

MIL-P-18547A(SHIPS)
 28 June 1963
 SUPERSEDING
 MIL-P-18547(SHIPS)
 22 August 1955

MILITARY SPECIFICATION
 PUMPS, ROTARY, POWER DRIVEN, NAVAL SHIPBOARD
 MAIN LUBRICATING OIL SERVICE

1. SCOPE

1.1 Scope. - This specification covers positive displacement rotary main lubricating oil service pumps, motor driven, turbine driven, chain driven or attached pumps driven by the main reduction gear.

1.2 Classification. - Pumps shall be of the following types and classes (see 6.1):

Types:

Type I - Cam and plunger
 Type II - Screws with timing gears
 Type III - Screws without timing gears
 Type IV - Impellers with timing gears
 Type VI - Spur, helical or herringbone gears with timing gears

Classes:

Class O-1 - Main Lube Oil Service.
 Class CO-1 - Main Lube Oil Service, Commercial Marine.

1.2.1 All types are applicable to both class O-1 and CO-1 pumps.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids, or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

FF-B-171 - Bearings, Ball, Annular (General Purpose).
 FF-B-185 - Bearings, Roller, Cylindrical; and Bearings, Roller, Self-Aligning.
 FF-B-187 - Bearing, Roller, Tapered.
 HH-P-96 - Paper, Gasket, Fiber (Animal or Plant), Sheet.
 GGG-E-950 - Extractor, Stuffing Box and Pump Packing (and Tamper); and Extractor, Lantern Gland.
 GGG-P-781 - Puller and Puller Kit, Mechanical, and Mechanical Puller Attachment.

MILITARY

MIL-B-857 Bolts, Nuts, and Studs.
 MIL-S-901 Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
 MIL-D-963 Drawings, Electrical, Hull and Mechanical Equipment for Naval Shipboard Use.
 MIL-Q-9858 Quality Control System Requirements.
 MIL-P-15024 Plates, Identification -Information and Marking for Identification of Electrical, Electronic and Mechanical Equipment.
 MIL-M-15071 Manuals, Equipment and Systems.
 MIL-P-15137 Provisioning Technical Documentation for Repair Parts for Electrical and Mechanical Equipment (Naval Shipboard Use).
 MIL-P-16789 Preservation, Packaging, Packing and Marking of Pumps General, and Associated Repair Parts,

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- MIL-L-17331 - Lubricating Oil, Steam Turbine (Noncorrosive).
- MIL-G-17859 - Gear Assembly, Speed Decreaser; and Gear Assembly, Reverse (Naval Shipboard Use).
- MIL-B-17931 - Bearings, Ball, Annular, for Quiet Operation.
- MIL-P-22808 - Paint, Epoxy, Hydraulic Fluid Resistant.

STANDARDS

MILITARY

- MIL-STD-10 - Surface Roughness Waviness and Lay.
- MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment.
- MIL-STD-278 - Welding and Allied Processes for Machinery for Ships of the United States Navy.
- MIL-STD-438 - Schedule of Piping, Valves, Fittings and Associated Piping Components for Submarine Service.
- MIL-STD-740 - Noise Measurements of Shipboard Machinery and Equipment.
- MIL-STD-758 - Packaging Procedures for Submarine Repair Parts Utilizing Transparent, Flexible, Heat Sealable Film.
- MIL-STD-777 - Schedule of Piping, Valves, Fittings and Associated Piping Components for Surface Ships.

DRAWINGS

BUREAU OF SHIPS

- B-153 - Packing and Gaskets; Application of.
- B-2 14 - Root connections for Attaching Piping.
- 5000 -S1112-1385778 - Mount, Resilient, EES Type.

PUBLICATIONS

BUREAU OF SHIPS

- NAVSHIPS 250-637-2 - Instructions for Torch Brazing of Ferrous and Non-Ferrous Piping.
- NAVSHIPS 250-648-8 - Inspection and Tests of Silver-Brazed Piping Systems.
- NAVSHIPS 250-660-30- A Guide for Design of Shock Resistant Naval Equipment.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids, or request for proposal shall apply.

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York 16, N. Y.)

AMERICAN GEAR MANUFACTURERS' ASSOCIATION

American Gear Manufacturers' Standards

(Application for copies should be addressed to the American Gear Manufacturers' Association, Empire Bldg., Pittsburgh 22, Pa.)

HYDRAULIC INSTITUTE

Test Code of Standards - Rotary Pump Section - "Factory tests at the pump manufacturer's plant. "

(Application for copies should be addressed to the Hydraulic Institute, 122 East 42nd Street, N.Y. 17, N. Y.)

NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Washington 25, D. C.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Qualification. - Class O-1 pumps furnished under this specification shall be products which have been tested, and passed the qualification tests specified herein, and have been listed or approved for listing on the applicable qualified products list.

3.2 Preproduction model. - Prior to beginning production a preproduction model of a class O-1 pump shall be tested as specified in 4.6.

3.3 Materials not applicable to class CO-1 pumps. -

3.3.1 For the materials of construction of major parts of pumps covered by this specification, see table It of 6.2. This table lists a number of materials which are considered adequate for the applications, and the table should be followed; however this specification is not intended to be restrictive provided proposed alternate materials will give equal or better service, and Bureau of Ships approval is obtained prior to offering equipment in response to invitations for bids. Manufacturers are urged to make use of class C drawings (basic design drawings) to obtain approval of any desired alternate materials (see 3.8.2.3).

3.4 General design. -

3.4.1 The principle of reliability is paramount and no compromise of this principle shall be made with any other basic requirements of design. Pumps shall be designed to operate for 40,000 hours over a period of twenty years with a minimum of servicing. The pumps shall operate the first 9000 hours without replacement of any parts except packing. Where wear or erosion is unavoidable, the parts subjected to such wear or erosion shall be of the best materials available for the purpose in order to reduce these detrimental effects to a minimum. The design and construction of all pumps shall be the most compact consistent with the following requirements:

- (a) Reliability.
- (b) Accessibility for repair.
- (c) Resistance to wear or corrosion.
- (d) Economy.
- (e) Unless otherwise specified in the contract or order, satisfactory operation when inclined as follows:

Surface ships. -

- (1) Up to 15 degrees from the normal horizontal position in any direction (permanently inclined).
- (2) With the ship rolling up to 45 degrees from the vertical to either side.
- (3) With the ship pitching 10 degrees up and down from the normal horizontal plane.

Submarines:

Trim (permanent)	30 degrees
Pitching	10 degrees
Time of complete pitch cycle	4 seconds
List (permanent)	15 degrees
Rolling	60 degrees
Time of complete roll cycle	8 seconds

Note 1 - Degrees indicated are measured from the vertical to either side for list and roll, and from the normal horizontal plane up or down for trim and pitch.

Note 2 - Horizontal pumps shall be suitable for installation either fore and aft or athwartship.

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3.5 Pump characteristics.- The general range of pump characteristics shall be in accordance with table I. Characteristics of pumps to be procured shall be as specified (see 6.1).

Table I -Pump characteristics.

Discharge pressure	Rated capacity	Suction lift at rated capacity ¹	Viscosity range of liquid for test purposes	Range of liquid temperatures under operating conditions ²	Type of drive
P.s.i.g.	G.P.M.	Inches of mercury	SSU	° F.	As specified (see 6.1)
25 - 100	100 to 1250	5 - 15	130 to 2500	60 - 160	

¹Referred to centerline of pump rotors.

²Temperatures do not necessarily correspond with the viscosity range, but indicate temperature pumps may be expected to encounter in service.

3.5.1 Attached pumps (see 3.6.16) will operate in parallel with motor or turbine driven lubricating oil service pumps during low speed ahead operation of the ship.

3.5.2 Attached pumps shall be capable of reverse rotation during astern operation of the ship. Recirculating lines for use during astern operation will be provided by the Government or shipbuilder.

3.6 Detail design. -

3.6.1 Shockproofness. -

3.6.1.1 The design of all complete pump units, except commercial marine pumps, shall be such that they are capable of passing the type A, High Impact (H. I.) shock test specified in MIL-S-901. Grade A, class III equipment in accordance with MIL-S-901 is required. NAVSHIPS 250-660-30 may be used as a guide for design of shock resistant Naval equipment.

3.6.1.2 Shockmounts are not to be used unless the bureau or agency concerned approves the mount and its proposed application.

3.6.1.3 Bolts designed to be stressed in shear shall be installed in holes with a minimum of clearance. Hole diameters shall be no more than 1/32 inch larger than the bolts up to 3/4 inch size, and no more than 1/16 inch larger than bolts of greater than 3/4 inch size. Mounting twits for fastening the equipment shall conform to grade 2 of MIL-B-857.

3.6.2 Noise and vibration. - The design, construction, and workmanship, of the equipment shall be such that a minimum practical noise level will result under all operating conditions. Airborne noise, structure-borne vibration and pump discharge pulsation requirements shall be as specified (see 6.1).

3.6.2.1 When specified (see 6.1) the manufacturer shall provide means for supporting the pump on Navy furnished sound isolation mounts designed to Drawing 5000 -S1112-1385778. The support mounting shall be on a plane through the approximate center of gravity of the complete equipment. Such support mounting shall be integral with the subbase or other supporting structures. This arrangement shall be clearly delineated on the drawings.

3.6.3 Alignment between separate components of a unit shall be maintained by means of keyways, dowel pins, fitted bolts, or other adequate means.

