MEPNN Supplier Scouting Opportunity Synopsis

Section 1: General Information

Scouting Number	2024-286
Item to be Scouted	Plate and Frame Gasketed Type Heat Exchanger
Days to be scouted	30
Response Due By	10/18/2024
Description	For the construction of the new Energy and Minerals Research Facility (EMRF) for the U. S. Geological Survey (USGS) at the Colorado School of Mines (Mines), 1000 18th Street, Golden, Colorado 80401, provide packaged Plate and Frame Gasketed Type Heat Exchangers delivered to the EMRF construction site. This project is federally funded by the President Joe Biden's Bipartisan Infrastructure Law (BIL). Therefore, the material used for construction is required to be compliant with the Build America, Buy America Act (BABAA). This NIST MEP Supplier Report seeks BABAA compliant equipment that meets or exceeds the basis of design. The basis of design are Armstrong PFHX, described herein (including additional information). The basis of design equipment meets or exceeds the design requirements including the strict technical requirements, maximum size requirements, maximum delivery schedule, and the maximum cost parameters enclosed. See also the requirements stated in the enclosed specifications, drawings, dimension and performance requirements, and other documents including warranty requirements. Packaged VFDs and associated components and accessories include, but are not limited to, the following: 1. Frames: Carbon steel with baked epoxy enamel paint (minimum 3-mil thickness), stainless steel side bolts, and shroud. The frame assembly design shall allow for additional plates as noted in the equipment schedule shown on the drawings. 2. Plates: Stainless steel Type 304. The plate pack shall be covered with an aluminum shroud in accordance with OSHA. 3. Carrying and Guide Bars: The carrying and guide bar surfaces in contact with the plate pack shall be stainless steel. The bolt lengths shall allow for additional plates as noted in the equipment schedule shown on the drawings. A roller bearing shall be provided on the movable cover for all units with port sizes 3-inch or larger. 4. Gaskets: Provide Nitrile rubber gaskets. Gaskets shall be designed to indicate leakage across the sealing gaskets prior to the intermixing of fluids. Gasket surfaces shall be used for sealing plates, and not for plate alignment. 5. Nozzles: Locate nozzles on fixed end plate. For 4-inch and larger, provide studded port connections to align with ANSI Flange connections. Each studded port shall be lined with a material compatible with the process fluid, to prevent process fluid from coming in contact with the painted cover. 6. Design Rating: 150 PSIG at 200 °F. 7. The heat exchanger shall be designed, constructed, and tested in accordance with Section VIII, Division I of the ASME Pressure Vessel Code, and shall be code stamped. ASME nameplate shall be attached on the face of the fixed cover. 8. The heat exchanger shall be hydrostatically factory tested in accordance with the requirements of the ASME Code Section VIII Div. 1, para. UG-99. 9. Provide the following accessories with the heat exchanger: A. Provide Aluminum OSHA Insulated Shroud Enclosure. B. Tie-Rod Protectors. C. Tie-Rod Nut Wrench.
Notify Requester Immediately	
State item to be used in	Colorado

Section 2: Technical Information

Type of supplier being sought	Manufacturer
Reason	BABA
Describe the manufacturing processes (elaborate to provide as much detail as possible)	Electronic and mechanical assembly.
Provide dimensions / size / tolerances / performance specifications for the item	See information provided.
List required materials needed to make the product, including materials of product components	Various, see information provided.
Are there applicable certification requirements?	Yes
Details	See enclosed specifications for additional reference standards, regulations, and certifications required including, but not limited to, ASME, AHRI, TEMA.
Are there applicable regulations?	No
Are there any other stndards, requirements, etc.?	Yes
Details	See above. See the enclosed specification requirements including spare parts, warranty, manufacturer qualifications, delivery, storage, and handling.
NAICS 1	332410 Power boiler and heat exchanger manufacturing
NAICS 2	
Additional Technical Comments	See enclosed specification section and the Armstrong PFHX heat exchangers basis of design information.

Section 4: Business Information

Estimated potential business volume	Limited to one set of equipment AND the quantities of the equipment to be included. See the basis of design information.
Estimated target price / unit cost information (if unavailable explain)	Total combined cost is a maximum of $20,530. This includes 2 heat exchangers, shipping, start up services including commissioning and coordinating with Building Automation System, and required minimum manufacturer's warranty (see specifications). Costs also include providing approved submittal paperwork required in the specifications.
When is it needed by?	Heat Exchanger lead time is 20 weeks but shipped to, and on-site, no later than 3/1/2025, 2:00 pm local time. If the schedule has delivery prior to the date above, the cost of holding equipment until the project can receive the equipment will not be allowed. Provide written manufacturer's submittal at least 90 days before they are required by manufacturer for review and approval.
Describe packaging requirements	Crate and package equipment and components for secure and undamaged transportation and delivery.
Where will this item be shipped?	Shipping will be to Golden, Colorado 80401, at the construction site address listed above.

Additional Comments

Is there other information you would like to include?	Point of Contact information for questions including BABA/Buy American compliance: The Energy and Minerals Research Facility (EMRF) facility for the U. S. Geological Survey (USGS) is at the Colorado School of Mines (Mines) Robert Lee ralee@mines.edu Please copy scouting@nist.gov on all correspondence.

EMRF Armstrong Plate and Frame Heat Exchangers
NIST MEP Submittal
7/19/2024

Products: Armstrong Plate and Frame Heat Exchangers A20H-150-69-600 from Canada.

Product Codes: NAICS - 332410, PSC - 4420

Performance Criteria: 150psig @ 200°F. Models and performance as specified, see attached documentation.

Cost Information: Total cost $20,530. Includes 2 PFHX, insulation package, shipping and 3-years parts warranty.

Schedule Parameters: 20 week lead time, required on site date of 3/1/2025.

Dimensions: Frame length of 2.11ft, 69 plates @ 0.0157 in thick each providing an effective area of 155.78 sq/ft. See attachments below.

