SECTION 33 57 55

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

PART 1 GENERAL

1.1 SUMMARY

This section defines the requirements for system components as related to a non-hydrant fuel distribution system. Provide the entire fuel distribution system as a complete and fully operational system. Size, select, construct, and install equipment and system components to operate together as a complete system. Substitutions of functions specified herein will not be acceptable. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration, and acceptance of the system. System components and piping specified herein must be designed to handle a working pressure of 275 psig for stainless steel systems 285 psig for carbon steel systems at 100 deg F. Components specified herein must be compatible with the fuel to be handled. Components must be suitable for outside, unsheltered locations, and to function normally in ambient temperatures between -30 degrees F and 110 degrees F.

This specification includes a fuel skid to be located within the bermed fuel tank area. The existing fuel tank has a nominal volume of 420,000 gallons. The No. 2 fuel oil in the the tank must be conditioned for use to ASTM D975 and SAE J1488 fuel quality standards for use in the emergency electricity generation system. To meet the fuel quality standards, this specification details the requirements for coalescing filters, fuel polishing pump and fuel forwarding pumps to the emergency gererator day tanks. The fuel polishing system must run continously and independent of the fuel forwarding pumps. The forwarding pumps must be two at 100-percent capacity each, in lead/standby configuration to forward fuel oil to the day tanks located in the Generator Building. A fuel forwarding pump must run upon a signal from any one of the day tanks. The Fuel Management Control Panel in the North Switch Station will monitor day tank fuel level, actuate the motorized ball valves and signal to the fuel skid, which mush in response start a fuel forwarding pump to maintain the day tanks at 90% level. The fuel polishing pump and forwarding pumps must be housed within a weatherproof enclosure to shelter the pumps. The enclosure must include a weatherproof intake louver, and exhaust fan, and thermostatic control of the fan.

1.1.1 Plans

The Contractor must submit detailed written plans for implementation of the System Start-Up Plan, and the Existing System Cleanliness Confirmation Plan. The plans must specify a detailed plan incorporating in a sequential manner all work specified in PART 3 EXECUTION of this specification section. Plan elements must include:

a. Personnel. List of Contractor's personnel by trade, list of key personnel, list of safety equipment, and list of miscellaneous equipment such as two-way radios and personnel transportation vehicles.

1.2 REFERENCES

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

AMERICAN PETROLEUM INSTITUTE (API)

API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API RP 2003	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API 650	(2021; API Standard 650, Welded Tanks for Oil Storage, Thirteenth Edition
API 653	(2025; API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
API STD 676	(2022;) Positive Displacement Pumps-Rotary

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B40.100	(2022) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM C827/C827M	(2023) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
ASTM D975	(2020) Standard Specification for Diesel Fuel Oils

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code
NFPA 77	(2024; ERTA 1 2023) Recommended Practice on Static Electricity
NFPA 407	(2022; TIA 24-2) Standard for Aircraft Fuel Servicing
NFPA 780	(2023) Standard for the Installation of Lightning Protection Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

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

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-130	(2007; Rev N; Change 1 2012) Identification Marking of U.S. Military Property
MIL-STD-161	(2005; Rev G; Notice 1 2010) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50696	(2016; Rev D) Reels, Static Discharge, Grounding, 50 and 75 Foot Cable Lengths

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2021) Motors and Generators
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

1.3 ADMINISTRATIVE REQUIREMENTS

Submit detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the system components and systems. Provide the drawings as one package with the design analysis. Shop fabrication drawings must include type of material, configuration, thickness, and necessary details of construction of the fuel polishing system. Shop drawings must also show the steel grating and supports. Submit Manufacturer's Catalog Data and Certificates of Compliance. Operation and maintenance information must be submitted for the system components items or systems listed in PART 2. Automatic pump controls must include step-by-step procedures required for system startup, operation, and shutdown.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing System Cleanliness Confirmation Plan; G, AE

