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* NOT MEASUREMENT *
*   SENSITIVE   *

WW-H-191D

SUPERSEDING
WW-H-191C
September 16, 1983

FEDERAL SPECIFICATION

HEATER, FLUID, INDUSTRIAL (INSTANTANEOUS, STEAM, WATER CONVERTOR TYPE)

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers shell-and-tube water heaters that use steam in the shell to raise the temperature of a continuous flow of water.

1.2 Classification.

1.2.1 Heaters. The heaters will be of the following types and classes, as specified (see 6.2):

Type I - U tube.
Type II - Straight tube, floating head.

Class 2 - 2 pass unit.
Class 4 - 4 pass unit.

1.2.2 Rear end heads. The rear end heads will be of the following styles,as specified (see 6.2):

Style a - Integral shell cover.
Style b - Externally sealed floating tubesheet.
Style c - Outside-packed floating head.
Style d - Floating head with backing device.
Style e - Pull through floating head.

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* Beneficial comments (recommendations, additions, deletions) and any pertinent*
* data which may be of use in improving this document should be addressed to: *
* Commanding Officer (Code 156), Naval Construction Battalion Center, Port   *
* Hueneme, CA 93043-5000, by using the self-addressed Standardization   *
* Document Improvement Proposal (DD Form 1426) appearing at the end of this   *
* document or by letter.   *

FSC 4520

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

PPP-P-40 - Packaging and Packing of Hand Tools.
PPP-T-60 - Tape, Packaging, Waterproof.
PPP-B-601 - Boxes, Wood, Cleated Plywood.
PPP-B-636 - Boxes, Shipping, Fiberboard.

MILITARY

MIL-V-3 - Valves, Fittings, and Flanges (Except for Systems Indicated Herein): Packaging of.
MIL-P-116 - Preservation, Method of.
MIL-C-5501 - Cap and Plug, Protective, Dust and Moisture Seal.

STANDARDS

FEDERAL

FED-STD-123 - Marking for Shipment (Civil Agencies).
FED-STD-595 - Color.

MILITARY

MIL-STD-129 - Marking For Shipment and Storage.
MIL-STD-209 - Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment.
MIL-STD-1186 - Cushioning, Anchoring, Bracing, Blocking, and Waterproofing, with Appropriate Test Methods.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Military Specifications and Standards,, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are Department of Defense (DOD) adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents which is current on the date of the solicitation (see 6.2).

American Society of Mechanical Engineers (ASME)

ASME Boiler and Pressure Vessel Code.
Section VIII, Division 1 - Pressure Vessels.

(Application for copies should be addressed to the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street,New York, NY 10017.)

ASTM:

ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
ASTM A 285 - Pressure Vessel Plates, Carbon Steel, Low and Intermediate Tensile Strength.
ASTM A 278 - Gray Iron Castings for Pressure - Containing Parts for Temperatures Up To 650 degrees Fahrenheit.
ASTM B 75 - Seamless Copper Tube.
ASTM B 111 - Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock.
ASTM B 395 - U-Bend Seamless Copper and Copper Alloy Heat Exchanger and Condenser Tubes.
ASTM D 3951 - Commercial Packaging.

(Application for copies should be addressed to the ASTM, 1916 Race Street, Philadelphia, PA 19103.)

TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION, INC. (TEMA):

Standards for Tubular Exchanger Manufacturers Association, Class "C" Heat Exchangers.

(Application for copies should be addressed to the Tubular Exchanger Manufacturers Association, Inc., 25 North Broadway, Tarrytown, NY 10591.)

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

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Description. The heater, as referred to in this specification, is a horizontal unit, multi-pass shell and tube heat exchanger, with saturated steam flowing in the shell side and water flow in the tube side.

3.2 First article. When specified in the contract or purchase order(see 6.2), a sample shall be subjected to first article inspection (see 4.2.1 and 6.3).

3.3 Codes and standards. Each heater shall conform to the requirements of TEMA standards for class C exchanger, ASME Section VIII, Division 1, and ASTM standards, as applicable.

3.4 Standard commercial product. The heaters shall, as a minimum, be in accordance with the requirements of this specification. Features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the heater being furnished. A standard commercial product is a product which has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.5 Interchangeability. All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts.

3.6 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new and fabricated using materials produced from recovered materials to the maximum extent possible 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. Unless otherwise specified, none of the above shall be interpreted to mean that the use of used or rebuilt products are allowed under this specification.

3.7 Design. Minimum design pressure for both the shell and tube sides shall be 125 pounds per square inch gage (psig). Pressure loss of the water flowing through clean tubes shall not exceed 6 psig, and the maximum water velocity shall be 7.5 feet per second (ft/s). The maximum acceptable nozzle steam velocity shall be 6,000 feet per minute. The rated heater capacity in gallons per minute (GPM), temperature of inlet water and temperature of outlet water in degrees Fahrenheit, and the pressure of steam available at the shell nozzle (psig) shall be as specified (see 6.2).

