INCH-POUND
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2 September 1988
SUPERSEDING
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(See 6.9)

MILITARY SPECIFICATION

HEATERS, FLUID, INDUSTRIAL (LUBRICATING OIL) (FOR NAVAL SHIPBOARD USE)

This specification 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.

1. SCOPE

1.1 Scope. This specification covers steam-heated lubricating oil heaters for use on board Naval ships.

1.2 Classification. Heaters shall be of the following types (see 6.6), as specified (see 6.2.1).

Type I - Extended surface tube with oil outside the tubes, each shell enclosing more than one tube element.
Type II - Shell and bayonet tube with steam inside the tubes and oil outside.
Type III - Plate tube with steam in the casing and oil circulated through plate tubes.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4420

SPECIFICATIONS

FEDERAL

FF-W-84	- Washers, Lock (Spring).
FF-W-92	- Washers, Flat (Plain).
QQ-B-637	- Brass, Naval: Rod, Wire, Shapes, Forgings, and Flat Products with Finished Edges (Bar, Flat Wire, and Strip).
QQ-C-465	- Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630, 632M and 642); Rod, Flat Products with Finished Edges (Flat Wire, Strip, and Bar), Shapes, and Forgings.
QQ-C-591	- Copper-Silicon, Copper-Zinc-Silicon, and Copper-Nickel-Silicon Alloys: Rod, Wire, Shapes, Forgings, and Flat Products (Flat Wire, Strip, Sheet, Bar, and Plate).
QQ-S-698	- Steel, Sheet and Strip, Low-Carbon.
TT-P-28	- Paint, Aluminum, Heat Resisting (1200°F).
TT-P-645	- Primer, Paint, Zinc Chromate, Alkyd Type.
WW-P-404	- Pipe, Steel, (Seamless and Welded, Black and Zinc-Coated (Galvanized)).
PPP-F-320	- Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.

MILITARY

MIL-P-116	- Preservation, Methods of.
MIL-S-901	- Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-S-1222	- Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts.
MIL-P-15024	- Plates, Tags and Bands for Identification of Equipment.
MIL-P-15024/5	- Plates, Identification.
MIL-S-15083	- Steel Castings.
MIL-C-15726	- Copper-Nickel Alloy, Rod, Flat Products (Flat Wire, Strip, Sheet, Bar, and Plate) and Forgings.
MIL-B-16541	- Bronze, Valve: Castings.
MIL-L-19140	- Lumber and Plywood, Fire-Retardant Treated.
MIL-C-20159	- Copper-Nickel Alloy Castings (UNS No. C96200 and C96400).
MIL-S-22698	- Steel Plate and Shapes, Weldable Ordinary Strength and Higher Strength: Hull Structural.
MIL-S-23284	- Steel Forgings, Carbon and Alloy, for Shafts, Sleeves, Couplings, and Stocks (Rudders and Diving Planes).
MIL-S-24093	- Steel Forgings, Carbon and Alloy Heat Treated.
MIL-P-24691	- Pipe and Tube, Carbon, Alloy and Stainless Steel, Seamless and Welded, General Specification for.
MIL-P-24691/1	- Pipe and Tube, Carbon Steel, Seamless.
MIL-G-24696	- Gaskets, Sheet, Non-Asbestos.

STANDARDS

FEDERAL

FED-STD-H28 - Screw-Thread Standards for Federal Services.

MILITARY

MIL-STD-278 - Welding and Casting Standard.
MIL-STD-438 - Schedule of Piping, Valves, Fittings, and Associated Piping Components for Submarine Service.
MIL-STD-777 - Schedule of Piping, Valves, Fittings, and Associated Piping Components for Naval Surface Ships.
MIL-STD-1186 - Cushioning, Anchoring, Bracing, Blocking and Waterproofing; With Appropriate Test Methods.
DOD-STD-1399, Section 301 - Interface Standard for Shipboard Systems Ship Motion and Attitude. (Metric)
MIL-STD-2073-1 - DoD Materiel Procedures for Development and Application of Packaging Requirements.

2.1.2 Other Government drawing and publications. The following other Government drawing and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DRAWING

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

B-214 - Root Connections for Attaching Pipe.

