

INCH -POUND

MIL-P-17639F (SH)
 AMENDMENT 4
 22 FEBRUARY 1996
 SUPERSEDING
 AMENDMENT 3
 25 May 1995

MILITARY SPECIFICATION

PUMPS, CENTRIFUGAL, MISCELLANEOUS SERVICE,
 NAVAL SHIPBOARD USE

This amendment forms a part of MIL-P-17639F(SH), dated 18 February 1986, and is approved for use within the Naval Sea Systems Command, Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

PAGE 2

2.1.1, under "SPECIFICATION, FEDERAL": Delete "QQ-N-288 - Nickel-Copper Alloy And Nickel-Copper-Silicon Alloy Castings" and add "MIL-A-907 - Antiseize Thread Compound, High Temperature. " and "MIL-G-5514 - Gland Design; Packing, Hydraulic, General Requirements for." and add "MIL-C-24723 Castings, Nickel-Copper Alloy."

PAGE 2

2.1.1, under "SPECIFICATION, MILITARY (Continued)": Delete DOD-D-1000 - Drawings, Engineering and Associated Lists; and "MIL-S-15083 - Steel Castings. "

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2.1.1, under "SPECIFICATION, MILITARY (Continued)": Delete the following:

"MIL-S-16993 - Steel Castings (12-Percent Chromium) .

MIL-C-20159 - Copper- Nickel Alloy Castings (UNS No. C96200 and C96400) .

MIL-P-24377 - Packing Material, Asbestos, Braided, Impregnated with PTFE (Polytetrafluoroethylene) , Surface Lubricate.

1 MIL-P-25732 - Packing Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 275°F (132°C)

QQ-N-288 - Nickel-Copper Alloy and Nickel-Copper-Silicon Alloy Castings

QQ N 288 Nickel-Copper-Aluminum Alloy, Wrought (UNS N05500)

QQ-C-390 - Copper Alloy Castings (including Cast Bars)

AMSC N/A

FSC 4330

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2.1.1, under "SPECIFICATIONS, FEDERAL: Add the following:

"A-A 50433 Grease, Sea Water Wash Resistant"

2.1.1, under "SPECIFICATION, MILITARY (Continued)". Add the following

"MIL-G-24696 - Gasket, Sheet, Non-asbestos.

MIL-G-22050 - Gaskets and Packing Material, Rubber, for use with Polar Fluides, Steam and Air at Moderately High Temperatures .

MIL-C-240707/1 - Castings, Ferrous, For Machinery and Structural Application.

MIL-C-24707/6 - Casting, Ferrous, Chromium Steel, For Pressure-Containing Parts Suitable for High-Temperature Service

MIL-C-24723 - Casting, Nickel-copper Alloy.

MIL--T-24747 - Technical Repair Standard (TRS Manual; Preparation of

MIL-P-24790 - Packing Material Braided Non-Asbestos.

MIL-P-83461 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275°F (135°C)

MIL-P-83248 - Rubber, Fluorocarbon Elastomer, High Temperature Fluid and Compress Ion Set Resistant (O-rings Class 1, 75 Hardness)

MIL-S-8660 - Silicone Compound NATO Code Number S-736

MIL-P-17416 - Packing Material, Metallic, Flexible

DOD-C-24176 - Cement Epoxy, Metal Repair and Hull Smoothing (Metric)

PAGE 4

* 2.1.1, under "STANDARDS, MILITARY (Continued): Add "MIL-STD-1388/2 - DOD Requirements For A Logistic Support Analysis Record"; and add "MIL-STD-2035 - Nondestructive Testing Acceptance Criteria" and delete DOD-STD-2147 - Technical Repair Standards (TRS); Hull, Mechanical and Electrical (HM&E), Preparation of. (Metric)"

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2.2, under "AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) : Delete

"B 584 - Standard Specification for Copper Alloy Sand Castings for General Application

* 2.2, under "AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) . Add

A 744 - Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service

B 348 - Standard Specification for Titanium and Titanium Alloy Bars and Billets

B 369 - Standard Specificator for Casting, Copper Nicket Alloy.

B 473 - Standard Specification for UNS N08020, UNS N08026 and UNS N08024 Nickel Alloy Bar and Wire

B 494 - Standard Specification for Castings, Nlckel and Nickel Alloy

B 446 - Standard Specification for Nickel-Chromu.um-Molybdenum-Columb~um Alloy (UNS N06625) Rod and Bar

D 638 - Standard Test Method Test method for Tensile Properties of Plastics

D 790 - Standard Test Method for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.

D 695 - Standard Test Method for Compressive Properties of Rigid Plastics

D 2344 - Standard Test Methods for Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short Beam Method.

D 3846 - Standard Test Method for In-plane Shear Strength of Re-inforced Plastics.

D 3433 - Standard Recommended Practice for Fracture Strength in Cleavage of Adhesives in Bondage Joints.

D 2583 - Standard Test Method for Identation Hardness of Rigid Plastics by Means of a Barcol Impresser

D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials

D 646 - Standard Test Method for Deflective Temperature of Plastics Under Flexural Loads.

D 696 Test Method fox Coefficient of Linear Termal Expansior of Plastic.

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D 256 - Test Methods for Impact Resistance of Plastics and Electrical Insulating Material

D 579 Standard Test for Water Absorption of Plastics.

