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USACE / NAVFAC / AFCEC / NASA **UFGS-33 57 00 (August 2011)**

Preparing Activity: USACE **Superseding**
UFGS-33 52 44 (April 2008)
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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2014
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SECTION 33 57 00

BULK FUEL RECEIVING/DISPENSING EQUIPMENT
08/11

****
NOTE: This guide specification covers the requirements for fuel receiving/dispensing equipment for both aviation distribution systems and general service fuel piping systems. Do not use this specification for designs related to pressurized hydrant fueling systems. For such systems, refer to Standard Design 078-24-28 PRESSURIZED HYDRANT FUELING SYSTEM (TYPE III).

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

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

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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NOTE: Use this UFGS in conjunction with UFC 3-460-01 "Design: Petroleum Fuel Facilities". Include in this specification any additional equipment/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, etc.), the designer will have to modify this specification appropriately.

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

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

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

****

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

AMERICAN PETROLEUM INSTITUTE (API)

API RP 2003	(2008; 7th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API Std 610	(2010; Errata 2011) Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries

ASME INTERNATIONAL (ASME)

ASME B1.1	(2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Nuts for General Applications:

	Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.3	(2012) Process Piping
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2013) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A182/A182M	(2013a) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2012a) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2013) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A216/A216M	(2012) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A276	(2013a) Standard Specification for Stainless Steel Bars and Shapes
ASTM A312/A312M	(2013b) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A582/A582M	(2012; E 2012) Standard Specification for Free-Machining Stainless Steel Bars
ASTM A743/A743M	(2013a) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B241/B241M	(2012; E 2013) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B247	(2009) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM D229	(2013) Rigid Sheet and Plate Materials

Used for Electrical Insulation

ASTM F436 (2011) Hardened Steel Washers

ENERGY INSTITUTE (EI)

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

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1100 (2005) Emerald Book IEEE Recommended Practice for Powering and Grounding Electronic Equipment

IEEE 142 (2007) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA MG 1 (2011; Errata 2012) Motors and Generators

NEMA MG 11 (1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

NFPA 407 (2012; TIA 11-1) Standard for Aircraft Fuel Servicing

NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013) National Electrical Code

NFPA 77 (2014) Recommended Practice on Static Electricity

NFPA 780 (2014) 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 (2007; Rev A) Aircraft Pressure Refueling Nozzle

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-83413 (2012; Rev C) Connectors and Assemblies,

	Electrical, Aircraft Grounding, General Specification for
MIL-DTL-83413/4	(2013; Rev D) Connectors and Assemblies, Electrical, Aircraft Grounding: Plugs, for Types I and II Grounding Assemblies
MIL-DTL-83413/7	(2012; Rev E; Am 1 2013) Connectors and Assemblies, Electrical, Aircraft Grounding Clamp Connector for Types I and III Grounding Assemblies, Clip, Electrical
MIL-PRF-370	(2002; Rev J) Hose And Hose Assemblies, Nonmetallic: Elastomeric, Liquid Fuel
MIL-PRF-4556	(1998; Rev F; Am 1 1999; CANC Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-PRF-52747	(1996; Rev F) Nozzle Assembly, Closed-Circuit Refueling, Standard and Arctic Service
MIL-PRF-52748	(1995; Rev F; Notice 1 2004; Notice 2 2010) Nozzle, Adapter, Closed-Circuit to Gravity Fill, Standard and Arctic Service

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50696	(Basic) 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

UNDERWRITERS LABORATORIES (UL)

UL 330	(2009; Reprint Aug 2013) UL Standard for Safety Hose and Hose Assemblies for Dispensing Flammable Liquids
UL 842	(2007; Reprint Oct 2013) Standard for Valves for Flammable Fluids
UL 87	(2001; Reprint Jun 2008) UL Standard for Safety Power-Operated Dispensing Devices for Petroleum Products
UL 913	(2013) UL Standard for Safety Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations
UL Subject 87A	(2014) Outline of Investigation for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 - E85)

1.2 SYSTEM DESCRIPTION

Equipment specified herein shall be designed to handle a working pressure of 1900 kPa 275 psig at 38 degrees C 100 degrees F. Equipment specified herein shall be compatible with the fuel to be handled.

1.3 SUBMITTALS

****

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

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

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

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

****

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

SD-02 Shop Drawings

Grounding and Bonding

SD-03 Product Data

Loading Arm
Tank Truck off-loading Assembly
Venturi Tube
Fuel Meter

Relaxation Tank
Aviation Fueling Hose
Non-Aviation Fuel Hose
Aircraft Pressure Fueling Nozzle
Aircraft Nozzle Adapter
Dry-Break Coupler
Liquid Level Gauge
Automatic Air Eliminator
Differential Pressure Gauge
Differential Pressure Transmitter
Control Stations
Product Dispensing Unit
Management Control System

SD-07 Certificates

Demonstrations

SD-10 Operation and Maintenance Data

Loading Arm
Tank Truck Off-loading Assembly
Venturi Tube
Fuel Meter
Relaxation Tank
Aviation Fueling Hose
Non-Aviation Fuel Hose
Aircraft Pressure Fueling Nozzle
Differential Pressure Gauge
Differential Pressure Transmitter
Control Stations
Product Dispensing Unit
Management Control System

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment 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 equipment shall have been in satisfactory commercial or industrial use for a minimum two years prior to bid opening. The two year period shall include applications of the equipment and materials under similar circumstances and of similar size. Materials and equipment shall 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.]

