UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 33 52 43.23

AVIATION FUEL PUMPS
08/18, CHG 1: 02/21

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NOTE: This guide specification covers the requirements for refueling pumps used in aircraft refueling systems constructed to the requirements of the DoD Type III/IV/V, and Cut and Cover Hydrant Refueling System Standards

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

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

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

PART 1 GENERAL

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NOTE: NOTE: DoD Type III systems must conform to Standard Design AW 078-24-28 PRESSURIZED HYDRANT FUELING SYSTEM TYPE III. DoD Type IV/V systems must conform to Standard Design AW 078-24-29 PRESSURIZED HYDRANT DIRECT FUELING SYSTEM TYPE IV/V. Cut and Cover systems must conform to Standard Design AW 078-24-33 UNDERGROUND VERTICAL STORAGE TANKS CUT AND COVER. Field fabricated ASTs must conform to AW 078-24-27 ABOVEGROUND VERTICAL STEEL TANKS WITH FIXED ROOFS.Standards can be found on the Whole Building Design Guide at the following location https://www.wbdg.org/ffc/dod/non-cos-standards.

Subject Matter Expert (SME) must be defined as Service Headquarters Subject Matter Experts: Air Force - The Air Force Fuels Facilities Subject Matter Expert (HQ AFCEC/COS), Army - Headquarters, U.S. Army Corps of Engineers, POL-MCX Facilities Proponent (CECW-EC) through the Army Petroleum Center (APC), Navy/Marine Corps - NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, CI11).
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1.1 REFERENCES

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

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

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

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

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 7	(1995; Stabilized (S) 2013) Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plan

AMERICAN PETROLEUM INSTITUTE (API)

API STD 610	(2010; Errata 2011) Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries
API STD 682	(2014) Pumps Shaft Sealing Systems For Centrifugal and Rotary Pumps

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A182/A182M	(2023) Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A487/A487M	(2021) Standard Specification for Steel Castings Suitable for Pressure Service
ASTM A582/A582M	(2022) Standard Specification for Free-Machining Stainless Steel Bars
ASTM A743/A743M	(2021) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures

HYDRAULIC INSTITUTE (HI)

HI M100	(2009) HI Pump Standards Set

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 112	(2017) Standard Test Procedure for Polyphase Induction Motors and Generators

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint,

	Epoxy-Polyamide, General Specification for
MIL-PRF-4556	(1998; Rev F; Am 1 1999; CANC Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks

1.2 ADMINISTRATIVE REQUIREMENTS

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NOTE: Add number of days below. For COE Projects, include in MOU specific AIR FORCE REPRESENTATIVES to be notified when factory test dates are submitted by the CONTRACTING OFFICER.
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Design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT.

a. Tests: Hydrostatic, performance, vibration, and NPSH tests must be conducted at the factory on each pump in accord with API 610. Test each pump with the actual motor which will drive the pump in the field, unless the water test media will cause overload of the motor. If so, provide vibration test report for motor separately. Vertical turbine pump vibration test must be run with field driver. All tests will be observed by the Contracting Officer or the designated representative. Provide the Contracting Officer 30 [_____] days notice prior to performance of factory tests in order to schedule observing such tests. Remote access via web cam must be made available. Performance testing must not occur prior to acceptance of shop drawing submittal.

b. Test reports must bear the serial number of both pump and driver. Submit manufacturer's certified reports of hydrostatic, performance, and NPSH tests. Submit manufacturer's certified test curves..

c. Operation and Maintenance Manuals must be submitted for the pumps and appurtenance specified herein. Refer to Section 01 78 23.33OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted.

d. 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 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. Motors must be high efficiency type and in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.3 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that

require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

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

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

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

SD-02 Shop Drawings

Fueling Pumps (FP-1 through FP-5); G[, [_____]].

Offload Pumps; G[, [_____]].

Fuel Transfer Pump; G[, [_____]].

Water Draw-Off Pump; G[, [_____]].

SD-03 Product Data

Fueling Pumps (FP-1 through FP-5); G[, [_____]].

Offload Pumps; G[, [_____]].

Fuel Transfer Pump; G[, [_____]].

Water Draw-off Pump; G[, [_____]].

SD-06 Test Reports

Certified Test Curves

SD-07 Certificates

Fueling Pumps (FP-1 through FP-5); G[, [_____]].

Offload Pumps; G[, [_____]].

Fuel Transfer Pump; G[, [_____]].

Water Draw-off Pump; G[, [_____]].

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]].

