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MILITARY SPECIFICATION

COOLERS, FLUID, INDUSTRIAL, NAVAL SHIPBOARD

(SAMPLE WATER COOLERS)

1. SCOPE

1.1 Scope. - This specification covers sample water coolers for Naval shipboard application. Coolers are normally used for cooling samples of water for chemical testing.

1.2 Classification. - The coolers shall be of the following types and classes, as specified (see 6.1):

Type I - For cooling samples of water from the boiler. Shell and coil design, with water sample circulated through the coil and cooling fluid (salt water) circulated through the shell.

Type II - For cooling samples of deaerated feed water for oxygen determination.

Class 1 - Shell and coil design with water sample circulated through the coil and cooling fluid (chilled fresh water) circulated through the shell.

Class 2 - Double tube design with water sample circulated through the inner tube and cooling fluid (chilled fresh water) circulated through the outer tube.

2. APPLICABLE DOCUMENTS

2.1 The following specifications, standards and drawings, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-585 - Boxes, Wood, Wirebound.
PPP-B-591 - Boxes, Fiberboard, Wood-Cleated.
PPP-B-601 - Boxes, Wood-Cleated, Plywood.
PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636 - Boxes, Fiberboard
PPP-T-60 - Tape, Pressure Sensitive Adhesive, Waterproof-for Packaging and Sealing.
PPP-T-76 - Tape, Pressure-Sensitive Adhesive, Paper, Water Resistant.

MILITARY

MIL-P-116 - Preservation, Methods of
MIL-B-857 - Bolts, Nuts and Studs
MIL-S-901 - Shockproof Equipment, Class HI (High Impact) Shipboard Application, Tests for
MIL-D-963 - Drawings, Production, Procedure for Procurement of
MIL-B-10377 - Boxes: Wood-cleated, Veneer, Paper Overlaid
MIL-L-10547 - Liners, Case, Waterproof
MIL-C-15726 - Copper-nickel Alloy Rods, and Flat Products (Flat Wire, Strip, Sheet, Bar, and Plate)
MIL-T-16420 - Tube, Copper-nickel, (70-30 and 90-10), Seamless and Welded
MIL-A-17472 - Asbestos Sheet Compressed (Packing Material)
MIL-E-19323 - Electrodes, Welding, Covered, Copper-nickel Alloy

STANDARDS

MILITARY

MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-278 - Welding and Allied Processes for Machinery for Ships for the United States Navy.

DRAWINGS

BUREAU OF SHIPS

B-214 - Root Connections for Attaching Piping.

(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 shall apply.

OFFICIAL CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules.

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

AMERICAN STANDARD
ASA B31.1 - Code for Pressure Piping.

(Application for copies should be addressed to the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, New York.)

AMERICAN SOCIETY FOR TESTING MATERIALS

B-42	- Seamless Copper Pipe, Standard Sizes
B-43	- Seamless Red Brass Pipe, Standard Sizes
B-88	- Seamless Copper Water Tube
B-98	- Copper-Silicon Alloy Rod, Bar, and Shapes
B-139	- Phosphor Bronze Rod, Bar, and Shapes
B-143	- Tin-Bronze and Leaded, Tin-Bronze Sand Castings
B-150	- Aluminum Bronze Rod, Bar, and Shapes
B-152	- Copper Sheet, Strip, Plate, and Rolled Bar
B-164	- Nickel-Copper Alloy Rods and Bars (Tentative)
B-171	- Copper-Alloy Condenser Tube Plates

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.)

3. REQUIREMENTS

3.1 Preproduction unit. - When specified (see 6.1), a preproduction unit shall be furnished and subjected to the tests of 4.2.

3.2 Materials. -

3.2.1 Type I. - The materials for type I coolers shall conform to the requirements of table I.

3.2.2 Type II. - The materials for type II coolers shall conform to the requirements of table II.

3.3 Welding. - Welding and allied processes shall be in accordance with Standard MIL-STD-278.

3.4 Design. -

3.4.1 The coolers shall be of the lightest and most compact design consistent with reliability.

3.4.2 Shockproofness. - The design of the coolers shall be such that they will be capable of withstanding the high impact shock tests specified in 4.2(b).

3.4.3 Supports. - Each cooler shall be provided with a bracket for mounting.

3.4.4 Coil wall thickness. - Minimum wall thickness of coils shall be determined by use of the formula given in the Code for Pressure Piping, except that for type I coolers, coil wall thickness shall not be less than 0.065 inch. For the composition 70-30 copper-nickel alloy specified for type I coolers, the maximum allowable fiber stress shall be 9600 pounds per square inch (p. s. i.).