3.8 Construction.

3.8.1 Shell. The shell shall be fabricated from seamless carbon steel pipe conforming to ASTM A 53. The shell front end shall be a bolted flanged joint. The shell rear end for type I heater shall be welded integral with the shell cover. The shell rear end for type II heater shall be a bolted flanged joint. Unless otherwise specified (see 6.2), the nominal shell diameter and shell length
(rounded off to the nearest inch) shall conform to the manufacturer's standard dimensions. The shell length for type I heater is the dimension from the face of
the front end flange to the tangent line of the rear end shell cover. The shell length for type II heater is the dimension from the face of the front and rear flanges.

3.8.2 Tubes. Tubes shall be seamless copper or copper alloy conforming to ASTM B 75, ASTM B 111, or ASTM B 395. Tubes shall be no less than 5/8-inch outside diameter and 18 gauge wall thickness.

3.8.3 Tubesheet. Tubesheet material shall be comparable for tubes specified in 3.8.2 used in commercial practice and designed that the tube bundle be removable from the shell. Tubes shall be rolled unto a single tubesheet. When specified (see 6.2), tubes shall be seal welded or brazed to the tubesheet.

3.8.4 Heads. Heads shall be fabricated from carbon steel conforming to ASTM A 285, grade C or cast iron conforming to ASTM A 278, grade 30. The front head cover shall be a one-piece flanged bonnet. The rear head for type I heater shall be an integral bonnet cover. The rear head for type II heater shall be a floating head with a one-piece flanged bonnet or flanged shell cover, as applicable. All flanged joint(s) shall be provided with metal jacketed or non-asbestos composition gasket(s).

3.8.5 Saddle support. Unless otherwise specified (see 6.2), saddle support shall be provided.

3.8.6 Impingement protection. Impingement baffle shall be provided at the steam inlet nozzle.

3.8.7 Nozzles. Nozzles 2 inches Iron Pipe Size (IPS) and smaller shall be a female pipe thread connection. Nozzles 2 1/2-inches IPS and larger shall be flanged. Unless otherwise specified (see 6.2), nozzle orientation and location shall be in accordance with manufacturer’s standard practice.

3.8.8 Vent and drain. A 3/4-inch IPS vent and drain shall be provided.

3.8.9 Instrument connections. A 3/4-inch IPS pressure gage and thermometer connection shall be provided on the pipe stub portion of the flanged nozzles.

3.9 Performance. When connected to the specified source of steam supply, the heater shall be capable of providing a continuous flow of hot water at the rated flow and temperature as specified herein (see 3.7).

3.10 Lifting and tiedown attachments. The heater shall be equipped with lifting and tiedown attachments. Lifting and tiedown attachments shall conform to type II or type III of MIL-STD-209. A nonferrous transportation plate shall be provided and mechanically attached to the heater. Transportation plates shall be inscribed with a diagram showing the lifting attachments and lifting slings, the capacity of each attachment, and the required length and size of each sling cable. A silhouette of the item furnished showing the center of gravity shall be provided on the transportation plate. Tiedown attachments may be identified by stenciling or other suitable marking. Tiedown marking(s) shall clearly indicate that the attachments are intended for the tiedown of the heater on the carrier during shipment.

3.11 System of measurement. The dimensions used in this specification are not intended to preclude the use of the metric system of measurement in the fabrication and production of the material, individual parts, and the finished product, provided form, fit, and function requirements are satisfied.

3.12 Cleaning, treatment, and painting. Surfaces normally painted in good commercial practice shall be cleaned, treated, and painted as specified herein. The color of the finish coat, conforming to FED-STD-595, shall be as specified (see 6.2). Surfaces to be painted shall be cleaned and dried to insure that they are free from contaminants such as soil, grease, welding slag and spatter, loose mill scale, water, dirt, corrosive product, or any other contaminating substances. As soon as practicable after cleaning, and before any corrosion or other contamination can result, the surfaces shall be prepared or treated to insure the adhesion of the coating system. The painting shall consist of at least one coat of primer and one finish coat. The primer shall be applied to a clean, dry surface as soon as practicable after cleaning and treating. The total dry film thickness shall be not less than 2.5 mils over the entire surface. The paint shall be free from runs, sags, orange peel, or other defects.

3.13 Identification plate. An identification plate shall be furnished by the contracting officer for each heater. The contractor shall stamp all necessary data in the blank spaces of the plate provided for that purpose, and securely affix a plate to each heater in a conspicuous place with nonferrous screws, rivets, or bolts not less than 1/8-inch in diameter. The applicable nomenclature contained in the contract item description shall be placed in the top blank. This identification plate shall be in addition to markings required in accordance with TEMA standard.