3.6.4 In no case shall a piece of equipment be rigidly supported from more than one plane.

3.6.5 All pumps shall be self -priming and capable of removing air from the suction lines. The pumps may at times be required to handle oils lighter than those specified, such as lubricating oil heated to 180°F, used for flushing lubrication systems. Hence, where the lubrication of the pump is supplied by the fluid pumped,

the bearings, rotors, and gears shall be of such design and materials that the pumps will operate in a manner satisfactory to the bureau or agency concerned when pumping such fluids for limited periods,

3.6.6 Mounting. -

3.6.6.1 Pump units shall be horizontally or vertically mounted, as specified (see 6.1).

3.6.6.2 Each horizontal pump and motor or turbine drive shall be mounted on a common bedplate.

3.6.6.3 Each vertical unit shall be base mounted or table mounted, as specified (see 6.1),

3.6.6.4 For the base mounted units, the base may be either integral with the pump casing or a separate piece, and the base shall have provision for bolting to a foundation,

3.6.6.5 For the table mounted units, the table mount may be either integral with the pump casing or bracket, or it may be a separate piece.

3.6.6.6 A suitable bracket shall be provided between the pump and driver of vertical units.

3.6.6.7 Bedplates, bases, table mounts and brackets shall be designed so that they shall be sufficiently rigid to permit handling, shipment and installation of the unit onboard ship, without disturbing the alignment of the assembled units, and such that the normal distortion, weaving or vibration of the supporting structures onboard ship cannot cause misalignment between the pumps and driving units.

3.6.6.8 Each component part of an assembled unit supported directly by the bedplate, base, table mount, or bracket, shall be doweled or rabbetted thereto to facilitate reassembly and maintenance of alignment.

3.6.6.9 All bearing and seating surfaces of bedplates, bases, table mounts, or brackets shall be finished machined to a maximum roughness height rating of 125 in accordance with MIL-STD-10. Class CO-1 pumps may be exempt from this requirement if not normally finished machined.

3.6.6.10 In the event special bulkhead mounting is required, sideplates shall be furnished subject to all the conditions specified for baseplates.

3.6.6.11 Horizontal pumps shall be designed so that all bearings, rotors, and shafts may be removed and replaced without disconnecting piping, except stuffing box gland seal piping, and without removing the pump or its driving unit from the bedplate or base.

3.6.6.12 Each vertical unit, in order to facilitate interchangeability, shall be mounted to permit rotation of the pump with respect to its driver. Eight or more positions of pump flanges relative to the driver shall be available.

3.6.7 Bearings. -

3.6.7.1 Types. -

3.6.7.1.1 Radial and thrust bearings may be of the sliding surface or rolling contact types.

3.6.7.1.2 Rolling contact bearings shall be in accordance with FF-B-171, FF-B-185 and FF-B-187, except where prior approval of the bureau or agency concerned has been granted.

3.6.7.1.3 Rolling contact bearings for submarine applications shall be specially selected for quiet operation in accordance with MIL-B - 17931.

3.6.7.1.4 Sleeve radial bearings may be of the fixed or self aligning type as approved for design and application by the bureau or agency concerned. Ample bearing surface shall be provided for each sleeve bearing.

3.6.7.2 Thrust bearings. - Pumps shall be designed to counteract any unbalanced hydraulic or mechanical thrust under normal service condition. In this connection consideration shall be given to the fact that the normal motion of a ship at sea, or an abnormal list or trim giving an inclined operating platform, may introduce mechanical thrust in a unit which might otherwise be in satisfactory balance.

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3.6.7.2.1 Thrust bearings may be of the straight thrust ball or roller type, combined radial and thrust ball or roller type, or plain sliding surface type.

3.6.7.2.2 Thrust bearings of the ball or roller type, and the installation thereof, shall be in accordance with FF-B-171, FF-B-185 and FF-B-187, as applicable.

3.6.7.2.3 Sliding surface thrust bearings shall be as approved for design and application by the bureau or agency concerned.

3.6.7.3 Bearing installation. -

3.6.7.3.1 Where sleeve bearings are fitted in closed heads they may be of the solid bushing type secured by pins or keys. For independent bearings on brackets fitted at stuffing box ends, the sleeve bearings shall be split along the axis. All sleeve bearings shall be so arranged to permit renewal or refitting without removal of the pump rotor from the casing, and they shall be securely fitted to prevent axial movement.

3.6.7.3.2 For either internally or externally mounted bearings, the bearing housing shall be cast integral with the pump case or bearing bracket, or secured thereto in such a manner as to insure alignment.

3.6.7.3.3 Bearing brackets shall be either cast integral with the casing, securely bolted to the casing on a machined shoulder, or held in alignment with the casing by at least two heavy dowels and securely bolted thereto. The use of bolts alone for securing brackets is prohibited.

3.6.7.3.4 The number, type and arrangement of bearings shall be as approved by the bureau or agency concerned.

3.6.7.4 Bearing lubrication. -

3.6.7.4.1 Ball, roller or sleeve bearings may be lubricated by the fluid pumped, provided the bearing housings are so designed that there are no pockets, which may act as water, sediment, or sludge traps, and a continuous circulation of fresh oil is provided through such bearings.

3.6.7.4.1.1 Bearings lubricated by the fluid pumped shall be required to operate in a manner satisfactory to the bureau or agency concerned throughout the test specified in 4.5.4.1, however, deterioration to a point requiring replacement of the bearings immediately after the test will not disqualify the bearings,

3.6.7.4.1.2 Steam turbine driven pumps may be retained in a stand-by condition for long periods of time, that is with just enough steam through the turbine to keep the rotating element turning slowly, ready to be speeded up to full speed at any time. The drawings and manuals shall state the minimum speeds at which the pump can be operated continuously and safely.

3.6.7.4.2 Externally mounted ball or roller bearings shall be lubricated in accordance with FF-B-171, FF-B-185 and FF-B-187, as applicable.

3.6.8 Piping and valves. -

3.6.8.1 Suction and discharge connections shall be flanged for mating with flanges specified for the service in accordance with MIL-STD-438 or MIL-STD-777 as applicable. Suction and discharge pressure gage connections shall be flanged; the flange connections shall be in accordance with Drawing B-214.

3.6.8.2 Gland seal piping, shall be extra heavy steel pipe, 1/8 inch iron pipe size (i.p. s.), with steel valves and steel fittings. Valves shall have socket weld ends. Fittings shall be flareless mechanical "bite" type. Mechanical "bite" type fittings with SAE straight threads and "O" rings for boss mounting may be used for root connections. Mechanical "bite" type fittings, with SAE "Dryseal" or equal, tapered pipe threads may also be used for root connections. Gland seal piping for commercial marine pumps may be furnished in accordance with the manufacturer's normal standards for such pumps.

3.6.8.3 Tapered threads shall not be used in equipment required to be shockproof, except as permitted in MIL-STD-438 and MIL-STD-777. Pipe connections shall be of the flanged, union, brazed or welded type as applicable. Should this not be feasible, a straight thread fitting of a type approved by the bureau or agency concerned may be used.

3.6.9 Drains.- The bottom of all pump casings or heads shall be provided with a drain connection. Drains shall be fitted to drip pockets.

3.6.10 Casings and heads. -

3.6.10.1 Casings, also referred to as cylinders, are those parts which enclose the rotors. The bores of the casing are parallel to the rotors.

3.6.10.1.1 Casing liners, also referred to as rotor housings, are replaceable parts located between the casing bore and the rotors. Casing liners, or casings if not fitted with liners, are wearing parts,

3.6.10.2 Casings shall be made as light as possible consistent with strength and shall be ribbed and braced on the outside as necessary to give stiffness and rigidity under the working pressure. The interiors shall be smooth cored with easy bends wherever the direction of flow is changed.

3.6.10.2.1 It is preferred that pump casings be equipped with easily removable liners. However, consideration will be given by the bureau or agency concerned to pumps not having this feature. Either liners or casings shall be supplied as repair parts as recommended in 6.3.

3.6.10.3 Suction and discharge openings shall be cast integral with the casings, heads, or outlet elbows, and shall be located as approved by the bureau or agency concerned.

3.6.10.4 The heads shall have accurately machined faces in accordance with MIL-STD- 10. Joints between casings and heads may be made up either metal to metal, or with a thin plant or animal fiber gasket in accordance with HH-P-96, not exceeding 0.010 inch in thickness. Heads shall be rabbetted or doweled to the casings.

3.6.10.5 Forcing bolts and lifting bolts shall be provided as necessary for convenient handling during overhaul.

3.6.11 Rotors and shafts. -

3.6.11.1 All rotors shall be accurately finish machined or ground throughout. They shall be integral with secured to the shafts by keys or other method approved by the bureau or agency concerned. Rotors shall be secured positively against lateral displacement on shafts.

3.6.11.2 Means shall be provided for the escape of the liquid pumped from all points between rotors or gear teeth where it may be trapped during operation and thereby create a dangerously high pressure. Means of entrapment relief shall be approved by the bureau or agency concerned.

3.6.11.3 Deflector rings, or other similar method approved by the bureau or agency concerned, shall be used to prevent leakage from the stuffing boxes running along the shafts. The use of felt seal rings only are not approved. If authorized by the bureau or agency concerned, in combination with other methods, they shall be installed so that they can be replaced without dismantling the pump.

3.6.11.4 All shafts shall be accurately machined and ground. Means shall be provided on the driven or driving shaft of each unit so that a portable tachometer may be quickly and easily applied unless a revolution counter is permanently installed. Either the tachometer or revolution counter shall be of a type which is satisfactory to the bureau or agency concerned. Provision for the use of a tachometer will not be required on pumps driven by alternating current motors. Shafts shall have a minimum hardness of 275 Brinell.

3.6.12 Timing gears. - Timing gears may be of the spur or double helical type. Timing gears of steel shall be case hardened to a minimum depth of 0.0625 inch and shall have a 57 to 63 Rockwell "C" hardness. Gears shall be fully enclosed and adequately lubricated. Timing gears shall be secured to the shafts so as to prevent either radial or lateral movement. The method shall be approved by the bureau or agency concerned.

