

MIL-T-17600D(SHIPS)  
AMENDMENT 4  
3 November 1982  
SUPERSEDING  
AMENDMENT 3  
1 May 1979

MILITARY SPECIFICATION  
TURBINES, STEAM, PROPULSION  
NAVAL SHIPBOARD

This amendment forms a part of Military Specification MIL-T-17600D(SHIPS), dated 18 March 1968 and is approved for use by the Naval Sea Systems Command, Department of the Navy and is available for use by all Departments and Agencies of the Department of Defense.

PAGE 1

2.1, under "SPECIFICATIONS, FEDERAL": Delete reference to "QQ-S-624", "QQ-S-634", and "QQ-S-635", and add the following:

"QQ-C-390 - Copper Alloy Castings (Including Cast Bar).  
TT-P-28 - Paint, Aluminum, Heat Resisting (1200°F)."

PAGES 1 and 2

\* 2.1, under "SPECIFICATIONS, MILITARY": Delete reference to "JAN-W-562", "MIL-S-890", "MIL-P-15137", "MIL-L-15719", "MIL-T-22051", and "MIL-S-24093", and add the following:

"MIL-G-2860 - Glasses, Sight-flow, Clear, Borosilicate.  
MIL-T-15377 - Temperature Monitor System, Naval Shipboard.  
MIL-M-17060 - Motors, 60-Hertz, Alternating Current,  
Integral-Horsepower, Shipboard Use.  
MIL-M-17413 - Motor, Direct Current, Integral Horsepower,  
Naval Shipboard.  
MIL-P-18547 - Pumps, Rotary, Power Driven, Naval Shipboard  
Main Lubricating Oil Service.  
MIL-V-22682 - Valves, Astern (For Shipboard Use).  
DOD-G-24508 - Grease, High Performance, Multi-Purpose  
(Metric)."

PAGE 2

2.1, under "STANDARDS, MILITARY": Add:

"MIL-STD-1552 - Provisioning Technical Documentation,  
Uniform DOD Requirements for."

2.1, under "PUBLICATIONS": Delete reference to "NAVSHIPS 250-644-2" and add "NAVSHIPS 283-228-1000 - Bearing Babbitting Procedures."

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PAGE 3

2.2, under "AMERICAN SOCIETY FOR TESTING AND MATERIALS": Add the following:

- "A 322 - Hot-Rolled Alloy Steel Bars.
- A 331 - Steel Bars, Alloy, Cold-Finished.
- A 537 - Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel.
- A 565 - Martensitic Stainless Steel Bars, Forgings, and Forging Stock for High-Temperature Service.
- A 575 - Merchant Quality Hot-Rolled Carbon Steel Bars.
- A 576 - Steel Bars, Carbon, Hot-Rolled Special Quality.
- A 663 - Merchant Quality Hot-Rolled Carbon Steel Bars Subject to Mechanical Property Requirements.
- A 675 - Steel Bars and Bar Size Shapes, Carbon, Hot-Rolled, Special Quality, Subject to Mechanical Property Requirements."

2.2, under "UNITED STATES OF AMERICA STANDARDS INSTITUTE": Delete reference to "B1.2".

\* 2.2: Add:

"SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)  
AMS 5698 - Alloy Wire, Corrosion and Heat Resistant 72 Ni - 15.5  
Cr - 0.95 (Cb + Ta) - 2.5 Ti - 0.70 Al - 7.0 Fe No. 1  
Temper.

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)"

"AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
B16.5 - Steel Pipe Flanges and Flanged Fittings.

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)"

PAGE 5

\* 3.2.2.1: Add as item (aa):

"(aa) Astern valve (submarine) and control mechanism at turbine  
(see 3.10.3.2)."

\* 3.2.2.2(b): After "system", add "(surface ship)".

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\* 3.3.1: Add: "NAVSEA approval shall be obtained if the proposed design requires planned maintenance actions different from figure 1. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance and strength."

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3.4: Add: "Cadmium plating is not permitted on those parts which, during normal operation, are exposed to oil."

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\* 3.4.1 and 3.4.1.1: Delete and substitute:

"3.4.1 Special requirements for saturated steam applications. Where turbines are to be used with saturated steam at inlet to turbines, 12 chrome materials shall be used for the following items, in high pressure and single casing turbines:

- (a) Casings. (Seal weld area of valve seat bore shall have inlay of nickel-chromium-iron alloy of sufficient thickness to prevent the occurrence of a heat affected zone in the 12 chrome base material when making the valve seat to casing weld.)
- (b) Valve chest cover.
- (c) Nozzle blocks.
- (d) Steam shields.
- (e) Diaphragms.
- (f) Packing boxes or casing when separate from casing.

The material for the high pressure turbine or single casing turbine low pressure hood (exhaust end wall), low pressure turbine inner and outer casings, low pressure turbine packing boxes and packing casings, low pressure turbine diaphragms, and astern steam rings shall be 12 chrome material or carbon-manganese steel in accordance with MIL-S-15083 class 65-35, or MIL-S-22698 EH-365 and DH-36, or ASTM A 537 class 2 with stainless steel inlays on all steam seal surfaces except astern steam ring. Corrosion/erosion resistant material shall be used for HP packing re-entry connections and associated piping and for external drain piping and valves located in this piping (i.e., steam chest, first stage shell, jumper pipes, packing re-entry). Steam supply and piping connections to the lower half of the turbine casing shall be welded connections. Rotors shall be MIL-S-860, grade G, unless otherwise specifically approved by NAVSEA. The use of 12 chrome journals with babbitted bearings is not acceptable; therefore, journals of 12 chrome rotors shall be either chrome plated, sleeved or otherwise protected by a means approved by NAVSEA. Steam chest control valves of bar lift design shall have button heads attached to stem by screw threads (see 3.11.7.5.2). The following associated components shall be fabricated from corrosion/erosion resistant material, or otherwise suitably protected by stainless steel cladding. Drains from these components shall be fabricated from corrosion/erosion resistant material.

