

PF & PFDW Series Plate Heat Exchangers OPERATING INSTRUCTIONS



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1.0 General

Name and address of manufacturer:

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www.taco-hvac.com

1.1 User information

These instructions refer to standard design Taco plate heat exchangers (PHE).

Special designs may require supplementary operating and maintenance instructions. Please always follow the specifications related to the respective purchase order! Only qualified personnel should carry out operating and maintenance of PHE.

National and international rules concerning pressure equipment, dangerous liquids and gases as well as accident prevention and operational safety are to be complied with.

Chapters where operating methods and instructions must be strictly complied with in order to avoid any danger to persons or system damage, are marked with a warning triangle (shown below):



Attention

Chapters where operating methods, operating conditions and maintenance instructions must be strictly complied with to guarantee faultless function of the PHE as well as efficient operation, are marked with the following sign:



Important!

Before starting work all personnel should receive proper instructions from an experienced user. The operating instructions must always be available.

If the required work is not listed in these instructions, or if any instructions are not understood, then contact Taco before starting any work on the PHE.



1.2 Intended use

Taco PHE are designed for special conditions of use specified by the customer, including temperature, pressure, volumetric flow and flow media and are fabricated in conformity with EC-PED 97/23 and designed, constructed and tested in accordance to the ASME Code Section VIII, Division I, except where customers order specifications dictate otherwise.

In the event of any change in design or operation from the order specification, written approval by Taco is necessary to avoid affecting the warranty/liability terms and conditions.

Heavy pressure surges or hydraulic shocks may cause mechanical damage or material damage and must be avoided in all cases!

1.3 Identification / Name Plate

Each Taco PHE is provided with a nameplate placed on the outside of the Frame Plate (Fixed Plate). The nameplate showing the following data must always be accessible and recognizable:

MAWP

– Maximum Working Pressure

– Minimum Design Metal Temperature

Serial Number

Year Manufactured

Model Number

Connection information


– Inlets and outlets for the Hot side and Cold side

Dimension (PP) also referred to as (A)

List the Maximum and Minimum tightening dimension.

Order information (special request) i.e., tag numbers, customer PO number, would be listed at the bottom on the name plate if required by the customer.


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**583 Bedford Street
Fall River, MA 02720**

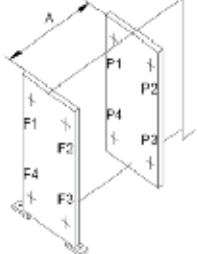
MAWP _____	PSI	AT	_____	° F	
MDMT _____	° F	AT	_____	PSI	
SERIAL # _____		YEAR	_____		
MODEL # _____					

CONNECTIONS:	DIMENSION "A" or "PP":
IN / OUT _____ / _____	MAX _____
IN / OUT _____ / _____	MIN* _____



WARNING

READ INSTRUCTION MANUAL
BEFORE INSTALLATION
OPERATION AND MAINTENANCE
TO AVOID INJURIES
OR DAMAGE



*OVERTIGHTENING BELOW 'A' MIN WILL DAMAGE HEAT TRANSFER PLATES

FIGURE 1

PF & PFDW Series Plate Heat Exchanger

2.0 Basic Safety Instructions



Attention

Plate heat exchangers (PHE) are pressure-containing equipment and must be connected, operated and maintained only by qualified personnel!

It is the responsibility of each person operating or working on PHE's to comply with all applicable safety regulations, including National and International directives for pressure equipment, dangerous liquids and gases.

Do not attempt to perform any work on the PHE while it is still under pressure. All fluids must be drained and the temperature of the PHE should not exceed 104°F (40°C).

The edges of the plates can be very sharp! When working with the plates, always wear suitable protective gloves to prevent injuries!

Store and handle the plates only in the horizontal position. In the vertical position plates are unstable.

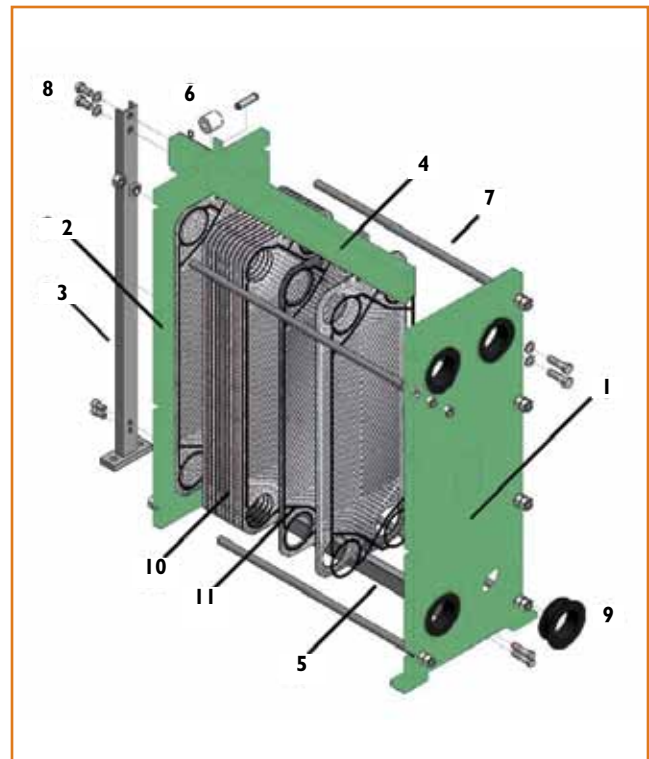
If injury could be caused by product leakage, the PHE must be provided with a protective shroud.

If operating temperatures exceed 194° F (90°C), then a protective shroud is required.

3.0 Functional Description

3.1 Design - Main Components

1. Frame Plate (Fixed Plate)
2. Pressure Plate (Movable Plate)
3. Support Column
4. Upper Carry Bar
5. Lower Guide Bar
6. Pressure Plate Roller
7. Tightening Bolt
8. Fixing Screws
9. Rubber or Metal Liners
10. Heat Transfer Plates
11. Gaskets



3.2 Function specification / graphical presentation

The PHE consists of a pack with linked up embossed plates with passage openings. Every channel is created by rotating the channel plate 180° creating a passage for the fluid to travel. (See Figure 2).

All plates are provided with clip on, snap on or glued gaskets, which completely seal the various flow gaps from the outside and separate the second media involved in heat exchange.

