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An American National Standard

Standard Specification for Rotary Positive Displacement Distillate Fuel Pumps[1]

This standard is issued under the fixed designation F1718; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the requirements applicable to the design and construction of rotary positive displacement distillate fuel pumps for shipboard use.

1.2 Lineal dimensions and units of force in this specification are expressed as inches and pounds respectively. A companion metric standard is in the process of preparation.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A36/A36M Specification for Carbon Structural Steel
A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A106/A106M Specification for Seamless Carbon Steel Pipe for High-Temperature Service
A193/A193M Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
A194/A194M Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
A269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A276 Specification for Stainless Steel Bars and Shapes
A312/A312M Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A354 Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
A434 Specification for Steel Bars, Alloy, Hot-Wrought or Cold-Finished, Quenched and Tempered
A449 Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
A563 Specification for Carbon and Alloy Steel Nuts
A564/A564M Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
A574 Specification for Alloy Steel Socket-Head Cap Screws
A582/A582M Specification for Free-Machining Stainless Steel Bars
A743/A743M Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
A747/A747M Specification for Steel Castings, Stainless, Precipitation Hardening
B148 Specification for Aluminum-Bronze Sand Castings
B150/B150M Specification for Aluminum Bronze Rod, Bar, and Shapes
B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B271 Specification for Copper-Base Alloy Centrifugal Castings
B505/B505M Specification for Copper Alloy Continuous Castings
B584 Specification for Copper Alloy Sand Castings for General Applications
D1418 Practice for Rubber and Rubber Latices—Nomenclature
D2000 Classification System for Rubber Products in Automotive Applications
D3951 Practice for Commercial Packaging
F104 Classification System for Nonmetallic Gasket Materials
F467 Specification for Nonferrous Nuts for General Use
F468 Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use
F593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
F594 Specification for Stainless Steel Nuts
F837 Specification for Stainless Steel Socket Head Cap Screws
F880 Specification for Stainless Steel Socket, Square Head, and Slotted Headless-Set Screws

[1] This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

F912 Specification for Alloy Steel Socket Set Screws
F1511 Specification for Mechanical Seals for Shipboard Pump Applications
2.2 *ANSI Standard:*[3]
B16.24 Pipe Flanges and Flanged Fittings
2.3 *ANSI/HI Standard:*[3]
3.6 Rotary Pump Tests
2.4 *AMS Standards:*[4]
3215 Acrylonitrile Butadiene (NBR) Rubber Aromatic Fuel Resistant 65-75
4676 Bars and Forgings, Corrosion Resistant, Hot Finished, Precipitation Hardenable 66.5 Ni, 3.0 AL, 0.62 Ti, 28 Cu
4677 Bars and Forgings, Corrosion Resistant, Annealed 66.5 Ni, 2.9 AL, 30 Cu
5894 Bars, Sheet, and Plate, Alloy 60 Co, 28 Cr, 4.5 W, 1.15 C, Solution Heat Treated
2.5 *ABMA Standards:*[5]
9 Load Ratings and Fatigue Life for Ball Bearings
11 Load Ratings and Fatigue Life for Roller Bearings
2.6 *AGMA Standard:*[6]
390.03 Gear Classification, Materials and Measuring Methods for Unassembled Gears
2.7 *Military Standards:*[7]
MIL-STD-167-1 (Ships) Mechanical Vibrations of Shipboard Equipment (Type 1—Environmental and Type 2—Internally Excited)
MIL-STD-740-1 (Ships) Airborne Sound Measurements and Acceptance Criteria of Shipboard Equipment
MIL-STD-740-2 (Ships) Structureborne Vibratory Acceleration Measurements and Acceptance Criteria of Shipboard Equipment
2.8 *Military Specifications:*[7]
MIL-N-25027 Nut, Self-Locking, 250°F, 450°F and 800°F, 125 KSI FTU, 60 KSI FTU and 30 KSI FTU
MIL-S-901 Shock Tests, HI (High Impact) Shipboard Machinery, Equipment and Systems, Requirements for Navy
MIL-R-83248 Rubber Fluorocarbon Elastomer, High Performance Fluid, and Compression Set Resistant
2.9 *International Standards Organization Standards:*[3]
ISO 9001 Quality Systems and Quality Assurance—Design/Development, Production, Installation, and Service
ISO 9066 Information Processing Systems—Text Communication—Reliable Transfer—Part 2: Protocol Specification

3. Terminology

3.1 *Definitions:*

3.1.1 *capacity, n*—the quantity of fluid actually delivered per unit of time at the rated speed, including both the liquid and dissolved or entrained gases, under stated operating conditions.

