

SECTION 237500

HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 RELATED STANDARDS/DOCUMENTS

- A. All applicable sections of the Mechanical Requirements are part of the work of this Section.
 - a. Division 23 Section "Mechanical Vibration and Seismic Controls for HVAC"
 - b. Division 23 Section "HVAC Insulation"
 - c. Division 23 Section "Meters and Gages for HVAC"
 - d. Division 23 Section "Hydronic Piping and Valves"
 - e. Division 23 Section "High Pressure Steam Piping"
 - f. Division 23 Section "Instrumentation and Controls"
- B. The American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section VIII, Division 1 – Rules for Construction of Pressure Vessels.
- C. The National Board Inspection Code (NBIC).
- D. American National Standards Institute (ASME).
- E. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- F. Standards of the Tubular Exchangers Manufacturers Association (TEMA).
- G. International Building Code (IBC).
- H. Local health and safety codes.
- I. Current industry standards.

1.2 SUMMARY

- A. This section includes TEMA class "C" high pressure steam (HPS) to low temperature water (LTW) shell and tube heat exchangers for use with high pressure steam; also known as low temperature water converters.

1.3 DEFINITIONS

- A. High Pressure Steam (HPS) – steam pressure greater than 15 PSIG.
- B. Low Pressure Steam (LPS) – steam pressure less than 15 PSIG.
- C. Low Temperature Water (LTW) – operates at a temperature of 250°F or less. The maximum operating pressure for a LTW system is 160 PSI or less.

- D. Channel – component of the heat exchanger with low temperature water inside the tubes.
- E. Shell – component of the heat exchanger with high pressure steam outside of the tubes.
- F. Tube Bundle – heat transfer barrier between the high pressure steam and low temperature water.

1.4 SUBMITTALS

- A. Submit product data in accordance with applicable submittal standards. Submit the following:
 - a. Heat exchanger top assembly drawing – detailed equipment assemblies, dimensions, weights, required clearances and the location and size of each field connections
 - b. Operation and maintenance manual
 - c. Heat exchanger performance specifications
 - d. Heat exchanger material thickness verifications for the specified operating pressure for each of the following
 - i. Shell
 - ii. Channel
 - iii. Tubesheet
 - iv. Tubes
 - e. Heat exchanger seismic loading calculations in accordance with the IBC

1.5 QUALITY ASSURANCE

- A. Product Options: drawings shall indicate size, profiles, performance, and dimensional requirements of heat exchangers and are based on the specific equipment indicated.
- B. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. Each heat exchanger must be registered with the National Board of Pressure Vessel Inspectors.
- C. Testing and Certification: Each unit shall be factory tested prior to shipment. The factory hydrostatic test pressure shall be 1.3 times the design pressure or as required by the end user/owner. This test shall be provided for each individual shell and channel side of the heat exchanger. Provide ASME Code and National Board of Pressure Vessel Inspectors inspection and stamping for both the tube side and the shell side; the manufacturer must furnish shop inspection certificates. Individually certified shell and channel sections are not acceptable.
- D. Design of the tube bundle shall allow for expansion and contraction. Arrange the nozzles, instrumentation ports and fittings to prevent rubbing and abrasion as the system parts move during temperature changes.
- E. Each heat exchanger shall have factory installed welded saddles with drilled holes for anchors. One end must be slotted to allow for expansion and contraction.

- F. Prior to shipping, the heat exchanger internals shall be cleaned thoroughly. All exterior surfaces shall have a coating suitable for the specified operating temperature. The coating shall include the saddles. Coating applications must be in accordance with coating manufactures recommendations.
 - a. Carboline Thermaline 450
 - b. ThurmaloX 225HD

- G. General Construction: Provide for convenient removal and replacement of the tube bundle through flanged shell and channel openings. The tube bundle weight shall be indicated through stamping or nameplate identification on the tubesheet. All connections shall be tight and free of leaks at test and operating pressures. Provide a minimum of 0.0625" corrosion allowance for all carbon steel pressure parts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide by one of the following:
 - a. Howard's Engineering Heat Transfer Products – Pico Rivera, CA.
 - b. Substitutions must meet the following minimum requirements
 - i. Ten years of experience manufacturing shell and tube heat exchangers for use in HPS systems
 - ii. Demonstrate the engineering and manufacturing knowledge to manufacturer shell and tube heat exchangers for us in HPS systems
 - iii. Familiarity with the TEMA standards

2.2 LOW TEMPERATURE WATER CONVERTOR

- A. The convertors shall be installed where shown on the drawings and schedules and constructed as noted in the specifications.

- B. TEMA "C" class heat exchanger, type BEU configuration.

