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MIL-H-16235C(SHIPS)
8 May 1963
SUPERSEDING
MIL-H-16235B(SHIPS)
29 September 1955

MILITARY SPECIFICATION

HEATERS, VENTILATION, DUCT TYPE, SHIPBOARD

1. SCOPE

1.1 Scope. - This specification covers duct type ventilation heaters for use in heating, ventilating and air conditioning systems aboard ship.

1.2 Classification. - Ventilation heaters shall be of the following types as specified (see 6.1).

Type I - Standard construction.
Type II - Non-magnetic construction.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL
TT-P-664 - Primer Coating, Synthetic, Rust-Inhibiting, Lacquer-Resisting.

MILITARY
MIL-S-901 - Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment or Systems, Requirements for.
MIL-D-963 - Drawings, Electrical, Hull and Mechanical Equipment For Naval Shipboard Use.
MIL-F-1183 - Fittings, Tube, Cast Bronze, Silver-Brazing.
MIL-Q-9858 - Quality Control System Requirements.
MIL-P-15328 - Primer, Pretreatment, Formula No. 117, for Metals.
MIL-E-15599 - Electrodes, Welding, Covered; Low- and Medium-Carbon Steel.
MIL-P-17545 - Primer Coating, Steel Ship Maintenance, Alkyd-Red Lead Type, Formula No. 116.

STANDARDS

MILITARY
MIL-STD-278 - Welding and Allied Processes for Machinery for Ships of the United States Navy.

DRAWINGS

BUREAU OF SHIPS
S3802-66970 - Ventilation Heater for Shipboard Use.

PUBLICATIONS

BUREAU OF SHIPS
NAVSHIPS - 250-637-2 Instructions for Torch Brazing of Ferrous and Non-Ferrous Piping.

FSC 4520

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

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

OFFICIAL CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules.

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

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
Standard 33-58 - Methods of Testing and Rating Forced-Circulation Air Heating and Air Cooling Coils.

(Application for copies should be addressed to the American Society of Heating Refrigerating and Air-Conditioning Engineers, 345 East 47th Street, New York 17, N. Y.).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
A93 - Zinc Coated (Galvanized) Iron or Steel Sheets, Coils, and Cut Lengths.
A164 - Electrodeposited Coatings of Zinc on Steel.
A165 - Electrodeposited Coatings of Cadmium on Steel.
A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.
A415 - Hot-Rolled Carbon Steel Sheets, Commercial Quality.
B-6 - Slab Zinc (Spelter).
B-88 - Seamless Copper Water Tube.
B-201 - Chromate Finishes on Electrodeposited Zinc, Hot-Dipped Galvanized, and Zinc Die-Cast Surfaces.
B260 - Brazing Filler Metal.

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

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

3. REQUIREMENTS

3.1 Qualification.- The ventilation heaters furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein and has been listed on or approved for listing on the applicable qualified products list.

3.2 Materials.-

3.2.1 Materials used in the construction of the heaters shall be of high grade, free from defects, capable of being punched or formed, or both, without the creation of cracks and suitable for the purpose intended.

3.2.2 The type 1 ventilation heater shall be made of galvanized steel equal to that of ASTM A-93 with commercial thickness zinc coating, or black steel equal to that of ASTM A-415 except that the heating elements shall be made of copper.

3.2.2.1 All parts made of black steel shall be galvanized by the hot-dip process in accordance with ASTM A-386 with the spelter conforming to grade 5 of ASTM B-6, by electroplating with zinc in accordance with type LS of ASTM A-164, or by electroplating with cadmium in accordance with type NS of ASTM A-165. Electroplating with zinc or cadmium shall be followed by a chromate treatment conforming to ASTM B-201.

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3.2.3 The type II ventilation heater shall be made of aluminum, brass, copper or corrosion-resisting steel which has a permeability of less than 2.0 after fabrication. The heating element shall be made of copper.

3.2.4 Dissimilar metals. - Aluminum and aluminum alloys shall not be placed in direct contact with copper or any copper bearing alloys.

3.3 Design and construction. -

3.3.1 General design and construction. - Ventilation heaters shall be of the double tube type except for heaters with four or less tubes and a face dimension length of less than 20 inches. These heaters may be of the single tube serpentine type. Tubes shall not be more than one row deep in direction of air flow and the supply and return connections shall be at the same end.

3.3.2 Shock. - The ventilation heater shall be designed for grade A, class I equipment in accordance with MIL-S-901.

3.3.3 Sizes. - Sizes of ventilation heaters shall be limited to those on Drawing S3802-66970 as specified (see 6.1).

3.3.3.1 The physical dimensions, mounting dimensions and tolerances of the ventilation heaters shall conform to Drawing S3802-66970 for sizes specified (see 6.1).