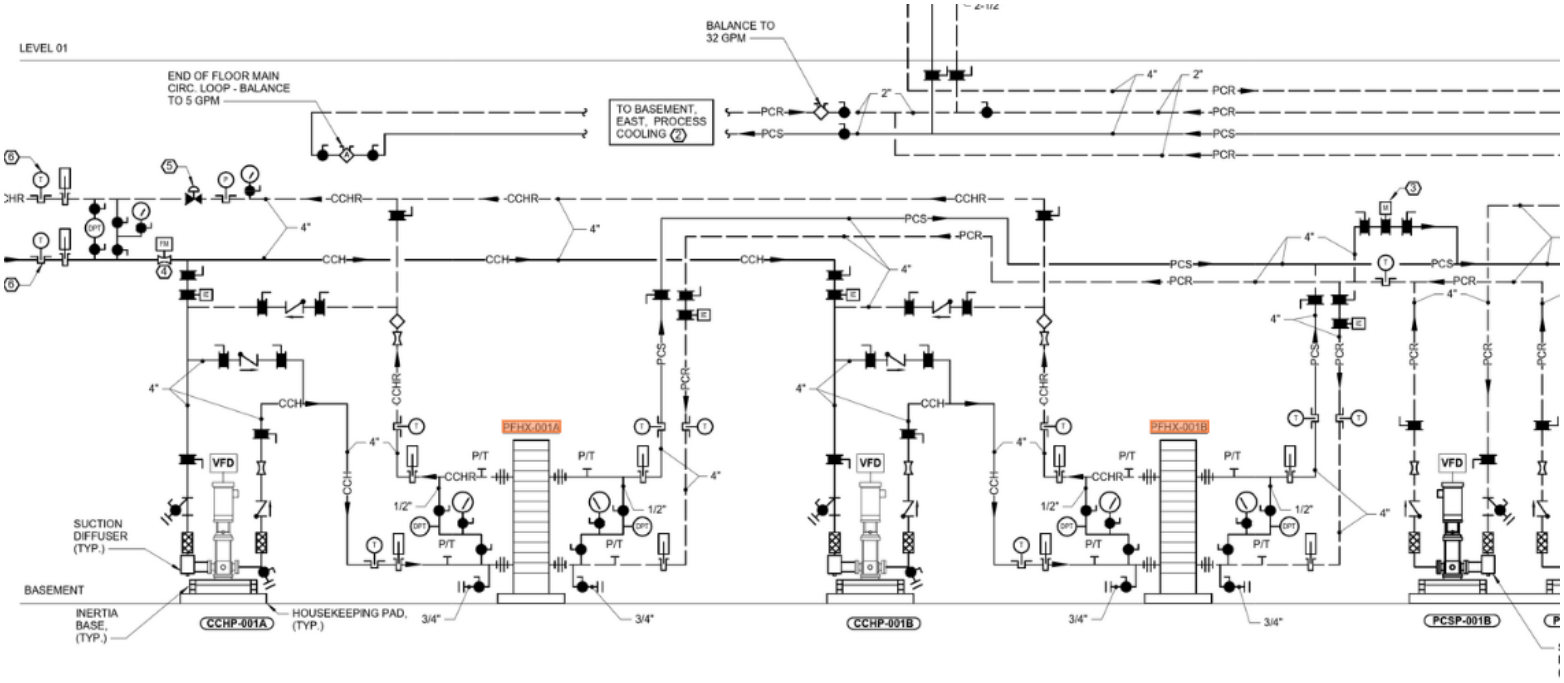
MTech Justification Write Up: Armstrong PFHX are basis of design and MTech is unaware of a manufacturer able to provide a compliant equivalent.

-Superior heat transfer: Armstrong PFX offer excellent heat transfer coefficients, allowing for smaller builds and footprints compared to other heat transfer devices.
-Compact design: Their compact design facilitates installation in tight spaces.
-Lowest installed cost: The combination of space saving and efficient performance results in cost-effective solutions.
-Turbulent-flow design: The turbulent-flow pattern enhances responsiveness to changes in system demand, ensuring superior space conditioning.
-Expandable design: Adaptation to changing heating or cooling demands is cost-effective.
-Low operating risk and cost: Reliable operation with minimal risk.
-Sustainability: Armstrong PFX heat exchangers contribute to energy-efficient HVAC systems.

PLATE & FRAME HEAT EXCHANGER SCHEDULE

DESIG.	MFR.	MODEL	SERVICE	HEAT TRANSFER AREA (SQ. FT.)	# OF PLATES	HOT SIDE (BUILDING SIDE)					COLD SIDE (CAMPUS SIDE)					MBH	APPROX. O.D. DIM. (IN)			APPROX. OPER. WEIGHT (LBS.)	REMARKS
						FLUID TYPE	EWT (°F)	LWT (°F)	FLOW (GPM)	FPD (FT W.C.)	FLUID TYPE	EWT (°F)	LWT (°F)	FLOW (GPM)	FPD (FT W.C.)		LENGTH	WIDTH	HEIGHT		
PFHX-001A	ARMSTRONG	A20H-150-69-600	LABORATORY PROCESS COOLING WATER	156	69	100% WATER	70.0	60.0	220	14.8	100% WATER	45.0	61.0	137	6.4	1,100	30.0	16.0	38.0	670	(1) (2) (3) (5)
							70.0	60.0	220	14.8		48.0	60.5	175	10.0	1,100					
PFHX-001A	ARMSTRONG	A20H-150-69-600	LABORATORY PROCESS COOLING WATER	156	69	100% WATER	70.0	60.0	220	14.8	100% WATER	45.0	61.0	137	6.4	1,100	30.0	16.0	38.0	670	(1) (2) (3) (4) (5)
							70.0	60.0	220	14.8		48.0	60.5	175	10.0	1,100					

1. WATER SIDE FOULING FACTOR = 0.0001 HR SQFT DEG F / BTU.
2. PROVIDE FRAME SIZE TO INCREASE 15% OF PLATES FOR (F) ADDITIONAL CAPACITY.
3. FACTORY PROVIDED REMOVABLE INSULATION COVER.
4. HEAT EXCHANGER IS 100% REDUNDANT (N + 1).
5. CAMPUS CHILLED WATER SUPPLY TEMPERATURE RESET FROM 45 °F TO 48°F, PERFORMANCE FOR BOTH CONDITIONS SHOWN.