- (a) Steam strainer body.
- (b) Astern valve body.

Internal threaded fasteners, pins, dowels, keys, etc., used in turbines and associated components shall be made from corrosion/erosion resistant material. Grounding devices to prevent electrostatic potential build-up between the turbine rotor and casing shall be installed on turbines for self-mounted applications. Lead or lead containing lubricants shall not be used on assembly of parts in steam path."

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3.4.2.1.1: Add: "Any materials used by the manufacturer for a particular application shall be shown on this list. When a manufacturer's material on this list is no longer to be used, the material comparison sheet for that material shall be revised to so indicate, and the comparison sheet shall be resubmitted to NAVSEA for information. The discontinued material shall continue to be shown on the preferred materials list for tie-in with detail drawings which will still reference this material."

PAGE 9

3.5.4: Add as second sentence: "Single ended or solid type couplings are permitted."

3.5.4: Add: "Bolting will be furnished by the gear manufacturer."

3.5.6: Add: "The astern element casing horizontal joint shall be metal to metal (no gaskets permitted)."

PAGE 10

3.7.1, third sentence: Delete and substitute: "Thermometer wells shall be furnished with the turbine and shall be in accordance with Drawing 810-1385917, except that wells for by-pass stages shall be of the flanged type in accordance with figure 4."

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\* 3.8.7: Delete and substitute:

"3.8.7 Sight flows. An oil sight flow shall be provided for each journal bearing and each thrust bearing. Sight-flows shall provide visual indication of discharge oil during standby, and all ahead and astern speeds. Sight flow fittings shall not be located in pressurized oil supply piping. Sight flows shall never run flooded. Bolted-on-fittings shall be bronze or steel. Windows shall be shock-resistant glass in accordance with MIL-G-2860, type I, flat (1/4 inch minimum thickness) or type II cylindrical (5/32-inch minimum thickness). Provisions for thermometers shall be in accordance with 3.7.2."

3.8.9, line 2: Delete "under any operating condition" and substitute "under any specified operating condition".

3.8.9: Add: "Oil feed to sight flow shall not come directly from bearing inlet for the purpose of reducing indicated oil temperature."

3.8.10, second sentence: Add "but not to exceed the above maximum settings."

3.8.11, line 3: Delete "MIL-L-15719" and substitute "DOD-G-24508".

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\* Add as paragraph 3.8.12:

"3.8.12 Lube oil leaks. Lube oil to atmosphere interfaces, such as the bearing brackets and control components, shall be designed to prevent leakage."

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3.9.1: Add: "Supply valves for saturated applications which are subjected to main steam pressures shall be hard-faced with chrome-cobalt material."

\* 3.10.2, first sentence: Delete and substitute: "Power-assist system may utilize hydraulic, pneumatic, electrical or combination thereof (i.e., electrohydraulic) means to reduce operator effort, except that pneumatic control is not permitted in submarines. Where a hydraulic system is used, oil pump switching transients which result in reduced steam flow (less than 20 percent of full steam flow) are acceptable."

\* 3.10.3.2: Delete and substitute:

"3.10.3.2 Astern control. Astern control shall be provided as follows:

(a) For submarines. Astern valve shall be furnished by the turbine vendor. Astern valve and associated control system shall meet shock requirements specified in 3.13, material requirements shall be as specified in 3.4.1 and figure 2, and quality assurance provisions specified in section 4. Valve shall be in accordance with MIL-V-22682, except as modified herein, and as specified in 6.2.2. The valve disc assembly shall be top guided and bottom guided, if deemed necessary. Steam joint surfaces shall be protected against steam cutting with corrosion/erosion resistant material. The turbine manufacturer shall supply astern steam piping from the main steam strainer to the astern valve. Provision (downstream of the valve seat) shall be made for a shipbuilder furnished pressure gage. The astern valve shall have provision for connection to a shipbuilder furnished handwheel and reach rod system, and shall also be designed to be shut down by turbine overspeeding. Required parts for the speed-limiting device and associated hydraulic sensing for actuating system shall be supplied by the turbine manufacturer.

(1) Flanges shall be 600 lb flanges in accordance with ANSI B16.5.

(2) Drain sizes shall be as determined by the contractor and concurred in by the contracting activity.

(b) For surface ships. Astern valve, handwheel, and connecting system will be furnished by the shipbuilder."

3.10.4, second sentence: Delete and substitute: "Handwheel and turbine lead screw rotation, when viewed from the operator's position in front of the handwheel or the input end of the lead screw, shall be such that valves close with clockwise motion when facing the handwheel."

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\* 3.10.5: Delete and substitute:

"3.10.5 Handwheels."

\* 3.10.5.1: Delete and substitute:

"3.10.5.1 Size. Handwheels are furnished by the shipbuilder and are normally 24 inches in diameter for ahead and 18 inches in diameter for astern."

\* 3.10.5.2(a), line 2: Delete: "(tangential pull of 20 pounds at wheel rim)".