System Start-Up Plan; G, AE

AST Inspection Report

SD-02 Shop Drawings

Grounding and Bonding; G, AE

Contractors Nozzle Installation Plan

SD-03 Product Data

Pressure Gages; G, AE

Differential Pressure Gauge; G, AE

Automatic Pump Controls; G, AE

Tightness Monitoring System; G, AE

Filter/Separator; G, AE

Water Draw-Off System; G, AE

SD-06 Test Reports

Final Nozzle Install Inspection Report

SD-07 Certificates

System Supplier; G, AE

Certification of Entire System; G, AE

SD-10 Operation and Maintenance Data

Automatic Pump Controls; G

Rotary Gear Pump; G

Filter/Separator; G

Water Draw-off System; G

1.5 QUALITY ASSURANCE

Submit the following data for approval:

a. Certification stating that the System Supplier has provided and installed at least five Programmable Logic Control (PLC)-based pump control systems in the last five years, for automatic cycling of pumps based upon varying dispensing demands, utilizing multiple pumps. These systems must be for dispensing diesel and burner fuel oils.

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

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

1.5.1 Contractor Qualifications

Refer to Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT) for the requirement that a single responsible Contractor must be responsible for the entire fuel oil transfer and distribution system from its connections to the existing tank and piping, to its connections within the North Switch Station, and the leak monitoring system. Related Specification Sections include but may not be limited to 33 01 50.31 LEAK DETECTION FOR FUELING SYSTEMS, 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT), and 33 57 55 FUEL SYSTEM COMPONENTS (NON-HYDRANT).

1.5.2 Material and Equipment Qualifications

Provide materials and system components that are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship. Materials and system components must have been in satisfactory commercial or industrial use for a minimum two years prior to bid opening. The two year period must include applications of the system components and materials under similar circumstances and of similar size. Materials and system components must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two year period.

The Contractor must submit detailed written plans (prepared by the System Supplier) for implementation of the System Start-Up Plan, and the Existing System Cleanliness Confirmation Plan. Plans must specify a detailed plan incorporating in a sequential manner all work specified in PART 3 EXECUTION of this specification section. Plan elements must include:

a. Personnel. List of Contractor's personnel by trade, list of key personnel, list of safety equipment, list of miscellaneous equipment such as two-way radios, and personnel transportation vehicles.

Submit the following data for approval:

a. Certification stating that the Contractor has provided start-up services (including start-up, existing system cleanliness confirmation, and performance testing experience) for five similar systems in the last five years.

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

1.5.2.1 1.5.1.1 Certification of Entire System

Prior to the acceptance of the newly constructed system by the Government, all installed mechanical and electrical system components must be inspected and approved by the Contracting Officer. Provide the Contracting Officer days notice in order to schedule the Installation Performance Testing, and approval. Any deficiencies observed must be corrected by the Contractor without cost to the Government.

1.5.3 Nameplates

Attach nameplates to system components, gauges, and valves defined herein. List on each nameplate the manufacturer's name, address, contract number, component type or style, model or serial number, catalog number,

capacity or size, and the system that is controlled. Construct plates of stainless steel. Install nameplates in prominent locations with nonferrous screws, nonferrous bolts, or permanent adhesive. Minimum size of nameplates must be 1 by 2-1/2 inches. Lettering must be the normal block style with a minimum 1/4-inch height. Accurately align lettering on nameplates.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

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

2.1 MATERIALS

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

2.1.1 Types of Fuel

Components must be suitable for use with No. 2 Fuel Oil, Ultra Low Sulphur Diesel Fuel, (ULSD); ASTM D975 Components to be ANSI Class 150(275 psig at 100 degrees F) unless noted otherwise. Components must be suitable for outside, unsheltered locations, and to function normally in ambient temperatures between -10 degrees F and 110 degrees F.

2.1.2 Composition of Materials

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

2.1.3 Gaskets

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

2.1.4 Bolts and Nuts

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

2.1.5 Flanges

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

2.1.6 Nitrile Butadiene (Buna-N)

Provide Buna-N material that conforms to SAE AMS3275.