AHRI 18.9G-A #4645-231205160900

Customer		*Date*	05-Dec-23
Project	49952 - CSM USGS EMRF Energy & Minerals R	*Engineer*	Jonathan Zheng
HEX Type	A20H-150-69-600	*Contact Person*	Jeremy Raisch
		E-mail	
Units Connected	1 (Parallel)		

Calculated Parameters	**Unit**	**Hot Side**	**Cold Side**
Flow Type		CounterCurrent	
Heat Load	BTU/h	1100242.06	
Inlet Temperature	°F	70.0	48.0
Outlet Temperature	°F	60.0	60.5
Mass Flow Rate	lb/h	109944.88	87847.31
Volumetric Flow Rate	GPM (US)	220.00	175.60
Total Pressure Drop	psi(g)	6.42	4.34
Fouling Factor	Hrft²°F/KBTU	0.0000	0.0000
Surface Margin	%	0.0	
LMTD	°F	10.7	
HTC (Available/Required)	BTU/ft²·hr·°F	660 / 660	

Properties of Fluid	**Unit**	**Hot Side**	**Cold Side**
Fluid		Water	Water
Liquid Viscosity	cP	1.0486	1.2405
Wall Viscosity	cP	1.2405	1.0486
Liquid Density	lb/ft³	62.31	62.37
Liquid Heat Capacity	BTU/lb·°F	1.0007	1.0020
Liquid Thermal Conductivity	BTU/h·ft·°F	0.3446	0.3385

Specifications		**Unit**	**Hot Side**	**Cold Side**
HEX Type			A20H-150-69-600	
Number of Plates			69 / TKTM48	
Grouping			1x34 + 0x0 / 1x34 + 0x0	
Plate Thickness		in	0.0157	
Plate Material / Ratio			AISI304 / 21%	
Effective Area		ft²	155.78	
Gasket Material			NBRH (HangOn) 5/302 °F	
Frame	*Type*		IG, painted frame	
	Length	ft	2.11	
	Maximum Number of Plates		100	
	Assembly Measurement	in	7.1309	
Volume		ft³	0.66	0.66
Weight, empty/operating		lb	585	666
Paint Category			Category C2L	
Paint Color			Armstrong Red	
Connection	*Inlet*		F1: 2.5 INCH studded end connection ANSI B16.5 #150	F3: 2.5 INCH studded end connection ANSI B16.5 #150
	Outlet		F4: 2.5 INCH studded end connection ANSI B16.5 #150	F2: 2.5 INCH studded end connection ANSI B16.5 #150
Pressure Vessel Code			None	
Minimum Design Temperature		°F	48.0	
Maximum Design Temperature		°F	210.0	
Maximum Differential Pressure		psi(g)	150.0	
Maximum Test Pressure		psi(g)	195.0	
Maximum Design Pressure		psi(g)	150.0	150.0

H1.6-1.3.28

This Heat exchanger is certified by the AHRI Liquid to Liquid Heat Exchangers Certification Program, based on AHRI standard 400. AHRI certified units are subject to rigorous and continuous testing, have performance ratings independently measured and are third party verified. Certified units may be found in the AHRI Directory at www.ahridirectory.com

AHRI CERTIFIED® www.ahridirectory.org Liquid to Liquid Heat Exchangers AHRI Standard 400

Insulation Jacket for Small PHE Types

Type of Box: Fully Closed or Divided Back Panel
Panel Fixation: Plastic Rivet Fitting

Recommended Applications:
The Sondex insulation jacket for plate heat exchangers is primarily used in district heating and cooling systems.

Design Principle
The Sondex insulation jacket for heating applications minimizes the waste of energy and improves the working environment in order to avoid excessive temperatures and prevents burns related to the heat exchanger.

Insulation jackets for cooling applications are used to prevent waste of energy and to avoid condensation and icing of the heat exchanger surface.

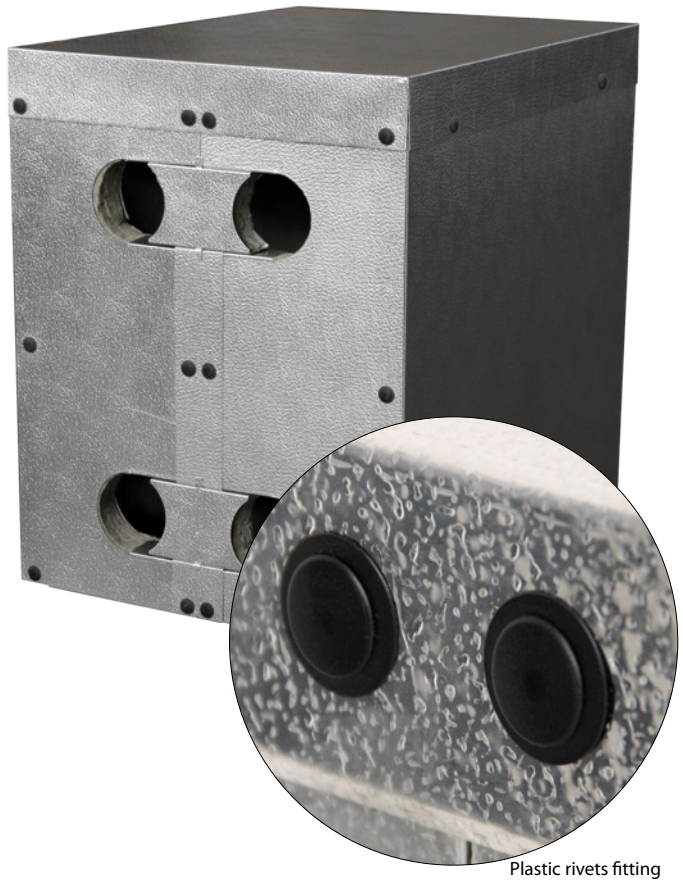
Materials
As standard the coverings are encased with an aluminium plate with an exterior Stucco pattern. For heating applications the insulation material is a high quality mineral wool, and for cooling applications the insulation material is PU foam, both meeting international standards.

Pre-fabricated Sizes
The insulation jacket is available in a variety of pre-fabricated sizes of heights and lengths. The length of all insulation jackets is adjusted to the plate heat exchangers upper and lower bar and the maximum number of plates. If there are fewer plates in the plate heat exchanger there will be extra space in the box, however, this trapped stagnant air insulates additionally.

The insulation jackets are available in two different designs; fully closed or with divided back panel where the column and tie bolts will be visible outside the insulation jacket.

Both designs are manufactured in sections joined with plastic rivet fitting which ensures an easy maintenance process and a simple assembly/ disassembly.

Note:
There is no bottom cover in the design of the insulation jackets.
Custom-made solutions are available upon request.



Plastic rivets fitting

Freight and Storage
The insulation jackets are delivered disassembled to minimize freight costs as well as being space-saving for storage.

Material specification for small plate heat exchanger types. Fully closed back panel.