3.6.12.1 Provision shall be made for replacement of timing gears in the field, so that it will be satisfactory to carry and replace individual parts of rotating elements. The method of installing and timing the timing gears shall be thoroughly explained, with sketches if necessary, in the manuals (see 3.9).

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3.6.13 Couplings.-

3.6.13.1 Unless otherwise specifically approved by the bureau or agency concerned, a flexible coupling of all metal construction, of a design satisfactory to the bureau or agency concerned, shall be installed between the pump and the driving unit.

3.6.13.2 Extension shafts when used shall be rigidly coupled to the pump shaft and shall be connected to , the transmission drive by a flexible coupling.

3.6.13.3 All coupling hubs, which are to be fitted to driven shafts larger than 1 inch in diameter, shall be fitted to the shafts on a taper, shall be secured against turning on the shafts by keys fitted parallel to the taper, and shall be secured on the shafts by lock nuts.

3.6.13.4 Horizontal flexibly coupled units with bedplates shall have coupling guards provided. Guards shall be designed to permit ready access to the coupling for lubrication and inspection.

3.6.14 Stuffing boxes and packing.-

3.6.14.1 Stuffing boxes shall be of adequate depth and so designed that when properly packed leakage is reduced to a minimum under all operating conditions.

3.6.14.2 Pump gland packing shall conform to the applicable specifications listed on Drawing B-153. Sufficient space shall be provided between the bearings and stuffing boxes to permit ready renewal of packing and inspection and overhaul of the bearings.

3.6.14.3 Where a stuffing box is subject to discharge pressure, the design of the box shall be such as to trap the leakage therefrom by the use of a seal ring, or other method approved by the bureau or agency concerned, and return same by drain piping to the suction side of the pump, with needle valve to control the flow where necessary. Where a stuffing box is subject to suction pressure, suitable means shall be provided by seal rings and seal piping connected to the discharge of the pump for sealing the packing to prevent leakage of air into the pump suction. The sealing piping shall be fitted with a needle valve or valves as necessary for proper control.

3.6.14.4 Glands and seal rings, if used, shall be split in halves with the halves secured together in a manner to form solid rings for setting up.

3.6.14.5 All stuffing box glands shall be set up by nuts threaded on gland swing bolts or studs secured in the casings.

3.6.14.6 Seal rings shall be constructed insofar as practical, so that lantern gland extracting tools in accordance with GGG-E -950 may be used.

3.6.14.7 Mechanical shaft seals shall be used in all pumps intended for installation on ships having nuclear powered main propulsion plants and for installation on other ships when specified (see 6.1). Pumps equipped with mechanical shaft seals shall also have a back-up stuffing box to accommodate a minimum of two rings of packing for use in the event of mechanical seal failure.

3.6.15 Pump drivers. -

3.6.15.1 Pump drivers shall be of the types, have the characteristics, and be in accordance with the specifications specified (see 6. 1).

3.6.15.2 Pumps may be direct, geared, or chain connected to the driving units as specified (see 6.1).

3.6.15.3 The continuous duty horsepower (hp.) rating of each motor shall be not less than that required by the pump when handling the fluid at the temperature and viscosity extremes indicated in 3.5. In addition, the motor shall be suitable for short time duty rating of one hour driving a pump handling 7000 Saybolt seconds universal (SSU) viscosity oil. The actual motor rating shall be in accordance with the Navy standard motor ratings as indicated in the applicable motor specification.

3.6.15.4 Motor controllers. - Motor controllers shall have the characteristics and be in accordance with the specifications specified (see 6.1).

3.6.15.4.1 The selectors switch shall be of the three positions, maintained contact type, with markings "OFF," "AUTOMATIC," and "MANUAL." With the selector switch in the automatic position the motor shall start automatically when the pressure switch closes *on* drop in pressure below a predetermined value. Once started, the motor shall continue to run, regardless of the pressure switch opening on restoration of pressure, until stopped by turning of selector switch to the off position. An indicator light shall be provided in the selector switch enclosure to indicate when the switch is in the automatic position. With the selector switch in the manual position, the motor shall run continuously and the pressure switch shall be completely disconnected from the circuits to permit adjustment of repair without hazard to personnel.

3.6.15.5 Reduction gears. - Where reduction gears are used, they shall be of the spur, single or double helical, or worm type in accordance with MIL-G-17859, except that class CO-1 pump gears may be in accordance with applicable practices of the American Gear Manufacturers. Reduction gears shall be independent of the pump and connected thereto by a flexible coupling. Such reduction gears may, however, be an integral part of the driving unit.

3.6.16 Attached pumps. -

3.6.16.1 Pumps may also be driven either by a chain drive off the ship's main propeller shaft or by a power take-off from the ship's main reduction gear as specified (see 6.1).

3.6.16.2 Chain driven pumps. - The arrangement of pumps with respect to the propeller shaft, size of the propeller shaft, and other details shall be as specified (see 6.1).

3.6.16.2.1 Chain drive. - The pumps shall be driven by a roller chain, or equivalent, as approved by the bureau or agency concerned.

3.6.16.2.2 The chain shall be provided with detachable links to allow quick disassembly when the propeller shaft is stationary. The chain links shall be locked by cotter pins. A special tool (see 3.10.2) shall be provided for each pump to facilitate disconnection of the chain. To insure availability, the tool shall be mounted on the exterior of the chain case. Permanent detail instructions to fully cover chain disconnection and removal shall be provided. These instruction plates shall be in accordance with MIL-P -15024 and shall be mounted on the chain case.

3.6.16.3 Sprocket mounting. -

3.6.16.3.1 The pumps shall have the driven sprocket mounted on the pump drive gear shaft. A positive means of alignment for the driven sprocket shall be provided on the shaft.

3.6.16.3.2 The driving sprocket shall be in two halves, and shall be mounted on the main propeller shaft.

3.6.16.3.3 The driving and the driven sprockets shall be of cast or forged steel.

3.6.16.4 Chain guard. - The chain and sprockets shall be encased in a steel chain guard. The chain guard shall be provided with hinged, quick-opening covers on at least one side and on the top in an appropriate location to permit easy access for disconnection and removal of the chain. The chain guard shall be fitted with a lucite, or equal, window to provide visual inspection of the drive sprocket. The chain guard shall be provided with substantial means of support.

3.6.16.5 Fabrication. - The lubrication of the chain drive, the gears of the unit, and the pump bearings shall be provided from the discharge side of the pump.

3.6.16.5.1 The lubricating system shall include a sight feed valve, strainer, and a drain connection.

3.6.17 Rubbing speeds. - The maximum rubbing speed in feet per minute for a particular type pump shall be the speed established for that type pump during the qualification tests (see 4.5.2).

3.6.18 Threaded parts. - Threaded parts shall conform to Handbook H28.

3.6.19 Welding and allied processes. - Welding and allied processes shall be in accordance with MIL-STD-278. Cast nodular iron parts shall not be welded.

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3.6.19.1 Silver brazed joints shall be in accordance with NAVSHIPS 250-637-2. Preinserted ring fittings shall be used for joints 1/2 inch and larger. Face feed fittings may be used for sizes below 1/2 inch.

3.6.20 Painting. - Ferrous castings and weldments shall be cleaned by a sulfuric acid pickling process and shot blasting(not sandblasting) to remove all scale, rust and loose weld beads. After machining, ferrous castings and weldments shall be treated by a manganese phosphate rust inhibiting process (Parkerizing or equal). After assembly, all surfaces to be painted shall be thoroughly cleaned and free from oil and grease. All external nonworking ferrous and aluminum surfaces shall be painted with two coats of light gray epoxy hydraulic fluid resistant paint conforming to MIL-P-22808. Paint shall not be applied to any internal surface. When desired for convenience or appearance, contiguous non-ferrous surfaces may also be painted.

3.7 Identification plates and information plates. -

3.7.1 Identification plates and information plates shall be furnished on each pump. These plates shall be type A or B in accordance with MIL-P - 15024, except that identification plates of aluminum or plastic shall not be used.

3.7.2 Identification plates and information plates shall be firmly secured to the equipment with corrosion resistant metallic screws.

3.7.3 Pump identification plates shall contain data as follows:

- (a) Manufacturer's name.
- (b) Manufacturer's model or type and size.
- (c) Service application.
- (d) Manufacturer's serial number.
- (e) Salient design characteristics:
 - (1) Capacity in gallons per minute (g.p.m.).
 - (2) Discharge pressure.
 - (3) Suction lift.
 - (4) Speed of shaft in revolutions per minute (r.p.m.).
 - (5) Brake horsepower, under rated conditions.
 - (6) Hydrostatic test pressure.
 - (7) Viscosity range (operating).
- (f) Contract or order number and item number for multiple unit orders.
- (g) Federal stock number.
- (h) Section for inspector's stamp.

3.7.3.1 Required data not normally on the manufacturer's commercial plates may be put on a supplementary plate for class CO-1 pumps.

3.7.4 Each driving unit and each accessory unit shall have an identification plate in accordance with the applicable equipment specification.

3.8 Drawings. - All drawings and lists shall conform to MI L-D-963, with exceptions and additional requirements contained herein.

3.8.1 Drawings of the following classes shall be furnished as required by the contract or order:

- Class A - Master drawings.
- Class B - Certification data, outline drawings, drawing lists.
- Class C - Basic design drawings.
- Class D - Ship equipment drawings.

3.8.2 Class A and Class D drawings. - Class A and class D drawings shall be so complete as to permit:

- (a) Evaluation of performance and quality of the equipment against requirements of this specification.
- (b) Evaluation of operational and personnel safety.
- (c) Procurement of parts by the supply system.
- (d) Installation, operation, maintenance and repair, without manufacturer's assistance.