2.1.7 Acrylonitrile Butadiene Rubber (NBR)

Provide NBR material that conforms to SAE AMS3275.

2.2 SYSTEM COMPONENTS AND MATERIAL

2.2.1 General

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

2.2.2 System Supplier

Because the pump control system, including but not limited to pump control panel, transmitters, flow switches, fueling system pumps, all field instrumentation, tightness monitoring system, and control valves with all hardware and software, is an integrated system, it must be furnished by a single systems supplier regularly engaged in the supplying of these system components. System Supplier must be a company whose regular, normal, and primary business is representing manufacturers in the distribution and start-up of facility fuel systems, and have no affiliation with the Contractor other than as a seller to the Contractor. Supplier must provide all system components and appurtenances regardless of manufacture, be a factory authorized certified representative, and be responsible to the Contractor for satisfactory operation of the entire system, and must oversee the installation of the system components. Substitutions of functions specified will not be acceptable. The Contractor and the System Supplier must be present at the system commissioning, and must coordinate and schedule the work during construction, testing, calibration, and acceptance of the system. The System Supplier must be on-site with their mechanical and control personnel to supervise and assist the contractor during pre-commissioning check-out of the mechanical systems and control systems, initial fuel receipt, initial filing, hydrostatic testing, pigging, flushing, cleaning, system component tests, performance testing and all training for the owner's representatives. The System Supplier must be responsible to the Contractor for scheduling the Contractor, Sub-contractor, and manufacturer's service personnel during system

start-up and final commissioning.

The following system requirements for the Automated Fuel Polishing System must be met:

A. Provide a factory assembled and tested system capable of continuously filtering and de-watering stored Ultra Low Sulphur Diesel (ULSD) and ULSD blended biodiesel fuel. Coalesce and remove both the free water and saturated/emulsified water from the fuel. The factory filters must be SAE J1488_201010 tested and verified to effectively remove saturated/emulsified water to at least a 92% efficiency rating with ULSD and ULSD blended to a minimum of B20 (Interfacial Tension of 15 mN/m). A letter confirming SAE J1488_201010 test results of greater than 92% must be supplied by an accredited testing organization authorized by SAE such as Southwest Research Institute on their calibrated test bench. The system must have the ability to clean, and maintain both the fuel and the tank by eliminating microbial growth through simple filtration without the addition of additives.

B. The designed system must filter and treat the contents of the main fuel storage tank 420,000 USG. The fuel filtration equipment must be capable of working with a 400 GPM gear pump assembly and connected to a minimum of three 42-inch diameter ASME SS pressure vessels. The vessels must provide a means of lifting the closure heads off and out of the way for filter element change.

C. An ISO 4406 calibrated and certified fuel quality monitoring control and management system must be integrated with each main fuel oil transfer pump control system contained in separate NEMA 12 cabinets. The control system cabinet must contain (as a minimum) the following devices:

1. An intuitive Siemens color HMI (human machine interface) touchscreen and PLC (programmable logic controller) system to control and manage system functions as described below:
a. System main disconnect.
b. Combination circuit breaker/motor starters for circulating pump motors.
c. IP 65 rated resistive direct sunlight readable touch-screen user interface controls for the following:
1) Hand Mode, Auto Mode, Stop for the main circulating pump.
2) A scheduling system whereby the operator can store independent cycle schedules for each day of the 7 weekdays
3) Alarm acknowledge/reset
4) Setting the system date & time
5) Filter change reset
6) Password protected admin configuration area

2. Visual indicators for the following:
a. Pump running
b. Auto mode
c. Hand mode
d. Live schematic view of system showing color coded component states
e. General system fault alert with detailed fault messages
f. Leak tray level alarm
g. Pump overload alarm
h. Accumulated water in filter canister alarm

D. The following alarm points must send an alarm notice and activate an external flashing lamp with audible siren which must remain activated

until the alarm is acknowledged and cleared:

1. General system fault alarm
2. Leak tray level alarm
3. Pump overload alarm
4. Accumulated water in filter canister alarm