Application	Heating	Cooling
Material	45 mm mineral wool Not flammable DIN EN 4102A2	40 mm PU-foam DIN 4102-1 B2
Outer cap	1 mm Aluminium "Stucco" Embossed	1 mm Aluminium "Stucco" Embossed
Internal insulation	0,05 mm aluminium foil	0,05 mm aluminium foil
Panel fixation	Plastic rivets fitting	Plastic rivets fitting
Temperature	20 - 200°C	-50 - 80°C
U-value	0,55 W/m^{2}K	0,38 W/m^{2}K
Insulation class (DK)	3*	4*
Heat loss	17,1 W/m^2	-

Front

Fully Closed Back

Divided Back Panel.
The column and tie bolts will be visible outside the insulation jacket.

Please Note: Inlet and outlet temperatures in the heat exchanger have been based on 90/50 – 30/70° C.
* The loss of heating/cooling is stated per m^2 surface on the insulation covering.

A possible loss of ventilation is mostly dependant on the mounting of the heat exchanger, and the fact that the bottom of the heat exchanger is not insulated has been left out in the calculation of the heat loss.

Created: 03.10.2014
Modified: 23.05.2016

Sondex A/S • Marsvej 5 • DK-6000 Kolding • Denmark • Tel. +45 76 306 100 • Fax +45 75 538 968 / Fax +45 75 505 019 • info@sondex.dk • www.sondex.net