\* 3.10.5.2(b), line 2: Delete: "(tangential pull of 40 pounds at wheel rim)".

Add as paragraph 3.10.5.4:

"3.10.5.4 Valve position indicator. A valve position indicator shall be provided on the nozzle control valve linkage and shall indicate closed over-travel, closed and full-open, and shall be located as approved by the procuring activity."

3.10.6.5: Add: "Cams and levers which do not transmit torque can be locked with set screws."

3.10.7: Add as second sentence: "A speed-limiting device shall be provided for submarine turbines which do not drive through clutches, for surface ship turbines for which the primary turbine control station is remote from the engine room, and for turbines driving controllable-pitch propellers."

\* 3.10.7.1: Add: "In the event the turbine requires control oil pressure greater than that furnished by the shipbuilder, the turbine vendor shall provide two booster pumps for each propulsion unit, one as an installed backup, to raise oil pressure. Pumps shall be in accordance with MIL-P-18547, type III, class O-1. For submarines one pump shall be driven by a motor in accordance with MIL-M-17060, and the second pump shall be driven by a motor in accordance with MIL-M-17413."

PAGE 14

3.10.7.3, item (c): Add: "without major disassembly of bearing housings. Access ports with cover plates will be permitted."

\* 3.10.7.5: Delete and substitute:

"3.10.7.5 Override feature. Where either overspeed protection or power assist is furnished, the design shall provide for operation of ahead and astern valves upon loss of control oil or component failures in the power-assist or overspeed system. If control oil pressure is lost, the valve gear shall not be automatically reactivated on restoration of oil

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pressure so as to cause uncontrolled reopening of the turbine control valves. The throttle control system shall be designed such that the throttle control handwheel must be returned to the shut position (power assist) following a loss of control oil before the throttle can be reopened with power assist. Inadvertent overtravel into the manual operation band with control oil on shall not result in shutting of control valves. The control system override feature shall be approved by NAVSEA. For submarine turbines, override capability shall be possible without requiring any action by the throttlerman other than further opening of the handwheel. For surface ships, local manual control or other means to restore operational capability is acceptable. In override condition, the torque required to operate ahead or astern handwheels shall not exceed 50 pound-feet and number of turns from normal full closed to full open in override shall not exceed 50. The 50 pound-feet torque and 50 turn requirement also applies to local manual control station on ships with control from the "Bridge". (Breakdown of 50 pound-feet torque for either manual override or local manual control is 40 pound-feet for turbine system and 10 pound-feet for shipbuilder furnished system.)"

3.10.9: Add: "Torque required to operate low pressure turbine steam control valves during singled-up operation shall not exceed 50 pound-feet, and the number of turns from full-closed to full-open shall not exceed 50."

PAGE 15

3.11.1: Add: "Recording and determining life of gaskets used in oil systems in turbines will not be required unless the hydraulic fluid

enclosed is at a pressure of 100 lb/in<sup>2</sup> and above, and the material in the gasket is of rubber or synthetic rubber with a definite shelf life. Taper pipe threaded connections between piping, machinery and valves and in piping system joints are not permitted, except in the following areas:

- (a) Pipe plugs, of a material compatible with the parent equipment, in sizes 3/4 inch and below used for applications where pressures do not exceed 50 lb/in<sup>2</sup>.
- (b) Instrumentation, controls, vent filling and drain connections for applications where pressures are 50 lb/in<sup>2</sup> and below, and where fluids handled are neither toxic nor dangerous nor could cause atmospheric contamination, and which would not cause, in event of failure, a major breakdown of the equipment nor create a hazard to the surrounding area nor affect the operation of other visual equipment."

3.11.2.2, first sentence: Delete and substitute: "Steam piping connections to which the shipbuilder connects shall be accessible, shall terminate at a point outside of turbine lagging line, and should preferably be welded."



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Add as paragraph 3.11.2.3:

"3.11.2.3 Exhaust spray system. Shipbuilder shall provide condensate water for turbine cool sprays (see 3.12.7.2). A 40 mesh (0.017-inch hole size) strainer shall be installed immediately upstream of the turbine connection."

3.11.3, first sentence: Delete and substitute: "Crossover pipes and bolting for same shall be furnished with the turbines to be fitted and installed by the shipbuilder (upon shipbuilder agreement crossover pipes and bolting may be furnished fully fabricated with no field fitting required)."

3.11.5, line 5: Delete "12 chrome material or equivalent" and substitute "corrosion/erosion resistant material".

3.11.6: Add: "Valves shall be capable of being lifted by hand to check freedom of movement at atmospheric pressure without removal."

3.11.7.1: Add: ", except when steam chests or casings are 12 chrome. Valve bodies for 12 chrome applications can be of carbon steel or low alloy steels provided all flange joints and other surfaces where a high rate of erosion could occur are protected with a corrosion/erosion resistant material."

PAGE 16

3.11.7.5.2, second sentence: Delete.

3.11.7.6, first sentence: Delete and substitute: "Valve gear springs shall be corrosion protected."

PAGE 17

3.12.7.1, third sentence: Delete.

\* 3.12.7.2, following second sentence: Add: "The portion of the spray nozzle with the minimum flow area shall have a diameter of 0.080 to 0.110 inch and shall be of corrosion/erosion resistant material. The water spray system shall be fabricated of a corrosion/erosion resistant material, designed to minimize clogging. Spray nozzle removal shall not require lifting of turbine casing."

