 must be protected by a minimum of four guard rods.

2.11.2.3 High Level Shutoff

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

2.11.2.4 Level Sensors

The level sensors must be ultrasonic tip sensitive level control switches, NEMA 7/9, weatherproof, explosion proof for Class I, Div I, Group D, temperature T2D (215 degrees C 419 degrees F), 120-volt input power, SPST relay output, 25 mm one-inch flanged mounting.

2.11.2.5 Vent

Tank vent outlet must 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 must be 151 cubic m 5400 cubic feet per hour, vacuum capacity must be 136 cubic m 5000 cubic feet per hour.

2.11.3 Non-Surge Check/Air Block Valve

Refer to Section 33 52 43.14 AVIATION FUEL CONTROL VALVES.

2.11.4 Offload Fuel Hose

The offload fuel hose must 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, non-collapsible, threaded, male NPT, both ends, and have UV protection.

2.11.5 Offload Sight Flow Indicator

The Truck Offload sight flow indicator must be 100 mm 4-inch wafer pattern sight glass, plane indicator aluminum construction.

[2.11.6 Flood Lights

Mount three floodlights on the off load skid, approximately 3.66 m 12 foot high, two on one pole, one on another pole to provide 10 fc of illuminance at the offload connection point and 1 fc of general illumination in the offload area. Fixtures must operate on 277 volts, single phase, 60 Hz. Luminaires must be rated for installation in wet locations and have narrow vertical and wide horizontal beam spread. Luminaires must 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.

]2.11.7 Flowmeter

Meter must be positive displacement type as indicated in paragraph METERS, designed for a continuous flow of [600][300] GPM.

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

][2.11.9 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). Indicate the desire interlock control functions on the drawings.
****

System must include grounding [clamp][plug], grounding cable, and monitoring and control module. System must 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 must conform to MIL-DTL-83413 and MIL-DTL-83413/7.][Grounding plug must [conform to MIL-DTL-83413 and MIL-DTL-83413/4] [_____].] Grounding cable must be corrosion resistant steel strands sheathed in a Hytrel jacket. Cable must be the spiral, self-retracting type. Cable must be a minimum 9 m 30 feet in length. Monitoring and control module must be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations.

Module must include status lights (red for no ground verification and green for positive ground verification) and a lockable bypass switch. Module must include a switch contact to allow interlock functions.

]2.11.10 Other Offload System Components

For other system components shown on the drawings as part of the offload system, refer to this Section and refer to this Section.

2.12 DEAERATOR TANK

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NOTE: For off-loading over the road tank trucks using a direct off-loading system. See UFC 3-460-01 for when this is used.

Note: If the deaerator tank and downstream meter are followed by a filter separator in reasonably close proximity, the air block function can be added to the filter separator control valve by adding solenoid enable feature to that valve.

****

Deaerator tank must be constructed of carbon steel, designed, constructed and labeled in accordance with ASME Code, Section VIII, Division I, and must be interior epoxy coated in accordance with MIL-PRF-4556. No ferrous or zinc-coated material bronze, brass or other copper bearing alloys must be used in contact with the fuel. It must be rated for a working pressure of [1.90 Mpa] [1.97 Mpa] [275 psig] [285 psig]. Unit must be sized for a flow rate of [_____] lpm gpm and incorporate 100 mm 4-inch Class 150 flanges per ASME B16.5. Unit must incorporate an internal baffle/diffuser plate to inhibit the passage of air through its outlet flange. The unit is intended to prevent the passage of air through the downstream flow meter, and requires the use of a downstream air/block valve. Unit to be complete with the following accessories:

a. A 13 mm 1/2-inch stainless steel sight gauge for level indication.

b. A 50 mm 2-inch FNPT, two-stage, automatic air vent with outlet check.

c. A 50 mm 2-inch FNPT, stainless steel, 100 mesh, strainer for under Automatic Air Vent (AAV).

d. A 25 mm one-inch by 25.4 mm one-inch flanged relief valve, ASME Code, set at working pressure.

e. A 50 mm 2-inch MNPT, Explosion-proof, Class I, Div. I, Group D, side mount, float type level switch, SPDT, mounted a minimum of 635 mm 25-inches above the tank's outlet flange, to be wired to the air/block valve.

f. A 12.7 mm 1/2-inch flanged drain valve.

2.12.1 Deaerator Tank Air Block Valve (DTBV)

Refer to Section 33 52 43.14 AVIATION FUEL CONTROL VALVES.

2.12.1.1 Size

As indicated.

2.12.1.2 Flow

As indicated.