ARMSTRONG

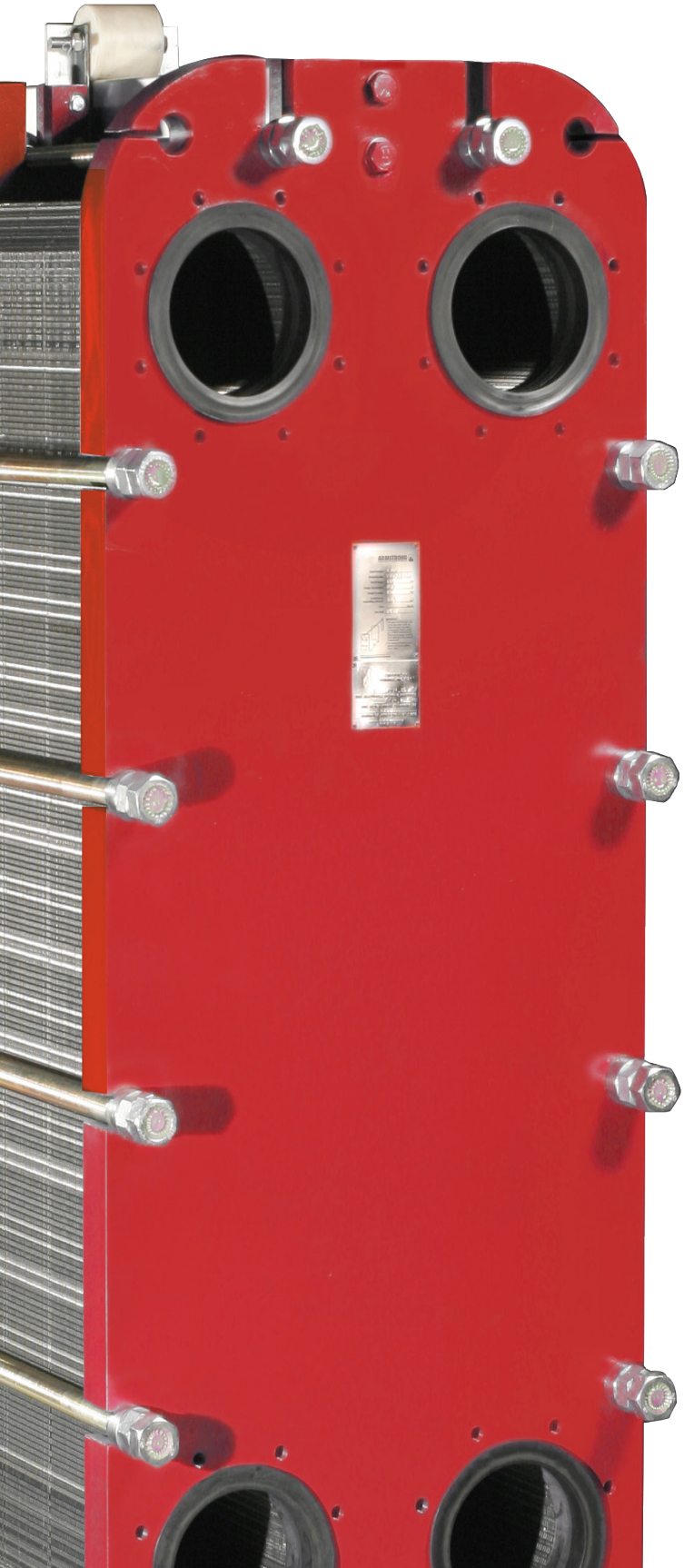


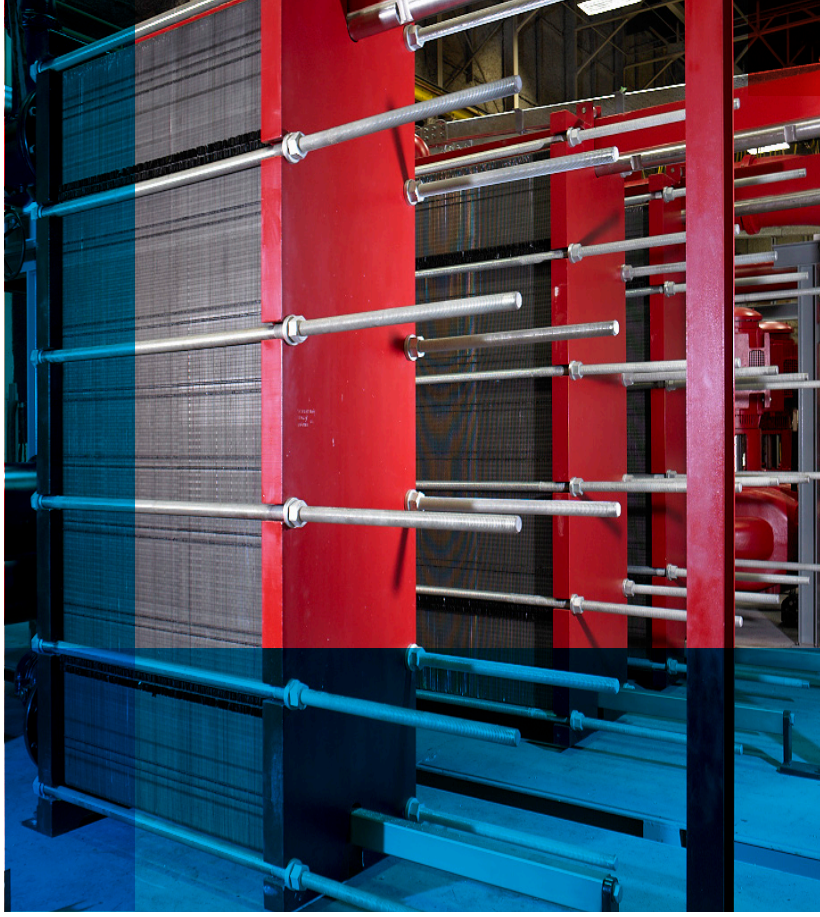
Plate Heat Exchangers

SOLUTION OUTLINE

FILE NO: 113.12
DATE: MAY 2024

SUPERSEDES: 113.12
DATE: JANUARY 2024

EFFICIENT HEAT TRANSFER IN A COMPACT DESIGN



Armstrong's gasketed Plate Heat Exchanger (PFX) product line includes a the large global selection of models and offers the most configurations, connections and material options, providing a superior heat transfer solution for any HVAC application.

MARKET CHALLENGES

Rising demand for tenant space in commercial buildings and an ever-increasing focus on reducing energy consumption have created numerous challenges for designers and contractors. These challenges include the requirement for mechanical room optimization and energy recovery or free cooling systems such as water-side economizers, geothermal heating/cooling and deep-lake water cooling. There is now, more than ever, a growing demand for compact heat exchangers capable of transferring heat at low approach temperatures to achieve greater temperature crossing, which saves energy.

In addition, factors such as global warming, high frequency of building conversions, and smaller mechanical rooms have led to a demand for heat exchangers that can be maintained easily and are flexible with regards to future expansion.

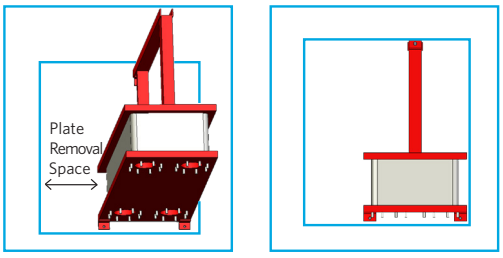
ADDING VALUE TO HYDRONIC SYSTEMS

SPACE SAVINGS

Due to their high heat transfer capabilities, Armstrong PFX series heat exchangers are substantially smaller in size than other heat transfer devices, yet provide the same or better performance. Plate heat exchangers save up to 75% of the floor area, and up to 85% of the floor length required for shell and tube heat exchangers (including area to service the heat exchanger).

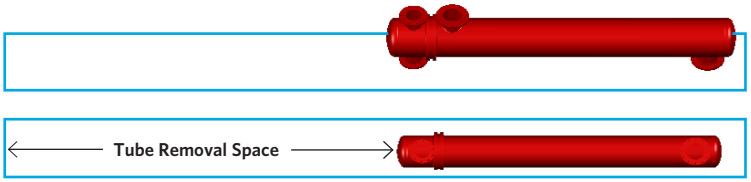
Plate heat exchanger footprint

Space required in feet (metres) = 5.3 (1.60) × 4.7 (1.43) = 24.9 ft² (2.29m²)
Based on Model s106-1250



Shell & Tube heat exchanger footprint

Space required in feet (metres) = 2.5 (0.76) × 32.3 (9.85) = 80.8 ft² (7.5 m²)
Based on Model w2214



PROJECT RISK MINIMIZATION

All units are certified for safety by the appropriate agency (i.e. ASME, PED, AHRI, etc). Heat transfer plates can be added, replaced or removed easily to maintain or increase the system performance. Gaskets are vented between passages, so there is no cross contamination from a gasket failure. Every unit is provided with a safety shield that surrounds the plates and gaskets. Double-wall heat transfer plates are available for domestic water applications. Select models are available with a design pressure up to 435 psi (30 bar).

MAINTENANCE

Single-pass PFX units are designed with all four system connections on the fixed head. This ensures the unit can be easily maintained without having to break the connecting piping. In addition, plate heat exchangers can be installed in a corner of a mechanical room to optimize the space. When maintenance is required, gaskets are easy to replace and plates can be removed and installed from one side of the unit.

INSTALLATION ADVANTAGE

Armstrong's plates are designed to be taller and wider than our competition. This reduces the required floorspace in the mechanical room.

Connections are typically on the same plane for easy piping. Studded flanged connections reduce piping loads on the plate heat exchanger. Units can be certified at the factory and then shipped disassembled for delivery and installation in tight quarters. The vertical piping arrangement (inlet on top and outlet on bottom) of PFX series units makes them ideal for condensing steam service.

OCCUPANT COMFORT

Armstrong PFX series heat exchangers react quickly to system demand changes, and provide reduced down-time and longer life span due to corrosion resistant materials, anti-scaling effect (due to turbulent flow) and ease of maintenance.

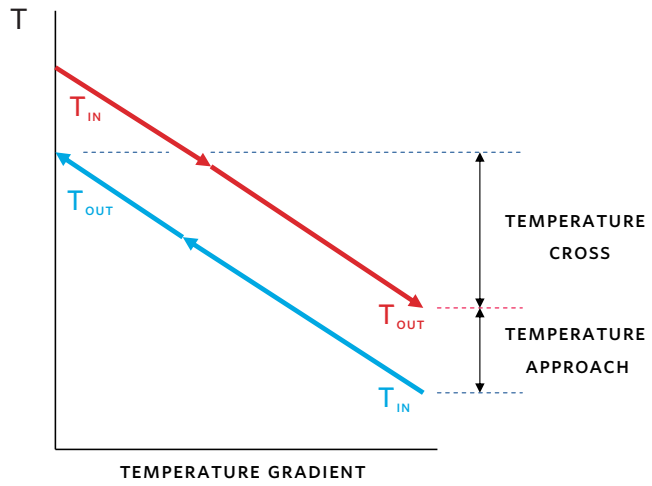
ENERGY EFFICIENCY

The Armstrong PFX series achieves the highest efficiency and heat transfer rates by flowing the two media in opposite directions (counter-current) in a highly turbulent fashion. The temperature gain or loss between the hot fluid and the cold fluid at a given flow rate is the regeneration rate. With counter-current flows, high turbulence and optimized corrugation, Armstrong PFX series units provide regeneration rates of up to 90%.

$$\% \text{ Regeneration} = (T_{\text{in [hot fluid]}} - T_{\text{out [hot fluid]}}) / (T_{\text{in [hot fluid]}} - T_{\text{in [cold fluid]}}) \times 100$$

Armstrong PFX series heat exchangers offer multiple plate geometries to provide the optimum heat transfer solution for a given application.