PAGES 19 and 20

3.13 through 3.13.5: Delete and substitute:

"3.13 Shock. When shock design is required (see 6.2.2) for the intended application, propulsion turbines shall be grade A hull-mounted equipment as defined by MIL-S-901. Degradation of performance after the turbines have experienced shock loads shall not exceed 5 percent (i.e., with design steam flow, the propulsion unit shall be capable of producing at least 95 percent of design full power). Unless otherwise specified (see 6.2.2), the basis for shock design and acceptance shall be as specified in 3.13.1 through 3.13.3. The intended use of a shock-proof turbine is to



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continuously deliver power in accordance with the performance requirements specified herein after being subjected to the shock of the magnitude specified in MIL-S-901. Further, the turbine when subjected to shock, shall not suffer damage to the extent that it creates a possible hazardous situation such as fire or injury to personnel, or such as to result in likely failure of components if the unit is not immediately shut down for corrective action. Where damage is revealed during shock test or during post-shock test inspection and tests, acceptance will be based on NAVSEA approval of corrective action proposed by the contractor.

"3.13.1 Shock test requirements. For each propulsion turbine (HP or LP unit) which is capable of being tested, by reason of its weight and size not exceeding capacity of available test facilities, a shock test on a floating shock platform shall be conducted by the turbine manufacturer in accordance with the procedure specified in MIL-S-901 and amplified in the ordering data (see 6.2.2). The basis for shock design for units so tested shall be their ability to pass the test. The turbine manufacturer shall be responsible for all corrective actions (shock hardening of all units under the contract) resulting from failure to pass the test and refurbishing the test unit to meet its intended use. A report of the test results including recommendations for any design changes, if applicable, shall be submitted to NAVSEA for appropriate action.

\* "3.13.2 Static design method. Shock design of the propulsion units not capable of being tested in accordance with 3.13.1 shall be based on the following minimum "g-load" values:

Application	Static "g-load" values		
	Vertical	Athwartships	Fore and aft
Surface ships	50	20	10
Submarines	50	50	20

"3.13.2.1 Use of "g-load" values. The propulsion unit shall be capable of withstanding shock loads due to steady acceleration at the static "g-load" values applied separately in each direction (plus or minus). Each mass element of the unit shall have an inertia load applied equal to  $(dm \times G \times g)$ , where:

dm = distributed mass  
G = static g-load value tabulated above  
g = acceleration of gravity

The resulting stresses and deflections, when added to the maximum normal operating values, shall not exceed allowable stresses or deflections."

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"3.13.2.2 Allowable stresses. The combination of shock and operating stresses shall not exceed the 0.2 percent offset yield strength at operating temperature unless otherwise approved by NAVSEA. The unit loading for combined shock and operating loads on babbitted bearings shall be limited to 22,000 lb/in<sup>2</sup>. The criteria for failure when plastic set is permissible is the effective yield strength of the material; in tension, shear, and crush, this is represented by  $\sigma$ ,  $\tau$ ,  $\sigma_c$ , respectively, which are defined as:

$$\begin{aligned}\sigma &= \sigma_y + F (\sigma_u - \sigma_y) \\ \tau &= 0.6 \sigma \\ \sigma_c &= 1.6 \sigma\end{aligned}$$

Where:  $\sigma_y$  is the 0.2 percent offset yield, elastic limit or other normal definition of material yield strength.

$\sigma_u$  is the normal definition of material failure strength.

F is a factor which takes into account the efficiency with which the material in the member is utilized and is dependent on the kind of loading and cross section of the member. The value of F is equal to -1 (that load required to completely yield the member divided by that required to just initiate yielding) -1. F equals zero for members in tension and where material has less than 10 percent elongation before fracture in a tension test; F equals 0.5 for a rectangular section in pure bending.

"3.13.2.3 Dynamic analysis. When specified (see 6.2.2), the manufacturer shall conduct a concurrent dynamic analysis. Items found deficient by the analysis shall be identified and corrective actions proposed. Design changes will be incorporated at the option and expense of the Government.

"3.13.2.4 Stress report. A stress summary report shall be submitted to NAVSEA for information. Report shall cover all areas for which shock stresses were calculated and shall indicate the applicable yield strength for each stress reported.

\* "3.13.3 Exceptions. The above basis for shock design applies except in the following cases:

- (a) When the turbine proposed is of identical design to one that has been previously shock tested and finally accepted by the Navy, such design shall be acceptable if it meets all other requirements for the proposed application.
- (b) When the turbine proposed is of identical design to one that has been previously dynamically analyzed and such analysis has been finally accepted by the Navy, such design shall be acceptable if:
  - (1) The mathematical model applies without change; i.e., the equipment involved is a repeat procurement for which the foundation and other equipment affecting the model are the same.

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- (2) The turbine meets all other requirements for the proposed application.
- (c) When the turbine proposed is similar, but not identical, to a design previously tested or dynamically analyzed and accepted by the Navy, the turbine manufacturer may define areas of dissimilarity, including calculated "g-load" capability in these areas, and propose to the Navy the acceptance of such design in lieu of the requirement in 3.13.2. If NAVSEA concurs that the similar design will provide equal or better shock capabilities in the intended application, extension approval will be given.
- (d) Gland seal regulators, sentinel valves, and other valves such as a transfer valve for HP-LP turbine and submarine astern valve may, at the manufacturer's option, be separately shock tested in accordance with MIL-S-901."

PAGE 22

3.16: Add: "Design minimum axial and radial clearances shall be maintained by a knife edge (thin metal section) design to prevent major turbine damage if a rub occurs. No heavy diaphragm section shall be within 1/4 inch of rotating parts."