3.8.2.1 Class A and class D drawings, covering pumps under this specification are identical as far as form and content are concerned. Class A drawings shall be approved only by the Bureau of Ships. Bureau of Ships field representatives may approve the drawings as class D drawings only (thereby authorizing manufacture without waiting for Bureau of Ships action), and at the same time or subsequently they may recommend to the Bureau of Ships that the drawings be considered as class A drawings.

3.8.2.1.1 Master plans or type I drawings furnished under earlier editions of MIL-D-963 and the earlier edition of this pump specification are considered as fulfilling the requirements of class A drawings under this specification, regardless of the source of approval of those drawings. However approval of modifications to those drawings after the date of this specification shall be by the Bureau of Ships only.

3.8.2.2 Class B drawings. - Class B drawings shall be furnished as a supplement to all class A and class D drawings required under a contract or order. They are not required in connection with class C drawings.

3.8.2.3 Class C drawings. - Class C basic design drawings covering pumps under this specification are intended for submittal to the Bureau of Ships prior to and independent of invitations for bids. Each drawing may cover a range of sizes of pumps so long as they are of the same basic design. A class C drawing may indicate a variation in materials from that called for in 6.2 and if approved by the Bureau of Ships that variation in material will be accepted in subsequent procurements as being in accordance with this specification. All such material variations shall be specifically pointed out in the transmittal letter. A further advantage of class C drawings is that when bids are accompanied by an applicable approved class C drawing, then production may be authorized immediately on signing of a contract. Approval of a class C drawing does not preclude the requirement for class A or D drawings and class B drawings applicable to a particular contract or order.

3.8.3 Format. - The manufacturer's commercial format may be used if the requirements for drawing content (see 3.8.4), material identification (3.8.5), and drawing identification (3.8.6) are satisfied.

3.8.4 Drawing content. -

3.8.4.1 General requirements for all classes. -

3.8.4.1.1 "Manufacturer's Use Only" notes. - Information intended for manufacturer's use only shall be designated. Conversely, on a commercial drawing with wide usage it is permissible to designate portions thereon, "For Navy Use Only."

3.8.4.1.2 Dimensional tolerance. - Unless otherwise indicated by note, legend, or key it will be assumed that all tolerances shown on a drawing must be complied with during both manufacture and maintenance repair.

3.8.4.2 Types and contents of class A and class D drawings. - Drawings of the types specified in 3.8.4.2.1 and 3.8.4.2.2 shall be furnished.

3.8.4.2.1 Sectional assembly drawings. - Sectional assembly drawings shall include a sectional assembly with complete list of material, with references to applicable detail drawings. All running clearances shall be shown. The list of material shall include every part required in the pump assembly, including those parts not required to be detailed. This may necessitate some side or partial views in order to show parts not otherwise shown in the main section view. The list of material shall include an indication of each part required by this specification to be furnished as an onboard repair part (this is not a repair parts list).

3.8.4.2.2 Detail drawings. - Detail drawings shall be furnished of all parts and subassemblies necessary for evaluation of the equipment, and of all parts necessary for maintenance, and overhaul of the pumps. Details of these parts shall be so complete as to permit emergency manufacture by a Naval shipyard without assistance from the original manufacturer. Details of pump casings and rotating elements shall be furnished, but the dimensioned development of these parts need not be shown. Subassemblies whose parts cannot be procured or serviced individually, should be shown as a single part and so indicated. Multidetail drawings are preferred, but monodetail drawings may be used.

3.8.4.2.2.1 The only detail drawings required for class CO-1 pumps are of the shaft, shaft sleeves and sleeve bearings.

3.8.4.3 Contents of class B drawings. - Outline drawings including certification data shall be furnished as a supplemental drawing to all class A and class D drawings. Separate class B drawings shall be furnished

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under each contract or order unless the complete equipments covered by the outline drawing and the referent drawings are in fact identical in all respects.

3.8.4.3.1 Additional sheets shall contain complete performance curves. These curves shall be the performance test curves required by 4.7.1. The curves shall be on graphs which shall have dimensions approximately but not greater than 7 inches by 10 inches. Each graph shall contain the data required by 4.7.1. Promptly after completion of the performance tests the additional sheets shall be completed.

3.8.4.3.2 After approval of the sheet of the class B drawing, which contains the curves, four positive (white background) prints of each graph shall be forwarded to the Bureau of Ships and any other bureau or agency concerned. Each graph shall be on a sheet which has the same dimensions as the sheets comprising the manuals (see 3.9). Each graph shall be arranged on a sheet in such manner that all information shown thereon may be easily read after insertion, by the bureau or agency concerned, in the manual. Reference to these curves shall not be contained in the index or text of the manual. Delivery of the final manuals shall not be delayed by actions required to complete and deliver to the bureau or agency concerned the four sets of pages showing the performance acceptance test curves.

3.8.4.3.3 The class B drawings, in addition to the certification data required by MIL-D-963, shall contain the following

- (a) Dimensional outline assembly drawing of the pump with its prime mover, bedplate and attached auxiliaries.
- (b) Complete performance data of pump, prime mover, and attached auxiliaries, if applicable.
- (c) Table of weights of individual components and weight of complete unit.
- (d) List of shipbuilder's connections showing size, type and dimensions of flanges.
- (e) Center gravity of the pump component and of the complete assembly.
- (f) Radii of gyration of complete assembly about each of the three principal axes (required only if the equipment is to be sound mounted).
- (g) Identification of system in which installed.

Note. - Items (c) (table of weights), and (e) (center of gravity), shall be filled out on the initial submission of drawings for approval. The drawing shall indicate whether these values are calculated or measured. The values shown on the final drawings shall be actual measured values and shall be so indicated.

3.8.4.3.4 Onboard repair parts list (not required for class CO-1 pumps) .- A list of onboard repair parts shall be furnished with class B drawings. This list shall be prepared on Provisioning List forms in accordance with MIL-P -15137 with the additional requirement that the list shall be assigned a manufacturer's drawing number. The forms shall be assigned sheet 2, sheet 3, and so forth, of the class B drawing. This list shall be furnished whether or not the parts are required in the pump contract or order. This list shall not be modified to indicate parts or quantities of parts furnished under supplementary or separate contracts or orders. The list is intended as a record of recommendations of the manufacturer and purchaser at the time of equipment drawing approval. The list of onboard repair parts actually purchased shall be prepared as required by MIL-P-15137 and need not include a manufacturer's drawing number.

3.8.4.4 Contents of class C drawings. - The intent of class C drawings is specified in 3.8.2.3. These drawings shall consist of small scale (not necessarily to scale) plan and elevation views showing over-all dimensions. If the plans cover a family of pump sizes all of the same design, the dimensions may be tabulated. The range of capacities, pressure and speeds shall be shown. The main part of this drawing shall be an undimensioned sectional assembly with complete list of material which shall include every part required in the pump assembly. If materials of some parts may change with various pump characteristics or with differing fluids to be pumped, a table shall be included to show these variations. The main sectional assembly shall show conventional packing, and a side or partial view shall show a mechanical shaft seal arrangement. Other alternate subassembly arrangements of different parts may be included as desired.

3.8.4.4.1 Detail drawings of individual parts are not required in connection with class C drawings, but may be included if desired by the manufacturer for clarification, or to obtain advance approval.

3.8.5 Material identification. -

3.8.5.1 Preferred material reference. - Where materials of identical or equal quality can be identified by more than one specification or standard, the drawings need reference only one such specification or standard. In selecting the specification or standard to be referenced the following is the order of preference:

- (a) Federal specification or standard.
- (b) Military specification or standard.
- (c) Industry and Technical Society specification or standard.
- (d) Manufacturer's specification or standard.

3.8.5.2 Material substitutions. - Where materials other than covered by (a), (b), and (c) of 3.8.5.1 are referenced and approved, the drawings shall show the complete chemical and physical properties of the approved material. In addition, the drawings shall identify the material in terms of the nearest Federal or Military specification, in order to enable Naval repair facilities to make emergency repairs as necessary from Navy material stocks.

3.8.6 Drawing identification. - As indicated in MIL-D-963, Bureau of Ships drawing numbers are no longer assigned; hence, the manufacturer's drawing number is now the sole reference identification. "Manufacturer" in this case is defined as the company which produces the part, or parts, shown on the drawing.

3.8.6.1 Prime vendors who purchase items from subcontractors shall use the subcontractor's drawing number as the single reference identification in all cases where the part(s) delineated thereon are produced by the subcontractor. The prime vendor shall not add his drawing number to the drawing except as an unofficial reference outside the drawing border or margin.

3.8.6.2 Prime vendors who purchase semi-finished parts from subcontractors for final production, test or selection phases in their own shops, have the option of using as the single drawing identification, either their own title block and drawing number, or the title block and drawing number of the subcontractor, but not both.

3.8.7 Prints for approval. -

3.8.7.1 Approval of drawings by either the Bureau of Ships or its field representatives does not relieve the vendor or manufacturer of complete responsibility for furnishing equipment meeting all performance requirements and characteristics required by the contract or order.

3.8.7.2 Prints of the following class A and class D drawings shall be submitted for approval prior to manufacture of equipment:

(a) Sectional assembly drawings (see, 3.8.4.2.1) and detail drawings of the following parts:

- (1) shafts.
- (2) Rotating elements.
- (3) Casings and heads.
- (4) Timing gears.
- (5) Shaft sleeves.
- (6) Bearing housings.
- (7) Sleeve bearings (if used).

3.8.7.2.1 If manufacture has been authorized, immediately upon signing of a contract based on previously approved class C drawings, then class A or class D drawings shall be submitted for approval within 60 days after the date of the contract.