1.4.2 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 equipment, 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 resistance, 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 shall be 25 by 65 mm 1 by 2-1/2 inches. Lettering shall 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 shall identify its function.]

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment 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

2.1 MATERIALS

****

NOTE: Include the bracketed information if aviation fuel will be handled.

****

Internal parts and components of equipment, piping, piping components, and valves that could be exposed to fuel during system operation shall not be constructed of zinc coated (galvanized) metal[, brass, bronze, or other copper bearing alloys]. Do not install cast iron bodied valves in piping systems that could be exposed to fuel during system operation.

2.1.1 Nitrile Butadiene (Buna-N)

Provide Buna-N material that conforms to SAE AMS3275.

2.1.2 Acrylonitrile Butadiene Rubber (NBR)

Provide NBR material that conforms to SAE AMS3275.

2.2 ELECTRICAL WORK

****

NOTE: Show electrical characteristics, motor

starter type(s), enclosure type, and maximum rpm in the equipment schedules 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 equipment and circuits and when recommended by the manufacturer. Where adjustable speed drives (ASD) are specified, reference Section 26 29 23 VARIABLE FREQUENCY DRIVE 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 equipment. Coordinate the area classification and the electrical design with UFC 03-460-01.

****

2.2.1 General

Provide motors, motor starters, controllers, integral disconnects, contactors, controls, and control wiring with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide switches and devices necessary for controlling and protecting electrical equipment. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Controllers and contactors shall have a maximum of 120-volt control circuits and shall have auxiliary contacts for use with the controls provided. For packaged equipment, the manufacturer shall provide controllers including the required monitors and timed restart.

2.2.2 Motors

Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Provide polyphase, squirrel-cage medium induction motors, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

2.2.3 Motor Controllers

[Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Use solid-state variable-speed controllers for motors rated 7.45 kW 10 hp or less and adjustable frequency drives for larger motors.] [Provide variable frequency drives for motors as specified in Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.]

2.2.4 Underground Wiring

Enclose underground electrical wiring in PVC coated conduit. Dielectrically isolate conduit at any steel storage tank connection.

2.2.5 Grounding and Bonding

Grounding and bonding shall be 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.

2.3 FLANGED END CONNECTIONS

2.3.1 Flanges

Provide flanged end connections on equipment defined herein in accordance with ASME B16.5, Class 150.

2.3.1.1 Carbon Steel

Carbon steel flanges shall conform to ASTM A105/A105M.

2.3.1.2 Stainless Steel

Stainless steel flanges shall conform to ASTM A182/A182M, Grade F304 or F304L, forged type.

2.3.1.3 Aluminum

Aluminum flanges shall conform to ASTM B247, Alloy 6061-T6.

2.3.2 Flange Gaskets, Non-Isolating

Provide flange gaskets that are 3.2 mm 1/8 inch thick and that conform to ASME B16.21, that use a Buna-N binder, and that have a raised-face type unless otherwise indicated. Provide gaskets that are factory cut from one piece of material.

2.3.3 Flange Gaskets, Electrically Isolating

****
NOTE: Indicate the location of each electrically isolating connection on drawings.
****

Flange gaskets shall conform to ASTM D229 and shall provide an electrical insulating material of 1000 ohms minimum resistance. Provide gasket material that is chemically compatible with the fuel to be handled. Provide gaskets that are the full face type. Provide flanges that have a

full surface 762 micrometers 0.03 inch thick, spiral-wound mylar insulating sleeves between the bolts and the holes in the flanges. Bolts may have reduced shanks of a diameter not less than the diameter at the root of the threads. Provide high-strength 3.2 mm 1/8 inch thick phenolic insulating washers next to the flanges with flat circular stainless steel washers over the insulating washers and under bolt heads and nuts. Provide bolts long enough to compensate for the insulating gaskets and stainless steel washers.

2.3.4 Flange Protectors

****
NOTE: Use flange protectors to minimize the exposure of flanged end connections to corrosive environments and thus extend the maintenance life of the connections. Flange protectors also help prevent foreign matter from shorting out or bridging over an insulating gasket within an electrically isolating flange. Delete this paragraph if not applicable.
****

Protectors shall protect the bolts, studs, nuts, and gaskets of a flanged end connection from corrosion or damage due to exposure to the environment. Protectors shall be weather and ultraviolet (UV) resistant. Protectors shall allow for quick and easy removal and re-installation by maintenance personnel. [Provide protectors that allow visual inspection of the flange gasket without requiring removal.]

2.3.5 Flange Bolts, Nuts, and Washers

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than two full threads beyond the nuts with the bolts tightened to the required torque. Bolts shall be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A193/A193M, Class 2, Grade B8, stainless steel, when connections are made where a stainless steel flange is involved, and Grade B7 when only carbon steel flanges are involved. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes 25 mm 1 inch and smaller and Eight-Pitch Thread Series for sizes larger than 25 mm 1 inch. Nuts shall conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7 for carbon steel bolts. Nuts shall be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes 25 mm 1 inch and smaller and Eight-Pitch Thread Series for sizes larger than 25 mm 1 inch. Provide washers under bolt heads and nuts. Washers to be ASTM F436, flat circular stainless steel for stainless steel bolts, and carbon steel for carbon steel bolts. Torque wrenches shall be used to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer. Anti-seize compound shall be used on stainless steel bolts.

2.4 TANK TRUCK OFF-LOADING ASSEMBLY

****
NOTE: Refer to NAVFAC Standard Design 140-40-05 TRUCK UNLOADING SYSTEM and UFC 3-460-01 for detailed information of an off-loading assembly.