3.4.5 External connections. - Coil circuit external connections shall terminate in 1/2 inch iron pipe size diameters and shell external connections shall terminate in 3/4 inch iron pipe size diameters, unless otherwise specified (see 6.1). External connections shall conform to Drawing B214 and shall extend 4 inches outside the shell. Flange or sleeve requirements for external connections, when required, shall be as specified (see 6.1).

3.4.6 Special provisions for type I coolers. - The design shall provide a minimum clearance of 1/8 inch between adjacent turns of the coil, between coil and shell, and between coil and baffles when used, to permit free flow of coolant. Coil supports or spacers, if used, shall be silver brazed to the coil at all points of contact or close clearance, in order to avoid the formation of crevices. All joints in the coil circuit (subjected to boiler pressure) shall be socket welded.

3.4.7 Capacity. - The surface provided shall be based on a 10 percent fouling factor applied to the overall heat transfer coefficient for clean tube surface.

3.4.7.1 Type I. - The cooler shall be designed for an operating pressure of 1415 pounds per square inch gage (p. s. i. g) and to cool 0.25 gallons per minute (g. p. m.) from 590° F. to 100° F., unless otherwise specified (see 6.1), using sea water at 85° F.

Table I - Materials for type I

Part	Material	Specifications
Shells and shell internals	Copper-nickel-alloy[1]	MIL-C-15726
	Copper-nickel-alloy[1]	MIL-T-16420
	Valve-Bronze; or Gun-metal	ASTM B143 alloy 2A
		ASTM B143 alloy 1B
Coils[2]	Copper-nickel-alloy composition 70-30	MIL-T-16420
Bolts[3] for joints involving salt water tightness:		
For submarine service	Nickel-copper-alloy class a	ASTM B164
For other service	Aluminum bronze, stress relieved phosphor bronze; or copper-silicon alloy	ASTM B150 alloy 3 ASTM B139 alloy A or D ASTM B98
Nuts[3] for joints involving salt water tightness:		
For submarine service	Nickel-copper-alloy	ASTM B164
For other service	Aluminum bronze, stress relieved phosphor bronze; or copper-silicon-alloy	ASTM B150 alloy 3 ASTM B139 alloy A or D ASTM B98
Bolts and nuts for other use	Steel[4]	MIL-B-857
Gaskets	Compressed asbestos	MIL-A-17472
Welding electrode	Copper-nickel	MIL-E-19323

[1] Where cooling will be by a submarine salt water system subject to submergence pressure (see 6.1) copper-nickel alloy shall be composition 70-30.
[2] Specification MIL-T-16420 shall be applicable for chemical and physical properties. Outside diameter and wall thickness of coil may be as required (see 3.4.4).
[3] Form shall be in accordance with Specification MIL-B-857.
[4] Steel bolts and nuts shall be coated in accordance with Specification MIL-B-857.

Table II - Material for type II

Part	Material	Specification
Shell and shell internals	Bronze, aluminum, wrought[1]; brass, Naval wrought; pipe, red brass copper, rolled; pipe, copper gun metal; or valve bronze	ASTM B150 alloy 3 ASTM B171 ASTM B43 ASTM B152 ASTM B42 ASTM B143 alloy 1B ASTM B143 alloy 2A
Coil or tubes	Tubing, copper	ASTM B88
Bolts and nuts	Steel[2]	MIL-B-857
Gaskets	Compressed asbestos	MIL-A-17472

[1] Parts fabricated of bronze, aluminum, wrought shall be adequately annealed to prevent stress corrosion cracking.
[2] Steel bolts and nuts shall be coated in accordance with Specification MIL-B-857.

3.4.7.2 Type II. - The cooler shall cool 0.125 g.p.m. of sample water from 260° F. to 70° F. when supplied with coolant from a source of chilled fresh water (see 6.1). The amount of coolant required shall be the minimum possible. Coolant operating pressure shall be 66 p.s.i.g.; sample water operating pressure 50 p.s.i.g.

3.4.8 Hydrostatic pressure. - The cooler shall withstand, without leakage, rupture, bulge or flow, the following pressures under hydrostatic test:

	Coil	Shell	Inner Tube	Outer tube
Type I	[1] 2123 p.s.i.g.	[2] 225 p.s.i.g.	----------	----------
Type II, class 1	75 p.s.i.g.	100 p.s.i.g.	----------	----------
class 2	----------	----------	75 p.s.i.g.	100 p.s.i.g.