PAGE 23

3.19.2.3: Delete.

3.19.3.1: Delete and substitute:

"3.19.3.1 Regular versus heavy series. Where necessary for purposes of bearing loads, pressure tight flanges, shock and other special applications, heavy series shall be used."

PAGE 24

\* 3.19.3.5: Add: "Self locking threaded fasteners shall not have been threaded on to an engaging part more than five times. Self locking bolts are permitted where plastic insert type fasteners are appropriate. Anaerobic locking compounds (Loctite or equal) are permitted for certain applications below 250° F when specifically approved by NAVSEA."

3.19.3.7, second and third sentences: Delete and substitute: "Studs shall be class 2A or 3A and shall be bottomed. Details of bottoming shall be approved by NAVSEA. For an internal socket driving provision, a square drive of 1/2, 3/4 or 1 inch shall be used dependent on stud size. One nut studs for horizontal joints shall have nut on top side unless specifically approved by NAVSEA."

PAGE 25

Add as paragraph 3.20.3.1:

"3.20.3.1 Leakage. The external joint of each steam containing pressure boundary shall not leak to the atmosphere. Leakage is considered cause for rejection of the unit."

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PAGE 26

- \* 3.20.7: Add: "The packing housing lower half shall be either cast integrally with or welded to the lower half turbine casing."

3.20.8, line 3: Delete "or by blank flanges." Second sentence: Delete and substitute: "Plugs shall be seal welded after installation."

- \* Add as paragraph 3.20.9.4:

"3.20.9.4 Exhaust sprays. Where a flexible rubber connection is used between the turbine and condenser, exhaust sprays shall be provided with the turbine to maintain temperatures of the connection below 220°F for all modes of operation. Resistance type temperature elements shall be installed in the turbine casing in at least two points in the immediate vicinity of the rubber exhaust joint. The exhaust sprays shall be tack welded to the spray assembly pipe. Exhaust sprays shall be accessible for removal either by access through the exhaust casing openings or by removal of the exhaust spray assembly. Exhaust spray assembly shall not have unsupported cantilever sections. Drawings of the exhaust spray assemblies shall be submitted for approval; submitted data shall include assembly natural frequency."

- \* 3.20.11, first sentence: Add: "(for submarines set is only for lifting one turbine at one time; parts shall fit both turbines)."

PAGE 27

- \* 3.20.13.1, item (c): Delete and substitute:

"(c) Drain manifold. Stage drains (except for last stage) for saturated steam applications shall be drained through passageways integral with the turbine casing. They may be drained collectively to the condenser, however, provisions shall be provided for collecting these drains with funnel drains."

PAGE 28

3.22.2: Delete and substitute:

"3.22.2 Journal bearing. Preferred bearing type is pivot-pad. Elliptical and axial groove types are permitted in a design supported by a previous satisfactory operating history."

- \* 3.22.2.1, line 2: Delete "250 psi" and substitute "250 lb/in<sup>2</sup> or less than 110 lb/in<sup>2</sup>".

PAGE 29

- \* 3.22.2.9: Add: "Use of adjustable seating shims or pads which allow changing the radial position of the rotor is prohibited."

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3.22.2.10, second and third sentences: Delete and substitute: "The boss shall be 1-inch square by 1-1/4-inch high mild steel fabrication. Holes in sides shall be drilled and tapped 10/32 inch through, centered and 7/16 inch from top surface. Hole in top surface shall be drilled and tapped to 10/32 inch and centered (depth shall be 7/16 inch, or break-through into side holes). Holes shall be perpendicular (within plus or minus 1 degree) to sides of block. Faces of block shall be surface ground to a finish of approximately 32 microinches after holes are drilled and tapped."

3.22.2.11.2, line 2: Delete "NAVSHIPS 250-644-2" and substitute "NAVSHIPS 283-228-1000".

PAGE 30

\* 3.22.2.13: Delete and substitute:

"3.22.2.13 Rotor radial position setting. Use of adjustable seating shims or pads is prohibited. Rotor radial position shall be fixed."

3.22.3.1, line 2: Delete "equal size".

3.22.3.2: Add: "Design shall be such that loading and surface speed at maximum permitted operating speed does not result in operating temperatures higher than 250°F as measured by RTE's (see 3.22.4). This requirement is intended to provide a margin below the maximum RTE alarm set point of 270°F (see 3.8.10)."

PAGES 30 and 31

\* 3.22.3.5: Delete and substitute:

"3.22.3.5 Collar. The thrust collar shall be integral with the rotor shaft or rotor shaft extension. A removable thrust collar keyed to the shaft is not permitted unless rotor base material is 12 chrome, standardization or interchangeability with existing designs is an overriding consideration. Excess thickness shall be provided on integral collars to allow for refurbishment should the collar become excessively scored in service. Removable thrust collar keyed to shaft shall be submitted to NAVSEA for approval."

PAGE 31

3.22.3.7, item (a): Delete and substitute:

"(a) Collar - 16 RHR or less for all including integral collars. (350 + 50 Brinell minimum for all except integral collars)."

\* 3.22.4: Add: "The RTE shall be located in the calculated full power hot spot for one ahead and one astern thrust shoe."

3.22.4.1, line 2: Delete "MIL-T-22051" and substitute "MIL-T-15377".