E. The components must be factory mounted on a structural steel base.

1. The polishing pump and two forwarding pumps must be housed inside a weatherproof enclosure built of structural side, top, and bottom panels with insulation having a minimum R-value of 13. The enclosure must be of a height and space to allow personnel to stand comfortably inside with the door closed, with Code-compliant electrical clearances. The enclosure must have a hinged and weatherstripped personnel door with lever-type latch to enter the standing space, and a bolted and gasketed removable access panel for servicing pumps and valves on the opposite side. The enclosure must include an LED light fixture and switch inside, a dark-skies compliant LED light fixture and weatherproof switch outside to light the control panel and polishing vessels, and a GFCI 120-Volt service receptacle with weatherproof in-service hinged cover on the outside powered by the skid package transformer.
2. The enclosure must have an intake louver with low-leak motorized damper and close-coupled actuator on one end, and a 200 cfm exhaust fan with backdraft damper on the other, with an adjustable thermostatic temperature control to open the intake damper and energize the fan when the temperature in the enclosure is above setpoint (initial setpoint 85 degrees F).
3. An integral 4-inch steel containment lip, seam welded to form a leak-tight drip tray inside the dog house. Tray(s) must extend beyond any fitting, valve, pump or strainer to assure that a fuel leak from any component, fitting, or packing in the system must be contained within the pan.
4. The enclosure must be fitted with access door for inspection and equipment removal.
5. The steel base must have the coalescing filters mounted and piped to the pumps and their discharge back to the fuel tank.
6. The structural steel base must include a stair supported fully by the base without resting on the existing containment membrane, stair handrail, and Code-compliant safety guardrails.

F. Provide an approved diesel fuel leak detector, which must provide an alarm when any fuel accumulates within the drip tray.

G. The three fuel filtration pressure vessels must be 42 inches in diameter, holding a minimum of five replaceable coalescing filters as described in this section. The vessels must be fabricated of Type 304 stainless steel and certified ASME “U” or “UM” stamp as required for the state of New York. Components of the fuel filtration system must not be constructed of plastic, polycarbonate or any other material that will not withstand regulated or specified heat and fire ratings.

H. The stainless steel filter canisters must have a removable top gasketed with a fluoroelastomer rubber (FKM) “O” ring, and be fitted with an integral water containment sump with an electronic water detector.

I. The electronic water sensor in the fuel canister must be intrinsically safe.

J. The three stainless steel fuel pressure vessels must be tested to hold replaceable SAE J1488_201010 certified coalescing fuel filters. These filters must have a greater than 92% efficiency rating for removing free and saturated/emulsified water from ULSD and ULSD blended with biodiesel to an interfacial tension (IFT) of 15 mN/m representing approximately B20 blended biodiesel. A letter confirming SAE J1488_201010 test results of greater than 92% must be supplied by an accredited testing organization authorized by SAE such as Southwest Research Institute.

K. The replaceable SAE J1488_201010 filter must also filter particulate at a 0.2 sub-micron level.

L. The fuel filtration system must be provided with a continuous duty positive displacement fuel circulating pump. The pump must be capable of flowing the stored diesel fuel volume through the filtration system for twelve-hour continuous cycles.

M. Provision of a pressure relief valve for the pump piped to the common return line back to the main fuel storage tanks. Relief valve must be constructed with a stainless steel shaft sized to pass the full flow of the pump without overloading the pump drive motor.

N. General: Provide factory assembled Fuel Pump Skid and enclosure as specified herein and according to plan drawings. Foundation for the fuel pump skid is defined in the structural drawings and specifications.

O. Control Panel and Transformers: The control panel and power distribution within the skid package must include a transformer to provide 120V/1ph/60Hz power for the GFCI receptacle and controls, and other transformer(s) as necessary to provide other control voltages needed by the supplier's controls.

Requirements stated herein establish the basic requirements of the system. The Fuel Pump Skid must also meet any applicable requirements of the Project Specifications including Codes and Standards.