****

Assembly shall be a packaged, factory fabricated, skid-mounted unit. Provide a vertical air eliminator for each off-loading pump used in the assembly.

2.4.1 Off-loading Pump

Pump shall conform to API Std 610, except as modified herein. Pump shall be a vertical in-line, single stage, single suction with double volute construction to assure radial balance. Pump shall be designed to permit removal of the impeller, shaft, bearings and bearing housing as an assembly, without disconnecting the suction or discharge piping. Shutoff head shall have a 20 percent head rise to shutoff. Pump shall be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pump shall not overheat or be damaged while operating continuously at a minimum flow condition of 25 percent required capacity or continuously at a maximum flow condition of 125 percent required capacity. Pump shall operate at a flow of 12.5 percent required capacity without exceeding the vibration limits given in API Std 610. The gasket fit for seal gland to stuffing-box shall be of the controlled compression type with metal-to-metal joint contact. Pump shall have oil lubricated, anti-friction, radial and thrust bearings that provide a minimum L-10 rating life of 25,000 hours in continuous operation.

2.4.1.1 Case and Cover

Case and cover construction shall be carbon steel that conforms to ASTM A216/A216M, WCB.

2.4.1.2 Impeller

Impeller construction shall be stainless steel that conforms to ASTM A743/A743M, GR CF8M or ASTM A743/A743M, CA 6NM.

2.4.1.3 Wear Rings

Wear rings construction shall be stainless steel that conforms to ASTM A182/A182M, GR F6 or ASTM A276, TP410 or 416.

2.4.1.4 Shaft

Shaft construction shall be stainless steel that conforms to ASTM A582/A582M, Type 416.

2.4.1.5 Power Factor Correction Capacitors

****

NOTE: Indicate on the electrical drawings the size and rating required for each pump power factor correction capacitor.

****

Pump motor controls shall include power factor correction capacitors that are 3 phase, suitable for 600 volts, with multiple cells, and that are assembled in parallel in a NEMA 250, Type 3 enclosure. Each capacitor cell shall be protected against cell rupture. Capacitors shall have a metalized polypropylene film dielectric system for an instantaneous self-healing action and reduced energy losses. Capacitors shall be encased in a

non-flammable vermiculite filler. Discharge resistors shall be included to reduce voltage to 50 volts or less within one minute of de-energization. Capacitors shall be suitable for operation over a temperature range of -40 degrees C to 50 degrees C -40 degrees F to 122 degrees F. Power factor capacitors at the offload area shall be supplied by the offload skid manufacturer.

2.4.2 Vertical Air Eliminator

****

NOTE: Indicate on the drawings the size of all piping connections to the eliminator. Flanged end connections should be used for all connections (no threaded connections).

NAVFAC Standard Design 140-40-05 TRUCK UNLOADING SYSTEM uses 3 separate level switches on the eliminator tank to modulate the speed of the off-loading pump (150 gpm, 300 gpm and 600 gpm). The more fuel that is collected in the eliminator, the faster the pump will operate.

****

Eliminator shall be the vertical tank, suction side type. Eliminator shall be factory-fabricated and be specifically designed for tank truck off-loading applications. Eliminator tank shall be designed and constructed of carbon steel in accordance with ASME BPVC SEC VIII D1. Eliminator shall have a stainless steel high level shut-off mechanism with pressure relief. Coat the vessel's interior surfaces with an epoxy coating that conforms to MIL-PRF-4556. Bolt the eliminator to the off-loading assembly to prevent vibration during operation. Provide flanged end connections on all piping connections (inlet piping, outlet piping, vent piping, pressure relief piping, drain piping, and level switch connections). Eliminator outlet piping connection shall have an anti-vortex device. Provide eliminator with each of the following

a. Liquid Level Gauge Taps. Provide taps for mounting dual liquid level gauges. Gauges shall measure the tank's full operating range. Gauges shall conform to paragraph LIQUID LEVEL GAUGE.

b. Pressure/Vacuum Relief Tap.

c. Air Venting Tap. Locate tap on top of vessel in order allow trapped air to be vented.

d. Drainage Tap. Locate tap in the bottom of the vessel in order to allow the drainage of water, fuel, and sediment.

e. Level Switch Taps.

2.4.3 Level Switches

Switches shall be the ultrasonic tip-sensitive type. Switch enclosure shall be weatherproof as well as explosion-proof in accordance with NFPA 70 for Class I, Division I, Group D locations. Switch shall be double pole double throw (DPDT). Switch power shall be 120 volts, single phase, and 60 hertz. Switch shall have a flanged end connection.

2.4.4 Pressure/Vacuum Relief Valve

Valve shall be the dual purpose type (provide both pressure and vacuum relief) that conforms to NFPA 30. Pressure and vacuum relief settings shall be factory set. Pressure relief shall be set at [_____] kPa [_____] ounces per square inch. Vacuum relief shall be set at [_____] kPa [_____] ounces per square inch. Valve body shall be constructed of aluminum and be designed for an outdoor installation (weather-resistant). Valve trim shall be stainless steel. Inner valve pallet assemblies shall have a knife-edged drip ring around the periphery of the pallet to preclude condensation collection at the seats. Valve intake shall be covered with a 40 mesh stainless steel wire screen.

2.4.5 Meter

Meter shall conform to paragraph FUEL METER.

2.4.6 Flow Control Valve (FCV)

Valve shall be the non-surge check valve type in accordance with Section 33 52 43.14 AVIATION FUEL CONTROL VALVES.

