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DIVISION 15 - MECHANICAL

SECTION 15050

MECHANICAL EQUIPMENT, FUELING

03/99

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-- End of Section Table of Contents --

GUIDE SPECIFICATION FOR CONSTRUCTION

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SECTION 15050

MECHANICAL EQUIPMENT, FUELING
03/99

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NOTE: This guide specification covers the requirements for geneal equipment required for aircraft refueling systems as part of the Air Force Type III Standard (78-24-28-88. This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-345-700 for military construction and in accordance with ER 1110-2-1201 for Civil Works construction.

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change (Notice) to this guide specification. During the reference reconciliation process, SPECSINTACT will automatically remove references from this paragraph that have been removed from the text.
****

Waiver to Use MilStds and MilSpecs in Air Force Fuel Projects, HQ AFCESA/CESM (01/29/96).

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

ASME INTERNATIONAL (ASME)

ASME B16.5 (1988; Errata) Pipe Flanges and Flanged Fittings

ASME B40.1 (1991) Gauges--Pressure Indicating Dial

	Type--Elastic Element
AMERICAN PETROLEUM INSTITUTE (API)	
API RP 1615	(1996) Installation of Underground Petroleum Storage Systems
AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)	
ASTM A 48	(1983; R 1990) Gray Iron Castings
ASTM A 536	(1984) Ductile Iron Castings
ASTM C 827	(1987) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
ASTM D 2751	(1993) Acrylonitrile-Butadene-styrene(ABS) Sewer Pipe and Fittings
ASTM D 4355	(1984) Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1989) Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1985; R 1990) Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1986) Breaking Load and Elongation of Geotextiles (Grab Method)
ASTM D 4751	(1987) Test Method for Determining the Apparent Opening Size of a Geotextile
ASTM D 4833	(1988; R1996) Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM F 758	(1990) Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ENVIRONMENTAL PROTECTION AGENCY (EPA)	
EPA 40 CFR Part 280	Underground Storage Tanks; Technical Requirements and State Program Approval, Final Rules
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 30	(1990) Flammable and Combustible Liquids Code
NFPA 70	(1996) National Electric Code

MILITARY SPECIFICATIONS (MS)

MS MIL-P-24441	(Rev. B, 1991; Supp. 1) General Specification for Paint, Epoxy - Polyamide
MS MIL-T-5624	(Rev. N, 1990) Turbine Fuel, Aviation, Grades (JP-4, JP-5 and JP-5/JP-8)
MS MIL-T-38219	(Rev. B, 1987; Amend. 1) Turbine Fuel, Low Volatility, JP-7
MS MIL-T-83133	(Rev. C, 1990; Amend. 1) Turbine Fuels, Aviation, Kerosene Types, NATO F-34(JP-8) and NATO F-35

MILITARY STANDARDS (MIL-STD)

MIL-STD-130	(Rev. G, 1988) Identification Marking of U.S. Military Property
MIL-STD-161	(Rev. F, 1985; Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3275A	(1994) Acrylonitrile Butadiene (NRB) Rubber Sheet, Non-Asbestos Fiber Fuel and Oil Resistant

STEEL TANK INSTITUTE (STI)

STI P3	(1987) Exterior Corrosion Protection of Underground Steel Storage Tanks

UNDERWRITERS LABORATORIES (UL)

UL 58	(1986) Steel Underground Tanks for Flammable and Combustible Liquids

1.2 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

Indicate submittal classification in the blank space using "GA" when the submittal requires Government approval or "FIO" when the submittal is for information only.

****

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-01 Data

Manufacturer's Catalog Data

Pressure Gages; GA.

Automatic Pump Controls; GA.

Meters; GA.

Product Recovery Tank and Accessories; GA.

Hydrant Outlet Pits and Isolation Valve Pits; GA.

High Point Vent and Low Point Drain Pits; GA.

Operating Tank Level Indicator; GA.

Water Draw-Off System; GA.

Meters; GA.

Venturi Tubes; GA.

Hydrant Outlet Pits, Isolation Pits, High Point Pits, Low Point Pits; GA.