3.1.1.1 *Discussion*—In the absence of any gas or vapor entering or forming within the pump, the capacity is equal to the volume displaced per unit of time, less slip.

3.1.2 *capacity, maximum, n*—the quantity of fluid delivered that does not exceed the limit determined by the formula in 4.1.2.1.

3.1.3 *capacity, rated, n*—the minimum quantity of fluid delivered at the specified conditions of discharge pressure, inlet pressure and viscosity as shown in Table 1.

3.1.4 *displacement, n*—the volume displaced per revolution of the rotor(s).

3.1.4.1 *Discussion*—In pumps incorporating two or more rotors operating at different speeds, the displacement is the volume displaced per revolution of the driving rotor. Displacement depends only on the physical dimensions of the pumping elements.

3.1.5 *dry operation, n*—a brief run during priming or stripping with suction and discharge lines unrestricted and pump chamber wet with liquid but pumping only air or vapor available from the suction.

3.1.6 *efficiency, mechanical, n*—the ratio of the pump power output (hydraulic horsepower) to the pump power input (brake horsepower) expressed in percent.

3.1.7 *efficiency, volumetric, n*—the ratio of the pump's capacity to the product of the displacement and the speed expressed in percent.

3.1.8 *fuel, clean, n*—fuel purified for direct use.

3.1.9 *fuel, dirty, n*—fuel before purification that may contain water and some solids.

3.1.10 *net positive inlet pressure available (NPIPA), n*—the total inlet pressure available from the system at the pump inlet connection at the rated flow, minus the vapor pressure of the liquid at the pumping temperature.

3.1.11 *net positive inlet pressure required (NPIPR), n*—the net pressure above the liquid vapor pressure at rated flow and pumping temperature and at the pump inlet connection required to avoid performance impairment due to cavitation.

3.1.12 *pressure, cracking, n*—sometimes called set pressure, start-to-discharge pressure, or popping pressure; the pressure at which the relief valve just starts to open.

3.1.12.1 *Discussion*—This pressure cannot be determined readily in a relief valve that bypasses the liquid within the pump.

TABLE 1 Pump Sizes

Size	A	B	C	D	E	F	G	H
Rated capacity (gpm)	10	25	50	75	100	200	300	400
Maximum capacity (gpm)	13	30	59	86	114	221	328	433
Flange rating (lb)	150	150	150	150	150	150	150	150

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.
[5] Available from American Bearing Manufacturers Association (ABMA), 2025 M Street, NW Suite 800, Washington, DC 20036, http://www.abma-dc.org/.
[6] Available from American Gear Manufacturer's Association (AGMA), 500 Montgomery St., Suite 350, Alexandria, VA 22314-1581, http://www.agma.org.
[7] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

3.1.13 *pressure, differential, n*—the difference between discharge pressure and inlet pressure.

3.1.14 *pressure, discharge, n*—the total pressure at the outlet of the pump; discharge pressure is sometimes called outlet pressure.

3.1.15 *pressure, inlet, n*—the total pressure at the inlet of the pump. Inlet pressure is sometimes called suction pressure.

3.1.16 *pressure, maximum allowable working, n*—the maximum continuous pressure for which the manufacturer has designed the equipment (or any part to which the term is referred) when handling the specified fluid at the specified temperature.

3.1.16.1 *Discussion*—This pressure should not be greater than two thirds of the hydrostatic test pressure of the pressure containing parts.

3.1.17 *rated condition, n*—defined by discharge pressure, inlet pressure, capacity, and viscosity.

3.1.18 *rotary pump, n*—a positive displacement pump consisting of a casing containing gears, screws, lobes, cams, vanes, shoes, or similar elements actuated by relative rotation between the drive shaft and the casing.

3.1.18.1 *Discussion*—There are no inlet and outlet valves. These pumps are characterized by their close running clearances.

3.1.19 *slip, n*—the quantity of fluid that leaks through the internal clearances of a rotary pump per unit of time.

3.1.19.1 *Discussion*—Slip depends on the internal clearances, the differential pressure, the characteristics of the fluid handled and in some cases, the speed.

3.1.20 *speed, maximum allowable, n—in revolutions per minute*, the highest speed at which the manufacturers' design will permit continuous operation.

3.1.21 *speed, minimum allowable, n—in revolutions per minute*, the lowest speed at which the manufacturers' design will permit continuous operation.

3.1.22 *speed, rated, n*—the number of revolutions per minute of the driving rotor required to meet the rated conditions.

3.1.23 *suction lift, n*—a term used to define a pump's capability to induce a partial vacuum at the pump inlet.

3.1.24 *temperature, maximum allowable, n*—the maximum continuous temperature for which the manufacturer has designed the equipment (or any part to which the term is referred) when handling the specified fluid at the specified pressure.

3.1.25 *unit, pump, n*—the pump and motor assembly; it also includes a gear box, base, couplings, guards, as required.

4. Classification

4.1 Pumps shall be classified as follows:

4.1.1 *Types:*

4.1.1.1 *Type II*—Screws with timing gears.

4.1.1.2 *Type III*—Screws without timing gears.

4.1.1.3 *Type IV*—Impellers with timing gears.

4.1.1.4 *Type V*—External gear (spur, helical, herringbone, lobe).

4.1.1.5 *Type VIII*—Internal gear, internal rotary lobe.

4.1.1.6 *Type X*—Vane (sliding).

4.1.1.7 *Type XI*—Sliding shoe.

4.1.2 *Sizes:*

4.1.2.1 Standard pump sizes shall be as shown in Table 1. Rated capacity shall be based on 150-psig discharge pressure, 10-psia inlet pressure and 32-SSU viscosity (1034-kPa gauge, 69 kPa absolute, and 2 centistoke, respectively). Rated capacity equals the minimum capacity. The maximum capacity shall not exceed the amount determined by the following formula:

$$Q_{max} = Q\left[1 + \frac{1}{1 + Q^{0.4}}\right] \quad (1)$$

where:

Q = the rated capacity (minimum capacity) and

Q_{max} = maximum allowable capacity, at 32-SSU viscosity Q_{max} shall be rounded to nearest whole number.

5. Ordering Information

5.1 The ordering activity is to provide the following information to the potential bidders:

5.1.1 Title, number, and date of specification.

5.1.2 Type and size of each pump (see Section 4).

5.1.3 Quantity of each pump type and size (see Table 1).

5.1.4 Mounting configuration (vertical, horizontal).

5.1.5 Motor characteristics and specifications (see 7.6 and motor specification if applicable).

5.1.6 Discharge pressure.

5.1.7 System relief valve cracking pressure and full flow bypass pressure (see 7.6 and 7.15).

5.1.8 Preservation, packaging, packing, and boxing requirements (see Section 14).

5.1.9 Quantity of drawings (see 13.2).

5.1.10 Quantity of manuals (see 13.3).

5.1.11 Format and quantity of each type of test report (see 12.1.1.4 and S12.3.8).

5.1.12 Shock, noise, and vibration requirements, if applicable (see S12.3).

5.1.13 Types of certified data required (see 12.1.2).

5.1.14 Instruction plates and locations, if required.

5.1.15 Define shipbuilding specification, if applicable (see 13.1).

6. Materials

6.1 Pump component parts shall be constructed of the materials shown in Table 2.

7. General Requirements

7.1 Pumps shall be designed to pump distillate fuel and aviation turbine fuel with a viscosity range of 32 to 100 SSU (2 to 21 cSt).

7.2 Pumps shall be capable of sustained operation during inclinations up to 45° in any direction.

7.3 The pumps shall be capable of withstanding environmental vibration induced by shipboard machinery and equipment in the frequency range of 4 to 25 Hz.

