

*Speciality Trust Quality*

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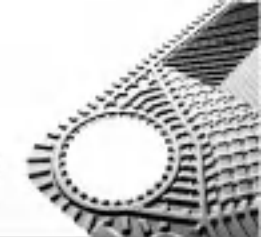
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**Accessen**  
ACCESSEN GROUP



Accessen Plate Heat Exchanger  
Operation & Maintenance Manual



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## Notice !

### Attention Please

To avoid hand injuries, protective gloves should always be worn when handling plates.

### Protective Plates

It is the responsibility of each person operating or repairing equipment to take the necessary precautions to comply with all applicable safety regulations.

ACCESSEN will provide protective plates as accessories for all our plate heat exchangers if necessary. These plates will prevent possible injuries and/or damage as a result of sudden leakage from the plate package.





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## Dear Users

When you are using our Accessen plate heat exchanger (PHE) in every different condition, this instruction should be your director. Accessen wish you study this book carefully before installing, repairing and operating our PHE. This manual would be nothing if it is hanged by the wall.

Accessen should not be responsible for the damage caused by wrong operation against Accessen's instruction.

If the special malfunction not listed in this manual happened to our plate heat exchanger, please do not hesitate to contact us, we would try our best to help you.



## CHAPTER 2 NAMEPLATE AND INDICATION MARKS



(2-1)



(2-2)

When communicating with us, please write down the model number and produced date in order to check the equipment in a timely and accurate manner by us.

Customers can distinguish the place where the product was made according to the series number marked on the nameplate on our equipments.

All parts of plate heat exchanger can be distinguished by one number. You have to offer us the mark number when you contact ACCESSEN (please see page 57 and page 58 for the detail instruction about how to buy the spare parts).



(2-3)



## CHAPTER 3 STRUCTURE AND FUNCTION OF PHE

### Structure

Plate heat exchanger comprises of fixed head (1), carrying bar (2), guiding bar (3) and movable end (4). Many of them also have support column (7).

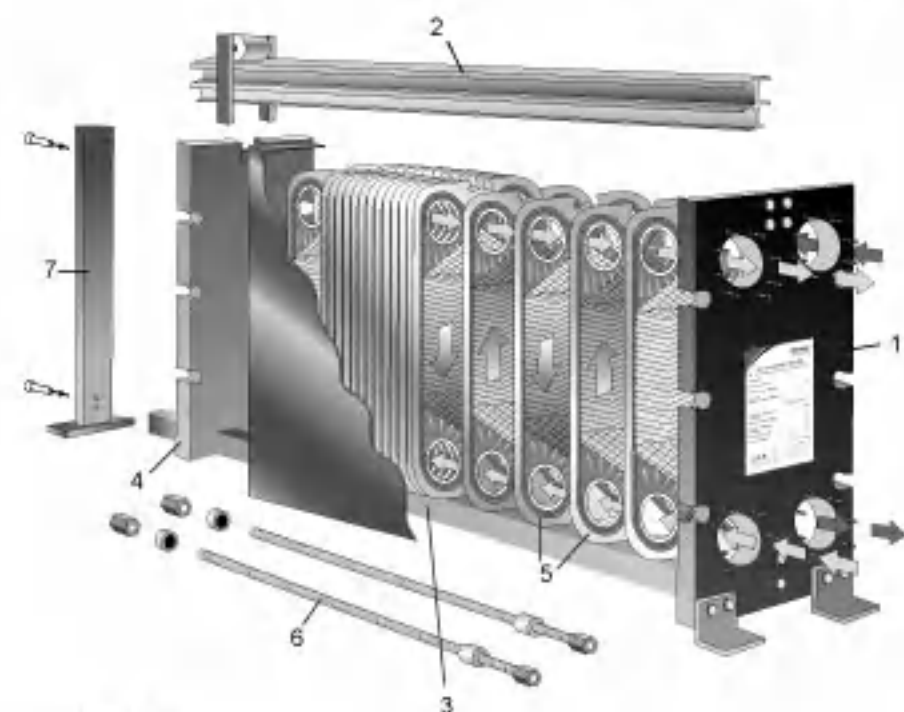
There are calculated plates (5) with gaskets hanging between fixed head and support column.

All plates are installed on the frames, with 180° rotation angle of the adjacent plates.

That is, there are double gaskets around the hole on every two plates in the passage between the plates.

The plate cluster is pressed by tightening bolts and nuts (6).

( 3-1 )



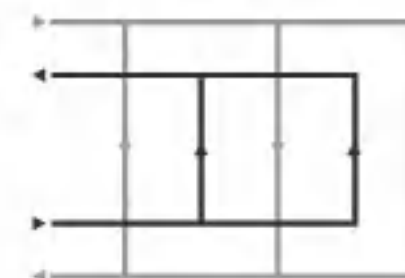
( 3-2 )

### Function



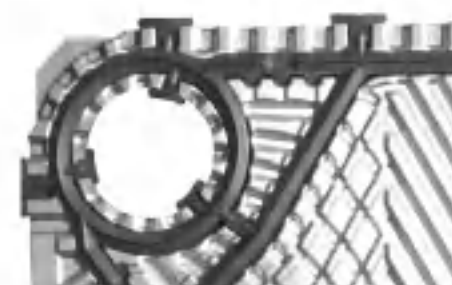
( 3-3 )

The plate cluster forms a series of parallel passages. Each liquid flows into the proper passages between the plates. Generally, it is the countercurrent flow. Refer to picture 3-3.



( 3-4 )

The composition of the plates depends on the actual requirements. The multiple parallel passages form single or multiple pass flow. Refer to picture 3-4.



( 3-5 )

There are gaskets clipped on the plates. When the plates are pressed, the gaskets can guarantee the effective sealing between fluid medium and atmosphere. Refer to picture 3-5.



( 3-6 )

The double gaskets near the inlet can prevent the mixture of the different media between the inlet and heat transfer areas. Refer to picture 3-6.





## CHAPTER 3 STRUCTURE AND FUNCTION OF PHE

### Sketch Map for Pipe Connection and Installation

Plate heat exchangers could meet various kinds of demands. The required transfer area could be obtained by installing specific quantities of plates.

The plates cluster could be assembled into single pass or multiple passes flow. For each pass, there are several parallel fluid passages.

Picture 3-7 in page 7 is the sketch map of single pass, which is the most common in use.

All connections are on fixed head. Refer to picture 3-8.

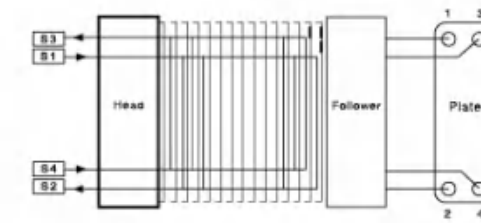
The picture on the top of page 7 indicates the combination code of the barricading holes on the plate. For instance, 1234 indicates that the holes on all the 4 plate's corners have been barricaded. V0230, however, is a left-side plate. The corner holes are barricaded on position 2 and 3 and the other two corners are not. H1200 is a right-side plate and the two upper corners have been barricaded.

A 180° rotation of the two adjacent plates forms left-side plates and right-side plates. Thus the gasket will determine the flow direction of the fluid. Picture 7 is only taken for an example. Different flow paths can be combined. For instance, a recycling secondary passage, multiple flow path and unequal passages can be added.