Water Drawoff System; GA.

SD-04 Drawings

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems.

Meter; GA.

Venturi Tubes; GA.

Water Draw-off System; GA.

Hydrant Outlet Pits, Isolation Pits, High Point Pits, Low Point Pits; GA.

Product Recovery Tank Vault; GA.

Provide the drawings as one package with the design analysis. Shop fabrication drawings shall include type of material, configuration, thickness, and necessary details of construction of the steel tank and vault. Shop drawings shall also show the steel grating and supports.

SD-09 Reports

Test Reports

Leak Detection System; GA.

SD-13 Certificates

Certificates of Compliance

Coating Products; GA.

UL Labeled products; GA.

STI-P3 labeled products; GA.

Pits; GA.

Geotextile; FIO.

Frame and Cover; FIO

SD-19 Operating and Maintenance Manuals

Operation and maintenance information shall be submitted for the equipment items or systems listed below. Refer to Section 01730 FACILITY OPERATION AND MAINTENANCE MANUAL for the information to be submitted for various type of equipment and systems.

Pressure Gauges; GA.

Automatic Pump Controls; GA.

Product Recovery Tank and Accessories; GA.

Operating Tank Level Indicator; GA.

Water Draw-off System; GA.

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

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

Components shall be suitable for use with [JP-4 turbine fuel; specific gravity 0.76 at 60 degrees F., viscosity 0.92 CS at 60 degrees F., Reid vapor pressure 2 to 3 psi, MS MIL-T-5624] [JP-5 turbine fuel; specific gravity 0.82 at 60 degrees F., viscosity 1.62 CS at 60 degrees F., Reid Vapor pressure less than 0.05 psi, MS MIL-T-5624] [JP-7 turbine fuel; specific gravity 0.79 at 60 degrees F., viscosity 1.95 CS at 60 degrees F., Reid vapor pressure less than 0.05 psi, MS MIL-T-38219] [JP-8 turbine fuel; specific gravity 0.81 at 60 degrees F., viscosity 1.62 CS at 60 degrees F., Reid vapor pressure less than 0.05 psi, MS MIL-T-83133]. Components to be ANSI Class 150 (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 F. and [___] degrees F.

2.2 COMPOSITION OF MATERIALS

Materials in contact with the fuel shall be noncorrosive. No zinc-coated metals, brass, bronze, iron, lead or lead alloys, copper or

copper alloys, or other light metal alloys containing more than 4% copper shall be used in contact with the fuel.

2.3 ELECTRICAL WORK

Motors, manual or automatic motor control equipment except where installed in motor control centers, and protective or signal devices required for the operation specified herein shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Any wiring required for the operation specified herein, but not shown on the electrical plans, shall be provided under this section in accordance with Section 16415 ELECTRICAL WORK, INTERIOR.

2.4 MATERIALS AND EQUIPMENT

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

2.4.1 Supplier

The Contractor's attention is directed to the fact that the pump control system, including but not limited to pump control panel, venturi tubes, transmitters and control valves with all hardware and software is an integrated system, shall be furnished by a single systems supplier regularly engaged in the supplying of this equipment. Supplier shall provide all equipment and appurtenances regardless of manufacture, and be responsible to the Contractor for satisfactory operation of the entire system. Substitutions of functions specified will not be acceptable. The Contractor shall coordinate the work of the system manufacturer's service personnel during construction, testing, calibration, and acceptance of the system.

2.5 PRESSURE GAGES

Pressure gages shall conform to ASME B40.1 with metal cases and 4-inch diameter white dials. Gages shall be bottom connected, without back flanges. A pulsation dampener, adjustable to the degree of dampening required, shall be provided for each gage. Range of gages shall be as indicated. A ball valve shall be provided for each pressure gage. Gages shall have all parts immersed in silicone oil. Gages shall be labeled with the calibration date.

2.6 GASKETS

Gaskets shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.7 BOLTS AND NUTS

Bolts and nuts shall be in accordance with Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM.

