D-8 OUTLINE SPECIFICATION FOR HTHW HEAT EXCHANGERS

GENERAL: This document provides performance requirements and guideline information for Heat Exchanger equipment for Colorado College only, and is not intended for use, in whole or in part, as a specification. The purpose of providing this information is to communicate overall site-specific information and technical requirements for the Consultants review prior to the design phase of any project. The Owner believes this information will enhance the overall design of any mechanical project for Colorado College by keeping design solutions both simple and effective for the operations of the campus. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of the document to the Colorado College Facilities Services.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes shell-and-tube heat exchangers utilizing High Temperature Hot Water (HTHW) for heating hot water and domestic hot water applications.

1.2 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. Maintenance Data: For heat exchangers to include in maintenance manuals specified in Division 1.

C. Warranties: Special warranties specified in this Section.

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

1.3 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.
C. Warranty Period: not less than ten (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Shell-and-Tube Heat Exchangers:
   a. Adamson.
   b. Aerco
   c. Amtrol, Inc.
   d. Armstrong Fluid Handling; Div. of Armstrong International, Inc.
   e. Patterson-Kelley Co.; Div. of Harsco Corp.
   f. Taco, Inc.

2. Cast Steel Valves (Gate, Globe, and Check)
   a. Crane
   b. Newco
   c. Stockham
   d. Velan

3. Forged Steel Valves (Gate, Globe, and Check)
   a. Anvil
   b. Newco
   c. RP&C Valve
   d. Velan
   e. Vogt

4. Plate Heat Exchanger
   a. Tranter “Maxchanger”

5. Control Valves
   a. Fisher, Design EZ
2.2 SHELL-AND-TUBE HEAT EXCHANGERS FOR DOMESTIC HOT WATER (ALTERNATE BID)

A. General: Shell and tube heat exchangers for heating hot water systems shall be constructed for the following temperature and pressure classifications:

1. Tube Bundle: 400 psig at 400 deg. F operating conditions.

B. Tube and Tube Sheet Materials: Seamless 90-10 Cu.Ni. tubes, 3/4-inch OD x 18 BWG tube wall thickness, with steel tube sheets.

C. Baffles: Teflon.

D. Piping Connections: Flanged head ports. Flanged or threaded shell ports.

E. Circulating Pump: Provide bronze circulating pump for domestic hot water circulation within heat exchanger, see Section 15185 for specific requirements.

2.3 SHELL-AND-TUBE HEAT EXCHANGERS FOR DOMESTIC HOT WATER (BASE BID)

A. General: Shell and tube heat exchangers for domestic hot water systems shall be constructed for the following temperature and pressure classifications:

1. Tube Bundle: 400 psig at 400 deg. F operating conditions.
2. Shell: 150 psig at 200 deg. F operating conditions.

B. Configuration: Two, four, or six pass, U-tube type design, vertical configuration. Unit shall be supported in a vertical arrangement and shall be capable of disassembly in place for maintenance and inspection purposes without disconnection of the domestic water piping.

C. Shell and Head Materials: 90-10 Cu.Ni. or stainless-steel shell and fabricated 90-10 Cu.Ni. or stainless-steel head.


E. Baffles: Teflon.

F. Piping Connections: Flanged head ports. Flanged, or threaded shell ports.

G. Accessories:
1. Temperature & Pressure Relief Valve: Bronze body, ASME rated, factory set at 150 PSIG and 210 Deg. F.
2. Circulating Pump: Bronze body, prewired to factory furnished control panel.
3. Shell Insulation: Flexible foam insulation laminated to a durable reinforced PVC jacket.

H. Controls:
1. Panel: NEMA 4 panel with hinged door and latch assembly.
3. High Limit Safety: High Limit Thermostat controlling double solenoid valves (One to dump overheated water from the heater and the other to exhaust control air from the normally closed pneumatic control valve).
4. Pneumatic Control Valve: Class 300 Cast steel valve as specified below under paragraph “Specialty Valves”. Provide with position feedback potentiometer for connection to the BAS.
5. Transducers: Provide Electric to Pneumatic transducer capable of 0-10V or 4-20 milliamp input with linear 0-20 PSI output to control valve. Transducer shall be connected to the BAS for control. Provide restrictors as required to regulate rate of movement of the valve as required.
6. Provide terminal strip for all connections to the BAS including temperature sensors. Temperature sensors will be provided by BAS system manufacturer.