Pumps must be the electrically driven, non-overloading, rotary gear type which conform to API STD 676. Pumps must be selected per the drawing schedules. Pump motors must conform to NEMA MG 1, be totally enclosed, and have sufficient horsepower for the service required. Pump motors must have a 1.15 Service Factor to prevent overloading with pump operating at any point on its characteristic curve. Pump speed must not exceed 1,750 rpm. The Fuel Polishing Pump motor must be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in the power panel. The Fuel Forwarding Pump motors must be equipped with an across-the-line magnetic lead/standby controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in the power panel. Electrical components must meet Class I Division II as defined in the National Electrical Code.

After assembly the skid must require only the following connections:

1. Power distribution of 480V/3Ph/60Hz to the single-point power connection.
2. Fuel piping connections to the existing 420,000-gallon fuel tank suction and discharge piping to the fuel tank and fuel forwarding pumps. Provide two API 650 and API 653 code compliant connections

with steel piping to the existing fuel tank: 4-inch for the polishing return, and 2-inch for the generator day tank return. The existing fuel tank will be inspected by a API 653 Certified Inspector. The AST Inspection Report will be submitted for review and government approval prior to installation of the nozzles. The API 653 Inspector will approve the Contractors Nozzle Installation Plan for government approval. Following installation of the nozzles API Certified Inspector will inspect the installation for compliance with API 653 requirements and submit a Final Nozzle Install Inspection Report.

3. Fuel Management Input/Output to the remote panel on the Fuel Pump Skid.
4. Anchorage/tie-down to the foundation system.

2.3 ELECTRICAL

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

2.3.1 Grounding and Bonding

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

2.4 PRESSURE GAGES

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

2.5 DIFFERENTIAL PRESSURE GAUGE

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

pressure gauge to indicate the high pressure and have a range of 300 psi.

2.6 AUTOMATIC PUMP CONTROLS

The control system components specified in this paragraph must be obtained from a single supplier of such products (see the paragraph SYSTEM SUPPLIER in this section for the requirements). The supplier must be responsible for furnishing components that are compatible and that operate as a system to perform the required pump control functions. Control tubing between controls/instruments and fuel lines must be installed to eliminate air entrapment. Control tubing must be as specified in Section 33 52 40 FUEL SYSTEMS PIPING (NON-HYDRANT). Each system component specified hereafter must have manufacturer's authorized service personnel present to assist in performance testing.

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

2.6.1 Pump Control System

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

a. Control valves

b. Transfer pipeline pumping system

2.6.2 Pump Control Panel

As described herein, to contain controls and wiring connections.

2.6.3 Control Stations

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

2.6.3.1 Pump Control Start/Stop Station

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

2.6.3.2 Emergency Fuel Shut-Off (EFSO) Station

Enclosure must be corrosion resistant. In hazardous areas, enclosure must be electrogalvanized iron alloy with factory coating or copper-free aluminum. In non-hazardous areas, enclosures must be galvanized steel, stainless steel, electrogalvanized iron alloy with a factory coating or copper-free aluminum. All enclosures must be provided with a hinged glass

or polycarbonate front and an open bottom. Paint the enclosure red. Mounting hardware must be corrosion resistant. Mount an emergency pushbutton inside the station housing. Pushbutton must be accessible through the hinged front. Pushbutton must be a momentary contact single unit with a jumbo mushroom operator, 1-NC and 1-NO contact. Mount a caution sign beside the emergency shutdown station, with red 2-inch letters stating "EMERGENCY SHUTDOWN". The sign must have white background and be of noncorrosive construction.

2.7 MISCELLANEOUS USE PUMPS

Pumps must be driven by an explosion-proof motor for Class I, Division 2, Group D hazardous locations as defined in NFPA 70. Pump assemblies must be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow. Pump motors must be non-overloading throughout their entire pump curve.