PART 2 PRODUCTS

2.1 FUELING PUMPS (FP-1 through FP-5)

2.1.1 Capacity

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

Capacity must be 45 L/s 600 gpm against a total head of [_____] m feet when driven at 3600 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum of [_____] percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump shut-off head must have a 10 to 20 percent head rise to shut off. Pump must be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pumps must not overheat or be damaged in any way while operating continuously at a minimum flow condition of 11 L/s 150 gpm and continuously at a maximum flow condition of 125 percent required capacity. The unit will also be required to operate at a flow of 12.5 percent required capacity GPM without exceeding the vibration limits given in API STD 610 at that flow rate. These pumps are for parallel operation and must have equal head at minimum continuous stable flow, plus or minus 2 percent.

2.1.2 General Requirements

a. The pumps must meet the requirements of API STD 610, latest edition. Whenever the information contained herein conflicts with said standard, the information herein must govern. The pumps must run at a nominal 3600 rpm and must be single stage centrifugals, horizontally mounted, vertical or radial split case, enclosed impeller, with end suction and top vertical discharge. Pumps must be of the back pull-out design to permit removing case half from rear for access to internal parts without disturbing the suction or discharge piping or the driver. All parts must be factory inspected so that parts are interchangeable. Pumps and motors must be furnished as complete units as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from minimum flow to 120 percent of design flow.

b. The pump must require no more than 5.5 m 18-feet of net positive

suction head (NPSHR) when it is operated with water at a capacity of 45 L/s 600 gpm at rated head and speed. A hydrocarbon reduction or correction factor must not be used. Pump suction specific speed must be less than 12,000.

c. The pump must be horizontal, single stage, single suction with double volute construction to assure radial balance. It must be designed to permit removal of the impeller, shaft, bearings and bearing housing as an assembly, without disconnecting the suction or discharge piping.

d. The pump case must be end suction, centerline discharge type for ease of piping alignment. Flange ratings must be class 105 kg 300-pound per ASME B16.5. The case must be designed for maximum discharge pressure at pumping temperature but not less than 3.8 MPa 550 psig, with a minimum corrosion allowance of 3 mm 1/8-inch. The suction and discharge flanges as well as the cover bolting surfaces must be backfaced or spotfaced for positive bolt seating. The radial case to cover split must be a metal-to-metal fit with a confined, controlled compression gasket.

e. The pump cover must contain a stuffing box designed to accept an unbalanced mechanical seal. The stuffing box must have a minimum of 75 mm 3-inch studs for seal gland bolting. The gasket fit for seal gland to stuffing box must be of the controlled compression type with metal-to-metal joint contact.

f. Both case and cover are to be fitted with renewable wear rings.

g. The impeller must be of the enclosed type, dynamically and hydraulically balanced. It must be key driven, held in place by a positive lock, threaded against rotation. The running clearance between the impeller and case-cover wear rings must be as required by API STD 610.

h. Mechanical Seal: A single unbalanced mechanical seal per API STD 610 code USTHN, unbalanced single seal with throttle bushing seal gland, a nitrile seal-ring-to-sleeve gasket and carbon against silicon carbide faces, of multiple spring design must be supplied. The seal gland must be tapped for three connections and each must be stamped for identification as follows: Q for quench; F for flush; and D for drain. A non-sparking throttle bushing pressed into the seal end plate against an outside shoulder must be provided to minimize leakage on complete seal failure.

i. Bearing Housing: Oil lubricated anti-friction, radial and thrust bearings of standard design must be supplied. The bearings must be selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Bearings must be retained on the shaft and fitted into housings in accordance with ABMA 7. Locking of the ball thrust bearing to the shaft must be by series W tank type washer. Minimum spacing between bearing centerlines must be 162 mm 6.5-inches.

j. A sight glass for checking oil level with a permanent indication of proper oil level must be supplied.

k. Bearing housings must be equipped with labyrinth type end seals and deflectors where the shaft passes through the housing; lip-type seals must not be used. Deflectors must be made of non-sparking material. The deflector design must effectively retain oil in the housing and

prevent entry of foreign material into the housing.

l. Shafts must be of ample size to transmit the maximum torque required under specified operating conditions, and to withstand continuously all stresses resulting from supported weights, thrusts and starting, including across-the-line motor starting. It must be key seated to provide positive drive for the coupling, shaft sleeve and impeller. The shaft stiffness factor must be under[70 for Type III][88 for Cut and Cover]. The radial bearing centerline to impeller centerline, distance and the pump shaft diameter under the sleeve must be provided to calculate the factor.

m. A spacer coupling must be supplied. The spacer length must permit the removal of the assembled pullout element without disturbing the driver or the suction and discharge piping. Couplings must be properly keyed in place. Cylindrical fits must be light enough to permit easy removal of the hub in the field without the need for heating. A service factor of at least 1.5 must be used in selecting couplings based on manufacturer's ratings.

n. Removable coupling guards of the non-sparking type must be supplied. They must comply with the requirements of OSHA.