3.14 Technical publication. The technical manual, normally provided in the commercial marketplace, shall be furnished with each heater.

3.15 Repair parts and maintenance tools. When specified (see 6.2), repair parts and maintenance tools shall be furnished. The repair parts required and the quantity thereof shall be as specified in the contract, or, when applicable, shall be determined in accordance with the provisioning procedures of the contract.

3.16 Workmanship.

3.16.1 Steel fabrication. The steel used in fabrication shall be free from kinks, sharp bends, and other conditions which would be detrimental to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to insure uniformity of size and shape.

3.16.2 Bolted connections. Bolt holes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

3.16.3 Welding. Welding procedures shall be in accordance with a nationally recognized welding code. The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure

when the parts connected by the weld are subjected to proof and service loadings.

3.16.4 Castings. All castings shall be sound and free from patching, misplaced coring, warping, or any other defect which reduces the castings ability to perform its intended function.

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 (examinations and tests) 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 ensure 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

a. First article inspection (see 4.2.1).
b. Quality conformance inspection (see 4.2.2).

4.2.1 First article inspection. The first article inspection shall be performed on one heater when a first article is required (see 3.2 and 6.3). This inspection shall include the examination of 4.4 and the tests of 4.5. The first article may be either a first production item or a standard production item from the supplier's current inventory provided the item meets the requirements of the specification and is representative of the design, construction, and manufacturing technique applicable to the remaining items to be furnished under the contract.

4.2.2 Quality conformance inspection. The quality conformance inspection shall include the examination of 4.4, the hydrostatic test of 4.5.1, and the preparation for delivery inspection of 4.6. This inspection shall be performed on the samples selected in accordance with 4.3.

4.3 Sampling. Heaters of the same classification offered for delivery at one time shall be considered a lot for purpose of sampling. The unit of product shall be one complete heater. The number of unit(s), to be selected in random from the lot, for quality conformance inspection, shall be as specified (see 6.2). When a lot is rejected, the contractor may rework it to correct the defects or screen out the defective assemblies and resubmit for inspection. If the rejected lot is reworked, reinspection shall be performed to determine compliance to all specified requirements. If the rejected lot is screened, reinspection shall be limited to the defect causing rejection.

4.4 Examination. This element of inspection shall encompass all visual examinations and dimensional measurements. Noncompliance with any specified requirements or presence of one or more defects shall constitute cause for rejection.

4.5 Tests.

4.5.1 Hydrostatic test. The hydrostatic test shall be conducted in accordance with TEMA Standards. Failure of any heater to pass the test shall be cause for rejection.

4.5.2 Performance test. The first article sample shall be tested to verify compliance with the requirements of 3.7 and 3.9. The heater shall be mounted in the test piping with necessary controls and safety devices. When a continuous flow of water at the rated capacity is discharged from the heater outlet, saturated steam shall be gradually admitted to the heater shell until the steam pressure specified for the heater selected is obtained. Outlet water temperature shall be recorded after stabilization of water temperature is achieved. Failure of the heater to meet the required flow and outlet temperature specified shall be cause for rejection.

4.6 Preparation for delivery inspection. The preservation, packaging, packing, and marking of the item shall be inspected to verify conformance to the requirements of section 5.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or commercial as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning and drying. Prior to the application of preservative compounds or paint, surfaces shall be cleaned by process C-1 and dried by any applicable procedure of MIL-P-116.

5.1.1.2 Valves and fittings. Valves and fittings shall be preserved in accordance with the level A requirements of MIL-V-3.

5.1.1.3 Unprotected surfaces. Unprotected exterior metal surfaces requiring the application of a contact preservative in accordance with MIL-P-116 and not specifically provided for herein shall be preserved with P-1.

5.1.1.4 Openings. All openings into the heaters shall be sealed with caps and plugs conforming to MIL-C-5501 or with tape conforming to PPP-T-60.

5.1.1.5 Maintenance tools. Maintenance tools shall be preserved in accordance with the level A requirements of PPP-P-40.

5.1.1.6 Technical publications. Technical publications for each piece of equipment shall be preserved method 1C-1 or 1C-3.

5.1.1.7 Repair parts. The preservation application criteria and application methods of preservation of MIL-P-116 shall be used to preserve repair parts.

5.1.1.8 Consolidation. Tools, repair parts and publications for each heater shall be consolidated in containers conforming to PPP-B-636, class weather-resistant.