3.8.7.2.2 After approval, each of the above mentioned drawings shall be lettered or stamped with the approval notation which shall include reference to the letter of approval and the drawing class for which approval is received (class A from Bureau of Ships only). In addition, the notation on the sectional assembly drawing shall indicate satisfactory compliance with this pump specification.

3.8.7.2.3 Responsibility for all other detail drawings (see 3.8.4.2.2) rests with the vendor. Each such drawing shall bear a notation indicating review and approval by a responsible official of either the vendor or his subcontractor. The notation shall include the name or initials of approving official, his title and the date of approval. Prints of these drawings need not be furnished to the Bureau of Ships or its field representatives prior to delivery of the final drawings, unless specifically requested.

3.8.7.3 Prints of class B drawings shall be submitted for approval at the same time as submittal of the class A or class D drawings. If the class B drawing is submitted covering previously approved class A drawings, prints of the class A drawings shall accompany the class B drawings for information.

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3.8.7.4 Prints of class C drawings shall be submitted to the Bureau of Ships for approval.

3.8.7.5 Drawings of drivers and associated equipment shall be in accordance with the specifications covering those equipments as specified in the contract or order.

3.8.8 Final drawings shall be furnished in strict accordance with requirements of MIL-D-963.

3.9 Manuals. -

3.9.1 Unless otherwise specified in the contractor order, manuals shall be in accordance with type I of MIL-M- 15071. For class CO-1 pumps the manufacturer's commercial type manuals, or manuals prepared in accordance with his commercial practice, may be used whenever it is generally equivalent to the requirements of MIL-M-15071.

3.9.2 A separate manual shall be furnished for each different pump unit except in special cases when manuals covering more than one pump may be approved. Preliminary manuals submitted for approval shall include all proposed sections complete.

3.9.3 Illustrations.- The following illustrations shall be included in the manuals:

- (a) Two photographs, taken 180 degrees apart on a horizontal plane.
- (b) Reduced size reproductions of approved outline, assembly and sectional drawings of the complete unit.
- (c) Approved drawing excerpts of parts or assemblies requiring detailed instruction.
- (d) Master drawings covering the driver and control equipment.
- (e) Complete operation and maintenance instructions covering driver, control and accessories.

3.9.4 Distribution - Two copies of manuals shall be packed with each unit. Additional copies of manuals shall be furnished as specified (see 6.1). If final manuals are not available at the time pumps are shipped then two copies of preliminary manuals shall be packed with each unit; and the final manuals shall be delivered at a later time in accordance with MIL-M-15071.

3.10 Repair parts and special tools. -

3.10.1 Onboard repair parts. - Onboard repair parts shall be furnished and processed in accordance with MIL-P -15137. Each set of repair parts shall consist of those parts listed on the latest approved Allowance Parts List (APL) covering the particular equipment being furnished under the contract or order.

3.10.1.1 If no approved APL exists covering the particular equipment under contract or order then table III of 6.3 shall be used as the basis for the provisioning forms required by MIL-P-15137.

3.10.2 Special tools and wrenches. - Special tools are defined as those tools not listed in the Federal Supply Catalog. (Copies of this stock list may be consulted in the office of the Government Inspector.) Special tools shall be detailed, and included in the list of material.

3.10.2.1 One set of special operating tools and wrenches shall be furnished with each pump unit, and shall include all wrenches and tools required for the operation of the complete pump units. Each set of special operating tools and wrenches shall be furnished in separate boxes. If there are no more than two such tools per set they may be attached to the pumps in a secure but readily accessible manner, rather than boxed (see 3.6.16.2.2).

3.10.2.2 Each tool or wrench shall be indelibly marked indicating the intended purpose.

3.10.2.3 Tools which are available in the Federal Supply Catalog, such as common wrenches and standard pullers, will not be required. Standard, complete or limited sets of pullers, or parts of puller sets, in accordance with GGG-P -781 shall be identified as to type and use in notes on the outline or section assembly drawings.

3.10.2.4 Each box containing onboard repair parts and tools shall contain a list entitled "List of onboard repair parts and tools. " The list shall be in a format suitable for use on outline drawings and in the manuals. It shall not be less than nominal 8-1/2 by 11 inches in size.

- 3.10.2.4.1 The format of the list shall include a beading and columns of data for the items listed. The shall include titles and applicable entries as follows:

Reproduced from drawing number _____
 Number of ships _____
 Application _____
 Contract or order number. _____
 Manufacturer _____
 Quantities are for _____ units per ship
 The columns shall include:
 Piece number _____
 Name of part _____
 Quantity _____
 Drawing number _____
 Federal Stock Number _____
 Additional columns may be used as applicable

- 3.10.2.4.2 The list shall be so treated as to be resistant to oil, water and fading.

3.10.3 Stock. - The selection, stock numbering and quantities of repair parts for stock shall be determined and processed in accordance with MIL-P-15137.

3.10.3.1 Unless otherwise specified in the contract or order, the cognizant inventory control point for repair parts for stock shall be Ships Parts Control Center, Mechanicsburg, Pennsylvania.

3.10.4 Onboard and stock repair parts for the drivers and accessories shall be in accordance with the related equipment specifications.

3.10.5 Workmanship. - The equipment, including all parts and accessories, shall be manufactured and finished with first class workmanship in all respects.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification; where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality control system (for class O-1 pumps only). - The supplier shall provide and maintain a quality control system acceptable to the Government for the supplies covered by this specification. The system of quality control shall be in accordance with MIL-Q-9858 supplemented as specified in 4.2.1 through 4.2.3.1.

4.2.1 Description of procedures. - Procedures shall be assembled in manual form and shall indicate organization and responsibility for the control of quality.

4.2.2 Inspection during manufacture. - The contractor shall establish and maintain inspection at appropriately located points in the manufacturing process, beginning with the receipt of raw materials and subcontracted parts through final testing and preparation for shipment of completed units, to assure continuous control of quality of parts, components and assemblies.

4.2.3 The contractor shall provide and maintain gages, instruments and other measuring and testing equipment and devices necessary to assure that supplies conform to contract requirements. These devices shall be calibrated against measurement standards or designated measuring equipment at established periods to assure continued accuracy. The contractor shall prepare and maintain a written schedule for the maintenance and calibration of such equipment based on the type, purpose and degree of usage.

4.2.3.1 All instruments used in preproduction and performance tests shall be calibrated before and after tests.

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4.2.3.2 No instruments containing mercury shall be used in the manufacture or testing of any equipment destined for installation on a nuclear powered ship. This point shall be covered in the manufacturer's quality control manual. Test reports shall contain a certification, signed by a responsible official of the manufacturer that no mercury containing instruments have been used in the manufacture or testing of the equipment.

4.3 Inspection of material. -

4.3.1 Materials used in the pumps and accessories and identified on approved drawings by Federal and Military specifications listed in table II of 6.2, or elsewhere in this specification, shall be subjected to inspection requirements of the applicable specification by which identified.

4.3.2 Materials used in the pumps and accessories which are identified on approved drawings by Industry and Technical Society specifications or standards shall be subjected to inspection requirements of the applicable specification or standard by which identified.

4.3.3 The contractor shall establish a system of inspection and identification to insure that specified and approved materials are used in accordance with approved drawings.

4.3.3.1 Upon request of the Government inspector, the contractor shall furnish samples of materials and available information concerning their quality and use. When the identity or quality of an item is in doubt, and in the absence of valid and acceptable test data, the contractor shall conduct such tests as are necessary to determine or verify its identity or quality.

4.4 Classification of tests. -

- (a) Qualification tests (see 4.5).
 - (1) Performance tests (see 4.5.1).
 - (2) Life test (see 4.5.4.1).
- (b) Preproduction tests.
 - (1) Performance tests (see 4.7.1).
 - (2) Endurance test (see 4.6.3).
 - (3) Shock tests (see 4.7.2).
 - (4) Vibration tests (see 4.7.3).
 - (5) Noise tests (see 4.7.4).
 - (6) Inclined operation tests (see 4.7.5).
- (c) Production tests (see 4.7).
 - (1) Performance tests (see 4.7.1).
 - (2) Shock tests (see 4.7.2).
 - (3) Vibration tests (see 4.7.3).
 - (4) Noise tests (see 4.7.4).
 - (5) Inclined operation tests (see 4.7.5).
 - (6) Routine tests:
 - a. Hydrostatic tests (see 4.8.5).
 - b. Silver-brazed joint tests (see 4.8.6).

4.5 Qualification tests (not applicable to class CO-1 pumps) .- ¹ Qualification tests shall be conducted at a laboratory satisfactory to the Bureau of Ships. Qualification tests are required on each type of pump. Separate qualification tests are required on vertical and on horizontal units of each type of pump. Qualification tests shall consist of all the tests specified in 4.5.4.

4.5.1 The qualification tests shall be conducted to determine that performance and design of the pumps are in compliance with this specification. Minor deviations in materials may be allowed in the pumps at the discretion of the Bureau of Ships. The pressure, capacity, and other characteristics of units for qualification tests shall be as arranged between the Bureau of Ships and the exhibitor. The units shall have Characteristic ratings of not less than the following:

Rated capacity	200 g.p.m.
Discharge pressure	50 p.s.i.
Suction lift	10 inches mercury (Hg) at 500 SSU

¹Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.4 and 6.5).

4.5.2 Units submitted for qualification tests shall be operated at the maximum rubbing speed for which the unit is designed. Pumps delivered under contracts or orders, operating at a rubbing speed (see 3.6.17) greater than that of the design, type and size approved on the qualification tests, shall not be furnished without an additional life test (see 4.5.4.1). The life test specified in 4.5.4.1 is intended to demonstrate the reliability of the type.

4.5.3 Unless otherwise arranged between the Government and the exhibitor, the pump for the qualification test shall be complete with a prime mover and necessary accessories. The prime mover need not be made to Government specifications. Qualification of a pump does not include qualification of the driver.