The plate pack is assembled in the frame by means of the upper carry bar and lower guide bar and is compressed between a frame plate and pressure plate by means of tightening bolts. During service life the gaskets of a PHE are subject to a normal fatigue process and therefore the plate pack can be tightened several times - dependent on conditions of use - until "PP"-min. is reached.

The connections for the fluids involved in the Plate Heat Exchanger are typically located on the Frame Plate (Fixed Plate); however, in case of multi-pass flow the connections could also be on the Pressure Plate (Movable Plate). (See basic scheme on page 6, Figure 5.)

Special materials are available depending on application:
Plate materials are: 304L, 316L, Titanium, Hastelloy, Incoloy, Inconell and SMO.

Gasket materials are: NBR, EPDM, Viton, silicone and special materials



Attention

Depending on concentration, temperature and pH-value of the medium, chlorides can affect corrosion resistance of chromium nickel steels and chromium nickel molybdenum steel (also Hastelloy, Incoloy, Inconell)!

3.3 Special feature of FPG, FPSF, FPDW Series FPG Series

Principle of design and function are the same as described under 3.2.

The PHE of FPG series, however, consists of cassettes with 2 plates, each welded together. One outside of the cassette has a normal gasket, creating alternating flow gaps with welded external sealing and normal gasket.

The FPG series is used for higher pressures applications and where the medium could attack the gasket material or in refrigeration engineering.

FIGURE 2

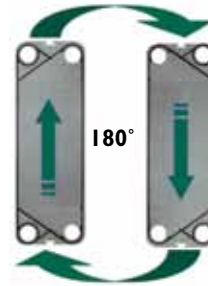
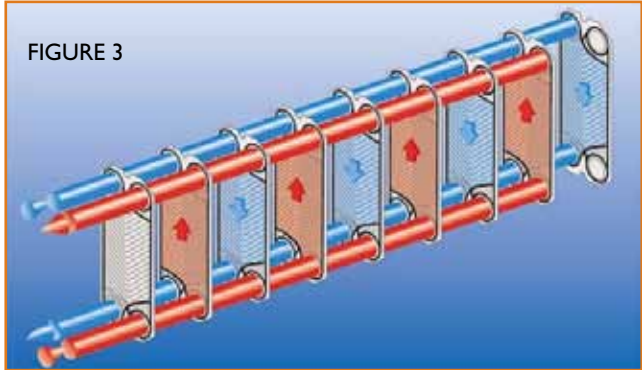
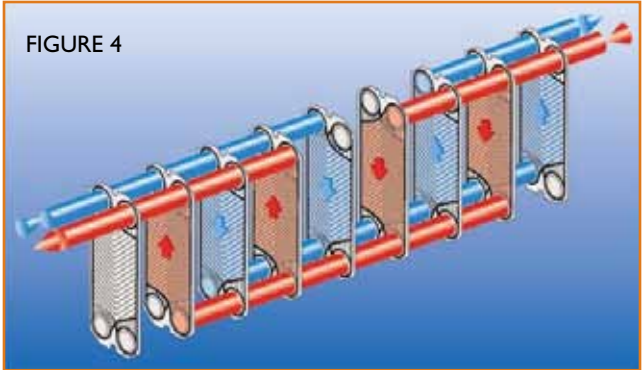


FIGURE 3



Single-pass flow - all connections are on the frame plate (left side)

FIGURE 4



Multi-pass (2) flow – 2 connections are on the frame plate and 2 on the pressure plate



Attention

Attention: Cleaning of the flow gaps inside the cassettes can only be done by flushing.

FPSF Series

This "free-flow version" has a special plate embossing, creating visibly larger free area to flow ("free flow"). Thus media with higher viscosity or even liquids with suspended solids can be used – depending upon design.

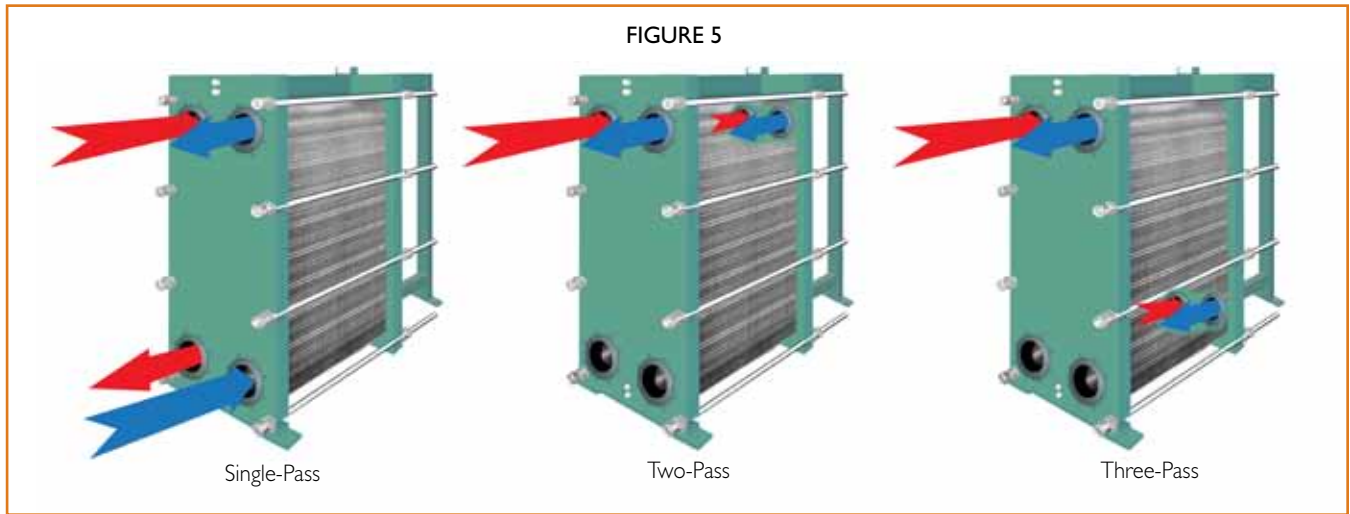
FPDW Series

The FPDW safety PHE consists of double wall plates. This line of products guarantees the greatest possible safety with regard to intermixing of primary and secondary media. "One" heat exchanger plate consists of two superimposed plates. This double plate incorporates a small leakage gap.

