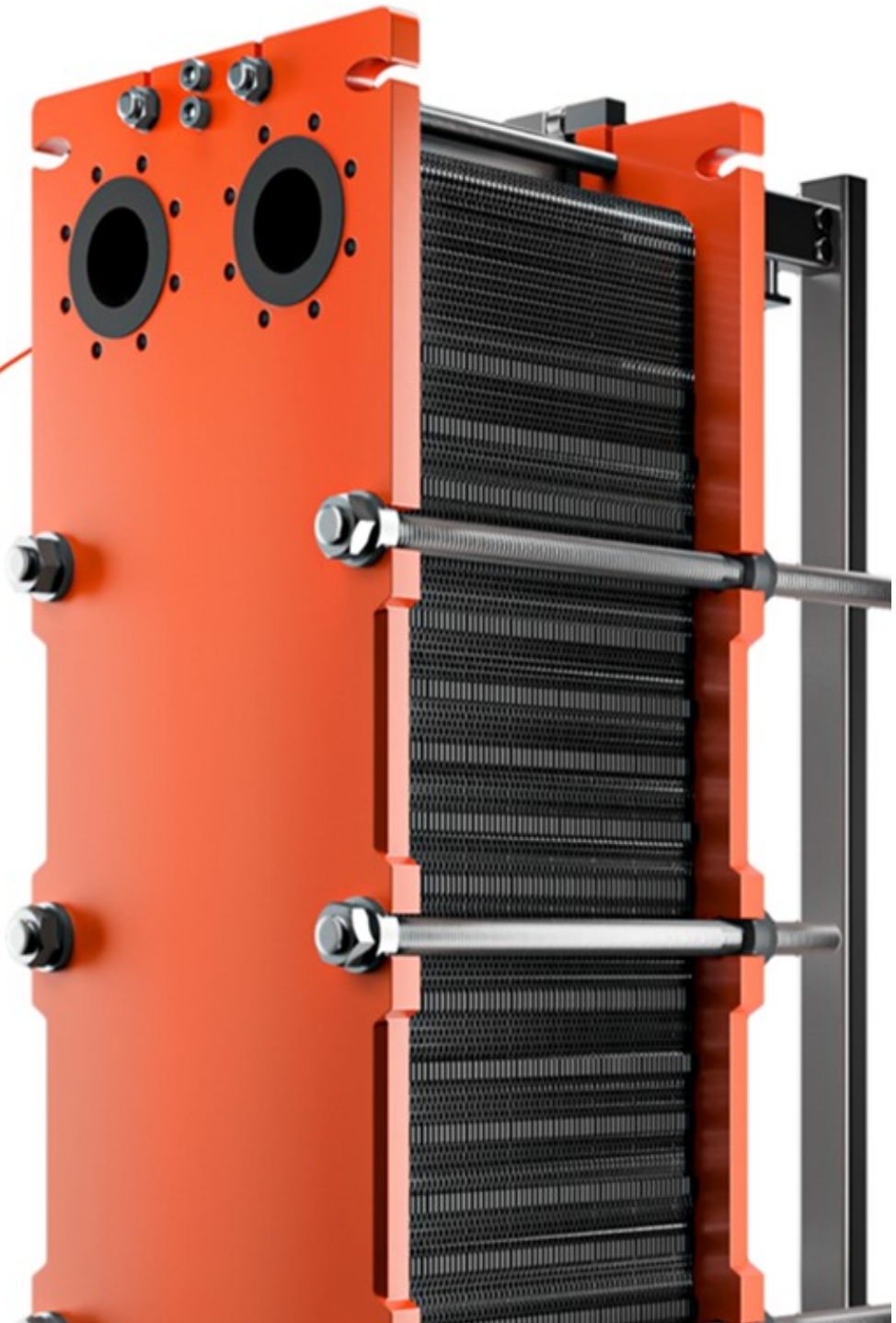
HEXONIC | HEAT EXCHANGERS

# OPERATION AND MAINTENANCE MANUAL

## JAG Plate Heat Exchanger Operating Manual



Let's
exchange

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# From our passion for innovation, a new product has been born – the JAG Plate Heat Exchanger with a unique heating plate jagged pattern.

## 1. INTRODUCTION

This document contains a manual which serves as a guide for the installation, operation and maintenance of HEXONIC Sp. z o.o. plate heat exchangers. It is meant for persons responsible for the installation and operation of heat exchangers. HEXONIC Sp. z o.o. recommends to review the manual prior to commissioning.

The attached manual applies to JAG Plate Heat Exchangers manufactured by HEXONIC Sp. z o.o. HEXONIC Sp. z o.o. shall not be held liable for any damage resulting from improper installation, operation or maintenance of the delivered heat exchangers.

Plate heat exchangers are specifically designed and built by HEXONIC Sp. z o.o. for use under the operating conditions specified by the customer. A sudden pressure increase above the normal operating pressure value, which may occur when starting or stopping the system, can cause serious damage to the equipment. HEXONIC Sp. z o.o. shall not be held liable for any damage resulting from the equipment operating under conditions deviating from the original design assumptions.

NOTE:

**Please review the entire manual before attempting to install and start the pressure equipment. Failure to comply with the manual may result in loss of warranty and approval for operation of this equipment.**

**Only the manufacturer may implement any changes or modifications to the pressure equipment.**

# 2. SAFETY

This manual contains the basic safety rules that should be followed during installation, starting, servicing and operation of the above pressure equipment. Installation and service personnel must review this manual and related manuals (component manuals) before installation and starting the equipment. Operators or maintenance staff working on the above pressure equipment must be properly qualified. The scope of their responsibility and competences must be entirely controlled by the customer. If the personnel is not properly qualified, they must be trained and instructed. The customer should also ensure that the personnel have fully understood the contents of this manual.

## 2.1. GENERAL OHS REQUIREMENTS

General occupational safety requirements are covered by national standards that specify in detail the operation rules for this type of equipment. Fire safety and electric shock protection regulations should also be taken into consideration.

The following are applicable in all cases:

- Remove working medium leaks, as they pose direct risk to the health and life of the operating personnel. Leak points should be properly secured. In case a leak is identified in pressure installations, remove such leaks by tightening the screws or fasteners, provided that pressure from the installation has been fully relieved.

- Keep the pressure equipment clean, e.g. remove spilled working medium immediately, even if it is a small amount or single drops.

- The heat exchanger operating room should be equipped with a fully functional ventilation system and fire equipment.

- Electrical control and measuring instrumentation should be connected by qualified personnel in order to avoid the risk of electric shock.

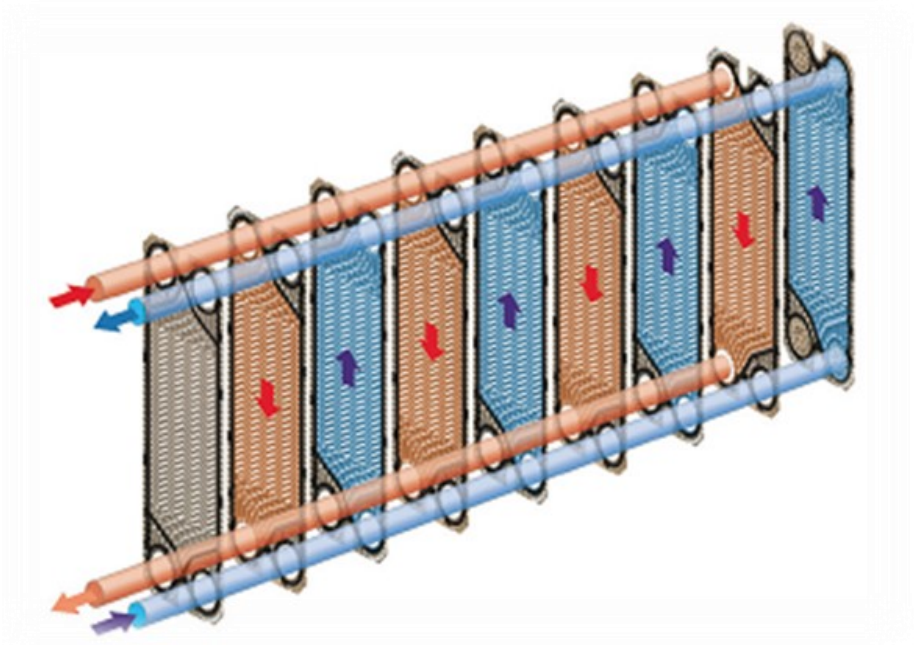
- Should any pipelines be welded to the heat exchanger, this is only admissible once they are washed, dried and ventilated thoroughly.

- The pressure equipment should only be disassembled once pressure has been safely equalized between the chambers and the environment.

# 3. PRINCIPLE OF OPERATION

The heat exchanger consists of pressure elements, including fasteners, pressure and heating plates, as well as other elements not exposed to pressure that constitute the exchanger frame. Heating plates are placed between pressure plates that are tightened with fasteners. Heat penetrates from one medium to the other through special extrusion of the heating plates.

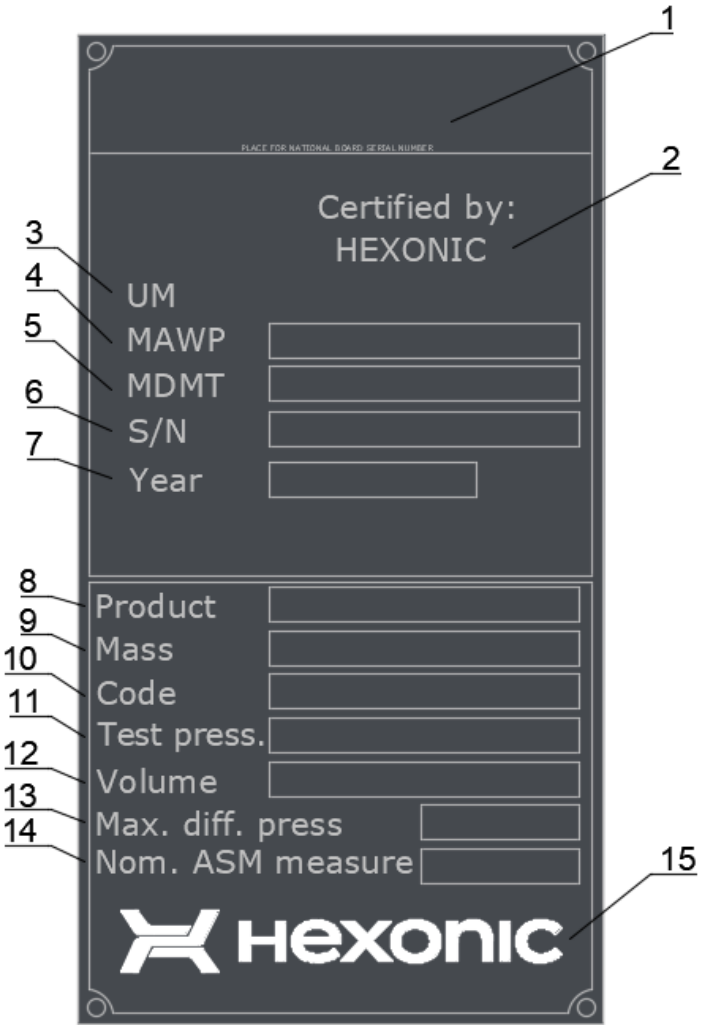
Every heating plate is equipped with a gasket so that the plates form a pressure system of flow channels, with media flowing alternately in every other channel. The gaskets are installed on the plates to ensure tightness between the fluids and discharge outside the exchanger. When installing heating plates between the cover plate, every other plate must be rotated at 180° so that they form separate channels. The front and/or rear plate have piping connections that allow fluids to flow through heat exchanger.



## 4. MARKING

All plate heat exchangers delivered by HEXONIC Sp. z o.o. have a nameplate on the front plate. The nameplate contains the information necessary for warranty reports and ordering spare parts. The serial number contains all information on the product.

## NAMEPLATE (EXAMPLE)




1. Number of the notified unit
2. Manufacturer
3. Designator ASME
4. Max. allowable working pressure
5. Min. design metal temp.
6. Equipment serial number
7. Manufacturing year
8. Exchanger identification
9. Weight of the device
10. Equipment code
11. Test pressure
12. Volume
13. Max. pressure difference
14. Nominal assembly measure
15. Manufacturer's logo

# 5. APPLICATION

Plate heat exchangers are used in many branches of the industry. Some of the popular applications include:

- industrial refrigeration, where heat exchangers operate at low temperatures, using properly selected materials for the seals and heating plates;
- chemical industry, which requires easy contamination removal;
- power industry, including the nuclear industry;
- food industry, including the beverage industry, which includes processing juices, beer, oils, yoghurts, kephirs or cheeses;
- pulp and paper industry as part of heat recovery in paper processing;
- steel industry for the treatment and cooling of processed materials;
- wastewater treatment plants as part of the treatment process;
- and many others.

Benefits of plate heat exchangers:

- high energy efficiency which results in low system operational cost;
- flexible configuration options allow the heat exchange surface can be modified as needed;
- compact design of the exchanger allows for easy installation;
- servicing the exchanger does not pose a problem, as its design allows for easy access both for inspection, as well as CIP cleaning and washing.

# 6. FLUIDS: REQUIREMENTS AND LIMITATIONS

## 6.1. REQUIREMENTS FOR STAINLESS STEEL HEATING PLATES

In order to ensure corrosive protection for the heating plates, their surface must remain clean during operation to allow for a passive layer to form. Nevertheless, there are cases of surface corrosion, caused by such factors as:

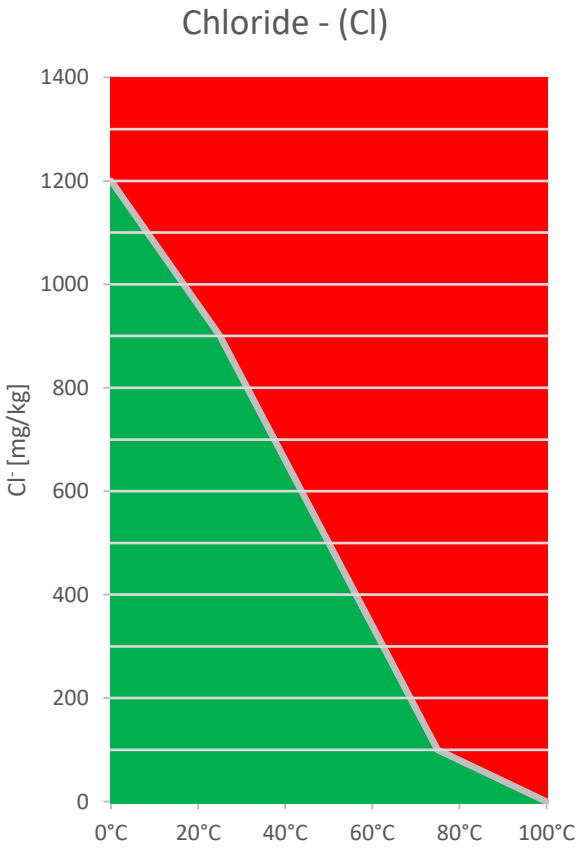
- hydrochloric acid and chlorine impact;
- contaminations, such as calcium, cement or other metallic inclusions;
- leaving an exchanger filled with an acidic fluid, which increases acid concentration after water evaporation.