2.4.7 General Valves and Piping Components

Pipe, pipe fittings, general valves, strainers, sight flow indicators, and pressure gauges shall conform to Section 33 52 43 AVIATION FUEL DISTRIBUTION SYSTEMS.

2.4.8 Off-Loading Hose and Coupler

Hose shall conform to paragraph [AVIATION FUELING HOSE] [NON-AVIATION FUEL HOSE]. Coupler shall conform to paragraph QUICK DISCONNECT COUPLER. Provide assembly with a hose hanging rack capable of supporting all off-loading hoses simultaneously. Hooks used in hanging racks shall be stainless steel.

2.4.9 Grounding System

Grounding system shall conform to paragraph TANK TRUCK GROUNDING UNIT.

2.4.10 Flow Switch

Switch shall conform to paragraph FLOW SWITCH.

2.5 LOADING ARM

****

NOTE: Loading arm assemblies are used primary in tank truck and tank car loading applications. Top loading type assemblies are not permitted per UFC 3-460-01.

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 load 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 1,400 mm (55 inches).

****

Loading arm shall be the factory fabricated, factory assembled, bottom loading type. Loading arm shall include swivel joints, boom assemblies, and riser standpipe. Loading arm's pipe and fittings shall be [Schedule 10S, Grade TP304L, stainless steel in accordance with ASTM A312/A312M][or][Schedule 80 aluminum alloy 6061-T6 in accordance with ASTM B241/B241M]. [Provide adjacent loading arm assemblies with the ability to crossover one another during operation.]

2.5.1 Dispensing End

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

2.5.1.1 Hose Loader Type

Dispensing end shall be the fixed reach, hose loader type. Hose used in the loading arm assembly shall be in accordance with paragraph [AVIATION FUELING HOSE] [NON-AVIATION FUEL HOSE].

2.5.1.2 A-Frame Type

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

2.5.2 Swivel Joints

****
NOTE: Only include the bracketed sentence if the project is a NAVAIR related project. Reference Aircraft Refueling NATOPS Manual, NAVAIR 00-80T-109 for NAVAIR approved components.
****

Swivel joints shall be the flanged, non-lubricated type with non-lubricated bearings. Swivel joints shall 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 shall be warranted for two years against leakage due to both positive and negative pressure conditions. Swivel joints shall be capable of 360 degree rotation. [NAVAIR approved swivels are Aeroquip single plane, Chiksan 2-plane, EMCO Wheaton single plane, CLA-VAL 2-plane, J.C. Carter single plane, and J.C. Carter 2-plane.]

2.6 PANTOGRAPH

Provide pantographs as specified in Section 33 52 43.12 AVIATION FUEL PANTOGRAPHS.

2.7 FILTER/SEPARATOR

Provide filter/separator as specified in Section 33 52 43.28 FILTER SEPARATOR.

2.8 VENTURI TUBE

Venturi shall be a velocity head, impact, differential producing device designed to measure differential pressure of the fuel being handled. Venturi shall consist 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. Venturi shall be constructed of Type 304L stainless steel. Provide flanged end connections on both the inlet and outlet pipe connections. Venturi shall be of sufficient thickness to withstand the same stresses as the upstream and downstream piping.

2.8.1 Discharge Coefficient

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

"C" shall be 2 percent for Reynolds number range of 10,000 to 1,000,000.

2.8.2 Manometer

One manometer, complete with hoses, shall be provided with fittings and suitable tables for each venturi tube. The tables shall convert Pascal inches w.g. differential pressure to liters per second gallons per minute. Maximum range of the manometer shall be 1-1/2 times the maximum flow tube differential. Furnish manometers with a permanent carrying case capable of storing the manometer, hoses, fittings and tables.

2.9 PUMPS

Provide pumps as specified in Section 33 52 43.23 AVIATION FUEL PUMPS.

2.10 FUEL METER

****

NOTE: Fuel meters will be provided at each aircraft direct fueling station and each truck fillstand in accordance with UFC 3-460-01. For each meter, indicate the maximum flow rate to be metered as well as the allowable pressure drop at the maximum flow rate.

****

Meter shall be the continuous duty, positive displacement, straight-through flow type, designed for outdoor installation. Meter shall be factory-fabricated. Meter shall conform to ASME BPVC SEC VIII D1. Meter housing shall be constructed of Type 304 or 316 stainless steel or 3003, 6061-T6, or 356-T6 aluminum alloy. Meter shall be reversible and be capable of momentary overspeeding to 125 percent of maximum rated capacity without damage or impairment of accuracy. Pressure drop across a meter shall not exceed 35 kPa 5 psig when operated at rated capacity. Provide meter with flanged end connections on the inlet and outlet piping. Provide a leakproof drain at the lowest point of the meter housing.[Provide meter with electronic thermal compensation.][Equip meter with a heating device for protection from low or freezing temperatures.][Provide meter with a card printer.] Equip meter with an accuracy adjustment mechanism that will operate without change during the life of the meter, except by manual adjustment. Meter shall be factory calibrated. Manual adjustment of a meter shall be possible while under pressure without leakage or loss of product and without requiring disassembly other than removal of a cover plate. Meter shall be equipped with a digital readout register mounted on the meter housing.[Register shall mounted on a swivel base capable of 180 degrees of rotation.] Meter register shall contain a seven-figure nonsetback totalizer and a five-figure setback flow indicator without the milliliter tenth-of-gallon indicator. Digits on a meter register shall be a minimum 19 mm 3/4 in in height. Meter error shall not exceed 0.1 percent for any one predetermined flow rate and accuracy setting. The maximum meter error shall not exceed 0.3 percent for any one given accuracy adjustment at any flow rate ranging from 1.9 to 37.9 L/s 30 to 600 gpm. Provide meter with a digital pulse transmitter that is compatible with the meter as well as to the connected control and monitoring system. Transmitter shall not require recalibration due to power outages. Transmitter enclosure shall be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations (maximum temperature rating of T2D - 215 degrees C 419 degrees F). Transmitter shall be UL listed. Transmitter output shall be a 4 - 20 mA dc, linear

signal between 0 - 100 percent of the input.