3.3.4 Casing. - The ventilation heater casing shall be of continuously welded construction, with corners of flanges made smooth and airtight by welding to receive matching duct flanges. Intermediate tube supports shall be provided when the face dimension length exceeds 23 inches and the distance between tubes supports shall not exceed 23 inches.

3.3.5 Heating element. - The heating element shall be of the double tube extended surface type consisting of 5/8 inch outside diameter (o.d.) copper tubing expanded into fins, an inner steam distributing tube of 3/8 inch o.d. copper tubing and a single header. The tubes shall conform to ASTM B-88 and shall have a minimum wall thickness of 0.035 inch for the outer tube, and 0.031 inch for the inner tube. Brazed joints of the heating element shall be made with silver brazing alloy, or phosphorous copper in accordance with ASTM B-260. Brazing procedures shall be in accordance with NAVSHIPS 250-637-2, as applicable.

3.3.5.1 The heating element for serpentine type coil shall be constructed as specified in 3.3.5, except that the header and inner steam distributing tube are not required. When used in the construction of the heating element, hairpin tubes shall have a minimum wall thickness of 0.035 inch throughout the bend and tube.

3.3.5.2 Fins shall be of the smooth continuous plate type, not less than .016 inch thick and shall be uniformly spaced. Fins shall have rolled collars with tubes expanded into the collars to form a permanent bond. Fin spacing designation (see 6.1) and minimum final temperature of air leaving a heater shall be as specified in table I. The final air temperature shall be based on 25 pounds per square inch gage (p.s.i.g.) dry saturated steam supplied to the heating element and 60°F. entering air at a heater face velocity of 1000 feet per minute (f.p.m.).

TABLE I - Fin spacing designation, and minimum final temperature.

Fin spacing designation	Fin spacing per lineal inch of tube	Final temperature, °F.
L	3	78
M	5	88
H	7-1/2	101

3.3.5.2.1 The fin surface of the heating element shall be made of copper known commercially as "electrolytic touch pitch copper".

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3.3.5.3 Brass, copper or corrosion-resisting steel ferrules shall be provided where tubes pass through tube sheets and intermediate tube supports. Tubes shall be expanded into ferrules to allow wear due to expansion and contraction to occur between ferrules and tube sheets.

3.3.5.4 When required the header (see 3.3.5), shall be made of copper and shall have a wall thickness equivalent to type K tubing of ASTM B-88. The header shall be enclosed with the supply and return connections secured to the enclosure to relieve the header joints from stresses due to external pipe whip. The enclosure shall be secured to the casing by continuous welding or by rivets spaced on not more than 2 inch centers.

3.3.5.4.1 The supply and return connections shall be fitted with unions conforming to MIL-F-1183 with pre-inserted rings. Union sizes shall be as specified on Drawing 53802-86970.

3.3.5.5 When tested as specified in 4.5, the heating element shall show no leakage.

3.4 Welding. - The surfaces of all parts to be welded shall be free from rust, scale, paint, grease and other foreign matter. All welding shall be at least equal to that required by MIL-STD-278.

3.4.1 Where zinc-coated steel is used for fabricating parts, the metallic zinc shall be removed from all points and surfaces on which welds are to be deposited and for a distance of 1/2 inch from the expected toes of the welds. In areas where the metallic zinc cannot be removed and it is necessary to weld over the zinc-coated surfaces, electrode MIL-6010 in accordance with MIL-E-15599 shall be used.

3.5 Protective coatings. -

3.5.1 Brass surfaces, copper surfaces and corrosion-resisting steel surfaces shall not be painted.

3.5.2 Aluminum alloy surfaces shall receive a thorough wash and a hot phosphoric, or chromic acid treatment, or a pretreatment coating in accordance with MIL-P-15328, prior to applying two coats of primer conforming to TT-P-664.

3.5.3 All zinc-coated surfaces including welds and areas damaged by shearing, punching, bending, welding, or any other fabricating process, shall receive a thorough wash and a hot phosphate acid treatment, or a pretreating coating in accordance with MIL-P-15328, prior to applying two coats of primer conforming to TT-P-664 or MIL-P-17545.

3.6 Identification plate. - Each ventilation heater shall be provided with an identification plate not to exceed 3 by 8 inches. The identification plate shall be etched, engraved, or cast, using either monel, brass, corrosion-resisting steel or aluminum alloy, or shall be of anodized aluminum photographic process (see 3.6.2). The identification plate shall contain the following information:

(a) Item name.
(b) Size and fin designation (see 3.6.1).
(c) Federal stock number (FSN).
(d) Component identification number (CID).
(e) Contract number.
(f) Manufacturer's name and address.