## 6.1.1. QUALITY REQUIREMENTS FOR WATER AS MEDIUM

NOTE:

Do not use any mediums causing AISI 316L/304L (1.4404/1.4307) steel corrosion when working with the exchanger.

| | | |
|---|---|---|
| water pH (at 25°C [77°F]) | | 7 -10 |
| electrical conductivity | | 10-500 [µS/cm] |
| free ammonia | $NH_3$ | < 2.0 [mg/L] |
| Carbon dioxide | $CO_2$ | < 20 [mg/L] |
| iron | $Fe^{3+}$ | <1.5 [mg/L] |
| manganese | $Mn^{2+}$ | <0.1 [mg/L] |
| chloride | $Cl^-$ | *graph* |
| nitrates | $NO_3^-$ | < 80 [mg/L] |
| Sulphates | $SO_4^{2-}$ | < 80 [mg/L] |
| water hardness | | 1,06-2,67 [mmol/l] |
| free chloride | $Cl_2$ | < 0.4 [mg/L] |
| hydrogen sulfide | $H_2S$ | < 0.04 [mg/L] |
| bicarbonates | $HCO_3^-$ | < 250 [mg/L] |
| sulfites | $SO_3^{2-}$ | < 1.0 [mg/L] |
| sulfides | $S^{2-}$ | < 1 [mg/L] |
| nitrites | $NO_2^-$ | <0.1 [mg/L] |
| aggressive carbon acid | $H_2CO_3$ | < 20 [mg/L] |



## 6.2. REQUIREMENTS FOR OTHER MATERIALS

Heat exchanger containing heating plates made of materials other than stainless steel, e.g. titanium, must work with a medium that will not have any corrosive effect on the plates.

## 7. CORROSION PROTECTION

As a standard, all exchangers are provided with anticorrosive protection in the C3 corrosion class – medium as per PN-EN ISO 12944, which means that heat exchangers can operate in production rooms with high humidity and moderate air pollution (e.g. food facilities, laundries, breweries, dairies) and urban or industrial environment, with moderate pollution, as well as coastal areas with moderate salinity.

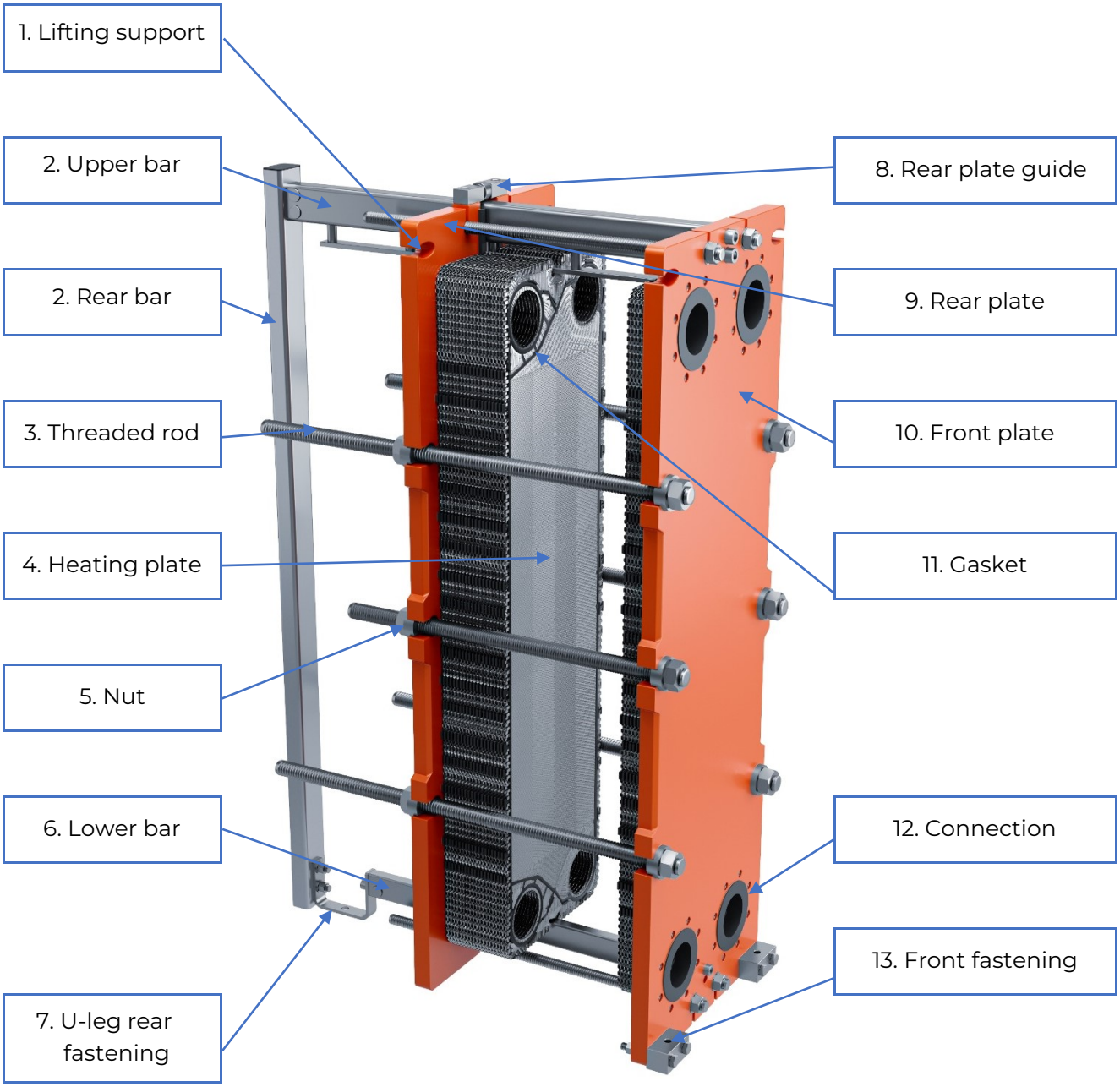
C4 – high and C5 – very high anticorrosive protection is available as an option.

The C4 corrosion class applies mainly to chemical plants, swimming pool halls, ship and boat repair yards and industrial and coastal areas with moderate salinity.

The C5 corrosion class applies mainly to building structures or areas with almost permanent condensation and high pollution; these are industrial areas with high humidity and aggressive atmosphere, as well as coast and offshore areas with high salinity.

## 8. CONSTRUCTION

The plate heat exchanger consists of a pack of thin heating plates, usually made of stainless steel. The heating plates are provided with the proper, characteristic corrugations, allowing for proper medium flow, which in turn results in better heat energy transfer and additionally stiffens the plates and protects them from pressure differences. The plate heat exchanger consisting of the following elements:



1. Lifting support – designed for lifting, positioning the device.

2. Upper bar – the length of the top (supporting) bar depends on the number of heating plates and the size of the entire heat exchanger. The main function of the upper bar is rear plate guidance and positioning, as well as supporting the heating plate pack in larger exchangers.

3. Rear bar – the top and bottom bars are mounted to this element; in some cases an element is mounted to fasten the exchanger to the ground.

4. Threaded rod – connects the heating plates pack by pressing front and rear plates together. The number of rods, their size and length depends on the plate heat exchanger model.

5. Heating plate – The plate pack consists of channel (corrugated) plates, end plates, gaskets and in some cases pass-through plates. Heat is exchanged between the media through plates.

6. Nut – nuts selected based on calculations are to maintain stiffness of the entire exchanger to ensure proper operating pressure.

7. Bottom bar – aligns the position of the channel plates and pressure plate at their lower end. Connected with the rear bar and front plate.

8. U-leg rear fastening – bottom bar element that facilitates heating plates installation, while at the same time allows for mounting the rear portion of the exchanger to the ground.

9. Rear plate guide – this element, as an integral part of the rear plate, allows for sliding the rear plate during installation, disassembly or when cleaning the exchanger.

10. Rear plate – mounted on the top and bottom bars as a sliding plate that presses the heating plates pack against the front plate. In multi-flow exchangers it may be fitted with connection ports.

11. Front plate – fixed plate to which the top and bottom bars are mounted. Connection size depends on the exchanger version and its purpose.

12. Gasket – an element that ensures tightness and separation of the two plate pack operating spaces. The type of gaskets and their application depends on the medium used and the exchanger operating parameters.

13. Connection – connections in the front plate allow for media inflow and outflow from the plate heat exchanger. Different types of connections are available, depending on the exchanger size. Rubber inserts (Rubberliner) or stainless steel inserts are used in flanged connections.

14. Front fastening – elements screwed onto the front plate allow for a stable mounting of the exchanger to the ground.

## 8.1. STANDARD COMPONENTS AND MATERIALS

### 8.1.1. FRONT AND REAR PLATE

Made of carbon steel or stainless steel. Bores may have different configurations, depending on the application and distribution of connections on the front or rear plate.

### 8.1.2. FASTENERS

Threaded rods are made of carbon steel or stainless steel, and the thread may be metric or imperial.

### 8.1.3. NOZZLES AND FLANGES

Nozzles and flanges are made of carbon steel, stainless steel or titanium. Nozzles may have a metric or imperial thread, whereas flanges may be selected as per PN-EN 1092-1 or ASME B16.5.

### 8.1.4. HEATING PLATES

Corrugated plates used in plate heat exchangers are manufactured from metal or alloy that can be cold-formed. Stainless steel, nickel or titanium alloys are among the most popular materials. The cold-forming process gives the plate a jagged pattern. The plate material differs depending on the function of the plate heat exchanger. Fluid parameters and corrosion are decisive for material quality.

Most plate models are divided into two types, L (Low) and H (High), as depicted in ***Fig. 8.4.*** Plates have different heat transfer and pressure drop values. Therefore, it is important to specify each plate during installation or when ordering parts. The most common plate materials are: AISI316, AISI304 and titanium grade 1, steel 304, 316, titanium. Heating plates feature corrugations in the medium distribution area (***Fig. 8.5***) to increase turbulent flow. This also allows uniform medium flow through the entire plate surface, which increases heat transfer.

The plates can be made in the "double wall" standard, then any standard plate can be replaced by a pair of plates with sealed the ports between them.

## 8.1.4.1. HEATING PLATES CONFIGURATIONS USED IN THE EXCHANGER

The plate pack is composed of the starting plate, channel plates (H and L) and end plate (*Fig. 8.1*).

- *Starting plate* Plate with all ports sealed.
- *Left plate / right plate* These plates are identical when compared to each other. The left plate will become the right plate if it is rotated by 180°.
- *End plate* The end plate of the packet.

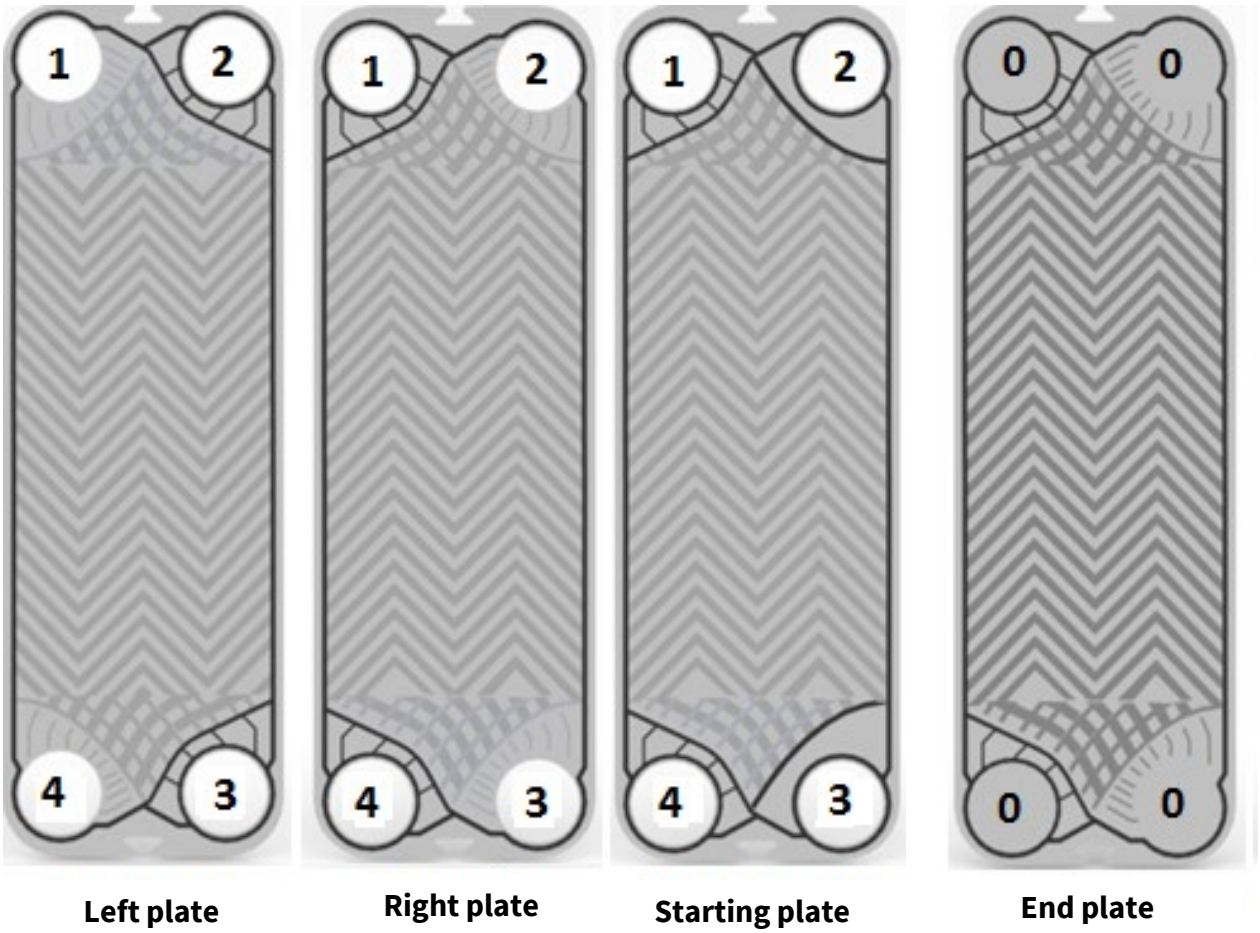
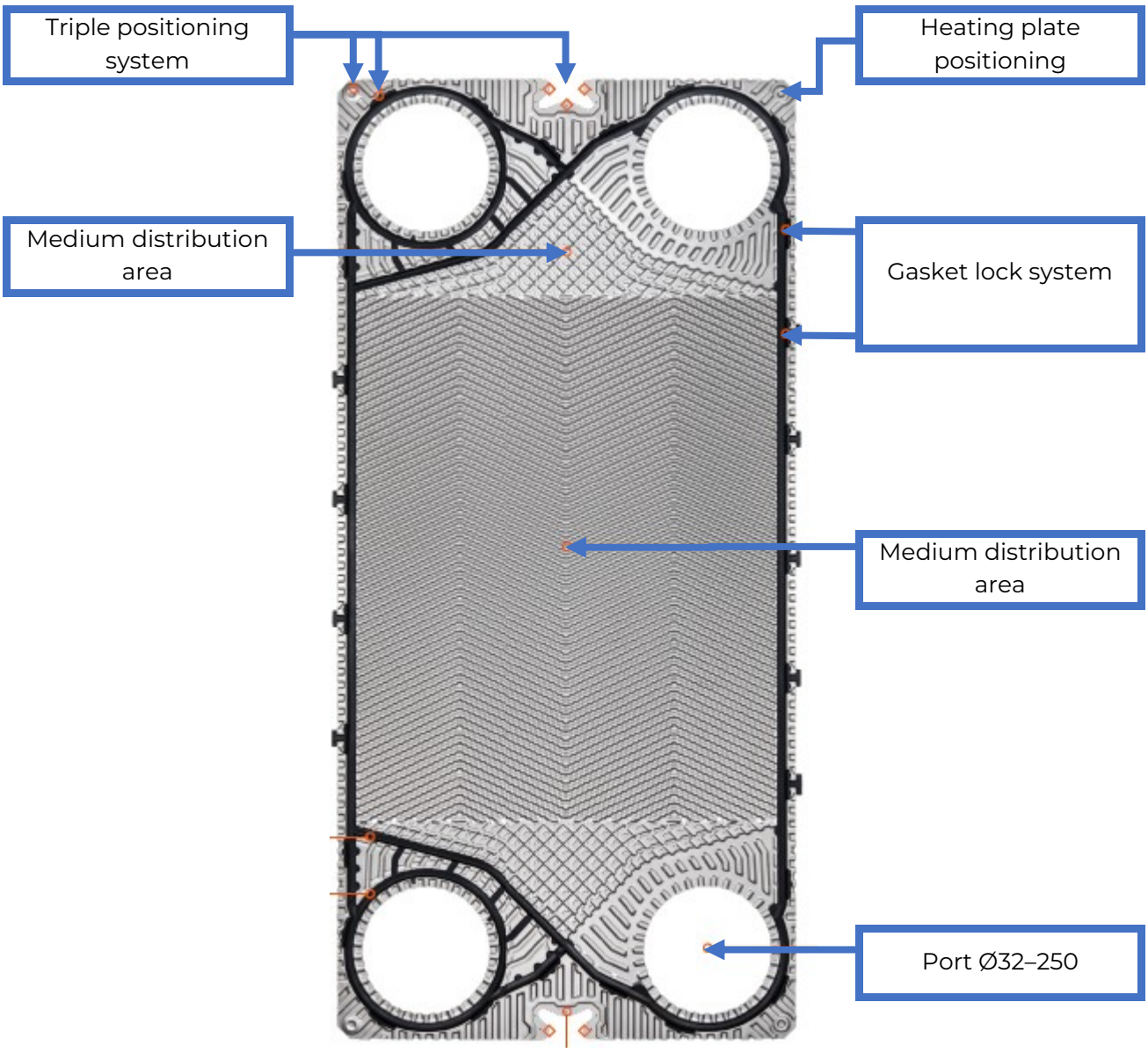