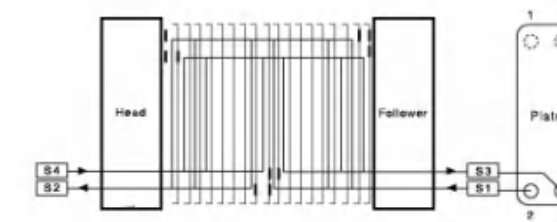
Serial numbers are not labeled on single flow plate heat exchangers but on other kinds of plate heat exchangers. The fixed head is No.1 and all the numbers are toward the upper direction.

#### Notice

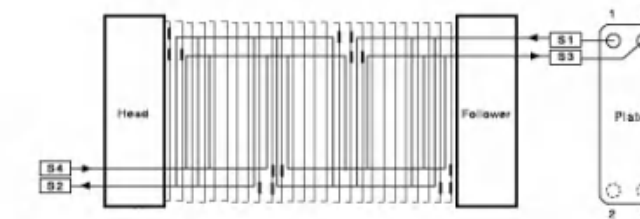
Pipe connecting can be designed according to our specification sheet.



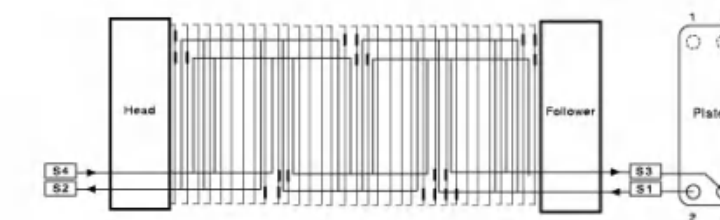
3-7



3-9

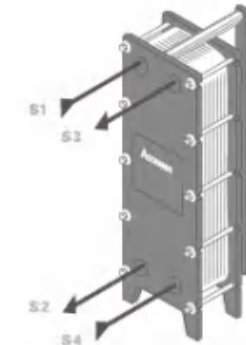


3-11

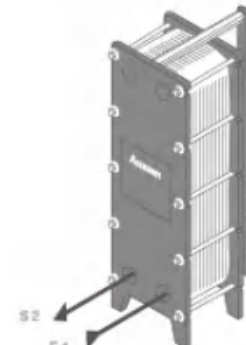


3-13

\* There can be backflow connection



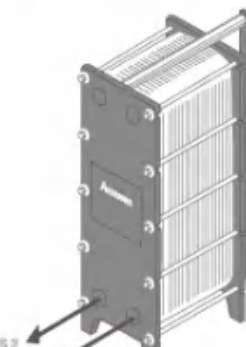
3-8



3-10



3-12



3-14



## CHAPTER 4 INSTRUCTION FOR INSTALLATION

### Storage

In this section, names of heat exchanger parts are mentioned for the first time. For more information, see part1, chapter3.

1. Unless otherwise agreed, ACCESSEN delivers the plate heat exchanger ready to be put in service upon arrival. This means the plates are tightened to its correct measurement A. (See diagram 4-1).

Should it be necessary, however, to store the equipment for a long period (1 month or more) before, certain precautions should be made in order to prevent unnecessary wear and tear of the equipment.

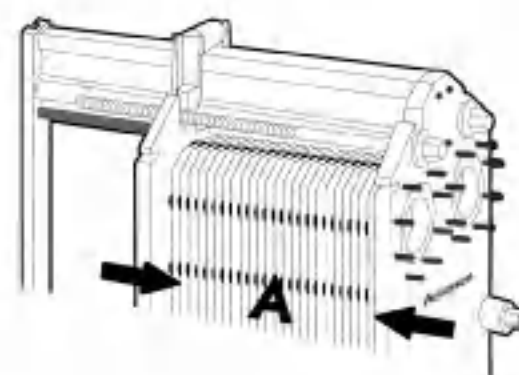
2. Preferably, the heat exchanger should be stored indoor with a temperature around 15 to 20 degrees Celsius (60 to 70 degrees Fahrenheit) and humidity around 70%.

### Notice

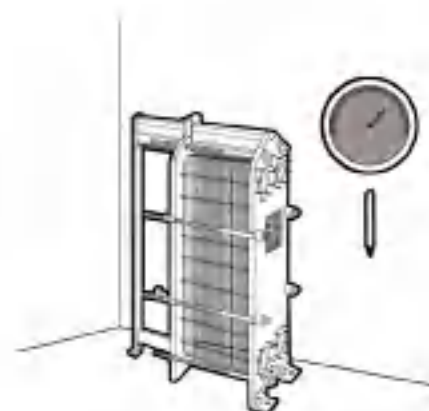
There should absolutely not be any ozone-producing equipment in the room, like electric motors or arc-welding equipment, since ozone destroys many rubber materials (cracking).

Do not store organic solvents or acids in the room.

Avoid heat or ultraviolet radiation.



( 4-1 )



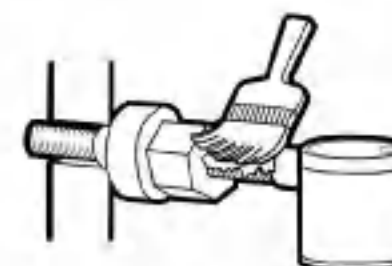
( 4-2 )



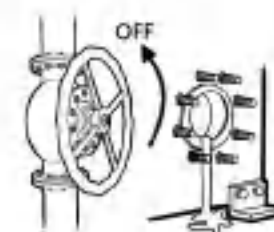
( 4-3 )



(4-4)



(4-5)



(4-6)

3. Putting PHE into packing case is a good precaution.

In this case, please inform us in advance in order to take proper preparation before packing.

4. Plate may also need to be packed by the opaque plastic membrane. See diagram 4-4.

5. The tightening bolts should be well covered with good rust preventing coating such as ESSO, Rustban 326 or similar anticorrosion paint. And if not connected to the pipe system, the connections should be covered. See diagram 4-5.

If the heat exchanger has to be stored outdoors, the precautions mentioned above should be taken into practice. The need for protection against the climate etc. is of course even more important in this case.

6. If for some reason the heat exchanger is removed from service for a long period, it is advantageous to follow the advice above, even if the equipment is not moved from the location. See diagram 4-6.

The heat exchanger should be VENTED AND DRAINED, and depending on the media processed, RINSING AND DRYING is recommended before it is stored.

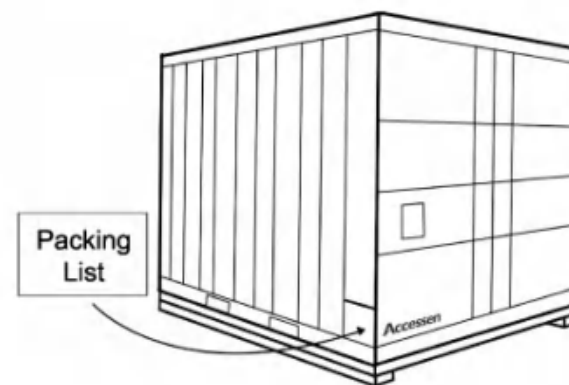


## CHAPTER 4 INSTRUCTION FOR INSTALLATION

### Packing List and Opening Box

#### 1. Packing list will be attached with goods

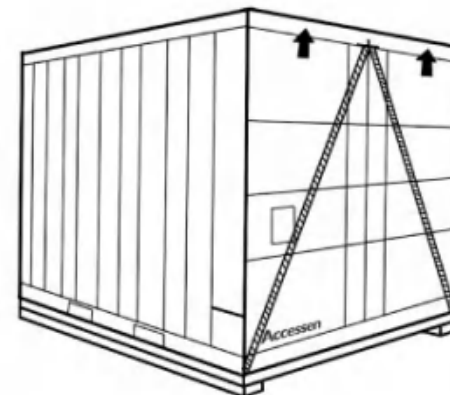
In order to make sure of the safety of equipment during delivery, instrument, valves and other parts should not be installed during delivery. Please check all parts according to the packing list, and pay attention to the parts which is easy damaged.  
(See diagram 4-7).