7.4 The internally excited vibration levels of the pump shall not exceed 0.003-in. (0.076-mm) displacement peak to peak

TABLE 2 Materials

Component	Materials	Specification (UNS)
Casings, heads and covers	Aluminum bronze	B148 (C95800)
	Leaded tin bronze	B584 (C93700)
	Stainless steel, precipitation hardening	A747/A747M
Shafts	Ni-Cu-Al alloy (Monel K-500)	AMS 4676, AMS 4677 (N05500)
	Stainless steel	A564/A564M (S17400)
Rotors	Aluminum bronze	B150/B150M (C63000)
	Leaded tin bronze	B584 (C93700)
	Ni-Cu-Al alloy (Monel K-500)	AMS 4676, AMS 4677 (N05500)
	Austenitic stainless steel	A276 (S21800)
	Stainless steel, precipitation hardening	A564/A564M (S17400)
Rotor housings, liners, and disks	Leaded tin bronze	B584, B505/B505M, or B271 (C93700)
	Stainless steel, precipitation hardening	A564/A564M, A747/A747M (S17400)
	Stellite	AMS 5894
Glands	Stainless steel	A743/A743M Gr. CF8M (J92900)
	Tin bronze	B584, B271, or B505/B505M (C90300)
Bedplates and brackets	Aluminum	B209 Gr. 5086, B221 Gr. 5086
	Steel pipe	A53/A53M, A106/A106M
	Stainless steel	A240/A240M, A269, A312/A312M
	Structural steel	A36/A36M
Timing gears	Nitrided steel	A434 Gr. 4140, C1.BC
	Stainless steel	A582/A582M (S41600)
Studs, bolts, hex head cap screws	Medium carbon and alloy steel	A449, A193/A193M Gr. B7, A354 Gr. BD
	Austenitic stainless steel (304/316)	A193/A193M Gr. 8/8M, F593 Grp. 1 or 2
	Ni-Cu alloy	F468 (N04400)
	Ni-Cu-Al alloy	F468 (N05500)
Socket head cap screws	Alloy steel	A574
	Austenitic stainless steel	F837, Grp. 1
Socket set screws	Alloy steel	F912
	Austenitic stainless steel	F880
Nuts, hex	Carbon steel	A563, Gr. B
	Medium carbon steel, quenched and tempered	A194/A194M Gr. 8/8M, A563 Gr. DH (equiv. Gr. 8)
	Austenitic stainless steel	A194/A194M Gr. 8/8M, F594, Grp. 1 or 2
	Ni-Cu alloy	F467 (N04400)
Flange nuts, hex	Carbon steel	A563
Self-locking hex nuts, nylon inserts	Carbon steel	A563, Gr. DH (equiv. SAE Gr. 8) and MIL-N-25027
	Austenitic stainless steel	F594, Grp. 1 or 2 and MIL-N-25027
O-rings and other elastomers	Fluorocarbon (Viton, Fluorel, or equal)	D1418 Class: FKM, MIL-R-83248, D2000 Type and Class: HK
Gaskets	Plant and animal fiber	F104, I.D. No. P 3313B
	Fluorocarbon	D1418 Class: FKM, D2000 Type and Class: HK
Vanes and shoes	Nitrile (Buna-N or equal)	AMS 3215
	Leaded tin bronze	B584 (C93700)
	Thermoset composite	None

during rated operation when readings are measured on the pump case near the coupling perpendicular to the pump shaft.

7.5 At the conditions in 4.1.2, the airborne noise level of the pump unit shall meet the requirements in Table 3.

7.6 The pump shall be driven by an electric motor. The driver shall be sized for maximum flow at the relief valve full flow bypass pressure, at maximum viscosity.

7.7 If a reduction gear is required between the driver and the pump, it shall be provided by the pump manufacturer. Reduction gears shall meet the requirements of the American Gear Manufacturers Association Gear Hand Book Volume 1, AGMA 390.03. Minimum acceptable gears are AGMA Class 7 and minimum acceptable pinions are AGMA Class 8. Bearings shall be designed for a minimum L10 life of 15 000 h.

TABLE 3 Acceptable Octave Band Sound Pressure Levels (in dB re 20 µPa)

Octave Band Center Frequency, Hz								
31.5	63	125	250	500	1000	2000	4000	8000
91	88	85	82	79	76	73	70	67

7.8 All pump units shall incorporate guards over couplings, belts, and other external rotating parts. The guards shall prevent personnel contact with the rotating elements. Guards shall be rigid enough to support a 200-lb (88-kg) person standing on it.

7.9 The seating surfaces of mounting bedplates, bracket mounting plates, or other mounting arrangements shall be machined.

7.10 Mounting bedplates, brackets, and plates shall be provided with holes of sufficient size and quantity to ensure adequate attachment to shipboard foundation or mounting structure. Means shall be provided for attaching lifting gear for installation or removal.

7.11 Vertical units with face mounted motors shall be arranged so there are four possible orientations of motor driver to pump. Other drivers are to be oriented per the ordering data.

