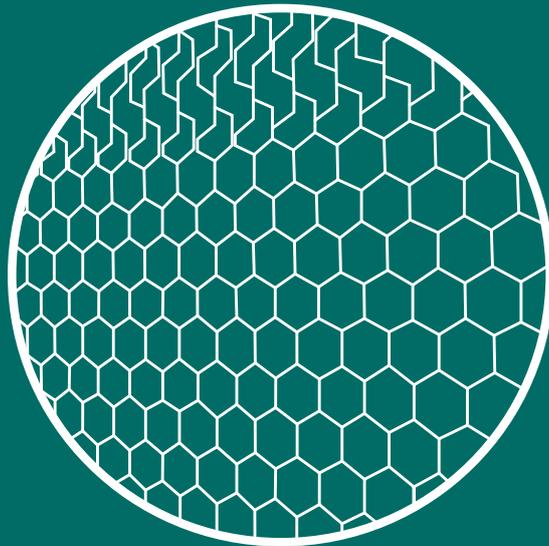


**HFM**

*Hofmann*  
Plate Heat Exchanger

# HFM MANUAL

For Owners and Operators  
of HFM Plate Heat Exchangers





HFM is a global brand of plate heat exchangers and fluid handling equipment supply nowadays. It is rooted in China, and now the brand network spans from Asia, Oceania, Africa, Europe to North America and South America.

We hope this manual could help you to comprehend these equipment and solve problems. Yet, if there are some parts you can not understand or anything beyond this manual, you are welcome to reach us through the methods below.



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Hofmann (Beijing) Engineering Technology Co., Ltd.

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# 1. Preface

**T**his manual is intended to be an instruction to guide anyone who is obligated to operate and maintain the plate heat exchangers supplied by HFM in perspective and safely.

You may not need to go through this manual thoroughly at first. Yet, before commencing any work with your PHE, for the benefit of your health and safety, we recommend you check the index and read the corresponding chapter in the first place, which is very important.

Some sections are demonstrated in both texts and video streams to make you understand easier.

## 1.1. Package

To prevent the movement of the PHE unit in the box during shipping, we use steel strips, plastic film, long screws and some cork woods to fix the position inside the box. If you have not decided to install and operate the PHE in the short term, we recommend you to leave it as is in case of any damage from the environment or further transport.

The external packages are usually plywood, wooden pallet, iron sheets and steel strips, which could be reused or recycled. Whereas, for your safety concerns, please remove or slice off the exposed nails before moving or using them. Besides the HFM Manual itself, there is a “Quality Certificate” you need to preserve too, which contains “After-sale service card” and “PHE Hydraulic pressure test record card”.

## 1.2. Safety Precautions

Plate heat exchanger is a vessel with multiple components. People who are not familiar with it should not participate in installing, operating and disassembling processes.

- Plate heat exchangers in operation or service are not permitted to be moved or dissembled. Always check the instructions of this manual before using or maintain the plate heat exchanger.
- Every PHE has been specially designed and manufactured for the customer-specified operating conditions concerning pressure, temperature, flow rates, and flow-through media type and composition. Sudden pressure surges exceeding these operating conditions, e.g. When suddenly starting or stopping the PHE, may cause damage and must be avoided at all costs.

**HFM accepts no liability for the serviceability of the PHE under operating conditions deviating from those specified in this manual.**

## 1.2. Symbols Meaning



This symbol indicates improper operation could lead to serious injury or death.



This symbol indicates improper operation may cause minor or medium injury.



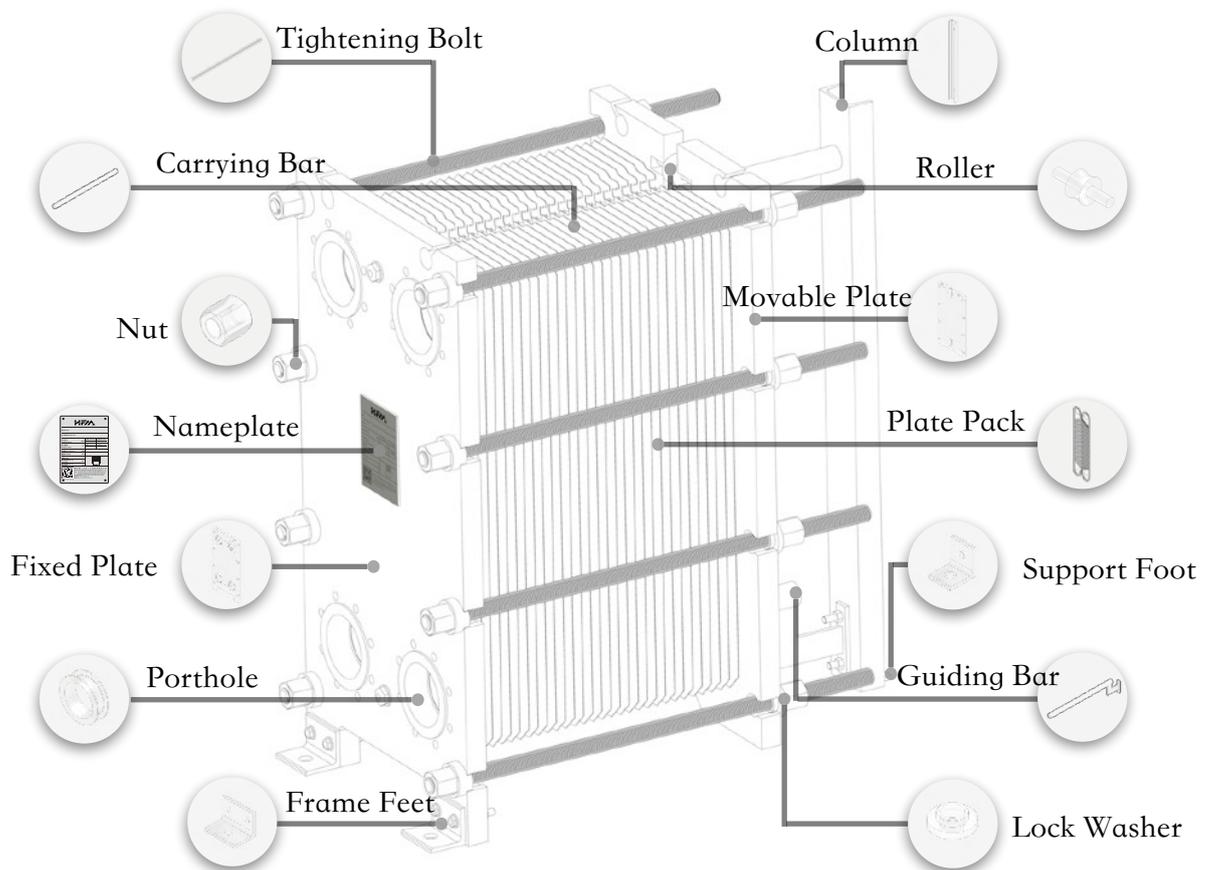
This symbol indicates improper operation could result in permanent damage to the PHE.