COUNTER CURRENT FLOW & TEMPERATURE



TECHNICAL DATA

FLOW RANGE		Up to 32,000 gpm (2000 L/s)
DUTY		Up to 57,000,000 btu/hr (16,700 kW)
MAX. FLUID TEMPERATURE	NITRILE GASKETS	284°F (140°C)
	EPDM GASKETS	302°F (150°C) for standard applications 356°F (180°C) for steam applications
MAX. WORKING PRESSURE		435 psi (2999 kPa, 30 bar)

MATERIALS OF CONSTRUCTION

PLATES	304 and 316 stainless steel, titanium
GASKETS	Nitrile, EPDM, Viton

Other materials are available on request.

CERTIFICATIONS

Safety: ASME, PED, CRN, NSF 61

Performance: AHRI

AHRI CERTIFIED® www.ahridirectory.org

NSF Certified to NSF/ANSI 16

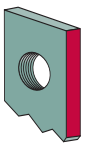
HOW IT WORKS

The Armstrong PFX series uses robust stainless steel and titanium plates (standard construction) as the primary medium for heat transfer. Each plate is stamped with an optimized corrugated design. The series of plates create alternating independent channels for both the process and service fluids. The two medium circuits are configured to induce true counter-current flow, enabling the heat exchanger to perform at extremely low temperature approaches. This is further improved by using Armstrong plates. As each fluid passes through its individual channel, it flows over the 'chevrons' (the corrugated pattern), which increases fluid turbulence, and increases heat transfer through the plates. Heat is transferred from one medium to the other. The Armstrong PFX series uses a gasketed seal to separate the service side from the process side.

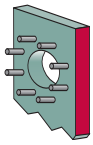
DESIGN FEATURES

1. All connections are threaded or studded to the cover in order to eliminate nozzle loads caused by the piping.
2. Gaskets are double-vented at the port area to eliminate cross contamination of the fluids. Gaskets are attached mechanically to the plate. They attach to the plate only one way, eliminating assembly errors and wasted time during servicing. The gaskets are visible from outside the unit so proper installation is guaranteed.
3. Models with ARMLock gaskets are self locating and locate plates together, minimizing service time. Also, models with ARMLock gaskets minimize exposure to the air, increasing gasket life.
4. Tightening bolts are designed so that all tightening is done from the fixed end (nuts at the moveable end are locked). Bolts are coated for corrosion resistance. This makes servicing the heat exchanger quicker and easier.
5. The bars that hold the plates are corrosion resistant for ease of maintenance.
6. Heavy duty pressure-retaining headers are designed using the latest stress calculation data, as per ASME and PED, to ensure lengthy and safe service.
7. Heat transfer plates are stamped using multiple plate patterns and selected according to the application requirements.
8. Armstrong's plates are designed to be taller and wider than our competition. This increases the effective heat transfer area per plate compared to the traditional design and also reduces the floorspace required in the mechanical room.
9. An galvanized safety shield covers the top and sides of the plate pack.

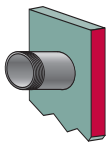
STANDARD CONNECTION TYPES



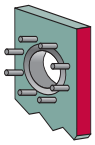
THREADED INTERNAL



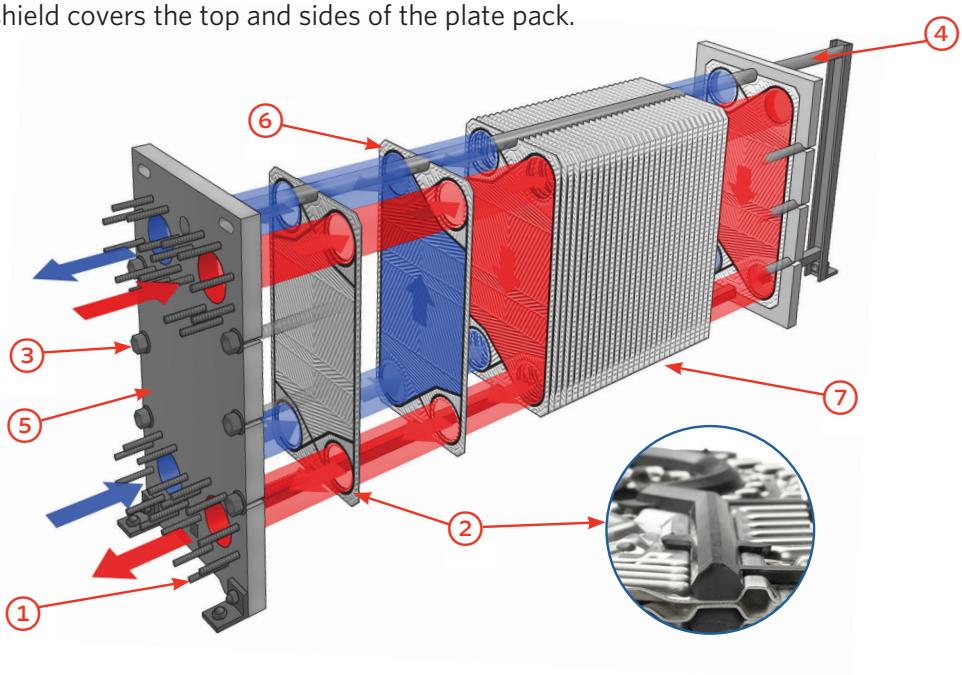
STUDDED



THREADED EXTERNAL ALLOY



STUDDED ALLOY LINER



SECTION 23 57 00
HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plate & Frame Cleanable Gasketed type heat exchangers.
B. Steam-to-liquid vertical flooded type heat exchangers.

1.2 RELATED REQUIREMENTS

A. Drawings, all other Sections of Division 23 and General Provisions of the Contract, including General and Supplementary Conditions, as well as Division 01 Specification Sections, apply to this Section.
B. All materials, equipment, fabrication and installation shall meet and comply with all adopted current codes, regulations, standards, etc. as applicable to the product(s) specified in the section, as scheduled on the drawings as well as Division 01 and Division 23 related documents whether called for or not.