7.12 Vertical units that are motor driven shall be assembled with the conduit box mounted over the pump inlet flange, unless otherwise specified.

7.13 Couplings between pump and driver shall be keyed to both shafts.

7.14 Alignment between pump and driver shall not exceed 0.005-in. (0.13-mm) offset and 0.0005-in. per inch (0.01-mm per mm) angularity.

7.15 A relief valve shall not be provided with the pump unless otherwise specified.

7.16 Direction of rotation shall be indicated by an arrow cast into the pump or by a label plate attached to the pump.

7.17 Inlet and outlet connections shall be indicated by a label attached to each flange.

8. Pump Design

8.1 The pump inlet and outlet connections shall be flanged. Nonferrous material flanges shall be in accordance with ANSI B16.24 flat face, unless otherwise stated in the ordering data. Spool piece adapters (threaded and seal welded, or O-ring sealed to the pump case on one end and flanged on the other end) may be furnished to meet the flanged inlet and outlet requirement.

8.2 The pump cases shall be equipped with vent, drain, inlet, and outlet gauge connections. The connection shall be straight thread with O-ring seal. Tapered pipe thread connections are prohibited. Small pumps do not require these connections.

8.3 The pumps shall be equipped with radial and thrust bearings as necessary to counteract any unbalanced forces in the pump and to ensure that the pump will operate satisfactorily under the conditions stated in 7.2.

8.4 The bearings shall be securely fitted (by snap rings or shoulders or other means) to prevent axial movement. Bearing housings shall be integral to the pump case or secured to the pump case in such a manner as to ensure alignment. Usage of bolts alone is not considered sufficient to ensure alignment.

8.5 The bearings may be sealed and self or externally lubricated or may be lubricated by the liquid being pumped.

8.6 The rolling contact bearings shall be selected in accordance with AFBMA standards and shall have a minimum L10 life of 15 000 h as calculated in accordance with AFBMA Standard 9 or 11 as appropriate.

8.7 The pumps shall be equipped with mechanical shaft seals in accordance with Specification F1511. The installation shall ensure that adequate circulation of liquid at the seal faces occurs to minimize deposit of foreign matter and to provide adequate lubrication of the seal faces.

8.8 The mechanical seals shall be positioned or located on the shaft axially, by a positive means such as a stub, step, or shoulder positively located on the pump shaft. Set screws shall not be used to position seals or seal sleeves axially. An antirotation pin shall be provided for shaft sizes 1 in. and larger to prevent the mechanical seal-mating ring from rotation, if required by the ordering document.

8.9 The pump head or end covers, or both, shall be located to the pump case by a means such as rabbet, dowels, or pilot to ensure proper alignment.

8.10 The rotors and timing gears shall be machined and positively secured in position to maintain required clearances and prevent undue wear.

8.11 The fasteners shall be selected from Table 2, taking into consideration temperature of operation, mechanical properties, and corrosion resistance.

8.12 The pumps shall be provided with removable liners in pump sizes “C” or larger.

9. Performance Requirements

9.1 Pumps of each size shall deliver a capacity within the respective ranges shown in Table 1 when tested at 10-psia (69-kPa absolute) inlet pressure, 150-psi (1034-kPa) discharge pressure, and a fluid viscosity of 32 SSU.

10. Painting and Coatings

10.1 *Painting*—External unmachined and nonmating machined surfaces shall be thoroughly cleaned and painted with a fuel resistant, anticorrosive (lead and chromate free) primer and topcoat.

10.2 Painting external surfaces of nonferrous parts and components is not required but is permissible to avoid excessive masking. Identification and information plates should not be painted or over sprayed.

11. Equipment Identification Plates

11.1 The identification plates shall be made of brass or stainless steel and furnished on each pump unit.

11.2 The plates shall be secured to equipment with corrosion-resistant metallic fasteners.

11.3 The pump unit identification plates shall contain data as follows:

11.3.1 Manufacturer’s name.
11.3.2 Manufacturer’s model or type and size.
11.3.3 Service application.
11.3.4 Manufacturer’s serial number.
11.3.5 Salient design characteristics if applicable.
11.3.5.1 Capacity.
11.3.5.2 Discharge pressure.
11.3.5.3 Pump rated speed (r/min).

11.4 Accessory units, such as the driver and gearbox, shall have an identification plate in accordance with the applicable equipment specification. If not specified, the manufacturer shall use its commercial nameplate.