4-7

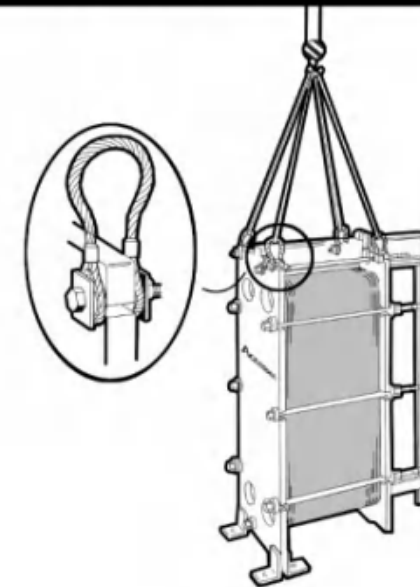
2. When the packing box or shelf is lift, please pay attention to the marks of hook location. The gravity is very important, which is marked on the top face of the box. But the real gravity is on the vertical line below the mark.  
See diagram 4-8.

Usually ACCESSEN would inform users how to place the plate heat exchanger in the box in advance.



4-8

It is dangerous if the straps was placed around the connections and other key locks



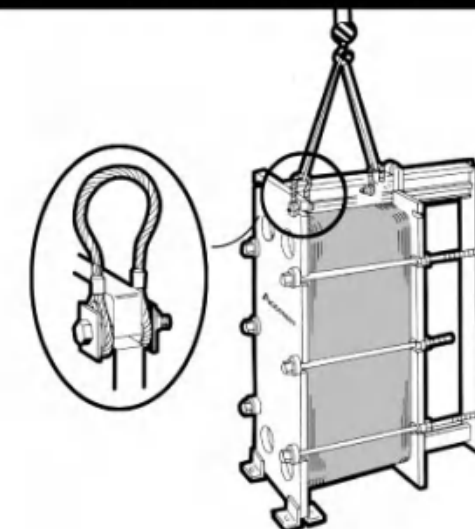
4-9

### Lifting Preparation

(Plate heat exchanger-Connection size: 200mm-500mm).  
See diagram (4-9).

Whenever the heat exchanger is lifted, a sling should be placed around tightening bolts on both sides of the unit, as shown in picture. If lifting lugs or lifting eyes are provided, the sling always is placed on the lugs or eyes.

It is dangerous if the straps was placed around the connections and other key locks

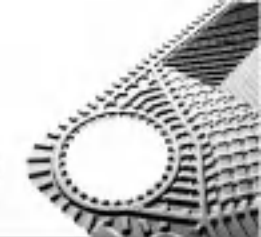


4-10

(Plate heat exchanger-Connection size: 25mm-200mm).  
See diagram (4-10).

Whenever the heat exchanger is lifted, a sling should be placed around tightening bolts on both sides of the unit, as shown in picture. If lifting lugs or lifting eyes are provided, the sling always is placed on the lugs or eyes.

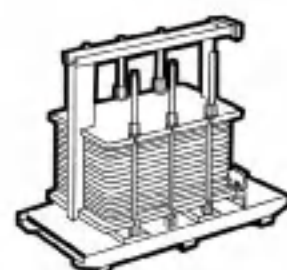




## CHAPTER 4 INSTRUCTION FOR INSTALLATION

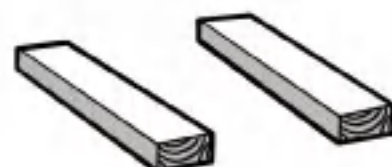
### Lifting of Plate Heat Exchanger

1. Remove the support feet.  
(See diagram 4-11).



4-11

2. Put two quadrate stick on the ground.  
(See diagram 4-12).



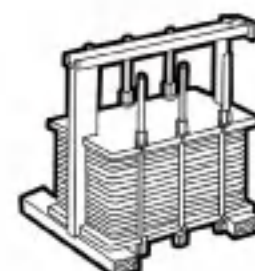
4-12

3. Use the sling to lift the plate heat exchanger from pallet.  
(See diagram 4-13).

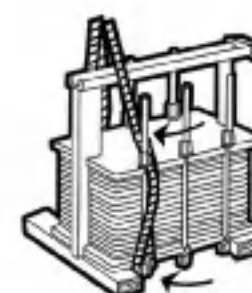


4-13

4. Put the plate heat exchanger on to the two sticks.  
(See diagram 4-14).



4-14



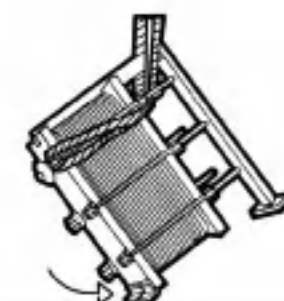
4-15

5. Place the trap around one bolt on each side.  
(See diagram 4-15).



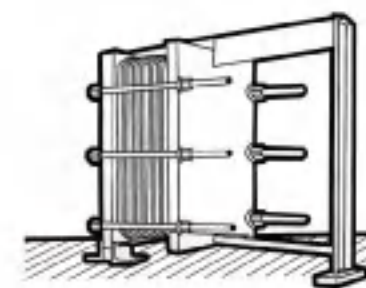
4-16

6. Lift the plate heat exchanger from the quad rate stick.  
(See diagram 4-16).



4-17

7. Screw the support feet on.  
( See diagram 4-17).



4-18

8. Put the plate heat exchanger flatly on the ground.  
(See diagram 4-18).

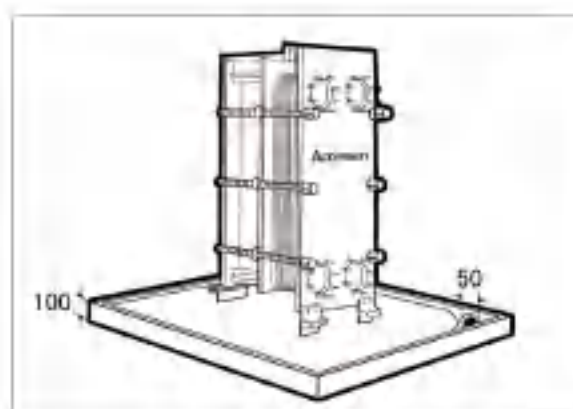


## CHAPTER 4 INSTRUCTION FOR INSTALLATION

### Ground Work

All information necessary for the preparation of the ground work appears on the data sheet provided by ACCESSEN.

In some cases (installation on a ship, processing corrosive liquids, etc.), it may be more practical to place the heat exchanger in a DRAINAGE BOX, which with the same volume as the heat exchanger. The outlet of the drainage box should be generously dimensioned with the diameter not less than 50mm (2").

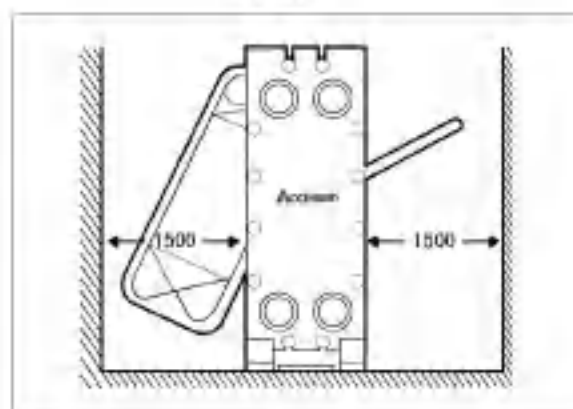


4-19

### Installation

Before connecting any piping to the heat exchanger, make sure that all foreign objects have to be flushed out of the system.