3.6.1 The letters "NM" to designate that the heater is constructed of nonmagnetic material shall be added after size and fin designation on type II ventilation heaters.

3.6.2 Anodized aluminum photographic process. - Anodized aluminum identification plates shall have the photosensitive silver compounds imbedded within the oxide layer. After photographic processing the image shall be sealed in the oxide layer by suitable chemical treatment of the layer. Stamping of additional marking information shall not be permitted.

3.7 Drawings. - Drawings delineating the equipment shall be class B and class C in accordance with MIL-D-963, and as specified herein. Class C drawings are not to be titled to show application to particular ships or purchase orders.

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3.7.1 Assembly drawings. - Assembly drawings shall show clearly the details of design, construction and shall identify each part and its location. Parts shall be identified with piece numbers in the list of material. The drawings shall show overall dimensions and tolerances. Any additional information shall be included on the drawings to reflect compliance with the requirements of this specification.

3.7.2 Certification data. - Certification data shall be furnished and shall be approved by the purchasing activity.

3.8 Workmanship. - Ventilation heaters shall be free from defects that affect their appearance or their operation. Casing tube sheets shall not show cracks due to punching or forming and fin collars shall not show cracks after tubes are expanded into collars. Fin edges shall be free of burrs and shall not be bent. Casing corners shall be square and flanges shall be parallel and as smooth as possible. The workmanship shall be first class in every respect.

4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 The supplier shall provide and maintain a quality control system acceptable to the Government for the equipment covered by this specification. The system of quality control shall be in accordance with MIL-Q-9858 supplemented as specified in 4.1.1.1. and 4.1.1.2.

4.1.1.1 Procedures shall be assembled in manual form and shall indicate organization and responsibility for control of quality.

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

4.2 Qualification tests. - 1/ Qualification tests shall be conducted at a laboratory satisfactory to the Bureau of Ships. Qualification tests shall consist of the tests specified in 4.2.1, 4.2.2 and 4.5. These tests shall be conducted on one size 27 heater, or larger, with H fin spacing (see 3.3.5.2). Qualification of the type submitted will include qualification of both types, all fin spacing designations and sizes.

4.2.1 High impact shock test. - The test shall be type A in accordance with MIL-S-901. The heater tested shall be mounted by means of standard mounting fixture 4C in accordance with MIL-S-901. The test shall be conducted after the initial heat transfer test and prior to the routine test. Evidence of fragmentation of missile effect of parts, evidence of leakage when heater is subjected to the specified hydrostatic or air pressure, reduction of heat transfer by more than 3 percent of that produced on test before the shock test shall be cause for rejection. The heat transfer rate determined as specified in 4.2.2 shall be based on the rate of condensate.

4.2.2 Heat transfer test. - The heater shall be tested prior to and after the shock test in accordance with ASHRAE Standard 33-58, except as follows:

(a) The steam supply at the heater shall be dry, saturated steam at a pressure not less than 23 p.s.i.g. nor more than 27 p.s.i.g.
(b) The mean delivered air temperature at the specified air face velocities shall not be less than that shown in table II when the inlet air temperature is 60° F.

1/ Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 8.2 and 8.3).

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Table II - Minimum delivered air pressure.

Velocity, f. p. m.	Temperature °F.
800	108
1800	98

(c) Heat transfer capacity and delivered air temperature shall be corrected to 85 p. s. i. g. steam pressure, 60°F. inlet air temperature and 1000 f. p. m. air face velocity.

4.3 Sampling for production inspection. -

4.3.1 Lot. - All ventilation heaters of the same size, fin spacing and type offered for delivery at one time shall be considered a lot.

4.3.2 Sampling for examination. - Sample ventilation heaters shall be selected at random from each lot in accordance with table III for the examination specified in 4.4. The acceptable quality level shall be 1.5 percent defective.

Table III - Sampling for examination.

Number of heaters in inspection lot	Number of heaters in sample	Acceptance number defective	Rejection number defective
40 and under	10	0	1
41 to 110	15	0	1
111 to 300	26	1	2
301 to 500	35	1	2
501 to 800	50	2	3
801 to 1300	75	3	4
1300 to 3200	110	4	5
Over 3200	150	5	6

4.4 Examination. - Each of the sample ventilation heaters selected in accordance with 4.3.2 shall be examined and measured to verify compliance with the requirements of this specification not requiring tests. The classification of defects in table IV is the minimum that is to be considered in the examination. Any heater in the sample containing one or more defects shall not be delivered, and if the number of defective heaters in any sample exceeds the acceptance number for the sample, the lot represented by the sample shall not be delivered.