2.8 AUTOMATIC PUMP CONTROLS

The pressure and flow transmitters specified in this paragraph shall be obtained from a single supplier of such products. The same supplier shall also furnish the associated venturi tubes and GPM meter. The supplier shall be responsible for furnishing components that are compatible and that operate as a system to perform the required pump control functions. Control tubing between controls/instruments and fuel lines shall be installed to eliminate air entrapment. Control tubing shall be as specified in Section 15060 PIPE, MANUAL VALVES, AND FITTINGS, FUELING SYSTEM. Each item of equipment specified hereafter shall have manufacturer's authorized service personnel present to assist in PERFORMANCE TESTING as specified in Section 15899 SYSTEM START-UP, FUELING SYSTEM. Items specified under this paragraph shall be submitted for approval concurrently with items specified in Section 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM.

2.8.1 Pressure Indicating Transmitters

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

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be $\pm$ 20 percent of calibrated span including combined effects of linearity, hysteresis and repeatability.

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

indicating dial shall be provided with suitable over-range protection.]

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

****
NOTE: SELECT TYPE OF DISPLAY PER DIRECTIONS FROM COMMAND FUELS FACILITY ENGINEER.
****

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

e. Provide a HART (Highway Addressable Remote Transducer) protocol interface handheld calibration device.

2.8.2 Flow Switches

Switches shall be actuating vane type flow switch with single adjustable set-point. Switches shall mount on ASME B16.5 Class 150 raised face flange. Provide snap action switch mechanism U.L. listed for Class I, Division 1, Group D hazardous locations. Switches to be double pole double throw (DPDT). Switch power shall be 120 volts, single phase, 60 hertz, 10 amps minimum.

2.8.3 Venturi Tubes

a. The venturi tubes shall be provided in conjunction with Section 15970 PUMP CONTROL AND ANNUNCIATION SYSTEM.

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

****
NOTE: SELECT TYPE OF FUEL.
****

c. The venturi tubes shall be low loss differential pressure producers consisting of a short housing piece and a fully machined, contoured throat section providing a restriction at the center, with both inlet approach and exit having geometrically symmetrical curves. They shall be velocity head, impact, differential producing devices designed to measure differential pressure of [JP-4] [JP-5] [JP-7] [JP-8]

fuel. They shall be constructed of 304L stainless steel with ANSI Class 150 flanges on each end and be suitable for operation of 275 psig at 100 degrees F. They shall be of sufficient thickness to with-stand the same stresses as the upstream and downstream piping. Each venturi tube shall have a minimum of four 1/2-inch connections. An individual head-capacity curve shall be furnished for each venturi tube.

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

(1) Issue Venturi Tube. Minimum inlet-to-throat differential pressure at 2,400 gpm: 200 in. H2O.

(2) Return Venturi Tube. Minimum inlet-to-throat differential pressure at 600 gpm: 200 in. H2O.

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

(4) Provide two portable GPM Meters, one for each size of venturi. The meters shall be complete with valves, hoses and connecting disconnects, and carrying case. The meters shall have stainless steel bellows, mounting bracket, 500 psi swp, 6-inch dial with 270 degrees arc. Dial shall read GPM Jet Fuel. Range of scale shall be 1.5 times GPM flow requirement. The venturi manufacturer shall provide the portable meters with the venturi in order to be compatible. The venturi tubes shall also be provided with a suitable table to convert inches differential pressure to gallons per minute.

2.8.4 Differential Pressure Transmitter

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

a. Transmitter body shall be stainless steel with stainless steel diaphragm capsule process connecting to a 1/2 inch NPT. Drain and vent valves to be stainless steel. Accuracy shall be " 0.20 percent of

calibrated span including combined effects of linearity, hysteresis and repeatability.