o. Total indicated shaft runout at coupling end must be 0.025 mm 0.001-inches or less. Total shaft deflection must be no more than 0.050 mm 0.002-inches at face of stuffing box.

p. Baseplate: The baseplate must be of fabricated steel construction. It must be of the drain pan style, sloping from back to front. Connections for a drain must be tapped (25 mm (1-inch minimum) at the pump end and located to accomplish complete drainage. A sufficient number of grout holes of at least 125 mm 5-inches minimum diameter must be supplied and must have 13 mm 1/2-inch minimum raised lip edge. Pump pedestals must be trapezoidal in design.

q. Materials: No zinc, brass, bronze or other copper bearing alloy must come in contact with the fuel. Materials must be material class C-6, unless otherwise noted.

r. The case and cover must be constructed of stainless steel ASTM A487/A487M GR CF8M or ASTM A487/A487M GR CA6NM.

s. Impeller material must be stainless steel ASTM A487/A487M GR CF8M or ASTM A743/A743M CA 6NM or CA 15.

t. Wear rings must be stainless steel ASTM A182/A182M GR F6 or ASTM A276/A276M TP410 or 416.

u. Shaft must be stainless steel ASTM A276/A276M type 410 or 416 or ASTM A582/A582M Type 410 or 416 or ASTM A743/A743M CA15 HT-403.

v. Testing: All shop testing must be performed in accordance with the API STD 610.

2.1.3 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, attached by stainless steel pins at an accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service

nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, L/sgpm
Pumping head, mft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.1.4 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 6 mm 1/4-inch high must bear the equipment number as shown on the drawings.

2.1.5 Exterior Primer Coat

Exterior surfaces of the baseplate must be primed by the manufacturer. Coating must be applied meeting requirements of SSPC PA 1. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441, Type 1, Class 3. Dry film thickness must be 0.05 to 0.10 mm 2 to 4 mils.

2.1.6 Exterior Topcoat

Manufacturer's standard exterior topcoat must be applied at factory to the base plate.

2.1.7 Motors

a. Motor must be furnished by the pump manufacturer and must be non-overloading with 10 percent head increase, and suitable for the environment and operating conditions to which it will be subjected. The motors unity service factor may be used to conform to the non-overloading through-out the curve requirement for the 10% head increase condition only. Select the lowest horsepower for the motors that will meet the non-overloading requirement and co-ordinate the MCC if different than shown. Motors for vertical turbine pumps must be provided with anti-reversing ratchet. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor must be UL listed for use in Class 1, Division 1, Group D hazardous areas, and must have a maximum temperature rating of T2D (218 degrees C 419 degrees F) as defined by NFPA 70. The motor nameplate must include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating must be 460 volts, 3 phase, 60HZ. Motor nominal speed must match pump. Motors must be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10 percent above or below rated voltage.

c. Pump manufacturer must assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve. In addition to having sufficient horsepower-output rating at rated speed,

motor must have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of 10 starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors must conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are subject to variation, service factors above unity must not be applied in sizing motor.

d. Motor must be squirrel-cage induction type. Motor must be NEMA Design B (normal-torque, low starting current).

e. Motor insulation must be non-hydroscopic, NEMA Class H, 180 degrees C 82 degrees F for motors over 7.5 kW 10 hp and NEMA Class F, 150 degrees C 302 degrees F for 7.5 kW 10 hp and smaller. Stator windings must be epoxy impregnated. The impregnations must be applied by the vacuum and pressure process.

f. Winding temperature rise, (based on a maximum ambient temperature of 40 degrees C 104 degrees F at 1006 m 3300-feet altitude) must not exceed 80 degrees C 176 degrees F.

g. Bearings must be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures must be totally enclosed, weather sealed, fan cooled, explosion-proof and must be listed and labeled for Class 1, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections must be terminated within a single terminal housing.

i. The dynamic balance, overspeed withstand capability, and sound power levels of the motor must conform with NEMA standard requirements.

j. The pump manufacturer must furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor must be provided with temperature limiting thermostats within the motor frame when required to meet Class 1, Group D requirements.

l. Pump motor must be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower must be the premium efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies must be (based on 3600, 2 pole, totally enclosed):

15 kW20 hp	92.0 percent	56 kW75 hp	95.5 percent
19 kW25 hp	92.0 percent	75 kW100 hp	93.5 percent
22 kW30 hp	92.0 percent	93 kW125 hp	94.5 percent
30 kW40 hp	92.0 percent	112 kW150 hp	94.5 percent
37 kW50 hp	92.5 percent	149 kW200 hp	94.5 percent
45 kW60 hp	92.5 percent	447 kW600 hp	94.5 percent

n. Other motors of different speed or housing classification must also be of the premium efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor efficiencies must have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in IEEE 112, Method B. All shop drawing submittals on motor driven equipment must include the motor efficiency.

