

# TMXFLOW

## Gasketed Plate Heat Exchangers User's Manual



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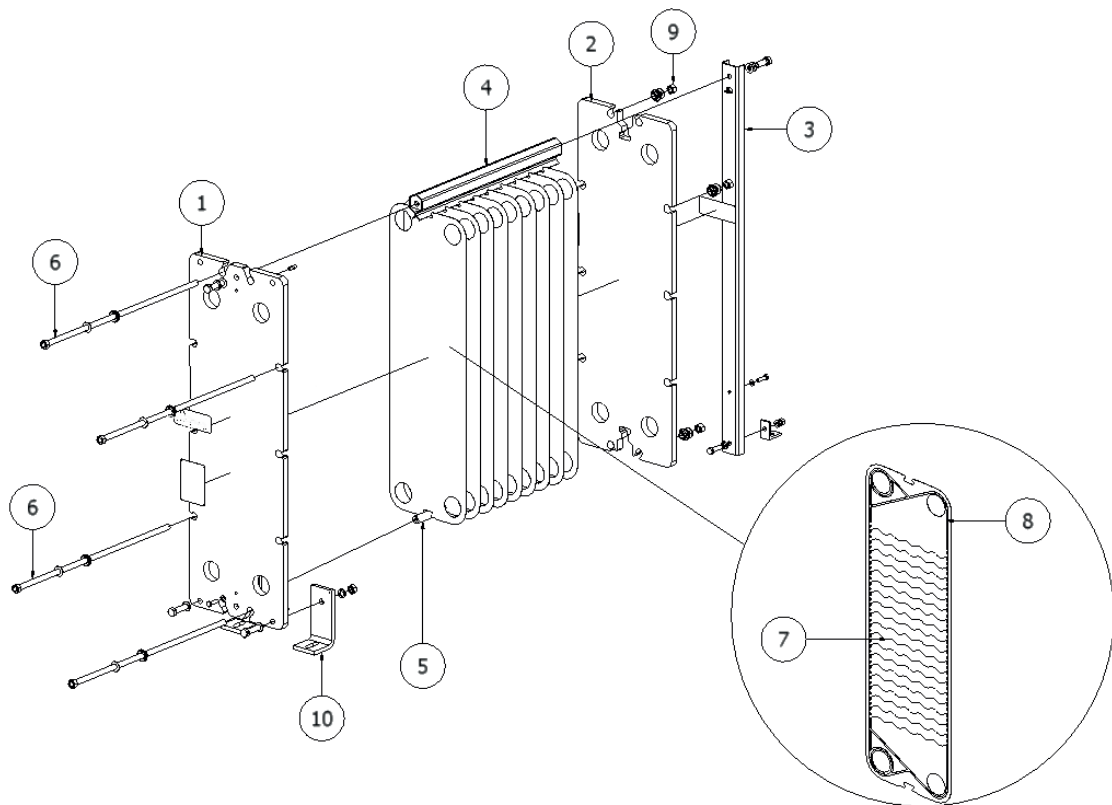
Dear Customer.

Thank you for choosing TMXFLOW equipment!