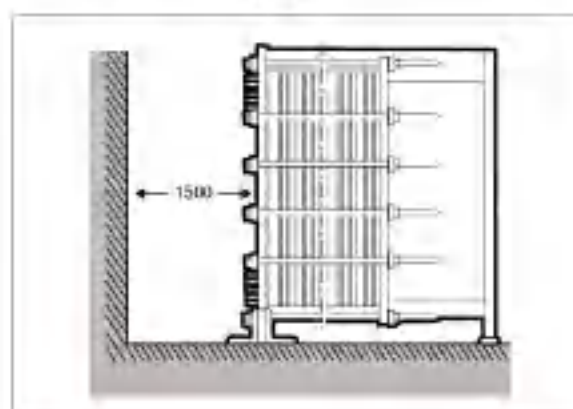
The measurements given in the picture above are recommended by ACCESSEN. It is necessary to leave free space around the equipment to be accesses and make maintenance. No further space is required for maintenance except a place where the disassembled plates placed.



4-20

### Notice

The measurements given in the picture are recommended by ACCESSEN, to provide good working conditions during installation and maintenance of PHE. The dimension suggested can be reduced depend on users if floor space is restricted.



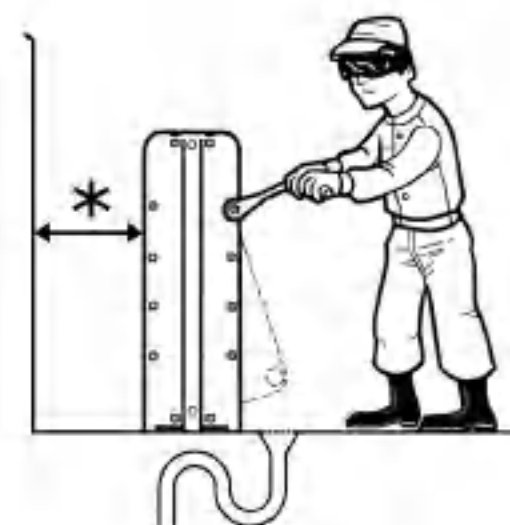
4-21

### Required Space for Installation

The installation position of the plate heat exchanger should facilitate its usage, repair and maintenance.

### Protection Board

When the protection board is designed as the splash cover or heat insulating cove, there is no need to take away the pipes (refer to page 19). For plate heat exchanger with protection board, the pipes within 100mm from the heat exchanger interface should be straight and there should not be thermometers, manometers or drain valve etc. on it (the thicker the heat insulating layer is, the longer the distance needs).



4-22

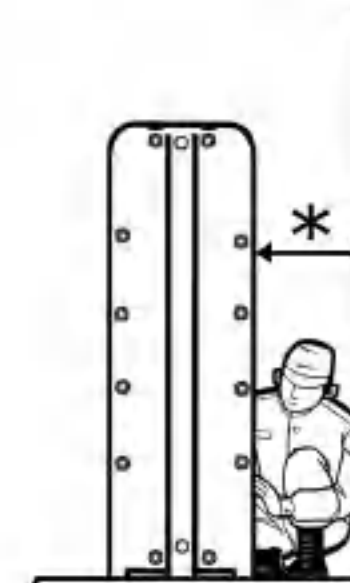
### Disassembly and Assembly

There should be sufficient space for the disassembly of the plates from the carrying bar, as well as for tightening and examining the plate cluster (Pic 4-22). The distance of pic 4-22 means the distance from the wall or similar objects should be enough for the examination and disassembly of the splash cover or heat insulating.

### Floor Drain

There should be floor drain near the plate heat exchanger.

If the floor drain is connected with the public sewage system, the pollution of the materials on the system should be considered. If the two kinds of materials can not be directly discharged into the floor drain, a drip tray should be installed under the heat exchanger. When necessary, a liquid level alarming device should be installed in the tray.





## CHAPTER 4 INSTRUCTION FOR INSTALLATION

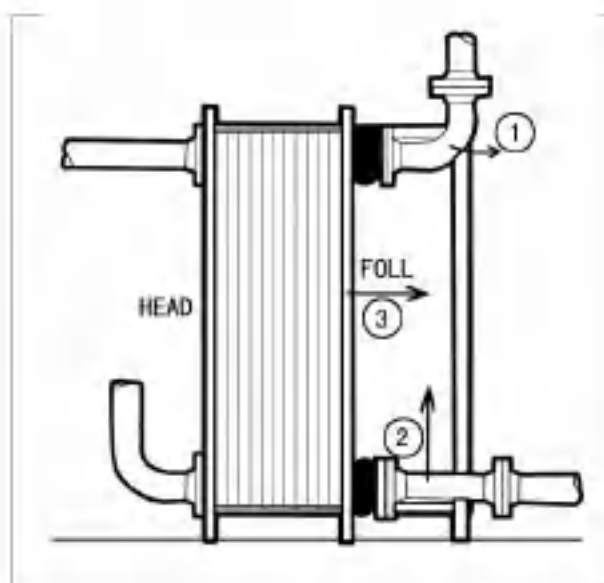
### Pipe Connecting

The pipes of the plate heat exchanger should be connected strictly according to the instruction labels on the interface.

A proper filter should be installed on the liquid inlet.

A shut-off valve should be installed on each pipe. Thermometers and manometers should also be installed according to the requirements so as to detect the functions of the plate heat exchanger.

Proper measures should be taken to protect the plates and gasket when welding the pipes near the heat exchanger.



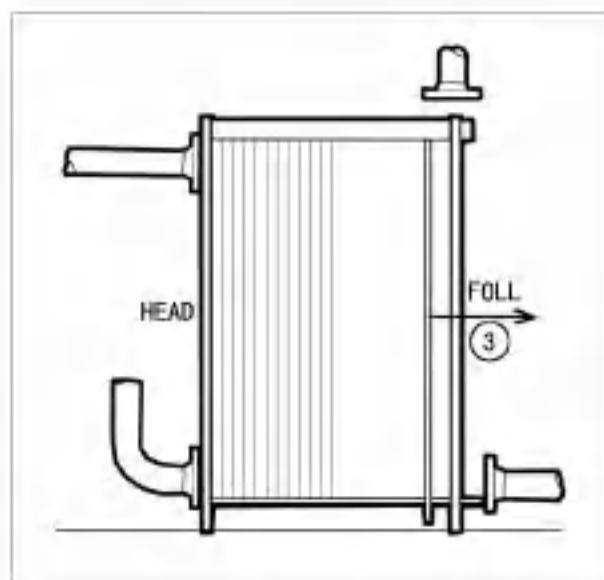
4-23

### Proper Installation of the Pipes

If pipes are connected with movable end as indicated in picture 4-23, pipe (1) and elbow (2) should be able to be disassembled from carrying bar so as to facilitate cleaning and examination, as indicated in picture 4-24.

The pipes installed on the movable end (3) should be soft so as to repress the plate cluster. Corrugated pipes can be adopted to meet the above mention requirements. All the pipes should be supported by proper supporters so as to avoid extra stress on the plate heat exchanger.

For clean-in-place (CIP) heat exchanger, that is, the heat exchanger is not opened when cleaning. In that case, pipe materials and pipe allocation should be designed according to special requirement in advance.



4-24

### Pressure Fluctuation

The pressure fluctuation/vibration of plunger pump, gear pump and metering pump should not be transmitted to the plate heat exchanger, or there will be endurance failures for the plates.