PUBLICATIONS

NAVSEA

0900-LP-001-7000 - Fabrication and Inspection of Brazed Piping Systems.
0908-LP-000-3010 - Surface Ship Shock Design Criteria.

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the non-government documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service. (DoD adopted)

A 515 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service. (DoD adopted)

B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications. (DoD adopted)

D 3951 - Standard Practice for Commercial Packaging. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4 and 6.3).

3.1.1 Reliability. The mean time between failures of the heater assembly shall be not less than 20,000 hours of operating time. A failure is any condition or malfunction that requires the heater to be taken or kept out of service for corrective maintenance.

3.1.2 Maintainability. The heater shall be such that all maintenance, both preventive and corrective, can be accomplished at the organizational level without outside assistance.

3.1.2.1 Preventive maintenance time. The mean preventive maintenance time shall be not greater than 2 man-hours a month. The time required to perform any one preventive maintenance action shall be not greater than 3 man-hours.

3.1.2.2 Corrective maintenance time. The heater shall have a geometric mean time to repair (MTTRg) of not more than 3 man-hours. The maximum time to perform any corrective action (95th percentile) shall not exceed 5 man-hours. Times to repair are assumed to fit a lognormal distribution for purposes of calculating MTTRg and maximum time to repair.

3.2 Material. Material requirements for heaters of types I and II shall be as specified in table I, and for heaters of type III in table II. Materials for parts not listed in tables I and II shall be of quality for the purpose intended.

TABLE I. Materials for heaters of types I and II.

Part	Material	Specification
Shells	Seamless drawn steel tubing; Pipe, steel, (seamless and welded, black and zinc-coated (galvanized)); Steel plate, grade 60; Steel plate, hull structural, type I, grade M; or Pipe, steel, seamless	MIL-P-24691/1 WW-P-404 ASTM A 515 MIL-S-22698 ASTM A 106
Heads	Cast steel; Welded or seamless drawn steel tubing; Steel plate, grade 60; Steel plate, hull structural, type I, grade M; or Pipe, steel, seamless	MIL-S-15083 MIL-P-24691/1 ASTM A 515 MIL-S-22698 ASTM A 106
Tubes	Seamless drawn steel	MIL-P-24691/1
Tube sheets	Steel plate, grade 60; or Steel plate, hull structural, type I, grade M	ASTM A 515 MIL-S-22698
Flanges for shells and welded heads	Steel plate, grade 60; Steel plate, hull structural, type I, grade M; Steel forgings; or Steel bars	ASTM A 515 MIL-S-22698 MIL-S-24093 MIL-S-23284
Stay rods	Bolt material, grade 2	MIL-S-1222
Bolts	Bolt material, grade 2	MIL-S-1222
Nuts	Forged steel, grade 1	MIL-S-1222
Baffle plates	Steel plate, grade 60; or Steel plate, hull structural, type I, grade M	ASTM A 515 MIL-S-22698
Fins	Steel plate, grade 60; or Steel, sheet or strip	ASTM A 515 QQ-S-698
Gaskets	Non-asbestos, sheet	MIL-G-24696
Washers	Iron or steel	FF-W-92

TABLE II. Material for heaters of type III.

Part	Material	Specification
Casing	Copper-nickel alloy; Copper alloy C90300; or Copper-nickel alloy, cast	MIL-C-15726 ASTM B 584 MIL-C-20159
Tube halves	Copper-nickel alloy (not less than 0.020 inch thick)	MIL-C-15726
Oil tube centers	Steel, cold rolled; or Copper-nickel alloy	Commercial MIL-C-15726
Covers	Copper-nickel alloy; Copper-nickel C90300; or Copper-nickel alloy, cast	MIL-C-15726 ASTM B 584 MIL-C-20159
Reinforcement plates	Copper-nickel alloy	MIL-C-15726
Pipe plugs	Copper alloy C90300; or Valve bronze	ASTM B 584 MIL-B-16541
Bolts, studs, and nuts	Nickel alloys	MIL-S-1222
Gaskets	Non-asbestos, sheet	MIL-G-24696
Washers	Bronze, aluminum, wrought; Brass, naval wrought; or Iron or steel	QQ-C-465 QQ-B-637 FF-W-92
Lockwashers	Various	FF-W-84
Brazing sheet	Electrolytic copper	Commercial

3.2.1 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.2.2 Prohibited materials. The following materials shall not be used for service, manufacture, test or inspection of steam-heated lubricating oil heaters:

(a) Mercury (except for fluorescent or mercury vapor lighting).
(b) Carcinogenic materials.
(c) Cadmium, magnesium or asbestos.