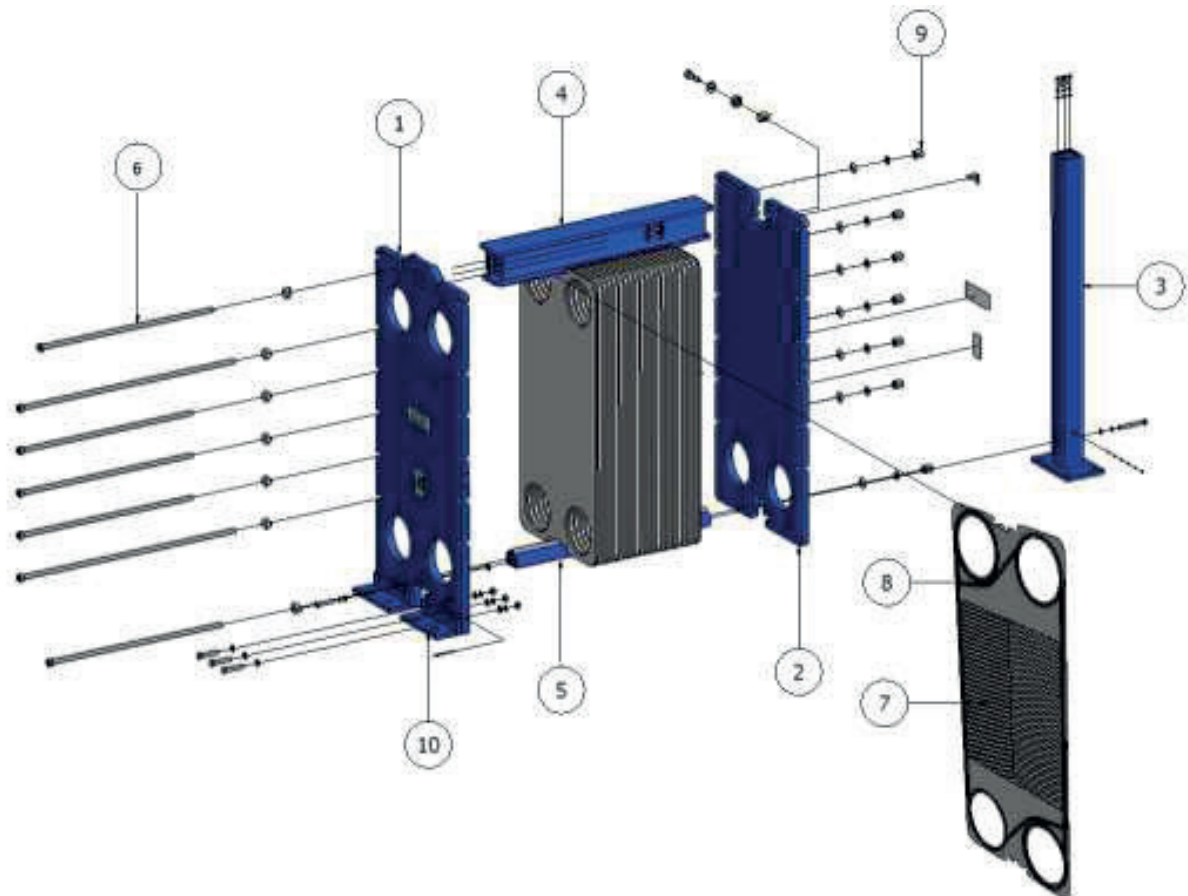
The purpose of this manual is to provide you with important information on operating your Plate Heat Exchanger.

Read this manual carefully before unpacking the equipment.