*Fig. 8.1 Plate pack.*


Triple positioning system
Heating plate positioning
Medium distribution area
Gasket lock system
Medium distribution area
Port Ø32–250

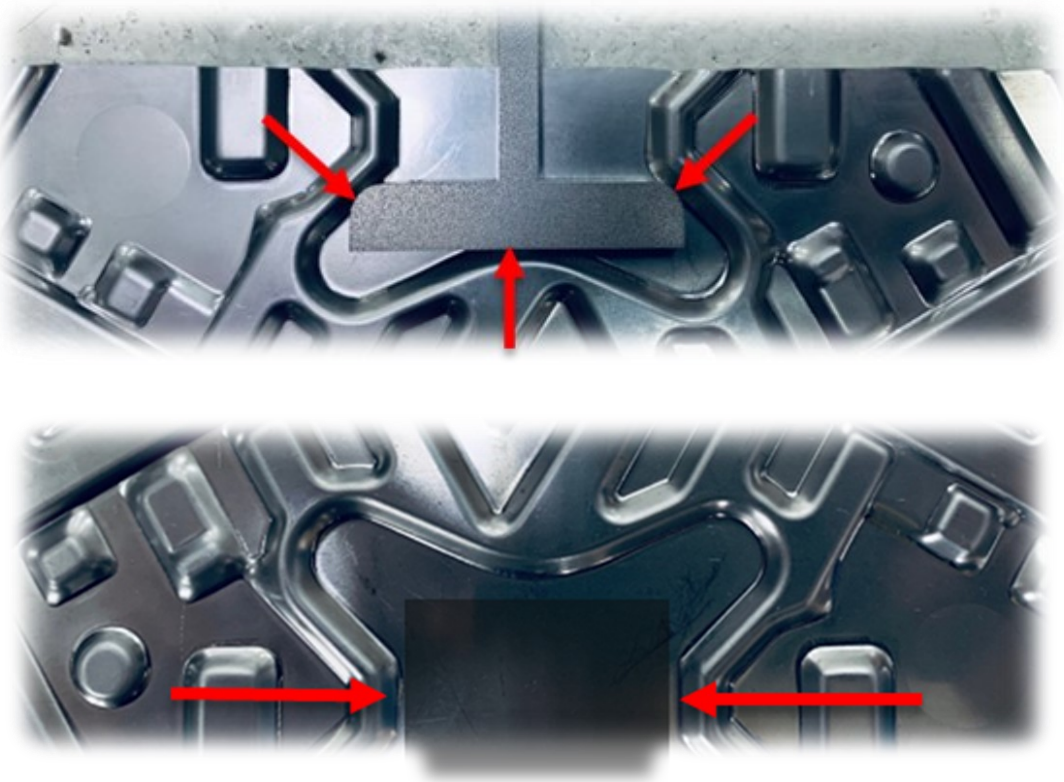


*Fig. 8.2 Five-arm heating plates positioning system.*

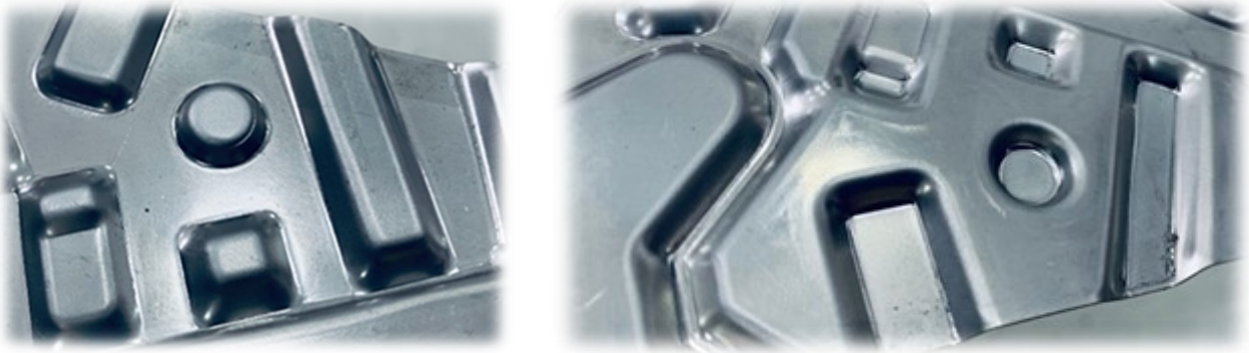


*Fig. 8.3 More precise horizontal and vertical plate positioning and good sealing in the entire plate pack.*

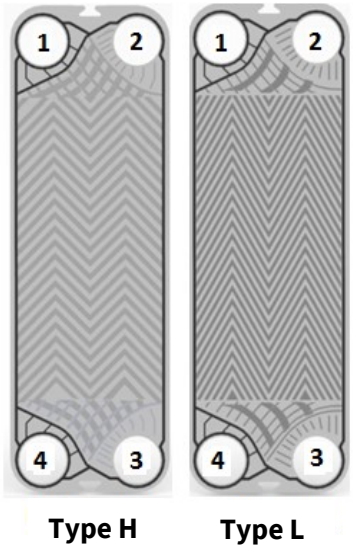



*Fig. 8.4 H and L plate types.*

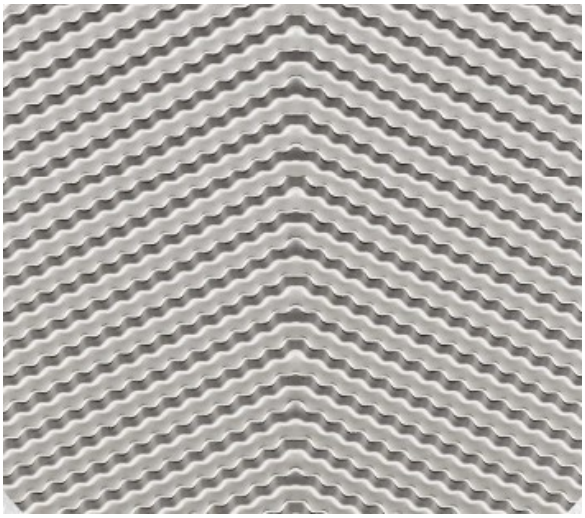
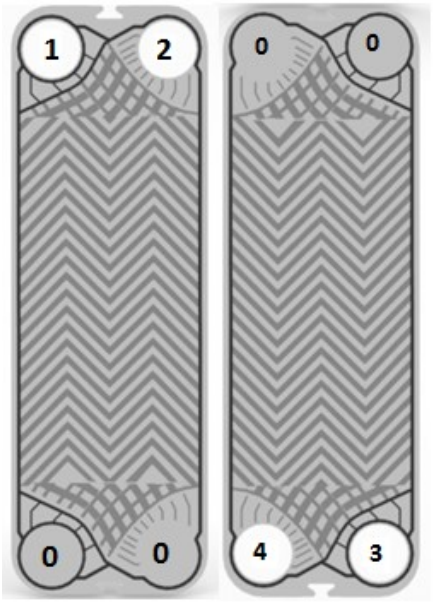


*Fig. 8.5 Medium distribution area.*

## 8.1.4.2. PLATE OPENINGS AND PLATE TYPE IDENTIFICATION

The plates may have different openings configurations, depending on the application and distribution. Each opening is marked with a number. For example, JFA-003 L1234 means that this is model JFA-003, "L" plate with 4 unsealed openings. Number 0 means that there is no opening. For example, JFA-003 L1200 means that ports 1 and 2 are open and ports 3 and 4 have been sealed. It is important to know the plate type ("(right)" or "(left)") before deciding on the port configuration.

- **Flow plate** — P1234 - L1234 wherein: L – left plate; R – right plate.
- **End plate** — 0000
- **Pass-through plate** — Different combinations – 1200, 0034, 1034, etc.




P1200 H L0034 H

## 8.2. GASKET

The performance and life span of the plate heat exchanger depend on the gaskets used and the durability of gasket material. Gaskets in plate heat exchangers are usually made of one elastomer piece and their type is selected based on the liquid, temperature and operating conditions. Gaskets are seated in grooves to prevent working liquid leakage from the equipment.

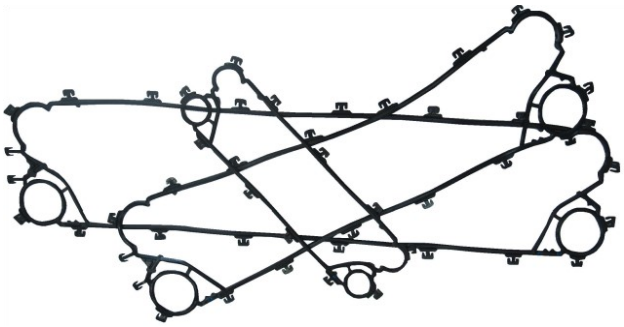
The groove embossed and located in the plates holds the gasket. A gasket alignment and positioning system prevents the gasket from shifting during equipment operation. Each pin is pressed into the corresponding cut-out in the plate.

NBR HT – yellow marker,

EPDM HT – blue marker,

FKM – violet marker,

KALREZ – TBN.

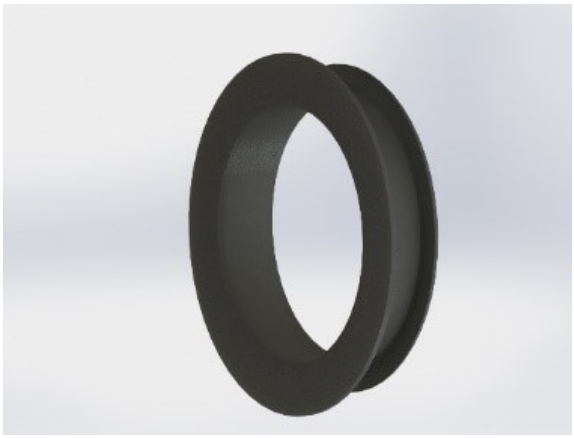


NOTE:

It is recommended to replace the gaskets during exchanger operation on average every 3 years. When threshold temperature values for the particular gasket material are reached or exceeded, this period may be significantly shorter.

## 8.3. COMPONENTS FOR FLANGED CONNECTIONS

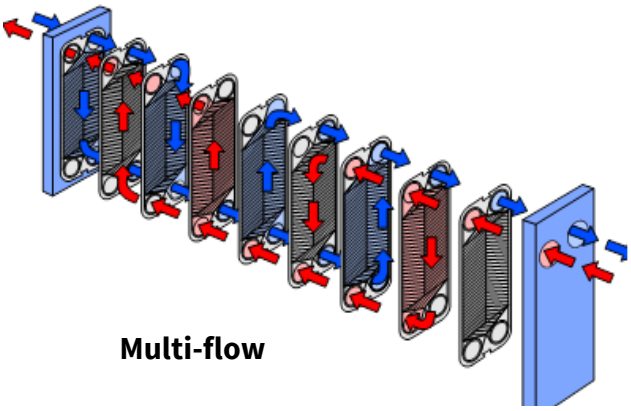
In accordance with EN 1092-1 or ASME B16.5, rubber liners made of EPDM, NBR, VITON and 316L stainless steel liners are applied for flanged connections.



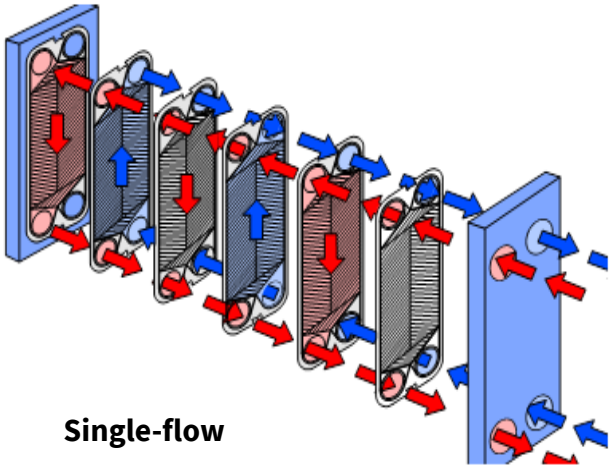
- Rubber linings for medium flow velocity up to 14,76 fps in flange connection.
- Stainless steel linings for medium flow velocity above 14,76 fps in flange connection.

## 8.4. FLOW SYSTEM

In single-flow system plate heat exchanger, the design allows each fluid flow in only one direction. Multi-flow system is used to force flow in the opposite direction in part of the exchanger.



**Multi-flow**



**Single-flow**

NOTE:

For more detailed information, when ordering spare parts, please provide the plate heat exchanger serial number found on the nameplate.

# 9. TECHNICAL SPECIFICATION

The working parameters of individual exchangers from the JAG range are presented in section *9.1*.

The tables in section *9.2* contain the main dimensions and connection sizes of the 150 psi, and 250 psi exchangers. The maximum tightening torque values for screw nuts of threaded rods have also been provided.

## 9.1. OPERATING PARAMETERS

Heat exchanger operation is permitted only within the specified parameters range.

### 9.1.1. JFA TYPE EXCHANGERS

| |  |  |  |
|---|---|---|---|
| | JFA-003 | JFA-006 | JFA-009 |
| FRAME TYPE | ROD | ROD | ROD |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [$ft^2$] | 29,1 | 58,1 | 87,2 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 66,04 | 66,04 | 66,04 |

## 9.1.2. JFB TYPE EXCHANGERS

| |  |  |  |
|---|---|---|---|
| | **JFB-010** | **JFB-015** | **JFB-025** |
| FRAME TYPE | ROD | ROD | ROD |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [ft$^2$] | 161,4 | 242,1 | 403,5 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 198,13 | 198,13 | 198,13 |

## 9.1.3. JFC TYPE EXCHANGERS

| |  |  |  |
|---|---|---|---|
| | **JFC-015** | **JFC-025** | **JFC-035** |
| FRAME TYPE | ROD | ROD | ROD |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [ft$^2$] | 290,5 | 484,2 | 677,9 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 484,31 | 484,31 | 484,31 |

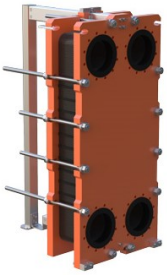
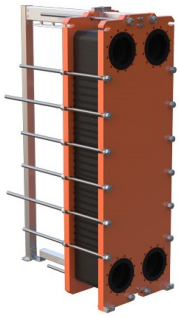
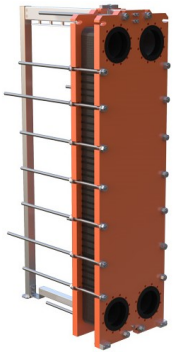
## 9.1.4. JFD TYPE EXCHANGERS

| |  |  |  |
|---|---|---|---|
| | **JFD-030** | **JFD-030** | **JFD-060** |
| FRAME TYPE | ROD | PROFILE | PROFILE |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [$ft^2$] | 1646,3 | 1646,3 | 3292,6 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 748,48 | 748,48 | 748,48 |

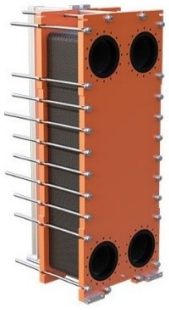
## 9.1.5. JFE TYPE EXCHANGERS

| |  |  |  |  |
|---|---|---|---|---|
| | **JFE-045** | **JFE-065** | **JFE-085** | **JFE-115** |
| FRAME TYPE | PROFILE | PROFILE | PROFILE | PROFILE |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [$ft^2$] | 2474,8 | 4616,0 | 6036,4 | 8166,8 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 1673,09 | 1673,09 | 1673,09 | 1673,09 |

## 9.1.6. JFG TYPE EXCHANGERS

| |  |  |  |
|---|---|---|---|
| | JFG-100 | JFG-150 | JFG-200 |
| FRAME TYPE | PROFIL | PROFIL | PROFIL |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [ft$^2$] | 7381,4 | 11072,0 | 14762,7 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 4623,01 | 4623,01 | 4623,01 |

## 9.1.7. JFH TYPE EXCHANGERS

| |  |  |  |
|---|---|---|---|
| | JFH-150 | JFH-200 | JFH-250 |
| FRAME TYPE | PROFIL | PROFIL | PROFIL |
| Maximum allowable working pressure [psi] | 150/250 | 150/250 | 150/250 |
| Maximum allowable working temperature [°F] | 350 | 350 | 350 |
| Minimum allowable working temperature [°F] | -4 | -4 | -4 |
| Max. heat transfer area of the exchanger [ft$^2$] | 13390,3 | 18696,9 | 22238,2 |
| Maximum flow rate [gal/m] (for water with temp. of ~68°F, max. velocity at the connection 21,3 fps) | 7660,99 | 7660,99 | 7660,99 |

## 9.2. DIMENSIONS

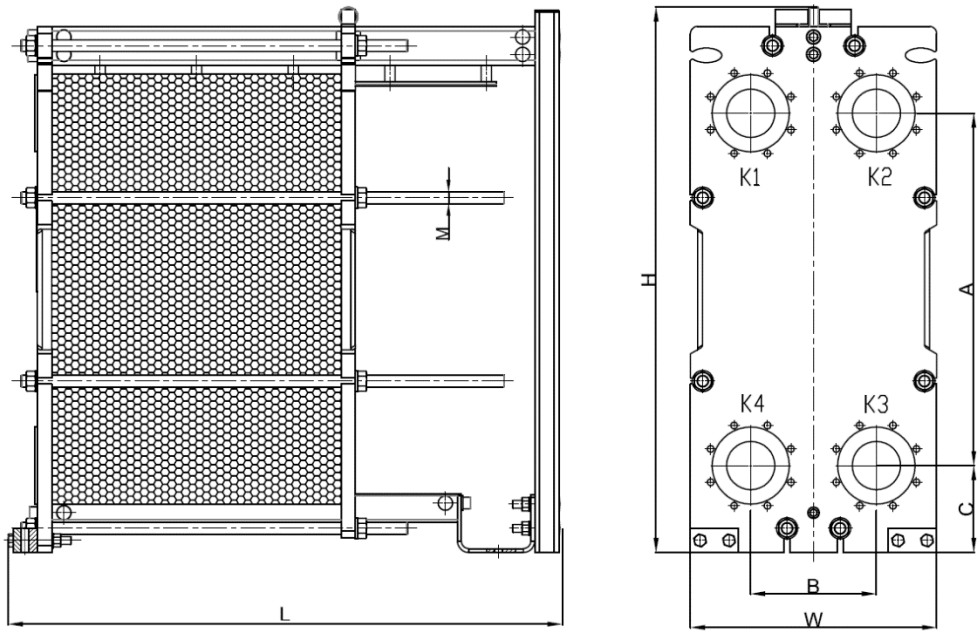



*Fig. 9.1* *Main exchanger dimensions designations*

*Table 9.1* Main exchanger dimensions values and tightening torque for 150 psi.

| JAG | W [mm] | H [mm] | A [mm] | B [mm] | C [mm] | L* [mm] | M Main tightening screws size | Max. tightening torque for screw nuts of threaded rods [Nm] | Connections |
|---|---|---|---|---|---|---|---|---|---|
| JFA-003 | 8,27 | 15,94 | 11,02 | 2,76 | 3,05 | 10-21,81 | 5/8" | 47,2 | 1¼" NPT |
| JFA-006 | 8,27 | 24,21 | 19,31 | 2,76 | 3,05 | 10-21,81 | 5/8" | 40,9 | 1¼" NPT |
| JFA-009 | 8,27 | 32,87 | 27,95 | 2,76 | 3,05 | 10-21,81 | 5/8" | 38,1 | 1¼" NPT |
| JFB-010 | 12,4 | 23,03 | 15,75 | 5,24 | 3,82 | 20-43,62 | 1" | 62,3 | 2" NPT |
| JFB-015 | 12,4 | 36,42 | 29,13 | 5,24 | 3,82 | 20-43,62 | 1" | 55,2 | 2" NPT |
| JFB-025 | 12,4 | 50,59 | 43,3 | 5,24 | 3,87 | 20-43,62 | 1" | 55,2 | 2" NPT |
| JFC-015 | 17,32 | 26,38 | 15,35 | 8,46 | 5,51 | 20,67-44,29 | 1" | 67,9 | 3" ANSI B16.5 cl.150lbs |
| JFC-025 | 17,32 | 39,06 | 28,35 | 8,46 | 5,51 | 20,67-44,29 | 1" | 62,9 | 3" ANSI B16.5 cl.150lbs |
| JFC-035 | 17,32 | 50,39 | 39,76 | 8,46 | 5,51 | 20,67-44,29 | 1" | 58,7 | 3" ANSI B16.5 cl.150lbs |
| JFD-030 rod | 21,65 | 43,7 | 28,74 | 10,24 | 7,87 | 29,53-45,28 | 1 3/8" | 139 | 4" ANSI B16.5 cl.150lbs |
| JFD-030 profile | 21,65 | 44,49 | 28,74 | 10,24 | 7,87 | 55,12-104,33 | 1 3/8" | 208 | 4" ANSI B16.5 cl.150lbs |
| JFD-060 | 21,65 | 69,29 | 54,33 | 10,24 | 7,87 | 29,53-104,33 | 1 3/8" | 186 | 4" ANSI B16.5 cl.150lbs |
| JFE-045 | 25,83 | 55,12 | 35,43 | 12,8 | 9,23 | 40,75-107,68 | 1 3/8" | 297 | 6" ANSI B16.5 cl.150lbs |
| JFE-065 | 25,83 | 70,86 | 51,18 | 12,8 | 9,23 | 40,75-107,68 | 1 3/8" | 257 | 6" ANSI B16.5 cl.150lbs |
| JFE-085 | 25,83 | 82,67 | 62,99 | 12,8 | 9,23 | 40,75-107,68 | 1 3/8" | 283 | 6" ANSI B16.5 cl.150lbs |
| JFE-115 | 25,83 | 102,26 | 82,68 | 12,8 | 9,13 | 40,75-107,68 | 1 3/8" | 261 | 6" ANSI B16.5 cl.150lbs |
| JFG-100 | 36,81 | 83,44 | 55,11 | 17,91 | 12,81 | 49,45-108,50 | 1 3/4" | 545 | 10" ANSI B16.5 cl.150lbs |
| JFG-150 | 36,81 | 111,18 | 82,68 | 17,91 | 12,80 | 49,45-108,50 | 1 3/4" | 423,2 | 10" ANSI B16.5 cl.150lbs |
| JFG-200 | 36,81 | 130,81 | 102,36 | 17,91 | 12,80 | 49,45-108,50 | 1 3/4" | 399,3 | 10" ANSI B16.5 cl.150lbs |
| JFH-150 | 46,46 | 99,80 | 65,35 | 23,43 | 15,55 | 51,57-110,63 | 1 3/4" | 910,6 | 14" ANSI B16.5 cl.150lbs |
| JFH-200 | 46,46 | 121,06 | 86,61 | 23,43 | 15,55 | 51,57-110,63 | 1 3/4" | 798,4 | 14" ANSI B16.5 cl.150lbs |
| JFH-250 | 46,46 | 134,84 | 100,39 | 23,43 | 15,55 | 51,57-110,63 | 1 3/4" | 703,1 | 14" ANSI B16.5 cl.150lbs |

** The L dimension depends on the number of heating plates (length of the upper bar) and the thickness of the front cover plate. The range from the shortest to the longest possible length has been provided. The maximum upper bar length of 2500 mm has been assumed.*

*Table 9.2* Main exchanger dimensions values for 250 psi.

| JAG | W [mm] | H [mm] | A [mm] | B [mm] | C [mm] | L* [mm] | M Main tightening screws size | Max. tightening torque for screw nuts of threaded rods [Nm] | Connections |
|---|---|---|---|---|---|---|---|---|---|
| JFA-003 | 8,27 | 15,94 | 11,02 | 2,76 | 3,05 | 10-21,81 | 5/8" | 47,2 | 1¼" NPT |
| JFA-006 | 8,27 | 24,21 | 19,31 | 2,76 | 3,05 | 10-21,81 | 5/8" | 40,9 | 1¼" NPT |
| JFA-009 | 8,27 | 32,87 | 27,95 | 2,76 | 3,05 | 10-21,81 | 5/8" | 38,1 | 1¼" NPT |
| JFB-010 | 12,4 | 23,03 | 15,75 | 5,24 | 3,82 | 20,2-43,82 | 1" | 62,3 | 2" NPT |
| JFB-015 | 12,4 | 36,42 | 29,13 | 5,24 | 3,82 | 20,2-43,82 | 1" | 82,5 | 2" NPT |
| JFB-025 | 12,4 | 50,59 | 43,3 | 5,24 | 3,87 | 20,2-43,82 | 1" | 82,5 | 2" NPT |
| JFC-015 | 17,32 | 26,38 | 15,35 | 8,46 | 5,51 | 20,87-44,49 | 1" | 101,4 | 3" ANSI B16.5 cl.300lbs |
| JFC-025 | 17,32 | 39,06 | 28,35 | 8,46 | 5,51 | 20,87-44,49 | 1" | 93,9 | 3" ANSI B16.5 cl.300lbs |
| JFC-035 | 17,32 | 50,39 | 39,76 | 8,46 | 5,51 | 20,87-44,49 | 1" | 87,7 | 3" ANSI B16.5 cl.300lbs |
| JFD-030 rod | 21,65 | 43,7 | 28,74 | 10,24 | 7,87 | 29,72-45,47 | 1 3/8" | 139 | 4" ANSI B16.5 cl.300lbs |
| JFD-030 profile | 21,65 | 44,49 | 28,74 | 10,24 | 7,87 | 55,31-104,53 | 1 3/8" | 311 | 4" ANSI B16.5 cl.300lbs |
| JFD-060 | 21,65 | 70,08 | 54,33 | 10,24 | 7,87 | 29,92-104,72 | 1 3/8" | 277 | 4" ANSI B16.5 cl.300lbs |
| JFE-045 | 25,83 | 55,12 | 35,43 | 12,8 | 9,23 | 40,94-107,87 | 1 3/8" | 444 | 6" ANSI B16.5 cl.300lbs |
| JFE-065 | 25,83 | 70,86 | 51,18 | 12,8 | 9,23 | 40,94-107,87 | 1 3/8" | 384 | 6" ANSI B16.5 cl.300lbs |
| JFE-085 | 25,83 | 82,67 | 62,99 | 12,8 | 9,23 | 40,94-107,87 | 1 3/8" | 422 | 6" ANSI B16.5 cl.300lbs |
| JFE-115 | 25,83 | 102,26 | 82,68 | 12,8 | 9,13 | 40,94-107,87 | 1 3/8" | 390 | 6" ANSI B16.5 cl.300lbs |
| JFG-100 | 36,81 | 83,44 | 55,11 | 17,91 | 12,81 | 49,84-108,9 | 1 3/4" | 545 | 10" ANSI B16.5 cl.300lbs |
| JFG-150 | 36,81 | 111,18 | 82,68 | 17,91 | 12,80 | 49,84-108,9 | 1 3/4" | 423,2 | 10" ANSI B16.5 cl.300lbs |
| JFG-200 | 36,81 | 130,81 | 102,36 | 17,91 | 12,80 | 49,84-108,9 | 1 3/4" | 399,3 | 10" ANSI B16.5 cl.300lbs |
| JFH-150 | 46,46 | 99,80 | 65,35 | 23,43 | 15,55 | 51,57-110,63 | 1 3/4" | 520,4 | 14" ANSI B16.5 cl.300lbs |
| JFH-200 | 46,46 | 121,06 | 86,61 | 23,43 | 15,55 | 51,57-110,63 | 1 3/4" | 443,5 | 14" ANSI B16.5 cl.300lbs |
| JFH-250 | 46,46 | 134,84 | 100,39 | 23,43 | 15,55 | 51,57-110,63 | 1 3/4" | 421,8 | 14" ANSI B16.5 cl.300lbs |

** The L dimension depends on the number of heating plates (length of the upper bar) and the thickness of the front cover plate. The range from the shortest to the longest possible length has been provided. The maximum upper bar length of 2500 mm has been assumed.*

# 10. STORAGE

The exchanger should always be stored in a locked warehouse, secured against penetration of external corrosive factors and dust.

Rubber components should be protected against factors causing their rapid degradation, such as oxygen, ozone, solvents, UV radiation, ionizing radiation, etc.

Air temperature inside the warehouse should be within the range from 5°C to 25°C (from 41°F to 77°F) and relative air humidity up to 70%.

- Connections should sealed for storage.
- Permissible gasket usability period during the storage for the individual materials:

  – NBR up to 5 years,

  – EPDM and FKM up to 7 years.

# 11. INSTALLATION AND MOUNTING – GENERAL REQUIREMENTS

- Before starting installation, inspect the external and internal surfaces of the exchanger in order to check for any potential damage during transport or storage.

- Make sure that all screws are fully tightened and the plate pack has correct the dimensions.

- Before starting the installation, review the documentation of the building where the heat exchanger will be installed and verify if its installation will not exceed admissible building structure load.

- Ensure that the surface where the plate heat exchanger is to stand is flat and even. Level during installation (*Fig. 11.1*).

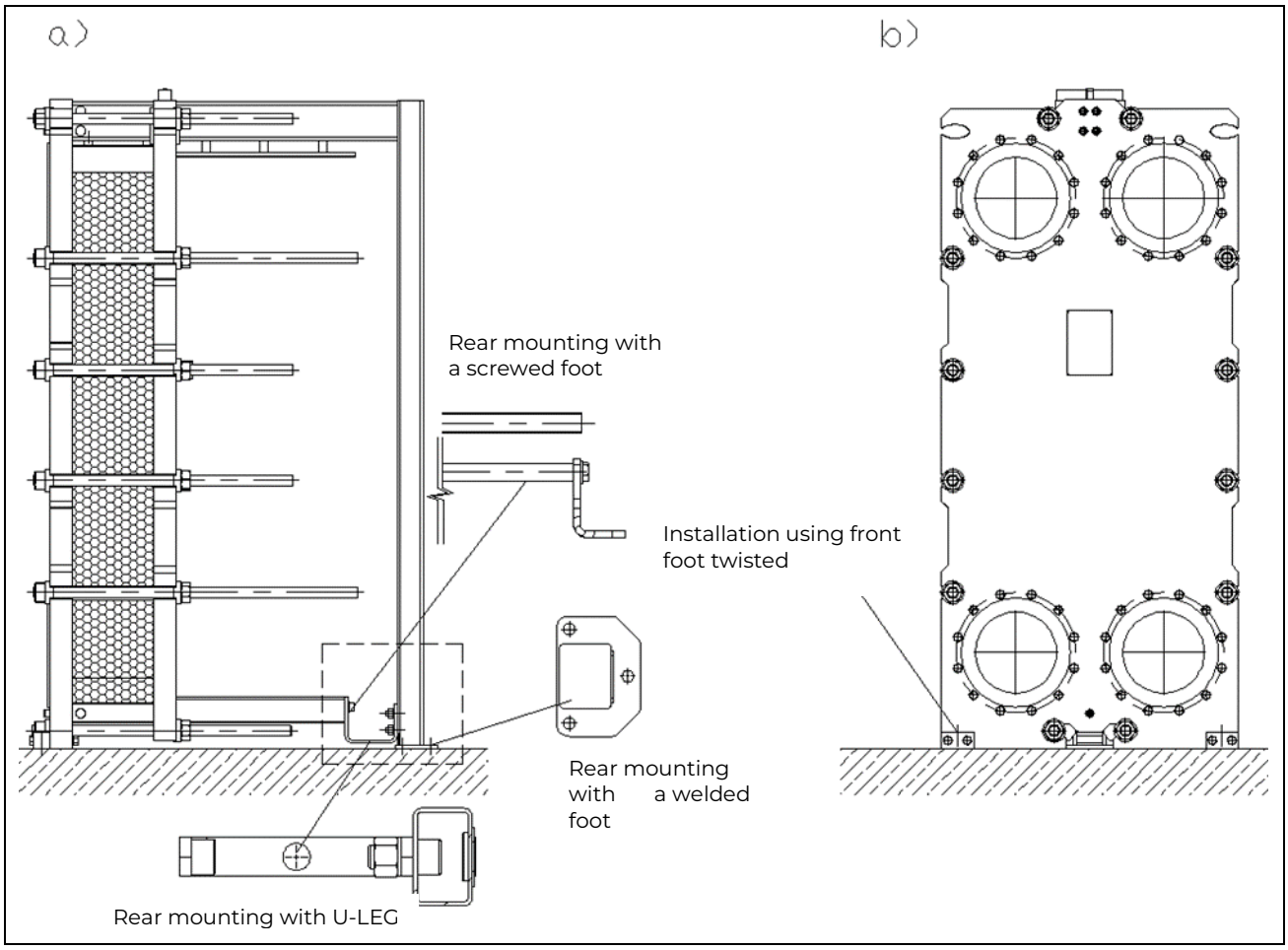



*Fig. 11.1 Plate exchanger mounting: **a)** back, **b)** front.*

- Heat exchanger location should ensure comfortable access, safe operation, ventilation and lighting.
- Check if the connection piping may removed in order to operate the equipment.
- Make sure that there is sufficient space for removing plates on one side of the plate heat exchanger (*Fig. 11.2*).

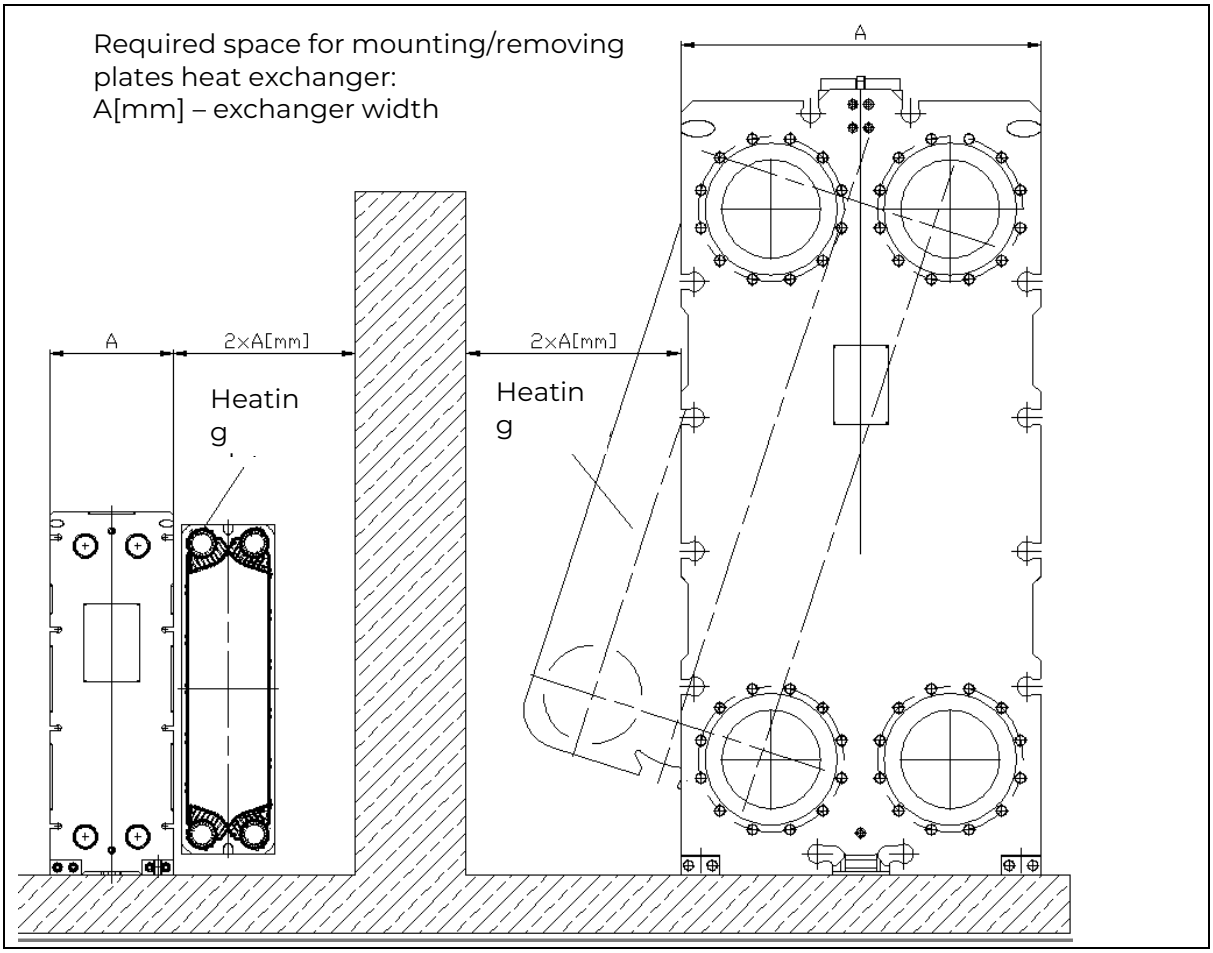



*Fig. 11.2 Required space for mounting/removing plates.*

- Before connecting the piping installation, make sure that the baseplates and feet are correctly screwed and the exchanger is firmly attached to the foundation. Some equipment is delivered with the racks disassembled or screwed on for easier transportation. In such case, the feet need to be appropriately set (screwed). Depending on the design, the exchanger should be fixed to the ground using the following mounting options:

| | |
|---|---|
| Front mounting | screwed foot (*Fig. 11.1 b*) |
| Back mounting | U-leg, screwed foot or welded foot (*Fig. 11.1 a*) |

- It is recommended to use protective sheets to cover the plate pack. They protect against contact with the hot plate pack or hot or aggressive liquids in the case of a leak.

### 11.1.1. EXCHANGER INSTALLATION

- During installation, all blinds that were used to seal the connections during transport and storage should be removed.
- Ensure appropriate cleanliness of the connected components throughout the installation.
- Installation works should be conducted at ambient temperature no lower than 0°C (32°F).
- Connection system pipelines must be clean, free from rust, burs, filings, weld spatters and lubricants.
- Pipelines should be connected in a manner eliminating mechanical stress, i.e. they must be supported in front of the exchanger in order to eliminate the transmission of forces and moments on the connection pipes of the heat exchanger.
- Expansion joints should be used in the pipelines in order to eliminate vibration transmission.
- When fixing valves, their weight should be taken into consideration.
- Due to the thermal stress caused by changing temperatures, the pipe handles in long pipelines should be screwed so as to allow for longitudinal movement of pipes under changing temperatures.
- Welding the connection pipelines directly to the fixing elements is not allowed.
- Pipelines connected to the exchanger should be equipped with venting and draining stub pipes.

NOTE:

**For proper venting, the vales should be situated at the highest point in the medium flow direction. In order to enable exchanger maintenance, when necessary, shut-off valves should be installed on all connections.**

- Once installation is complete, make sure that no tools or other items have been left in the pipeline or heat exchanger.

- In order to limit the risk of staff injury in the case of too high or low temperature of the heat exchanger surface, preventive actions should be taken, such as thermal insulation of the plate heat exchanger. Always verify whether the actions taken are in accordance with the local regulations.

## 11.1.2. FLANGE CONNECTIONS

- If the port connection is supplied with a rubber insert, the flange should be mounted to the end plate using the threaded holes available there. Tighten the screws evenly.

- If the connections do not include a rubber insert or the exchanger is equipped with a steel insert, appropriate gaskets should be used for connecting in order to seal the flanges. The flange should be mounted to the end plate using the threaded holes available there. Tighten the screws evenly.

NOTE:

The system should be equipped with devices that protect the exchanger against destruction or damage, including, but not limited to against pressure and temperature spikes, hydraulic shock and contamination.

Any temporary pressure increase at the time of tripping the protection device used must not be greater than 10%.

For proper venting, the vales should be situated at the highest point. In order to enable opening the exchanger, when necessary, shut-off valves should be installed on all connections.

# 12. OPERATION

## 12.1. BEFORE STARTING

- Only a person who has been specifically trained for this procedure should start the equipment.

- Exchanger repairs and cleaning may only be performed by authorized and appropriately trained staff.

NOTE:

**The exchanger should be taken out of operation and the medium supply valves should be closed during maintenance and cleaning.**

- Before starting, check whether the medium parameters do not exceed the rated values indicated on the nameplate of the exchanger.

- Check all system components for correct connection.

## 12.2. COMMISSIONING

- First, turn on the cold circulation pump. The heat exchanger supply pumps must be supplied with control valves. If the pumps can operate at a higher pressure than the rated pressure of the heat exchanger, safety valves must be installed. Pressure values higher than the rated values may cause gasket failure and working liquid leakage during commissioning.

NOTE:

**All processes should be started gradually when starting the equipment/resuming the production process. The suggested temperature increase must not be greater than 10°C/min (18°F/min) and the pressure increase must not be greater than 3 bar/min (43.5 psi/min) and must be applied interchangeably for both sides of the exchanger, so the pressure difference does not exceed 5 bar (72psi). After reaching the operating pressure on the lower-pressure side, pressure should be increased on the other side. The pressure difference value must not exceed 16 bar (232psi).**

- Pressure transducers, for commissioning purposes, should be placed on the media inlets to measure the maximum pressure. There must not be any other element between the measuring point and the exchanger's nozzle, apart from the straight section of the inlet pipe. It is recommended to instal the sensor with the minimum distance of 3 internal diameters of the straight pipe connection (L1≥ 3xID) from the front of the exchanger nozzle. Temperature transmitters should be placed on media outlets.

