# SECTION 235700 - HEAT EXCHANGERS FOR HVAC

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section includes [**shell-and-tube**] [**and**] [**plate**] heat exchangers.

### 1.3 DEFINITIONS

A. TEMA: Tubular Exchanger Manufacturers Association.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
2. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: Details and design calculations for seismic restraints for heat exchangers.

## 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Tube-removal space.
2. Structural members to which heat exchangers will be attached.

B. Seismic Qualification Certificates: For heat exchanger, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Heat Exchanger: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of heat exchanger anchorage devices on which certification is based and their installation requirements.

C. Product Certificates: For each type of shell-and-tube heat exchanger. Documentation that shell-and-tube heat exchangers comply with "TEMA Standards."

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's warranty.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including heat exchanger, storage tank, and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Shell-and-Tube, Domestic-Water Heat Exchangers:

1) Tube Coil: [**One**] <**Insert number**> year(s).
2) Other Components: [**One**] <**Insert number**> year(s).

b. Plate, Domestic-Water Heat Exchangers:

1) Brazed-Plate Type: [**One**] <**Insert number**> year(s).
2) Plate-and-Frame Type: [**One**] <**Insert number**> year(s).

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for heat exchangers.

B. Seismic Performance: Heat exchangers shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified[ **and the unit will be fully operational after the seismic event**]."
2. Component Importance Factor is [**1.5**] [**1.0**].
3. <**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

### 2.2 SHELL-AND-TUBE HEAT EXCHANGERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Description: Packaged assembly of tank, heat-exchanger coils, and specialties.

C. Construction:

1. Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
2. Fabricate and label shell-and-tube heat exchangers to comply with "TEMA Standards."

D. Configuration: [**U-tube with removable**] [**Straight tube with removable**] [**Straight tube with fixed**] bundle.

E. Shell Materials: [**Steel**] [**Stainless steel**].

F. Head:

1. Materials: [**Cast iron**] [**Cast stainless steel**] [**Fabricated steel**] [**Fabricated steel with removable cover**] [**Fabricated stainless steel**] [**Fabricated stainless steel with removable cover**].
2. Flanged and bolted to shell.

G. Tube:

1. [**Seamless copper**] [**Steel**] [**Stainless-steel**] [**Cupronickel**] [**Admiralty-metal**] tubes.

2. Tube diameter is determined by manufacturer based on service.

H. Tubesheet Materials: [**Steel**] [**Stainless steel**].

I. Baffles: [**Steel**] [**Stainless steel**].

J. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.

1. NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
2. NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

K. Support Saddles:

1. Fabricated of material similar to shell.
2. Fabricate foot mount with provision for anchoring to support.
3. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger saddles are anchored to building structure.

L. Capacities and Characteristics:

1. General:

a. Shell Diameter: <**Insert NPS (DN)**>.
b. Heat-Exchanger Length: <**Insert inches (mm)**>.
c. Heat-Exchanger Surface Area: <**Insert sq. ft. (sq. m)**>.
d. Number of Passes: <**Insert number**>.
e. Heat Exchanged: <**Insert Btu/h (kW)**>.
f. Operating Weight: <**Insert lb (kg)**>.

2. Shell Side:

a. Fluid: [**Water**] [**Steam**] <**Insert type**>.
b. Working Pressure: <**Insert psig (kPa)**>.
c. Supply Pressure: <**Insert psig (kPa)**>.
d. Steam Flow Rate: <**Insert lb/h (kg/h)**>.
e. Water Flow Rate: <**Insert gpm (L/s)**>.
f. Pressure Drop: <**Insert psig (kPa)**>.
g. Inlet Temperature: <**Insert deg F (deg C)**>.
h. Outlet Temperature: <**Insert deg F (deg C)**>.
i. Fouling Factor: <**Insert value**>.
j. Inlet Size: <**Insert NPS (DN)**>.
k. Outlet Size: <**Insert NPS (DN)**>.