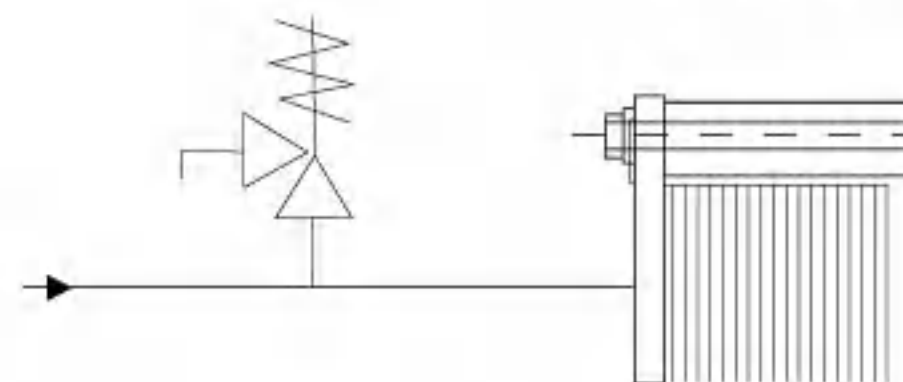
### Allowed Pressure

The working pressure and test pressure of plate heat exchanger are all labeled on the nameplate fixed on the fixed head.



### Overpressure Protection

Overpressure protection devices (picture 4-25) should be installed in case that the pressure is likely to exceed the pressure indicated on the nameplate. At the time of pump starting when fluid thermal expand or valve transferred, overpressure may be caused.



4-25



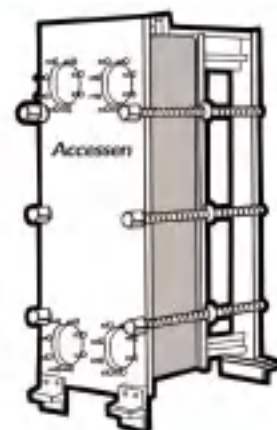


## CHAPTER 4 INSTRUCTION FOR INSTALLATION

### Pressure Impulsion

The plate heat exchanger is sensitive to pressure impulsion.

The case always happens at the time of commissioning test, switching or first start up, etc. We suggest installing a pneumatic throttle valve, adding damping relay to the circuit and installing automatic pump start-up device when the valve is closed.

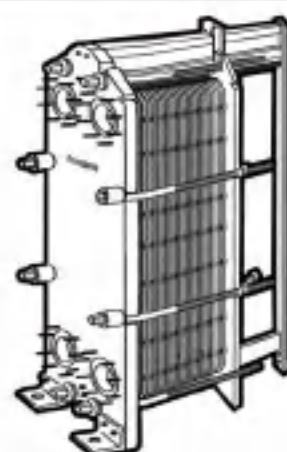


### Protection Board

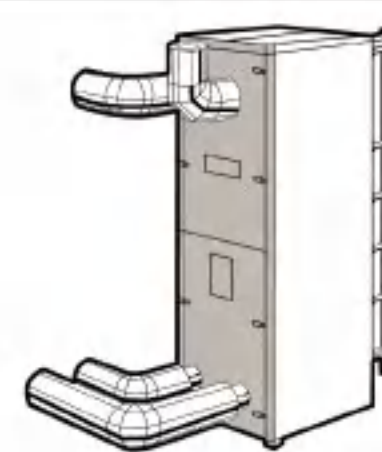
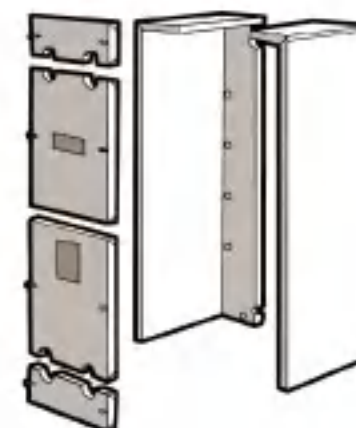
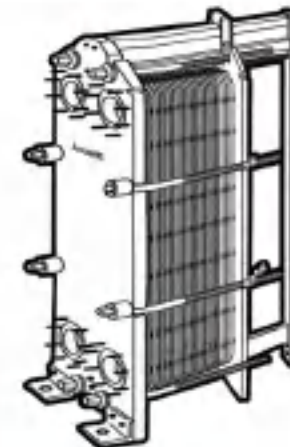
The protection board must be installed in the following cases:

- \* The liquid hammer may cause leakage of the plate cluster or the defect gasket may cause damage to the plate cluster.
- \* Fouling may be caused in case of high temperature.
- \* The local authority requires to do so.

ACCESSEN provides splash cover for various kinds of plate heat exchangers.



4-26



4-27

### Thermal Insulation

When thermal insulation is required for the protection board, ACCESSEN may provide heat insulating jacket, which can match the heat exchanger closely. It is not necessary to dismantle the connecting tubes when taking off the jacket.





## CHAPTER 4 INSTRUCTION FOR INSTALLATION

### Examination of the Pressure Degree

At the first start, the clamping dimension indicated on the nameplate should be checked against the technical requirements.

### Starting

The pressure and temperature fluctuation must be avoided, or damage will be caused to the plates and gaskets and thus result in leakage. The pump must be start when the valve is closed. The adjusting valve, diverting valve and cutoff valve should be opened and closed at a slow pace.

For plate heat exchanger with vapor as its heating medium, the vapor should be filled in at last.

Above measures apply to all types of plate heat exchanger.

The consequences above are particularly serious for the plate heat exchangers for large flow volume and long connecting tube.

### Stopping and Re-Starting

The following requirements should be met when stopping and re-starting.

The pressure rising /dropping speed should not exceed  $+10^{\circ}\text{C}$  bar per minute.

The temperature rising/lowering speed should not exceed  $+10^{\circ}\text{C}$  per minute.

### Leakage During Operation

There might be a little leakage occurs at the time of first start. But it will automatically stop when the temperature of the plate cluster and gasket reach the designed working temperature.

### Starting of the Plate Heat Exchanger with New Ethylene-Propylene Gaskets

For the plate heat exchanger with new ethylene-propylene gaskets, the temperature rise should be slow at the time of first start and shall not exceed  $25^{\circ}\text{C}$  per hour.

### Normal Operation

In case of normal operation, the temperature and pressure drop should be examined periodically. Increase of pressure drop or decrease of temperature indicates there is fouling on the plate, which means the plate heat exchanger need to be cleaned.

During the normal operation period, the case of overpressure should also be examined.

### Impurities Inside the Plate Heat Exchanger

Impurities (or dirt such as lime) which may cause fouling will worsen the heat transmission and increase pressure drop.

The temperature lowering under pressure will cause liquid hammer or other similar consequences and thus lead to leakage of the heat exchanger. The loose impurities such as sands, welding slag, will accumulate on the gasket and damage it.

### Cooling

Abrupt cooling should be avoided. The pressure also be dropped when cooling.

### Long-Term Non-Operation

If the plate heat exchange is not going to be used for a long time, we suggest discharging the liquid inside and assembling the plates as to clean the heat exchange.

Press the plate heat exchanger together and cover it so as to avoid dust deposit on the gasket and lighting.





## CHAPTER 4 INSTRUCTION FOR INSTALLATION

### The Risks of Not Complying with Start-up and Shut-down Procedures

Great energy caused by running liquid in a pipe system must be dealt carefully. Particularly when the fluid is stopped, it is imperative that it should be done smoothly.