4.5.4 The following tests, in the order listed shall be made to determine qualification:

- (a) Performance tests to demonstrate the ability of the pump to operate at the design characteristics (see 4.5.1). Sufficient data shall be taken during these tests to prepare pump characteristic curves as specified in 4.7.1.7, except that curves of capacity versus power input to the driving unit, as specified in 4.7.1.7(e), will not be required.
- (b) Additional operating runs under conditions to be selected by the Bureau of Ships to determine:
 - (1) Volumetric efficiency, (2) mechanical efficiency and (3) capacity, at varying speed.
- (c) Dismantle pump and measure all parts subject to wear and erosion.
- (d) Life test (see 4.5.4.1).
- (e) Dismantle pump to measure extent of wear and erosion and to note general condition of pump.
- (f) Duplicate runs under (a) and (b) to determine loss of volumetric efficiency, mechanical efficiency and capacity due to wear (see 4.5.4.2).

4.5.4.1 Life test. - The life test shall consist of a run of 50 hours' continuous duration using a mixture of 1 percent fuel oil and 99 percent fresh water, temperature about 100° F., at rated discharge pressure of the pump and with a suction lift of 5 inches Hg, at the maximum rated speed of pump under test (see 3.6.7.4.1.1).

4.5.4.2 A comparison of the mechanical and volumetric efficiencies and the capacity of the pump before and after the life test shall be made to determine loss in efficiencies and capacity due to the life test. If such a comparison shows a decrease in the mechanical efficiency of two percentage points, or less, and a decrease in pump capacity of 2 Percent or less, and if the wear on any parts does not indicate possibility of complete pump failure, the unit will be considered suitable for service provided all other requirements of this specification are complied with. If, however, during the test, complete failure occurs for any reason, the unit will be rejected.

4.6 Preproduction inspection.

4.6.1 Prior to beginning production, the first unit of each type and design, and when specified each size (see 4.7.1.3 and 4.7.2), to be supplied under a contract or order shall be subjected to preproduction tests of 4.6.2 (see 6.6), except as follows:

- (a) Preproduction tests are not required on class CO-1 pumps.
- (b) A successful preproduction test performed under one contractor order will not have to be repeated under a subsequent contract or order unless a deficiency in design or workmanship develops with a pump in service, or unless a modification in design or materials is considered by the bureau or agency concerned to be extensive enough to warrant retest (see 4.6.3.1.1).

4.6.1.1 Any production started prior to approval of the preproduction unit shall be at the contractor's risk.

4.6.2 The following tests shall be made in the order listed:

- (a) Performance tests as required by 4.7.1.
- (b) Dismantle pump and measure and record all parts subject to wear and erosion, including bearings.
- (c) Endurance test as required by 4.6.3.
- (d) Rerun performance tests as required by 4.7.1. Changes in pump performance shall be shown by recorded data and superimposed performance curves.
- (e) Dismantle pump to measure and record the extent of wear and erosion, and to note general condition of pump. Changes in appearance, or physical condition of parts, from the previous inspection shall be noted and described in the test report.

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4.6.2.1 If any serious wear, drop in performance, or other deficiencies are noted which would necessitate replacement of parts or overhaul of the pump in less than 9000 hours of operation, except for packing, those facts shall be immediately communicated to the Bureau of Ships, the procuring agency, and the Inspector of Naval Material. The pump shall be left unassembled pending a decision by the Bureau of Ships.

4.6.2.2 If no serious wear, drop in performance or other deficiencies are noted, those facts shall also be immediately communicated to the Bureau of Ships, the procuring agency, and the Inspector of Naval Material. The pump shall be cleaned up, worn parts shall be replaced, and the pump prepared for further tests as required by 4.7.2, 4.7.3 and 4.7.5, as applicable.

4.6.2.3 Within 30 days after successful completion of the preproduction tests required by 4.6.2, copies of a complete test report including performance curves and recorded data shall be distributed as follows:

- (a) Three to the Bureau of Ships (attention Code 649).
- (b) Two to the purchasing activity (if other than the Bureau of Ships).
- (c) One to the primary inspection office.
- (d) One to the branch inspection office, if any.

4.6.2.3.1 This test report need not include the tests required by 4.7.2, 4.7.3 or 4.7.5.

4.6.2.3.2 Approval of the test report by the bureau or agency concerned shall be obtained prior to delivery of any pump on the contract or order. A period of 30 days after receipt of the report, by the bureau or agency concerned, shall be allowed for approval.

4.6.3 Endurance test (not applicable to class CO-1 pumps). - The endurance test shall consist of a running test of not less than 500 hours of actual running time. The 500 hours of actual running time shall not be continuous, but shall be broken by at least 3 rest periods of not less than 8 hours each. A minimum of 100 start-stop cycles shall be performed during the course of the 500 hour test. The test shall be run using Navy symbol 2190TEP oil in accordance with MIL-L-17331, or oil with similar characteristics.

4.6.3.1 During the early part of the endurance test the pump shall be operated continuously for 24 hours at rated discharge pressure, maximum rated speed, with a suction lift of not less than 10 inches Hg and with the oil at approximately 60°F. (2500 SSU). During the last 24 hours of the test the pump shall be operated continuously at rated discharge pressure, maximum rated speed, with a suction lift of 10 inches Hg and with the oil at not less than 160° F. The remainder of the test shall be run at rated discharge pressure, maximum rated speed, with a suction lift of 10 inches Hg and with oil at a viscosity of approximately 130 SSU (with temperature held within plus 15°, minus 5°F. of the temperature required for 130 SSU viscosity).

4.6.3.1.1 If the manufacturer desires to establish the endurance test reliability under more severe conditions than required by the contract or order, that is, at higher rotating speed, in order to preclude the necessity for repeating the test under a later contract or order, this may be done if requested by the manufacturer and approved by the bureau or agency concerned. The request should give full details as to contract requirements and the desired test conditions. If such a test is approved, then the performance tests required by 4.6.2(a) and (b) shall be run under both the contract conditions and the more stringent conditions proposed by the contractor.

4.6.3.2 See 4.7.4.2 for noise tests which may be required to be run during the endurance test.

4.6.3.3 The performance test required by 4.6.2(d) shall be run immediately following the endurance test.

4.7 Production tests. - Production tests are applicable to class O-1 and CO-1, and all types of pumps under this specification, except as otherwise specifically noted, and shall include the tests covered by 4.7.1 to 4.8.6 inclusive.

4.7.1 Performance tests. -

4.7.1.1 Performance tests shall be conducted and reported in accordance with the Test Code of Standards of the Hydraulic Institute, Rotary Pump Section, for tests classed as "Factory tests at the pump manufacturers plant."

4.7.1.2 Driving units shall be tested as required by the applicable equipment specifications (see 6.1).

4.7.1.3 One pump of each size, class and type on contract or order shall be tested as required by 4.7.1.4 4.7.1.9, inclusive. The tests may be included in the preproduction tests. If identical pump units are in several orders simultaneously, the performance tests of one pump will be accepted as applicable to all the simultaneous contracts or orders.

4.7.1.4 The complete pump unit, including the turbine and reduction gear, if used, or the motor and controller shall be given a test to determine the overall power or steam consumption of the unit under the specified or guaranteed conditions. The bureau or agency concerned may consider waiver of overall power or steam consumption tests if identical units with identical guarantees have been previously tested. Test report of unit previously tested shall be submitted with request for waiver.

4.7.1.5 For turbine driven pumps, the functioning of the speed governors shall be carefully observed during these tests, and all adjustments that may be necessary to insure satisfactory operation at all normal operating speeds shall be made before the units are accepted. The governors shall function as specified in the turbine specifications (see 6.1). When pressure regulating governors are specified, the foregoing requirements shall apply to this equipment also, and compliance with the governor specifications shall be demonstrated.

4.7.1.6 Performance tests shall adequately demonstrate the ability of the pump to handle its rated capacity of specified liquid over the specified range of viscosities and at specified discharge pressure and at maximum suction lift or vacuum, as applicable.

4.7.1.7 Sufficient data shall be taken during the tests of 4.7.1.2 and 4.7.1.3 to prepare pump characteristic curves as specified below. The curves shall be corrected in all cases to the steam or the electric power operating conditions specified in the contract or order. Complete operating characteristics of the pump and its driver, as specified in the contract or order, as well as the operating characteristics of the unit during the particular test run, shall be shown on each curve sheet. The capacity shall be expressed in g.p.m., the discharge pressure in pounds per square inch gage (p.s. i.g.), the suction lift in inches of Hg, the viscosity in SSU (unless otherwise specified in the contract or order), and the speed in r.p.m. Curves shall be furnished as follows:

- (a) At least two curves of capacity versus pump speed at constant specified discharge pressure and at constant specified maximum suction lift when handling specified lubricating oil as follows:
 - (1) One curve at maximum specified viscosity.
 - (2) One curve at minimum specified viscosity.
 - (3) One curve at each intermediate viscosity that maybe specified in the contract or order.
- (b) A curve of capacity versus pump mechanical efficiency for each of the curves obtained under item (a).
- (c) A curve of capacity versus volumetric efficiency for each of the curves obtained under item (a).
- (d) A curve of capacity versus hp. input to the pump for each of the curves obtained under item (a).
- (e) A curve of capacity versus power input to the driving unit, expressed in pounds of steam per hour or electrical hp. as applicable, for each of the curves obtained under item (a).
- (f) One curve of capacity versus suction lift at specified maximum discharge pressure and at rated speed for each of the viscosity values specified in item (a).

4.7.1.7.1 An exception to 4.7.1.7 will be permitted in the case of pumps driven by single speed alternating current motors in which case the pump may be run at constant speed and a curve of capacity versus pump discharge pressure submitted in lieu of the curves required under item (a) of 4.7.1.7. The curves of efficiency and power shall be plotted versus discharge pressure in lieu of versus capacity as required under items (b), (c), (d) and (e) of 4.7.1.7.