3.3 Standardization. Each supplier of heaters shall standardize the proposed equipment as far as possible, holding the number of models and sizes offered to the Government to a minimum commensurate to the range of capacity and operating pressures that may be required.

3.3.1 Interchangeability. 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.

3.4 Screw thread standards. Screw threads on threaded parts shall be in accordance with FED-STD-H28. Standard wrenches shall be usable to the greatest extent possible. Tapered threads shall not be used.

3.5 Welding, allied processes, and castings. Welding, allied processes, and castings shall be in accordance with MIL-STD-278. Brazing shall be in accordance with NAVSEA 0900-LP-001-7000, except that requirements for use of pre-inserted brazing rings shall be applicable only to pipe fittings.

3.6 Painting. Heaters shall be painted as follows:

(a) External ferrous surfaces shall be thoroughly cleaned and coated with two coats of heat resisting paint in accordance with TT-P-28 or commercial equivalent.
(b) Nonferrous surfaces shall not be painted.

3.7 Space and weight. Space and weight shall be held to a minimum consistent with strength and performance.

3.8 Ship attitude and motion. Performance of heaters shall be independent of ship attitude and motion within the limits specified in DOD-STD-1399, section 301.

3.9 Shock resistance. Shock resistance requirements shall be as specified in 3.9.1 through 3.9.2.

3.9.1 Shock tests. Shock tests of complete heaters shall be required as specified (see 6.2.1). When specified in the contract or order, shock test reports shall be prepared (see 6.2.2).

3.9.1.1 Shock test modification. Shock tests shall be performed as specified in MIL-S-901, except that under the test procedure for medium weight equipment, the first blow in each group shall be applied using the standard horizontal mounting adapter. The second blow in each group shall be applied with the unit mounted on an adapter holding it at a 30-degree angle from the horizontal in the direction of its least transverse strength.

3.9.1.2 Extension requests. When previous shock tests are applicable as described in MIL-S-901, and when specified in the contract or order, a request for shock test extension shall be prepared (see 6.2.2).

3.9.2 Shock resistance grades. Shock resistance of heater assemblies shall be in accordance with the following grades as specified (see 6.2.1):

(a) Grade A. After sustaining mechanical shock, the heater assembly shall operate normally and no parts of the assembly shall create a missile hazard to personnel or to other equipment. The assembly shall not in any other way constitute a personnel hazard (as by rupture of parts containing steam or hot water, with consequent danger of scalding) at the time of the shock.

(b) Grade B. The requirements of grade B shall be the same as those of grade A except that the heater assembly shall not need to operate normally after sustaining mechanical shock.

3.9.3 Bolt holes for shear-stressed bolts. Unless otherwise specified in the contract or purchase order (see 6.2.1), bolts designed to be stressed in shear shall be installed in holes no greater in diameter than the following:

Nominal bolt diameter (inches)	Maximum diameter of hole (inches)
3/4 and smaller	Nominal bolt diameter plus 1/32
Larger than 3/4	Nominal bolt diameter plus 1/16

3.9.4 Rigidity of support structures. Assemblies that are rigidly supported shall be attached only to structures that cannot deflect relative to one another under shock loadings.

3.9.5 Shock mounts. Shock mount construction shall have approval of the drawing review agency (see 6.7) before the shock mounts are installed.

3.9.6 Bracing. Where braces must be employed to afford stability under vibration, the braces shall be constructed to fail under a force load equal to five times the weight of the unit. This load shall be considered to act at the center of mass of the unit.