2.12.1.3 Operation

Deaerator block valve must be hydraulically operated. Upon a rise in air level in the deaerator tank as indicated by the level switch, the main valve must close tightly. The main valve must remain closed until a rise in tank fluid level above the level switch occurs.

2.12.1.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.12.1.5 Flow Control

Valve to limit flow to [_____] lpm gpm. Sensing must be by orifice. Valve to modulate to limit flow without hunting. Rate of flow to be manually adjustable and utilize a downstream orifice plate holder.

2.12.1.6 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.12.1.7 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 34 to 172 kPa 5 to 25 psi.

2.12.1.8 Opening Feature

The valve must be equipped with an adjustable differential pressure pilot and a quick cover exhaust system to allow the valve to open in 3-4 seconds when pressure is greater than [_____][207] kPa [_____][30] psig.

2.12.1.9 Solenoid Control

The valve must be provided with solenoid control. The solenoid must close the DTBV upon low level alarm activation. The solenoid must be energized to close.

2.13 REFUELER TRUCK FILLSTAND (PANTOGRAPH TYPE)

For pantograph style fillstands, provide refueler and tactical refueler truck fillstand pantographs as specified in Section 33 52 43.12 AVIATION FUEL PANTOGRAPHS.

2.14 REFUELER TRUCK FILLSTAND (HOSE TYPE)

2.14.1 Truck Fillstand Hose

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NOTE: For bottom loading applications of refuelers and tactical refuelers that uses hoses instead of pantographs, include this paragraph. Indicate the size and length of each hose on the drawings.

EI 1529, as referenced below, covers hoses that vary in diameter from 25 to 100 mm one to 4-inches. Per the API standard, hoses are to be cut to length by the hose manufacturer and not spliced in the field. In addition, couplings are to be installed on both ends of each hose by the hose manufacturer. Specifically indicate on the drawings the size of the couplers required.

For unsupported hose applications, suggest designing a hose tray and nozzle holder or some type of hose hanging rack.

a. Hose Tray and Nozzle Holder. Construct the tray and holder of either aluminum or stainless steel to be compatible with the piping. Design trays to support the entire length of the fueling hose, allow for draining of rainwater, support the fueling hose at the proper height, protect the hose from the sun's ultraviolet rays, and allow for easy insertion and removal of the hose. Suggest designing hose trays with a hinged cover when the trays are not located under a canopy or roof.

b. Hose Hanging Rack. These type racks are most commonly provided for Tank Truck Off-Loading Assemblies. Refer to DoD Standard Design AW 078-24-28 "Pressurized Hydrant Fueling System Type III" for details.

****

Provide hose that conforms to EI 1529, Grade 2, Type C, semi-hardwall. Provide each hose end with a coupler that conforms to paragraph [DRY-BREAK COUPLER][QUICK DISCONNECT COUPLER].

2.14.2 Truck Fillstand Swivel Joints

Flanged swivel joints must be stainless steel, single plane, capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe [and][or] elbow is not permitted. Swivel joints must be of the non-lubricated, maintenance free type with sealed bearings and no lubricating fitting. Swivel joint must be flanged at the end connecting to the piping system and threaded (female NPT) at the end connecting to the fuel hose. No leakage must be permitted under positive or negative pressure conditions. No leakage must be permitted under high or low temperature conditions. Welding of swivel joint to six-bolt flange connector is permitted. The swivel joints must be warranted for three years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps. The electrical continuity from one flange to another (without the use of ground straps) must be less than 1000 ohms. Each swivel joint must have two ball bearing raceways, primary and secondary seals with leak detection port, and dust seal.

2.15 TANK TRUCK BOTTOM LOADING ARM

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NOTE: This section covers loading arm assemblies used to load bulk fuel into over-the-road tank trucks and rail cars. These have also been used to load specialty lube oils into tank trucks for distribution to aircraft carriers and submarines.

These systems are not used to load refueler trucks.

These are bottom loading systems.

This specification covers two types of loading arms; the hose loader type and the A-frame type. Delete either type if not applicable.

a. Hose loader type arms are designed to reach a fueling connection at a certain fixed distance. The drop hose in the assembly provides a little flexibility in the connection distance, but not significantly. These type arms do not collapse, but instead swivel on a riser swivel.

b. The A-frame type arms are expandable and collapsible and therefore can accommodate a fueling connection from varying distances and heights.

Where multiple loading arm assemblies are installed adjacent to one another, consider requiring each assembly to have crossover capabilities in order to provide the user with the most operational flexibility possible.