2.7.1 Rotary Gear Pump

Pump must be a rotary gear pump meeting the requirements of API Standard 676. Pump capacities must be as scheduled for the Polishing pump 400 gpm and fuel forwarding 20 gpm. The pump and motor must be mounted on a steel subbase. The motor must have sufficient power for the service required, be of a type approved by the manufacturer of the pump, be suitable for available electric service, be totally enclosed, fan cooled, TEFC, and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Pump must be provided with stainless suction screen. Electrical component must meet NEC 70 Class I Divsion II, explosion requiements.

2.8 WATER DRAW-OFF SYSTEM

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

2.8.1 Tank

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

2.8.2 Sight Glass

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

2.8.3 Return Pump

Product return pump (PRP-1 and PRP-2) must have the capacity of not less than 5 gpm against a total head of feet when driven at 3600 rpm. The pump must have flange connections and must be constructed of stainless steel or aluminum so as to have no zinc, brass or other copper bearing alloys in contact with the fuel. The unit must be explosion-proof, Class I, Division 1, Group D with maximum temperature rating of "T2D" (419 degrees F). The motor must not be overloading at any point on the pump

curve. Contractor has the option of selecting either centrifugal or positive displacement type pump with the restriction of the positive displacement type pump must include a pressure relief between the discharge and suction protecting the pump from overloading.

2.8.4 Anchoring

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

2.9 GROUNDING CABLE AND CLAMP

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

2.10 FUEL SYSTEM FLUSHING

2.10.1 Certification of Entire System

2.10.1.1 Fuel

Some fuel loss should be expected. Fuel that is lost during flushing and cleaning, equipment testing, and performance testing is viewed as a cost of Start-up and Performance Testing.

The Contractor is responsible for the disposal of any waste product.

The Government will provide fuel from the existing 420,000 gallon storage tank. The Contractor must provide a copy of the Start-up, Fuel Provisioning, and Performance Testing plans a minimum of 60 days in advance of System Start-up. Prior to introducing to fuel forwarding system to the the Generator Room Day Tanks, the Fuel Polishing system must be installed and commissioned, must have operated until the existing fuel meets ASTM D975, Standard Specification for Diesel Fuel Oils. Following certification of the fuel in the existing 420,000 gallon tank, the fuel can be introduced into the fuel forwarding system to the Day Tanks.

FLUSHING, EQUIPMENT TESTS and PERFORMANCE TESTING: The flushing and testing phases must be identified separately in the start-up and Performance Testing plans. Fuel used for flushing and testing will be contaminated; the fuel must be isolated and is considered off-specification until the quality can be verified. Fuel volumes required for flushing and testing must be minimized to limit costs; submit estimates of anticipated usage prior to use, and actual volumes used. The Contractor will be responsible for disposing of any waste product.

Upon satisfactory completion of the flushing and cleaning operations on the existing 420,000 gallon strage tank, the Government will supply the additional quantities of fuel required to complete the other work under this section. This larger volume of fuel will not be delivered to the system until the Contractor has satisfactorily completed all work and, in particular, the removal of preservatives and foreign matter from those portions coming in contact with the fuel valves, pumps, filter/separators and other such system components.

2.11 VALVE AND SYSTEM COMPONENTS EXTERIOR PROTECTIVE COATINGS

2.11.1 Factory Coating

Valves, system components, and components must be blasted clean according

to SSPC SP 5/NACE No. 1, and must be primed and coated in accordance with Section 09 96 00 HIGH PERFORMANCE COATINGS.

2.11.2 Field Coating

Painting required for surfaces not otherwise specified must be field painted as specified in Section 09 96 00 HIGH PERFORMANCE COATINGS. Do not paint aboveground stainless steel and aluminum surfaces. Do not coat system components or components provided with a complete factory coating. Prior to any field painting, clean surfaces to remove dust, dirt, rust, oil, and grease.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation

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

3.1.2 Anchoring

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

3.1.3 Grouting

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

3.1.4 Leveling and Aligning

Level and align system components in accordance with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or

wedges to support, level or align system components. Install only flat shims for leveling system components. Place shims to fully support system components. Wedging is not permitted. Shims must be fabricated flat carbon steel units of surface configuration and area not less than system components' bearing surface area. Shims must provide full system components support. Shims must have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges will not be 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.