Safety by Choice  
Not by Chance

## 2. Description

This chapter introduces some common sense of PHE, which contains the structure of PHE, name card and basic knowledge of the main components.

### 2.1. Construction



## 2.2. Nameplate

- ① Every plate heat exchanger supplied by HFM has a metallic nameplate nailed in the front of the fixed plate. Do not lost the nameplate in case the later users make mistakes due to missing information.
- ② When reassembling after replacing plate gaskets or cleaning, make sure the **Tensioning Dimensions** are in the range of “‘a’ max” and “‘a’ min”.
- ③ As given on the nameplate, the design pressure and the design temperature are the values against which the PHE is approved according to the pressure vessel code in question. The design temperature may exceed the maximum operating temperature for which the gaskets have been selected. The supplier should be consulted if the operating temperatures specified on the PHE drawing are changed.
- ④ When inquiring, you may choose to take a picture of the nameplate and send it to us or inform us of the Type and Serial No.

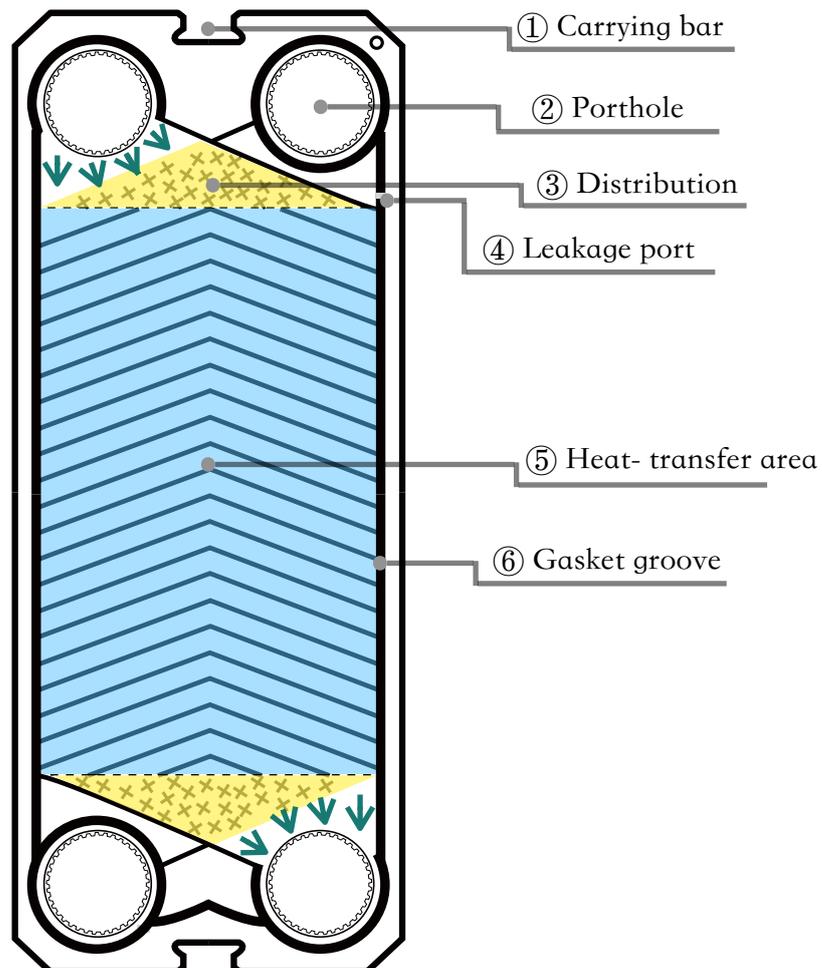
<b>HFM</b>			
Type			
Serial No.			
Design Press.	MPa	Cold side	Hot side
Design Temp.	°C	Cold side	Hot side
Capacity	KW		
Weight	KG		
Date			
"a" max	mm		
"a" min	mm		
		<b>Hofmann (Beijing) Engineering Technology Co., Ltd.</b> Add: B604, East International Building, No 2 DongZhiMen Outside Street, DongCheng District, Beijing, China Service line: (86)10-8447-8229/8604/8409 Web: www.hfm-phe.com E-mail: service@hfm-phe.com	

## 2.3. Heat Transfer Plate

There are thousands of models of PHE in the market, so are the plates. They are designed to achieve the same end—helping transfer thermal energy from one media to another. The demanded thermodynamic performance dictates the number and arrangement of the plates and their shape and size.