[1] Unless otherwise specified (see 6.1).
[2] Unless salt water cooled and to be used on submarines (see 6.1).

3.5 Drawings. - Drawings shall be furnished in accordance with Specification MIL-D-963.

3.5.1 Types of drawings. - In lieu of the drawing types listed in Standard MIL-STD-7, the following types are required.

3.5.1.1 An internal arrangement drawing, called "Outline Drawing" shall be furnished. This drawing shall show all necessary external views of the cooler and shall include all external dimensions necessary for guidance of the shipyard in installation of the cooler.

3.5.1.2 A drawing showing complete longitudinal and transverse cross-sectional views of the cooler called "Assembly Drawing" shall be furnished. This drawing shall be such that a thorough understanding of the design and construction of the cooler may be obtained without reference to related detail drawings.

3.5.1.2.1 The assembly drawing shall contain a list of materials showing names and materials of parts with identifying numbers. These numbers shall also be shown adjacent to the parts depicted in the various views, with arrows pointing to the parts.

3.5.1.3 Detail drawings completely dimensioned and with welding symbols indicated shall be furnished as required for manufacturing.

3.5.2 Outline, assembly and detail drawings may be combined on one sheet if desired.

3.5.3 Ship's drawing. - One drawing shall be a ship's drawing. It shall be titled "DRAWING LIST AND PERFORMANCE DATA FOR. . . . . SAMPLE WATER COOLER". (Type of cooler, for example, boiler, or deaerating feed tank, to be entered to complete the title.) A list of materials is not required for this drawing.

3.5.3.1 The "drawing list" tabulation shall include the following columns:

(a) Drawing title.
(b) Manufacturer's drawing number.
(c) Bureau or agency drawing number.
(d) Revision symbol.

This list shall include all drawings which comprise the given design. The revision symbol column shall be kept up to date to the time of manufacture so that it will finally indicate the latest revision of each drawing applicable to the equipment as built.

3.5.3.2 The "performance data" tabulation shall include the following:

(a) Identification of cooled and cooling mediums.
(b) Flow rate of cooled and cooling mediums (g.p.m.).
(c) Inlet temperature of cooled and cooling mediums (° F.).
(d) Outlet temperature of cooled and cooling mediums (° F.).
(e) Velocities of cooled and cooling mediums through coil and shell (feet per second).
(f) Working pressures of cooled and cooling mediums (p.s.i.g.).
(g) Test pressure, shell side (p.s.i.g.).
(h) Test pressure, coil side (p.s.i.g.).
(i) Logarithmic mean temperature difference (° F.).
(j) Heat transfer rates for both service and clean tube conditions (British thermal units (B.t.u.) per hour per square foot per ° F. logarithmic mean temperature difference).
(k) Cooling surface (square feet).
(ℓ) Heat transfer capacity at design point (B.t.u. per hour).

3.5.3.3 The ship's drawing shall include notes identifying the contract or order, the application (service) of the unit, the number of coolers per ship and per unit of parent equipment (such as boiler, or deaerating feed tank) and the dry and wet weights of the cooler.

3.5.3.4 The ship's drawing shall also include a view of the identification plate with all data entered, except date of manufacture and serial number. This view shall be enlarged when necessary to insure that data entries will meet lettering size requirements of Specification MIL-D-963.

3.5.3.5 Above the title block of this drawing there shall be entered the designations of the applicable vessels.

3.6 Painting. - Coolers shall not be painted.

3.7 Identification and information plates. - Identification and information plates of sheet or cast brass or bronze shall be furnished.

3.7.1 Identification plates. - Identification plates shall include the following:

(a) Name, that is, sample water cooler.
(b) Type and class, if applicable.
(c) Manufacturer's service part number.
(d) Federal stock number (allow 17 spaces).
(e) Manufacturer's name.
(f) Contract number.[1]
(g) Date manufactured.
(h) Serial number.
(i) Blank space for Government inspector's stamp.
(j) Maximum test pressure, shell side.
(k) Maximum test pressure, coil side.
(ℓ) Blank space for "unit" number.[2]
(m) The initials "U.S.".

[1]The bureau or agency contract or order number applying to the cooler purchase.
[2]This space is reserved for marking by the shipyard at time of installation.