## 1. Main components



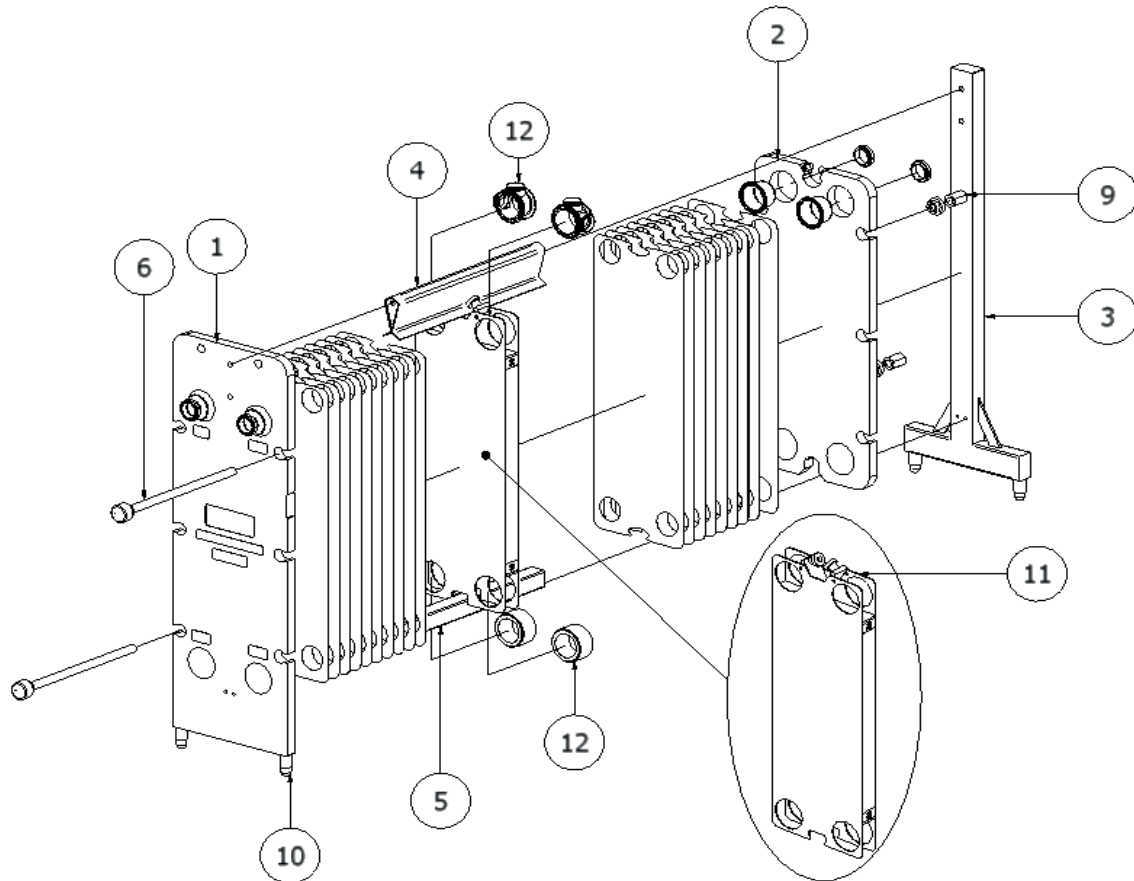
A typical small Plate Heat Exchanger



A typical large Plate Heat Exchanger

**Figure 1: Main components of TMXFLOW gasketed plate heat exchanger, industrial design**

1. **Head** for connections and clamping the plate pack
2. **Follower** for clamping the plate pack and any additional connections
3. **End support** for supporting the top and bottom bars
4. **Top bar** for carrying and guiding the follower and plate pack
5. **Bottom bar** for guiding the follower and plate pack
6. **Tie bars** for clamping the plate pack between head and follower
7. **Flow plate**
8. **Flow gasket**
9. **Nut** for tie bar
10. **Footplate** for securing the plate heat exchanger to the base.



**Figure 2: Main components of typical TMXFLOW sanitary / hygienic plate heat exchanger.**

1. **Head** for connections and clamping the plate pack
2. **Follower** for clamping the plate pack
3. **End support** for supporting the top and bottom bars
4. **Top bar** for carrying and guiding the follower and plate pack
5. **Bottom bar** for guiding the follower and plate pack
6. **Tie bars** for clamping the plate pack between head and follower
7. Flow plate (Figure 1)
8. Flow gasket (Figure 1)
9. **Nut** for tie bar
10. **Adjustable** or fixed **legs**
11. **Connector grid** for additional fluid connector bosses
12. **Connector bosses**

## 2. Operating Principle

### 2.1 Standard design

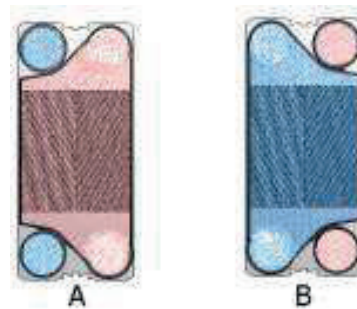
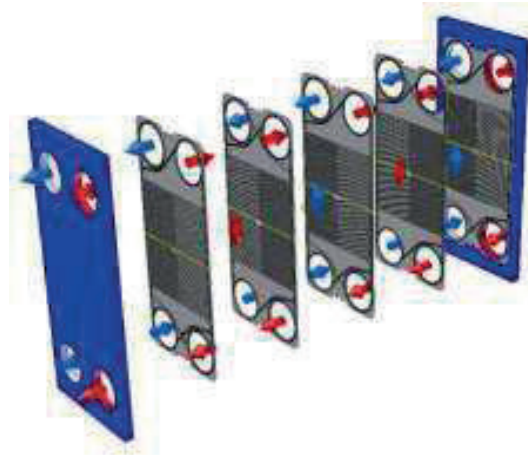
The plate heat exchanger consists of a number of thin corrugated metal plates.