3.9.7 Deflection snubbers. Where snubbers must be employed to limit deflection under shock loading, they shall be in accordance with NAVSEA 0908-LP-000-3010.

3.10 Capacity. The stated capacity shall be based on heating of oil of specified grade at the specified rate (see 6.2.1).

3.11 Operating conditions. Operating conditions shall be as specified in 3.11.1 and 3.11.2.

3.11.1 Standard conditions. Unless otherwise specified (see 6.2.1), oil operating gauge pressure shall be 100 pounds per square inch (lb/in^2) and steam operating gauge pressure shall be 150 lb/in^2. Standard commercial lines of heaters constructed for the above conditions are intended to be used as widely as possible. For the 150 lb/in^2 steam condition, the upper bound of operating temperature may be assumed to be 450 degrees Fahrenheit (°F) for design purposes.

3.11.2 Allowable oil pressure drop. With the heater heating the lubricating oil under specified conditions, the pressure drop through the heater shall not exceed the limit specified (see 6.2.1). Where no limit is given, the drop shall not exceed 5 lb/in^2.

3.12 Oil, steam, and condensate connections. Flanges, nozzles, and fittings for oil, steam, and condensate connections shall conform to MIL-STD-438 or MIL-STD-777, as applicable.

3.13 Venting and draining. Oil side vents and drains and a steam side vent shall be fitted as required by the heater configuration. Vent and drain connections shall have the increased wall thickness as specified in Drawing B-214 and shall be of one of the following types:

(a) Where welded steel construction is used, these connections shall be fitted in accordance with MIL-STD-278.
(b) Where nonferrous construction is used, these connections shall be welded in accordance with Drawing B-214 with sockets having a raised boss to permit ultrasonic inspection or welded in accordance with MIL-STD-278.

3.14 Fouling factor. In computing the constructed (service) overall coefficient of heat transfer, a fouling factor (fouling resistance) of not less than 0.005 shall be used, except that a fouling factor of 0.002 shall be used for type II heaters (fouling resistance (r), $(hr)(°F)(ft^2/Btu)$). For type I heaters, calculations of coefficients shall be based on the area of the extended (oil side) surface.

3.15 Identification plates. Identification plates in accordance with MIL-P-15024 and MIL-P-15024/5 shall be provided for each heater. Identification plate information shall include the following:

(a) Manufacturer's name.
(b) Name LUBRICATING OIL HEATER and type (see 1.2).
(c) Manufacturer's specific identification of the heater, such as service part number or model number applicable only to heaters of this identical size, configuration, and intended service.
(d) Government contract number, when acquired directly by the Government, or purchase order number when acquired by a contractor or shipyard.
(e) National stock number (allow 20 spaces).
(f) Date of manufacture.
(g) Maximum test pressure, oil side.
(h) Maximum test pressure, steam side.
(i) Blank space for Government inspector's stamp.
(j) Blank space for ship's identification number (allow 2 spaces).

3.16 Drawings. When specified in the contract or order, drawings shall be prepared (see 6.2.2).

3.17 Features of type I heaters. Features of type I heaters shall be as specified in 3.17.1 through 3.17.3.

3.17.1 General construction. The heater shall consist of one or more extended surface U-tubes enclosed in a shell. The steam shall pass through the U-tubes, and the oil shall pass through the shell and around the tubes. Baffles shall be fitted to direct the flow of oil within the shell. The U-tube and tube sheet subassembly shall be readily removable. One heater or a combination of two or more heaters in a compact stack or bank may be installed to perform the required duty.

3.17.2 Tubes. Tubes shall be not less than 1/2-inch outside diameter (od) and shall have wall thickness not less than 0.049 inch. Tubes of 3/4-inch od or smaller shall be fastened to the tube sheet by roller expansion. The tube expander shall be adjusted so that the depth of expansion extends not farther than within 1/8 inch of the inner face of the tube sheet.