3. Tube Side:

a. Fluid: [**Water**] [**Steam**] <**Insert type**>.
b. Working Pressure: <**Insert psig (kPa)**>.

c. Supply Pressure: <**Insert psig (kPa)**>.
d. Steam Flow Rate: <**Insert lb/h (kg/h)**>.
e. Water Flow Rate: <**Insert gpm (L/s)**>.
f. Pressure Drop: <**Insert psig (kPa)**>.
g. Inlet Temperature: <**Insert deg F (deg C)**>.
h. Outlet Temperature: <**Insert deg F (deg C)**>.
i. Fouling Factor: <**Insert value**>.
j. Inlet Size: <**Insert NPS (DN)**>.
k. Outlet Size: <**Insert NPS (DN)**>.

## 2.3 GASKETED-PLATE HEAT EXCHANGERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. Frame:

1. Capacity to accommodate [**20**] <**Insert number**> percent additional plates.
2. Painted carbon steel with provisions for anchoring to support.

E. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.

1. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger carrying and guide bars are anchored to building structure.

F. End-Plate Material: Painted carbon steel.

G. Tie Rods and Nuts: Steel or stainless steel.

H. Plate Material: [**0.024 inch (0.6 mm)**] [**0.031 inch (0.8 mm)**] [**0.039 inch (1 mm)**] <**Insert thickness**> thick before stamping; [**Type 304**] [**Type 304L**] [**Type 316**] [**Type 316L**] stainless steel.

I. Gasket Materials: [**Glued**] [**Glue free**] [**Nitrile rubber**] [**EPDM rubber**] <**Insert material**>.

1. Glue: Chlorine free.

J. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.

1. NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
2. NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

K. Enclose plates in solid [**aluminum**] [**stainless-steel**] removable shroud.

L. Capacities and Characteristics:

1. General:

a. Heat-Exchanger Surface Area: <**Insert sq. ft. (sq. m)**>.
b. Number of Plates: <**Insert number**>.
c. Number of Passes: [**One**] <**Insert number**>.
d. Heat Exchanged: <**Insert Btu/h (kW)**>.
e. Operating Weight: <**Insert lb (kg)**>.

2. Hot Side:

a. Fluid: [**Water**] [**Steam**] <**Insert type**>.
b. Working Pressure: <**Insert psig (kPa)**>.
c. Supply Pressure: <**Insert psig (kPa)**>.
d. Steam Flow Rate: <**Insert lb/h (kg/h)**>.
e. Water Flow Rate: <**Insert gpm (L/s)**>.
f. Pressure Drop: <**Insert psig (kPa)**>.
g. Inlet Temperature: <**Insert deg F (deg C)**>.
h. Outlet Temperature: <**Insert deg F (deg C)**>.
i. Fouling Factor: <**Insert value**>.
j. Inlet Size: <**Insert NPS (DN)**>.
k. Outlet Size: <**Insert NPS (DN)**>.

3. Cold Side:

a. Fluid: [**Water**] [**Steam**] <**Insert type**>.
b. Working Pressure: <**Insert psig (kPa)**>.
c. Supply Pressure: <**Insert psig (kPa)**>.
d. Steam Flow Rate: <**Insert lb/h (kg/h)**>.
e. Water Flow Rate: <**Insert gpm (L/s)**>.
f. Pressure Drop: <**Insert psig (kPa)**>.
g. Inlet Temperature: <**Insert deg F (deg C)**>.
h. Outlet Temperature: <**Insert deg F (deg C)**>.
i. Fouling Factor: <**Insert value**>.
j. Inlet Size: <**Insert NPS (DN)**>.
k. Outlet Size: <**Insert NPS (DN)**>.

## 2.4 BRAZED-PLATE HEAT EXCHANGERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Configuration: Brazed assembly consisting of embossed or pressed stainless-steel plates brazed together and two end plates, one with threaded nozzles and one with pattern-embossed plates.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. End-Plate Material: Type 316 stainless steel.

E. Threaded Nozzles: Type 316 stainless steel.

F. Plate Material: Type 316 stainless steel.

G. Brazing Material: [**Copper**] [**or**] [**nickel**].

H. Capacities and Characteristics:

1. General:

a. Heat-Exchanger Surface Area: <**Insert sq. ft. (sq. m)**>.
b. Heat Exchanged: <**Insert Btu/h (kW)**>.
c. Operating Weight: <**Insert lb (kg)**>.