As a minimum, show on the drawings the following construction requirements for each loading arm specified.

a. Size of all loading arm piping. Pipe sizes are typically 50, 75, or 100 mm 2, 3, or 4-inches.

b. The maximum distance the assembly is required to fully expand during operation. Also show the collapsible envelope in which the loading arm is expected to be contained.

c. The minimum elevation above grade that the assembly's dispensing end is required to couple with a tank truck or tank car. This elevation is typically 300 mm 12-inches.

d. The maximum elevation above grade that the assembly's dispensing end is required to couple with a tank truck or tank car. This elevation is typically 1400 mm 55-inches.

****

Loading arm must be the factory fabricated, factory assembled, bottom

loading type. Loading arm must include swivel joints, boom assemblies, and riser standpipe. Loading arm's pipe and fittings must be Schedule 10S, Grade TP304L, stainless steel in accordance with ASTM A312/A312M.[Provide adjacent loading arm assemblies with the ability to crossover one another during operation.]

2.15.1 Dispensing End

The weight of the loading arm's dispensing end (includes piping, valves, nozzles, miscellaneous components, and fuel weight) must be counteracted by a counterbalance system. The counterbalance system must be the [hydraulically actuated cylinder][or][spring counterweight] type. The counterbalance system must allow one operator to manually maneuver and control the dispensing end at all times. The counterbalance system must ensure that minimum force is transferred from the dispensing end to a fueling connection. Nozzle in the dispensing end must be in accordance with paragraph PRESSURE FUELING NOZZLE.

2.15.1.1 Hose Loader Type

Dispensing end must be the fixed reach, hose loader type. Hose used in the loading arm assembly must be in accordance with the paragraph in this Section TRUCK FILLSTAND HOSE.

2.15.1.2 A-Frame Type

Dispensing end must be the rigidly piped, variable reach, A-frame type.

2.15.2 Truck Loading Arm Swivel Joints

Swivel joints must be the flanged, non-lubricated type with sealed bearings. Swivel joints must come from the manufacturer with required flanged bodies and flanged elbows. Welded swivel joints and welding of swivel joints to the pipe [and][or] elbow will not be permitted. Welding of swivel joints to flange joints will not be permitted. Swivel joints must be warranted for two years against leakage due to both positive and negative pressure conditions. Swivel joints must be capable of 360-degree rotation.

****

NOTE: For bottom loading applications of refuelers and tactical refuelers that use pantographs instead of hoses, include this paragraph. Indicate the size and length of each pipe section on the drawings.

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2.16 TOP LOADING ARM

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NOTE: Top loading is not allowed by UFC 3-460-01 and is actively discouraged for safety reasons. It should only be used when the trucks being filled are incapable of bottom loading. Use of a top loading arm must be approved by the Service Headquarters or officially designated alternate.

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Top loading arm [50 mm- 379] [75 mm- 757] [100 mm- 1135]lpm [2-inch-100] [3-inch-200] [4-inch-300]gpm must have sufficient horizontal reach and

pivot points to assure the vehicle does not have to be re-spotted. Drop pipe length must be able to reach fill tank bottom and be at a safe elevation for refueler operation. Loading arm must have four planes of movement: up-down (to allow drop pipe to enter tank), side to side (to allow arm to rotate out to tank and back out of position), drop-tube (to assure drop-tube remains vertical), scissor arm pivot (which allows 360 degree rotation of secondary arm allowing the drop-tube to reach further out thus allows a larger spotting distance). Materials of construction must be stainless steel. Arm must be counterweight or spring assisted for effortless operation of loading arm. Swivel joints must be of the non-lubricated, maintenance free type with sealed bearings and no lubricating fittings. Assembly must be a regular product for the purpose of top loading fuel from a manufacturer who has successfully provided the product for at least the past five years.

2.17 NOZZLES AND ADAPTERS

2.17.1 Pressure Fueling Nozzle

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NOTE: Specify type of nozzle as directed by the Service Headquarters or officially designated alternate.

****

Nozzles must conform to SAE AS5877, Type [D-1] [D-2] [D-3]. Nozzles and nozzle components must be compatible with the fuel to be handled. Nozzles must be provided with an internal 60 mesh stainless steel strainer and a fuel sample connection tapping. Nozzle design must be for single point fueling of aircraft. Nozzles must be provided with a compatible dry break quick disconnect swivel. Coupler must allow for quick disconnect and reconnect of fueling nozzles with corresponding adapters. Coupler and adapter must provide a positive, leak proof connection under constant or surge flow. Coupler must be designed to prevent blowout of internal poppet.

2.17.2 Nozzle Adapter (SPR)

Adapter must be a nominal 63.5 mm 2-1/2-inches with self-closing valve in accordance with MIL-A-25896. Adapter must have a 100 mm 4-inch flange mounting and vacuum tight, locking dust cap using the SPR lugs.