3.7.2 Information plates. - Each type II cooler shall be provided with an information plate carrying the legend "WARNING - DO NOT USE AS BOILER SAMPLE WATER COOLER". This plate shall not be smaller than 4 by 1-1/2 inches, and the lettering shall not be less than 7/32 inch high. This plate shall be directly above the identification plate.

3.8 Workmanship. - The workmanship shall be first class in every respect.

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. 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 Preproduction testing. - Preproduction testing when specified (see 6.1) shall consist of the following:

(a) Performance test - A performance test shall be conducted to determine compliance with 3.4.7.1 or 3.4.7.2, as applicable. This test shall include accurate measurements of coolant and cooled medium flows, pressure drops, and heat dissipated.
(b) Shock test - The preproduction model shall be class HI shock tested in accordance with Specification MIL-S-901.

4.2.1 The tests specified in 4.2 will be conducted at a laboratory satisfactory to the Bureau of Ships.

4.3 Production inspection. -

4.3.1 Hydrostatic test shall be performed to insure compliance with the requirements of 3.4.8.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging (see 6.1). -

5.1.1 Level A. - Coolers shall be preserved and packaged in accordance with method III of Specification MIL-P-116. Dry air shall be circulated through the cooler to eliminate residual moisture. All openings shall be sealed with tape conforming to type I or type II, class 1 of Specification PPP-T-60. Each cooler shall then be packaged in a fiber box conforming to Specification PPP-B-636.

5.1.2 Level C. - Coolers shall be preserved and packaged in accordance with the manufacturer's commercial practice.

5.2 Packing. -

5.2.1 Level A. - Coolers, preserved and packaged for level A or C as specified (see 6.1) shall be packed in overseas type, wood cleated fiberboard, nailed wood, wirebound wood, fiber, wood cleated veneer paper overlaid, or wood cleated plywood boxes conforming to Specification PPP-B-591, PPP-B-621, PPP-B-585, PPP-B-636 (class 3), MIL-B-10377, or PPP-B-601, respectively, at the option

of the contractor. Shipping containers shall have caseliners conforming to Specification MIL-L-10547 and shall be closed and sealed in accordance with the appendix thereto. Caseliners for boxes conforming to Specification PPP-B-636 may be omitted provided all joints and corners of the boxes are sealed with minimum 1-1/2 inch wide tape conforming to Specification PPP-T-76. Boxes shall be closed and strapped in accordance with the applicable box specification or appendix thereto. The gross weight of wood or wood cleated boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.2 Level B. - Coolers, preserved and packaged for level A or C as specified (see 6.1) shall be packed in domestic type wood cleated fiberboard, nailed wood, wirebound wood, cleated plywood or wood cleated veneer paper overlaid boxes or class 2 fiber boxes conforming to Specification PPP-B-591, PPP-B-621, PPP-B-585, PPP-B-601, MIL-B-10377 or PPP-B-636, respectively, at the option of the contractor. Box closures shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.3 Level C. - Coolers, preserved and packaged, for level A or C as specified (see 6.1) shall be packed in containers which will insure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with the Uniform Freight Classification Rules or other regulations, as applicable, to the mode of transportation.

5.3. Marking. - In addition to any special marking required by the contract or order or herein, interior and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129.

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) Whether iron pipe size diameters shall differ from those specified (see 3.4.5).
(d) Whether flanges or sleeves (state applicable flange standard) shall be attached to external connections (see 3.4.5).
(e) For type I coolers, sample water operating pressure and temperatures when other than as specified in 3.4.7.1.
(f) For type II coolers, temperature and maximum permissible flow rate of the chilled coolant (see 3.4.7.2).
(g) For type I coolers, coil hydrostatic test pressure, when other than as specified in 3.4.8.
(h) Type I coolers, shell side hydrostatic test pressures if salt water cooled and if to be used on submarines (see 3.2.1 and 3.4.8). (For this application it will be necessary to design the shell for full submergence pressure and hydrostatic test to 1-1/2 times submergence pressure).
(i) Whether a preproduction unit is required (see 3.1 and 4.2).
(j) Selection of applicable level of preservation and packaging and packing (see 5.1 and 5.2).
(k) That bidders should furnish with bids, two sets of preliminary cross sectional drawings showing pertinent features of the design and overall dimensions.

6.2 Installation recommendations. - As a matter of information, it should be noted that the coolant flow rate to the type II cooler (deaerated feed water sample cooler) is so limited on some ships that it may be necessary to use a type I cooler (salt water cooled) in series between DFT and the type II cooler in order to reach the required 70° F. sample water outlet temperature.

Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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