[b. One differential pressure dial shall be supplied with each pair of transmitters. Differential pressure dial shall consist of a bellows type pressure sensing element, operating on a differential in pressure of fuel, and a mechanical indicator, driven by the bellows unit. The bellows shall be dual opposed, liquid filled, rupture-proof type with bellows movement converted to rotation and transmitted by a torque tube. Displacement of bellows shall be 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 500 psi. Liquid used to fill the bellows shall be suitable for the expected minimum ambient temperature. The indicating dial shall be at least 6 inches in diameter with a weatherproof glass cover. The case shall be finished with a weather resistant epoxy resin enamel. The indicating pointer shall traverse a 270 degree arc. The scales shall be graduated over the selected pressure ranges so that the flow rate can be accurately read in gallons per minute. Indicator accuracy shall be 0.5 percent of full scale. Differential pressure indicating dial shall be provided with built-in pulsation damper and suitable over-range protection.]

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

****
NOTE: SELECT TYPE OF DISPLAY PER DIRECTIONS FROM COMMAND FUELS FACILITY ENGINEER.
****

d. Differential pressure ranges shall be selected as necessary to operate in conjunction with associated venturi tube:

(1) Issue Venturi Tube - 0 to 2400 GPM (full range)

(2) Return Venturi Tube - 0 to 800 (full range)

Each venturi tube shall have two transmitters and one indicating dial per function and shall be installed as indicated on the drawings.

****
NOTE: SYSTEMS GREATER THAN 2400 GPM REQUIRE ISSUE VENTURI TUBE TO HAVE LOW RANGE (0-1500 GPM) AND HIGH RANGE (0- MAXIMUM SYSTEM FLOW IN GPM) TRANSMITTERS VERSUS ONE SINGLE FULL RANGE TRANSMITTER.
****

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

2.9 METERS

****
NOTE: Select type of fuel.
****

Meter shall be a one-way flow, positive displacement type meter designed for a continuous flow of 600 GPM at the truck fill stand. Meter shall have ANSI Class 150 flanges and body working pressure of not less than 200 psig and shall be suitable for hydrostatic testing of 275 psig. Meter shall be factory calibrated for [JP-4] [JP-5] [JP-7] [JP-8] jet fuel and capable of being calibrated in the field. The register shall have a non-setback total indicator and a setback type run indicator so that individual runs can be registered without affecting the total of all runs as shown on the indicator. The total indicator shall have a minimum of seven figures and the setback run indicator shall have a minimum of six figures. The register shall read in gallons and the smallest unit of indicated delivery shall be 1 gallon. Accuracy shall be within +0.3 percent between ten percent and maximum rated flow. Meters shall be provided with a suitable drain at the bottom, equipped with a ball valve.

2.9.1 Pressure Loss

Pressure loss through the meter shall not exceed 3 psi at 600 gpm flow rate.

2.9.2 Materials of Construction

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

2.10 PRODUCT RECOVERY TANK AND ACCESSORIES

****
NOTE: USE FIBERGLASS TANK IF DIRECTED BY COMMAND FUELS FACILITY ENGINEER, REFERENCE SPECIFICATION 13202, FUEL STORAGE SYSTEMS.
****

2.10.1 Tank Construction

Product recovery tank shall be a U.L. labeled, double wall, steel tank, with interstitial monitor. Tank shall be provided with calibrated gage stick and strapping chart. Tank shall be provided with a steel vault

attached to tank. Vault shall be provided with a rolling pit cover and removable access grating.

2.10.1.1 Steel Tank With Vault

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

b. Material shall be carbon steel plate.

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

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

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

f. A complete system of cathodic protection shall be provided for the tank and vault in accordance with Section [13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [13110 CATHODIC PROTECTION BY GALVANIC ANODES].

g. The interior and exterior surfaces of tank and vault shall be coated for corrosion protection. The interior surface shall be coated in accordance with MS MIL-P-24441, Formulas 150, 151, and 152. The exterior surface shall be coated in accordance with STI P3 and the tank shall bear the STI P3 label.

2.10.1.2 Leak Detection Monitor

a. An annular space shall be provided between the primary and secondary shells to allow for the free flow and containment of all leaked product from the primary tank.

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

sensor for testing and maintenance. The control panel shall be located where shown on the plans. Remote alarm shall be provided at the pump control panel(PCP), see section 15970. This control panel shall have a sign located adjacent to it indicating that the alarm indicates a leak in the fuel tank or the vault. The Contractor shall provide system operating instructions inside of the control panel.