PF & PFDW Series Plate Heat Exchanger

In case of a breach in the plates (caused for example by corrosive substances) the medium escapes through the leakage gap and the defective plate must then be replaced.

3.4 Position of single-pass and multi-pass connections



4.0 Transport and Installation

4.1 Transport handling and assembly

Usually the small PHE's are delivered either in horizontal or upright position to be lifted by a forklift truck from beneath the planks.

Figure 6 shows the skidding of a small PHE in the horizontal position.



FIGURE 6



FIGURE 7A

Figure 7A shows proper fork lift operations with a small PHE in a horizontal position. Large PHE must be lifted using slings or lifting wires suspended from suitable forklifts or cranes (see figure 7B).



FIGURE 7B



FIGURE 8

Figure 8 shows the slow setting upright over center of gravity.

Figures 9 & 10 show the fastening of a sling rope to the PHE in the upright position when lifting wires are not provided. Sling ropes of sufficient strength must be used to handle the weight of the unit.



FIGURE 9

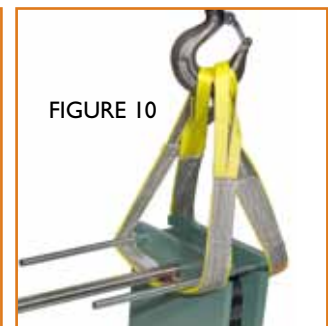


FIGURE 10

! **Important!**
Your order documents will show your connection orientation.
— See Appendix A for details of connection orientation.



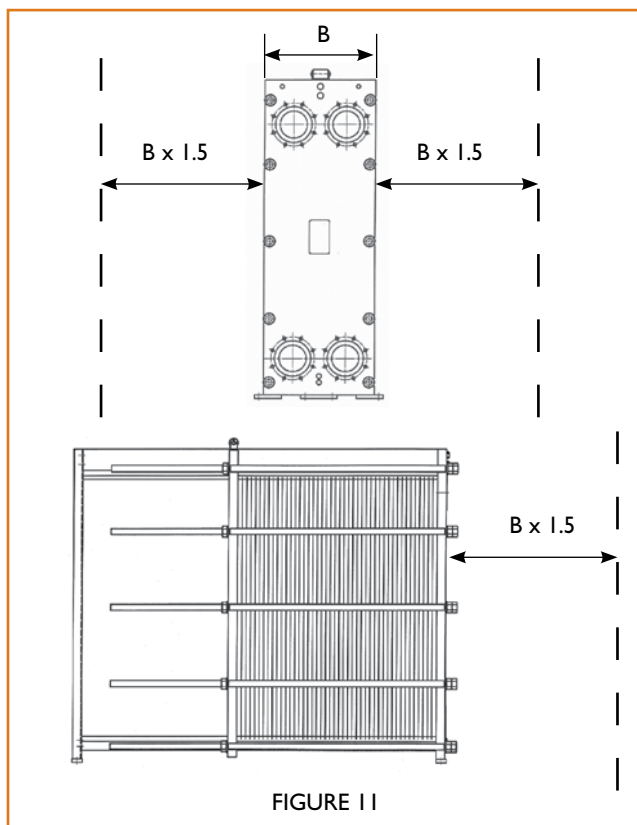
Attention

**Do not lift the PHE at the connection points, tightening bolts or pressure plate!
Do not use steel ropes or chains for lifting!**



Suspension ropes must be fixed carefully and if necessary, secured against slipping!

4.2 Required space / minimum distance



The minimum distances according to above sketches are required for quick maintenance and service work at site (for example replacement of plates or tightening of the plate pack), reduction of the minimum distances must be authorized in writing by Taco.

4.3 Ambient conditions: job site requirements and storing requirements



Important!

The PHE standard units are designed for use in closed Frost-free rooms. In an outdoor installation or for use in rooms with high atmospheric moisture (> 70%), a special safety device or a special design is required.

The standard PHE works on flat ground in the vertical position, unless the order specification requires a different fitting position.

Furthermore, it must be ensured that the ambient temperature does not exceed the maximum allowable operating temperature of the PHE and that gaskets of the PHE are protected against mechanical influence or harmful effects (For instance by acids, gases). Operating the PHE above the maximum allowable operating temperature may result in accelerated gasket failure. Acids and gases will accelerate corrosion and gasket failure.

Make sure that no ozone generating appliances are used at the job site or in the storage room (for instance arc-welding set). Ozone causes premature hardening of Elastomer gaskets. The same applies to direct solar radiation/ultraviolet light.

In case of outdoor storage, a corresponding cover must be used to protect the PHE against any climatic effects such as moisture, sunlight, and freezing.

The tightening bolts should be greased to minimize rust formation.



Attention

- All applicable safety and fire regulations must be observed particularly if fluids of category I (hazardous materials/substances) are used.
- If the PHE is operating in areas where leakage is dangerous, i.e., high temperatures, acids etc., a splash/drip protection is required! Where operating temperatures are exceeding 194°F (90°C) heat protection or damming is required!

It is very important that the system to which the heat exchanger is connected, is protected against sudden and extreme variations of temperature and pressure. This is not only for the heat exchanger but for all equipment and piping.

Tightening Bolts may loosen during transit. Upon receipt and before start up check to see if any bolts are loose. If bolts are loose, please refer to section 6.5 for closing and tightening of the PHE.

Tightening Bolts on units supplied with a small number of plates may be loose due to low compression forces.

The "PP" or "A" max, is located on the name plate.

Most likely bolts 1 thru 4 are tight; refer to figure 14 on page 10, as they are the main draw down bolts. The remaining bolts may not be under the same force which gives them an opportunity to loosen during transit.

4.4 Pipe assembly

For both circuits of the PHE vent valves must be installed at the highest point of the connections, enabling the air to escape when filling the unit.

The “opening space” of the PHE, which is between the pressure plate and support (See figure 12) should not be obstructed by fixed piping. Prior to assembly, the plate pack should be checked to ensure the pack is correctly tightened (especially in case of a multi-pass PHE). Compression dimension of a new PHE or a PHE with new gaskets is “PP” or “A” max (See nameplate or your specific technical documentation. See Appendix A for example of documentation. Section 6.5 describes the tightening of the plate pack).

Connections on pressure plate or on connecting pieces must always be flexible and must run parallel to the tightening bolts. For this purpose expansion joints must be installed. All feeding and discharging pipes should always have shut-off valves to isolate the PHE from adjoining systems during maintenance.