#### Notice

For this reason fast-closing valves should not be used unless the pipes of the system are very short. Valves must be operated gradually. The longer the pipes are, the higher the flow rate is, the more important this becomes.



### The Running Liquid in Closed System

Water hammer means a short duration pressure peak, traveling along the pipe as a wave at the speed of sound, and resulting from a sudden deceleration of the motion of the fluid in a closed system. Thus, it is usually related to the shutting down of a system. However, when starting up a system with open valves and empty pipes, the fluid may burst into some current limiting facilities, such as fine mesh strainer, flow meter or heat exchanger, and cause sudden reduction of flow rate. Water hammer also could be caused when the system has not come to full stop. The worst case is pressure impulsion caused by sudden stop, which has the pressure many times higher than normal one. Therefore, it is very important for the protection of the whole installation with starting and stopping carefully.

## CHAPTER 5 TROUBLE CLEARING

### Performance Degrading

If performance of the plate heat exchanger is lowered or the pressure drop is increased, the plates should be dismantled and cleaned and then the plate cluster should be pressed to the specified dimension according to the instructions on the nameplate.

### Visible Leakage

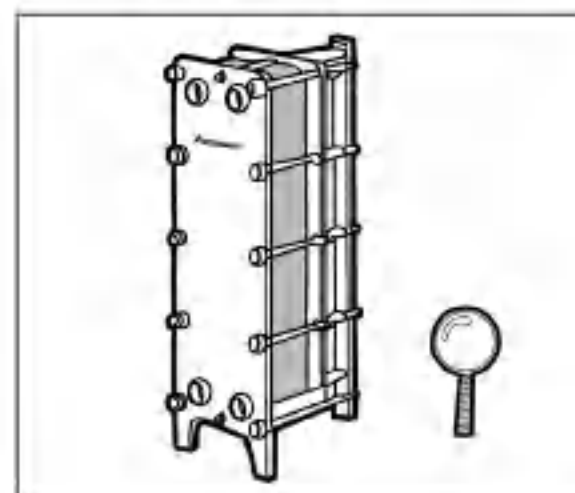
- \* Check the working pressure of the plate heat exchanger. If overpressure is found, it should be reduced to the specified working pressure.
- \* Tighten the plate heat exchanger but the dimension should not be smaller than the specified one. (According to diagram 4-1)
- The plates should not be tightened under pressure.
- Examine the fixed head and movable end to make them parallel.
- \* Disassemble the plate heat exchanger to check whether the plate is deformed or fouling is formed, whether the gaskets is elastic, deformed or clean.
- Clean all the plates and gaskets before installation. Even foreign matters such as sand may cause leakage.
- \* We suggest changing gasket if the plate cluster still leaks when it is cleaned and pressure to the minimum dimension.
- \* The liquid draining hole of gaskets may leak (picture 3-6, page 5). It is because there is defect on gasket or there is corrosion on plate in the liquid draining area.

### Invisible Leakage

This kind of leakage is detected when mixing two kinds of liquids. It is because there are holes on a certain plate or some of the plates. Only by changing the plate can stop the leakage.

The following measures can be adopted to find the plate with leakage:

- \* Dismantle a lower pipe and pressurize the pipes on the opposite side. If the liquid still flows from the lower interface (when the pressure is stable), it indicates that a plate or many plates are leaking.)
- \* Dismantle the plate cluster and examine each of the plates carefully.
- \* Dye penetrant should be used for the examination of the plates with problems.
- \* The holes on the plates are generally caused by corrosion or endurance crack. In both cases, we should change the plate, find out the cause of damage and take preventive measures.

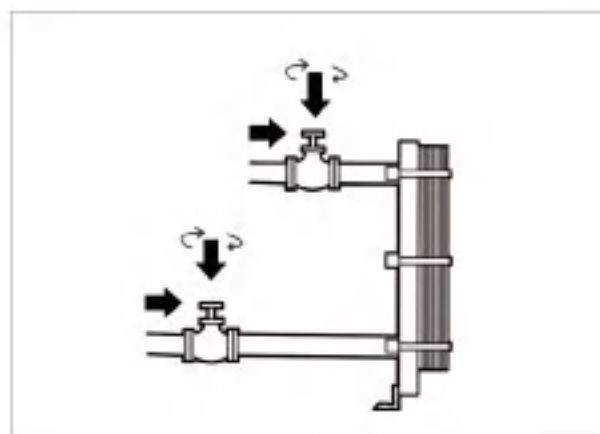




## CHAPTER 6 DISASSEMBLY AND ASSEMBLY

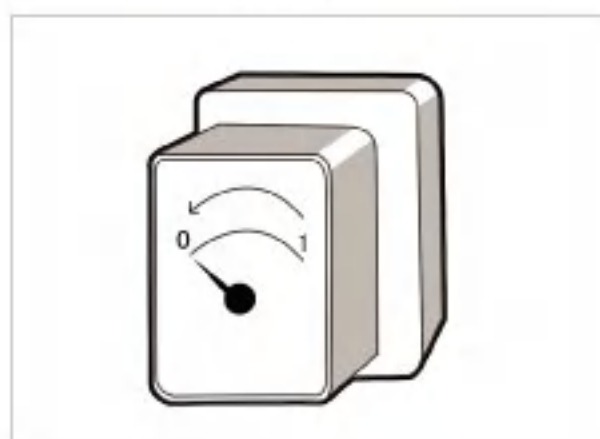
### Disassembly

1. Slowly shut down the valves on the inlets. First to shut down the valves on the inlet to reduce the pressure..



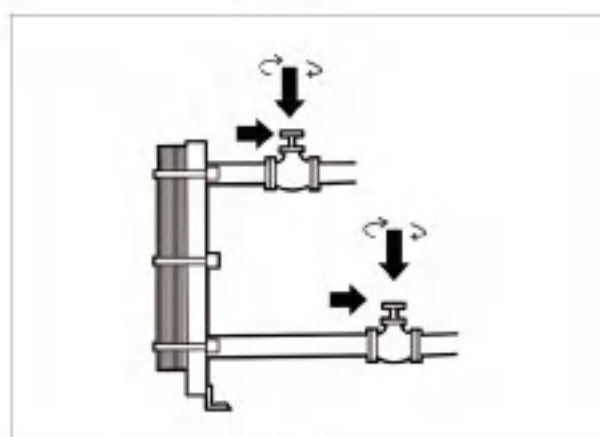
( 6-1 )

2. Switch off pumps.

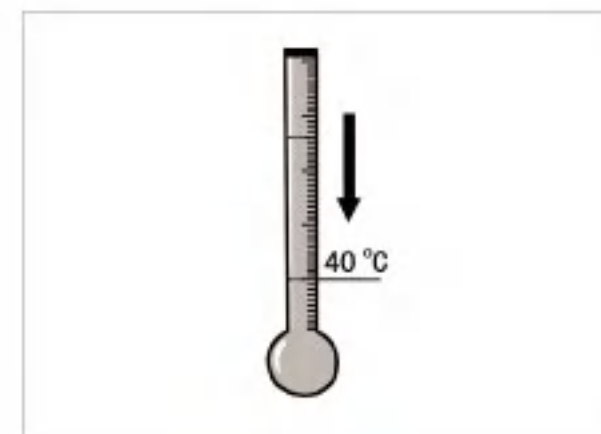


( 6-2 )