2.17.3 Tight-Fit Fill Adapter

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NOTE: Tight-fit fill adapters are commonly used on the inlet fill piping for horizontal fuel tanks and on the piping connections for tank truck load/unloading facilities.

Show the nominal size of each required adapter on the drawings. Adapters are typical available in either 75 or 100 mm 3 or 4-inches. Coordinate the size of each adapter with the size of the connecting coupler.

Select the type of adapter seal (top or side) based upon the type of the connecting coupler.

****

Adapter must be the [top seal] [side seal] type. Adapter must provide a tight-fit connection to prevent vapor emissions during fuel transfer. Adapter must be bronze and be fitted with a Buna-N or Viton gasket. Provide a locking cap with each adapter. Cap must mate with the adapter and have a latching mechanism that provides a watertight seal. Cap must provide some type of locking provision and be easily attachable and removable. Cap must be attached to the tight-fit vapor recovery adapter by a minimum 300 mm 12-inch section of brass cable or fuel resistant rope.

2.17.4 Tight-Fit Vapor Recovery Adapter

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NOTE: Tight-fit vapor recovery adapters are commonly used on the inlet fill piping for horizontal fuel tanks and on the piping connections for tank truck load/unloading facilities. Delete this paragraph if a vapor recovery system is included in the design.

Show the nominal size of each required adapter on the drawings. Adapter are typical available in either 75 or 100 mm 3 or 4-inches. Coordinate the size of each adapter with the size of the connecting coupler.

Select the type of adapter seal (top or side) based upon the type of the connecting coupler.

****

Adapter must be the [top seal] [side seal] type that includes an internal self-closing valve or poppet. Adapter must provide a tight-fit connection to prevent vapor emissions during fuel transfer. Adapter must be bronze and be fitted with a Buna-N or Viton gasket. The adapter's internal valve or poppet must be driptight throughout the entire specified temperature range. The adapter's internal valve or poppet must prevent vapor emissions when the locking cap is removed yet must open immediately when the adapter is connected to an appropriate coupler. The adapter's internal valve or poppet must operate at a lower pressure/vacuum than the system's pressure/vacuum relief vent in order for vapors to flow as designed instead of exiting to the atmosphere through the vent piping. Provide a locking cap with each adapter. Cap must mate with the adapter and have a latching mechanism that provides a watertight seal. Cap must provide some type of locking provision and be easily attachable and removable. Cap must be attached to the tight-fit vapor recovery adapter by a minimum 300 mm 12-inchsection of brass cable or fuel resistant rope.

2.17.5 Dry Break Coupler

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NOTE: Dry break couplers must be for over the road tank truck loading and offloading only.

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API RP 1004 coupler must be compatible with the connecting adaptor. Coupler must provide a positive, leakproof connection when under constant or surge fuel flow. Coupler must prevent vapor emissions during fuel

flow. Seals within the coupler must be Buna-N or Viton. Coupler must have an internal, manually operated shutoff valve. The valve must have an external operating handle with the valve's position (open or closed) clearly labeled. The internal valve must not be capable of being manually opened unless the coupler is properly connected to its connecting adapter. After connecting coupler and adapter, opening of the coupler valve must in turn open the poppet of the adjoining adapter to allow fuel flow.

2.17.6 Quick Disconnect Coupler

Coupler must be the quick disconnect, cam type that conforms to CID A-A-59326.[Provide coupler with a stainless steel dust plug and a stainless steel hanging eye for truck offloading systems.]

2.18 FILTER/SEPARATOR

Provide filter/separator as specified in Section 33 52 43.28 FILTER SEPARATOR, AVIATION FUELING SYSTEM.

2.19 HIGH POINT VENT AND LOW POINT DRAIN PITS

****

NOTE: Pits must be used at each high point vent as well as each low point drain. Use this aircraft rated pit at every location on the "Airside" of an airfield, even where it is unlikely an aircraft may stray, such as behind blast fences and small buildings. Indicate pit details along with internal piping details.

****

2.19.1 Pit Assembly

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

2.19.2 Pit

The basic pit must 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 must contain two integral concrete anchors. The fiberglass top flange must require no exposed corrosive material, weldments, or strongbacks within the pit to support the cast aluminum ring and cover assembly. The pits must be the standard products of a firm regularly engaged in the manufacture of such product and must essentially duplicate items that have been in satisfactory use for at least three years prior to bid opening. Proof of experience will be submitted.