Attention

No forces or vibrations to the connections of the PHE are allowed.

The piping system must be secured against sudden pressure surges and temperature fluctuations.

Quick-acting valves must be avoided!

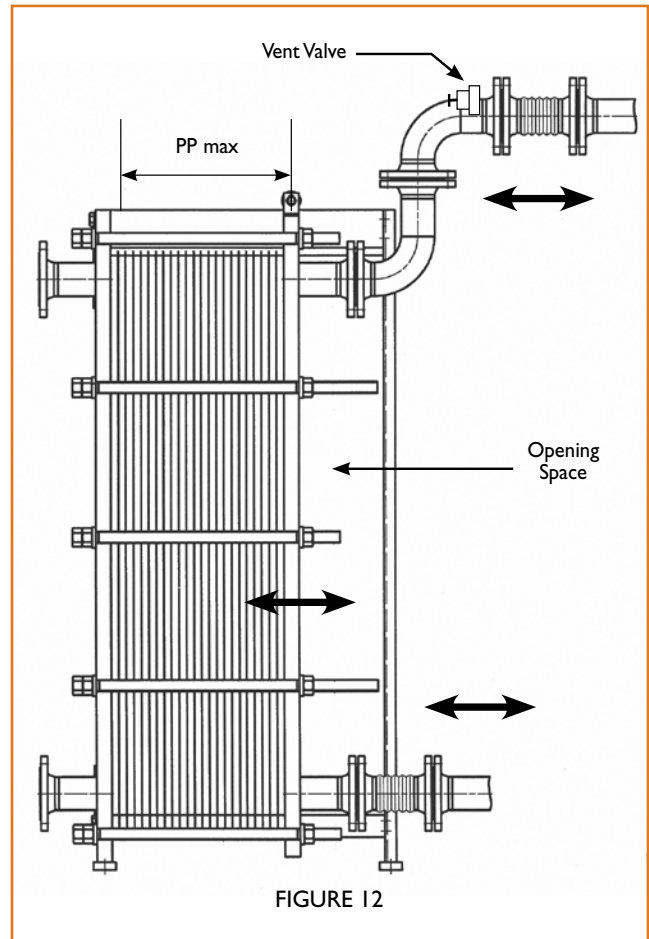


FIGURE 12

5.0 Operating Instructions

5.1 Initial operation

- I. Before starting up new units make sure that the plate pack is tightened to the correct compression dimension. (See nameplate for “PP” or “A” max dimension).

If necessary tighten again as described in section 6.5.

- II. Check to be sure media, pressure and temperature data correspond to data on the name plate and as specified by order!

- III. Check to be sure if piping connection is correct.

5.2 Starting up the PHE

Description for one flow direction of the PHE

1. Feed valve between pump and PHE is shut.
2. Fully open the valve at outlet nozzle (if present).
3. Open the vent valve.
4. Start pump.
5. Slowly open the feed valve.
6. Close vent valves after the air has completely escaped from the PHE.

Repeat steps described above for the second flow direction of the PHE.

5.3 Operation



Attention

Do not operate the PHE under pressure and temperature conditions exceeding the values specified on the nameplate and in the technical documentation.

Operating with severe temperature jumps and hydraulic shocks may cause mechanical damages or material damages and is not allowed! Taco Inc. will not be responsible for any PHE or part not installed or operated in conformity with this Document and instructions or which has been subject to accident, disaster, neglect, misuse, mis-application, inadequate operating environment, repair, attempted repair, modification, alteration or other abuse.

In case of severe temperature variations and sudden hydraulic shocks shut down the PHE until the defect is eliminated. In any case, the PHE must be checked!

Operating data of the PHE must be regularly recorded and evaluated to immediately detect fouling and a visual control must be done monthly.

The PHE must regularly be checked for tightness by qualified personnel.

5.4 Operational shut-down / shut down for a longer period

If the PHE is taken out of service proceed as follows:

1. Slowly close the feed valves
(Close the higher pressure channel first)
2. Switch off pumps.
3. Close valves in outlet pipes (if present).

If the PHE is out of service for extended periods of time proceed as follows:

4. Vent the PHE and drain all fluids.
5. If necessary rinse the plate pack or clean according to section 6.0.
6. Expand the plate pack by adding 10 % to the compression dimension (last compression dimension "pp" + 10 %) storage instructions in section 4.3.

6.0 Maintenance / Repair

6.1 Basic instructions for maintenance

Read all basic safety instructions (See section 2.0) before starting maintenance and repair work!

Necessary maintenance intervals of a PHE may be very different depending on the diversity of media used. Therefore, it is recommended that, in addition to the regular check described in section 5.3, maintenance be performed on the opened PHE at least once a year. During service life the PHE gaskets are subject to a normal fatigue process.

The plate pack can be tightened several times – dependent on conditions of use – until "PP" or "A" min is reached (see section 6.5)

Definition of compression dimensions (length of plate pack): (see fig.13)

- "PP" or "A" max = compression dimension of new PHE or PHE with new gaskets
- "PP" or "A" min = minimum compression dimension allowed
- "PP" or "A" – Current compression dimension between "PP" or "A" max and "PP" or "A" min after tightening

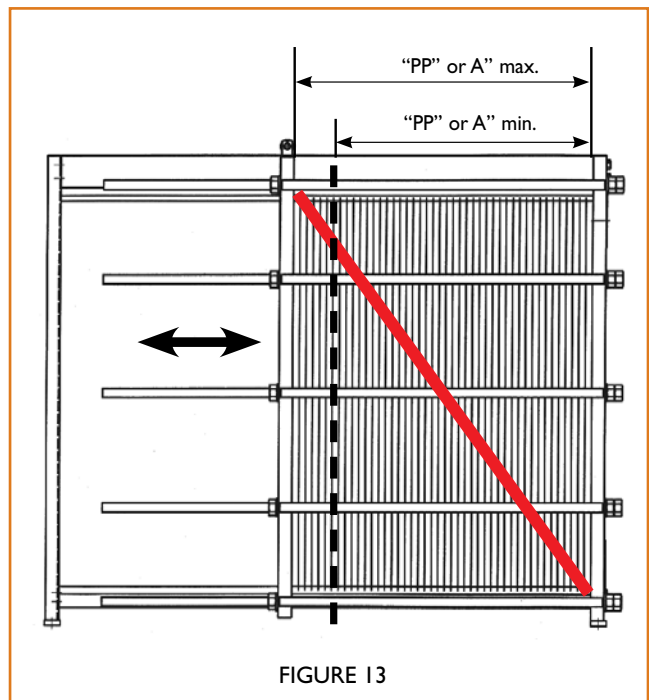


FIGURE 13

6.2 Shut-down and opening of the PHE

1. Slowly close the feeding valves (begin with the side with higher pressure).
2. Switch off the pumps.
3. Close valves of outlet pipes.
4. Cool down the PHE to approx. 104°F (40°C).
5. Vent the PHE and drain all fluid channels.
6. For a multi-pass PHE: Disconnect all feed lines at compression plate and if necessary also at intermediate elements.