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

2.10.1.3 Tank Appurtenances and Fittings

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

2.10.1.4 Tank Vents

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

****

NOTE: PROVIDE DEVICES IN ACCORDANCE WITH THE RECOMMENDATION OF NFPA 30, FEDERAL, STATE AND LOCAL CODES.

****

2.10.1.5 Manway

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

2.10.1.6 Sampling and Gauging hatch

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

2.10.1.7 Liquid-level Indicator

Liquid-level indicator shall provide local and remote indication. Unit shall be mounted as shown on the drawings and shall provided local and remote level indication. The gage processor unit shall serialize the data and shall provide communication over a 2 wire bus between level gage and the remote receiver. The units of measurement shall be feet, and the measuring increment shall be tenths of a foot.

a. Construction

The unit shall mount on a 6 inch ASME Class 150 flange. The unit shall be constructed of a drum compartment and a servo compartment with terminal box. The servo compartment shall be Factory Mutual approved or U.L. listed for use in Class I, Division 1, Group D hazardous locations, Group T2D (419 degrees F) and shall be provided with a thermostatically controlled electric heater for condensate and freeze protection. Measuring cable shall be 316 stainless steel and the measuring drum shall be grooved to receive the cable. Servo and drum compartment shall be cast aluminum with stainless steel trim and Buna-N O-rings. Provide RTD and self compensating temperature converter.

b. Service and Signal

Unit shall receive 120V/1 PHASE/60 Hz power and shall consume maximum 60VA.

c. Performance

The displacer shall be suspended from the measuring drum. The drum shaft shall be coupled to a weighing balance with a capacitive type detector. The detector shall operate the servo motor via an integration circuit, raising or lowering the displacer until balance is attained, thereby sensing the liquid level. Accuracy shall be $\pm$ 0.01 inch. Repeatability shall be $\pm$ 0.01 inch. Wave integration time shall be 1 to 10s, adjustable.

2.10.1.8 Float Switch Assembly

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

2.10.1.9 Fuel Transfer Pump (FTP-1)

Refer to Section 15140 PUMPS, FUELING SYSTEM

2.10.1.10 Electric Pump

The electric pump shall be a sliding vane type rotary pump. The pump construction shall permit the removal of the rotor and sliding vanes without disconnecting the pump. Pump capacity shall be 5 gallons per minute with a 15 feet suction head and a discharge head of 25 feet. The pump and motor shall be mounted on a cast iron or steel subbase. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump, shall be suitable for available electric service, shall be totally enclosed, fan cooled, TEFC, and shall conform to the requirements specified in Section \=16415=\ ELECTRICAL WORK, INTERIOR. Pump shall be provided with stainless suction screen, stainless steel pipe, and aluminum 1 1/2-inch cam type quick disconnect with dust cap.

2.10.1.11 Lockable Cap

A shall be provided for the 2-inch gravity fill line.

2.10.1.12 Overfill Valve (OV-1)

Refer to Section 15101 CONTROL VALVES, FUELING SYSTEM

2.10.1.13 Tank Calibration

Provide a certified tank calibration chart in 1/8 inch increments reading in gallons.

2.11 HYDRANT OUTLET PITS AND ISOLATION VALVE PITS (For On-shoulder and On-apron)

Pantograph and hydrant hose truck hydrant outlet pits and isolation valve pits shall be prefabricated units that are the standard products of a firm regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least (3) years prior to bid opening. The basic pit shall consist of .50-inch-t fiberglass walls and floor with main body dimensions as shown on the drawings. The pit shall contain twelve (minimum) integral concrete anchors or two integral anchors that run continuous on three sides of pit. The integral fiberglass top flange shall require no exposed corrosive material, weldments, or strongbacks within the pit to support the aluminum cover assembly. The manufacturer shall have had a minimum of three years successful experience in the production and usage of their fiberglass service pits and shall supply proof of experience at time of submittals. Pits shall be provided with a 2-inch pump-out line terminating with a male cam type bronze connector with female dustcap. Pits shall be provided with removable aluminum grating platform suitable for loading of 400 pounds per square foot. The grating shall cover the entire opening when the lid is in the open position.