2.11 RELAXATION TANK

****
NOTE: Include a relaxation tank in a design only when allowed by 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, etc.). Size each relaxation tank in accordance with UFC 3-460-01.
****

Tank shall conform to API RP 2003 and ASME BPVC SEC VIII D1. Tank housing shall be constructed of aluminum. 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).

2.12 AVIATION FUELING HOSE

****
NOTE: For aviation applications, 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 (1 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 NAVFAC standard design 140-40-05 "Truck Unloading System" 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].

2.13 NON-AVIATION FUEL HOSE

****
NOTE: For non-aviation applications, include this paragraph.
****

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

2.14 NOZZLES, ADAPTERS AND COUPLERS

2.14.1 Aircraft Pressure Fueling Nozzle

****
NOTE: Nozzles specified herein are intended to provide direct aircraft fueling connections. Coordinate the type of nozzles required with the using agency and the connecting aircraft. Indicate on the drawings the required nominal flow rate and operating pressure required at each nozzle.

For pantograph assemblies, require the pantograph control valve operational setting to be 345 kPa (50 psi). This setting is suitable for use with both SAE-AS5877 nozzles and MIL-PRF-52747 nozzles and will allow the use of either type nozzle. Note that if both SAE AS5877 and MIL-PRF-52747 nozzles are to be used at the same pantograph (interchangeable), confirm that each nozzle will be provided with a dry-break quick disconnect. Interchangeable nozzles can provide a user with a great deal of operational flexibility.
****

Provide each nozzle with an internal, stainless steel, 250 micrometer No. 60 mesh strainer. [Provide each nozzle with a compatible dry-break coupler with conforms to paragraph DRY-BREAK COUPLER.]

2.14.1.1 High Flow (600 gpm) Nozzle

****
NOTE: SAE AS5877 pressure refueling nozzles have an inside diameter of 63.5 mm (2-1/2 inches) and are intended for flow rates up to 38 L/s (600 gpm).

D-1R and D-2R nozzles are equipped with a hose end pressure regulator as part of the refueling nozzle assembly. These pressure regulators cannot be adjusted but can be removed for replacement. For NAVY/MARINE CORPS projects, regulators settings are typically 380 kPa (55 psig); regulators for Army

projects are typically 311 kPa (45 psig). Coordinate the regulator pressure with the using agency and the connecting aircraft. Include the second sentence if a hose end regulator is required.

D-1 and D-1R nozzles incorporate a 45 degree inlet elbow for preferential horizontal refueling; D-2 and D-2R nozzles incorporate a straight (90 degree) inlet for preferential vertical refueling.

****

Provide nozzle that conforms to SAE AS5877, Type [D-1] [D-1R] [D-2] [D-2R]. [Hose end regulators shall limit nominal pressure at the nozzle outlet to[380 kPa] [55 psig] [311 kPa] [45 psig]]. Provide nozzle with a fuel sampling connection port.

2.14.1.2 Medium Flow (100 gpm) Nozzle

****

NOTE: MIL-PRF-52747 pressure refueling nozzles have an inside diameter of 38.1 mm (1-1/2 inches) and are intended for flow rates up to 6.3 L/s (100 gpm). MIL-PRF-52747 nozzles are designed to limit downstream refueling pressure to 103 kPa (15 psi) with inlet nozzle pressures up to 862 kPa (125 psi). The pressure control device is integral to these nozzles and cannot be adjusted.

****

Provide nozzle that conforms to MIL-PRF-52747, Type I, Class A. [Provide nozzle with a nozzle adapter in accordance with MIL-PRF-52748 in order to allow for open port or gravity fill dispensing.]

2.14.2 Aircraft Nozzle Adapter

****

NOTE: Aircraft nozzle adapters are typically used in conjunction with aircraft pressure fueling nozzles or dry break couplers.

****

Adapter shall be the international standard 3-lug, 65 mm 2-1/2 inches (nominal) aircraft type. Adapter shall include an internal self-closing valve or poppet that is driptight throughout the entire specified temperature range and that is compatible with the associated working pressures. Adapter shall be constructed of stainless steel or aluminum. Provide adapter with a dust cap and a 100 mm 4 inch flanged end connection.

2.14.3 Tight-Fit Fill Adapter

****

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

2.14.4 Tight-Fit Vapor Recovery Adapter

****

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 shall be the [top seal] [side seal] type that includes an internal self-closing valve or poppet. Adapter shall provide a tight-fit connection to prevent vapor emissions during fuel transfer. Adapter shall be bronze and be fitted with a Buna-N or Viton gasket. The adapter's internal valve or poppet shall be driptight throughout the entire specified temperature range. The adapter's internal valve or poppet shall prevent vapor emissions when the locking cap is removed yet shall open immediately when the adapter is connected to an appropriate coupler. The adapter's internal valve or poppet shall 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 shall mate with the adapter and have a latching mechanism that provides a watertight seal. Cap shall provide some type of locking provision and be easily attachable and removable. Cap shall be attached to the tight-fit vapor recovery adapter by a minimum 300 mm 12 inch section of brass cable or fuel resistant rope.