4.7.1.8 In order to simplify the foregoing test procedure, the Bureau of Ships when requested, may authorize separate tests of the driving unit (including reduction gear, if any), and the pump at the works of different manufacturers, and will accept overall power or steam-consumption results and characteristic curves computed from the results thereof. This shall not be construed in any way to release the primary contractor from an operating run on one completely assembled unit from each contractor order for identical units. This operating test shall be run with the unit fully loaded, and shall demonstrate compliance with all requirements of this specification as to operation of pump pressure regulating governors, turbine governors, thrust, balance, and lubrication at maximum rated speed.

4.7.1.9 The capacity of the pump (selected as specified in 4.7.1.3) may be determined by any convenient method that will insure obtaining results with probable errors not greater than 2 percent. All gages shall be

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calibrated before and after the tests or oftener, if necessary. The specified viscosities shall be maintain within 5 percent regardless of temperatures.

4.7.2 Shock tests (not applicable to class CO-1 pumps~.-

4.7.2.1 Unless otherwise specified in the contract or order one complete pumping unit of each type, design and size shall be subjected to the high impact shock tests specified in MIL-S-901 for type A shockproofness, grade A, class III equipment, except as otherwise required herein.

4.7.2.2 When the shock tests are on a medium-weight shock machine six blows shall be applied as described in MIL-S-901, with the mounting platform in a horizontal position and the blows applied under the approximate center of gravity of the assembled pump unit. The pump shall be tested running and at standstill on alternate blows. In addition to the six blows required above, two additional blows shall be applied with the pump inclined at 30 degrees from the vertical and the blows applied under the approximate center of gravity. The pumps shall be mounted in such a way that the horizontal component of shock is transmitted across the axis in which the equipment is weakest. The blows shall correspond to groups II and III in table I of MIL-S-901 and the pumps shall be running during both blows. Pumps need not be running at rated speed during shock tests.

4.7.2.3 Equipment exactly duplicating that previously shock tested as required by 4.7.2.1 and 4.7.2.2, and accepted, under one contract or order will not have to be retested under a subsequent contract or order except when evidence of low shock resistance develops in installed units. The bureau or agency concerned will initiate action with the manufacturer for correction of deficiencies, and reserves the right to require additional shock tests.

4.7.2.4 Pump units shall be shock tested with drivers unless otherwise approved by the bureau or agency concerned. Flexible-coupled pumps shock tested with one driver will not be required to be shock tested again when supplied with a different driver of equal or lesser weight, subject to approval of the bureau or agency concerned. Prime movers are subject to shock tests in accordance with the applicable equipment specifications, except that, if tested on the medium-weight shock machine at least 2 blows shall be with the equipment mounted on the inclined fixture in accordance with MIL-S-901.

4.7.2.5 A pump unit shall be considered to have failed to pass the shock tests in the event of any of the following:

- (a) Breakage of any parts, including mounting bolts.
- (b) Distortion or dislocation of any part, such as shaft, mounting feet and bearings.
- (c) A mechanical unbalance of more than two times the amplitude of unbalance measured prior to tests at rated speed, or more than that permitted by the specifications for the driver. The amplitude of unbalance both before and after the shock tests, and the speed at which measured shall be recorded in the shock test report.

4.7.2.6 Where a manufacturer is unable to conduct these tests at his own plant, he may arrange to have them conducted at a commercial laboratory, or Government laboratory suitably equipped to conduct tests. Where shock tests are conducted at a Government laboratory, copies of the applicable approved drawings shall accompany the units.

4.7.2.7 Pump units which have been subjected to the high-impact shock test and have successfully passed this test shall be reconditioned by the manufacturer as follows:

- (a) Minor deformations affecting alignment shall be corrected.
- (b) All bearings shall be replaced.
- (c) Each part shall be carefully examined by the manufacturer and any part which he considers sub-standard shall be replaced.

Minor deformations shall be defined as those which do not cause unqualified rejection of the design under high-impact shock test but which are in excess of the design dimensional tolerances specified on the applicable pump drawings.

4.7.3 Vibration tests (not applicable to class CO-1 pumps) .- When specified (see 6.1) one complete pump unit shall be vibration tested in accordance with MIL-STD-167.

4.7.4 Noise tests (not applicable to class CO-I pumps) .-

4.7.4.1 When pumps are required by the contract or order to be sound isolated, airborne, structureborne and fluidborne (pressure pulsations), noise tests shall be conducted following the performance tests (see 4.7.1). Testing for airborne and structureborne noise and reporting of noise tests shall be in accordance with MIL-STD-740. Details of the pump noise test stand, instrumentation and test measurements shall be as mutually agreed upon between the pump manufacturer and the bureau or agency concerned.

4.7.4.2 During the preproduction tests (see 4.6) of pumps required by the contractor order to be sound isolated, a series of two noise tests shall be conducted as follows:

- (a) During the first 8 hours of the endurance test (see 4.6.3).
- (b) During the final hours of the endurance test.

The pump shall be running at maximum specified liquid temperature, minimum specified viscosity, specified capacity and discharge pressure, and the minimum specified suction head or maximum suction Lift, as applicable.

4.7.5 Inclined operation tests (applicable to class CO and CO-1 pumps) .- Inclined operation tests shall be conducted as specified for the driving unit, or as otherwise required by the contract or order. For these tests the unit shall be run at maximum operating speed, but need not be fully loaded. These tests may be included in the performance tests.

4.8 Routine tests. - Routine tests are applicable to every pump on the contract or order, except as otherwise specifically noted.

4.8.1 Each pump shall be tested in order to determine the ability to deliver the rated capacity of specified liquid at the minimum specified viscosity against rated discharge pressure and with the suction lift specified for the minimum viscosity. Pump delivery in excess of 10 percent of rated capacity under normal operating conditions is considered unsatisfactory. This test is to be of sufficient duration to indicate, to the representative of the bureau or agency concerned, that the specified characteristics have been met.

4.8.2 The tests specified in 4.8.1 and 4.8.3 may be conducted without the contract driving units, provided the contract driving units, including reduction gears, if used, have been independently tested as specified in 4.7.1.2.

4.8.3 All pumps shall be tested at rated speed for a continuous nonstop run of at least 30 minutes. While running at this speed the pump need not handle bad as this test is to insure proper alignment and balance.

4.8.4 All rotors, shafts and timing gears shall be tested for smoothness of running at all speeds including maximum rated speed.

4.8.5 Hydrostatic tests. -

4.8.5.1 Each pump casing shall be tested hydrostatically to a pressure of two times the maximum rated discharge pressure, but in no case to less than 150 pounds p.s.i.g. A light grade of mineral oil, not exceeding 200 SSU, maybe used for hydrostatic tests.

4.8.5.2 Hydrostatic test pressures shall be maintained for at least 15 minutes, or longer as necessary, for inspection of the entire casing.

4.8.6 Silver-brazed joints (not applicable to class CO-1 pumps) .- Inspection and test of joints in all systems designated as hazardous in manual NAVSHIPS 250-648-8 shall be in accordance with the requirements of that manual.

4.9 Test reports. -

4.9.1 Test reports shall be prepared for all tests conducted by the contractor including the shock and inclination tests. Recorded data of the performance tests may be logged on contractor's forms. The following identification data for each pump unit shall be furnished and included in the test report:

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- (a) Serial numbers of the pump and driving unit.
- (b) Ship for which intended.
- (c) Contract or order number.
- (d) Actual net weight of the unit in the "dry" and "wet" condition.

4.9.2 Distribution of performance test reports shall be as follows:

- (a) Two to the Bureau of Ships.
- (b) Two to each supervisor of shipbuilding for each ship's worth of pumps furnished (one for supervisor's files; one for shipbuilder) for privately built ships.
- (c) Two to each Naval shipyard for each ship's worth of pumps for Navy built ships.
- (d) One for primary inspection officer.
- (e) One for branch inspection office (if any).

4.9.3 Distribution of shock test reports and inclination test reports shall be as follows:

- (a) Six to the bureau or agency concerned, for approval.
- (b) One for the primary inspection office.
- (c) One for the branch inspection office (if any).

4.9.4 For reporting of preproduction tests see 4.6.2.1, 4.6.2.2 and 4.6.2.3.2.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early equipment installation and for storage of onboard repair parts. -5.1.1 Assembled pump units. -

5.1.1.1 Preservation and packaging. - Preservation and packaging shall be sufficient to afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the using activity and until early installation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.2 Packing. - Packing shall be accomplished in a manner which will insure acceptance by common carrier, at the lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.3 Marking. - Shipment marking information shall be provided on interior packages and exterior shipping containers in accordance with the contractor's commercial practice. The information shall include nomenclature, Federal stock number or manufacturer's part number, contract or order number, contractor's name and destination.

5.1.2 Onboard repair parts and tools. -

5.1.2.1 Surface ships. - Onboard repair parts and tools for surface ships (see 3.10) shall be preserved and packaged level A; packed level A, B or C, as specified (see 6.1), in accordance with MIL-P-16789.

5.1.2.2 Submarines. - Onboard repair parts and tools for submarines shall be preserved, packaged and packed as specified in 5.1.2.1, except that level A preservation and packaging methods shall be modified, wherever applicable, in accordance with MIL-STD-758 for items that can be stored in bins or drawers.

5.1.2.3 Onboard repair parts and tools for drivers and other accessories shall be preserved, packaged and packed in accordance with the applicable commodity specification.

5.2 Domestic shipment and storage or overseas shipment. - The requirements, and levels of preservation, packaging, packing and marking for shipment shall be specified by the procuring activity (see 6.1).