2.11.1 Pit Cover

The pit cover assembly shall consist of a completely removable one-piece aluminum lid attached to a rigid frame which is an integral part of the fiberglass pit. The lid shall be attached to the frame with hinges which do not carry wheel loads applied to the top surface of the lid in its closed position. The lid shall be equipped with a device to hold the lid in its fully-opened position. This lid-staying device shall automatically engage when the lid is opened to its fully-opened position. The device shall also be provided with a quick-release mechanism designed to be operated with one hand. The lid shall be considered fully-open when it is rotated approximately 90 degrees from its closed position. Each cover lid shall move smoothly through its entire range of motion and shall be counterbalanced sufficiently to require an externally-applied opening force of 35 pounds (maximum) to be applied to the center of the long side of the cover (opposite the hinge side). Similarly, the maximum closing force required to be applied at the same point shall be approximately 50 pounds. In addition, the cover shall be counterbalanced in such a fashion that the cover will not close under its own weight if released when open to any angle greater than 70 degrees (from its closed position). Operation of the lid will not have spring assist. Lifting handles (two minimum) shall be provided for each lid. Each handle shall provide comfortable, secure grip for and average adult male's full (gloved) hand. All covers shall be provided with a

latch, operable from the exterior of the vault, to securely hold the lid to the frame in the closed position. The latch will be capable of being released from either lifting handle. Tools shall not be required to engage (or disengage) the latch or the lid lifting handles. Latch and handle designs shall be weather-resistant with features to prelude freeze-up and the collection of dirt and precipitation. The pit and cover assemblies shall present a surface which is 0.5-inch below the concrete pavement upon completing their installation. Projections of the lid's hinges, lifting handles, or latches above the plane of the lid, whether temporary or permanent, shall not be allowed. The weight bearing flange surfaces of both the fiberglass pit liner and the aluminum cover lid shall be machined flat to assure uniform weight distribution. The word FUEL shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 1-inch high and raised to 0.0625-inch.

2.11.2 Pit Cover Materials, Design, and Testing

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

2.11.3 Pipe Seal

The pipe penetrations through the pit floor or wall shall be sealed by means of a Buna-N boot. The boot shall be secured to a metal collar welded to the pipe riser and to a flange at the pit penetration by stainless steel clamps. Collar shall be fabricated from the same material as the pipe. Buna-N (Nitrile Butadiene) material shall be in accordance with SAE AMS 3275A.

2.11.4 Hydrant Outlet Pit Equipment

At the Contractor's option, hydrant pits may be furnished complete with hydrant control valves and shutoff valves assembled in a pipe riser.

All valves and piping furnished by the pit manufacturer shall comply with the requirements specified herein. All control valves shall be of the same manufacturer.

2.12 HIGH POINT VENT AND LOW POINT DRAIN PITS (For On-Shoulder and On-Apron)

2.12.1 Pit Assembly

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

2.12.2 Pit

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

2.12.3 Pit Cover, General Requirements

The pit cover shall include a removable outer ring frame and an interior 18-inch diameter (clear opening) hinged lid that opens 180 degrees. Each cover lid shall move smoothly through it entire range of motion and shall require a maximum opening force of 25 pounds to be applied at a single lifting handle. Each handle shall provide a comfortable, secure grip for an average adult male's full gloved hand. Tools shall not be required to engage the lifting handle. Projections of the lid's hinges or handles above the plane of the lid, whether temporary or permanent, shall not be allowed. The pit service shall be integrally cast in raised letters on the top surface of each lid. The lettering shall be a minimum of 1-inch high and raised to 0.0625-inch. The weight bearing flanges of the fiberglass pit liner and the aluminum cover frame (and lid) shall be machined to assure uniform weight distribution.