2.19.3 Pit Cover, General Requirements

The pit cover must include a removable outer ring frame and an interior 457 mm 18-inch diameter (clear opening) hinged lid that opens 160 degrees.[The pit must have a tamperproof cover. The removable outer ring must 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 must have a means of being locked.] Each cover lid must move smoothly through its entire range of motion and must require a

maximum opening force of 150 N 35 pound-force to be applied at a single lifting handle. Each handle must provide a comfortable, secure grip for an average adult male's full gloved hand. Tools must 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, must not be allowed. The pit service must be integrally cast in raised letters on the top surface of each lid. The lettering must be a minimum of 25 mm one-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) must be machined to assure uniform weight distribution.

2.19.4 Pit Cover Materials, Design, and Testing

****

NOTE: Select per direction from Service Headquarters or officially designated alternate.

****

The cover frames and lids must 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 must 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 must be ductile, corrosion-resistant, impact-resistant, and suitable for the intended use. All covers must be non-skid surface construction and free of injurious defects. Welding for the purpose of structural repair of casting defects must not be allowed. Minor cosmetic welding is acceptable. The cover must 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 must be considered as failure. Actual load-tests must be performed on a minimum of 10 percent of all the covers supplied. Load-tested units must be randomly selected. Load-test conditions must model field-installed conditions as nearly as practicable. The 800 kN 200 Kip test-load must be applied to the cover for a minimum duration of 5-minutes. Absolute maximum deflection of the cover lid under the test-load must 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 must be plus 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 must be carefully examined for cracks or localized areas of permanent deformation. All results must be submitted for review and approval. A single failure to meet any of the stated criteria must be considered sufficient grounds for the testing of 50 percent of the units.

2.19.5 Pipe Riser Seal

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

2.20 FRP CONTAINMENT SUMP

****

NOTE: FRP sumps may be used as an alternative to

the vent and drain pits defined above, except that these sumps are non-load bearing and will not be used under an aviation apron.

Sumps may also be used as a leak collection point in belowground secondarily contained piping systems. In this application, sumps will be used in combination with leak sensors to make up the belowground pipe monitoring system.

Sumps may also be used at low drain points, high vent points, and at aboveground to belowground transitions. In addition, sumps may also be used to house belowground valves or system components.

Indicate on the drawings the size, location, and depth required for each FRP containment sump.

****

Sump must be constructed of fiberglass reinforced plastic (FRP) that is chemically compatible with the fuels to be handled. Do not connect sump in any way to the manway cover or concrete above. Cap the top of each containment sump with a [friction fit] [watertight] access cover. Construct cover of the same material as the sump. Cover must have a minimum diameter of 550 mm 22-inches. Cover must be easily removable through the manway above.

a. Rainfall drainage must not drain into a sump. Sump must be capable of withstanding underground burial loads to be encountered. Container must have a minimum 19 L 5 gal fuel storage capacity. Container must not contain any type of drain.

b. The sides of a containment sump must allow the penetration of carrier pipes, exterior containment pipes, conduits, and vapor pipes as required. Boot or seal penetrations in the containment sump sides to ensure that liquid will not escape from the sump in the event that the liquid level within the sump rises above the pipe penetration. Provide boots and seals that are chemically compatible with the fuel to be handled and that are water resistant to the influx of ground water. Boots and seals must be designed and installed to accommodate the anticipated amount of thermal expansion and contraction in the piping system.

2.21 LIQUID LEVEL GAUGE

****

NOTE: Included the bracketed sentence if required by the using agency. Use with caution as if the glass breaks the tank will drain down to the break point.

****

Gauge must be the factory fabricated, sight glass assembly type designed to allow visual observation of liquid levels within a vessel. Assembly must include a 15 mm 1/2-inch [glass] [fully shielded glass] tube, a ball check in both the upper and lower fittings, a shutoff valve in both the upper and lower fittings, guard rods, and a blowoff cock in the lower fitting. Gauge's body must be constructed of stainless steel.[The gauge

must contain a colored density sensitive ball.]

2.22 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. 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 direction from Service Headquarters or officially designate alternate.
****

Level accuracy plus/minus 1.25 mm 0.05-inches

Corrected volume accuracy plus/minus 0.1 percent

Density accuracy plus/minus 1 percent

Temperature accuracy plus/minus minus 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 must include an ENDRESS+HAUSER RTU 8130 and a local display similar or equal to a CP/2500. The RTU must transmit data to the Base FAS System located in the RCC via telephone lines as shown on the drawings. Base personnel must coordinate reprogramming of the FAS System to accept this new data.

]2.23 OPERATING TANK LEVEL SWITCHES

****
NOTE: Select per direction from Service Headquarters or officially designate alternate.
****

The switches must 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 must 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 must have provisions to check level switch operations without increasing the fuel level in the tanks as shown on the contract drawings.