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\* 3.22.4.4: Delete and substitute:

"3.22.4.4 RTE wire grooves and connection blocks. The three wires attached to the RTE shall be brought through a radially-drilled 0.187 inch maximum diameter hole and channeled in a groove (approximately 1/8 inch X 3/16 inch) connecting radial hole with a connection block (see figure 7) recessed in bearing edge or end at, or close to, the bearing part line. A hardening epoxy-resin or nonoil soluble room temperature vulcanizing silicone rubber (RTV) shall be applied in groove to protect wire. Both wires shall be soldered to the connection block (see figure 8)."

\* 3.22.4.5, first sentence: Delete and substitute: "Wiring between turbine bearing connection block and the casing (or bearing pedestal) wall shall be sheathed in stainless steel flexible cover and shall be recessed in epoxy-resin, nonoil soluble silicone rubber (RTV) filled grooves, in holes, or in conduit to protect it against damage."

3.22.4.6, second sentence: Add ", class C, E, or R."

PAGE 32

3.23.4, line 3: After "shrunk-on couplings", add "are acceptable", and add as second sentence: "Shrunk-on couplings shall also be keyed or dowelled to the shaft and the keys or dowels shall be capable of transmitting the maximum torque loads involved."

PAGE 33

\* 3.24.9.2: Delete and substitute:

"3.24.9.2 Number of blades per shroud strip. Number of blades per shroud strip shall be selected on the basis of minimizing blade vibratory stresses, and shall be indicated on applicable drawings and on technical data required by figure 14. Long shrouds shall be utilized to minimum tangential mode blade stresses caused by per-revolution excitations. This design technique shall be used for all blading with calculated fundamental tangential frequency equal to or less than seven times running frequency at maximum turbine revolutions."

PAGE 34

3.24.9.8: Delete and substitute:

"3.24.9.8 Slanted shrouding. The installation of slant shrouds at angles greater than 20 degrees requires specific NAVSEA approval."

3.24.10: Add: "Two-tang axial-entry roots shall not be used."

PAGE 35

\* 3.24.12.3: Delete and substitute:

"3.24.12.3 Radial seals. Use of radial seals or spill bands shall be minimized and shall only be used in performance critical turbines. Radial seals shall be approved by NAVSEA."

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3.25.6.1, line 3: Delete "either". Line 4: Delete ", or by suitable shielding".

3.25.8: Delete.

PAGE 36

3.27.1, line 4: Delete "MIL-P-15137" and substitute "MIL-STD-1552", and add as item (f):

"(f) Casing blades and intermediate segments. Each stock-numbered row of casing blades and intermediate segment shall consist of all material necessary to affect replacement in its entirety (i.e., blades, shroud segments, bolts, seal strips, caulking, etc.)."

PAGE 38

3.28.2.7: Add: "Double identification, as defined above, is required for all new drawings generated under contracts which involve this specification. Drawings already in existence and approved under previous contracts and specifications do not require revision to show double identification."

PAGE 40

3.28.3.3.7, Note 2: Delete.

PAGE 41

3.28.4.1: Add as item d.:

"d. Revisions to any category drawing. Revisions to drawings which have been approved by the Government and contractor approved drawings which depict a part or component as furnished require approval of NAVSEA when the revision affects either installation, performance, maintainability, or stock repair parts."

PAGE 42

Add as paragraph 3.29.5.1:

"3.29.5.1 Scope. Cards which have been previously submitted to the Navy under other contracts need not be resubmitted unless the drawing has been revised."

PAGE 44

Add as paragraph 3.30.4.3.1:

"3.30.4.3.1 Section entity. For a description of parts and components applicable to a number of different turbines (e.g., thrust and journal bearings, buckets, regulators, packing, etc.), it is acceptable to provide a master technical manual section, which, when initially approved



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by NAVSEA and determined correct for equipment being furnished, can be inserted into future manuals without resubmitting this section for approval. This section should bear its own identification and page numbering and shall be as self sufficient as possible."

PAGE 45

3.30.4.6: Add as item (f):

"(f) Valve and valve seat replacement. Cover instructions for removal and replacement of seats, including seal weld procedure and use of strong back during seal welding. Provide guidance for timing of valves."

PAGE 47

3.33: Add as item (c):

"(c) Use of materials with chemical analysis or mechanical properties outside of specification limits where factors of safety are met, and welding, corrosion/erosion resistant properties are not adversely affected."

3.33.2, line 2: Delete "under the following conditions" and substitute "when all conditions listed are satisfied."

PAGE 48

3.33.3 and 3.33.4: Delete and substitute:

"3.33.3 Procedure for approval of variations. The following shall be used for approval of variations:

- (a) Variations shall be referred to NAVSEA for approval via the local Government inspector within thirty days after occurrence. Submittals shall be in the same manner as established for obtaining drawing approval which on shipbuilder furnished equipment, will require submittal via the shipbuilder and cognizant supervisor. Any work done on equipment with variations prior to obtaining Government approval shall be at the contractor's risk.
- (b) Each variation referred to NAVSEA shall be accompanied by a letter report containing:
  - (1) The contract number and item involved.
  - (2) The date on which the variation was discovered.
  - (3) The circumstances or conditions under which the variation occurred.
  - (4) A complete description (including sketch or drawing to scale) of the nature and extent of the variation.
  - (5) The corrective measures proposed.
    - a. For the part or parts containing variations.
    - b. To prevent the recurrence of similar variations.

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- (6) The effect of the variation (as corrected) on performance, endurance, stress levels, and parameters cited in 3.33.1, including:
  - a. Detailed engineering basis for acceptance.
  - b. Certification of the part or parts as corrected.
- (7) Identification of the benefit to the Government, if variation is accepted as modified.
- (c) Copies of all correspondence involving repair parts shall be forwarded to Ships Parts Control Center, Mechanicsburg, PA 17055.