E 162 - Test Method for Surface Flammability of Materials Using Radiant Heat Energy Source.

E 228 - Standard Test Method for Linear Thermal Expansion of Solid materials with a Vitreous Silica Dilatometer.

E 662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

F 1511 - Standard Specification for Mechanical Seals for Shipboard Pump Applications."

PAGE 5

2.2, under "AMERICAN NATIONAL STANDARD INSTITUTE (ANSI) : Add the following ANSI standards:

s 2.19 - Mechanical Vibration - Balance Quality Requirement of Rigid Rotors, Part X: Determination of Permissible Residual Unbalance (ASA 86)

2.2, under "INTERNATIONAL STANDARDS ORGANIZATION (ISO) : Add the following ISO standards:

ISO 19.40 - Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - part I: Determination of Permissible Residual Unbalance (First Edition)

ISO 9002 - Quality Systems - Model for Quality Assurance In Production, Installation, and Servicing

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Add new paragraph 3.2.8.6.

"3.2.8.6 Except for pumps in any part of the saturated-steam propulsion plant (see 6.2.1), all threaded fasteners in seawater pumps and fasteners in fresh and potable water pumps not exposed to the fluid being pumped, shall be coated with a thin layer of Anti-seize compound in accordance with MIL-A-907. For pumps in any part of the saturated-steam propulsion plant (see 6.2.1), the standard lubricant and compound requirements specified in 6.2.1 applies.

3.2.9 Delete and substitute paragraphs 3.2.9 through 3.2.9.3:

3.2.9.1 Packing, Gaskets, and O-rings

"3.2.9.1. Packing and Gaskets shall be in accordance with drawing B-153 except that sheet gasket shall be non asbestos in accordance with MIL-G-24696, packing for water service pumps shall be non asbestos in accordance with MIL

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P 24790; and packing for lube oil and diesel fuel services shall be in accordance with MIL-P-17416 (symbol 1430) ."

"3.2.5.2. Gasket compression and tolerance shall not affect bearing bushing or wearing ring fits to an extent that will adversely affect reliability or performance. Spiral wound gaskets shall be used only where use of a sheet gasket or O-ring is impractical. Internal spiral wound gaskets shall be completely enclosed at both the inner diameter and the outer diameter of the spiral elements to prevent the gasket from unwinding and entering the fluid being pumped."

"3.2.5.3. o-ring gland design shall be in accordance with MIL-G-5514. O-ring shall be referred to by the standard part numbers specified in AS-568 and the O-ring military specification cited below."

"3.2.9.4. For pumps in systems to which detrimental material requirements do not apply (see 6.2.1) and pump temperatures do not exceed 275 degrees Fahrenheit ("F) of normal fluid temperature and 300°F intermittent fluid temperature, O-rings shall be made of fluorocarbon rubber in accordance with MIL-R-83248. For pumps with a design temperature above 275°F normal fluid temperature, the o-ring material shall be justified to the design review activity. For pumps handling seawater, the o-ring groove shall be packed with grease in accordance with A-A-50433."

"3.2.9.5. For pumps in systems to which detrimental material requirements apply (see 6.2.1. (mm)) and the pump temperatures does not exceed 270°F normal fluid temperature and 300°F intermittent fluid temperatures, o-rings shall be ethylene propylene in accordance with MIL-G-22050, grade 3 and shall be lubricated as necessary with silicon compound in accordance with MIL-S-8660. For pumps operating with higher fluid temperatures, the type of joint and, if an o-ring joint. O-ring material shall be justified to the design review activity.

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3.3.1.1.2: Delete "Pumps shall have constantly rising head capacity characteristic curves." Substitute "Pumps shall have head versus capacity characteristics wherein for all capacities from shutoff to free delivery the pump head decreases as capacity increases."

PAGE 16

3.3.1.1.5: Delete and substitute:

"3.3.1 .1.5 Pump casing joints shall be made up using compressed sheet gaskets, in accordance with MIL-G-24696, except circular joints which shall be sealed by O-rings as specified (see 6.2.1), O-rings may be used to seal casing joints in other applications when approved by the design review activity.

3.?. 1.2.1 Delete: "Pumps shall be capable of parallel operation and shall have constantly rising head capacity characteristics curves "Substitute "Pumps shall be capable of parallel operation and shall have head versus

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capacity characteristics wherein for all capacities from shutoff to free delivery the pump head decreases as capacity increases. "

3.3.1.2.5: Delete and substitute:

"3.3 .1.2.5 Pump casing joints shall be made up using compressed sheet gaskets, in accordance with MIL-G-24696 except circular joints which shall be sealed by o-rings as specified (see 6.2.1). o-rings may be used to seal casing joints in other applications when approved by the design review activity."

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3.3.311: Delete the word "asbestos" in the 1st sentence

PAGE 18

Insert new Paragraph 3.3.3.15:

3.3.3.15. Ceramic Filled Polymeric Compounds. Casing volutes for fresh and salt water pumps, not excluded by 3.3.3.17 (also see paragraph 6.2.1), that are exposed to the pumped fluid, with the exception of bearing and sealing surfaces, shall be coated with no less than 8 mils of ceramic filled polymeric compounds conforming to the requirements of Type I materials (alkali resistant in accordance with DOD-C-24176 (SH) . Table VII provides a partial listing of products conforming to DOD-C-24176 requirements.