1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 01 - Rules for Construction of Pressure Vessels.
B. ASME Section II – Material Testing.
C. ASME Section V – Non-Destructive Testing.
D. ASME Section IX – Welding and Brazing Qualifications.
E. AHRI Standard 400 – Liquid -to-Liquid Heat Exchangers.
F. TEMA Standards – "Standards of the Tubular Exchanger Manufacturers Association".

1.4 SUBMITTALS

A. Product Data: Provide data with dimensions, locations, and size of tap and performance data, include heat transfer surface area, fouling factors, fluid media and concentrations, materials of construction. Where more than one set of performance parameters are included in the schedule(s) the submittal shall include all multi-variable operating performance data. Include service clearances required for heat exchangers.
B. Shop Drawings:
   1. Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.
   2. Test Reports: Indicate tube bundle pressure tests.

C. Certificates: Certify that products meet or exceed specified requirements. Include certification and stamp documentation as required for compliance with respective pressure vessel codes.
D. Manufacturer's Installation Instructions: Submit manufacturer's published installation requirements.
E. Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.
F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Division 01 Section "Operation and Maintenance Data", for additional provisions.
H. Spare Parts
   1. Extra Gaskets: One set of each type and size.
   2. Plate Type Heat Exchanger Tools: One set of wrenches for disassembly.
   3. Provide the Owner a receipt for spare parts delivered; obtain a signature with date. Include a copy of signed receipt with the O & M Manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of heat exchangers with minimum ten (10) years of documented experience.
B. In no case shall any manufacturer provide less heat transfer surface area than scheduled on the drawings, regardless of what the calculation indicates. The fouling factors noted on the drawings shall be used to determine heat transfer area.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps on all openings, to protect the internals from entry of foreign material.
B. Handle heat exchangers carefully to prevent damage, breaking, denting, and scoring. Do not install damaged units or components; replace with new.
C. Store heat exchangers in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
D. Comply with manufacturer's rigging and installation instructions for unloading heat exchangers and moving them to final location.

1.7 WARRANTY

A. Refer to Division 01 Section "Closeout Procedures", for warranty requirements. In addition to these requirements, the manufacturer(s) shall provide the following additional extended warranty for the product described:

1. Provide 36-month manufacturer warranty for AHRI certified plate and frame heat exchangers from date of turn over to Owner.
2. Provide 60-month manufacturer's warranty for steam to liquid vertical flooded type heat exchanger and condensate control valve and an 18-month warranty for heat exchanger components and performance.

PART 2 - PRODUCTS

2.1 PLATE AND FRAME GASKETED TYPE HEAT EXCHANGER

A. Manufacturers: The manufacturers listed are subject to compliance of all the requirements within the contract documents; provide the product indicated on Drawings or a comparable product by one of the following:
   1. Ameridex.
   2. Alfa Laval.
   3. Armstrong.

B. General: Provide the type, sizes, capacities, and performance as scheduled on the drawings.

C. Frames: Carbon steel with baked epoxy enamel paint (minimum 3-mil thickness), stainless steel side bolts, and shroud. The frame assembly design shall allow for additional plates as noted in the equipment schedule shown on the drawings. Piping connections shall be provided on the fixed frame, with a movable frame at the opposite end.

D. Plates: Stainless steel Type 304. The plate pack shall be covered with an aluminum shroud in accordance with OSHA.

E. Carrying and Guide Bars: The carrying and guide bar surfaces in contact with the plate pack shall be stainless steel. The bolt lengths shall allow for additional plates as noted in the equipment schedule shown on the drawings. A roller bearing shall be provided on the movable cover for all units with port sizes 3-inch or larger.

F. Gaskets: Provide Nitrile rubber gaskets. Gaskets shall be designed to indicate leakage across the sealing gaskets prior to the intermixing of fluids. Gasket surfaces shall be used for sealing plates, and not for plate alignment.

G. Nozzles: Locate nozzles on fixed end plate. For 4-inch and larger, provide studded port connections to align with ANSI Flange connections. Each studded port shall be lined with a material compatible with the process fluid, to prevent process fluid from coming in contact with the painted cover.

H. Design Rating: 150 PSIG at 200 °F.

I. The heat exchanger shall be designed, constructed, and tested in accordance with Section VIII, Division I of the ASME Pressure Vessel Code, and shall be code stamped. ASME nameplate shall be attached on the face of the fixed cover.

J. The heat exchanger shall be hydrostatically factory tested in accordance with the requirements of the ASME Code Section VIII Div. 1, para. UG-99.

K. Provide the following accessories with the heat exchanger:
   1. Provide Aluminum OSHA Insulated Shroud Enclosure.

2. Tie-Rod Protectors.
3. Tie-Rod Nut Wrench.

2.2 STEAM TO LIQUID VERTICAL FLOODED TYPE HEAT EXCHANGER

A. Manufacturers: The manufacturers listed are subject to compliance of all the requirements within the contract documents; provide the product indicated on Drawings or a comparable product by one of the following:
   1. Maxi-Therm, (No Substitutions)

B. General: Provide the type, sizes, capacities, and performance as scheduled on the drawings.

C. Provide steam-to-water packaged heat exchanger factory pre-piped and wired controls assembled on a painted and fabricated equipment steel frame, ready for field piping connections.

D. The factory-built heat exchanger system shall include the following components and functions:
   1. Heat Exchanger: Vertical U-tube
   2. Liquid & Steam Piping: Schedule 40 carbon steel.
   3. Liquid Condensate Piping: Schedule 80 carbon steel.
   4. Stabilizing pump with isolation valves and stainless-steel check valve.
   5. Modulating electric control valve on the condensate outlet, fail safe, pre-wired to the control panel. The valve body shall be of A 216 Gr. WCB cast steel fabrication with ANSI 300 PSIG flanged connections. Control valve shall be provided with digital positioner with position feedback analog output. Actuator to have a manual override.
   6. Thermowells, electric temperature sensor, with thermometers located at the liquid inlet and outlet, and condensate outlet.
   7. Pressure transmitter on steam inlet, flow sensor on the liquid inlet, overheat butterfly security valve on the steam side, start-up valve on the steam inlet,
   8. NEMA 4 UL approved control panel, pre-programmed to include the following:
      a. Programmable controller with optimal control sequence.
      b. Factory wiring to all sensors and valves.
      c. Color HMI graphic interface with different users' access levels.
      d. Access via the building automation system to all parameters for remote monitoring and remote control.
      e. BACnet (IP) communication protocols are available.
      f. IoT ready with data acquisition and secure remote access capabilities (ISO 27001 and ISECOM STAR certified) with OPC US Embedded Server. Internet connectivity must be provided to the panel via an ethernet cable by the customer for remote troubleshooting and monitoring.
      g. Continuous display and datalogging of liquid inlet, water outlet, condensate outlet temperatures, steam pressure, liquid flow in GPM, condensate control valve and main steam valve position (via the feedback output of the valves) and heat transfer rate in BTU/hr.