3. Close the valves on both outlets.

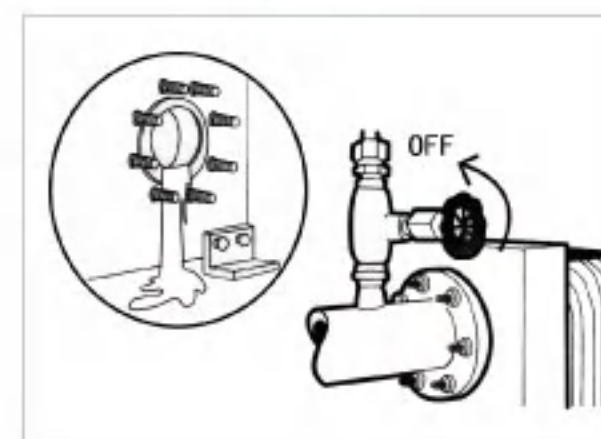


( 6-3 )



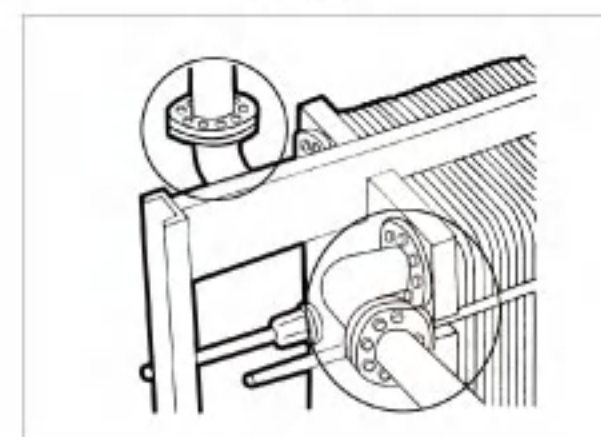
( 6-4 )

4. If the heat exchanger is too hot, wait until it has cooled down to about 40°C (100° F)



( 6-5 )

5. Drain



( 6-6 )

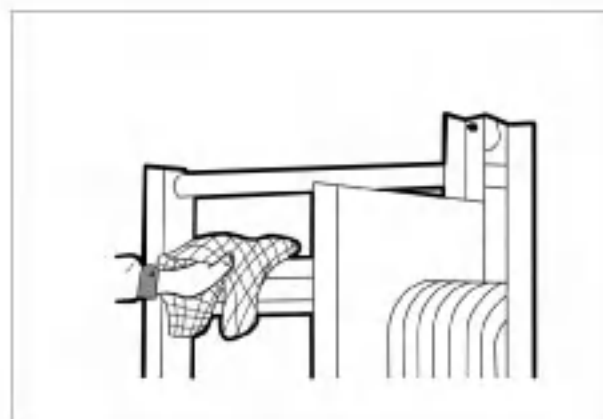
6. Dismantle all bends connected to the movable end so that it can be moved freely along the carrying bar.



## CHAPTER 6 DISASSEMBLY AND ASSEMBLY

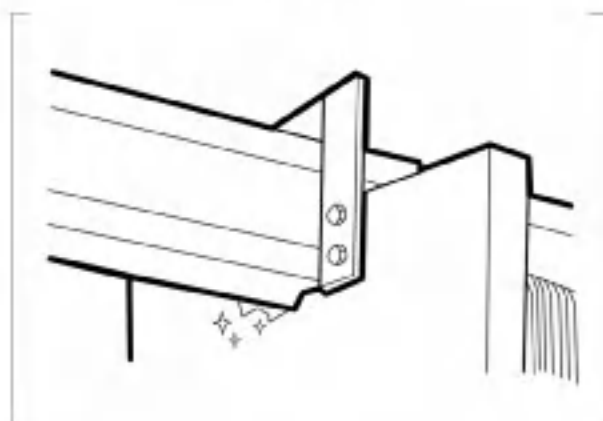
### Disassembly

7. Inspect the sliding surfaces of carrying bar and wipe it.



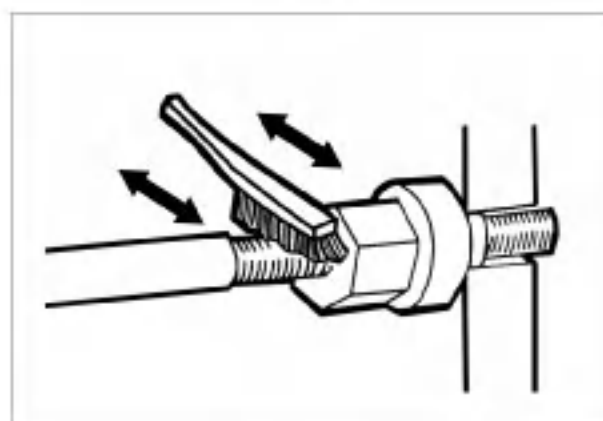
( 6-7 )

8. Inspect roller of movable end.

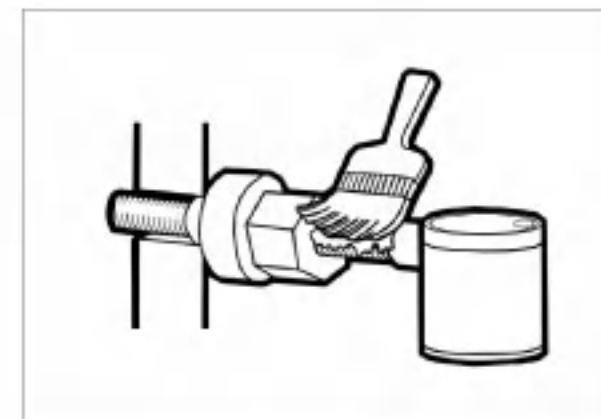


( 6-8 )

9. Pull back the plastic covers on the tightening bolts; Brush the threads clean with iron brush..

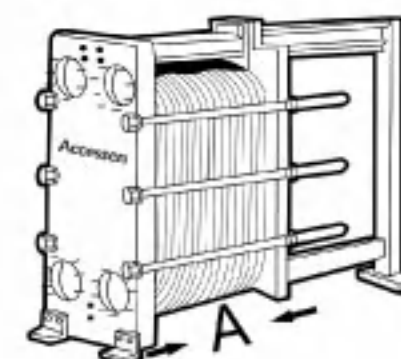


( 6-9 )



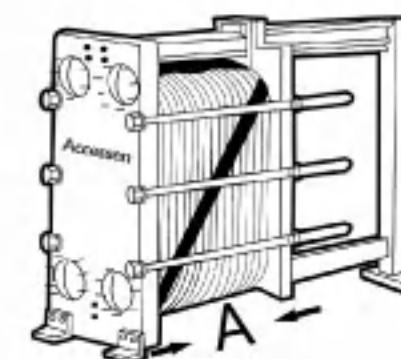
( 6-10 )

10. Lubricate the threads with a thin layer of grease, eg. Gleitmo800 or equivalent.



( 6-11 )

11. Mark the plate assembly on the outside by a diagonal line, or number the plates in sequence.



( 6-12 )