Insert new paragraph 3.3.3.16:

3.3.3.16. Toxicology. Ceramic filled polymeric compounds shall exhibit no adverse toxicological effects on the health of personnel when used with fresh water and/or salt water applications. Tables III, IV, V, and VI contain the prescribed levels of contaminants in the fluid exposed to these ceramic filled compounds. Testing shall be done in accordance with paragraph 4.6.8,

Insert new paragraph 3.3.3.17:

3.3.3.17. Exclusions: Ceramic filled polymeric compounds shall not be used on (1) pumps with detrimental material requirements, (2) pumps in any part of the saturated-steam propulsion plant, (3) pumps related to the primary propulsion system, steering system, potable water system, lube oil system, diesel and JP-5 fuel systems, fresh water collecting system and/or distillate water systems of surface ships. (see paragraph 6.2.1).

3.3.5.?: Delete and substitute:

"3.3.5.2 Impellers shall be keyed or, the shaft and securely held against movement by locked nuts or other means approved by the design review agency (see 6.2.1). Impellers between bearings shall be restrained in a manner similar to that shown in Figure 1A. Impellers not between bearings shall be restrained in a manner similar to that shown in Figure 1B."

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3.3.8.1: Add at the end of the second sentence, "Pumps in which the operating conditions in the seal cavity do not exceed 150 psig or 170 degrees Fahrenheit at 3600 rpm or less shall be provided with mechanical shaft seals in accordance with ASTM F1511. For pumps in which the operating conditions fall outside of the limits set by the preceding sentence, the mechanical seal design shall be recommended by the pump manufacturer and shall be approved by the design review authority."

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3.3.8.3: Third sentence, "The packing shall be . . ." delete "in accordance with MIL-P-24377." and substitute "in accordance with 3.2.9.1".

3.3.8.5: Add the following sentence to the end of paragraph 3.3.8,5 as follows:

"When required by the requirements of the ordering data (see paragraph 6.2.1) the cavity inside the mechanical seal, in sea water pumps, shall be packed with grease in accordance with A-A-50433 during assembly by the manufacturer. "

3.3.10: Add the following at the end of the paragraph; "Copper-silicon and silicon-bronze fasteners are prohibited."

PAGE 23 TO 25

Table I. Materials

(1) For applications involving Casings and Diffusers Salt Water Service, for Surface Ships under the Specification column delete MIL-C-20159 UNS C964000; under the ASTM Publication column after B 369 UNS 96400 add " with S1 through S7".

(2) For applications involving Casings and Diffusers Salt Water Service, for Submarines for Copper-Nickel (70-3C) diffusers under the Specification column delete MIL-C-20159 UNS C964000; under the ASTM Publication column after B 369 UNS 96400 add "with S1 through S7". Under the Applications column add, "Surface Ships Use Only 21/"

(3) For applications involving Casings and Diffusers involving Fresh Water Service for Copper-Nickel (70-30) under the Specification column delete MIL-C-20159 UNS C96400; under the ASTM Publication column after B369 UNS C96400 add "with S1 through S7". Under the Specification column for 12% Chrome Cast Steel delete MIL-S-16993 and substitute MIL-C-24707/6. Under the Applications column add, "surface Ships Use Only 21/"

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(4) For application involving Impellers for Salt Water Service add a new subrow under all columns. Under Application column; add "Surface Ships Only 20/". Under Materials Column add; "Composite material", under ASTM Publication column, add "See Table II"

(5) For applications involving Impellers for Fresh Water Service for Nickel Copper Alloy , under the Material column, change "copper-nickel" to "Nickel-copper", under the Specification column, delete "QQ-N-288 Comp E" and substitute "MIL-C-24723 Comp M30"; under the ASTM Publication column add "A494 S22 Comp M30C with S22". Add a new subrow under all columns. Under Application column; add "Surface Ships Only 20/". Under Materials Column add; "Composite material", under ASTM Publication column, add "See Table II"

(6) For application involving Casing Wearing Rings for Salt water service, Under the Materials column, delete "Ni-Cu-Mo-Cb" and substitute "Ni-Cr-Mo-Cb", Under the Specification column delete "QQ-N-288 Composition B or D" and substitute "MIL-C-24723 M30H M25S"; under the ASTM Publication column add "A494 Comp M25S with S10 and S21 or M30H". Under Application column; add "Surface Ships Only 20/". Under Materials Column add; "Composite material", under ASTM Publication column, add "See Table II"

(7) For applications involving Casing Wearing Rings for fresh water service with Nickel-Copper Alloy, Under the Specification column delete "QQ-N-288 Composition B or D" and substitute "MIL-C-24723 M30H M25S"; under the ASTM Publication column add "A494 Comp M25S with S10 and S21 or M30H". Under the Material column delete "Gun Metal", under the Specification column delete "QQ-C-390 Alloy C90300". Add a new subrow across all columns and under Application column; add "Surface Ships Only 20/". Under Materials Column add; "Composite material", under ASTM Publication column, add "See Table II"

(8) For applications involving Shafts in salt water service, Under the Material Column, add a new subrow and insert "Highly Alloyed Corrosion Resisting Steel", under the ASTM Publication column, add a new subrow and insert "B473 UNS 08020" and add a second subrow for the same service and under the column for Materials insert "Ni-Cr-Mo-Cb", under the column for ASTM Publication insert " B 446 UNS 06625".