Users from various fields possess many different media. It could be gas or liquid, corrosive or non-corrosive, viscous or watery, high-pressure or low-pressure, etc., to complex and various types of plates.

Through this chapter, you are going to cognize the basic design philosophy of heat transfer plates.



# I Areas Attribution

 Demonstration- Plate Structure  
<https://youtu.be/7wz2xhfcaFs>

## ① Carrying bar slot

There are different shapes of carrying bar slots compliant with upper and lower bars. Never suspend plates on the wrong carrying bar in case of plate pack instability.

## ② Porthole

That is where the channel forms when multiple plates are put together. You must have noticed there are two types of seal rings in the gasket upon the portholes. The channels without double seal rings allow fluid or gas to go through. On the contrary, it does not.

Plate types like endplate and turning plate, their portholes have not been opened.

## ③ Distribution area

Consider this area as a shower, it helps the water spread broader and more well-distributed, and this is the function of the distribution area. As a result, media will fill up all over the plate, and thus the heat transfer efficiency reaches the peak, the probability of scaling will also be minimized.

## ④ Leakage port

The leakage port is insurance. Once leakage happens, fluid will flow out of the seal. And the operator could easily find the leakage point from the plate pack.

⑤ Heat- transfer area

This area is the largest, though the other areas are also involved in the heat transfer, more or less. This area's heat transfer efficiency is the highest because the Chevron corrugation that we build on purpose increases the heat transfer area and promotes fluid turbulence.

⑥ Gasket groove

PHE is a pressure vessel. Thus sealing is the most critical issue. Mismatching could lead to leakage, plate pack dislocation even deformation.

## II Working Principle

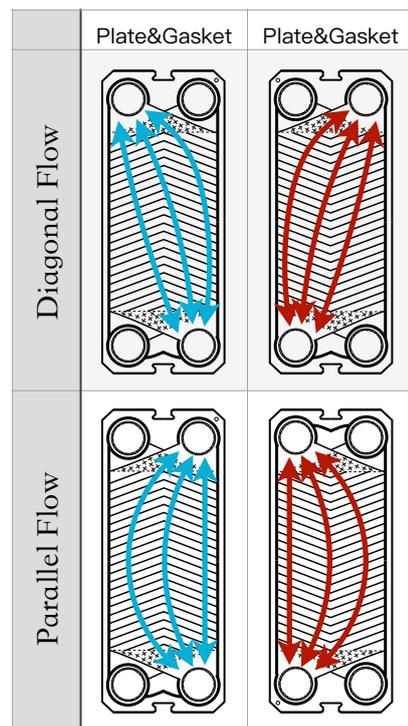
① Diagonal and Parallel Flow

Under single-section(pass) PHE, Two neighbouring plates A and B, are stacked.

The gaskets on each plate form a flow channel, where the fluids flow alternately and exchange heat through the thin metal plates.

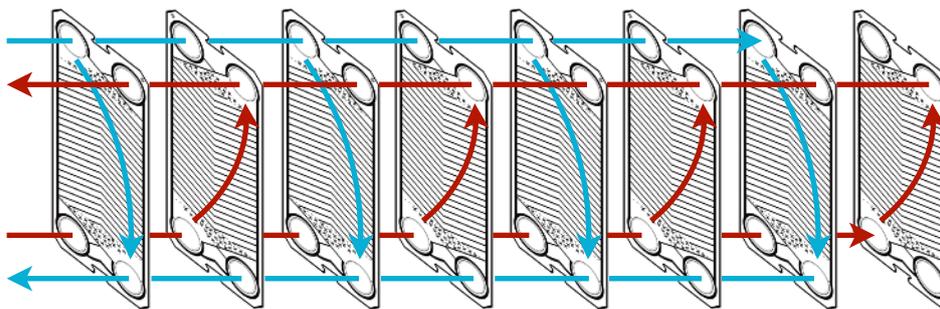
Users always opt to use either parallel or diagonal flow depending on existing piping connections. However, they vary in thermo-hydraulic performance.

The diagonal arrangement of the PHE has better heat transfer and pressure drop performance. The effect may increase in the case of wider plates.

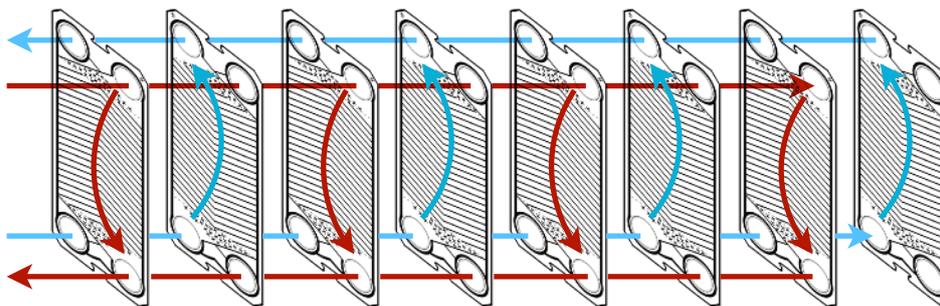


② Single-pass

In a single-pass process, cold fluid and hot fluid flow in and out on the same side. Single-pass is the simplest and commonly used where there is a big temperature difference.



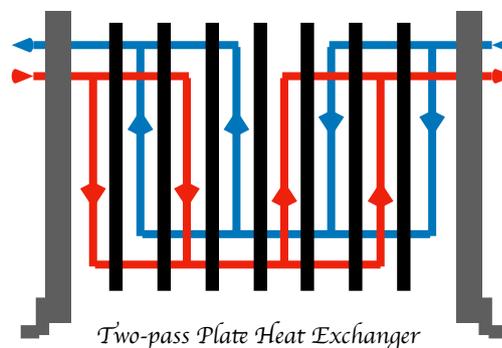
*Diagonal Flow*



*Parallel Flow*

③ Multi-pass

Multi-pass, on the other hand, is applied for the small temperature difference. The heat transfer efficiency increases as more passes were added. In exchange, the pressure drop goes up.



*Two-pass Plate Heat Exchanger*

### III Material

	Applicable Mediums	Thickness
304SS	Pure water/ Edible oil/ Ethanol	0.4/ 0.5/ 0.6
316SS	Water/ Edible oil/ Ethanol/ Carbonic acid/ Low temperature 20% Sulphuric acid(without Cl <sup>-</sup> )	0.4/ 0.5/ 0.6
254SMO	Low temperature 20% Sulphuric acid(without Cl <sup>-</sup> ) / Inorganic acid	0.6
Titanium	Sea water/ 130°C Chloride	0.5/ 0.6
Ti0.2Pa	70% Nitric acid/ Hydrochloride(Cu <sup>+</sup> &Fe <sup>+</sup> )	0.5/ 0.6
Hastelloy C-276	98% Sulphuric acid/ Nitric acid/ 40% Hydrochloride/ 50% Phosphoric acid	0.6
Nickle 200/201	50-70% Alkali	0.6
Graphite	Strong corrosive medium	0.6

*Material selected should be compatible with the process.*

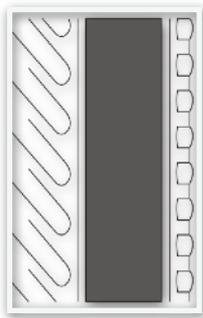
## 2.4. Sealing Gasket

### I Materials

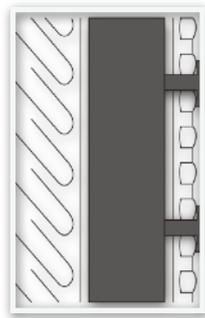
Gasket	Temperature/ °C	Media
<b>EPDM</b> Ethylene propylene diene monomer	-25-140	Water, aqueous solution, lean acid and base
<b>NBR</b> Nitrile rubber	-30-100	Water, aqueous solution, fat, vegetable oil and mineral oil, ethanol and glycol
<b>FKM/Viton-B</b> Fluoro rubber	-15-150	High-concentration inorganic acids (oxidizing acids, etc.), alkalis, salts, petroleum products, hydrocarbons
<b>FKM/Viton-G</b> Fluoro rubber	-15-180	Hot water and steam, high-temperature mineral oil, solvents
<b>CR</b> Chloroprene rubber	-30-120	Ammonia and various fluorine-containing refrigerants
<b>HNBR</b> High Temperature Nitrile rubber	-30-120	Water, aqueous solution, fat, vegetable oil and mineral oil, ethanol and glycol
<b>EPDMHT</b> Ethylene propylene diene monomer	-20-150	Water, aqueous solution, lean acid and base

*Material selected should be compatible with the process.*

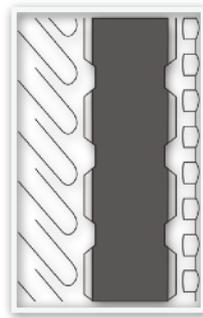
## II Types



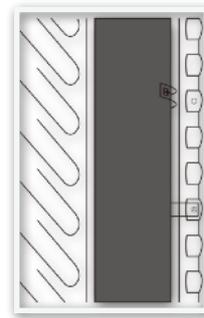
Glue



Clip-on



Lock



Snap-on

## 2.5. Frame

### I Attribution

The heat transfer plates are clamped together to a predetermined dimension by the tie bars between two thick metal slabs: a fixed slab (head) and a movable slab (follower). Connections for the fluid inlets and outlets can be made on either slab. The plates are hung on the top bar and guided by the bottom bar. An end column supports the top and bottom bar ends.

### II Thickness and Tolerable Maximal Pressure

The thickness of the large plate is generally determined according to the size and pressure level of the heat exchanger. The standard of design pressure could roughly be divided into three classes, 1.0 MPa, 1.6 MPa/162 Psi and 2.5 Mpa/351 psi.

## 3. Assembly

**T**his chapter introduces the progress of assembling a PHE from scratch. People who have not mastered the knowledge and skills should not participate in assembling progress, mainly on personal and property safety grounds.

### 3.1. Precaution on Using Crane

#### I Safe Sling Use

This chapter applies to all kinds of slings, including but not limited to Synthetic Slings, Wire Rope Slings, Alloy Steel Chain Slings, Metal Mesh Slings.



- Never attach the lifting slings to the connecting nozzles.
- Never transport the PHE with a pallet truck.
- Always transport the PHE while suspended.



Demonstration- PHE Lifting and Raising

<https://youtu.be/wRaqEWh61JQ>





## 3.2. Assembling Process

If you are about to assemble a PHE from spares to one unit without any veteran, reading carefully through this chapter will be beneficial, especially the tips listed below every step.

Before starting, you should have known all essential knowledge about PHE, including what components a PHE has, how they look like and work.

### I Prepare

- For those who will set up a new PHE from the beginning, please find out the drawing (composition diagram) and collect all the components, making sure their size corresponds with the data.
- For those who will assemble with used plates, it is strongly recommended to perform dye penetration tests on all of them.
- For those who are going to reconstitute a PHE, please put those plates in the original order. Usually, plates deform irreversibly due to inappropriate tightening methods or repetitive assembling. Thus setting them in original order could minimize the probability of terrible consequence (however, if you find most of the plates are incurable, maybe it is time to replace them all).

### II Mounting Up Gasket

- Before carrying out, please verify the specific type of your gasket (refer to chapter 2.4) and watch the following corresponding video



Glue

<https://youtu.be/dLo0xNgKmlU>



Clip-on

<https://youtu.be/cF4U5bmROhY>

Lock



Snap-in

<https://youtu.be/CJq0dH31nBU>

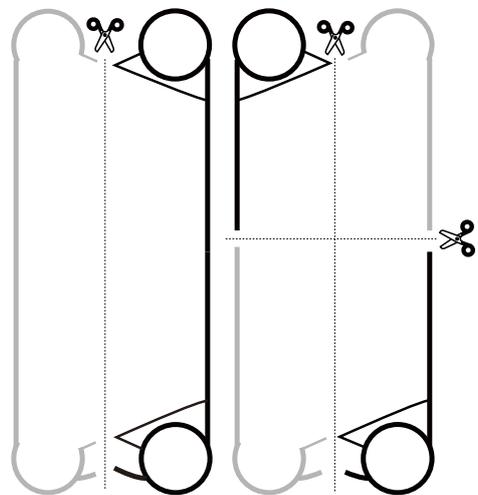
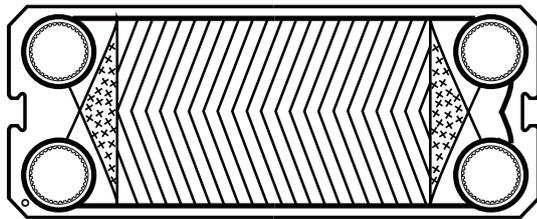
- How to make an end-gasket?



Self make end-gasket

[https://youtu.be/\\_GKh5vQBRw](https://youtu.be/_GKh5vQBRw)

Find two gaskets and clip according to the figure shown on the right. Then put them on the plate and check if the joints are fit. If not, cut out excess parts.



- Given you may have to use old gaskets to install, to prevent leak or duplication of work, please follow the steps below to identify if it could reuse or not:
  - ① Visual inspect every gasket, make sure what you are going to mount up are unbroken and clean.
  - ② Bend the gasket. If it is lack elasticity, do not reuse it.
  - ③ Mount gasket on the plate, if it does not fit, do not reuse (to be specific, the gasket could be extended during its service, it could be longer)

④ If the gaskets were fixed with adhesive, please rub them off with anti-adhesive oil. However, some adhesives can not be removed in that way. You may use a heat gun to heat the reverse of the groove with hot air. The temperature should not be beyond 150°C.

- If you find the gasket is more than 1 millimetre thicker than the depth of the gasket groove, please do not use them and report it to your supplier.
- Before attaching the gaskets to the plates, make sure both sealing surfaces are dry, clean and free from any foreign matter.

- **Orientation**

Most of the gaskets are easy to tell which one is front or back, such as inspecting the exposure direction of the leakage port(sometimes looking for the colour code is easier), putting the gasket on the plate, and checking whether they fit.

But for some specific gaskets, there is no difference between front and back. You may use both sides to attach.

If you have no idea about the orientation, please feel free to contact us.

- **3 Ways To Gasket the Start Plate**

① For most cases, we could use two-pass plate gaskets to reunite a double seal gasket.

② Using ring ports is a more concise way, but not always inapplicable. Please send the model's name when inquiring.

③ If the depth of the gasket groove is higher than the corrugation, you may need to cut the highest points at the edge (imagine if you mount up the gasket and put the start plate on the frame, you will find out there is no sealing between them. Instead, the edge of the plate adjoins the frame) and cut a piece of rubber whose material must be as same as the original gasket.

Put the rubber with the plate on the frame and cut the excess part, make sure it fits the plate size as close as possible.

Dig holes corresponding with the flange holes upon the fixed plate, then carefully and evenly apply adhesive to the prepared rubber, finally put it onto the frame.

- **Adhesive**

Only use heat exchanger exclusive glue, which has to be a chloride-free glue. The composition usually contains nitrile rubber, resin and some solid glue.

To ensure the adhesive force of the gaskets, please pile all gasketed plates up, and always put a flat and heavy thing on the top of the plate.

### III Set Up Frame

 Demonstration- Set Up Frame  
<https://youtu.be/kjmI8jkP4kA>



If you are going to use a crane and sling to set up a frame to minimize the risk of personal injuries or damaging them, please strictly comply with the operation rules mentioned in **Chapter 3.1**. Due to the frames are made of solid metal, and their shapes are flat and tall, it takes some training and skills to keep its balance. There is a potential death hazard from lifting frame.

If the size of the PHE is small and light, you may carry the frame with your body, but we strongly recommend you put on safety shoes (such as steel-toe work boots) and slip-proof gloves.

You may put two pads like square timbers beneath the frame and one anti-slip mat at the standing position.

After fixing the carrying and guiding bars, you may assemble the movable plate.

**Note:** If it is not necessary, please keep the hanging height as low as possible!

## IV Hang Up Plates



### Demonstration- Hang Up

<https://youtu.be/Aa9bysKlQdQ>

Before hanging, you need to figure out the order of the plates. Therefore you have to be fully aware of the PHE working principle (refer to chapter 2.3- II).

- ① There is always lubricant residuals around new frame portholes. If it is metal lined or nozzle type, use clean rags to wipe out the residuals.
- ② Hang up the first plate, put it against the fixed plate.
- ③ Hang up the plates to the carrying bar alternately. The plate pack should be mounted against the fixed plate. Each plate is moved along the upper guide bar and is pressed against the preceding plate.
- ④ Press the plates pack together.



- ⑤ Always check both lateral plate pack if there are any following issues:
- A. Gaskets are not attached or out of the grooves.
  - B. There are few specific plates sticking out of the plate pack.
  - C. Both sides do not look like an integral “honeycomb” (This rule applies to most models).

I strongly advise you to solve the issues above before tightening.

## V Tightening



Manually push the movable plate against the endplate. Use a crane if necessary, but still, you have to be very careful with it. Given the size must be enormous to use a crane, do make the force follow the direction of the carrying bar, freeze if there is any slight vibration from the frame feet.

You may choose to tighten the PHE manually or with hydraulic tools depending on the size or number of the plates. Either way, you have to follow the rules below:

- A. Tightening symmetrically.
- B. Make sure the frame plate and pressure plate are parallel when closing. Use a ruler to frequently measure the value “a” at both sides’ top, middle, and bottom.

- C. When tightening, the distance (**Tensioning Dimensions**) between the two frame plates shall never be less than the minimum “a” marked in the **Nameplate**. (If the plates number has been changed, consult your supplier or calculate by the formula below:

$$\max a = (c + \delta) \times n$$

$$\min a = \min a - 5\% \times \min a$$

$a$  = Tightening dimension.

$c$  = Depth of the corrugation.

$\delta$  = Thickness of the plate.

$n$  = Number of the plate.

- D. Tighten each bolt simultaneously and evenly.
- E. During tightening, visually inspect if the gasket has been squeezed out, use snap ring pliers to open the spot, and a screwdriver to slightly prod it into the groove.

**\* It will be too late to inspect after finishing tightening.**

### 3.3. Hydro Test

For single-pass setup, pressurized hot and cold sides independently. Actual test pressure shall not exceed the specified test pressure. Overpressure could result in heat transfer plate deformation or leaking. The test pressure value is the “**Design Pressure**” (marked in the Nameplate) multiplied by 1.1.



In a multi-pass setup, all sections of the same side must be tested simultaneously.

The recommended test time is 30 minutes for each media side.

\*If you intend to pneumatic test the setup, the whole process is the same as the hydro test, but you have to be more careful, especially on the “**Test Pressure**”, do not exceed [1.1 multiply “**Design Pressure**”]. During the process, keep your distance from PHE. When compressed air or nitrogen for the pneumatic test leaks, it is hazardous since there would be an impact caused by volume expansion in addition to such test pressure.

Local laws and regulations regarding the hazard involved in testing with a compressible medium must be respected. Hazardous examples are explosion risk due to uncontrolled medium expansion and/or suffocation risk due to oxygen depletion.

## 4. Installation

### 4.1 Before Installation

I strongly recommend you to read through chapter “3.1 Precaution on Using Crane” firstly.

Always inspect the unit for the first time no matter when you are going to install it because PHE has a possibility of damage during transportation.

Acknowledge its situation and give HFM feedback in the first place could avoid delaying your schedule. If you find any damage existing, please fill out the scope and types of damage in the freight documents.

Check if all nuts of tensioning bolts are firmly tightened.

Check the value “a” from the **Nameplate** nailed in the fixed plate and measured the actual value “a” at the top, middle, and bottom sides of both sides if it is within the numerical interval. If they are not, tension the plate pack to the maximum “a”(refer to 3.2- V Tightening), and feel welcome to consult with us.

Make sure all foreign objects have been flushed out of the piping system that should be connected to the PHE.

#### Space

Provide enough clearance around the unit for maintenance (Replacing spares, shortening or extending, opening the unit, tightening the plate pack, etc.)

#### Foundation

The foundation bed prepared for the PHE should be flat and solid to support the weight. The PHE should be firmly fixed to the foundation before connecting pipes.

#### Drainer

PHE unit should be installed nearby drainer.

The following accessories should be prepared :

#### Elbow

For the convenience of maintenance, an elbow should be fitted to the connection in the pressure plate, directed upwards or sideways, and with another flange located just outside the contour of the heat exchanger.

#### Shut-off Valve

To be able to open the heat exchanger, shut-off valves should be provided in all connections. However, to prevent water hammers, fast-close valves are forbidden.

#### Gauges

Although you might have an integrated monitor, it is crucial for the on-site operator to have intuitionistic indicators, so installing the temperature and pressure gauges is necessary. On the other hand, avoid no indicator risk during the period of system crash.

The following accessories could be considered :

#### In-line Filter

When the fluid contains large particles, like river water as the cooling medium, the efficiency of your PHE could go down, and maintenance cost goes up. An in-line filter(Strainer) would be helpful.

#### Insulation Jacket

PHE is not permanently installed in a warm room. Some harsh environments make the equipment's efficiency and lifetime below design effect. An insulation jacket could keep the unit from losing thermal energy.

## Drip Tray

A right size and anti-corrosion drip tray could not only help the maintainer collect residual during disassembling but also prevent minor leakage.

## 4.2 Installing The Pipe Connections

Every PHE manufactured by HFM is customized by the order and need of the customers, so as the connections come with.

When connecting the pipe system to the heat exchanger, make sure that no stress or strain is imposed on the heat exchanger by the pipe system.

- Heavy pipes need to be supported, but they shall neither be loaded on the frame nor installed in the maintenance area.
- Always install vents on both sides of the heat exchanger to remove air from the system. Vent vales must always be fitted at the highest point. (When all air is out, the liquid will flow out of the vent, close the vent.)
- Clean the pipes inside out before connecting to the PHE.



### **Threaded Pipe Connections**

If a plate type heat exchanger is provided with threaded pipe connections, make sure that these connections do not rotate when fitting to the pipework. It could damage the gasket on the start plate. You need to make a “counter hold” on the connection!

## **Flange Connections**

If the connection is rubber lined, the liner will act as the flange gasket. Bolt the connecting flange directly to the endplate using the drilled and tapped holes provided.

Tighten the bolts evenly- do not over-tighten as this could strip the threads cut into the frame plate.

If loose backing flanges are fitted to the heat exchanger, a suitable gasket is required to seal the flange.

The fluid circuits should be connected to flow in reverse directions through the exchanger (counter-current) unless otherwise stated. Refer to the contract drawing or quotation details if the connections are not marked.

The benefits of installing flexible connections:

- Protect both PHE and pipe from the vibrations on PHE.
- It is more convenient for the longitudinal displacement of the plate pack.

Ensure that the pipe system connected to the PHE is secured against sudden pressure surges and temperature fluctuations.

Feed systems operating on the piston principle must be equipped with vibration dampers.

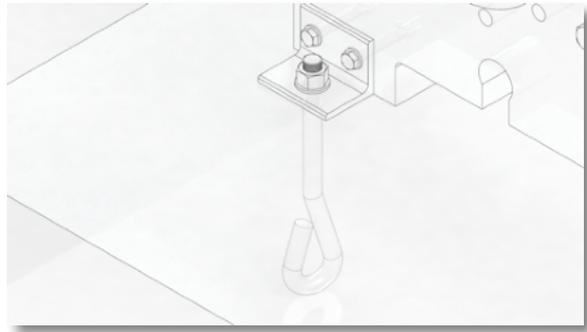
## **Frame Feet**

All frame feet manufactured by HFM are detachable. Once finishing all the connections you may anchor the support feet.

There are two types installation methods.

### Anchor Bolt

- Drill a hole on the ground for burying the nut. The centre points of the foot anchor hole and nut should be aligned. And the nut has to be fixed beneath.
- Install the frame foot and tighten the bolt.



### Expansion Bolt

- Drill a hole on the ground. The centre points of the foot anchor hole and hole should be aligned.
- Insert the expansion bolt through the anchor hole. Put on and tighten the nut until they are secure.



# 5. Commissioning and Operation

## 5.1 Commissioning

### I Pre-checks

- ① Ensure the PHE is ready and every required apparatus has been installed in terms of chapter “4- Installation”.
- ② If the operating system has been changed, and the media are different too, please consult your supplier whether this PHE is still suitable.
- ③ Read the **Nameplate** on the fixed plate again. The PHE will not accept unpermitted temperature or pressure levels.

### II Insurances

To prevent hydraulic and thermal shock (water hammer), the rules below should be followed:

- ① Gradually open or close the valves.
- ② Avoid rapid temperature changes of the media inside the PHE if the ambient temperature has been changing widely. An insulation jacket is necessary.
- ③ Make sure the vent valves are fully opened before start-up.
- ④ If there is high corrosive or vapour involved, please take the necessary guard measure.

## 5.2 Operation

### I Start-up



Open one circle, then another.

Sometimes the sequence matters due to significant temperature difference could damage the plates, and the sequence mainly depends on the medias' temperatures. So flow the not too hot/cold media circle first.

Low ambient temperature and too cold media could make the gaskets lack elasticity, which leads to cold leaks.

Visually inspect leakage during start-up. If hazardous media or vapours are involved, please keep a safe distance or inspect through a transparent shield.

When all the air is expelled into the vent, close it in case of back-flow.

#### **Multi-section PHE**

Ensure that when commissioning multi-stage PHE, all sections must be pressurized or relieved evenly.

#### **Steam**

If there is steam(saturated vapour) as media involved, besides the note above, please ensure that the steam trap is correctly sized to allow full condensate discharge- this prevents water clogging inside the exchanger.

## II Daily Operation and Inspection

Record the temperature and pressure data every day, and it is the chief engineer's responsibility to keep them within a reasonable range. Otherwise, the lifetime of the spares or PHE could shrink.

Flow rates should be adjusted slowly to protect the system against sudden and extreme variations of temperature and pressure.

Check the floor nearby the PHE or drip tray if there are any signs of leakage.

Suppose you encounter issues like leakage or poor performance. Please go down to **chapter 7.1. Checklist**.

## III Shut down



Close one circle than the others. Please close the valve slowly.

The close sequence should be reversed in "Start-up".

If the downtime takes more than one week, please drain all the fluids inside the unit. Collect and pack hazardous residuals which are forbidden to discharge.

## 6. Maintenance

Like all the other types of machinery, PHE requires regular servicing, which generally conclude with cleaning and regasketing.

The most consumable spare is the gasket. HFM recommends changing in every fixed period, which mainly depends on your working condition.

### 6.1. CIP- Clean In Place

CIP is effective under the following conditions:

- The size of the PHE is relatively small.
- Frequent and short-term regular cleaning.
- The cleaning agent could easily dissolve the scale without damaging the plates and gasket.

Tips:

- ① The chemical properties of the media on the PHE and the cleaning agent should also be considered in case there are still residuals after draining.
- ② For thorough cleaning, it is necessary to flow CIP solution from bottom to top to ensure wetting of all surfaces with cleaning solution. When cleaning multiple pass units, it will be required to reverse flow for at least 1/2 the cleaning time to wet all surfaces.
- ③ Cleaning by reverse flushing is a possible alternative to CIP cleaning. Reverse flushing is employed when the flow media contain coarse dirt particles plugging the manifold channels. The dirt particles are removed from the PHE by briefly reversing the flow direction.

## 6.2. Manual Cleaning

Due to the complex corrugation structure of the plates, CIP could never reach “No dead corner cleaning”. However, it is convenient and economical. On the other hand, manual cleaning would cost you more labour, but you get a brand new PHE in return.

### I Opening



PHE is not allowed to open under the following circumstances:

- Before draining all fluid out of the system.
- PHE temperature is still high.

Always measure and record the actual value “a” at the top, middle, and bottom sides of both sides before loosening any bolt.

If the bolts and carrying bar have not been adequately cared for a long time, I suggest cleaning and grease them to loosen easily without damaging them.

Loosen the tightening bolts diagonally and equally, so the movable plate shall have a parallel opening motion.

If it is a big size or a large number of plates within, you may need to use the hydraulic wrench to replace 4 or 6 diagonal cuts to tighten a little bit, then loosen the other bolts.

Carefully remove the bolts one by one.

Slowly push the movable plate until the plates are loose enough to detach.

Push aside the plate pack and inspect the level of fouling and scaling.

Check the plates on both(single-section) or all circles(multi-section).

## II Cleaning Without Taking Off Plates

If the condition is fine, use a high-pressure hydraulic cleaner to flush the plates while they are hanging.

To avoid plates falling out during cleaning, you should control the space between plates.

## III Cleaning Removed Plates

If the surface of the plates have severe scaling or you had detected leakage when the PHE was running, please prepare to remove them for thorough washing.

Number all the plates before taking off.

Open the plate pack by letting the pressure plate glide on the carrying bar, piles them on a pad like corrugated paper.

Detach all the gaskets gently.

Use a high-pressure hydraulic cleaner to wash out the scale as clean as possible.

## Chemical Cleaning



If the scale could not be removed completely with the method above. You may consider chemical cleaning.

Before carry out please follow the procedure below:

- Consult your technical department or us what cleaning agent made available for this plate material;
- If aggressive chemical will be involved. Please do wear goggles, rubber gloves and all the other protective clothing.

Prepare a proper size basin and fill cleaning agents in.

Immerse plate into the agent. If you want to know about the agent temperature, concentration and immersion time please step up to the following link-

<https://www.hofmann-heatexchanger.com/phe-service/phe-cleaning>.

Finally, use a high-pressure hydraulic cleaner to wash again and wipe dry.

# 7. Appendix

## 7.1. Checklist

Please check the following items during the commissioning or operation.

1. If there is suspicious fluid stain around the PHE. Please find out where it happens. The table below shall guide you how to do.

Fault	Cause	Remedy
Leaks between the heat transfer plates	Incorrect tensioning dimension of PHE	Check the correct tensioning dimension in the Nameplate
	Excessive operating pressure	Check operating pressure according to the Nameplate
	Operating temperatures too high or too low	Check operating temperatures according to the Nameplate
	Heat transfer plate gaskets are not properly seated	Open the PHE and correct the seat of heat transfer plate gaskets
	Heat transfer plate gaskets are soiled	Open the PHE and clean the heat transfer plate gaskets
	Heat transfer plate gaskets either defective or hardened	Open the PHE and replace the heat transfer plate gaskets

Fault	Cause	Remedy
Leaks between heat transfer plates and frames, reinforcement plates and intermediate plates	Incorrectly seated heat transfer plate and frame gaskets	Open the PHE and correct seat of plate and frame gaskets
	Heat transfer plate and frame gaskets are soiled	Open the PHE and clean the heat transfer plate and frame gaskets
	Heat transfer plate and frame gaskets are defective	Open the PHE and replace the heat transfer plate and frame gaskets
Leaks between frame connection and pipe-work	Excessive load of frame connection from pipework	Reduce connecting loads to permitted values
	Gasket improperly seated	Slacken off frame connection and correct gasket seat
	Dirty gasket	Slacken off frame connection and clean the gasket
	Defective gasket	Slacken off frame connection and replace the gasket
	Flange connection is not sufficiently tightened	Check gasket and retighten connection evenly if required
Damaged heat transfer plates	Excessive tightening of heat transfer plate pack (tensioning dimension below min a)	Replace defective heat transfer plates
	Corrosion of heat transfer plate material	Check design of PHE regarding flow media, contact HFM
Damaged heat transfer plates at the beginning or at the end of the PHE	Incorrect earthing when welding on special connections to open frame connecting pipes	Replace defective heat transfer plates

2. If you find the PHE is running at poor performance as it should be. Please check the table below.

Fault	Cause	Remedy
Reduced heat transfer	Deposits on the heat transfer plates	Clean the heat transfer plates according to <b>chapter 6.1. or 6.2.</b>
	Operation, flow media etc. differing from the design case	Have PHE design with new operating data checked by HFM
Excessive pressure loss	Plugging of manifold flow gaps obstructs flow	Clean the heat transfer plates according to <b>chapter 6.1. or 6.2.</b>
	Incorrect installation of heat transfer plates obstructs flow	Check installation order by means of circuit diagram
	Operation, flow media etc. differing from the design case	Have PHE design with new operating data checked by HFM

## 7.2. Common Cleaning Agents

The following table introduces some common cleaning agents for heat transfer plates.

Types	Plate Material	Effective against	Temperature	Concentration	Method
Water-based degreaser	All	Mineral oil	25 ~ 40°C	2~6%	Immersion
Descaling agent	All	Inorganic salt fouling	25 ~ 40°C	10%	Rinse/ Immersion
Caustic cleaner	Stainless steel	Organic and inorganic scaling	50~80°C	0.5~3%	CIP

If you want to know more detail about the cleaning agents please step up to the following link-  
<https://www.hofmann-heatexchanger.com/phe-service/phe-cleaning>.