Before opening the PHE proceed as follows:

1. Clean the outside of carrier roller; carrying bar and lower guide bar and plate pack. Grease carrier roller if necessary.
 2. Clean and grease tightening bolts.
 3. Paint a diagonal colored line across the side of the plate pack (see figure 13).
 4. Note the current compression dimension "PP" or "A"
- Removal of tightening bolts at pressure plate and opening of the PHE (See figure 14).

1. The first tightening bolts shown on the Figure 14, Number 1, may be removed in any order.
The four remaining tightening bolts maintain equal pressure distribution over the plate and should not be removed.
2. Tightening bolts 1 – 4 (according to Figure 14, Number 2) to be unscrewed diagonally in pairs, alternating as follows:
1 – 2, 3 – 4, 1 – 2, 3 – 4 and so on.
Make sure that the pressure plate does not tilt more than .25" or 6 mm over the width (1-3/4-2) and more than .079" or 2 mm over the diagonal (1-2/3-4)! (see figure 15)
3. After all the tightening bolts are removed, slide the pressure plate up to the support column. The plate pack is now accessible. If possible, fasten the pressure plate to avoid slipping!

It is now possible to move the lower section of the channel plate towards the pressure plate for removal from the lower guide bar. Then laterally swivel and remove them. (see figures 16 & 17)



Attention

Never unscrew the fixing screws on the frame plate (fixed plate)! Wear protective gloves when handling the PHE plates.

Plates may have sharp edges. Removing or adding a plate should be done one plate at a time.

Example of how to unscrew tightening bolts on pressure plate:

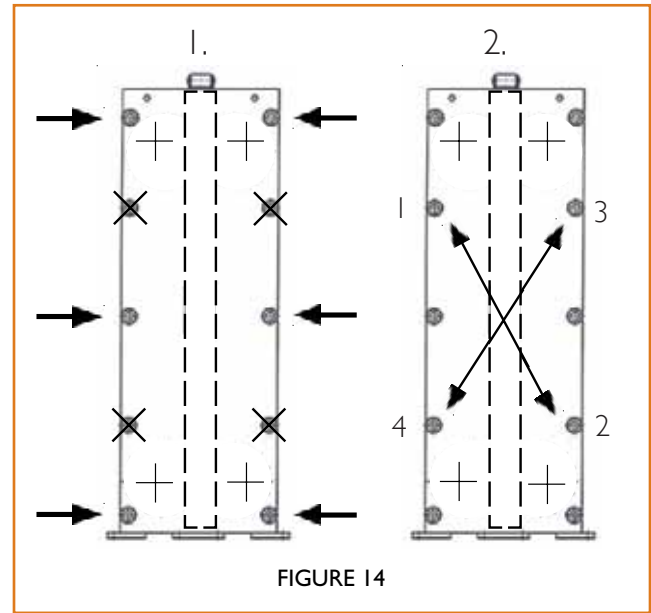


FIGURE 14

For maintenance and repair work all removed plates are to be handled and stored in horizontal position! Do not stack more than 60 plates!

When removing the plates make sure that the order and direction are not changed (technical documentation)!

Note: Different chevron (patterns) plates may be combined in a PHE.



FIGURE 15

Correct opening and closing of the PHE checking the allowed inclination of the pressure plate and the "PP" or "A" dimension when tightening the PHE



FIGURE 16



FIGURE 17

6.3 Cleaning of plates

Soft deposits on plates may be removed with directly circulating hot fresh water and a soft brush when the PHE is opened (See figure 18). To remove more stubborn deposits a high-pressure cleaner can also be used.



Important!

Care should be taken to ensure the surface (passive layer/oxide layer) of stainless steel plates are not damaged by cleaning. Therefore, abrasive cleaning or polishing agents and metal brushes should not be used! When using a high-pressure cleaner, keep enough distance from the plate to avoid the possibility of gaskets being dislodged from the groove by the high-pressure water jet!

Very stubborn plate deposits can be removed in an open chemical bath or by cleaning in place.

The chosen cleaning agent should be compatible with the gasket and plate materials and its suitability must be confirmed by the manufacturer of the cleaning agent.

Some suggested cleaning agents:

In case of calcareous sediment or similar incrustation:

Cleaning agent:.....phosphoric acid
 Concentration:.....max. 5 %
 Max. temperature:.....68°F (20°C)
 Recommended reaction time:.....approx. 1 hour

For oils, greases, biological contamination – bacteria, formation of algae and the like:

Cleaning agent:.....caustic soda solution
 Concentration:.....max. 4 %
 Temperature:.....185°F (85°C)
 Recommended reaction time:up to 24 hours

The safety instructions of the cleaning agent manufacturer must be followed! Always clean with chloride-free or low-chloride water with a low degree of hardness.



Attention

Chlorides reduce corrosion resistance of chrome-nickel steels and chrome-nickel molybdenum steels (also Hastelloy, Incoloy and Inconel), depending on concentration, temperature and pH-value of the medium.

Soft deposit contamination is easily removable by manually cleaning the plates. After cleaning always rinse with adequate clear water.



FIGURE 18

6.4 Replacement of plates and gaskets

Most of the PHE-gaskets are mechanically fixed in the gasket groove by means of clip on or snap on systems without any glue. The gaskets are fastened locally at certain distances in the gasket groove. (figure 19, 20 & 22). Gaskets can be replaced very quickly. Before fastening new gaskets the gasket groove must be cleaned carefully. Special lines of products have glued gaskets with solvent-free glue such as:

- 3M® Scotch-Grip® 1099 (one-component adhesive) or
- UHU plus endfest 300 (mixed adhesive)

Replacement of glued gaskets:



Attention

When carrying out the following work always follow the accident prevention rules, the fire prevention rules and also the precautionary instructions given by the glue manufacturer!