2.24 OPERATING TANK LEVEL SWITCHES

****
NOTE: Select per direction from Service Headquarters or officially designate alternate.
****

a. System must be designed and installed in such a way that the system must be continuously and automatically self-checking. Switches must be an external mount with a stainless steel fluid chamber. Electronic level sensors must 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 must be accessible from the stairway. Units must have provisions to check level switch operations without increasing the fuel level in the tanks as shown on the contract drawings.

b. Level alarms must be mechanically and electrically independent and be totally isolated from the gauging system. The level switches must 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 must be intrinsically safe.

[2.25 OPERATING TANK LEVEL SWITCHES

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

a. System must be designed and installed in such a way that the system must be continuously and automatically self-checking. Switches must be mounted on top of the tank, in the pump house, as indicated. Electronic level sensors must 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 must be accessible.

b. Level alarms must be mechanically and electrically independent and be totally isolated from the gauging system. The level switches must 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 must be intrinsically safe.

]2.26 WATER DRAW-OFF SYSTEM

****

NOTE: Use a FUEL SYSTEM WASTE WATER TANK when designing a CUT AND COVER SYSTEM if directed by Service Headquarters or officially designate alternate.

****

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

2.26.1 Tank

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

2.26.2 Sight Glass

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

2.26.3 Return Pump

****

NOTE: Insert site specific Pump requirements.

****

Product return pump (PRP-1 and PRP-2) must have the capacity of not less than 0.30 L/s 5 gpm against a total head of [_____] mm feet when driven at 3600 rpm. The pump must have flange connections and must 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 must be explosion-proof, Class I, Division 1, Group D with maximum temperature rating of "T2D" (216 degrees C 419 degrees F). The motor must 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 must include a pressure relief between the discharge and suction protecting the pump from overloading.

2.26.4 Anchoring

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

2.27 GROUNDING CABLE AND CLAMP

****

NOTE: Type I systems have 23 m 75 foot cable lengths. Type II systems have 15 m 50 foot cable lengths.

****

Grounding system must conform to CID A-A-50696, Type [I] [II].

[2.28 OPERATING TANK VENT

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

Tank vent outlet must 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 must be 75 L/s 9700 cubic feet/hour, vacuum capacity must be 115 L/s 14500 cubic feet/hour.

]2.29 GROUND VEHICLE FUELING SYSTEM COMPONENTS

2.29.1 Product Dispensing Unit

****
NOTE: Per UL 87, there are two types of dispensing units (remote control type or a self-contained type). Self-contained units include a power operated pump as part of the assembly (remote control type units do not). Self-contained units are commonly referred to as suction dispensers.

Dispensing units to be used with E85 fuel must be specifically designed and warranted as E85 compatible. Reference UL 87A if the use of E85 fuel is possible, otherwise reference UL 87. Materials that will be in direct contact with the E85 fuel must be either stainless steel or nickel plated aluminum.

****

Unit and unit hardware must be the factory fabricated type that conforms to [UL 87][UL 87A], except as modified herein.[Unit housing and housing top must be constructed of stainless steel or aluminum in accordance with [UL 87][UL 87A].][Materials for unit components that will be in direct contact with the fuel must be stainless steel or nickel plated aluminum.] Unit must be computer controlled, lighted, [single] [double] sided, with [one] [two] [three] [four] [_____] hose outlets [each] suitable for single product delivery flow rate of 0.76 liter per second 12 gallons per minute from each nozzle. Unit must be the [remote control] [self-contained] type. Unit housing must include a locking mechanism for each nozzle to allow securing each nozzle to the housing during non-operational periods.

2.29.1.1 Self-Contained Pump

****
NOTE: Delete this paragraph if remote control type units are to be specified. Remote control type units will be used in conjunction with pumps as defined in either Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT) or Section 33 52 10 FUEL SYSTEMS PIPING (SERVICE STATION) as applicable.

Self-contained pumps will only be used in conjunction with belowground storage tanks.
****

Provide internal gear-type rotary suction pumps with adjustable bypass valves and suction strainers.

2.29.1.2 Accounting Meter and Display

Provide unit with positive displacement type meter and the manufacturer's standard microprocessor that has the following functions:

a. Displays: Solid state liquid crystal displays (LCD'S)[, five-digit cash display to $999.99], with automatic shutdown, and four-digit volume display to 999.9 liters 999.9 gallons.

b. Totalizer: Eight-digit (999,999.99) electronic totalization with identification for each product volume in liters gallons.

[c. Price setting: Price-jog keyswitch on each computer housing to enable remote price setting from management control system.