3.17.3 Tube sheets. The tube sheet shall be of the same diameter as the shell and steam head flanges or of smaller diameter and secured in position in recesses turned in the faces of the flanges. Thickness of tube sheets shall be not less than 3/4 inch for 5/8-inch od tubes or larger or less than 1/2 inch for tubes of od less than 5/8 inch. The holes in the tube sheet for tubes shall be drilled and reamed 0.001 inch larger than the nominal tube diameter with tolerance of minus zero, plus 0.005 inch, on diameter of hole and shall be provided with two annular grooves. The grooves shall be approximately 1/64-inch deep and 1/8-inch wide.

3.18 Features of type II heaters. Features of type II heaters shall be as specified in 3.18.1 through 3.18.3.

3.18.1 Components. The heater shall consist of multiple bayonet type tubes; double tube sheets with condensate removal space between the tube sheets, the inner tube secured in the outer tube sheet and the outer tube secured in the inner tube sheet; a steam head to which the outer tube sheet may be secured; a shell with flange secured to the inner tube sheet and to the flange of the steam head; multiple cross baffles to direct flow of oil across the tubes, shell end opposite the steam head blanked; oil inlet, outlet, and drain connections on the shell; steam, condensate outlet and steam vent connections on the steam head; and necessary supports for attachment to foundation. One heater or a combination of two or more heaters in a compact stack or bank may be installed to perform the required duty.

3.18.2 Tubes and tube sheets. Tubes shall be fastened to the tube sheet by roller expansion. The tube expander shall be adjusted so that the depth of expansion shall extend not farther than within 1/8 inch of the inner face of the tube sheet. For joints of this type, the holes in the tube sheet shall be drilled and reamed 0.001 inch larger than the nominal tube diameter with tolerance of minus 0, plus 0.005 inch, on diameter of holes. Holes for 5/8-inch od and larger tubes shall be provided with two annular grooves approximately 1/64-inch deep by 3/32-inch wide.

3.18.2.1 Tube diameter and wall thickness. Inner tubes shall be not less than 1/2-inch od, and both inner and outer tubes shall have wall thickness not less than 0.049 inch.

3.18.2.2 Tube sheet thickness. Thickness of tube sheets shall be not less than 3/4 inch for 5/8-inch od tubes or larger or less than 1/2 inch for tubes of od less than 5/8 inch.

3.18.2.3 Bolting arrangement. The inner tube sheet shall be of the same diameter as the shell and steam head flanges, and the joint between the inner tube sheet and the shell flange shall be secured by bolting so that it will not be broken when the steam head is removed.

3.18.3 Removable parts. The steam head, outer tube sheet, and inner bayonet tubes shall be removable. The inner tube sheet, the outer tubes, and baffles shall be removable as a unit. A guide plate, drilled for the inner tubes, shall be provided to facilitate reassembly.

3.19 Features of type III heaters. Features of type III heaters shall be as specified in 3.19.1 and 3.19.2.

3.19.1 Components. The heater shall consist of a cast or fabricated casing and a core plate to which shall be attached plate tubes built up as a core and constructed with inlet and outlet connections for the oil. Use of a casing cover shall be optional.

3.19.2 Assembling. Plate tubes shall be assembled by furnace brazing formed tube-halves that have been mechanically positioned with brazing sheets. Grid centers shall be installed in the tubes to improve flow characteristics. Assembling of the plate tubes into cores shall be accomplished by furnace brazing. Differential expansion between tubes and core plate shall be adequately provided for by the details of construction and assembly.

3.20 Workmanship. Workmanship shall be of acceptable quality. Non-conformance to requirements of drawings shall be cause for rejection on grounds of poor workmanship.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies

submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection system. When specified in the contract or order, an inspection system program plan shall be prepared (see 6.2.2).

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) First article inspection (see 4.4).
(b) Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified herein, inspections shall be conducted under conditions that simulate those encountered in operation on board ship, except that ship list, trim and motion need not be simulated for inspections conducted on shore.

4.4 First article inspection. A sample heater of each type as required in the contract or purchase order (see 6.2.1) shall be inspected as specified in 4.4.1 through 4.5.2.2.

4.4.1 Performance test. A performance test shall be conducted on the heater under design conditions of flow, British thermal unit (Btu) removal and inlet and outlet temperature of the heated and heating medium.

4.4.2 Shock test. The heater shall be subjected to high impact shock testing in accordance with MIL-S-901 and shall meet the requirements specified in 3.9.1.