The plate corrugations form flow channels for the heat exchanging fluids and provide strength to the compressed plate pack.

The plates contain ports for fluid inlets, outlets and interconnect passages as required.

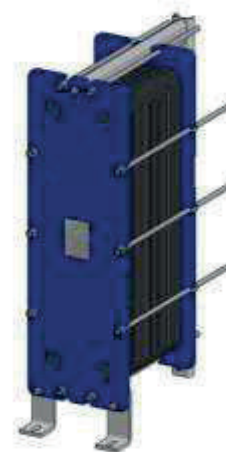
Gaskets are attached to the plates, forming a seal between the heat exchanging fluids and the surroundings.

In the example shown here, the cold fluid (blue) enters at the bottom and the hot fluid (red) at the top.



### 2.2 Frame

The plates are clamped together to a predetermined dimension by the tie bars between two thick metal slabs: a stationary slab (head) and a moveable 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.



## 2.3 Sanitary plate heat exchangers

Frames used for sanitary or hygienic duties are fabricated in solid stainless steel or carbon steel with stainless steel covering. Standard connections are usually sanitary tube fittings. Industrial fittings may be supplied when required.

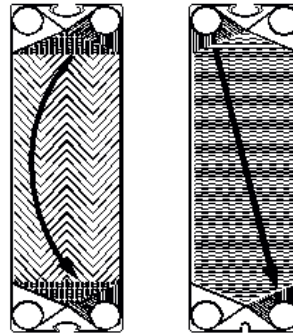
Plates may be either parallel flow or diagonal flow.

**i** Note: The type of plate, whether parallel or diagonal, affects the position of the fluid inlet and outlet connections, left/right.

Parallel plates have both flow inlet and outlet ports on the same side, e.g. left side for the hot medium and right side for the cold medium.

For diagonal plates, however, if the fluid enters the channel in the left corner, then it leaves the channel in the right corner

Parallel plates require only one type of plate, while diagonal plates require two different plates to form a flow channel.



## 3. Handling

### 3.1 Lifting

If the plate heat exchanger is packed and transported lying flat on the head, great care must be taken during raising it, to avoid sliding and impact of bending forces to the equipment base or feet.

TMXFLOW Plate Heat Exchangers are provided with lifting lugs or holes for safe lifting and transportation of the unpacked equipment.

When lifting an assembled heat exchanger frame, ensure that the lifting point is above the centre of gravity of the equipment.

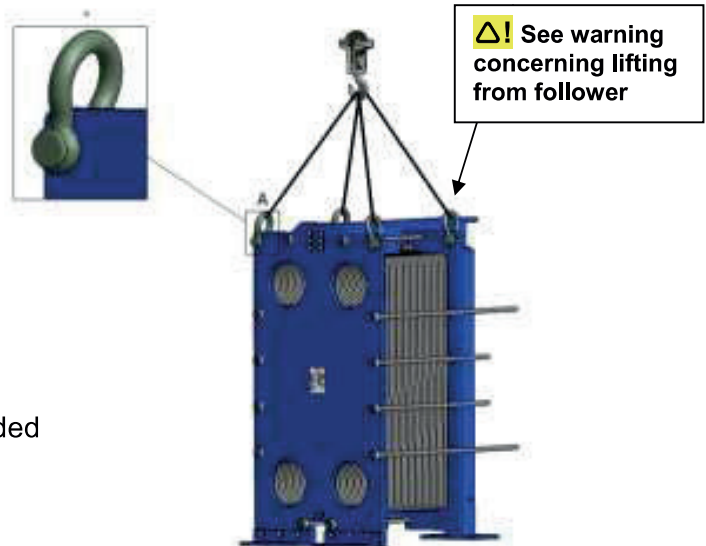
**⚠** The lifting equipment must be in good condition and should always be used in full compliance with the specifications and limitations given for the equipment.

**⚠** Always maintain the minimum angle between the lifting wires in order not to exceed the allowable wire tension. The angle should not exceed 120° at any time

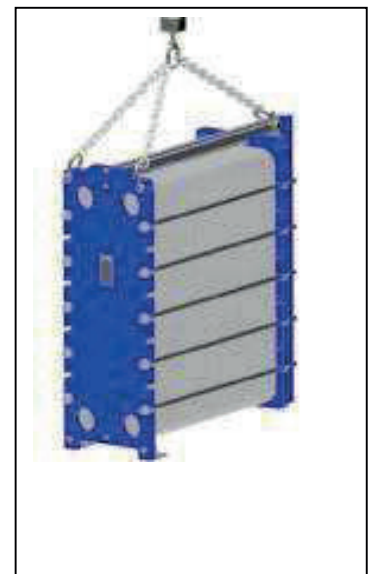
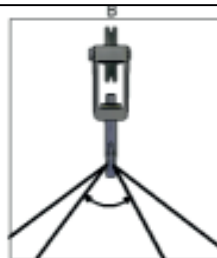
If the ceiling height does not allow for safe lifting angle, dollies or creepers can be used for moving the equipment.

**⚠** Always observe proper procedures for lifting and/or moving equipment and qualified personnel for the lifting and moving. Personnel must follow safe rigging practices.

Indiscriminate use of fork lift trucks may damage the PHE in critical areas.



**⚠** Warning: Lifting from the follower shown above is not acceptable for some models and plate damage may result. Check for warning signs on the follower supplied. Use alternative lifting eyes for example as shown below in those cases





## 4. Installation

### 4.1 Foundation

TMXFLOW Plate Heat Exchanger should be placed on a solid foundation floor. If the unit is provided with feet, the dimensions and placement of these are stated on the assembly drawing.

### 4.2 Space requirements

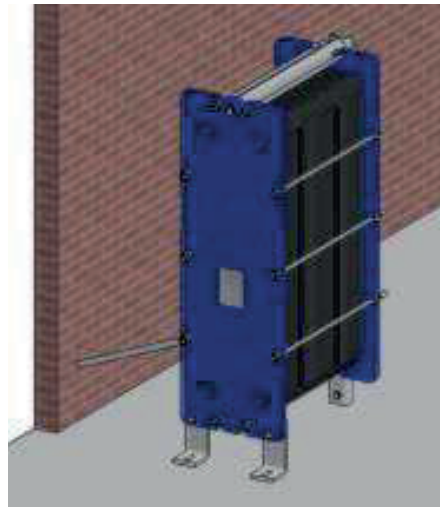
Ensure that there is sufficient space around the plate heat exchanger to separate the plate pack and to remove or insert plates. The amount of free space required is stated on the assembly drawing.

**⚠** Ensure sufficient space around the plate heat exchanger.

### 4.3 Connections

If the plate heat exchanger has liquid connections on the follower, it is important that the compressed dimension is checked against the drawing before the pipes are connected. For easy disassembly and reassembly of the plate heat exchanger, a pipe elbow should be used at all follower connections.

The plate heat exchanger connections on the follower and connector grids have little strength against pipe work or nozzle loads. Such loads can arise for example from thermal expansion. Proper care must be taken to avoid transfer of such pipe forces and moments to the PHE.



## 5. Storage

### 5.1 Short Term Storage (less than 6 months)

The plate heat exchanger must be stored in a cool and dry environment away from sunlight. It must be protected from water and debris with a waterproof cover, while also allowing for air circulation.

### 5.2 Long Term Storage (more than 6 months)

The heat exchanger must be stored in a cool and dry environment away from sunlight. It must be protected by a waterproof cover against water and debris, however still allowing for air circulation.

**⚠** Ozone-producing equipment, salt air and other corrosive atmospheres must be avoided at all times.

All connections must be closed to prevent water or debris to enter the heat exchanger. Factory installed plugs or covers may be used.

To extend gasket service lifetime, it is recommended to relax the gaskets by loosening the tie bars by approximately 10% of the compressed plate pack dimensions.

## 6. Start-up and operation

### 6.1 Start up

**⚠** Start-up of the plate heat exchanger must be undertaken slowly and smoothly to avoid any pressure shocks/water hammering which might damage the equipment or cause leakage.



Do not allow pressure changes of more than 10 bar (150 psi) per minute. Temperature changes may be harder to control but ideally should be limited to less than 10 deg C (20 deg F) per minute. Cyclic hydraulic or thermal conditions can cause serious damage to the PHE.

If the plate heat exchanger is provided with shut-off valves at the inlets, these should be closed prior to start-up and then opened slowly after pump start-up  
For sanitary heat exchangers with multiple sections, also read section 9.4 titled Reassembly before proceeding.

### 6.2 Operation

TMXFLOW plate heat exchangers are designed according to predefined temperatures, allowable pressure drops, design pressures and fluid compositions.

**⚠** Exceeding the design temperatures and pressures can be harmful to the equipment and personnel, and must be avoided.



Deviations from the designated fluid composition may cause corrosion of the plates and damage on the gaskets, even if the deviations occur over relatively short time periods.

## 6.2.1 Corrosion resistance

Before entering into operation you should assure that the media do not exceed the corrosion resistance level of the materials chosen for your Plate Heat Exchanger. Even unprocessed water may contain such high level of corrosive content (e.g. chloride content) that it may attack the plate surface. A high temperature may accelerate the corrosion process.

## 6.3 Shutting down

The heat exchanger must be shut down slowly and allowed to cool naturally to ambient temperature. Inlet valves, if used, should be closed before closing the outlet valves.

If steam is used as a heating medium, it must be shut off first. In chilling duties, the cooling

liquid must be shut down first to avoid freezing of the product.

**⚠** Sudden changes in the operating pressures and temperatures should be avoided. Shock cooling of the heat exchanger may cause leakages, due to sudden contraction of the sealing gaskets.



All liquids should be drained from the heat exchanger after shut down to prevent precipitation of products or scale build-up. In the case of corrosive media, it may also be necessary to flush with clean, non-corrosive water.

## 7. Maintenance

**⚠** Never open the TMXFLOW plate heat exchanger until the unit has cooled below 40°C (105°F).



**⚠** Never open an TMXFLOW heat exchanger, which is under pressure from any source.

**⚠** Never open an TMXFLOW plate heat exchanger with piping connected to the follower or connector grids.

### 7.1 Disassembly

Close the shut-off valves and drain the heat exchanger as much as possible.

Disconnect any pipes connected to the follower.

Loosening and tightening of tie bars in the TMXFLOW Medium and Small range plate heat exchangers can normally be accomplished with ratchet wrenches/ spanners. Larger units require hydraulic equipment or pneumatic/ electric torque converters.

Measure and record the compressed dimension of the plate pack before loosening the tie bars.

**⚠** As for any bolted vessel, bolts must not be slackened or tightened indiscriminately, but approaching a cylinder head sequence, balancing the opening on the right and left throughout the process.



In the process below, dimension X is the initial compressed dimension of the plate pack.

Loosen all tie bars in 3 mm increments to “X + 5%”, and then remove only the 2 top and the 2 bottom tie bars in the positions shown in the picture.

Loosen rest off the tie bars in increments of up to 6 mm to “X + 10%”.

For large or tall units ( where the distance between tie bars labelled 1 and 3, exceeds 1200 mm, 4 ft), remove all tie bars except 1 to 6. Loosen tie bars 1 to 6, moving in that order, in increments of max. 25mm until all tie bars become loose.