2.14.5 Dry-Break Coupler

Coupler shall be compatible with the connecting adaptor. Coupler shall provide a positive, leakproof connection when under constant or surge fuel flow. Coupler shall prevent vapor emissions during fuel flow. Seals

within the coupler shall be Buna-N or Viton. Coupler shall have an internal, manually operated shutoff valve. The valve shall have an external operating handle with the valve's position (open or closed) clearly labeled. The internal valve shall 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 shall in turn open the poppet of the adjoining adapter to allow fuel flow.

2.14.6 Quick Disconnect Coupler

Coupler shall 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.]

2.15 FUEL SAMPLING CONNECTION

Sampling connection shall include a 10 mm 1/4 inch stainless steel sampling probe, a 10 mm 1/4 inch stainless steel ball valve, and a stainless steel quick disconnect coupling. Fit the end of the coupling with a compatible aluminum dust cap. Connect the dust cap to the sampling connection with a bronze chain.

2.16 FLOW SWITCH

Switch shall be the actuating vane type that has a single adjustable setpoint. Switch shall mount on a flanged end connection. Switch shall be provided with a snap action switch mechanism that is UL listed. Switch enclosure shall be weatherproof as well as explosion-proof in accordance with NFPA 70 for Class I, Division I, Group D locations. Switch to be double pole double throw (DPDT). Switch power shall be 120 volts, single phase, 60 hertz, and 10 amps minimum.

2.17 LIQUID LEVEL GAUGE

****
NOTE: Included the bracketed sentence if required by the using agency.
****

Gauge shall be the factory fabricated, sight glass assembly type designed to allow visual observation of liquid levels within a vessel. Assembly shall 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 shall be constructed of stainless steel. [The gauge shall contain a colored density sensitive ball.]

2.18 AUTOMATIC AIR ELIMINATOR

Eliminator tank shall be designed and constructed of carbon steel in accordance with ASME BPVC SEC VIII D1. Eliminator shall release air at pressures up to 1034 kPa 150 psi with no fuel leakage. Provide the air eliminator with a non-return check valve feature, opening pressure of 7 kPa, 1 psi, to prevent air from being drawn into the unit via the air eliminator.

2.19 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).

****

Gauge shall be the direct-reading, piston type. Piston shall be spring-supported, corrosion resistant and shall travel vertically inside a glass cylinder. Gauge's scale shall be between 0 to 210 kPa 0 to 30 psi and shall have an accuracy of plus or minus 3.5 kPa 0.5 psi. Gauge's scale shall have 7 kPa 1 psi graduations. Gauge's maximum piston travel shall be 75 mm 3 inches. Gauge shall be rated for an operating pressure of 2068 kPa 300 psi in either direction. Glass cylinder shall have stainless steel end flanges with Viton O-ring seals. Gauge's high pressure inlet shall have a 10 micrometer 10 micron pleated paper filter. Provide a fine mesh stainless steel strainer on the gauge's low pressure inlet connection. Gauge's high and low pressure connections shall be 10 mm 1/4 inch NPT female with a stainless steel bar stock valve at each connection. Under a differential pressure of 210 kPa 30 psi, leakage past the piston shall not exceed 120 drops per minute. [Construction of the gauge shall be such that a 3-valve manifold is not necessary.]

2.20 DIFFERENTIAL PRESSURE TRANSMITTER

Transmitter shall be the capacitance type that is capable of providing an analog two-wire electrical 4-20 milliamp signal directly proportional to the differential pressure measured.[The transmitter shall also simultaneously produce a digital HART (Highway Addressable Remote Transducer) output signal.] Indicator accuracy shall be 0.5 percent of full scale and transmitter accuracy shall be 0.25 percent of pointer indication. Transmitter output shall be linear between 0 and 4 percent. Differential pressure ranges shall be selected as necessary to operate in conjunction with the connected system's operating pressures. During operating conditions the pointer shall be approximately in the mid-range of the gauge. Transmitter body, diaphragm, and connecting drain and vent valves shall be of stainless steel construction. Transmitter shall be provided with built-in pulsation damper and suitable over-range protection. Transmitter shall not require recalibration due to power outages. Transmitter enclosure shall be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations. Transmitter shall be UL listed. Transmitter shall be supplied with a factory assembled five-valve stainless steel manifold. Vent valves shall be furnished on upper ports of transmitter.

2.20.1 Local Display (LCD)

Provide each transmitter with a local [liquid crystal display (LCD)] [pressure dial] for displaying the differential pressures measured.[The LCD shall have a minimum 4 digit scale and be capable of being read in low light/no light conditions. The LCD's indicator scale shall be in L/s gal/min.][The pressure dial shall use a bellows type pressure sensing element. The mechanical indicator for the dial shall be driven by the bellows unit. The bellows shall be the dual opposed, liquid filled, rupture-proof type with bellows movement converted to rotation and transmitted by a torque tube. Displacement of bellows shall be 24.6 mL 1.5 cubic inches for full scale travel. Bellows housing shall be stainless steel and shall have a rated working pressure of not less than 3447 kPa 500

psi. Liquid used to fill the bellows shall be suitable for the expected minimum ambient temperature. The indicating dial shall be at least 150 mm 6 inches in diameter with a weatherproof glass cover. The case shall be finished with a weather resistant epoxy resin enamel. The indicating pointer shall traverse a 270 degree arc. The scales shall be graduated over the selected pressure ranges so that the flow rate can be accurately read. Indicator accuracy shall be 0.5 percent of full scale. Differential pressure indicating dial shall be provided with built-in pulsation damper and suitable over-range protection.]

