Designation: F1718 – 01 (Reapproved 2019)

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.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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 Steel, Alloy Steel, and Stainless 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

[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.

Current edition approved May 1, 2019. Published June 2019. Originally approved in 1997. Last previous edition approved in 2013 as F1718 – 01 (2013). DOI: 10.1520/F1718-01R19.

[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.

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
F912 Specification for Alloy Steel Socket Set Screws
F1511 Specification for Mechanical Seals for Shipboard Pump Applications

2.2 *ASME Standard:*[3]
B16.24 Pipe Flanges and Flanged Fittings

2.3 *ANSI/HI Standard:*[4]
3.6 Rotary Pump Tests

2.4 *AMS Standards:*[5]
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:*[6]
9 Load Ratings and Fatigue Life for Ball Bearings
11 Load Ratings and Fatigue Life for Roller Bearings

2.6 *AGMA Standard:*[7]
390.03 Gear Classification, Materials and Measuring Methods for Unassembled Gears

2.7 *Military Standards:*[8]
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:*[8]
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:*[4]
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.

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 Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.
[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.
[5] Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, http://www.sae.org.
[6] Available from American Bearing Manufacturers Association (ABMA), 2025 M Street, NW Suite 800, Washington, DC 20036, http://www.abma-dc.org.
[7] Available from American Gear Manufacturer's Association (AGMA), 500 Montgomery St., Suite 350, Alexandria, VA 22314-1581, http://www.agma.org.
[8] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

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.

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).