12. Testing Requirements

12.1 The pump manufacturer shall perform the following tests at the manufacturing facility or approved test facility. Equipment for specified tests shall be provided by the manufacturer.

12.1.1 *Performance Acceptance Tests*—Each pump shall meet the following performance acceptance tests.

12.1.1.1 *Mechanical Running Test*—The pump shall be tested at rated condition of 150-psig discharge pressure, 10-psia inlet pressure, and 32 (+13/–0) SSU viscosity to demonstrate that the pump is capable of delivering the required capacity as shown in Table 1.

12.1.1.2 *Noise Tests*—For pumps provided with drivers (units), each unit shall be tested to demonstrate the ability to meet the requirements of 7.5, if required by 5.1. The unit shall be operated at the discharge pressure (5.1.6) for these tests.

12.1.1.3 *Hydrostatic Tests*—Pressure-containing parts or the entire pump shall be tested hydrostatically with liquid to 225 psig for 10 min. The assembled pump shall be hydrostatically tested to 50 psig for 5 min. The tests shall be considered satisfactory when no leaks are observed. Seepage past blanking plates and seepage of other sealing apparatus to perform the test is allowed. Operation of the hydrostatic test pump to maintain pressure is acceptable.

12.1.1.4 *Test Reports*—A test report shall be submitted for each test conducted. Quantity and format as defined in the ordering data.

12.1.2 *Certified Data*—Certified performance data shall be supplied when required. Testing and reporting as defined by ANSI/HI 3.6 for Type IV, Level A tests. See 5.1.13.

13. Technical Documents

13.1 *General*—Drawings and technical manuals shall be submitted in an electronic format that is ISO 9066 compliant. When this specification is invoked in a shipbuilding specification, the shipbuilding specification shall take precedence for technical documentation requirements. When this specification is used for spares, replacements, or requirements without technical documentation requirements, the following paragraphs apply.

13.2 *Drawings:*

13.2.1 *Unit Drawings*—An outline or top drawing of the unit (pump and driver) shall be furnished. Length, width, height, mounting details, and connections shall be dimensioned. Brackets, bedplates, guards, couplings, identification plates, rotation arrows, and so forth shall be shown on the drawing. The weight and center of gravity (calculated or actual) of the unit shall be indicated on the drawing.

13.2.2 *Pump Drawings*—Pump drawings shall include a sectional assembly drawing. The sectional assembly drawing shall contain a complete list of materials or reference to a list of materials drawing, which shall be provided. Any subassembly made up of parts that require special alignment or assembly methods that cannot be disassembled, repaired, and reassembled onboard ship without the use of special tools and jigs shall be indicated as a subassembly in the list of material. The weight and center of gravity (calculated or actual) of the pump shall be indicated on the drawing.

13.2.3 *Associated Equipment Drawings*—Drawings for driver and associated equipment shall be in accordance with their respective specifications.

13.2.4 *Performance Curves*—Complete performance curves shall be furnished. The curves may be on graphs that can be printed on notebook size paper. Format as defined by ANSI/HI 3.6.

13.3 *Technical Manuals*—Instruction books or technical manuals shall be prepared for each different type or size of pump installed. A single manual shall contain not more than one type or size of pump. However, when several pumps are installed in a ship that are identical except for type of driver, they may be included in a single manual. Piece (item or find) numbers of parts referred to in technical manuals shall match the piece numbers shown on pump drawings. Technical manuals shall contain reproductions of pump drawings.

14. Packaging and Preservation

14.1 *Packaging*—Pumps, pump units, and accessories shall be packaged per Practice D3951 for warehouse storage and the following:

14.1.1 *Packaging for Domestic Shipment*—Pumps, components, and units to be used within six months may be packaged using standard commercial packaging. For storage of greater than six months or when multiple handlings are anticipated, package to ensure prevention of pilferage and resistance to damage from multiple handlings.

14.1.2 *Packaging for Overseas Shipment*—Packaging and marking for overseas shipments shall include sufficient protection from adverse atmospheric conditions and exposure to worst case handling and storage problems. All products shall be protected with water-resistant packaging material for the exterior shipping container, either treated corrugated cartons or boxes built from mildew resistant lumber, depending on the weight of the product or the configuration of the load.