- C. Design
 - a. HPS clean factor – at least 0.0005 HR-FT²-°F/BTU, or as specified
 - b. LTW pressure drop – as specified
 - c. LTW velocity – not to exceed 5.0 feet/second, or as specified
 - d. LTW clean factor – at least 0.0005 HR-FT²-°F/BTU, or as specified

- D. Channel
 - a. Service – LTW
 - b. Made from pressure vessel quality carbon steel. Castings are not acceptable.
 - c. Rated for at least 150 PSI at 350°F and a minimum of 150 PSI at 0°F.
 - d. ASME B16.5, 150# (minimum) flanges for the LTW inlet and outlet.
 - e. ASME B16.11, 3000# (minimum) socket weld couplings for LTW vent (at the highest point) and drain (at the lowest point). ASME B16.5, 150# flanged connections are acceptable.

- f. Provide (2) 600# (minimum) socket weld high-pressure gate valves with a NPT threaded connection beyond the second valve.
- g. ASME B16.11, 3000# (minimum) NPT threaded coupling for LTW instrumentation connection points. ASME B16.5, 300# flanged connections are acceptable.
- h. Recessed gasket surfaces (male to female) with a depth of at least 0.19" to eliminate the possibility of gasket blow-out.
- i. Gaskets must be engineered per the manufacturer's recommendation, taking into account pressure, temperature ratings and relative gasket surface. Fiber sheet gaskets are not acceptable.
- j. Provide lifting lugs for all channels exceeding 100 pounds.

E. Shell

- a. Service – HPS
- b. Made from pressure vessel quality carbon steel. Castings are not acceptable, even as points of connection.
- c. Rated for at least 150 PSI at 350°F and a minimum of 150 PSI at 0°F.
- d. Connections larger than 2" shall be ASME B16.5 flanged.
- e. HPS inlet and outlet sizes must be sized accordingly in order to avoid tube vibration from inadequate support.
- f. Provide ASME B16.11, 3000# (minimum) NPT threaded coupling for HPS instrumentation connection points. ASME B16.5, 150# flanged connections are acceptable.
- g. Recessed gasket surfaces (male to female) with a depth of at least 0.19" deep to eliminate the possibility of gasket blow-out.
- h. Gaskets must be engineered per the manufacturer's recommendation, taking into account pressure, temperature ratings and relative gasket surface. Fiber sheet gaskets are not acceptable.
- i. Provide lifting lugs for all shells exceeding 100 pounds.
- j. Saddles must be welded to the shell with "mouse-hole" openings on each to allow for ease of drain installation.

F. Tube Bundle

- a. Service – heat transfer barrier between the high pressure steam and low temperature water.
- b. Removable type "U" tube.
- c. Proportion: over-all length to be a maximum of 5.0 times diameter of shell.
- d. Designed to freely expand and contract as determined by the service.
- e. Designed for at least 150 PSI at 350°F and a minimum of 150 PSI at 0°F on the channel side; at least 150 PSI at 350°F and a minimum of 150 PSI at 0°F on the shell side.
- f. Tube holes must be finished in a manner that will not create a direct leak path from one side to the other.
- g. Tubesheet
 - i. Must be made of pressure vessel quality carbon steel
 - ii. Must have a full bolt circle with at least (4) shoulder bolts spaced evenly to retain the shellside gasket while servicing the channel. Tapping's for the shoulder bolts are not acceptable.

- iii. Must have at least (2) pull bolts – jackscrews – spaced at least 180° apart to aid in removal of the bundle, on the channel side of the tubesheet. The diameter of the pull bolts must be at least 0.50”.
- iv. Pass rib grooves must be machined into the channel side of the tubesheet.
- h. Tubes
 - i. Must be made of 90/10 copper nickel, titanium or as deemed acceptable for use in HTW systems. Substitutions should be submitted to the owner for final approval. Copper and stainless steel are not acceptable for use in HTW systems – no exceptions.
 - ii. Diameter to be either 0.625” or 0.750”, whichever yields a better design.
 - iii. The tube pitch must be arranged to allow for ease of cleaning.
- i. Baffles
 - i. Must be made of virgin grade Teflon sheet.
 - ii. Tube hole clearance to be as required by TEMA, no exceptions.
 - iii. Baffle supports to be as required by TEMA.
 - iv. Adequately spaced to eliminate the possibility of tube vibration while complying with all other performance specifications.
 - v. Shall be fabricated and arranged to prevent abrasion and wear on the tubes during service. The design shall allow convenient removal and replacement of the tube bundle from shell.
 - vi. Notched openings at the bottom of the baffle to allow for a clear drain path.

PART 3 - EXECUTION

3.1 LOW TEMPERATURE WATER CONVERTOR

- A. Verify that heat exchangers are installed and connected according to the Contract Documents.
- B. Adjust flows and controls to deliver specified performance.
- C. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain heat exchangers as specified below:
 - a. Train Owner’s maintenance personnel to procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining heat exchangers.
 - b. Review data in maintenance manuals. Refer to Division 1 Section “Contract Closeout.
 - c. Review data in maintenance manuals. Refer to Division 1 Section “Operation and Maintenance Data.”
 - d. Schedule training with the owner/end user, through Architect, with at least seven days advance notice.

END OF SECTION 237500