2.4 PLATE HEAT EXCHANGERS

A. General: Plate heat exchangers for heating hot water systems shall be constructed for the following temperature and pressure classifications:

1. Hot Side: 500 psig at 500 deg. F operating conditions.
2. Cold Side: 500 psig at 500 deg. F operating conditions.

B. Configuration: Fully welded assembly consisting of two end plates, one with nozzles, and pattern-embossed plates. Counter flow, single pass, single or double wall design.

C. End-Plate Material: ASTM A 666, Type 316L stainless steel.

D. Plate Material: ASTM A 666, Type 316L stainless-steel, 0.060” thickness.

E. Piping Connections: Flanged, raised face Type 316 stainless-steel, class 300 for high temperature hot water supply and return, class 150 for heating hot water supply and return connections.
2.5 PIPE MATERIALS AND FITTINGS

A. High Temperature Hot Water Piping:

1. Steel pipe 2 inches and smaller: ASTM A53 or A106, Type S (seamless) welded; Grade B; Schedule 80 and plain ends.
2. Steel pipe 2-1/2 inches to 10 inches: ASTM A53 or A106, Type S (seamless) welded; Grade B; Schedule 40 and plain ends.
3. Joints: Butt-welded for pipe sizes 2-1/2 inches and above; butt-welded or socket welded for pipe sizes 2 inches and below.
4. Fittings:
   a. Welded joints: Steel, ASTM A234; Grade B; ANSI B16.9; same schedule as adjoining pipe; all elbows shall be long radius.
   b. Socket-welded joints: Forged steel; ANSI B16.11; 3000 psig class.
   c. Reducer bushings will not be allowed.
5. Unions: On piping 2 inches and under, forged steel (3000 psig).
6. Flanges: Weldneck; ANSI B16.5; forged steel; ASTM 105; 300 psig class.
   a. Bolts: High-strength; ASTM 193; Grade B7; Nuts: ASTM 194; Grade 2H.
7. Gaskets: Non-asbestos, designed for service conditions. On HTHW service utilize "Flexitallic" spiral wound, "Lamons Grafoil Grade GHR", "Lamons Spiraseal" or equal.
8. Welding Materials: Comply, with Section II, Part C. ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

2.6 SPECIALTY VALVES AND FITTINGS

A. Cast Steel Gate Valves: Class 300 cast steel body complying with ANSI/ASME B16.34. Valve design shall be outside screw and yoke, bolted bonnet, rising stem, yoke sleeves with anti-friction bearings, flexible wedge, and seal welded seats. Furnish valves with the following trim:

1. Body: Carbon steel, ASTM A216, Grade WCB.
2. Seating Trim: 13% Chrome stainless steel to cobalt based hard facing.
5. Operator: Malleable iron handwheel, ASTM A47.
6. Drain and Bypass Connections: In accordance with MSS SP-45 with forged steel globe valve as specified under paragraph “Forged Steel Globe Valves”.

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B. Forged Steel Gate Valves: Class 800 forged steel body. Valve design shall be conventional port, outside screw and yoke, bolted bonnet, rising stem, solid wedge, and threaded (renewable) seats. Furnish valves with the following trim:

2. Seating Trim: 13% Chrome stainless steel to cobalt based hard facing.
3. Packing Material: Graphite with braided graphite end rings and zinc corrosion inhibitor.
4. End Connections:
   a. Socket Weld.
5. Operator: Malleable iron handwheel, ASTM A47.