(9) For applications involving Shaft Sleeves for Salt Water Service under the Materials column delete "Ni-Cu-Mo-Cb" and substitute "Ni-Cr-Mo-Cb". Add a new subrow across all columns and under Application column; add "Surface Ships Only 20/". Under Materials Column add; "Composite material", under ASTM Publication column, add "See Table II"

(10) For applications involving Shaft Sleeves for Fresh Water Service; Add a new subrow across all columns and under Application column; add "Surface Ships Only 20/". Under Materials Column add; "Composite material", under ASTM Publication column, add "See Table II"

(11) For applications involving Bearing Brackets and caps for sea water services, under the Materials column, delete "Gun Metal", under the Specification column delete "QQ-C-390 Alloy C90300", under the ASTM Publication column delete "B584 Alloy 903 or 905". For Copper Nickel (70-30) under the Specification column, delete "MIL-C-20159 C96400", under the ASTM publication column add "H169 C96400 S1 through S7".

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(12) For applications involving Glands and Throat Bushing for sea water service under the materials column for Copper-Nickel delete " (-70-30)", under the Specification column delete "MIL-C-20159 C96400 or C96200", under the ASTM Publication column add B369 C96400 or c96200 both with S1 through S7". In the Nickel Copper Alloy Row under the Specification column delete "QQ-N-288" and substitute MIL-C-24723 M30H, M25S", under the ASTM publication column add "A494 Comp M25S with S10 and S21, comp M30C with S22 or Comp 30H".

* (13) For applications involving Gland and Throat Bushings in Fresh Water Service, under the Material column delete "Gun Metal", under the Specification column delete "Q-C-390 Alloy C90300". Under the Specification column for Nickel-Copper -Alloy delete "MIL-C-20159, C96400 or C96200", and under the column for ASTM Publication add "B369 C96400, C96200 both with S1 through S7".

(14) For applications involving Mounting Brackets for closed coupled pumps under the material column delete "Gun Metal", under the Specification column delete "QQ-C-390 Alloy C90300". under the ASTM Publication column delete "B584 alloy 903 or 905". Under the Specification column for Copper-Nickel (70-30) delete "or C96200", under the ASTM Publication column add "B369 C96400 with S1 through S7"

(15) For application involving Bearing Brackets and Caps in Fresh Water Service under the Materials column delete "Gun Metal", under the Specification column delete "QQ-N-390 alloy C90300" and under the ASTM Publication column delete "B584 alloy 903 or 905". Under the ASTM Publication column for Copper-Nickel alloy add "B369 C96400 or C96200 both with S1 through S7". Under the Specification column for Nickel-Copper alloy delete "QQ-N-288" and substitute "MIL-C-24723 Comp M30C", under the ASTM Publication column add "A494 Comp M30C with S22".

(16) For applications involving Shaft or Impeller nuts, washers & Keys in sea water service, under the Material column delete "Nickel-Copper Alloy" and substitute "Ni-Cr-Mo-Cb", under the Specification column delete "QQ-N-281", under the ASTM Publication column delete "B164 Class A or B" and substitute "B446 UNS N06625". Under the materials column, delete "Ni-Cu-Al alloy" and substitute "Titanium", under the Specification column delete "QQ-N-286", under the ASTM Publication column add "ASTM B348". Add a new row and insert the following; Under the Material column add " Highly Alloyed Stainless Steel", under the ASTM Publication add "B473 UNS N08020".

(17) For application involving Cyclone separators under the Specification table delete "QQ-N-288", under the ASTM Publication add "A494 Comp M25S with S10 and S21, Comp M30C with S22 or M30H".

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¹ Note 6: At the end of Note 6, add; "In addition the following Supplementary Requirements of ASTM A744/A744M apply: S3 Liquid Penetrant Examination (Liquid penetrant the final surface of repair welds and meet acceptance criteria of MIL-STD-2035, Class D, S5 Examination of Weld Preparation (modified to liquid penetrant with acceptance criteria to MIL-STD-2035, Class 1), S6 Certification, S12 Test Reports (See ASTM A781/A781M), and S21 Intergranular Corrosion Test (Use ASTM A262, Practice E) .

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Add new Note 20: Use of composite material for internal pump components is not allowed for applications in which detrimental material requirements exist or for pumps in any part of a saturated-steam propulsion plant (see Paragraph 6.2.1) , A certificate of compliance for the Composite material characteristics in accordance with Table II shall be provided. In addition chemical test result to validate material characteristics and toxicological test results shall also be provided where appropriate. This certification shall list both, test result values and the corresponding acceptance criteria specified in Table II.