2.12.4 Pit Cover Materials, Design, and Testing

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

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

2.12.5 Pipe Riser Seal

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

2.13 OPERATING TANK LEVEL INDICATOR

The level indicating system must perform hydrostatic tank gauging. The level indicating system must use only a single differential pressure transducer 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 and ambient temperature. The reference point for all level measurements must be from the tank's datum plate. The system must attach to the tank's 6-inch stilling well to minimize the effects of turbulence on the measurements and still allow the government access to take quality control samples. The level indicating system must be able to measure in underground, aboveground and cut and cover tanks with all floor and roof types. The level indicating system must be able to measure multiple tanks with a single field interface unit. The level indicating system must be able to determine whether the tank is issuing or receiving fuel while in the transfer mode and also with the same unit be able to perform leak detection. The level indicating system must require no periodic calibration after installation is complete. The level indicating system must be approved for installation in a hazardous area and certified intrinsically safe by an approved agency and provide lightning protection. The level indicating system must be able to interface with government owned information systems. The level indicating system must provide five sets of alarm outputs; high intermediate high, low, intermediate low and static tank movement alarm.

****

NOTE: SELECT PER COMMAND FUELS FACILITY ENGINEER DIRECTION.

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Level accuracy ± 0.05 inches
Corrected volume accuracy ± 0.1%
Density accuracy ± 1%
Temperature accuracy ± 1EF

[It will be a ITT/Barton type Automatic Tank Gauging System. The system uses nitrogen gas to sense the level of fluid in the tanks at all times.] [It will be an ENRAF Servo Gauge Model 854 Automatic Tank Gauging System.]

2.14 OPERATING TANK LEVEL SWITCHES

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NOTE: SELECT PER COMMAND FUELS FACILITY ENGINEER DIRECTION.
****

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

2.14.1 Electronic Level Alarms

Level alarms shall be mechanically and electrically independent and be totally isolated from the gauging system. Two electronic high level alarms shall be provided for each tank. A High Level Alarm (HLA) shall be set at approximately 90 percent of the safe tank filling height and be arranged to actuate an audible alarm signal located where shown on the drawings and an indicator light at the control panel. A High High Level Alarm (HHLA) shall be set at approximately 95 percent of the safe filling height. HHLA shall actuate an audible and visual alarm where shown on the drawing and an indicator light at the control panel.

2.14.2 Level Alarm Control Panel

Panel shall be located where indicated and contain one light and one relay output for each alarm point. An audible alarm shall actuate whenever any alarm point has been reached. Panel shall further contain a green (Power ON) status light and push button controls for alarm reset and test. The alarm reset shall terminate the alarms specified in Paragraph - Electronic Level Alarms. the indicator lights on the alarm panel shall remain on until the fuel level has dropped below their set point levels. Panels shall consist of a NEMA 4 style water-tight housing for outdoor mounting locations. Panel shall operate with 115 VAC input power. Circuitry and cables from the panel to the electronic level sensors in the tank shall be intrinsically safe. Units shall have provisions to check level switch operation without increasing the fuel level in the tanks.

2.15 OPERATING TANK LEVEL SWITCHES

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NOTE: SELECT PER COMMAND FUELS FACILITY ENGINEER DIRECTION.
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System shall be designed and installed in such a way that the system shall be continuously and automatically self-checking without manual

check. Electronic level sensors shall be thermistors or optic type, and be intrinsically safe Class I, Division 1, Group D for hazardous environments, with recognized FM,CSA or UL approval. Both high electronic level sensors shall be contained in a single multi-sensor holder/junction box. The sensor holder/junction box shall be accessible from the tank top or stairway.

2.15.1 Electronic Level Alarms

Level alarms shall be mechanically and electrically independent and be totally isolated from the gauging system. Two electronic high level alarms shall be provided for each tank. A High Level Alarm (HLA) shall be set at approximately 90 percent of the safe tank filling height and be arranged to actuate an audible alarm signal located where shown on the drawings and an indicator light at the control panel. A High High Level Alarm (HHLA) shall be set at approximately 95 percent of the safe filling height. HHLA shall actuate an audible and visual alarm where shown on the drawing and an indicator light at the control panel.