"3.33.4 Workmanship and quality control records. Machinery errors and equipment variations which do not require Government approval (see 3.33.1) (such as nonsignificant and noncritical deviations from drawing dimensions or tolerances for castings, forgings, weldments, connections, or machine-processed parts) shall be documented, and a copy shall be furnished to the local Government inspector. If the inspector considers that an unclassified deviation does involve contractual requirements, then such deviation shall be classified and treated in accordance with 3.33 through 3.33.3. When a repair restores a part to original drawing dimensions, but involves no change of materials and uses a previously-approved repair process, the local Government inspector shall approve such repair. There shall be periodic reviews between the manufacturer and the inspector on the accumulated incidents of machining errors for determination of corrective measures to improve workmanship. The frequency and timing of such meetings shall be as determined by the inspector."

PAGE 49

3.34.1.1: Add as item (p):

"(p) RTE puddling procedure (see 3.22.4.3)."

PAGE 51

4.4.1, items "S<sub>t</sub>" and "S<sub>o</sub>": After "section VIII", add ", division 1".

\* 4.4.2: Delete and substitute:

"4.4.2 Magnetic particle and dye penetrant tests. There shall be 100 percent magnetic particle or dye penetrant testing of all accessible areas for items shown on figure 15. Acceptance criteria for welds and castings shall be in accordance with the class designation of figure 15. Finished machined parts fabricated from wrought material shall be free of cracks and other injurious surface defects, and shall preferably be dye penetrant inspected. For magnetic particle inspection of finished machined parts, the yoke method shall be used to prevent arc-strikes on the machined surface. For magnetic particle inspection, indications of nonmetallic inclusions, as verified by 5X magnification inspection, are acceptable if the individual indication does not exceed 3/16 inch long and the cumulative length in any square foot of surface area does not exceed 5 inches."

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\* Add as paragraph 4.4.2.1:

"4.4.2.1 Inspection of plates. For plates 1/3-inch and thicker, the plate edge prepared for welding shall be MT/PT inspected and shall not contain individual lamination or nonmetallic indications exceeding 1/2-inch long and cumulative length of 1.5 inch in any 12 inch length."

4.4.3, item (a)(4): Delete and substitute:

"(4) Front wall and first stage shell area (horizontal flange excluded) where inlet temperature to chest is 990°F or greater."

\* 4.4.3(b): Delete "Piping" and substitute "Piping welding".

4.4.5: Add: "Small sections of low pressure piping (such as gland seal vent lines, valve stem leakoffs, and lube oil connections) which are to be welded to nipples on turbine casing do not require hydrostatic tests. MT/PT to class 2 acceptance standards may be substituted."

PAGE 53

4.5.4: Add: "Temperature limits of 3.8.9 and 3.8.10 do not apply to the overspeed condition."

4.5.6, line 2: Delete "with approved procedures" and substitute "with documented procedures."

4.5.8: Delete and substitute:

"4.5.8 Steam tightness tests."

"4.5.8.1 Valves and seats. The turbine manufacturer shall demonstrate by contact dye checks that valves and seats have a continuous line contact within the seating area."

"4.5.8.2 Steam joints. The turbine manufacturer shall demonstrate by contact dye checks that the casings, packing boxes and steam chest joints meet or exceed a 75 percent surface contact over the entire joint and a minimum 1/2 inch inside continuous contact band in the joint material located between the bolts and the pressurized area of the turbine for pressures greater than 500 lb/in<sup>2</sup> absolute, 1/4 inch for pressures between 15 and 500 lb/in<sup>2</sup> absolute and a continuous contact line for pressure less than 15 lb/in<sup>2</sup> absolute."

4.5.11, third sentence: Add: "Where applicable, vibration levels shall be such that testing of overspeed devices can be safely conducted without damage to the units."

\* 4.5.14: Add: "The manufacturer shall identify any and all blading utilized that is different (longer or shorter lengths, new root designs, new materials, new tenon designs, new shroud design, etc.) from past Navy

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designs. An assessment of these differences in terms of their affects on both calculated frequencies and stress levels shall be provided, with recommendations on specific testing required to confirm that calculation method utilized is correct."

\* Add as paragraph 4.5.16:

"4.5.16 Override feature. When override feature (see 3.10.7.5) is provided, it shall be demonstrated that overtravel into the manual operating band with control oil on will not result in shutting of control valves."

\* 4.6.1: Delete and substitute:

"4.6.1 Lifting gear. In order to verify proper location of shipboard lifting pad eyes and minimization of interferences, shipbuilder turbine lifting and handling gear shall be fitted to the turbines in the first ship of a machinery class at each building yard. Unbolting the horizontal joint flange is not required for this demonstration."

PAGE 55

5.1: Add: "Turbine exteriors shall be painted as required by MIL-P-17286, except that for turbine parts that never exceed 250°F, such as support members, bases or bedplates, one coat of aluminum paint conforming to TT-P-28 is acceptable. Use of Egyptian Lacquer No. 56075 or equivalent in lieu of aluminum primer presently required is acceptable."

PAGE 56

6.2.2, item (d): Add as item (9):

"(9) If a prefitted crossover pipe is used, state the maximum tolerance in the setting location of the turbine crossover pipe flanges, with respect to each other, as to distance, offset and angular dimensions."

6.2.2, item (g): Delete and substitute:

"(g) Shock requirements.