14.2 *Preservation*—Items susceptible to deterioration or damage from environmental elements shall be preserved. Noncoated ferrous surfaces shall be preserved.

14.3 *Cushioning and Bracing*—Items susceptible to damage during shipment and handling shall be cushioned or shall be securely braced or blocked, or both, within the shipping container, to avoid damage.

14.4 *Container Marking*—Containers, boxes, or packages shall be clearly marked with the ship to address, contract or purchase order number, shipping point address, item nomenclature, and bar codes. The lifting points and orientation markings shall be clearly visible.

15. Quality Requirements

15.1 The manufacturer shall have a certified ISO 9001 quality system.

16. Keywords

16.1 distillate fuel pump; fuel pump; positive displacement pump; pump; rotary pump

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements established by the U.S. Navy, Commander Naval Sea Systems Command (NAVSEA) shall apply when specified in the contract or purchase order. When there is a conflict between the specifications and this Supplement, requirements of the Supplement shall take precedence.

S6.2 Materials other than shown in Table 2 are considered exceptions and are subject to approval by NAVSEA.

S7.3 The pumps shall be capable of withstanding environmental vibration induced by shipboard machinery and equipment in the frequency range of 4 to 25 Hz and be in accordance with MIL-STD-167-1 Type I. Maximum single frequency displacement (double amplitude) in the 4- to 15-Hz range is 0.060 in. (1.524 mm) and in the 16- to 25-Hz range is 0.040 in. (1.016 mm).

S7.4 The internally excited vibration levels of the pump shall be in accordance with MIL-STD-167-1Type II and shall not exceed 0.003-in. (0.076-mm) displacement peak to peak during rated operation when readings are measured on the pump case near the coupling perpendicular to the pump shaft.

S7.5 At the conditions in 4.1.2, the airborne noise level of the pump unit shall meet the requirements in Table 3 (see MIL-STD-740-1).

S7.6 At the conditions in 4.1.2, the structureborne noise level of the pump unit shall meet the requirements in Table S1.1 (see MIL-STD-740–2).

S7.19 Pumps shall meet the requirements of MIL-S-901 HI (High Impact) Shock, Grade A.

S8.7 Mechanical shaft seals shall be in accordance with Specification F1511, including Supplement S1.

TABLE S1.1 Acceptable Structureborne Vibratory Acceleration Acceptance Criteria in AdB re 10 μm/s^2 (Reference MIL-STD-740-2)

	Octave Band Center Frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
Resiliently mounted pumps	85	88	90	93	95	98	100	103	105
Solidly mounted pumps	65	68	70	73	75	78	80	83	85

S12.3 *Qualification Tests*—The first pump of each size, type, or design shall meet the following qualification tests. All tests shall be performed with the motor size required at rated condition as indicated in 4.1.2.

S12.3.1 *Performance Test*—The pump shall be tested at rated condition of 150-psig discharge pressure, 10-psia inlet pressure, and 32 (+13/–0) SSU viscosity to demonstrate that the pump is capable of delivering the required capacity as shown in Table 1. Record all test data, including electrical power input, for comparison to performance retest results (see S12.3.7).

S12.3.2 *Vibration Type II Test*—The pump shall be tested to demonstrate the ability to meet the requirements of S7.4. Record all test data, including electrical power input, for comparison to performance retest results (see S12.3.7).

S12.3.3 *Noise Tests*—The pump shall be tested to demonstrate the ability to meet the requirements of S7.5 and S7.6. Record all test data, including electrical power input, for comparison to performance retest results (see S12.3.7).

S12.3.4 *Vibration Type I Test*—The pump shall be tested to demonstrate the ability to meet the requirements of S7.3.

S12.3.5 *Shock Test*—The pump shall be tested to demonstrate the ability to meet the requirements of S7.19.

S12.3.6 *Endurance Test*—The endurance test shall consist of a running test of not less than 500 h of actual running time at rated condition. The 500 h shall be broken by at least three rest periods of 8 h or more each. A minimum of ten start-stop cycles shall be performed during the course of the test.

S12.3.7 *Performance Retest*—Upon completion of the tests in S12.3.1 through S12.3.6, repeat the performance test (S12.3.1), the vibration type II test (S12.3.2), and the noise test (S12.3.3). Record all test data.

S12.3.8 *Test Reports*—A test report shall be submitted for each test conducted. Quantity and format as defined in the ordering data.