Make sure that the workroom is sufficiently ventilated!

1. For removal of old glued on gaskets heat the underside of the gasket groove with hot air to approximately 302°F (150°C).
The glue softens sufficiently and the gasket can be removed from the groove.



Attention

Superheating of the plates must be avoided (temper colors) Remove glue residues in the groove with a blunt object (plastic or wood – but not metal) to ensure there is no scratching of the gasket groove or plate surface.

2. Glue new gaskets as follows:
 - Clean the groove of the PHE plate and the gaskets with extreme care to remove grease and then rub dry with a lint free cloth or absorbent paper.
 - In case of mixed adhesive: Mix the adhesive binder and hardener according to manufacturer's instructions.

Pay attention to the curing time!

- Fill a manual injection gun with the adhesive mixture (in case of one component adhesive, a bottle with spout) and apply a strand of adhesive (thickness of approximately 1 mm) to the plate groove (Figure 21).



FIGURE 19



FIGURE 20



FIGURE 21



FIGURE 22 (FP 04, 08, 14, 20)

- Distribute the strand uniformly throughout the base of the groove with a short-cut brush.
- Insert the gaskets into the groove and press them into place by hand.

After all gaskets are inserted, stack the plates on a flat surface. Each stack should not exceed 60 plates! Cover the stack of horizontal plates with a gasket-free plate and place a flat steel plate or a similar weighted device on top to apply pressure.

The adhesive needs approximately 12 hours at room temperature to cure. (observe manufacturer's data). Higher temperatures will accelerate curing as follows:

at 104°F (40°C) cures in approximately 180 minutes
at 158°F (70°C) cures in approximately 45 minutes
at 230°F (110°C) cures in approximately 10 minutes
(Does not apply to one-component adhesive).

After curing, using a blunt object, remove excessive adhesive which may have squeezed out of the groove (wood or plastic).



Attention

After following all working steps the plates must be stacked in the correct order. If the plates are out of order then follow the flow diagram of the technical documentation.
See Appendix A for example of technical documentation

6.5 Closing and tightening of the PHE

Before closing the PHE:

1. Check if all gaskets and plates are clean (even the smallest foreign matter on the gaskets may cause a leakage).
2. Make sure that the ring gaskets or rubber inserts in the connections are clean.
3. Clean the upper carrying beam and apply a thin grease layer.
4. Install all cleaned plates in the correct order and quantity in accordance with the flow diagram (in the reverse order as described in section 6.1)

Pay attention to the special first plate and end plate (figure 23 A and 23 B) at frame plate and pressure plate or intermediate elements (in case of PHE with several sections)!

The gasket of the first plate (start plate) in figure 23A points towards the frame plate (figure 24).

By means of the diagonal colored line painted on the outside of the plate pack (before opening the PHE) additionally check to ensure the plates are in the right order.

When all plates are correctly installed, the outside of the plate pack shows a continuous honeycomb pattern (See figure 25).

Plates of a small PHE can also be installed in horizontal position. (figure 26).

5. Push the pressure plate against the plate pack, slowly and evenly.
6. First attach the greased tightening bolts 1-2-3-4 from the side or insert them in an axial direction (figure 27). Make sure that the counter nuts at the frame plate are tight.
7. Fasten the tightening bolts 1-4 uniformly and in rotation (alternating and diagonal 1-2 and 3-4). During tightening continuously check the compression dimension "PP" or "A" max. (Also see figure 15 on page 10).

During tightening, the tilt of the pressure plate must not exceed .25" (1/4) or 6 mm over the width (1-3/4-2) and .5" (1/2) or 12 mm over the diagonal (1-2/3-4)!

The current final compression dimension "PP" or "A" must not vary by more than max. .039" or 1 mm among the individual tightening bolts.

8. Tighten the plate pack with bolts 1-4 (see figure 27) to compression dimension "PP or A" (before opening the PHE). The remaining tightening bolts must also be fixed and tightened during the process to reduce any chance of deflection of the pressure plate.

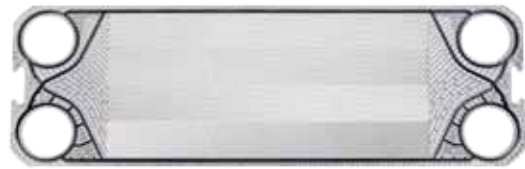


FIGURE 23A



FIGURE 23B



FIGURE 24

FIGURE 25

FIGURE 26

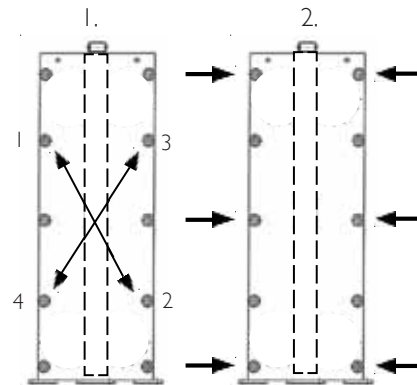


FIGURE 27

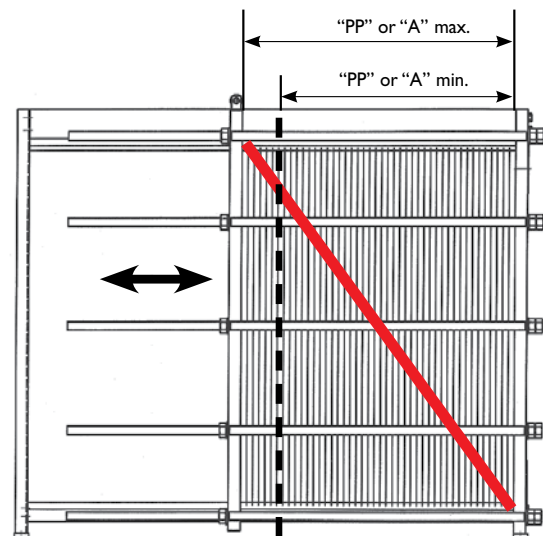


FIGURE 28

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If all gaskets and plates have been completely replaced, tighten to "PP" or "A" max. (Figure 28)

If the current "PP" or "A" - dimension is not achieved or is exceeded, check if the number of plates in the plate pack corresponds to the number of plates shown in the flow diagram. Furthermore, check if tightening nuts can be turned freely.