3.1.6 Precautions

Special care must be taken to ensure that system components and materials are stored properly to prevent damage and maintain cleanliness, and that the completed system is free of rocks, sand, dirt, and foreign objects. Take the following steps to insure these conditions.

a. System components brought to the site and not stored inside, must be stored on blocks or horses at least 18-inches above ground.

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

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

3.2 SYSTEM FLUSHING RQUIREMENTS

3.2.1 Existing System Cleanliness Confirmation

Contractor and System Supplier must conduct tests to confirm the cleanliness of the existing system before connecting it to the new system. The Fuel Polishing Skid must be used to clean the existing +/- 200,000 gllons of No. 2 Fuel oil in the 420,000 gallon tank. This is anticipated to have a duration of 6-10 weeks of circulating 400 gpm through the coalescing filters. Confirm that the fuel in the existing system meets ASTM D975, Standard Specification for Diesel Fuel Oils. Sampling must be performed by an independent fuel testing laboratory approved by the Contracting Officer.

3.2.2 Preparations for Flushing

The Upon completion of the 420,000 gallon fuel tank polishing to ASTM standards, the fuel can be introduced to the fuel forwarding pumps system and Day Tanks. Initially the Day Tanks must be jumpered out of the system so that only the underground piping will be flushed. The forwarding pumps must circulate fuel from the storage tank through a temporary coalescing filter and back to the storage tank for a minimum of 4 hours. The coalescing filter must be removed and inspected; this must be repeated until no visible contaminate or water is present. A detailed flushing procedure must be submitted for Government approval as part of the Existing System Cleanliness Confirmation Plan and System Start-Up Plan.

3.2.2.1 Protection of System Components

The following items must be removed from the system prior to start of flushing operations and, where applicable, replaced with spools of pipe, diameter equal to the item removed.

After flushing, the above items must be reinstalled in the system and the spool sections turned over to the Contracting Officer.

3.2.2.2 Strainers

Ensure strainers are clean before flushing. Temporary 40 mesh strainers with minimum 300 percent open area must be provided in the suction line ahead of each fueling pump for the entire flushing operation. A temporary strainer should be installed immediately upstream of the product recovery tank overfill valve. Any damaged permanent or temporary strainers must be replaced by the Contractor at no additional cost to the Government.

3.2.2.3 Water Draw-Off

Remove any accumulated water from piping and equipment. Drain water and return fuel via filtration to storage tank. Repeat process until all water is removed. Dispose of petroleum contaminated water in accordance with Installation, local, State, and Federal regulations.

3.2.3 Components

Ensure that filter-separators and other vessels are filled slowly by closing outlet valves and venting through air eliminators. Fill filter vessels using slow-fill line to maintain a packed condition in vessels throughout initial fill of piping system. Differential pressure across strainers must be continuously monitored. Any time a strainer differential pressure reaches 20 psig, it must be cleaned.

3.2.4 Fuel Quality

Fuel used during initial receipt must be considered contaminated and must be positively isolated, with blind flanges or closed-and-padlocked manual valves, from any active transfer, or tank truck loading operations. Fuel isolation must continue until all flushing and cleaning is completed. A method of checking fuel quality that is acceptable to the Contracting Officer must be provided at the beginning and end of any new piping section.

3.3 POSTED OPERATING INSTRUCTIONS

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

3.3.1 Each System

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

3.3.2 Each Tank

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

3.3.3 Each Item

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

3.4 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the system components/systems specified herein. Include pertinent safety operational procedures in the session as well as physical demonstrations of the routine maintenance operations. Furnish instructors who are familiar with the installation/system components/systems, both operational and practical theories, and associated routine maintenance procedures. The training session must consist of a total of 8 hours of normal working time and must start after the system is functionally completed, but prior to final system acceptance. Submit a letter, at least 21 working days prior to the proposed training date, scheduling a proposed date for conducting the on-site training.

-- End of Section --