4.4.3 Pressure drop test. The heater shall be tested to determine pressure drop under various flow conditions on the oil side and shall meet the requirements as specified in 3.11.2.

4.4.4 Reliability evaluation. The MTBF shall be determined and shall meet the requirements specified in 3.1.1.

4.4.5 Maintainability evaluation. A maintainability demonstration shall be conducted by removing and replacing or reinstalling each removable part expected to be removed for preventive or corrective maintenance on board ship. The heater shall meet the maintainability requirements specified in 3.1.2.

4.4.6 General evaluation. Design and materials shall be evaluated as specified in 4.4.1 through 4.5.2.2. A determination of the unit weight shall be included in the evaluation. Workmanship shall meet the requirements specified in 3.20.

4.4.7 First article inspection report. When specified in the contract or order, an inspection test report shall be prepared (see 6.2.2). If a separate report on 4.4.2 has been prepared it may be addressed by reference only.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the tests specified in 4.5.1 through 4.5.2.2.

4.5.1 Examination. Each heater offered for delivery shall be examined for alignment, fit, material, finish, and conformance to the requirements of this specification that do not require tests.

4.5.2 Hydrostatic tests. Hydrostatic tests shall be performed in accordance with 4.5.2.1 and 4.5.2.2.

4.5.2.1 Oil side. The oil side of each heater shall be subjected to a hydrostatic test pressure of 150 percent of the design oil operating pressure, with the steam side open to the atmosphere. Any signs of leakage shall be cause for rejection.

4.5.2.2 Steam side. The steam side of each heater shall be subjected to a hydrostatic test pressure of 150 percent of the design steam operating pressure, with the oil side open to the atmosphere. Any signs of leakage shall be cause for rejection.

4.6 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing and marking for shipment, stowage and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.5.)

5.1 General.

5.1.1 Navy fire-retardant requirements.

(a) Treated lumber and plywood. Unless otherwise specified (see 6.2.1), all lumber and plywood including laminated veneer material used in shipping containers and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B - Type II - weather resistant.
Category 1 - general use.

Level C - Type I - non-weather resistant.
Category 1 - general use.

(b) Fiberboard. Fiberboard used in the construction of class-domestic, non-weather resistant fiberboard, cleated fiberboard boxes including interior packaging forms shall meet the flame spread index and the specific optic density requirements of PPP-F-320 and amendments thereto.

5.2 Preservation. Preservation shall be level A, C, or commercial, as specified (see 6.2.1).

5.2.1 Levels A and C. Heaters constructed of corrosion-resistant material (nonferrous) shall be unit protected in accordance with method III of MIL-P-116. Heaters constructed of material susceptible to corrosion (ferrous material) shall have their exteriors painted with one coat of zinc chromate primer in accordance with TT-P-645. Unpainted surfaces of heaters constructed of material susceptible to corrosion shall be unit protected in accordance with method I of MIL-P-116, by applying preservative P2 of MIL-P-116. Preservative shall not be applied to the steam or oil side of heaters.

5.2.1.1 Closure of openings. Openings shall be sealed with pressure sensitive waterproof tape, plastic or metal caps or plugs, or waterproof barrier material. Where covered openings are vulnerable to puncture, the covering shall be further protected by hardboard, wood, plywood, or metal covers.

5.2.2 Commercial. Heaters shall be preserved in accordance with ASTM D 3951 with closure of openings as specified in 5.2.1.1.

5.3 Packing. Packing shall be level A, B, C, or commercial as specified (see 6.2.1).

5.3.1 Levels A, B, and C and containers. Each heater shall be anchored, blocked, braced, and cushioned in its shipping container in accordance with MIL-STD-1186 and the applicable container specification or appendix thereto. Shipping containers shall be of wood or wood cleated plywood box construction, or wood crates of the open or closed type as specified in the shipping container requirements of MIL-STD-2073-1, appendix C thereto. Boxes exceeding a gross weight of 200 pounds shall be modified with skids in accordance with the applicable box specification. Crates shall be used for heaters exceeding the weight limitations of the applicable box specification. Heaters, when shipped in open type crates, shall be provided with a flexible, reinforced waterproof, barrier material shroud in accordance with the applicable crate specification or appendix thereto. The plastic shroud thickness shall be a minimum of 0.0006 inch. Shrouds shall be secured to prevent damage or loss during handling, shipment, and storage. Shipping container closure shall be in accordance with the applicable container specification or appendix thereto.