2.2 FUELING PUMP (VERTICAL TURBINE) (FP)

2.2.1 Capacity

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

Capacity must be [45][68] L/s [600][900] gpm against a total head of [_____] m feet for the Fueling Pump, when driven at 1800 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum [_____] percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump must be capable of at least 5 percent head increase at rated conditions by installing a new impeller.

2.2.2 Assembly

The pump for this service must meet the requirements of API STD 610, latest edition, seventh edition for vibration. Wherever the information contained herein conflicts with said standard, the information herein must govern. The pump for this service must run at a nominal 1800 rpm and must be a multi-stage, vertical turbine pump. Pump and motor must be furnished as a complete unit as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from minimum flow to 120 percent of design flow. Flanged column, shaft, and bearing spacing must not exceed 1.5 m 5-foot sections to facilitate pump disassembly within pump room.

2.2.3 Materials

The materials of construction for the pump shaft and the impeller must be stainless steel. All other materials must be material class S-1 with the wetted ferrous parts such as the bowl interiors enamel-lined, bowl exteriors, column interior and exterior, discharge head interior epoxy-coated per MIL-PRF-4556, and discharge head exterior epoxy-coated per MIL-DTL-24441.

2.2.3.1 Mechanical Seal

API STD 682, balanced type, API Class Code BSTHN.

2.2.4 Construction

Castings used for any part of pumps must be sound and free of shrink or blow holes, scale, blisters, and other similar casting defects. The surfaces of casting must be cleaned by sand or shot blasting, pickling, or other standard methods used by the manufacturer. All mold parting fins and remains of gates and risers must be either chipped, filed, or ground flush with the surface of the casting. The repair of casting leaks and defects by peening or by the use of cement compounds is prohibited. All welding to be per ASME BPVC SEC IX.

2.2.4.1 Couplings

Couplings must be flanged, rigid spacer type, CPAT or equal. The couplings must be of the spacer-type with a spacer of sufficient length to permit replacement of the mechanical seal assembly without removing the motor. The pump half coupling must be of such design that it can be removed without the use of heat. Coupling halves must fit tightly to the shafts of the pump and the driver so as not to become loose during operation. The coupling must be provided with an OSHA approved coupling guard.

2.2.4.2 Impeller

Impeller must be enclosed and double keyed to the shaft for radial loads and fixed in the axial position by shaft sleeve nuts, or other positive positioning device. Impellers must be held to the shaft so that the impeller will not become loose should the pump accidentally rotate in reverse direction. The impeller must be statically and dynamically balanced to 8 W/N.

2.2.4.3 Wear Rings

Renewable stainless steel wearing rings must be positively locked on the impeller. Wearing rings must fit with close tolerances so as to permit a minimum of recirculation. Wear ring hardened surfaces differential must be at least Brinell 50. Positive locking case wearing rings must be provided so that the case wearing rings will not rotate or change position in the case. Clearances must be established for hydrocarbon (Jet Fuel) service.

2.2.4.4 Shaft

Shaft must be designed with a high safety factor to easily withstand the torsional loads and other stresses to which it may be subjected. It must be so designed that there will be no detrimental vibration stresses. Surfaces must be ground to accurate dimensions. Shaft deflection must be limited to 0.05 mm 0.0020-inch maximum when measured at the face of the mechanical seal under the operating condition of zero flow at shut off head. Seal piping from the discharge to the mechanical seal must be provided. The pump shaft must be in maximum 1.5 m 5 foot sections, and couplings must be keyed and split ring type, not threaded.

2.2.4.5 Finishing

Passageways and impellers must be finished to permit maximum efficiency and provide noise reduction. Overall sound levels must not exceed OSHA limits.

2.2.4.6 Bearings

Bearings must be product-lubricated. Sleeve type, carbon graphite must be provided. Bearing spacing must be per API STD 610, eight edition, but must not exceed 1.5 m 5-foot in any case.

2.2.4.7 Drilling and Tapping

Casting must be drilled and tapped for drain and seal recirculation lines. All connections must be provided with plugs.

2.2.4.8 Mounting Flange

Mounting flange must be coordinated with the tank's mounting flange, and must be ANSI or API pattern, and contain a 25 mm 1-inch tapping for air eliminator discharge.

2.2.4.9 Pump Discharge

Pump discharge head must include a 25 mm 1 inch tapping at the highest point with valve, 100 mesh strainer, and air eliminator valve, as specified in Section 33 52 43.13, AVIATION FUEL PIPING, with check valve on outlet.

2.2.4.10 Special Tools

Pumps must be furnished with special tools necessary to dismantle and reassemble the unit.