- (1) Whether or not shock design is required (see 3.13).
- (2) Shock test (see 3.13.1).
  - a. Test agenda requirements.
  - b. Test instrumentation requirements.
  - c. Acceptance criteria.
  - d. Test report requirement.
- (3) Whether or not concurrent dynamic analysis is required when shock design is based upon static g-load values (see 3.13.2.3)."

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PAGE 57

6.2.2.2, item (p)(3): Delete.

\* 6.2.2.2: Add:

"(t) Specify applicable paragraphs of MIL-V-22682 for submarine astern valves (see 3.10.3.2)."

PAGE 62

Figure 2, item (c): Delete and substitute:

Part or service		Applicable documents	Material and properties	Temperature limit (°F) (maximum)	Remarks
(c) Bearings thrust	(1) Shoes	ASTM A 576 or A 675	Carbon steel (.14 - .26C)		Up to and including 8 inch bearing size
		ASTM A 575 or A 663 (grade 1020)	Carbon steel (.14 - .26C)		From above 8 inch to 19 inch bearing size
		QQ-C-390, alloy number 951-960	Aluminum bronze		
(2) Leveling plates		ASTM A 576 or A 675	Carbon steel (.32 - .50C)		Bearing for light to moderate loads
		ASTM A 322 or A 331	AISI 4140, 4150 or 4340		High load bearings
(3) Collar (removable)		ASTM A 322 or A 331	AISI 4140		Heat treat to 350 ± 50 BHN

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PAGE 63

Figure 2, item (e): Delete and substitute:

Part or service	Applicable documents	Material and properties	Temperature limit (°F) (maximum)	Remarks
(e) Bolts, studs and nuts (and other screw-thread fasteners) for casing steam joints, valve chest cover, hold down bolts, nozzle blocks and other highly stressed (>2/3 yield) structural applications	MIL-S-1222, type I, grade B7	Cr-Mo alloy steel (bar)	775	Magnetic particle test is not required
	MIL-S-1222, type I, grade B16 and type II, grade 4	CR-Mo V-alloy steel (bar) Alloy steel (forged or bar)	900	
	MIL-S-861, class 422, condition HT	12 Cr corrosion-resisting steel (bar)	1000	

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PAGE 65

Figure 2, item (j), under "Applicable documents": Delete "JAN-W-562" and substitute "AMS 5698".

PAGE 67

Figure 3, under "Turbine or element for which required", opposite "Exhaust shell": Delete "HP and cruising turbines both ends of HP-IP turbines" and substitute "Single casing and HP cruising turbines and both elements of HP-IP turbines". Under "Thermometers location", opposite "First stage shell": Delete "Remote at main gageboard" and substitute "None".

PAGE 75

\* Figure 11, item 1, under second column: Delete "(see note)" and substitute: "(see notes)".

\* Figure 11, item 11, under second column: Add "(see notes)".

\* Figure 11: Add as note 2:

"2. For propulsion unit with two turbines with identical bearings, only one turbines worth of bearings is to be carried."

PAGE 76

Figure 12, enclosed subheading under "Number of shafts worth required": Delete "shown in columns 2 to 6" and substitute "shown in columns 2 to 4".

Figure 12, column 5 "Nozzle blocks" and column 6 "Nozzle diaphragms and intermediate segments": Delete.

Figure 12, notes 4, 5, and 6: Delete.

PAGE 83

\* Figure 14, item 4, under third column: Add:

"(e) Campbell diagram shall be provided for each stage."

\* Figure 14, item 4, under third column, item (b): After "stress" add "(nozzle passing and per-revolution)."



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\* Figure 14, item 4, under eighth column: Add:

- "(a) Unless otherwise approved, long shroud bands shall be utilized to minimize tangential mode blade stresses caused by per-revolution excitations. This design technique shall be utilized for all blading with a fundamental tangential frequency (1 TO) equal to or less than 7 times running frequency.
- (b) Indicate diaphragm allowable harmonic stimulus.
- (c) Indicate allowable steam bending stress.
- (d) Indicate mode of vibration for which calculated stress values are shown."

PAGE 84

Figure 15, item 7, under "PART OR SERVICE": Add: "(main welds on inner and outer rings)".

Figure 15, item 10, under "PART OR SERVICE": Add: "(castings and welds of fabrication)".

Figure 15, item 17: Delete and substitute:

"

PART OR SERVICE	MT/PT	RT	HT	UT	VISUAL
17. Control valves					
(a) Poppets and seats, life rods, valve stems, bushings and lift bars	-	-	-	-	X
(b) Seating surface of valve and seat	X - 1	-	-	-	-
(c) Seat welds and expansion rings	X - 2	-	-	-	-
(d) Inconel inlay	X - 2	-	-	-	-

"

PAGE 86

\* Figure 16: Add as items 9 and 10:

- "9. Steam leak. Steam joints shall be carefully inspected for steam leaks at all power levels. Describe all leaks observed, corrective actions taken to stop leakage and success of the actions.
- 10. Lube oil leaks. A thorough inspection for lube oil leakage is to be conducted at all power levels. Describe all leaks observed, corrective actions taken to stop leakage and success of the actions."

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LAST PAGE

\* DD Form 1426, Specification Analysis Sheet: Delete address and substitute:

"COMMANDER  
NAVAL SEA SYSTEMS COMMAND (SEA 5523)  
DEPARTMENT OF THE NAVY  
WASHINGTON, DC 20362"

NOTE: The margins of this amendment are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

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