If the plate pack is leaking during the pressure test, ensure that you don't have a gasket out of place causing the leak. If you see no sign of misplaced gaskets at the sight of the leak then the pack can be tightened step by step until the leak has stop or compression dimension "PP" or "A" min is reached.



Important!

Never tighten to below dimension "PP" or "A" min. Otherwise plate profiles could be damaged and the unit will not seal or operate correctly.

"PP or A min" and "PP or A max" values are shown on the nameplate and in the technical documentation.



Attention

Tighten only after the pressure has been released from the PHE!

Definitions of compression dimensions (length of plate pack):

- "PP" or "A" max = compression dimension for new PHE with new gaskets
- "PP" or "A" min = minimum allowed compression dimension
- "PP" or "A" = current compression dimension after tightening between "PP" or "A" max and "PP" or "A" min.
- Never remove double nuts from threaded rod on frame plate side. Always remove single nut from threaded rod on the pressure plate side. Removing nuts from threaded rod on frame plate side may cause an accident or personal injury.

6.6 General maintenance work

Operating data of the PHE must be regularly recorded and evaluated. To immediately detect fouling visual control must be done monthly.

Qualified personnel must check tightness and compressive strength of the PHE regularly.

All flexible parts must be greased efficiently to open the PHE easily at any time. Particularly the following parts are of concern:

- Surfaces between tightening nuts and pressure discs or pressure pieces.
- Thread of tightening bolt.
- Bearing of carrying roller at pressure plate and intermediate elements (if applicable).
- Upper carrying bar and lower guide bar; above and below.

Maintenance of steel frames:

The steel frames, coated with a weather-protective coldcured synthetic resin, can be cleaned with a sponge, a cloth or a soft brush and a sub alkaline solution. Damaged paintwork should be "touched up" after cleaning.

Maintenance of stainless steel frames:

Stainless steel frames (or covered with chrome-nickel steel) should be cleaned in the same way as steel frames and subsequently - in a dry condition - should be rubbed with acid-free grease.

Opening the PHE for maintenance and repair work is only necessary when increased pressure drops, temperature variations or leakages cannot be eliminated in a different way. (Opening PHE: see chapter 6.0)



Attention

Preventive maintenance is recommended, at a minimum, once a year,

7.0 Troubleshooting



Attention

National and international directives for pressure equipment (PED), dangerous liquids and gases as well as for prevention of accidents must always be followed! Never perform maintenance work and repair work when the PHE is under pressure!

If the PHE must be opened for removal inspection, after closing the plate pack it must be tightened again to the compression dimension "PP" or "A" max, (current compression dimension "PP" or "A" before opening) or it can be gradually reduced to "PP" or "A" min until the required compressive strength is reached. Proceed as described in section 6.0

Leakage between connection and fixed plate

Possible causes:

- Stress and force is acting on the connection
- Worn out ring gaskets, rubber liner or flange bolting
- Age induced material fatigue or material wear

Proceed as follows:

1. Check flanged joint and uniformly tighten loosened screws.
2. Check piping system for stress and force acting on the joint.

Check alignment and squareness of flanges and piping and correct if necessary.

If the leakage cannot be cured proceed as follows:

1. Open the PHE as described in section 6.0.
2. Release connection. Check, clean and if necessary replace the gasket.

Leakage between plate pack and frame plate or pressure plate

Possible causes:

- Worn out ring gaskets or rubber liner on the inside of the fixed plate or pressure plate.
- Worn out gasket or wrong fitting of the first plate.
- Age induced material fatigue or material wear.

Proceed as follows:

1. Mark leaking point.
2. Open the PHE as described in section 6.0.
3. Check if the first plate gasket is correctly fitted to the frame plate and correct if necessary. Clean or replace the gasket if necessary.
4. Check if rubber parts or gaskets at fixed plate or pressure plate are in need of replacement and replace if necessary.

External leakage between plates

Possible causes:

- Operating pressure or temperature has been exceeded.
- Pressure plate is not tightened plane-parallel.
- Incorrect "PP" or "A" compression dimension.
- Incorrectly positioned or damaged gaskets.
- Age induced material fatigue or material wear.

Proceed as follows:

1. Adjust operating pressure or temperature to the allowed values, and if necessary,
2. Tighten pressure plate square and parallel and, if necessary,
3. Adjust compression dimension "PP" or "A" correctly or reduce to "PP" or "A" min" step by step.

The compression dimension "PP" or "A" between the tightening bolts shall not differ by more than .039" or 1 mm!

If necessary:

4. Open the PHE as described in section 6.0.
Check correct fitting of the gaskets and, if necessary, clean and replace damaged gaskets.

Internal leakage / mixing of media

Possible causes:

- Worn out ring or diagonal at the double gasket near inlet area of a plate.
- Pitting corrosion or micro crack.
- Blockage of external leakage opening of the plate gasket near inlet.

Proceed as follows:

1. Open the PHE as described under section 6.0.
2. Drain one of the flow channels.
3. Remove the connecting pipes of this flow channel.
4. Apply slight pressure to the other flow channel.

Through the leakage the water enters the open flow channel and then escapes through the pipe connection. The defective plate gap can be located by means of a spotlight or flashlight.

5. Check the gasket and the total surface of the defective plate, clean it and if necessary replace the complete plate.

In case of a small internal leakage, which cannot be localized in the manner described above, the plates must be cleaned separately and must then be checked visually with good lighting.

Replace worn out gaskets or complete plate. In the event crack detection testing is required, please contact Taco.

Heavily decreasing performance of the PHE

If pressure drops are clearly increasing or performance is heavily decreasing, first check if this is caused by problems elsewhere in the production system (for instance changing quality of the media, changing inlet temperature or changing volume flow)

If no improvement is shown, the PHE must be shut down and cleaned as described in section 6.0.