C. Forged Steel Globe Valves: Class 800 forged steel body. Valve design shall be straight or y-pattern, conventional port, outside screw and yoke, bolted bonnet, rising stem, solid wedge, and renewable seats. Furnish valves with the following trim:

2. Trim: 13% Chrome stainless steel to cobalt based hard facing.
3. Packing Material: Graphite with braided graphite end rings and zinc corrosion inhibitor.
4. End Connections:
5. Socket Weld.
6. Operator: Malleable iron handwheel, ASTM A47.

D. Cast Steel Control Valves: Class 300 cast steel body complying with ANSI/ASME B16.34. Valve design shall be straight pattern, bolted bonnet, rising stem, and yoke sleeves with anti-friction bearings. Furnish valves with the following:

1. Body: Carbon steel, ASTM A216, Grade WCB.
2. Seating Trim: 13% Chrome stainless steel to cobalt based hard facing.
3. Packing Material: Flexible graphite rings with braided graphite end rings and zinc corrosion inhibitor.
4. End Connections:
   a. Flanged class 300 complying with ASME B16.5, raised face.
5. Operator: Pneumatic normally closed operation with a 3-5 psig spring range, and feedback potentiometer.
6. Operating characteristics: Equal percentage characteristics with range of 50 to 1, and full flow pressure drop of 3-5 PSIG.

E. Strainers: Class 300 cast steel, flanged or socket weld connections, and flanged strainer access with blowdown connection. Provide with stainless steel strainer.
PART 3 - EXECUTION

3.1 PIPE APPLICATION

A. High Temperature Hot Water, NPS 2 (DN 50) and Smaller: Schedule 80 steel, seamless pipe with socket welded joints using forged steel fittings. Threaded joints where indicated.

B. High Temperature Hot Water, NPS 2 1/2(DN 65) and Larger: Schedule 40 steel, seamless pipe with buttwelded joints using Schedule 40 wrought-steel welding fittings and Class 300 wrought-steel flanges where indicated.

C. High Temperature Hot Water Drain and Vent Lines: Schedule 80 steel pipe and fittings.

D. Refer to other Division 15 Specifications for Domestic Hot Water and Heating Hot Water Piping.

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

3.3 HEAT EXCHANGER INSTALLATION

A. Install heat exchangers according to manufacturer's written instructions.

B. Install shell-and-tube heat exchangers on saddle supports with provisions to drain shell.

C. Mount plate heat exchangers on 4” concrete housekeeping pad. Anchor heat exchanger to housekeeping pad using 1-1/2”x3/8” thick Z-clips

3.4 CONNECTIONS

A. Install HTHW piping with flanged or welded connections to tube bundle head ports on heat exchangers. Install gate valve on the HTHW supply piping to each heat exchanger. Install gate valve, strainer, control valve and gate valve on
the HTHW return piping with globe valve bypass from each heat exchanger. Install drain and vent between isolation valves at each heat exchanger.

B. In HTHW piping, install 3/4" forged steel globe valves at all low points to allow draining the system.

C. In HTHW piping, install air accumulators at all high points with two (2) 1/2" forged steel globe valves to allow venting air from the system (block and bleed valve application). Vent valves shall be mounted in a horizontal position or vertically with the downstream side of the valve pointed down for drainage. Pipe air vents to floor drain with end of pipe turned down over floor drain. If floor drain is not available, pipe air vents down a wall to within 6” of the floor and a minimum of 3’ from the vent valves. Anchor vent piping within 6” of termination and every 6’.

D. Install heating hot water piping with threaded or flanged connections to shell of heat exchangers.

E. Install domestic hot water piping with threaded, soldered, or flanged connections to shell of heat exchangers.

F. Install shutoff valves at heat exchanger inlet and outlet connections.

G. Install relief valves on heat exchanger heated-fluid connection.

H. Install drain valve on the shell side of each heat exchanger and at all low points in the heating hot water system.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable roller hangers hangers for individual horizontal piping.
2. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

C. Support HTHW piping within 12” of each elbow, at each control valve, at heat exchangers and with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
3.6 CLEANING

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

3.7 COMMISSIONING

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 safeties. Replace damaged and malfunctioning controls and equipment.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining heat exchangers.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.