5.3.2 Commercial. Heaters preserved as specified (see 5.2) shall be packed for shipment in accordance with ASTM D 3951 and herein.

5.3.2.1 Container modification. Shipping containers exceeding 200 pounds gross weight shall be provided with a minimum of two, 3- by 4-inch nominal wood skids laid flat, or a skid- or sill-type base which will support the material and facilitate handling by mechanical handling equipment during shipment and storage.

5.4 Marking, levels A, B, C, and commercial. In addition to any special marking required (see 6.2.1), shipping containers shall be marked for shipment and storage in accordance with MIL-STD-2073-1, appendix F, and shall include bar codes and applicable packaging acquisition options as specified (see 6.2.1). Heater serial number shall be marked on one face of the shipping container.

6. NOTES

6.1 Intended use. These heaters are intended for shipboard use in heating lubricating oil in the lubricating systems of Naval machinery. The purpose in heating the oil is to render its viscosity suitable for purification of the oil or for start-up of systems from a cold condition.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type required (see 1.2).
(c) When first article inspection is required (see 3.1 and 4.4).
(d) Whether shock tests are required, and if so, the required shock test grades (see 3.9.1 and 3.9.2).
(e) Diameter of holes for bolts stressed in shear if different from those specified (see 3.9.3).
(f) Grade of oil to be heated (cite symbol), oil flow in gallons per minute, and oil temperature rise to be achieved in °F (see 3.10).
(g) Pressure and condition of heating steam and working pressure of oil if other than the standard conditions (see 3.11.1).
(h) Allowable design pressure drop on oil side, lb/in^2 (see 3.11.2).
(i) When fire-retardant materials are not required (see 5.1.1).
(j) Level of preservation, packing and marking required (see 5.2, 5.3 and 5.4).
(k) Identity of drawing review agency (see 6.7).

6.2.2 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DoD FAR Supplement, Part 27, Sub-Part 27.475-1 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification are cited in the following paragraphs.

Paragraph no.	Data requirement title	Applicable DID no.	Option
3.9.1	Reports, equipment shock test	UDI-T-23753	----
3.9.1.2	Request, shock test extension action	UDI-T-23763	----
3.16	Drawings, engineering and associated lists	DI-E-7031	----
4.1.2	Inspection system program plan	DI-R-4803	----
4.4.7	First article inspection report	DI-T-4902	----

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5010.12-L., AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 First article. When a first article inspection is required, the item should be a first article sample. The first article should consist of one unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired 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 contract.

6.4 Provisioning. Provisioning Technical Documentation (PTD), spare parts, and repair parts should be furnished as specified in the contract.

6.4.1 When ordering spare parts or repair parts for the equipment covered by this specification, the contract should state that such spare parts and repair parts should meet the same requirements and quality assurance provisions as the parts used in the manufacture of the equipment. Packaging for such parts should also be specified.

6.5 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.6 Cross-reference of heater types. Shipboard lubricating oil heater types I through III were known formerly (before 1986) as types C through E, respectively. This change in type designation does not affect heater ability to be stored or used. Old stocks of heaters need not be altered merely to change type designation. Shipboard lubricating oil heater types formerly known as A and B have been deleted from this specification.

6.7 Drawing review agency. As used herein, the drawing review agency is generally a Government Command or agency (such as NAVSEA) or a commercial shipbuilder, or an authorized representative of either. Communication with the drawing review agency should be arranged through the acquiring activity.

6.8 Subject term (key word) listing.

Heat exchangers
Heating elements
Purification

6.9 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 4420-N059)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-H-17428B(SH)	HEATERS, FLUID, INDUSTRIAL (LUBRICATING OIL) (FOR NAVAL SHIPBOARD USE)

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.