2. Hot Side:

a. Fluid: [**Water**] [**Steam**] <**Insert type**>.
b. Working Pressure: <**Insert psig (kPa)**>.
c. Supply Pressure: <**Insert psig (kPa)**>.
d. Steam Flow Rate: <**Insert lb/h (kg/h)**>.
e. Water Flow Rate: <**Insert gpm (L/s)**>.
f. Pressure Drop: <**Insert psig (kPa)**>.
g. Inlet Temperature: <**Insert deg F (deg C)**>.
h. Outlet Temperature: <**Insert deg F (deg C)**>.
i. Fouling Factor: <**Insert value**>.
j. Inlet Size: <**Insert NPS (DN)**>.
k. Outlet Size: <**Insert NPS (DN)**>.

3. Cold Side:

a. Fluid: [**Water**] [**Steam**] <**Insert type**>.
b. Working Pressure: <**Insert psig (kPa)**>.
c. Supply Pressure: <**Insert psig (kPa)**>.
d. Steam Flow Rate: <**Insert lb/h (kg/h)**>.
e. Water Flow Rate: <**Insert gpm (L/s)**>.
f. Pressure Drop: <**Insert psig (kPa)**>.
g. Inlet Temperature: <**Insert deg F (deg C)**>.
h. Outlet Temperature: <**Insert deg F (deg C)**>.
i. Fouling Factor: <**Insert value**>.
j. Inlet Size: <**Insert NPS (DN)**>.
k. Outlet Size: <**Insert NPS (DN)**>.

## 2.5 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel [**supports**] [**cradles**] for mounting on [**floor**] [**wall**] [**structural steel**].

a. Minimum Number of Cradles: <**Insert number**>.

2. [**Factory**] [**Field**]-fabricated steel [**supports**] [**cradles**] to ensure both horizontal and vertical support of heat exchanger. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Shroud: [**Steel**] [**Stainless-steel**] [**Aluminum**] sheet.

C. Miscellaneous Components for High-Temperature Hot-Water Unit: Control valve, valves, and piping.[ **Include components fitted for pneumatic control.**]

D. Miscellaneous Components for Steam Unit: Strainers, steam-control valve, steam trap, valves, pressure gage, thermometer, and piping.[ **Include components fitted for pneumatic control.**]

E. Pressure Relief Valves: [**Cast iron**] [**Steel**] [**Bronze**] [**Brass**], <**Insert NPS (DN)**>, ASME rated and stamped.

1. Pressure relief valve setting: <**Insert psig (kPa)**>.

## 2.6 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect heat exchangers according to ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME label.

B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.

C. Heat exchangers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 SHELL-AND-TUBE HEAT-EXCHANGER INSTALLATION

A. Equipment Mounting:

1. Install heat exchangers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

B. Install heat exchangers on saddle supports.

C. Heat-Exchanger Supports: Use factory-fabricated steel cradles and supports specifically designed for each heat exchanger.

## 3.3 GASKETED-PLATE HEAT-EXCHANGER INSTALLATION

A. Install gasketed-plate heat exchanger on custom-designed wall supports anchored to structure as indicated on Drawings.

B. Install metal shroud over installed gasketed-plate heat exchanger according to manufacturer's written instructions.

## 3.4 BRAZED-PLATE HEAT-EXCHANGER INSTALLATION

A. Install brazed-plate heat exchanger on custom-designed wall supports anchored to structure as indicated on Drawings.

## 3.5 CONNECTIONS

A. Comply with requirements for piping specified in other Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements for steam and condensate piping specified in Section 232213 "Steam and Condensate Heating Piping" and Section 232216 Steam and Condensate Piping Specialties."

C. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.

D. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

E. Install shutoff valves at heat-exchanger inlet and outlet connections.

F. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

G. Install vacuum breaker at heat-exchanger steam inlet connection.

H. Install hose end valve to drain shell.

I. Install thermometer on heat-exchanger and[ **inlet and**] outlet piping, and install thermometer on heating-fluid[ **inlet and**] outlet piping. Comply with requirements for thermometers specified in Section 230519 "Meters and Gages for HVAC Piping."

J. Install pressure gages on heat-exchanger and heating-fluid piping. Comply with requirements for pressure gages specified in Section 230519 "Meters and Gages for HVAC Piping."

## 3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections[ **with the assistance of a factory-authorized service representative**]:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Heat exchanger will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.7 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

## 3.8 DEMONSTRATION

A. [**Engage a factory-authorized service representative to train**] [**Train**] Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 235700