5.1.2 Commercial. The equipment shall be preserved in accordance with ASTM D 3951.

5.2 Packing. Packing shall be level A, B, or commercial as specified (see 6.2).

5.2.1 Level A. Heaters shall be packed in a PPP-B-621, class 2 or a PPP-B-601, overseas type container. The closure shall be in accordance with the appropriate container specification. Interior cushioning, anchoring, blocking, and bracing shall be in accordance with MIL-STD-1186.

5.2.2 Level B. Packing shall be the same as specified in 5.2.1, except the shipping containers shall be domestic type.

5.2.3 Commercial. The equipment shall be packed in accordance with ASTM D 3951.

5.3 Marking.

5.3.1 Military agencies. Shipments to military agencies shall be marked in accordance with MIL-STD-129.

5.3.2 Civil agencies. Shipments to civil agencies shall be marked in accordance with FED-STD-123.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The heaters covered by this specification are intended for hot water heating systems, as supplements to storage tanks or as converters for steam-hot water systems.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in acquisition documents:

a. Title, number, and date of this specification.
b. Type and class of heater required (see 1.2.1).
c. Style of rear end head required (see 1.2.2).
d. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
e. When a first article is required (see 3.2 and 6.3).
f. Heater capacity (GPM), inlet water temperature (degrees Fahrenheit), outlet water temperature (degrees Fahrenheit), and steam supply pressure (psig) as required (see 3.7).
g. Nominal shell diameter and shell length if other than manufacturer's standard dimensions (see 3.8.1).
h. When tubes should be seal welded or brazed to tube sheet (see 3.8.3)
i. When saddle support should not be provided (see 3.8.5).
j. Orientation and location of nozzles, if other than manufacturer's standard (see 3.8.7).
k. Color of finish coat (see 3.12)
l. When repair parts and maintenance tools are required and the parts and quantities to be furnished (see 3.15).
m. Number of samples for quality conformance inspection (see 4.3).
n. Level of preservation and level of packing required (see 5.1 and 5.2).

6.3 First article. When a first article inspection is required, the item should be tested and should be a first production item or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The first article should consist of one unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the first article.

6.4 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements should 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 should be delivered by the contractor in accordance with the contract or purchase order requirements.

6.5 Compliance. Prior to approval of the first shipment, the contractor should submit for the approval of the contracting officer, or his authorized representative, satisfactory evidence that the heater he proposed to furnish under this specification meets the requirements of TEMA standard.

6.5.1 TEMA standard. Acceptable evidence of meeting the requirements of TEMA standard should be the ASME code stamp or label.

6.6 Selection guideline. Selection guidelines shown in tables I and II were requirements in WW-H-191C and were re-printed in this section for information only.

TABLE I. Design A heater capacity.

Heater Size	Length inches	Diameter inches	Minimum required water flow rate, GPH 1/ (2 pass design) 5 psig steam	10 psig steam	25 psig steam	(4 pass design) 5 psig steam	10 psig steam	25 psig steam
1	41	6 5/8				360	460	660
2	53	6 5/8				560	620	1,200
3	65	6 5/8			800	860	1,060	1,800
4	43	8 5/8				700	900	1,300
5	55	8 5/8				1,000	1,400	2,000
6	67	8 5/8			1,600	360	2,000	3,000

TABLE II. Design B heater capacity.

Inlet water = 180 degrees Fahrenheit;
Outlet water = 200 degrees Fahrenheit

Heater Size	Length inches	Diameter inches	Minimum required water flow rate, GPH 1/ (2 pass design) 5 psig steam	10 psig steam
1	41	6 5/8	1,200	2,300
2	53	6 5/8	2,100	4,100
3	65	6 5/8	3,600	5,000
4	43	8 5/8	2,800	5,000
5	55	8 5/8	4,800	8,400
6	67	8 5/8	7,800	10,000

1/ GPM = Gallon per hour (GPH)/60.

6.7 Cross-reference of classification. The classification of heaters in this document differs from the superseded specification in the following respect:

WW-H-191C	WW-H-191D
Type I	Type I
Type II	Type II
Design A	Not designated
Design B	Not designated
Design C	Not designated
Class 2	Class 2
Class 4	Class 4
Style a - Internal	Style a - Integral shell cover
Style b - Lantern ring or double-packed	Style b - Externally sealed floating tubesheet

Style c - Outside-packed	Style c - Outside packed floating head
Style d - Pull through	Style d - Floating head with backing device
	Style e - Pull through floating head

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

MILITARY INTERESTS:

Custodians:

Navy - YD
Air Force - 99

Review Activities:

Air Force - 84
DLA - CS

User Activities:

Army - CE
Navy - MS

CIVIL AGENCY COORDINATING ACTIVITY:

GSA-FSS

Preparing Activity:

Navy - YD

(Project 4520-0331)

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein.