



Standard Specification for Centrifugal Pump, Shipboard Use¹

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1. Scope

1.1 This specification covers the requirements applicable to the design and construction of centrifugal pumps for shipboard application. The three classes of service covered by this specification are as follows:

- 1.1.1 Class 1—Freshwater,
- 1.1.2 Class 2—Seawater, and
- 1.1.3 Class 3—Hydrocarbon pumps (less than 1500 SSU).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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
- 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
- A276 Specification for Stainless Steel Bars and Shapes
- A494/A494M Specification for Castings, Nickel and Nickel Alloy
- 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

A890/A890M Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application

A995/A995M Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts

B148 Specification for Aluminum-Bronze Sand Castings

B164 Specification for Nickel-Copper Alloy Rod, Bar, and Wire

B271 Specification for Copper-Base Alloy Centrifugal Castings

B369 Specification for Copper-Nickel Alloy Castings

B505/B505M Specification for Copper Alloy Continuous Castings

B584 Specification for Copper Alloy Sand Castings for General Applications

F468 Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use

F1511 Specification for Mechanical Seals for Shipboard Pump Applications

2.2 ANSI Standards:³

ANSI B1 ISO Metric Screw Threads (ANSI-B1 Report)

ANSI B1.1 Unified Screw Threads

ANSI B16.1 Cast Iron Pipe Flanges and Flange Fittings

ANSI B16.5 Steel Pipe Flanges, Flanged Valves and Fittings, 150, 300, 400, 600, 900, 1500, and 2500 lb

ANSI B16.11 Forged Steel Fittings, Socket Welding and Threaded

ANSI B16.24 Bronze Flanges and Flanged Fittings, 150, 300 lb

2.3 Hydraulic Institute Standards:³

ANSI/HI 1.1-1.5 American National Standard for Centrifugal Pumps for Nomenclature, Definitions, Applications and Operation

ANSI/HI 1.6 American National Standard for Centrifugal Pump Tests

¹ This specification is under the jurisdiction of 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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.



ANSI/HI 9.1-9.6 American National Standard for Pumps—General Guidelines for Types, Definitions, Applications and Sound Measurements

2.4 ABMA Standards:⁴

ANSI/ABMA 9 Load Ratings and Fatigue Life for Ball Bearings

ANSI/ABMA 11 Load Ratings and Fatigue Life for Roller Bearings

2.5 ISO Standards:³

ISO 9001 Quality Systems and Quality Assurance—Design/Development, Production, Installation and Service

3. Terminology

3.1 Definitions:

3.1.1 *best efficiency point (BEP)*, *n*—the capacity and head in which the pump efficiency is the highest.

3.1.2 *BHP*, *n*—power delivered to the pump from the driver in brake horse power.

3.1.3 *capacity*, *n*—the total volume output per unit of time.

3.1.4 *centrifugal pump*, *n*—a kinetic machine converting mechanical energy into hydraulic energy through rotating motion.

3.1.5 *close coupled pumps*, *n*—in this arrangement, no coupling is provided between the pump and the motor shafts, and the pump housing is flange mounted to the motor. The pump impeller is directly mounted to the motor shaft.

3.1.6 *coupled pumps*, *n*—in this arrangement, the pump and the motor must use a coupling to transmit the power from the driver to the pump shaft.

3.1.7 *gallons per minute (GPM)*, *n*—U.S. customary unit for capacity.

3.1.8 *head*, *n*—the expression of the energy content of the liquid referred to in any arbitrary datum. It is expressed in units of energy per unit of weight liquid. The measuring unit for head is foot (metre) of liquid.

3.1.9 *head, total discharge*, *n*—the sum of the pump's discharge gauge head, the velocity head at the gauge connection, and the elevation difference between the pump centerline and the gauge centerline.

3.1.10 *head, total*, *n*—the measurement of energy increase per unit weight of the liquid, imparted to the liquid by the pump, and is the difference between the total discharge head and the total suction head.

3.1.11 *head, total suction*, *n*—the sum of the pumps suction gauge head, the velocity head at the gauge connection, and the elevation difference between the pump inlet centerline and the gauge centerline.

3.1.12 *head, maximum rated*, *n*—the most head a pump can generate with the correct impeller diameter for the service conditions.

3.1.13 *hydrostatic test*, *n*—applying static pressure to the assembled pump or pressure containing components to determine structural integrity of the unit.

3.1.14 *maximum allowable working pressure*, *n*—the maximum discharge pressure that could occur in the pump when it is operated at the rated speed and suction pressure for a given application.

3.1.15 *maximum BHP rated impeller*, *n*—the highest power required by a pump with the correct impeller diameter for the service condition.

3.1.16 *minimum continuous flow*, *n*—the lowest possible flow rate at which the pump can run without generating excessive heat within the unit or damage to the pump.

3.1.17 *net positive suction head available (NPSHA)*, *n*—the total suction head absolute, determined at the first stage impeller datum, less the absolute vapor pressure of the liquid at a specific capacity.

3.1.18 *net positive suction head required (NPSHR)*, *n*—the amount of suction head over vapor pressure required at the pump to prevent more than a 3 % loss in total head from the first stage of the pump at a specific capacity.

3.1.19 *nonmetallic materials*, *n*—any material that would not be recognized as a metal. Examples include plastics, fiberglass resins, carbon fiber, fiberglass-reinforced vinyl ester, polytetrafluoroethylene (PTFE), or any similar material.

3.1.20 *non-overloading power characteristics*, *n*—this characteristic requires that the driver be sized for the highest possible power requirement from the pump.

3.1.21 *OEM*, *n*—original equipment manufacturer of the pump unit.

3.1.22 *pounds per square inch absolute (PSIA)*, *n*—the U.S. customary measure of pressure with zero as a true absolute zero in pounds per square inch.

3.1.23 *pounds per square inch gauge (PSIG)*, *n*—the U.S. customary measure of pressure with zero being adjusted to atmospheric pressure in pounds per square inch.

3.1.24 *pump efficiency (Eff)*, *n*—the ratio of the energy imparted to the liquid by the pump to the energy supplied to the pump from the driver.

3.1.25 *pump unit*, *n*—a typical pump unit consists of a separate pump and driver, combined pump and driver (close coupled), coupling, and coupling guard, and may include a gear box and base plate.

3.1.26 *rated point*, *n*—applies to the capacity, head, net positive suction head, and speed of the pump as specified by the order.

3.1.27 *specific gravity (Sp. Gr.)*, *n*—the ratio of the density of the liquid to the density of water at 64 °F (17.8 °C).

3.1.28 *vapor pressure*, *n*—the pressure exerted when a liquid is in equilibrium with its own vapor. The vapor pressure is a function of the substance and of the temperature.

3.1.29 *viscosity*, *n*—the resistance of a fluid to shear motion, its internal friction.

4. Ordering Information

4.1 Fig. 1 and Fig. 2 are provided for use by the procuring activity and the OEM. The sections of Fig. 1 and Fig. 2 marked "User Defined," must be completed by the procuring activity

⁴ Available from American Bearing Manufacturers Association (ABMA), 330 N. Wabash Ave., Ste. 2000, Chicago, IL 60611, <https://www.americanbearings.org>.