TABLE IV - Classification of defects.

Categories	Defects
Critical:	
1	None defined
Major:	
101	Size and fin spacing not as specified.
102	Tubing wall thickness less than specified.
103	Incomplete, parts missing.
104	Materials defective or not as specified; materials not non-magnetic (when required).
105	Aluminum parts come in contact with copper-bearing metals.
106	Fins not uniformly spaced.
107	Defective or insecure connections between fin collars and tubes, or fin collars cracked.

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TABLE IV - Classification of defects (Cont'd).

Categories	Defects
Major: (Cont'd)	
108	Steam and drain connections damaged, not union type, not as specified.
109	Ferrules not provided, tube not secured to ferrule or ferrule not free to move at tube sheets.
110	Casing damaged, or does not provide for expansion of heater tubes.
111	Mounting dimensions not as specified (see 3.3.3 and 3.3.3.1).
112	Overall dimensions exceed the specified limits (see 3.3.3 and 3.3.3.1).
Minor:	
201	Painting damaged, incomplete, or not as specified.
202	Identification plate marking not complete, missing, not permanent, illegible or not as specified.

4.5 Hydrostatic test. - The heating element of each assembled heater shall be tested with 200 p. s. i. g. air pressure while immersed in water of 300 p. s. i. g. hydrostatic pressure.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early equipment installation. -

5.1.1 Ventilation heaters. -

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

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

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

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

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

5.2.1.1 Preservation and packaging. -

5.2.1.1.1 Ventilation heaters. -

5.2.1.1.1.1 Level A. - Each heater shall be unit protected and packaged in accordance with method III of MIL-P-116. Contact preservative is not required. Each heater shall be provided with a waterproof cover fabricated from barrier-material conforming to UU-P-271, or minimum 0.003 inch thick polyethylene. Covers shall be sealed with gummed paper tape conforming to PPP-T-76 or equivalent.

5.2.1.1.1.2 Level C. - Preservation and packaging shall be sufficient to afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use. This level may conform to the supplier's commercial practice when such meets the requirements of this level.

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5.2.1.2 Packing.-

5.2.1.2.1 Level A.- Each heater, packaged as specified in the contract or order, shall be packed in containers conforming to any one of the following specifications at the option of the contractor:

Specification	Type or Class
PPP-B-591	Overseas type
PPP-B-601	Overseas type
PPP-B-621	Class 2
PPP-B-636	Class 2

When required, shipping containers shall have case liners conforming to MIL-L-10547. Case liners shall be closed and sealed in accordance with the appendix to MIL-L-10547. Case liners for fiberboard boxes, PPP-B-636, may be omitted provided all center and edge seams and manufacturer's joints are sealed and waterproofed with pressure sensitive tape in accordance with the applicable fiberboard box specification. Shipping containers shall be closed, strapped or banded in accordance with the applicable box specification or appendix thereto. Fiberboard boxes shall not exceed the weight limitations of the fiberboard box specifications. Fiberboard boxes conforming to class 2 of PPP-B-636 closed, sealed and banded as specified herein may be used as the shipping container.

5.2.1.2.2 Level B.- Each heater packaged as specified in the contract or order, shall be packed in containers conforming to any one of the following specifications at the option of the contractor:

Specification	Class
PPP-B-591	Domestic
PPP-B-601	Domestic
PPP-B-621	Class 1
PPP-B-636	Class 1

Shipping containers shall be closed in accordance with the applicable box specification or appendix thereto. Fiberboard boxes shall not exceed the weight limitations of the fiberboard box specifications.

5.2.1.2.3 Level C.- Each heater packaged as specified in the contract or order, shall be packaged in containers, at the lowest rates, in a manner which will insure acceptance by common carrier and will afford protection against physical or mechanical damage during direct shipment from the supply source to the first receiving activity for immediate use. This level shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may be the supplier's commercial practice when such meets the requirements of this level.

5.2.1.3 Marking.- In addition to any special marking required by the contract or order, interior packages and exterior shipping containers shall be marked for shipment in accordance with 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, size and fin spacing required (see 1.2, 3.3.3 and 3.3.5.2).
(c) Preservation, packaging, packing and marking required other than those required by 5.1 (see 5.2).

6.2 With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List QPL 16235, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Bureau of Ships, Department of the Navy, Washington 25, D.C. and information pertaining to qualification of products may be obtained from that activity.

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Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3).

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

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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- ☐ 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

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