]2.29.1.3 Filters

Provide a replaceable filter element on each product line with a nominal filtration efficiency of 0.005 mm 5 micron or smaller porosity filters for gasoline and ethanol products, and 0.025 mm 25 micron or smaller porosity filters for diesel and biodiesel product with a flow rating equal to the rate of the dispensing unit.

2.29.1.4 Battery Backup

Provide battery backup with automatic charging circuits to hold data for a minimum of three months without recharging. Sales display must remain visible for 15 minutes after power failure.

2.29.1.5 Interlocks

Provide nozzle supports interlocked to pump motor control switch to start and stop the pump by nozzle removal and replacement. Provide each unit with interlock switch and valve arrangement that prevents flow of product until meter is reset after dispensing nozzle is returned to holder.

2.29.1.6 Hose

Provide dispensing hose [conforming to UL 330] [of the coaxial vapor recovery type certified by the California Air Resources Board (CARB)], gasoline and oil resistant, statically grounded, flexible in sub-zero temperatures.[Hose must be compatible with E85 fuel.] Provide a minimum of [3] [3.7] meters [10] [12] feet of hose for each product line on the dispenser. Provide each hose with spring loaded cable to return device attached near mid-length of hose.

2.29.1.7 Nozzles

Provide manually activated, automatic shutoff type nozzles [with][without] a latch-open device. Nozzles must have full hand insulator to prevent splash-back.[Nozzles must be CARB certified for Stage II vapor recovery, contain an integral vapor valve[and evacuator], and be of the [bellows]

[bellowless] design.][Vapor recovery nozzles are not required for diesel dispensing systems.]

2.29.1.8 Breakaway Device

Provide each product hose with UL listed[and CARB certified] emergency breakaway device designed to retain liquid on both sides of breakaway point. Breakaway device must have pressure balancing chamber to override line pressure to prevent nuisance breaks caused by a restriction in delivery hose diameter.

2.29.1.9 Emergency Shutoff Valve

Provide valve that conforms to UL 842. Valve must provide complete shutoff of a fuel line in the event a dispenser is dislocated or overturned due to a sudden impact. Valve must include a secondary poppet to limit spillage from the dispenser after a knockdown or during installation.

2.29.1.10 Dispenser Sump

Provide a sump under each dispensing unit. Each sump must provide convenient service access to piping components enclosed in the sump. Sump must be constructed of fiberglass-reinforced plastic. Sump must be chemically compatible with the fuel to be handled by the dispensing unit and any connecting piping. Sump must prevent fuel from escaping to the soil and ground water from entering the sump. Sump must provide a liquidtight termination point for secondary containment piping that allows for the anticipated expansion and contraction of the piping system. Sump must withstand maximum burial loads. Sump must mount directly to the bottom of the dispensing unit with a centering ring or stabilizer bar to assure proper shearing action for the emergency shutoff valve.

2.29.1.11 Accessories

Equip each assembly with accessories such as built-in air eliminators, line check valves, and lockable housing.

2.29.2 Management Control System

Provide management control system that furnishes computerized control of station fuel dispensing system including operational, control, and management functions from a central control console with displays and separately mounted electronics and data cabinets. Provide functions to provide receipt and report printout types.

2.29.2.1 Operating Functions

System must operate up to [_____] fueling positions with up to [_____] different products. System must operate prepay on preset volume or dollar operation. System must display grade, dispenser number, volume, and sales amount in one sequence. Provide audible signals and flashing indicators to alert operator to customer needs and dispenser status. Provide functions to calculate change if tank is too full to accept prepaid amount.

2.29.2.2 Control and Management Functions

System must accumulate, store, and deliver full range of management information including pricing by grades and types of service. System must

provide totals for up to four shifts by product volume, cash and credit sales, and declining balance inventory.

2.29.2.3 Control Console

System must provide the following:

a. Indicators: Call, ready, in-use, used, stopped, unpaid

b. Manager's keyswitch: Key protection for setting operating modes

c. Keyboard: Standard international 11-pad numerical

d. Clock: Real-time operating, showing year, month, day, hour, minute, second

e. Function keys: Pump stop, pump start, mode, unit price, refund, recall, cash/credit, volume, print/enter, clear, credit paid, cash paid, authorize

2.29.2.4 Display

System must provide the following with light emitting diodes (LED'S):

a. Operating: Grade, pump number, volume, cash

b. Mode or memory: Mode number, sub-mode, memory data

c. Display indicators: Water, low inventory, new data, mode, prepay/preset, volume, cash, credit, return, price

2.29.2.5 Power

System must operate at 115 volts, 60 hertz.