2.21 CONTROL STATIONS

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

Electrical supply and electrical control equipment shall be suitable for Class I, Division 1, Group D locations, be intrinsically safe, be weather resistant and be in accordance with UL 913, NEMA 250, and NFPA 70. Mounting hardware shall be corrosion resistant.

2.21.1 Pump Control System

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

For pressurized hydrant fueling system designs, refer to UFGS33 09 53, UFGS 33 09 54, or UFGS 33 09 55 as applicable. The standard specification provides much more details regarding pump control systems for these type designs and therefore should be used in place of what is defined herein.
****

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

a. Control valves

b. Aircraft direct fueling station

c. Tank truck loading station

d. Tank truck fuel unloading station

e. Tank truck overfill and grounding system

f. Vehicle dispensing system

2.21.1.1 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 pantograph assembly.
****

Station shall be an 1.3 mm 18 gauge galvanized steel NEMA 250, Type 4 enclosure. Station shall have with a start pushbutton, a stop pushbutton, and a green indicating light. Mounting hardware shall be corrosion resistant. During activation, the start pushbutton shall maintain contact until deactivated by the stop pushbutton. The stop pushbutton shall maintain contact until deactivated by the start pushbutton.

2.21.1.2 Pump Control Panel

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

Panel shall include on and off indication lights for each pump. Panel shall contain an adjustable control logic for pump operation in accordance with the indicated operation. The panel shall also have a manual override switch for each pump to allow for the activation or deactivation of each pump.

2.21.2 Deadman Control

****
NOTE: Include the bracketed information on fuel sensing hose if hydraulically actuated deadmen are specified.

Indicate the control sequence of each deadman control on the drawings. Depressing a deadman should initiate the fueling process and close the corresponding thermal relief feature (valve). Releasing a deadman should stop the fueling process and open the corresponding thermal relief feature(valve).
****

Deadman control shall be the hand-held, [hydraulically actuated] [electrically actuated, intrinsically safe] type. Deadman handle and trigger shall be constructed of aluminum with a smoothly polished finish. Fuel flow through the associated receiving/dispensing application shall not be capable unless the deadman trigger is fully depressed. Deadman control shall be provided with a self winding reel and [8 m][23 m] [25][75] feet of [fuel sensing hose. Fuel sensing hose shall be the dual type with Buna-N or Viton tube, vertically braided textile body, fuel resistant neoprene cover, and stainless steel fittings.] [retractable cable].

2.21.3 Tank Truck Grounding Unit

****
NOTE: This specification covers 2 types of tank

truck grounding units; 1) Automatic Ground Verification System, and 2) Grounding Cable and Clamp. UFC 3-460-01 mandates that automatic ground verification systems be used on all loading and off-loading facilities except Air Force projects (choice to use a grounding cable and clamp is an option).

Coordinate grounding design with NFPA 77.

****

2.21.3.1 Automatic Ground Verification System

****

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

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

****

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

2.21.3.2 Grounding Cable and Clamp

****

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

****

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

2.21.4 Tank Truck Overfill Protection System

****

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

the system.

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

This paragraph is written in a general manner to allow bids from different vendors. Note however that some installations/organizations require very specific makes and models of such systems. If this is the case in a design, delete the following paragraph and replace with the vendor specific requirements; also document and provide the appropriate justification and allowance (J&A) information to the contracting officer as applicable.

****

System shall include connection plug, control cable, and monitoring and control module. System shall be the self-checking type that automatically and continually monitors the liquid-level within a tank truck's storage compartment during fueling. Connection plug shall conform to [_____]. System shall be rated for an explosion-proof environment in accordance with NFPA 70 for Class I, Division I, Group D locations. Module shall include status lights and a switch contact to allow interlock functions. Control cable shall be the spiral, self-retracting type. Cable shall be a minimum 9 m 30 feet in length.

2.21.5 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.

****

Station housing shall be a galvanized steel enclosure with a hinged glass front and an open bottom. Paint the enclosure red. Mounting hardware shall be corrosion resistant. Mount an emergency pushbutton inside the station housing. Pushbutton shall be accessible through the hinged front. Pushbutton shall be a single unit with a jumbo mushroom operator, 1-NC and 1-NO contact. During activation, the pushbutton shall maintain contact until deactivated by a key release. Mount a caution sign beside the emergency shutdown station, with red 50 mm 2 inch letters stating "EMERGENCY SHUTDOWN". The sign shall have white background and be of noncorrosive construction.

2.22 GROUND VEHICLE FUELING EQUIPMENT

2.22.1 Product Dispensing Unit

****

NOTE: Per UL 87, there are 2 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 Subject 87A if the use of E85 fuel is possible, otherwise reference UL Subject 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 shall be the factory fabricated type that conforms to [UL 87][UL Subject 87A], except as modified herein.[Unit housing and housing top shall be constructed of stainless steel or aluminum in accordance with [UL 87][UL Subject 87A].][Materials for unit components that will be in direct contact with the fuel shall be stainless steel or nickel plated aluminum.] Unit shall 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 shall be the [remote control] [self-contained] type. Unit housing shall include a locking mechanism for each nozzle to allow securing each nozzle to the housing during non-operational periods.