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2.16 WATER DRAW-OFF SYSTEM

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

2.16.1 Tank

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

2.16.2 Sight Glass

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

2.16.3 Return Pump

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NOTE: INSERT SITE SPECIFIC PUMP REQUIREMENTS.

****

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

2.16.4 Anchoring

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

2.17 LEAK DETECTION SYSTEM

Provide and install four inch perforated PVC or ABS pipe, smooth interior, to run over the top of the fuel distribution loop pipe and looped over the branch lines, within three feet above the pipe, capped above grade at the Pumphouse and capped in the hydrant pits. The pipe shall conform to ASTM F 758, type PS 46, or ASTM D 2751, with maximum SDR of 35. The perforations shall be between 3/16 inch and 1/8 inch with a minimum open area of 0.5 square inch per linear foot. Pull stations will be provided every 500 feet and at all changes in horizontal direction to facilitate future tube pulling. Pipe elbows will have a three foot radius. The pipe will be wrapped in a geotextile material. Pipe shall be capped in the pull boxes. Capes shall be threaded. Pull boxes shall be a minimum of 18 inches in diameter and 36 inches deep.

2.17.1 Geotextiles

Geotextiles shall be a nonwoven pervious sheet of polymeric material. Fibers used in the manufacture of the geotextile shall consist of long-chain synthetic polymers composed of at least 85% by weight polyolefins, polyesters, or polyamides. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. The geotextile physical properties shall equal or exceed the minimum average roll values listed in Table 1. Strength values shown are for the weaker principal direction.

TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	TEST VALUE
Apparent Opening Size (U.S. Sieve)	ASTM D 4751	70

TABLE 1. GEOTEXTILE PHYSICAL PROPERTIES

Permittivity, sec1	ASTM D 4491	0.5
Puncture, lbs	ASTM D 4833	40
Grab Tensile, lbs	ASTM D 4632	115
Trapezoidal Tear, lbs	ASTM D 4533	40
Ultraviolet Degradation (percent strength retained at 500 hours)	ASTM D 4355	70

2.17.2 Frame and Cover (for Pull Boxes)

Frames and covers shall be cast gray iron, ASTM A 48, Class 35B or cast ductile iron ASTM A 536, Grade 65-45-12. Covers shall have a minimum transverse proof-load strength of 25,000 pounds.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

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

3.1.2 Anchoring

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

3.1.3 Grouting

Equipment which is anchored to a pad to be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, and coatings which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide necessary formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting

shall be in accordance with ASTM C 827. Perform all grouting in accordance with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.1.4 Leveling and Aligning

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

3.1.5 Direct Drives

Alignment procedure follows:

3.1.5.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.1.5.2 End Play

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

3.1.5.3 Shaft Leveling and Radial Alignment

Check shaft leveling by placing a spirit level across the half faces. Radially align shafts by placing a straightedge across the two coupling half faces in both horizontal and vertical planes.

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 0.001 inch tolerance, except as other-wise required by more stringent requirements of equipment manufacturer.

3.2 INSTALLATION OF UNDERGROUND TANKS

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

3.2.1 Coating

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

3.2.2 Steel Tanks

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

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

c. Before proceeding with backfill, install the hold down straps and tighten the turnbuckles securely and evenly throughout the length of the tanks. The bottom and sides of the tanks to be fully and evenly supported by hand shoveling and tamping. Use tank bedding backfill up to 12 inches above the top of tank. Hand-guided power equipment can be used to place fill in 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 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

The Contractor shall submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided. The Contractor shall follow

these recommendations and shall apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

3.4 POSTED OPERATING INSTRUCTIONS

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

3.4.1 Each System

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

3.4.2 Each Tank

For each tank provide certified tank calibration chart in 1/8-inch increments reading in gallons.

3.4.3 Each Item

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

3.4.4 Diagrams

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

3.4.5 Volume of Fuel

The Contractor shall provide a certified system inventory of fuel in the pipe, tank, pumphouse, etc. The piping will show length of pipe, size of pipe, gallons per foot, and total gallons. Verify during initial fill.

-- End of Section --