h. Preprogrammed and adjustable alarms for liquid outlet high and low temperature, condensate outlet high temperature, high and low liquid flow as well as high steam pressure. Sensor/valve failure alarm is also standard.
i. The outside disconnect switch to be able to locally shut the power to the panel before opening the door.
j. Integral network switch and 120V power supply receptacle to plug in a laptop for easy tech support. Laptop can be plugged in with the control panel door closed for more safety.
k. Return to last known state after a power outage.

9. Flanged steam trap on condensate outlet, strainer with 40-mesh and blowdown valve on condensate outlet.

E. Tubes: Vertical u-tube type with 3/4 IN. OD minimum cupronickel (90/10 CuNi) tubes suitable for 150 PSIG working pressure and 375 ºF.
F. Shell: Steel pipe with threaded or flanged piping connections and necessary pipe tap connections, steel saddle and attaching U-bolts, prime coated.
G. Heads: Cast iron or fabricated steel with 304 stainless steel tube sheets; flanged for piping connections.
H. Water Chamber and Tube Bundle: Removable for inspection and cleaning.
I. Certification: ASME Certified construction.
J. Accessories:
1. Two (2) steam traps as drip traps.
2. Stainless steel vacuum breaker for steam inlet piping.
3. Stainless steel air vent for the steam inlet piping.
4. Condensate mixer with integrated check valves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Complete installation of heat exchanger(s) in compliance with the piping details shown on the drawings and otherwise as indicated in the contract documents.
C. Connect all inlet/outlet piping connections with unions or flanges and shut-off valves.
D. Install pipe support or hangers as required, to prevent the weight of the pipe free from imposing stress on the equipment flanges as recommended by the heat exchanger manufacturer.
E. For all heat exchangers, arrange and install piping, valves, controls, gauges, piping specialties, accessories, etc. to allow for easy disassembly of piping connections, with minimal disturbance to equipment and adjacent piping, in order to provide maintenance and service access. This includes tube removal for shell and tube heat exchangers, drawback space for plate and frame exchangers to allow separating of plates for cleaning or replacement; and replacement or removal of plate type heat exchangers.

F. Install heat exchangers on concrete housekeeping pad. Refer to Division 23 Section "Common Work Results for HVAC".
G. Install all temperature, pressure, flow switches, flow meters, wells, taps, etc., and all other pipe connections as required for the Temperature Control Contractor to complete their work.
H. For liquid side(s) of heat exchangers refer to the following sections for additional requirements:
   1. Division 23 Section "Meters & Gauges for HVAC Piping."
   2. Division 23 Section "Hydronic Piping."
   3. Division 23 Section "Hydronic Specialties."
I. For steam side(s) of heat exchangers refer to the following sections for additional requirements:
   1. Division 23 Section "Meters & Gauges for HVAC Piping"
   2. Division 23 Section "Steam & Condensate Piping, Valves, & Specialties."
J. Pipe water relief valves to nearest floor drain, which will not result as a trip hazard.
K. Pipe steam safety relief valves to outside the building and terminate in manner to avoid dangerous discharge to humans. Provide drip pan elbow at relief valve as recommended by the relief valve manufacturer.
L. Pipe drain valves to nearest floor drain, which will not result as a trip hazard.
M. Unless specifically noted otherwise all heat exchangers shall be insulated in accordance with Division 23 Section "Mechanical Insulation."
N. Where applicable, field install all electrical devices provided by the heat exchanger manufacturer not specified to be factory-installed.

3.2 STEAM TO WATER HEAT EXCHANGER TRIM

A. Refer to piping detail on the drawings.
B. Shell: Pressure gauge tapping with pigtail siphon, vacuum breaker
C. Steam Piping: Provide piping as indicated, including control valve with 3-valve bypass, strainer, and pressure gage on inlet; condensate dirt leg, steam trap with 3-valve bypass, strainer, and check valve on outlet; air vent or vacuum breaker on shell.
D. Water Inlet: Thermometer well, pressure gauge tapping, valved drain.
E. Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, thermometer well, pressure gauge taps.

3.3 WATER TO WATER HEAT EXCHANGER TRIM

A. Refer to piping detail on the drawings.
B. Water Inlets and Outlets: Thermometer wells, pressure gauge pipe taps.
C. Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, valved drain.

3.4 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to test, inspect, instruct, and oversee equipment startup.
B. Inspect for and remove blocks, shipping bolts, and tie-down straps.
C. System Flushing & Cleaning: Do not allow flow thru heat exchanger until the piping systems are flushed and clean free of oils, grease, slag and other contaminates. Provide temporary by-pass piping near piping connections on system side of shut-off valves, to circulate chemical treatment for flushing and cleaning.
D. Operational Test: Place each heat exchanger in to service to confirm it is operating properly.
E. Controls and Safety Switches: Test, adjust, and replace damaged/malfunctioning controls and equipment.
F. Coordinate all temperature control work with the BAS Control Contractor, Refer to Division 23 Section "Sequence of Operations for HVAC Controls."
G. Malfunctioning Units: Remove, replace, and retest as specified above.

3.5 COMMISSIONING

A. Refer to Division 01 Section "General Commissioning Requirements", for commissioning requirements.
B. Refer to Division 23 Section "Commissioning of HVAC" for additional commissioning requirements.
C. Perform functional tests as required by the Manufacturer and the Commissioning Agent's written commissioning plan.

3.6 ADJUSTING AND CLEANING

A. Cleaning: Clean factory-finished surfaces free of dust and debris using an approved cleaning solution and drying cloth. Repair any marred or scratched surfaces with manufacturer's touch-up paint. Unit shall be in "like-new" condition upon turn over to Owner.

3.7 TRAINING

A. Training: For heat exchanger type, provide services of manufacturer's technical representative for two (2) hours, to instruct Owner's personnel in operation and maintenance of equipment. Schedule with Owner and provide at least one (1) week notice to Contractor and Engineer of training date.

END OF SECTION