2.22.1.1 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 43 AVIATION FUEL DISTRIBUTION SYSTEMS or Section 33 52 10 SERVICE PIPING, FUEL SYSTEMS as applicable. Self-contained pumps will only be used in conjunction with belowground storage tanks.

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

2.22.1.2 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.]

2.22.1.3 Filters

Provide a replaceable filter element on each product line with a nominal filtration efficiency of 0.025 mm 25 microns with a flow rating equal to the rate of the dispensing unit.

2.22.1.4 Battery Backup

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

2.22.1.5 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.

2.22.1.6 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 shall 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.

2.22.1.7 Nozzles

Provide manually activated, automatic shutoff type nozzles [with] [without] a latch-open device. Nozzles shall have full hand insulator to prevent splash-back.[Nozzles shall 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.]

2.22.1.8 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 shall have pressure balancing chamber to override line pressure to prevent nuisance breaks caused by a restriction in delivery hose diameter.

2.22.1.9 Emergency Shutoff Valve

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

2.22.1.10 Dispenser Sump

Provide a sump under each dispensing unit. Each sump shall provide convenient service access to piping components enclosed in the sump. Sump shall be constructed of fiberglass-reinforced plastic. Sump shall be chemically compatible with the fuel to be handled by the dispensing unit

and any connecting piping. Sump shall prevent fuel from escaping to the soil and ground water from entering the sump. Sump shall provide a liquidtight termination point for secondary containment piping that allows for the anticipated expansion and contraction of the piping system. Sump shall withstand maximum burial loads. Sump shall 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.

2.22.1.11 Accessories

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

2.22.2 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.

2.22.2.1 Operating Functions

System shall operate up to [_____] fueling positions with up to [_____] different products. System shall operate prepay on preset volume or dollar operation. System shall 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.

2.22.2.2 Control and Management Functions

System shall accumulate, store, and deliver full range of management information including pricing by grades and types of service. System shall provide totals for up to four shifts by product volume, cash and credit sales, and declining balance inventory.

2.22.2.3 Control Console

System shall 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

2.22.2.4 Display

System shall 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

2.22.2.5 Power

System shall operate at 115 volts, 60 hertz.

2.22.3 Receipt and Totals Printer

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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

2.22.3.1 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

2.22.3.2 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.

2.22.3.3 Unit Price Summary

Configure printer and system functions to print the unit prices for cash and credit.

2.22.3.4 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

2.22.3.5 Diagnostic Messages

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

2.23 FINISHES

2.23.1 New Equipment and Components

2.23.1.1 Factory Coating

****
NOTE: For all Navy projects (regardless of location), the 500 hour salt spray test is required and must be specified.

For Army projects, a salt spray test is optional. The 125 hour test is suggested for mild or noncorrosive environments. The 500 hour test is suggested for extremely corrosive environments.
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Unless otherwise specified, provide equipment and components fabricated from ferrous metal with the manufacturer's standard factory finish.[Each factory finish shall be capable of withstanding [125] [500] hours exposure to the salt spray test specified in ASTM B117. For test acceptance, the test specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm 1/8 in on either side of the scratch mark immediately after completion of the test.] For equipment and component surfaces subject to temperatures above 50 degrees C 120 degrees F, the factory coating shall be appropriately designed for the temperature service.

2.23.1.2 Field Painting

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NOTE: Specify exterior, aboveground coatings per

Section 09 97 01.00 10 if SSPC QP 1 contractor certification is required for any other coatings on the project. If Section 09 90 00 is specified, consider choosing the option for the contractor to be certified to SSPC QP 1, as certified contractors are likely to have more experience working around fuel facilities.

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Painting required for surfaces not otherwise specified shall be field painted as specified in [Section 09 97 01.00 10 EXTERIOR COATING OF STEEL STRUCTURES] [Section 09 90 00 PAINTING, GENERAL]. Do not paint stainless steel and aluminum surfaces. Do not coat equipment 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 INSTALLATION

Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.3 and NFPA 30, except as modified herein. Safety rules as specified in NFPA 30 and NFPA 407 shall be strictly observed. When work is not in progress, securely close open ends of pipe and fittings with expansion plugs so that water, earth, or other substances cannot enter the pipe or fittings.

3.1.1 Equipment

Properly level, align, and secure equipment in place in accordance with manufacturer's instructions. Provide supports for equipment, appurtenances, and pipe as required. Provide floor-mounted pumps with mechanical vibration isolators or a vibration isolation foundation. Install anchors, bolts, nuts, washers, and screws where required for securing the work in place. Sizes, types, and spacings of anchors and bolts not indicated or specified shall be as required for proper installation.

3.1.1.1 Differential Pressure Gauge

Install gauge such that high pressure is applied to the top of the gauge piston.

3.1.1.2 Pumps

Properly level, align, and secure pumps in place in accordance with manufacturer's instructions. Support, anchor, and guide so that no strains are imposed on a pump by weight or thermal movement of piping. [Provide floor-mounted pumps with mechanical vibration isolators or a vibration isolation foundation.]

3.1.1.3 Fuel Sampling Connection

Install the sampling probe to piping through a 10 mm 1/4 inch threadolet. Install the open face of the probe in the center of the connecting pipe. Face the probe opening in the direction of the upstream fluid.

3.1.1.4 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.

3.2 SYSTEM COMMISSIONING

System commissioning shall conform to Section 33 08 55 COMMISSIONING OF FUEL FACILITY SYSTEMS.

3.3 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the equipment/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/equipment/systems, both operational and practical theories, and associated routine maintenance procedures. The training session shall consist of a total of [_____] hours of normal working time and shall 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 --