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Add new Note 21: "Fresh Water and Salt water centrifugal pump casings on Surface Ship services shall be coated with ceramic filled polymeric coating on the volute surfaces exposed to the pump fluid. This coating shall not be applied to any bearing or casing sealing surfaces. Use of epoxy coating shall not be used on (1) pumps with detrimental material requirements, (2) pumps in any part of the saturated-steam propulsion plant, (3) pumps related to the propulsion system, steering system or potable water system, lube oil system, diesel and JP-5 fuel systems, fresh water collecting system and/or distillate water system of surface ships (see Paragraph 6.2.1)

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Add new paragraph 3.3. 10.2

"3.3.10.2. Composite Materials. Composite materials shall only be applied in pump designs whose operating conditions do not exceed 1000 GPM, 175 PSI, 250°F and 3600 RPM of continuous operation of surface ship systems. Composite material components may be exposed to fresh water and seawater containing 20% hydrocarbon content and other aggressive fluids. Composite materials shall not be used in submarine applications or any application in which detrimental material requirements exist or in pumps in any part of the saturated-steam propulsion plant (see 6.2.1) ."

Add new paragraph 3.3. 10.2.a

a. Toxicology . When Composite Materials are used for the manufacturing of parts specified in Table I, pump manufacturer shall submit toxicological test reports validating the compliance of the manufacturer parts with the toxicological limits identified in Tables II, III, IV, V and VI. Due to toxicity requirements phenolic compounds, asbestos containing fillers, and harmful metallic compounds such as lead, mercury, and arsenic are prohibited. The manufacturer shall provide certification to this effect.

Add new paragraph 3.3. 10.2.b

b. chlorine and Bromine Exposure. It is common for ships to disinfect potable water supplies using chlorine or bromine. Manufacturers providing parts for use in potable water pumps shall submit results of long term exposure of composite material to chlorine and bromine concentrations of up to 1.0 parts per million (PPM)

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c. Galvanic Balance. Galvanic Balance shall not be affected by the addition of composite components to the pump and its associated systems. Composite components shall be galvanically neutral to aid in the prevention of anodic sacrifice of other pump components. The use of graphite and other materials of high galvanic nobility in the resin(s) comprising composite components shall be limited to inerted ingredients. The manufacturer shall certify that all materials used in the formulation of composite materials used in component manufacture as well as the finished component are galvanically neutral

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* Add new Table II.

Table II. Composite Material Property Requirement

Material Property	Test Method ASTM	Requirement
Tensile Strength	ASTM D 638	9900 PSI (Minimum)
Flexural Strength	ASTM D 790	14,000 PSI (Minimum)
Compressive Strength	ASTM D 695	37,000 PSI (Minimum)
Shear Strength In-Plane	ASTM D2344 or ASTM D3846	13,000 PSI (Minimum)
Modulus of Elasticity (Tension) Max. Elong. of Break	ASTM D 638	1,400,000 PSI (Minimum) 1.5*
Bond Strength/Pull Test	ASTM D3433	2,200 PSI (Minimum)
Impeller Drive Strength (Torsion)	Applicable Driver Locked Rotor Torque	125%
Hardness Barcol Rockwell	ASTM D 2383 ASTM D 785	40 Barcol
Temperature, Continuous Operation	None	250°F
Heat Distortion Temp	ASTM D 648	250°F at 264 PSI
Coefficient of Thermal Expansion	ASTM D 696 ASTM E 228	2 x 10 ⁻⁵ in/in/°C at 250°F (Maximum)
Izod Notched Impact	ASTM D 256	2.0 ft-lb/in (Minimum)
Moisture Absorption	ASTM D 570	2.0% in 48 hrs (Maximum)
Dynamic Balance (Dry) Balance of Partially Submersed (24 Hrs) Balance after Reverse Rotation	ANSI S 2.19 or ISO 19.40	Less than the Maximum residual imbalance allowed
Dimensional Stability		+1%, -1%
Surface Flammability	ASTM E162	25 (Maximum)
Smoke Density	ASTM E662	200 (Maximum)

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Add new Table III.

Table III. National Secondary Drinking Water Regulation Levels 1/

Contaminant	Maximum Contaminant Level (mg/l)
Aluminum	0.05 to 0.02
Chlorine	250
Color	15 color units
Copper	1
Corrosivity	Non-corrosive
Fluoride	2
Foaming Agents	0.5
Iron	0.03
Manganese	0.05
Odor	2 threshold Odor Number
pH	6.5 to 8.5
Silver	0.1
Sulfate	250
Total Dissolved Solids (TDS)	500
Zinc	5

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Add new Note 1 under Table III .

"1/ The contaminants covered by this regulation are those that may adversely affect the aesthetic quality of the drinking water. These secondary levels represent goals for drinking water quality but are not Federally enforced. However, all Navy and Marine Corps facilities and equipment handling potable water must provide safe drinking water of the highest quality in consonance with National Secondary Drinking Water Regulation (NSDWR) as well as the Federally enforceable national Primary Drinking Water Regulation (NPDWR).

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Add New Table IV. National Primary Drinking Water Regulations (NPDWR) Treated Water Quality Standards 1/,2/,3/,4/

Contaminant	MCLG (mg/l) (max)	MCL (mg/l) (max)	AQL (mg/l) (max)
Asbestos	7 million fibers/l longer than 10 micrometers	7 million fibers/l longer than 10 micrometers	
Arsenic		0.05	
Barium	2	2	
Cadmium	0.005	0.005	
Chromium	0.1	0.1	
Copper	1.3		1.3
Lead	0		0.015
Mercury	0.002	0.002	
Nitrate	10	10	
Nitrite	1	1	
Total Nitrate and Nitrite	10	10	
Selenium	0.05	0.05	
Fluoride	4	4	

Add new notes 1 through 4 under table IV:

"1/ Maximum contaminant level goal (MCLG) . The maximum level of a contaminant in drinking water at which no know or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety."