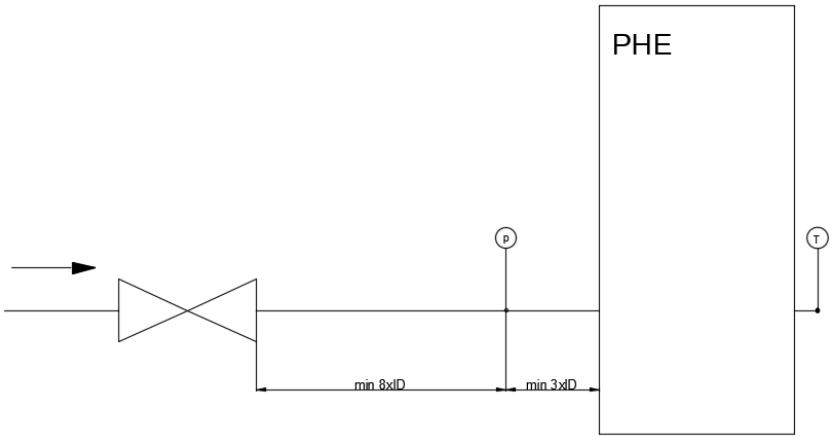



*Fig. 12.1* Diagram of measurement temperature and pressure.

- The equipment must be vented immediately after starting. Any remaining air may cause air blockage and serious plate deformation, which decreases heat exchange efficiency and increases the risk of corrosion.

- In exchangers with venting valves, venting is carried out according to the following instruction:

    1. Connect hoses with all the venting valves.
    2. Venting should be carried out with fill pressure until getting continous stream. Repeat this for each venting valve.
    3. After the procedure, disconnect hoses.

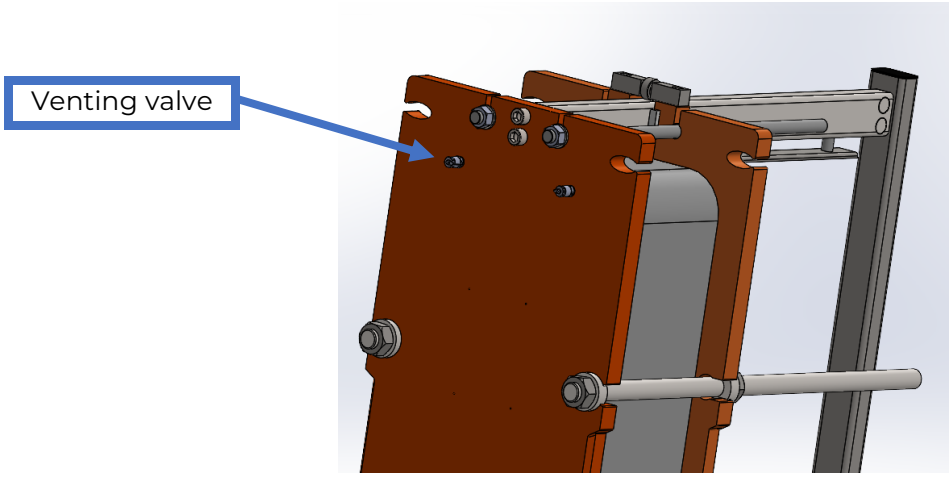



*Fig 12.2. Example location of venting valves*

*Fig 12.3. Hose to connect and open the venting valve*

- The flow of the media supplied to the equipment should ensure the smallest possible pulsation resulting from pump operation. Pulsations may generate vibrations and cause deformations, which may lead to leaks.

- Do not allow sudden media temperature changes.

- Always check the equipment for any leaks.

NOTE:

**Liquefication may occur under the exchanger during operation with certain media.**

- The exchanger should undergo regular technical inspections (checking for example: leak tightness, contamination degree, etc.).

## 12.3. SHUTDOWN

### 12.3.1. SHORT-TERM SHUTDOWNS

If the heat exchanger must be shut down for a short period of time, the following actions must be performed:

- slowly close the hot circulation valve, while maintaining full flow in the cold circuit;
- turn off the hot circulation pump;
- cool down the heat exchanger;
- gradually close the cold circulation valve;
- turn off the cold circulation pump;
- close all other shut-off valves (inlet and outlet, in both circuits).

### 12.3.2. LONG-TERM SHUTDOWNS

Conduct all of the short-term shutdown procedures, then perform the following:

- cool down the equipment, so it may be safely serviced;
- empty all circuits using drainage valves;
- grease stud threads in order to reduce friction before unscrewing;
- loosen the threaded rods until the plates are lose;

NOTE:

**Threaded rods should not be removed.**

**Loosened rods should prevent contamination penetration and the permeation of corrosive agents between the plates.**

- the plate heat exchanger must be completely dried, as media residues may cause corrosion and contamination on the plate surface;
- after drying the heat exchanger, refer to *CLOSING* instructions in Section *13.3.*

# 13. MAINTENANCE AND CLEANING

## 13.1. PRELIMINARY PROCEDURES

To avoid any sudden issues, HEXONIC Sp. z o.o. recommends preventive maintenance. Plate heat exchangers must be serviced periodically. It is also recommended for the user to have a minimum number of spare parts at their disposal, such as plates and gaskets, should any unexpected issues be caused by those elements.

Before starting operation of the plate heat exchanger:

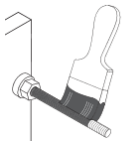
- wear safety clothing;
- ensure the exchanger is separated from the power source;
- ensure the exchanger has been cooled down to a temperature that enables servicing;
- ensure the exchanger is dried or the media inside the exchanger are not hazardous in contact with skin or through aspiration;
- ensure enough space to avoid injuries and allowing for free movement.

## 13.2. PLATE HEAT EXCHANGER DISASSEMBLY

NOTE:

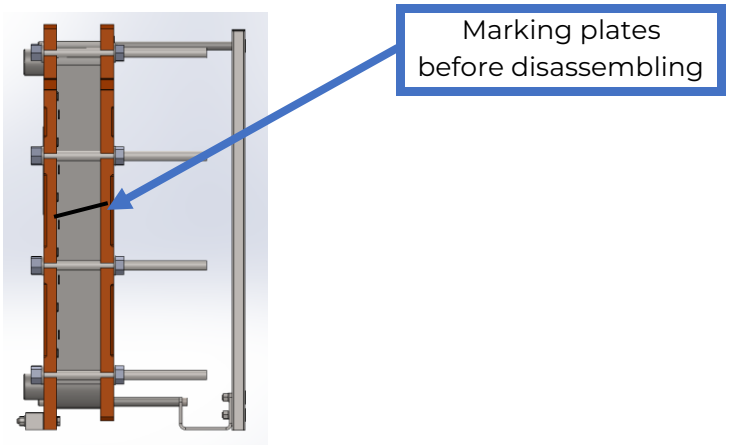
In order to disassemble the plate heat exchanger, carry out the *PRELIMINARY PROCEDURES 13.1* described under *MAINTENANCE AND CLEANING 13*.

- remove protective caps from the threaded rods;



- clean and grease stud threads in order to reduce friction during unscrewing;

- mark the order and the orientation of the plates with a marking pen, drawing a line on the lateral plate surfaces;




- using a set of wrenches, unscrew the nuts in the threaded rods of the rear plate as in *Fig. 13.1 a*. In option the heat exchanger with blocked nuts with bolts, use these nuts to unscrew.

- remove the threaded rods, pulling them through the openings in the front plate (or) on plates side;

- store the removed elements in a clean and dry place;

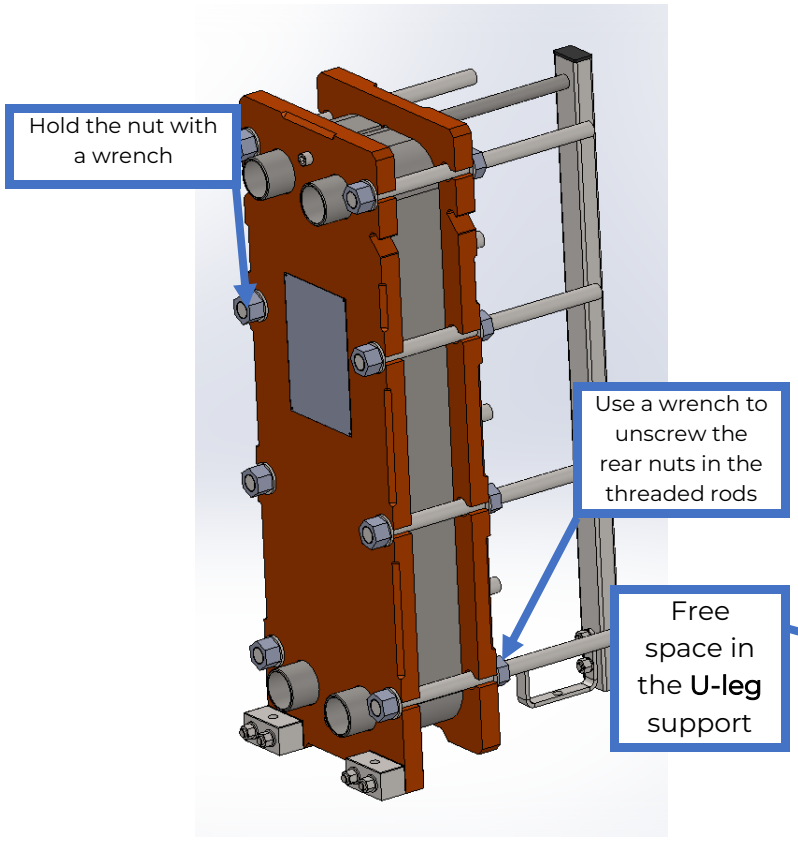



*Fig. 13.1 a*

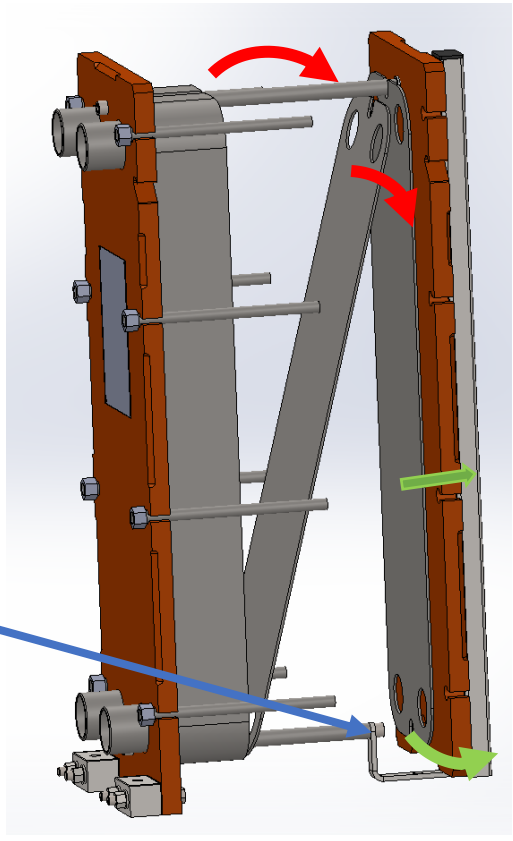


*Fig. 13.1 b*

- check the surface of the horizontal bearing bar and the rear (moving) plate roller for any obstacles/ clean the round rod of the upper bar from dirt and dust;
- slide away the rear exchanger plate to the end of the rear support;

NOTE:

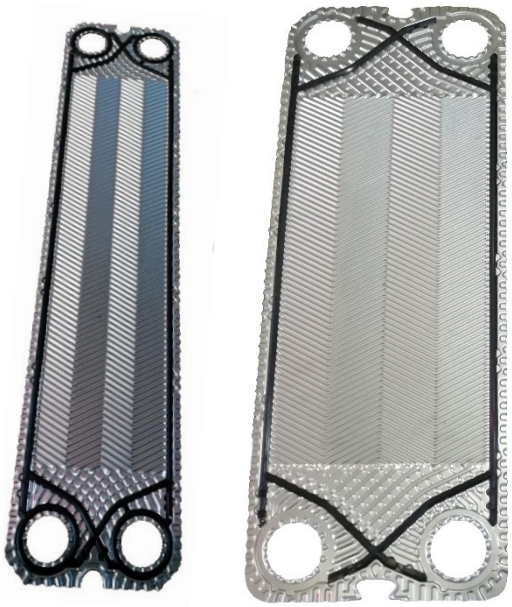
**Due to sharp edges of the heating plates, grab them cautiously, wearing protective gloves.**

- for exchangers with the U-leg support version, slide the heating plate completely to the end of the lower bar and remove the plate in perpendicular direction or at an angle toward you (*Fig. 13.1 b)* – red arrows);
- for standard support exchangers, tilt the heating plate towards the rear plate and remove it, rotating it at an angle toward you (*Fig. 13.1 b)* – red arrows);
- slide away the rear plate, in order to gain access to the plate pack.

## 13.3. CLOSING

### 13.3.1. PREPARING THE STARTING PLATE WITH A GASKET

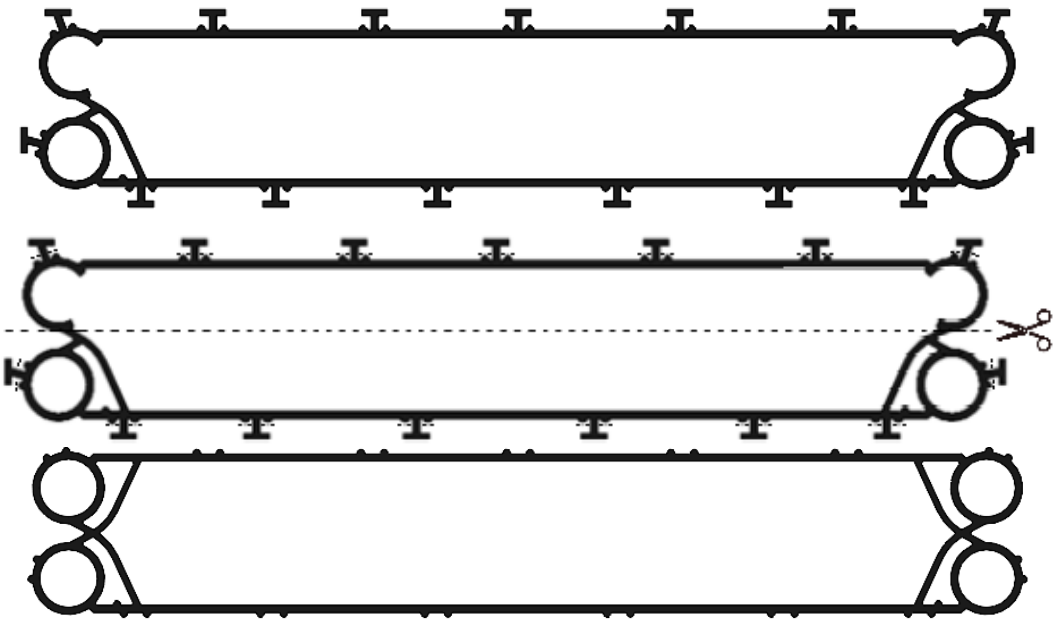
The starting plate requires appropriate sealing with the connection, therefore a gasket must be prepared. The gasket is fitted with additional clips to facilitate installation in the plate, however for the starting plate these are cut off, therefore an adhesive is required (e.g.: Bostik 1782, 3MEC 1099, Bond Spray 77, Plibond 20 or 30 synthetic adhesive). A small amount of the adhesive is applied into the gasket seat only for the starting plate and then the gasket itself is mounted. Sealing requires two gaskets to be cut in half and use only the parts with rings for flow openings. Then, the two halves are connected on the plate as in the figure. If Rubberliner is the connection, it also acts as the gasket, so there is no need for additional sealing around the openings (it is cut off there).



If it is necessary to replace the gasket, the old gasket must be ripped off the plate. Remove any remaining adhesive (usually it requires a suitable non-chlorine solvent). Before applying a new gasket, assure that all sealing surfaces are dry, clean and free of foreign matter such as fat, grease or similar. Then apply a layer of adhesive again and glue the previously prepared gasket.

NOTE:

**When removing the glued gasket, do not use any sharp tools that could damage the plate. Adhesives other than those recommended may contain chloride or other substances that could damage the plates.**



## 13.3.2. EXCHANGER INSTALLATION

NOTE:

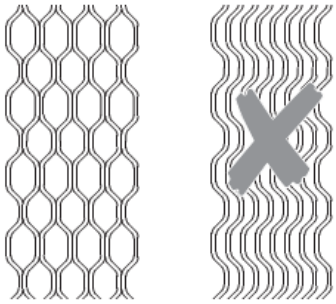
**Different types of tools, such as hydraulic and pneumatic tools, can be used in order to facilitate closing. Upon reaching the screwing dimension, it is recommended to wait 30 minutes and then adjust the tightening torque with a torque wrench.**

Following maintenance and repairs, assemble the heat exchanger according to following requirements:

- insert the heating plates one after another, following the order as per the installation card provided, checking each sealing surface to avoid any contamination between the plate and the gasket (make sure the plates are placed in their positions according to the line marked before disassembly or use the exchanger installation card).

- After inserting all the plates between the frame, press/close the rear plate so that the plate pack remains still between the pressure plates;

- check whether the plate pack has a honeycomb structure which indicates correct positioning as in the figure;



- apply some grease on the stud and nut thread to reduce friction forces;

- holding the nuts on the front plate side with a wrench, tighten the exchanger nuts evenly on the rear plate side. In option the exchanger blocked nuts with bolts, use these nuts for evenly tightening keeping in the same time the opposite nuts blocked. Perform the final tightening in the order indicated in *Fig. 13.2*; this order could be different depending on the number of threaded rods.

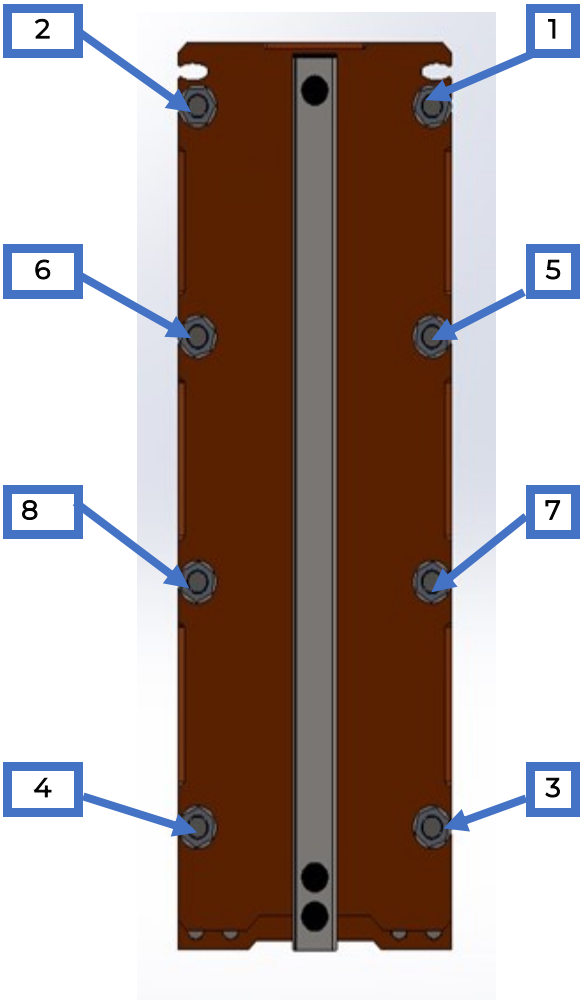



*Fig. 13.2*

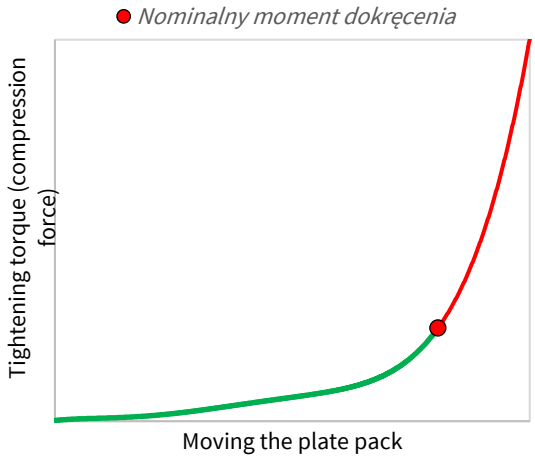
- the final tightening torque of the nuts should be as indicated in the TECHNICAL SPECIFICATION section.

NOTE:

Depending on the condition, the tolerance of the heating plates and the configuration of new and old plates, screw the exchanger together until full contact of the plates, which may result in different torque values indicated. Appropriate compression of the plates will result in sudden torque increase during tightening, as shown below.

NOTE:

During the final phase of tightening, use a certified torque wrench.




NOTE:

Inappropriate compression force may result in fluid leakage:

- too low tightening torque may result in leakage,
- too high tightening torque will damage the heating plates.

- Assure that the final difference in tightening the individual threaded rods does not exceed 1 [mm] per every meter of the screwed exchanger.
- Perform a pressure test before commissioning the heat exchanger in order to assure that there is no leakage. During test pressure, do not exceed maximum allowable working pressure (MAWP), as stated on the nameplate.
- follow the start-up procedure.

## 13.4. CLEANING

Most plate heat exchangers are exposed to soiling/contamination. Soiling/Contamination may occur at the inlet ports, in plates near the ports and on other plates. Contamination, if not cleaned, increases pressure drop and reduces heat exchange performance. Therefore, to avoid these issues, cleaning of the plates is necessary. Contamination on the heating plates can be removed manually or using CIP (cleaning in place). Plate heat exchanger cleaning may vary depending on the size, plates used and the gaskets material.

### 13.4.1. FRAME CLEANING

- Clean the frame of the plate heat exchanger from the outside, especially the bearing column, the bearing bar and the threaded rods.
- Grease the threaded rods to prevent corrosion.
- Any defects of the paint coating should be repaired to prevent corrosion from spreading.

### 13.4.2. PLATES CLEANING

Carefully choose the cleaning agent in order to remove contamination from the heating plates without damaging the plates or the gaskets. All stainless steel materials have a protective layer that must not be destroyed to provide protection of the steel against corrosion. We recommend requesting a confirmation from the cleaning agent supplier that the agent is appropriate both for the type of contamination and the material of the heating plates. Follow the instructions provided by the cleaning agent supplier.

### 13.4.3. CIP CLEANING

CIP (Cleaning in Place) is a method of cleaning a plate heat exchanger without disassembly. The cleaning agent is pumped through the channels to clean out mild/medium contamination from the plate surface. Depending on the application and contamination level, the CIP method may be the best solution. It is crucial to use an appropriate cleaning agent in order to effectively remove the contamination.

It is best to use cleaning agents recommended by HEXONIC Sp. z o.o.

## 13.4.4. MANUAL CLEANING

- Disassemble the exchanger according to the disassembly procedures provided.
- Clean each heating plate separately in a hanging position or on a flat surface, depending on the contamination level.

NOTE:

**Never use a steel brush on the heating plates. If a brush is required, use one made of hard plastic, which is soft and does not contain metal. Rubbing iron in a stainless steel surface may result in rust or corrosion.**

- Be careful not to scratch the gasket surface, which could lead to leakage.
- After brushing, wash each plate with clean water.
- High rinsing pressure can prove more effective.
- Wipe the gaskets dry. Remove solid particles (even a grain of sand can cause a leakage if it enters between the heating plate and the gasket).
- The lower part of each suspended heating plate in the equipment should be thoroughly checked and appropriately cleaned, as this is the main area where solid particles accumulate.

NOTE:

**For stainless steel, do not use chlorohydric acids or water containing more than 300 ppm of chloride.**

**For titanium heating plates, do not use phosphoric acid or sulfamic acid.**

**For cleaning, do NOT use the following solutions at concentrations exceeding 4% and temperatures exceeding 60°C (140°F).**

## 13.5. RECOMMENDED CLEANING AGENTS

| Cleaning agents – boiler scale sediment | | Concentration max 4%<br>Temperature max. 60°C (140°F). |
|---|---|---|
| SCALE | SLUDGE | CLEANING AGENTS |
| Calcium carbonate | Corrosion products | Nitric Acid |
| Calcium sulphate | Metal oxides | Sulfamic acid |
| Silicates | Silt | Citric acid |
| | Aluminum oxide | Phosphoric Acid |
| | Methabolic products | Complexing agents (EDTA, NAT)<br>Sodium polyphosphates |

| Cleaning agents – biological contamination, silt | Concentration max 4%<br>Temperature max. 60°C (140°F). |
|---|---|
| BIOLOGICAL CONTAMINATION – SILT | CLEANING AGENTS |
| Bacteria | Sodium hydroxide |
| Nematodes | Sodium carbonate |
| Protozoa | The cleaning result can be improved by adding small amounts of hypochlorite or surfactants. |

| Cleaning agents – oil residues, asphalt, fats | |
|---|---|
| SLUDGE | CLEANING AGENTS |
| Oil residues | Petrol-based paraffin solvent (e.g. kerosene) |
| Asphalt |  NOTE: EPDM gaskets expand in those media. Contact with this medium should be limited to 30 minutes. |
| Fats | |

| Cleaning agents – gasket adhesive | |
|---|---|
| GLUE RESIDUES | CLEANING AGENTS |
| Dried gasket adhesive | Methyl ethyl ketone (MEK), Acetone |

# 14. TRANSPORT

Installation of the plate heat exchanger requires caution. It is vital to follow the steps provided in order to act in a safe and appropriate manner. It is important to provide enough free space for servicing and replacement of plates and gaskets. When positioning the equipment, leave space on all sides of the equipment for easier operation. Inappropriate operation may result in damaging the plates and a leakage during start-up.

NOTE:

Risk of equipment damage!

Plate heat exchangers are heavy and vulnerable equipment. They can be damaged during transport and installation. Precautions should be taken in order to avoid damaging the plate heat exchanger and its components. Damage to the components can negatively affect the performance or the operability of the equipment.

NOTE:

Risk of injuries.

Do not allow unauthorized persons in the risk zone when manipulating the equipment. Do not move or lift the equipment manually. Use dedicated handles for lifting. Never work under a suspended load. The equipment or lose objects may fall. Damaged plastic belts may break. There can be sharp edges, fragments and nails on the case, pallet or equipment.

Principles to be followed:

- Plan lifting and transport carefully. Always complete a risk assessment.
- Wear personal protective equipment during operation, unpacking and installation.
- Determine the risk zone for lifting and transport of the equipment in a case, on a pallet or the equipment itself.
- Perform risk assessment for transportation routes and risk zone before lifting and transporting the equipment.
- The equipment in a case or on a pallet should not be exposed to rapid movement or shock. Cases are not adapted for withstanding load; do not place object on the cases or stack them.
- Lift the equipment according to the manual.
- Lift the equipment in a case on a pallet using a forklift.
- The length of the fork should be equal to or greater than the length of the pallet.

- Lift and transport the load slowly and gently. Use frames and equipment designed for this task.
- For lifting, use belts made of a soft material in order to avoid damaging (e.g. scratching or scraping) the outer surface of the exchanger.
- Never use connector pipes for lifting the exchanger.
- Never leave a hanging load unattended.
- Do not use lifting supports for horizontal transportation of the heat exchanger.
- Before transport/disassembly, empty the heat exchanger, seal all connections and cover any elements prone to damage during transport.
- Make sure that the transported equipment is stable. Always check the location of the center of gravity before unpacking or moving the equipment. Keep the center of gravity as low as possible.
- When lowering the case/pallet, make sure there is enough space around it for free access from every side.
- Check the floor's condition. Make sure the case (pallet) has a strong support. If necessary, place blocks or plates below.
- During work below a hanging load, always secure the load against falling down with wooden beams or similar items.
- The pressures and design temperatures for each model are specified on the nameplate. Exceeding these values is prohibited.
- Exchangers with beam above 2500mm, should be transport vertically.

NOTE:

Immediately report any damage or missing parts identified to the manufacturer.

## 14.1. POSITIONING THE EXCHANGER

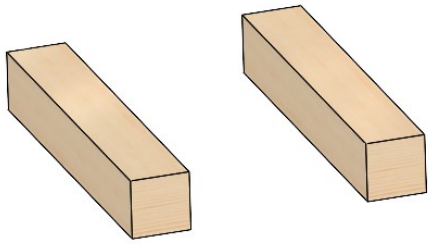
The following recommendations apply for positioning the plate heat exchanger after it has been delivered by HEXONIC Sp. z o.o. Use belts approved for the equipment's weight. Follow the instructions below.

NOTE:

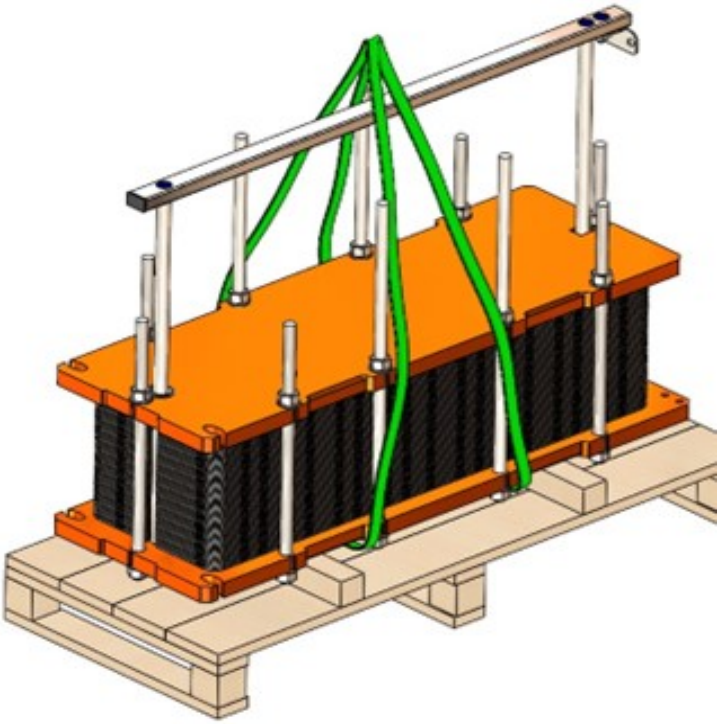
Risk of equipment damage!

The crane slings must be long enough to enable rotation of the equipment without any obstacles. In particular, include space required for the support in order to avoid damaging the exchanger components during positioning; always proceed with extreme caution.

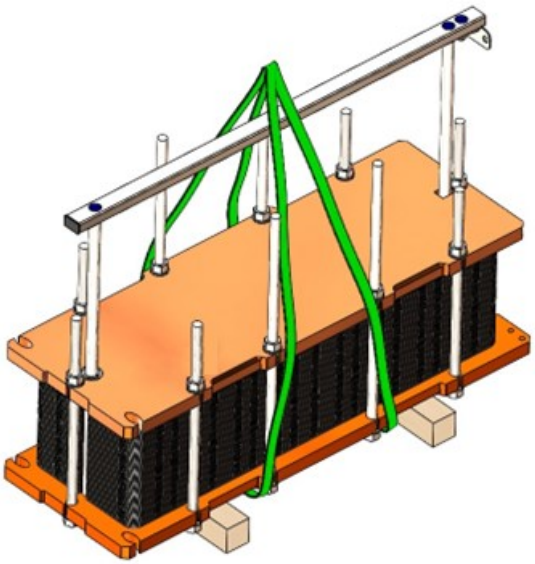
1. Place two wooden bars on the floor. Material other than wood can be used, such as hard plastic, etc.



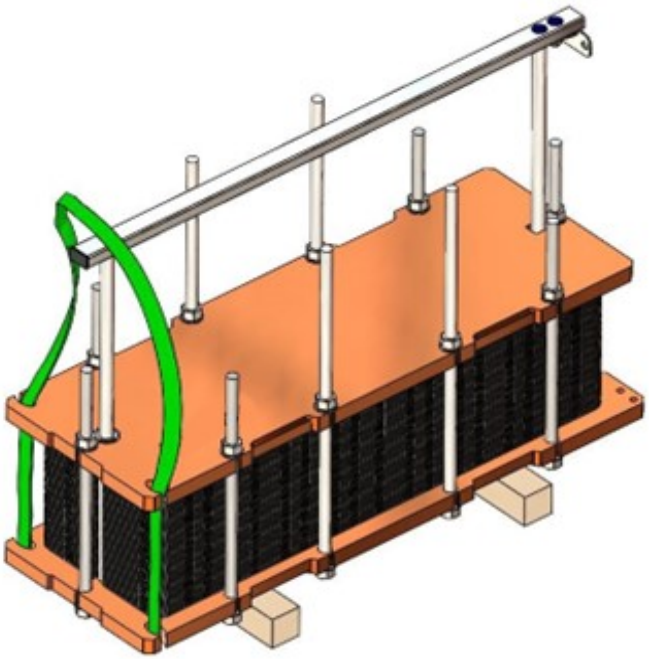
2. Lift the heat exchanger from the pallet with crane slings. It is important to balance the exchanger properly in order to avoid any fall or damage.



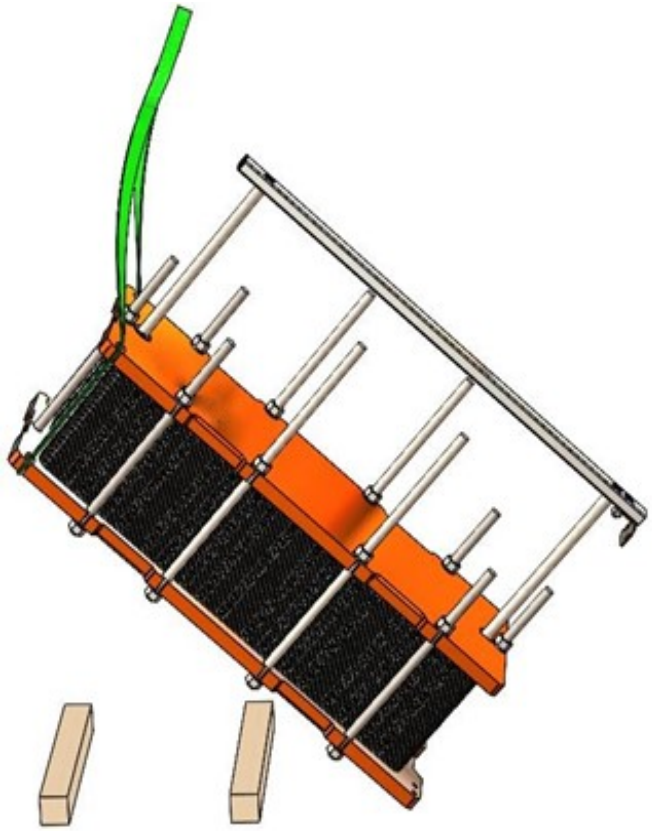
3. Place the plate heat exchanger on wooden bars.



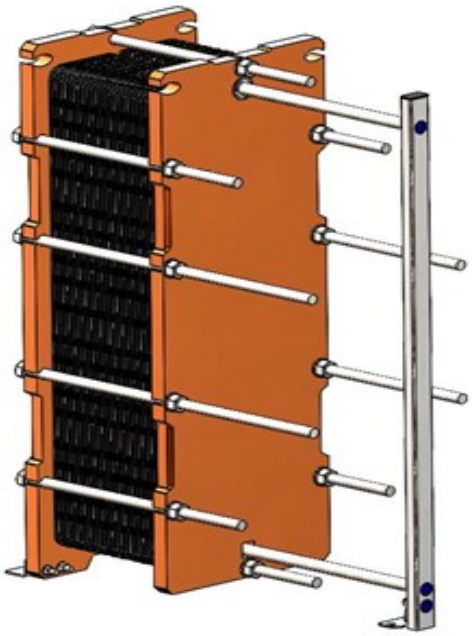
4. Pass the belts through the handles from bottom up, as shown in the figure.



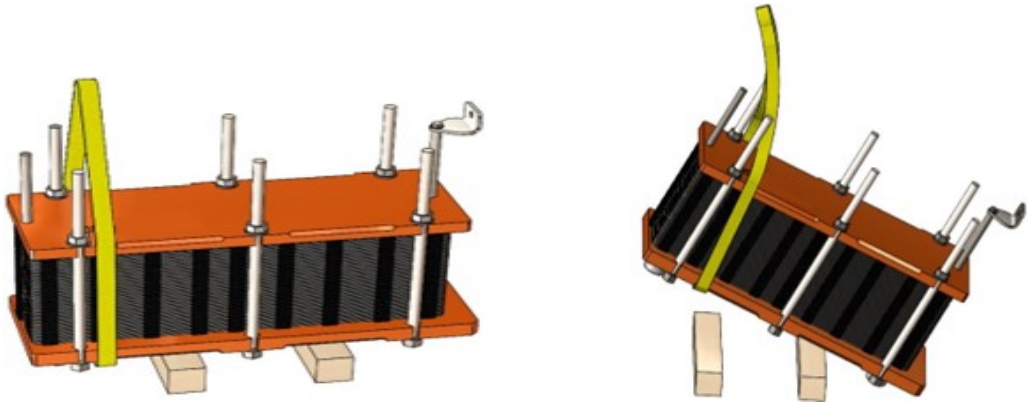
5. Lift the plate heat exchanger from the wooden bars. For this purpose, do not use other parts, like, studs, bearing column etc. in order not to cause damage. Make sure the ropes are even and will not cause a loss of equilibrium when lifting the equipment.



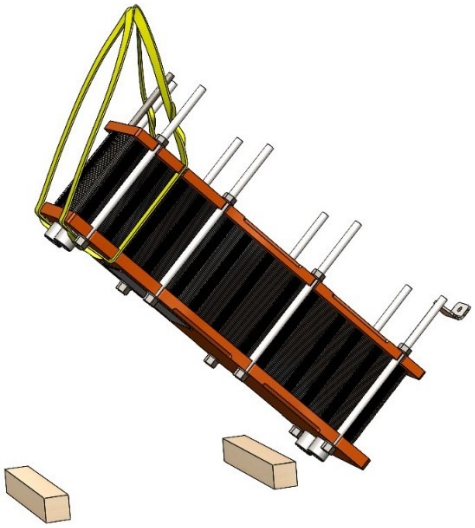
6. Pick up the plate heat exchanger to place it on the floor vertically.



There are no dedicated lifting handles for the small models (JFA); the exchanger can be wrapped with a belt from the bottom up, as in the figure.



If the handles are located lower, place crane slings behind the studs, as shown in the figure.

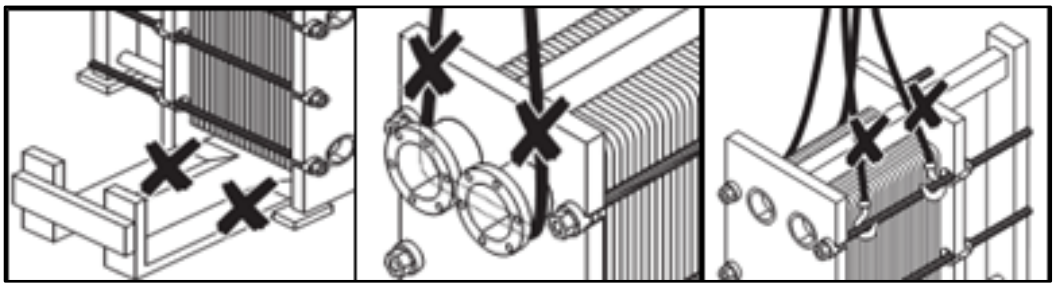


During these operations, pay attention to guidelines. Any damage to the plates or the frame structure can cause serious problems, such as leakage, bending of the metal sheets and connections.

For lifting devices with a beam length above 2500mm, use a traverse *(Fig 14.1)* with suitable strength according to *PN-EN 13155:2021-05.*

*Fig 14.1 Traverse*

NOTE:



# 15. DIAGNOSTICS

## 15.1. INSPECTION AND OPERATING ACTIVITIES

The equipment should undergo regular and periodic inspections (at least every six months):

- measurement instrumentation readings inspection;
- periodical leakage inspection of pipework and connections;
- keeping clean the external surfaces if the equipment operates in a dusty environment;
- inspection of the general appearance and inspection for any leakage, wipe dry all painted parts and inspect surfaces for damage;
- periodically inspect studs and bars for rust and cleanliness, apply some molybdenum grease or anti-rusting agent on threaded parts (ensure the grease etc. does not come in contact with gaskets);
- if there are rollers mounted to the rear frame plate, lubricate the bearings with a light machine grease.

Faulty operation or damage of the pressure equipment can manifest itself through:

- spillage,
- excessive pressure drop.

## 15.2. TROUBLESHOOTING

| PROBLEM | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Leakage | connection between the front plate and the pipework flange | inspect plastic lining (Rubberliner)<br>check the flange gasket<br>check the O-ring on the first plate<br>mount the pipes so that no tensions are transferred to the exchanger |
| | mixture of hot and cold fluids | inspect plates for openings or cracks |
| | heating plates pack | check mounting distance<br>check the condition of the gaskets<br>check proper gaskets positioning |
| | working pressure and temperature exceed calculated conditions | adjust working conditions |
| Insufficient performance | air in the system | vent the pipework using vent valves<br>inspect pipework for possible unvented segments (“air plugs”) |
| | working conditions different than specified | adjust working conditions (flow rate, inlet temperature) |
| | heat exchanger is dirty | clean the heat exchanger |
| | connections swapped | attach the connections to the pipework correctly, as in the template diagram |
| Excessive pressure loss | flow rate higher than assumed | adjust flow rate |
| | channels between plates are clogged | rinse/clean |
| | equipment malfunction | check the pressure indicator |
| | medium different from design assumptions | adding cleaning or anti-frost agents may impact performance |
| | air in the system | vent the pipework system<br>inspect pipework for possible unvented segments |
| | plugged inlets | perform CIP or open the heat exchanger to clean the ports |
| Mixed fluids | system connections are located incorrectly | change the pipework layout according to the data sheet |
| | ensure intermediate plates (in multi-flow exchanger) are distributed according to the installation card | open the heat exchanger and check correct placement of the intermediate plate as per the installation card |
| | make sure the gaskets are not displaced from the groove | open the heat exchanger and identify the gasket displacement site |
| | cracked heating plates | open the heat exchanger and perform and check for leaks with penetrating agent (PT penetrant, kerosene/chalk) |

# 16. WARRANTY TERMS AND CONDITIONS

Warranty terms are included in the General Warranty Terms and Conditions of HEXONIC Sp. z o.o.

# 17. ENVIRONMENTAL CONFORMITY

HEXONIC Sp. z o.o. is committed to environmental aspects during the development, design, manufacturing, servicing and distribution of its products.

At end of service life, the heat exchangers must be recycled according to applicable regulations.

- Waste management – separate, recycle or discard all materials and components in a safe and environmentally friendly manner or according to national or local regulations. When in doubt about the material used for manufacturing an element, contact your local dealer. Use a certified disposal or recycling company.

- Unpacking – the packaging may contain wooden, plastic, cardboard and metal tape elements. Wood and cardboard boxes can be reused, recycled or used for energy recovery. Plastic should be collected and segregated for reuse or disposed of in an authorized waste combustion plant. Submit metal tapes for material recovery.

- Disposal – all metal parts should be sent for disposal. Dispose of oil and all worn non-metal parts according to local regulations.

- Scrapping – following its end of service life, dispose of the heat exchanger according to local regulations. Also ensure proper disposal of any dangerous process liquid residues. When in doubt or if there are no local regulations, contact your local distribution company.

# 18. APPENDICES

## 18.1. TECHNICAL INFORMATION SUPPLIED

A complete O&MM consist of the following documents:

- declaration of conformity,
- spare parts list,
- technical drawing of the plate heat exchanger provided.

## 18.2. LIST OF AVAILABLE ACCESSORIES

- **Double-sided studs –** threaded stud bolts around the connections, which hold the flanged connections to the exchanger.

- **Protective sheets –** cover the plate pack, protecting from leakage of hot or aggressive fluids and the hot plate pack.

- **Mounting supports –** ensure stability and are used for mounting the plate heat exchanger with studs to the floor or structural elements of the system.

- **Stainless steel adjustable feet –** ensure stability and isolate the exchanger from the floor.

- **Drip tray –** protects against leakage during maintenance works and collects condensate from the surface of the exchanger.

- **Thermal insulation –** reduces heat loss and prevents unnecessary heating of the room where the exchanger has been installed.