2.2.4.11 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, securely attached by stainless steel pins at an easily accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, L/s gpm
Pumping head, m ft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.2.4.12 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 6 mm 1/4-inch high must be the equipment number as shown on the drawings.

2.2.4.13 Primer Coat

Surfaces of the pump and baseplate must be primed by the manufacturer. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441 Type 1, Class 3. Dry film thickness must be 0.05 to 0.2 mm 2 to 4 mils.

2.2.4.14 Topcoat

Topcoat must be factory applied and must be white and conforming to specification MIL-DTL-24441.

2.2.5 Motor

a. Motor must be furnished by the pump manufacturer and must be suitable for the environment and operating conditions to which it will be subjected and be provided with anti-reversing ratchet. The motors unity service factor may be used to conform to the non-overloading through-out the curve requirement for the 10% head increase condition only. Select the lowest horsepower for the motors that will meet the non-overloading requirement and co-ordinate the MCC if different than shown. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor must be UL listed for use in Class 1, Division 1, Group D hazardous areas, and must have a maximum temperature rating of "T2D 216 degrees C 419 degrees F " as defined by NFPA 70. The motor nameplate must include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating must be 460 volts, 3 phase, 60HZ. Motor nominal speed must match pump. Motors must be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10 percent above or below rated voltage.

c. Pump manufacturer must assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve based on the future potential of a 5 percent head increase. In addition to having sufficient horsepower-output rating at rated speed, motor must have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of 10 starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors must conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are subject to variation, service factors above unity must not be applied in sizing motor.

d. Motor must be squirrel-cage induction type, high thrust vertical P base, unless bearing frame pump is utilized. Motor must be NEMA Design B (normal-torque, low starting current).

e. Motor insulation must be non-hydroscopic, NEMA Class F, 150 degrees C 302 degrees F for motors. Motor windings must be supplied with extra dips and bakes.

f. Winding temperature rise, (based on a maximum ambient temperature of 40 degrees C 104 degrees F at 1006 m 3300-feet altitude) must not exceed 80 degrees C 176 degrees F.

g. Bearings must be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures must be totally enclosed, weather sealed, fan cooled, explosion-proof and must be listed and labeled for Class 1, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections must be terminated within a single terminal housing.

i. The motors must be dynamically balanced and vibration measured per NEMA MG 1, vibration and balance under category "precision". Motor overspeed withstand capability and sound power levels of the motor must conform with NEMA standard requirements.

j. The pump manufacturer must furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor must be provided with temperature limiting thermostats within the motor frame when required to meet Class 1, Group D requirements.

l. Pump motor must be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower must be the premium efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies must be (based on 1800 rpm, 4 pole, totally enclosed):

15 kW20 hp	92.0 percent	56 kW75 hp	95.5 percent
19 kW25 hp	92.0 percent	75 kW100 hp	93.5 percent
22 kW30 hp	92.0 percent	93 kW125 hp	94.5 percent
30 kW40 hp	92.0 percent	112 kW150 hp	94.5 percent
37 kW50 hp	92.5 percent	149 kW200 hp	94.5 percent
45 kW60 hp	92.5 percent	447 kW600 hp	94.5 percent

n. Other motors of different speed or housing classification must also be of the premium efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor efficiencies must have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in

IEEE 112, Method B. All shop drawing submittals on motor driven equipment must include the motor efficiency.

2.3 OFFLOAD PUMPS

2.3.1 Capacity

****
NOTE: Insert site specific pump requirements. Pump capacity to be provided by SME.
****

Capacity must be [45] [23] L/s [600] [300] gpm against a total head of [_____] m feet when driven at 3600 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum of 60 percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump shut-off head must have a 10 to 20 percent head rise to shut off. Pump must be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pumps must not overheat or be damaged in any way while operating continuously at a minimum flow condition of 11 L/s 150 gpm and continuously at a maximum flow condition of 125 percent required capacity L/s GPM. The unit will also be required to operate at a flow of 12.5 percent required capacity without exceeding the vibration limits given in API STD 610. These pumps are for parallel operation and must have equal head at minimum continuous stable flow, plus or minus 2 percent.

2.3.2 General Requirements

a. The pumps for this service must meet the requirements of API STD 610, latest edition. Whenever the information contained herein conflicts with said standard, the information here in must govern. The pumps for this service must run at a nominal 3600 rpm and must be single stage centrifugals, horizontally mounted, vertical or radial split case, enclosed impeller, vertical-in-line with end suction and discharge. All parts must be factory inspected so that parts are interchangeable. Pumps and motors must be furnished as complete units as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow.

b. The pump must require no more than 4.7 m 15.5-feet of net positive suction head (NPSHR) when it is operated with water at a capacity of [45] [23] L/s [600] [300] gpm at rated head and speed. A hydrocarbon reduction or correction factor must not be used. Pump suction specific speed must be less than 12,000.