"2/ Action Level (AL). Concentrations of lead or copper in water that determine, in some cases, whether a water system must install corrosion control treatment, monitor source water, replace lead service lines, and undertake a public education program.

"3/ The copper action level is exceeded if the concentration of copper or more than 10 percent of the tap water samples properly collected during any monitoring period is greater than 1.3 mg/l.

"4/ The lead action level is exceeded if the concentration of lead in more than 10 percent of water samples properly collected during a monitoring period is greater than 0.015 mg/l.

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* Add New Table V:

Table V. Contaminant Levels for Volatile Organic Chemicals (VOC)

Contaminant	MCLG (mg/l)	MCL (mg/l)
Benzene	0	0.005
Carbon Tetrachloride	0	0.005
1,2 Dichloroethane	0	0.005
1,1, Dichloroethylene	0.007	0.007
para-Dichlorobenzene	0.075	0.075
1,1,1 Trichloroethane	0.20	0.20
Trichloroethylene	0	0.005
Vinyl Chloride	0	0.002
o-Dichloroethylene	0.6	0.6
cis-1,2 Dichloroethylene	0.07	0.07
trans-1,2- Dichloroethylene	0.1	0.1
1,2 Dichloropropane	0	0.005
Ethylbenzene	0.70	0.7
Monochlorobenzene	0.10	0.1
Styrene	0.10	0.1
Tetrachlorobenzene	0	0.005
Toluene	1	1
Xylenes (Total)	10	10

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Add New table VI:

Table VI. Contaminant Levels for Organic Chemicals, Pesticides, and Polychlorinated Biphenyls (PCBs)

Contaminants	MCLG (mg/l)	MCL (mg/l)
Endrin	0.002	0.002
lindane	0.0002	0.0002
Methoxychlor	0.04	0.04
Toxaphene	0	0.003
2, 4-D	0.07	0.07
2, 4-5-TP (Silvex)	0.05	0.05
Alachlor	0	0.002
Atrazine	0.003	0.003
Carbofuran	0.04	0.04
Chlordane	0	0.002
1,2Dibromo-3-Chloropropane (DBCP)	0	0.0002
Ethylene Dibromide (EDB)	0	0.00005
Heptachlor	0	0.0004
Heptachlor epoxide	0	0.0002
PCBs (as decachlorobiphenyl)	0	0.0005
Aldicarb	0.001	0.003
Aldicarb sulfoxide	0.001	0.004
Aldicarb sulfone	0.001	0.002
Pentachlorophenol	0	0.001
Total Trihalomethanes (the sum of the concentrations of Bromodichloromethane, Dibromochloromethane, Tribromomethane (bromoform) and Trichloromethane (Chloroform))		0.10 This requirement applies only to water systems serving 10,000 individuals and which add a disinfectant to the water.

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* Add new Table VII.

Table VII. Partial Listing of Adequate Ceramic Filled Polymeric Compounds 1/

Manufacturer	Product Label
Belzona	Supermetal, Ceramic R-metal, Ceramic S-metal, Superglide, or Superglide
Chesterton	Steel Putty Plus, Steel Liquid Plus, Rapid Cure Steel Putty, Super Abrasion Resistant, or Abrasion Control Putty
Devcon	Titanium Putty, Brushable Ceramic, Ceramic Wear Putty, Ceramic Repair Putty, Fasmetal 5, Plastic Steel Putty A, Plastic Steel Putty B, Plastic Steel 5 minute Putty, Aluminum Putty, Special F Epoxy, AluminiumLiquid, Stainless Steel Putty, Bronze Putty or Wear Resistant Putty
IPI Inc	Ultrametel, Superapid, Fluid Ceramic or Gel Ceramic
Palmer-Enecon	DurAlloy, SpeedAlloy, CeramAlloy CL+ or CeramAlloy CP+
Philadelphia Resins	Super Alloy Titanium, Super Ceramic Putty, Phillybond #6, Phillyclad #8 or Phillyseal R

Add note 1 to Table VII,

1/ Pump manufacturer shall evaluate the application, and selection recommendations of the ceramic filled polymeric compound manufacturer when selecting the most appropriate compound formulation for use in the pump design.

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In paragraph 4.1 .1;

At the end of the first sentence, after "(see 6.2.1)"; add the following:

"or ISO 9002 with any specified supplements to ISO 9002 (see 6.2.1)."

At the end of the second sentence, after "(see 6.2.1)"; add the following:

"or ISO 9002 with any specified supplements to ISO 9002 (see 6.2.1)."

Add new paragraph 4.1.4:

"4.1.4 Toxicological Prohibitions The coating of pump casings with ceramic filled polymeric compounds and the utilization of composite material components shall comply with requirements identified in Tables II through VI. Where required (see 6.2.1), certification of compliance with requirements of

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Tables II through VII shall be developed and submitted by the contractor to the contracting activity for NAVSEA and/or design activity review and approval .

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Add new paragraph 4.5.2:

"4.5.2 A copy of a toxicological certificate of compliance and obtained material characteristics conformance with the requirements of Tables II thorough Table VII shall be sumitted (see 6.2.2) for review and approval by design review activity and/or NAVSEA.