2.29.3 Receipt and Totals Printer

****
NOTE: Include a receipt and totals printer only if required by the Using Agency.
****

Provide printer with the following characteristics:

a. Minimum print speed: 1.25 lines per second

b. Line length: 40 column, 12 characters per 25 mm inch

c. Paper: Roll, one- or two-ply, 86 mm 3-3/8 inches wide

d. Spacing: 6 lines per vertical 25 mm inch

e. Character types: Upper and lower case, 96-character alpha-numeric, normal and double-width

f. Printing mechanism life: 10 million cycles

g. Power: 115 volts, 60 Hz

2.29.3.1 Customer Receipt

Configure printer and system functions to print the following customer receipts.

a. Time, date, and day of week

b. Name and grade of fuel product

c. Pump number and unit price

d. Total sale by payment method (cash or credit)

e. Total sales volume in gallons or liters

f. Prepaid deposit

g. Discount amount where applicable

h. Transaction number

i. Three line customizable heading

j. Customer receipt available only after dispensing

2.29.3.2 Shift Change Totals

Configure printer and system functions to print the dollar and volume totals and totalizer readings for current, first, second, and third shift totals.

2.29.3.3 Unit Price Summary

Configure printer and system functions to print the dollar and volume totals and totalizer readings for current, first, second, and third shift totals.

2.29.3.4 Station Programming Data

Configure printer and system functions to print the list parameters that determine which station dispensing system will operate.

a. Prepay or post pay

b. Cash or credit pricing

c. Sales and volume ration limits

2.29.3.5 Diagnostic Messages

Include printer test, last mode entries, system power ON/OFF records, and other information for diagnosing problems by station personnel.

2.30 VALVE AND SYSTEM COMPONENTS EXTERIOR PROTECTIVE COATINGS

2.30.1 Factory Coating

Valves, system components, and components must be blasted clean according to SSPC SP 5/NACE No. 1, and must be primed and coated in accordance with

Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES.

2.30.2 Field Coating

Painting required for surfaces not otherwise specified must be field painted as specified in Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES. Do not paint aboveground stainless steel and aluminum surfaces. Do not coat system components or components provided with a complete factory coating. Prior to any field painting, clean surfaces to remove dust, dirt, rust, oil, and grease.

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 system components installation. Provide required clearances between equipment components, system components, apparatus, and accessories requiring normal servicing or maintenance to be accessible.

3.1.2 Anchoring

Anchor system components in place. Check alignment of anchor bolts before installing system components 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

System components which are anchored to a pad is to be grouted in place. Before setting system components 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 must be in accordance with ASTM C827/C827M. Perform all grouting in accordance with system components manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

Level and align system components in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align system components. Install only flat

shims for leveling system components. Place shims to fully support system components. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than system components bearing surface. Shims to provide for full system components 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 must 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 system components manufacturer.

3.1.6 Precautions

Special care must be taken to ensure that system components 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. System components brought to the site and not stored inside, must be stored on blocks or horses at least 450 mm 18-inches above ground.

b. Visual inspection must be made of each piece of system components to ensure that it is clean prior to installation.

c. The open ends of system components must be closed when work with that piece of system components is not in progress.

3.2 INSTALLATION OF UNDERGROUND TANKS

Installation must 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 must be tightness tested in accordance with NFPA 30.

3.2.1 Coating Testing

The coating must be examined for flaws and tested for thickness. Provide the facilities, personnel, and equipment for testing for flaws and thickness. Thickness must be measured electronically. Coating must 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 must 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 must be repaired with materials identical to those used originally, and after drying, must 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 must 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 must 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, must 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 must 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 VEHICLE DISPENSING UNIT

Following installation, fill island riser holes with clean sand. Install emergency shut-off valves with breaking point level with island surface. Isolate dispensing units from piping during flushing and cleaning operations.

3.5 POSTED OPERATING INSTRUCTIONS

For each designated system or system components 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:

3.5.1 Each System

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

3.5.2 Each Tank

For each tank provide a P.E. stamped certified tank calibration chart in 1/16-inch increments reading in gallons, except for tanks less than 5,000 gallons.

3.5.3 Each Item

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

3.5.4 Diagrams

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

3.5.5 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.

3.6 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the system components/systems specified herein. Include pertinent safety operational procedures in the session as well as physical demonstrations of the routine maintenance operations. Furnish instructors who are familiar with the installation/system components/systems, both operational and practical theories, and associated routine maintenance procedures. The training session must consist of a total of [_____] hours of normal working time and must start after the system is functionally completed, but prior to final system acceptance. Submit a letter, at least 14 working days prior to the proposed training date, scheduling a proposed date for conducting the on-site training.

-- End of Section --