c. The pump must be vertical in-line, single stage, single suction with double volute construction to assure radial balance. It must be designed to permit removal of the impeller, shaft, bearings and bearing housing as an assembly, without disconnecting the suction or discharge piping. Pump must be designed to remove the mechanical cartridge seal without removing the motor.

d. The pump case must be vertical in-line type for ease of piping alignment. Flange ratings must be class 100 kg 300-pound per ASME B16.5. The case must be designed for maximum discharge pressure at pumping temperature but not less than 3.8 MPa 550 psig, with a minimum corrosion allowance of 3mm 1/8-inch. The suction and discharge flanges as well as the cover bolting surfaces must be

backfaced or spotfaced for positive bolt seating. The radial case to cover split must be a metal-to-metal fit with a confined, controlled compression gasket.

e. The pump cover must contain a stuffing box designed to accept an unbalanced mechanical seal. The stuffing box must have a minimum of 75 mm 3-inch studs for seal gland bolting. The gasket fit for seal gland to stuffing box must be of the controlled compression type with metal-to-metal joint contact.

f. Both case and cover are to be fitted with renewable wear rings.

g. The impeller must be of the enclosed type, dynamically and hydraulically balanced. It must be key driven, held in place by a positive lock, threaded against rotation.

h. Mechanical Seal. A single unbalanced mechanical seal per API STD 610 code USTHN of multiple spring design must be supplied. The seal gland must be tapped for three connections and each must be stamped for identification as follows: Q for quench; F for flush; and D for drain. A non-sparking throttle bushing pressed into the seal end plate against an outside shoulder must be provided to minimize leakage on complete seal failure.

i. Bearing Housing. Grease lubricated anti-friction, radial and thrust bearings of standard design must be supplied. The bearings must be selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Pumps may be provided with or without bearing brackets.

j. Shafts must be of ample size to transmit the maximum torque required under specified operating conditions, and to withstand continuously all stresses resulting from supported weights, thrusts and starting, including across-the-line motor starting. It must be key seated to provide positive drive for the line motor starting. It must be key seated to provide positive drive for the coupling, shaft sleeve and impeller. The shaft stiffness factor must be under 70. The radial bearing centerline to impeller centerline, distance and the pump shaft diameter under the sleeve must be provided to calculate the factor.

k. A rigid type spacer coupling must be supplied. The spacer length must permit the removal of the assembled pullout element without disturbing the driver or the suction and discharge piping. Couplings must be properly keyed in place. Cylindrical fits must be light enough to permit easy removal of the hub in the field without the need for heating. A service factor of at least 1.5 must be used in selecting couplings based on manufacturer's ratings.

l. Removable coupling guards of the non-sparking type must be supplied. They must comply with the requirements of OSHA.

m. Total indicated shaft runout at coupling end must be 0.025 mm 0.001-inches or less. Total shaft deflection must be no more than 0.05 mm 0.002-inches at face of stuffing box.

n. Materials. No zinc, brass, bronze or other copper bearing alloy must come in contact with the fuel.

o. The case and cover must be constructed of stainless steel

ASTM A487/A487M GR CF8M or ASTM A487/A487M GR CA6NM

p. Impeller material must be stainless steel ASTM A487/A487M GR CF8M or ASTM A743/A743M CA 6NM.

q. Wear rings must be stainless steel ASTM A182/A182M GR F6 or ASTM A276/A276M TP410 or 416 or ASTM A743/A743M CA15 HT-403.

r. Shaft must be stainless steel ASTM A276/A276M type 410 or 416 or ASTM A582/A582M Type 410 or 416 with renewable shaft sleeve of ASTM A276/A276M type 316L with hard facing under mechanical seal gasket.

s. Testing. All shop testing must be performed in accordance with the HI M100.

2.3.3 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, attached by stainless steel pins at an accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, L/s gpm
Pumping head, m ft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.3.4 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 6 mm 1/4-inch high must bear the equipment number as shown on the drawings.

2.3.5 Exterior Primer Coat

Exterior surfaces of the baseplate must be primed by the manufacturer. Coating must be applied meeting requirements of SSPC PA 1. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441, Type 1, Class 3. Dry film thickness must be 0.05 to 0.1 mm 2 to 4 mils.

2.3.6 Exterior Topcoat

Manufacturer's standard exterior topcoat must be applied at factory to the base plate.