* 4.6.1: Add at the end of paragraph:

"When polymeric epoxy compounds are allowed for application to the interior surface of the pump casing, hydrostatic testing shall be performed prior to the application of this coating. Not performing a hydrostatic test on an uncoated pump casing shall be sufficlent reason for rejection of the unit."

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Delete first and second sentence of paragraph 4.6.3 (b) and substitute:

"(b) Operate the pump at the maximum rated speed with the pumped fluid at maximum normal temperature from recirculation flow to 130 percent of the greatest capacity specified in 6.2.1.d and with the minimum specified suction pressure prevailing. The unit shall be operated at shutoff, and at nine other capacities approximately evenly spaced between these two test points. These test points shall include operation of the unit at each capacity for which there is a total head requirement specified in 6.2.1.d. The test points that are not defined by the above requirements shall be evenly spaced between the test points that are defined by the above requirement."

4.6.3(b) Acceptance Criteria: Line 2, after "The head capacity . . ." add "characteristic" and line 6, after ". . . on the head-capacity" add "characteristic" and line 8, after ". . . then the head-capacity" add "characteristic" .

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Delete 4.6.6.1 except for the Acceptance Criteria and substitute:

"4.6.6.1 Performance test. The performance test shall be conducted and recorded in accordance with the requirements of the test specified in 4.6.3, (see 6.2), except that, in addition, a full performance map shall be established. The full performance map shall be developed by measuring and establishing curves for total head versus capacity, pump efficiency versus capacity, k take horsepower versus capacity, and net positive suction head required versus capacity. For each of those curves measurements shall be taken at shutoff, as close to free delivery as practicable, and at nine other capacities approximately evenly spread between these two test points. The proposed test procedure for this test shall be Submitted to the contracting activity for approval approximately at the time of drawing submittal. Test

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data shall be converted to specified operating conditions for plotting of all performance curves. The performance curves shall be determined at maximum and minimum operating speed for mult-speed pumps. A full net positive suction head (NPSH) curve is required on lead production unit and on subsequent units the NPSH shall be determined at design rated capacity only. "

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4.6.6.3: Delete: "After the tests, the packing and shaft sleeve shall be inspected and the results recorded " Substitute: "After the tests, the packing, shaft sleeve and shaft-to-shaft-sleeve o-ring shall be inspected and any damage or degradation recorded (see 6.2) ."

Acceptance Criteria: Add the following sentence at the end of the paragraph, "There shall be no damage to the packing shaft sleeve and the shaft-to-shaft- sleeve O-ring. "

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4.6.7.1.3: Delete and substitute:

"4.6.7.1.3 Endurance test shall not be continuous but shall be interrupted by at least three rest periods of approximately 8 hours each. The number of starts specified in 4.6.7.1 at full line voltage shall be performed during the course of the test. During an early part of the endurance test, the pump shall be operated continuously for 24 hours at a capacity as near free delivery as possible at maximum rated speed and normal specified temperature, submergence, and suction conditions. During the latter part of the endurance test, the pump shall be operated as near shut-off as possible for 12 hours continuously. The remainder of the endurance test shall be run at maximum rated speed and within plus 20°F minus 0°F of maximum specified liquid temperature. The pump shall be operated at one-third, two-thirds, and rated capacity in approximately equal time intervals. Operations shall be at minimum specified net positive suction head available or maximum specified suction lift or vacuum, as applicable. "

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Add new paragraph 4.6.8:

"4.6.8 Composite material contaminant level test. One test specimen of the composite material two inches wide by five inches long by half inch thick representative of the composite material formulation to be used in the final manufacturing of the parts shall be used to validate conformance with Table 111 through VI requirements. These specimens shall be submerged in a sealed uncontaminated\ container filled with distilled water which allows the water level to reach a maximum of one inch above the surface of the test specimen and also allows for one inch between the sides of the specimen and the sides of the container. Distilled water temperature shall be maintained at 150°F. Specimen test samples shall be allowed to sit for a minimum of 120 hrs without allowing the water level to drop below the stipulated limits. At the end of the 120 hrs the test specimen is to be removed from the container with clean, uncontaminated instruments. Sample(s) of the distilled water, in sufficient quantity. a minimum of 100 milliliters shall be preserved, contained and sealed and submitted to qualified lab to test for the contamination levels

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stipulated in Tables III, IV, V, and VI. A certificate of compliance shall be submitted to the contracting activity validating that contaminant levels have not been exceeded. Any changes to the formulation being certified will require re-testing for contaminant levels. (see paragraph 6.2.1)

Acceptance Criteria. Composite material and ceramic filled polymeric coatings shall only be accepted if testing to limits and characteristics invoked in Table II through VII are met and validated by the required documentation and certifications (see 6.2.1). Acceptance for use of composite and ceramic filled polymeric compounds shall only be considered for applications not covered by paragraph 3.3.3.17.