8.0 Appendix A

8.1 Specification Sheet



Specification sheet

Project: Sample

Date: 6/23/2010

contact person:
Direct dialing:

Plate-Heat-Exchanger, bolted

Version: 4.02.1.1a [HVAC]

Pos.: HEX-1 close loop

Unit: PF 50-125-4-NH

Technical data

Hot side

Cold side

Fluid

Water

Water

Mass flow rate	[lb/hr]	198798.59	[lb/hr]	198749.64
Volume flow rate	[USgal/min]	400.000	[USgal/min]	399.657
Inlet temperature	[°F]	98.00	[°F]	85.00
Outlet temperature	[°F]	88.00	[°F]	95.00

Physical properties

Dynamic viscosity	[cP]	0.736456	[cP]	0.761259
Density	[lb/ft³]	61.9672	[lb/ft³]	62.0052
Specific heat capacity	[BTU/lb°F]	0.998429	[BTU/lb°F]	0.998675
Thermal conductivity	[BTU/ft·hr°F]	0.364965	[BTU/ft·hr°F]	0.364436

P.H.E characteristic values

Heat duty	[BTU/hr]	1984836.27	
Eff. heat transfer area	[ft²]	661.98	
Log./Effective temperature difference	[K]	1.67/1.67	
Pressure loss	[ft (water)]	9.658	[ft (water)] 9.522
No. of passes in series		1	1
No. of channels total		124	
Mix of Channeltyp		57*HL + 5*LL	

Construction

Weight	[lb]	approx. 1769
Volume	[ft³]	2.846
Design pressure	[PSI]	150.0
Max. working temperature	[°F]	230.00

Material	Plates	AISI 304 (0.50 mm)
	Gaskets	NBR HT
	Frame	C-Steel, ASME, max. no. of plates: 150
	Painting	Taco Green, Standard
Connection	Hot side	F1 => F4 : Flange rubber lined, 3", NBR, for flange ANSI B16.5, 150 lbs.
	Cold side	F3 => F2 : Flange rubber lined, 3", NBR, for flange ANSI B16.5, 150 lbs.

Remark



8.2 Construction Sheet

Construction sheet

Project.: Sample

Date: 6/23/2010

contact person:
Direct dialing:

Plate-Heat-Exchanger, bolted

Version: 4.02.1.1a [HVAC]

Pos.: HEX-1 close loop Unit: PF 50-125-4-NH

Dimensional sketch - Not Certified

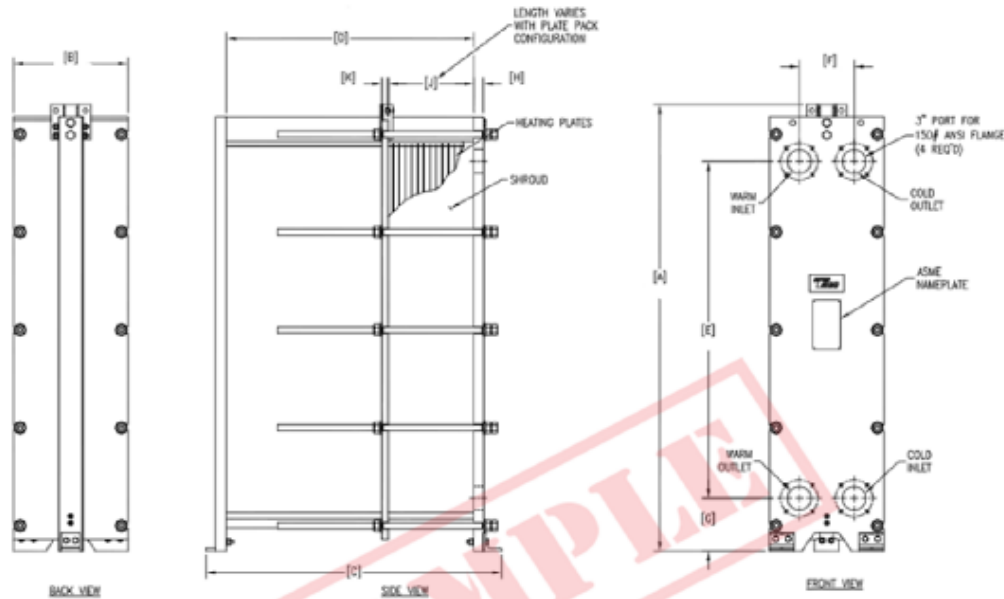


table of masses [appr. mm, inch], max. no. of plates 150

	:mm	:inch
A: Total height	:1828.8	:72.0
B: Total width	:560.38	:22.1
C: Total length	:1114.42	:43.9
D: Length of carrier bar	:1003.3	:39.5
E: Distance between nozzles, vertical	:1387.95	:54.6
F: Distance between nozzles, horizontal	:224.99	:8.9
G: midpoint of nozzle from the ground	:203.04	:8.0
H: Thickness of frame plate	:38.1	:1.5
K: Thickness of pressure plate	:25.4	:1.0
J: Length of the plate-package	:387.5	:15.3

Connections

Hot side: F1 => F4 :
Flange rubber lined, 3",
NBR, for flange ANSI B16.5, 150 lbs.

Cold side: F3 => F2 :
Flange rubber lined, 3",
NBR, for flange ANSI B16.5, 150 lbs.

Subject to change



8.3 Plate Placement Plan

Plate placement plan

Project.: Sample

Date: 6/23/2010

contact person:
Direct dialing:

Plate-Heat-Exchanger, bolted

Version: 4.02.1.1a [HVAC]

Pos.: HEX-1 close loop Unit: PF 50-125-4-NH

No. of passes in series hot:	1
No. of passes in series cold:	1
No. of packages:	1
No. of channels/package:	62

package arrangement:

57*HL + 5*LL

unit arrangement:

hot side: 1 No. of passes in series

HsL HL ... LL + He

cold side: 1 No. of passes in series

Index s ==> Startplate

Index e ==> Endplate

Index n ==> Baffle plate

Remarks for assembling:

1. 1-Pass arrangement

The startplate is a 4-hole plate

The endplate is a 0-hole plate

2. Multipass up to type of plate FP 20

The startplate is a 2-hole plate

The endplate is a 2-hole plate

3. 2-pass arrangement up from type of plate FP 20

The startplate is a 4-hole plate

The endplate is a 2-hole plate

4. Multipass up from type of plate FP 20

The startplate is a 4-hole plate

The endplate is a 4-hole plate

The baffle plate is always a 2-hole plate

The chevron angle of the startplate is to the bottom open \wedge , or $\wedge\wedge$
on the next plate to the top open \vee , or $\vee\vee$, a.s.o.

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