(5.2.1 The following provides various levels for protection during domestic shipment and storage or overseas shipment, which may be required when procurement is made.

5.2.1.1 Preservation, packaging, packing and marking.- The requirements and levels of preservation, kaging, packing and marking for shipment shall be in accordance with MIL-P-16789 as specified by the curement activity.)

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following:

- (a) Title, number and date of this specification,
- (b) Type and class required (see 1.2).
- (c) Pump characteristics (see 3.5):
 - (1) Discharge pressure.
 - (2) Rated capacity.
 - (3) Suction lift.
 - (4) Characteristics of liquid:
 - a. Viscosities,
 - b. Liquid temperatures.
 - (5) Type and characteristics of pump drivers (see 3.6.15.1):
 - a. Whether pumps are to be direct., geared or chained connected to driving unit (see 3.6.15.2).
 - b. Turbine or motor driven.
 - c. Turbine characteristics (for turbine drive), and applicable turbine and governor specifications:
 - 1. Steam conditions (pressure and temperature) at the throttle and the maximum designed boiler steam drum pressure of the installation for which the turbine is intended,
 - 2. Exhaust conditions (pressure or vacuum) at turbine exhaust,
 - d. Electrical characteristics (for motor drive) and applicable motor and controller specifications (see 3.6.15.4):
 - 1. Voltage, phase characteristics and frequency.
 - 2. Service class,
 - 3. Ambient temperature,
 - 4. Duty.
 - 5. Enclosure.
 - 6. Winding (d.c.) or design of motors (a.c.).
 - 7. Bearings.
 - 8. Insulation.
- (d) Airborne noise, structureborne vibration and pump discharge pulsation requirements (see 3.6.2).
- (e) Whether manufacturer is to furnish means for supporting pumps on isolation mounts (see 3.6.2.1).
- (f) Installation:
 - (1) Horizontal or vertical mounting (see 3.6.6.1).
 - (2) If vertical units are to be base or table mounted (see 3.6.6.3).
 - (3) Size of the inlet and outlet connections, or a statement that these shall be as approved by the bureau or agency concerned.
 - (4) Limits of length, width, and height for disassembly of unit for normal maintenance overhaul, if limits are required for particular installation.
 - (5) A statement as to the location of inlet and outlet connections.
 - (6) Bid plan for units driven either by a chain drive off the ship's main propeller shaft or by a power take-off from the ship's main reduction gear (see 3.6.16.1 and 3.6.16.2).
- (g) A complete list of all items of equipment, not essentially parts of the pump, which the pump contractor is required to furnish. Usual mention should be made in such a list of repair parts and tools. The following items should be considered also if it is required to have the pump manufacturer or contractor supply them:
 - (1) Relief valves or relief by-pass valve.
 - (2) Drain valves.
 - (3) Suction and discharge valves.
 - (4) Pressure, vacuum or combined gages.
 - (5) Thermometers and thermometer sockets.
 - (6) Air or vent valves and cocks.
 - (7) Motor controllers.
 - (8) Technical publications required.

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- (h) Whether additional copies of manual are required (see 3.9.4).
- (i) Whether mechanical seals are required for other than nuclear powered ships (see 3.6.14.7).
- (j) Whether vibration tests are required (see 4.7.3).
- (k) Preservation, packaging and packing for onboard repair parts and tools (see 5.1.2).
- (l) Preservation, packaging, packing and marking requirements other than those required by 5.1 (see 5.2).

6.2 Materials for class O.1 pumps maybe in accordance with table II, as applicable,

Table II - Materials for class O-1 pumps.

Application	Material	Applicable document
Casing and heads	Cast steel or Gun metal or Nodular iron	MIL-S-15083, grade B or ASTM A27-62, grade 60-30 MIL-M-16576 or ASTM B143-61, alloy 1B MIL-I-17166 or ¹ ASTM A339-55, grade 60-45-10
Shafts	Forged steel or Nitrided steel or Nickel-copper-aluminum alloy or Nickel-copper-alloy, rolled	MIL-S-890, alloy No. 2 or ASTM A237-62T MIL-S-869, class A or B, or ASTM A355-57T, grade A or B QQ-N-286 (K-monel) QQ-N-281, class A or B or ASTM B164-61, class A
Rotors	Forged steel or Nitrided steel or Iron, gray, high test or Nodular iron or Gun metal or Copper-silicon alloy	MIL-S-890, alloy No. 2 or ASTM A237-62T MIL-S-869, class A or B or ASTM A355-57T, grade A or B QQ-I-652 or ¹ ASTM A48-62 MIL-I-17166 or ¹ ASTM A339-55, grade 60-45-10 MIL-M-16576 or ASTM B143-61, alloy 1B QQ-C-591 or ASTM B98-58
Sleeve bearings	Bearing bronze or Phosphor bronze	MIL-B-16261, grade II or ASTM B144-52, alloy 3A MIL-B-16540, grade A or ASTM B143-61, alloy 2B
Rigid couplings	Forged steel	MIL-S-890, alloy No. 2 or ASTM A237-62T
Rotor housings or cylinder liners	Bearing bronze or Iron, gray, high test or Nodular iron	MIL-B-16261, grade II or ASTM B144-52, alloy 3A QQ-I-652 or ¹ ASTM A48-62 MIL-I-17166 or ¹ ASTM A339-55, grade 60-45-10
Timing gears	Forged steel or Nitrided steel	MIL-S-890, alloy No. 2 or ASTM A237-62T MIL-S-869, class A or B or ASTM A355-57T, grade A or B

¹Composition should be by agreement between the contractor and the bureau or agency concerned.

Table II - Materials for class 0-1 pumps (cent'd).

Application	Material	Applicable document
Casing side wearing plates	Chromium cobalt placed, 33 Rockwell "C" hardness (minimum) or Nitrided steel	Haynes alloy No. 93 or equal MIL-S-869 or ASTM A355-57T, grade A or B
Stuffing box glands	Bronze, valve, castings or Bearing bronze or Gun metal	MIL-B-16541 or ASTM B143-61, alloy 2A MIL-B-16261, grade I or ASTM B144-52, alloy 3A MIL-M-16576 or ASTM B143-61, alloy 1B
Piston slide pins	Iron, gray, high test or Nodular iron	QQ-I-652 or ¹ ASTM A48-62 MIL-I-17166 or ¹ ASTM A339-55, grade 60-45-10
Bolts, studs and nuts, hexagon head	Steel	MIL-B-857 or ASA B18.2-60
Cap screws, socket head	Steel	FF-S-86 or ASA B18.3-61
Cap screws, hexagon and slotted head	Steel	FF-S-85 or ASA B18.6.2-56
Machine screws, slotted or cross recessed	Steel	FF-S-92 or ASA B18.6.3-62

¹Composition should be by agreement between the contractor and the bureau or agency concerned,

6.3 Recommended onboard repair parts (see 3.10.1.1) are specified in table III.

Table III - Recommended onboard repair parts.

Item	Name of part	Quantity per set
(a) (b) (c) (d) (e)	Ball or roller bearings Oil seals Packing, if special, and packing spacers Coupling bushings, pins, springs, and other wearing parts Mechanical shaft seals	100 percent complete replacement for all installed units per vessel
(f) (g)	Sleeve bearings Cams, slides, slide pins, liners, and similar wearing parts	One to four units per vessel, 100 percent replacement for one pump Over four units per vessel, 100 percent replacement for two pumps
(h) (i)	Timing gears, reduction gears and pinions, driven sprocket and chain Complete rotating element including bear- ings and complete coupling	100 percent replacement for one pump

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Notes to table III:

- (1) Casings when supplied, shall be in accordance with item (g) of table III for pumps not equipped with housings or liners (see 3,6,10.2).
- (2) Pump rotor, item (i) of table III, shall be completely assembled ready for installation in the pump for which intended. This shall be interpreted to include any nonrotating part which can be installed only by removing some rotating part or parts of the pump rotor.
- (3) The quantities of onboard repair parts listed in table III, for items (a) to (i) inclusive, shall not be reduced by reason of the same part being furnished with complete rotor, item (i).
- (4) Repair parts such as those for turbines, reduction gears, motors, and controllers, and pump pressure regulating governors shall be furnished in accordance with the applicable component specifications.

6.4 With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List QPL18547, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Bureau of Ships, Department of the Navy, Washington 25, D. C., and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.5).

6.5 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania.

6.6 Preproduction. -

6.6.1 Invitations for bids should provide that the Government reserves the right to waive the requirement for preproduction samples as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

Preparing activity:
Navy - Ships
(Project 4320-N080Sh)

SPECIFICATION ANALYSIS SHEET
NAVSHIPS-4863 (8-61)
INSTRUCTIONS

BUDGET BU. NO. 45-R309

This sheet is to be filled out by personnel either Government or contractor, involved in the use of specification in procurement of products for immediate use by the Bureau of Ships

This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured

with a minimum amount of delay and at the least cost.

Comments and the return of this form will be appreciated.

Fold on dotted lines on reverse side, staple in corner, and send to Bureau of Ships, Specifications and Standardization Branch, Washington 25, D.C.

SPECIFICATION

ORGANIZATION

CITY

STATE

CONTRACT NO

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A DIRECT GOVERNMENT CONTRACT

OR A SUBCONTRACT

1 HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

a. GIVE PARAGRAPH NUMBER AND WORDING

b. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2 COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3 IS THE SPECIFICATION RESTRICTIVE?

IF THE ANSWER IS "YES", IN WHAT WAY?

YES

NO

4 REMARKS (Attach any pertinent data which may be of use in improving this specification.) PLACE THIS FORM AND PAPERS IN AN ENVELOPE AND SEND TO THE BUREAU.

SUBMITTED BY (Print name and activity)

DATE

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