Add new paragraph 4.6.9;

"4.6.9 Composite Impeller Drive Strength Testing. Impeller drive strength shall be verified on cured final product impellers. The finished impeller shall withstand 125% of the locked rotor torque of the driver associated with each application. This may be accomplished by using a callibrated hydraulic torque wrench and a fixed impeller, (an impeller held stationary, keyed to a shaft, with the key/shaft dimensions the same as that of the intended application

Acceptance Criteria. Acceptance of impeller/key assembly shall be determine by successfully passing the Drive Strength Testing without any cracks, failure, fatigue, damage or degradation of the impeller, key or shaft. If the impeller is mechanically or chemically bonded, the interface between the bonded surfaces shall not exhibit any separation, disbonding or weakening of the attached surfaces.

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6.2.1: Delete second item "(33)" and substitute: "(kk)".

6.2-1: Add as new item: "(11) Whether circular joints are required for casing joints (see 3.3. 1.1.5 and 3.3.1.2.5)".

6.2-1: Add as new items:

"(mm) Whether detrimental material requirements apply to the system in which the pump will be installed (see 3.2.9, 3.3.3.17, 3.3. 10.2 and note 20 and 21 of Table 1)".

"(nn) Whether the mechanical seal cavity in sea water pumps is to be packed with grease (see 3.3.8.5)."

"(oo) Does this pump operates in any part of a saturated-steam propulsion plant? (see paragraph 3.3.3.17, 3.3.10.2, and notes 20 and 21 of table 1)"

"(pp) Does this pump support the operator of propulsion system, steering system, potable water system, lube oil system, diesel fuel or JP-5 fuel system, fresh water collecting system and/or distillate water systems? (see paragraph 3.2.9.3)"

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"(qq) Identify requirements for standard lubricants and compounds applicable to pumps in any part of a saturated-steam propulsion plant (see 3.2.8.6)"

"(rr) Does this pump support the primary propulsion system, steering system, potable water system, lube oil system, diesel and/or JP-5 fuel system, fresh collecting system and/or distillate water system of surface ships? (see paragraph 3.3.3.17)"

"(ss) is ISO 9002 to be supplemented by additional requirements? (see 4.1.1)"

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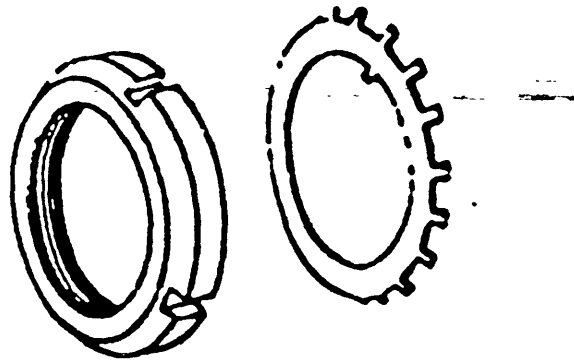


FIGURE 1A - IMPELLER BETWEEN BEARINGS

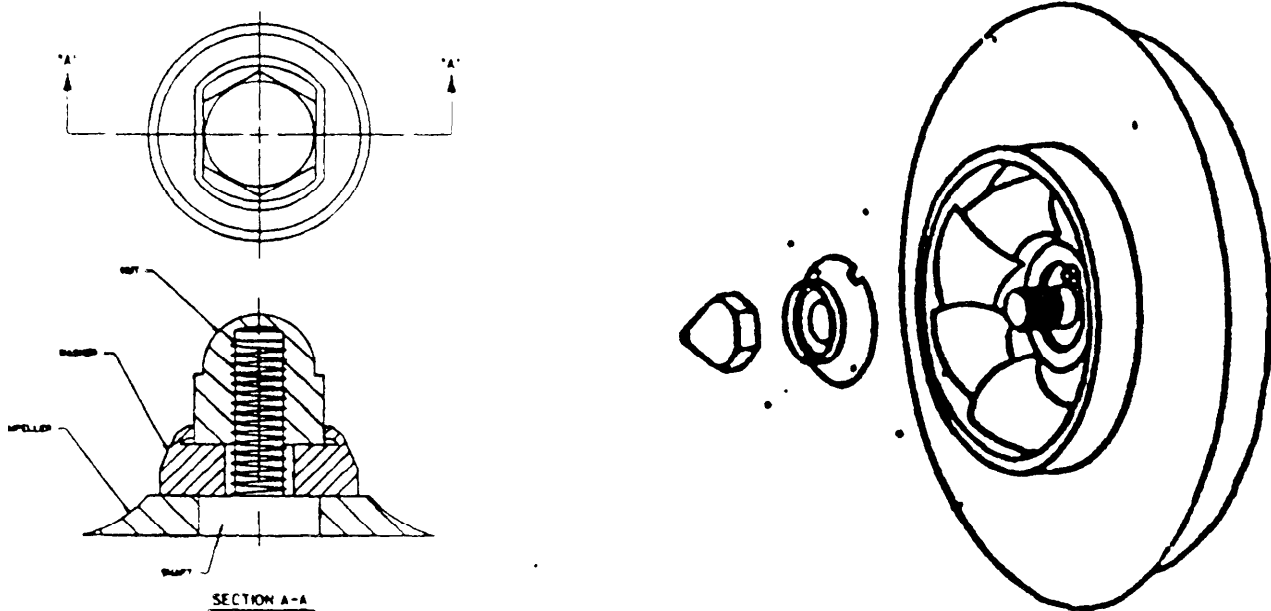


FIGURE 1B - IMPELLER NOT BETWEEN BEARINGS

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