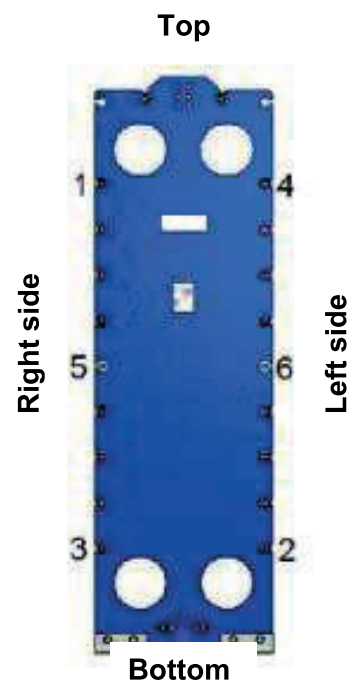
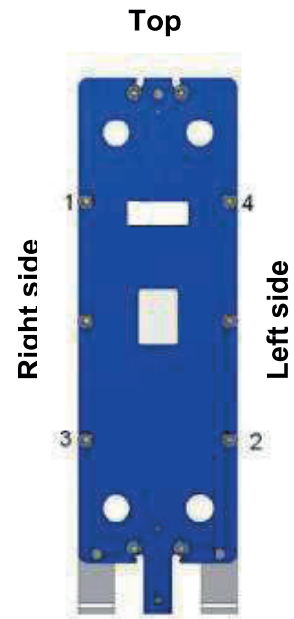
For smaller units, (distance between bars 1 and 3 is less than 1200 mm, 4 ft) remove all tie bars except 1 to 4. Loosen tie bars 1 to 4, moving in that order, in increments of max. 25mm until all tie bars become loose.

When using hydraulic tightening units, ensure that each tie bar is loosened equally during opening.

When the plate pack is fully released and the tie bars removed, the heat exchanger can be opened by pushing the follower back against the end support.

**⚠** For large units, block the follower into position, for example by tying it to the end support, to provide extra safety against accidental rolling of the follower during maintenance.

Separate the plate pack carefully to avoid damaging the gaskets or the plates.



**⚠** Always wear protective gloves when handling plates.

Remove the plates by lifting them backwards and then sideways off the top bar and then sliding out of the frame.



## 7.2 Cleaning

The plate heat exchanger can be cleaned without opening (i.e. cleaning-in-place) and manual cleaning.

### 7.2.1 Manual Cleaning

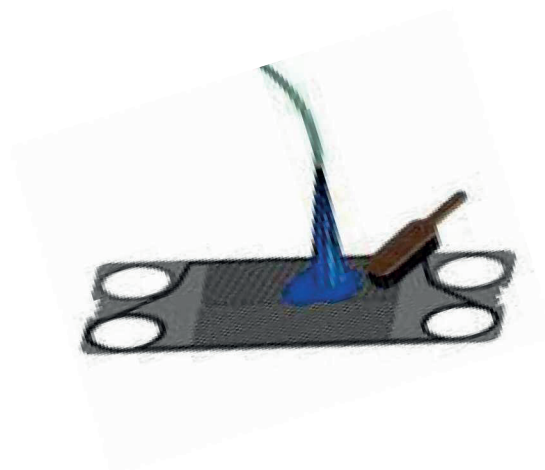
Manual cleaning is normally accomplished by washing down the plates with a soft non metal brush, water and a cleaning agent.

**⚠** Cleaning agents must not be aggressive or corrosive to the plates or the gaskets. If in doubt, contact the cleaning agent supplier.

Cleaning agents should always be used according to safety regulations and as specified by the supplier.

It is recommended to lay the plate on a flat surface during brush cleaning to avoid the risk of bending the plate.

If the heat exchanger is heavily fouled, care must be taken to remove all debris from the gasket sealing surfaces when the heat exchanger is reassembled. Any debris will most likely lead to sealing failures. Do not



forget that for glue free gaskets, gasket sealing surfaces to be checked are at the top as well as bottom surface of the gasket.

In many cases, fouling may be far too tenacious. TMXFLOW service centres around the world may be approached for thorough cleaning and inspection of the plate pack and regasketing.

### 7.2.2 **Cleaning-In-Place**

Cleaning in place (CIP) is accomplished by circulating a suitable cleaning solution through the plate heat exchanger instead of opening it.