2.3.7 Motors

a. Motor must be furnished by the pump manufacturer and must be suitable for the environment and operating conditions to which it will be subjected. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor must be UL listed for use in Class 1, Division 1, Group D hazardous areas, and

must have a maximum temperature rating of T2D (216 degrees C 419 degrees F) as defined by NFPA 70. The motor nameplate must include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating must be 460 volts, 3 phase, 60HZ. Motor nominal speed must match pump. Motors must be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10 percent above or below rated voltage.

c. Pump manufacturer must assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve. In addition to having sufficient horsepower-output rating at rated speed, motor must have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of 10 starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors must conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are subject to variation, service factors above unity must not be applied in sizing motor.

d. Motor must be squirrel-cage induction type. Motor must be NEMA Design B (normal-torque, low starting current).

e. Motor insulation must be non-hydroscopic, NEMA Class F, 150 degrees C 300 degrees F for motors. Stator windings must be epoxy impregnated. The impregnations must be applied by the vacuum and pressure process.

f. Winding temperature rise, (based on a maximum ambient temperature of 40 degrees C 104 degrees F at 1006 m 3300-feet altitude) must not exceed 80 degrees C 176 degrees F.

g. Bearings must be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures must be totally enclosed, weather sealed, fan cooled, explosion-proof and must be listed and labeled for Class 1, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections must be terminated within a single terminal housing.

i. The dynamic balance, overspeed withstand capability, and sound power levels of the motor must conform with NEMA standard requirements.

j. The pump manufacturer must furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor must be provided with temperature limiting thermostats within the motor frame when required to meet Class 1, Group D requirements.

l. Pump motor must be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower must be the premium efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies must be (based on 3600 rpm, 2 pole totally enclosed):

15 kW20 hp	92.0 percent	56 kW75 hp	95.5 percent
19 kW25 hp	92.0 percent	75 kW100 hp	93.5 percent
22 kW30 hp	92.0 percent	93 kW125 hp	94.5 percent
30 kW40 hp	92.0 percent	112 kW150 hp	94.5 percent
37 kW50 hp	92.5 percent	149 kW200 hp	94.5 percent
45 kW60 hp	92.5 percent	373 kW500 hp	94.5 percent

n. Other motors of different speed or housing classification must also be of the premium efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor efficiencies must have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in IEEE 112, Method B. All shop drawing submittals on motor driven equipment must include the motor efficiency.

2.4 FUEL TRANSFER PUMP (FTP-1) AND WATER DRAW-OFF PUMP (WSP-1 AND WSP-2)

2.4.1 Capacity

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

Capacity must be 3.8 L/s 50 gpm against a total head of [_____] m feet for the Fuel Transfer Pump, and 3.8 L/s 50 gpm against a total head of [_____] m feet for the Water Draw-off Pump, when driven at 1800 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum [_____] percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump must be capable of at least 10 percent head increase at rated conditions by installing a new impeller.

2.4.2 Assembly

****
NOTE: Select pump stage requirements.
****

The pump for this service must meet the requirements of API STD 610, latest edition, seventh edition for vibration. Wherever the information contained herein conflicts with said standard, the information herein must

govern. The pump for this service must run at a nominal 1800 rpm and must be a [single stage] [multi-stage], vertical turbine pump. Pump and motor must be furnished as a complete unit as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from minimum flow to 120 percent of design flow.

2.4.3 Materials

The materials of construction for the pump shaft and the impeller must be stainless steel. All other materials must be material class S-1 with the wetted ferrous parts such as the bowl interiors enamel-lined, bowl exteriors, column interior and exterior, discharge head interior epoxy-coated per MIL-PRF-4556, and discharge head exterior epoxy-coated per MIL-DTL-24441.

2.4.3.1 Mechanical Seal

API STD 682, balanced type, API Class Code BSTHN.

2.4.4 Construction

Castings used for any part of pumps must be sound and free of shrink or blow holes, scale, blisters, and other similar casting defects. The surfaces of casting must be cleaned by sand or shot blasting, pickling, or other standard methods used by the manufacturer. All mold parting fins and remains of gates and risers must be either chipped, filed, or ground flush with the surface of the casting. The repair of casting leaks and defects by peening or by the use of cement compounds is prohibited.by ASME BPVC SEC VIII D1.

2.4.4.1 Couplings

Couplings must be flanged, rigid spacer type, CPAT or equal. The couplings must be of the spacer-type with a spacer of sufficient length to permit replacement of the mechanical seal assembly without removing the motor. The pump half coupling must be of such design that it can be removed without the use of heat. Coupling halves must fit tightly to the shafts of the pump and the driver so as not to become loose during operation. The coupling must be provided with an OSHA approved coupling guard.

2.4.4.2 Impeller

Impeller must be keyed to the shaft for radial loads and fixed in the axial position by shaft sleeve nuts, or other positive positioning device. Impellers must be held to the shaft so that the impeller will not become loose should the pump accidentally rotate in reverse direction. The impeller must be statically and dynamically balanced.

2.4.4.3 Wear Rings

Renewable wearing rings must be positively locked on the impeller. Wearing rings must fit with close tolerances so as to permit a minimum of recirculation. Positive locking case wearing rings must be provided so that the case wearing rings will not rotate or change position in the case.

2.4.4.4 Shaft

Shaft must be designed with a high safety factor to easily withstand the

torsional loads and other stresses to which it may be subjected. It must be so designed that there will be no detrimental vibration stresses. Surfaces must be ground to accurate dimensions. Shaft deflection must be limited to 0.05 0.0020-inch maximum when measured at the face of the mechanical seal under the operating condition of zero flow at shut off head. Shaft must be protected through the mechanical seal by means of a shaft sleeve. Seal piping from the discharge to the mechanical seal must be provided.

2.4.4.5 Finishing

Passageways and impellers must be finished to permit maximum efficiency and provide noise reduction. Overall sound levels must not exceed OSHA limits.

2.4.4.6 Bearings

Bearings must be product-lubricated. Sleeve type, carbon graphite must be provided. Bearing spacing must be per API STD 610.

2.4.4.7 Drilling and Tapping

Casting must be drilled and tapped for drain and seal recirculation lines. All connections must be provided with plugs.

2.4.4.8 Mounting Flange

Mounting flange must be coordinated with the tank's mounting flange, and must be ANSI or API pattern.

2.4.4.9 Special Tools

Pumps must be furnished with special tools necessary to dismantle and reassemble the unit.

2.4.4.10 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, securely attached by stainless steel pins at an easily accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, L/s gpm
Pumping head, m ft
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.4.4.11 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 6 mm 1/4-inch high must be the equipment number as shown on the drawings.

2.4.4.12 Exterior Primer Coat

Exterior surfaces of the pump and baseplate must be primed by the manufacturer. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441 Type 1, Class 3. Dry film thickness must be 0.05 to 0.1 mm 2 to 4 mils.

2.4.4.13 Exterior Topcoat

Manufacturer's standard exterior topcoat must be factory applied and must be white.

2.4.5 Motor

Refer to paragraph, Motors for the Fueling Pumps.

PART 3 EXECUTION

3.1 PREPARATION FOR SHIPMENT

3.1.1 Rust Preventative

Exterior machine surfaces must be coated with a rust preventative. Pumps must be disassembled after the shop running tests and inspected, and internal parts must be coated with a rust preventative before reassembling.

3.1.2 Closure of Openings

Threaded openings must be provided with metallic plugs or caps. Flanges must be gasketed with rubber and closed with 4.8 mm 3/16-inch thick plate of the same outside diameter as the match flange. A minimum of four full-diameter bolts must hold closure in place.

3.1.3 Assembly

Pumps must be shipped assembled or a field service engineer must be furnished to supervise the field assembly at no additional cost to the Government.

3.1.4 Bracing

Each unit must be suitably prepared for shipment, supported and braced, with auxiliary equipment secured to prevent damage during shipment.

3.1.5 Vapor Inhibiting Wraps

Exposed shafts and shaft couplings must be wrapped with waterproof moldable waxed cloth or vapor inhibitor paper. The seams must be sealed with adhesive tape.

3.1.6 Shipping Identification

Each pump must be identified with a metal tag showing the item number. Material shipped separately must be marked with a metal tag indicating the item number for which it is intended.

3.2 INSTALLATION

Install equipment and components 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 must be easily accessible.

3.2.1 Anchoring

Anchor equipment in place as indicated on the drawings or per manufacturer's recommendations. Minimum anchor bolt size is 127 mm 5 inch. Check alignment of anchor bolts and/or bolt holes before installing equipment and clean-out associated sleeves. Do not cut bolts due to misalignment. Notify the 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.

3.2.2 Grouting

Equipment which is anchored to a pad must 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, coatings and other materials which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide 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 to meet requirements of ASTM C827/C827M. Perform all grouting in accord with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.2.3 Leveling and Aligning

Level and align equipment in accord 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.

3.2.4 Direct Drives

Alignment procedure follows.

3.2.4.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.2.4.2 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.

3.2.4.3 Shaft Leveling and Radial Alignment

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

3.2.4.4 Angular Alignment and End Clearance

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

3.2.4.5 Final Recheck

Check adjustments with dial indicator after completing recheck. Align shafts within 0.05 0.002-inch tolerance, except as otherwise required by more stringent requirements of equipment manufacturer.

3.2.5 Start-up Representative

****

NOTE: Consult with SME to determine if additional training is required.

****

A manufacturer's field service representative must be provided at no additional cost to the Government to check the pumps for proper operation prior to start-up and also to witness, as a minimum, the first two days of operation. Any additional time required due to delays or corrections must be provided at no additional cost to the Government. The manufacturer's field service representative must also instruct the required personnel in the proper operation and maintenance of the pumps.

-- End of Section --