CIP works best in the reverse direction of normal flow. Good results are also possible with same direction flow and at higher velocities than the product flow velocity.

The cleaning solution must be circulated at sufficient velocity to flush out the product. Higher viscosity products generally require higher velocity flushing to properly clean.

The cleaning solution must be able to dissolve the fouling on the plates and great care must be taken to select a proper cleaning solution that does not damage plates or gaskets.



#### **Example of CIP-cleaning:**

- 1 Drain product residues, cooling and heating media.
- 2 Rinse with cold or lukewarm water.
- 3 Circulate warm cleaning fluid solution.
- 4 Rinse with warm water or warm water with softener added.
- 5 Rinse with cold or lukewarm water.



In simple cases cleaning can also be effected without circulation but by pouring a cleaning fluid solution into the system. After some time of standing, flush the solution with clean water.

If the heat exchanger is to be out of service for a long time, it is advisable to empty it, separate the plates, and clean the unit. After cleaning, lightly re-clamp the plate pack and cover it to protect from dirt and UV light. Please refer to section 7.0 on Storage.

### **Determination of correct CIP system**

The heat exchanger must be opened for inspection at regular intervals. This is necessary especially during the initial start up period, until experience has been gained on the effectiveness of the cleaning regime. With these inspections, it will gradually be possible to determine circulation times, temperatures, and chemical concentrations with great certainty.


Insufficient cleaning is most often due to:

- Insufficient circulation rate.
- Insufficient cleaning time or temperature.
- Insufficient Concentration of the cleaning agent.
- Excessive periods of operation.

**⚠!** Do not use chlorine-containing agents such as hydrochloric acid (HCl).



Example of an acceptable solution for dairy applications and AISI 316 plates and NBR gaskets:

- Oils and fats are removed with a water-emulsifying oil solvent, e.g. BP-System Cleaner.
- Organics and greasy coatings are removed with Sodium hydroxide (NaOH) -max. concentration 2.0% - max. temperature 85°C (185°F). 2.0% concentration corresponds to 5.0 litre 30% NaOH per 100 litre water.
- Mineral scale deposits are removed with Nitric acid (HNO<sub>3</sub>)-max. concentration 0.5% - max. temperature 65°C (150°F). 0.5 % concentration corresponds to 0.58 litre 62% HNO<sub>3</sub> per 100 litres water.
-  Excess Nitric acid can seriously damage NBR and other types of rubber gaskets.
- Non-organic deposits can be removed by special cleaners.
  
- Several alternatives to Nitric acid can be used, e.g.: Phosphoric acid up to 5% and 85°C.

#### 7.4 Gasket replacement

For ordering of spare parts and for re-gasketing, refer to section 10: "Spare Parts". In a small number of cases, gaskets may be attached with glue. For the correct and important processes for removing the glued gasket correctly and fitting of new gaskets correctly, consult TMXFLOW service.

## 7.5 Re-assembly

Wipe the top bar clean with a soft cloth.  
Apply suitable grease on the hanging surface where plates will slide.

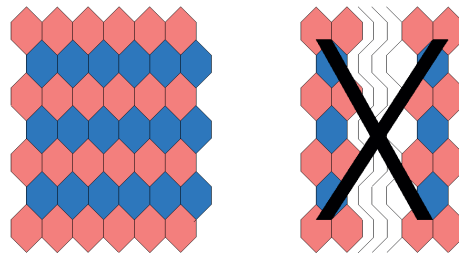
When replacing old plates, ensure that the new plates are reinstalled in the correct sequence and orientation as stated on the PHE Plate arrangement drawing.

**⚠** Do not permanently bend or scratch the plates or damage the gaskets during the installation. Some plates must be carefully bent to install them.



Push the plates towards the head checking carefully that they are correctly mounted.

When the plate pack has been correctly assembled, in most models, plate edges will create a honeycomb. So, check the edge of the plate pack for unusual patterns before tightening the PHE.



Check the tie bars. Brush clean and grease over the working lengths.

Once the plate pack has been carefully pushed towards the fixed head and then the follower is pushed against the plate pack, then tie bars have to be placed in their positions