12. Measure and record the dimension A.



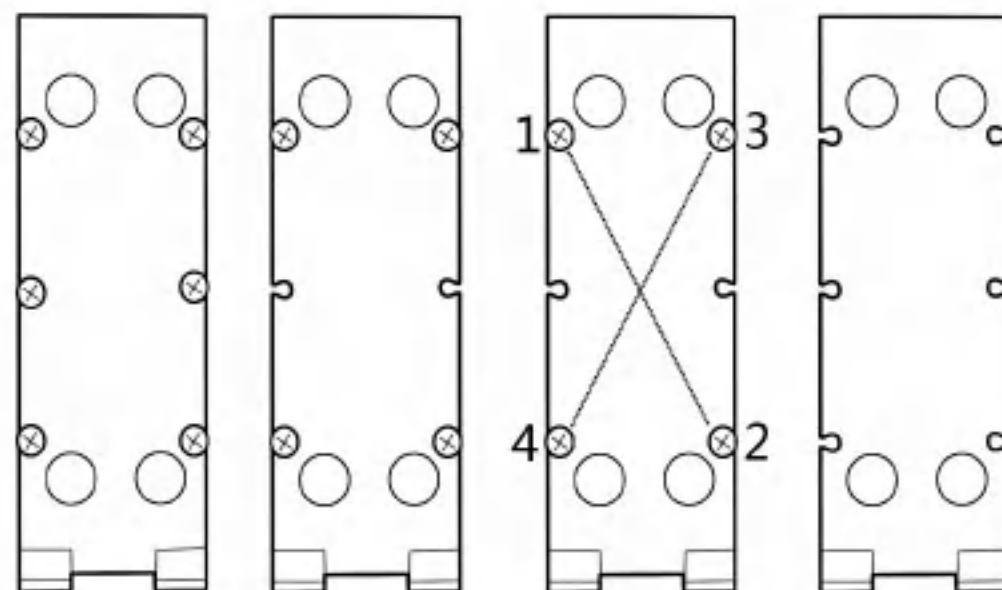


## CHAPTER 6 DISASSEMBLY AND ASSEMBLY

### Disassembly

13. Remove the bolts without bearing boxes.

14. If the bolts are fitted with bearing boxes, open them alternately and diagonally as following diagram. Skewing of movable end not exceed 10mm (2 turns per bolts) in width and 25mm in length (5 turns per bolts vertically.) when disassemble the movable end.

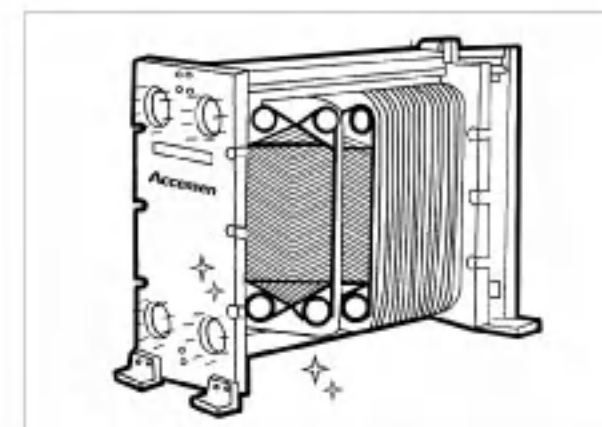


No.	Bolt No.	Dimension
1	1-2-3-4	1.05A
2	1-2 or 3-4	Disassembly

( 6-13 )

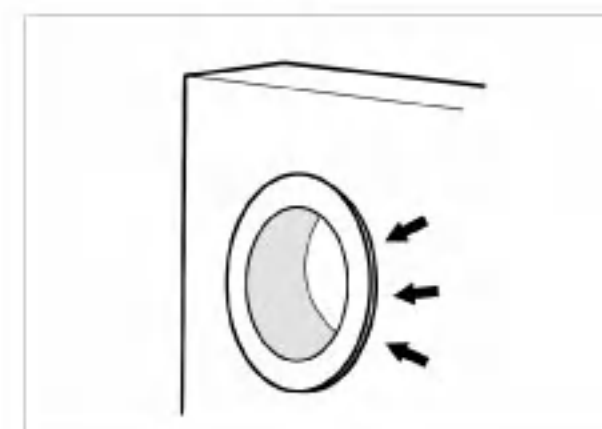
### Assembly

1. Check all the sealing surfaces, which contact with the heat transfer medium, are clean.



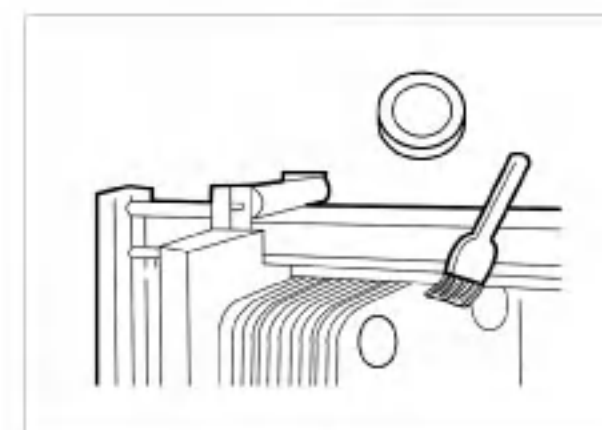
( 6-14 )

2. Check ring washers are in position and in good condition when fitted in connection.



( 6-15 )

3. Clean and lubricate the sliding surfaces of the carrying bar.



( 6-16 )

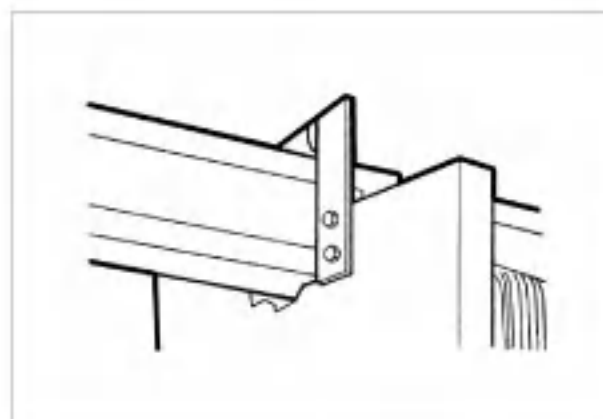


## CHAPTER 6 DISASSEMBLY AND ASSEMBLY

### Assembly

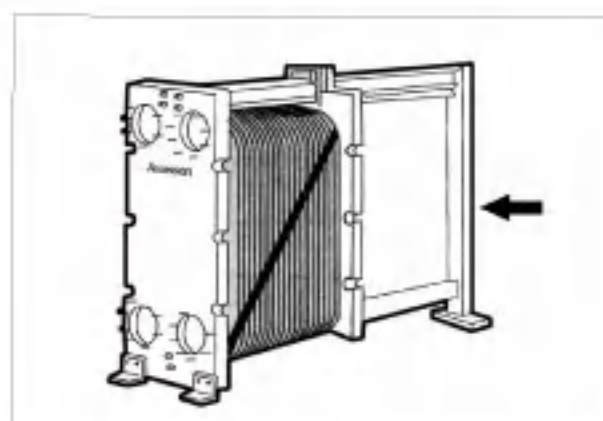
4. Inspect the pressure plate roller.

5. Check against the drawing or flow sheet (provided with each heat exchanger) to make sure the plates are hanging in correct order.



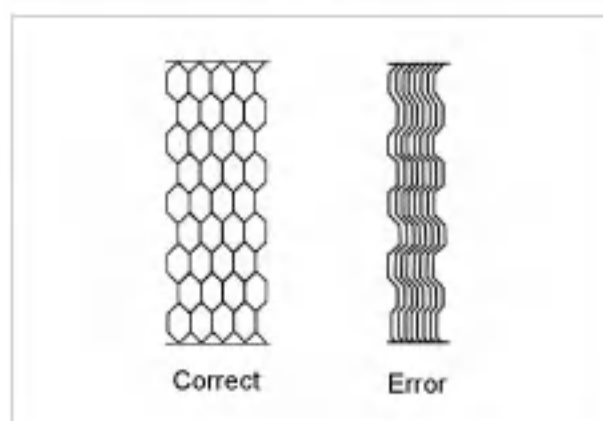
(6-17)

6. Compress the plate cluster.

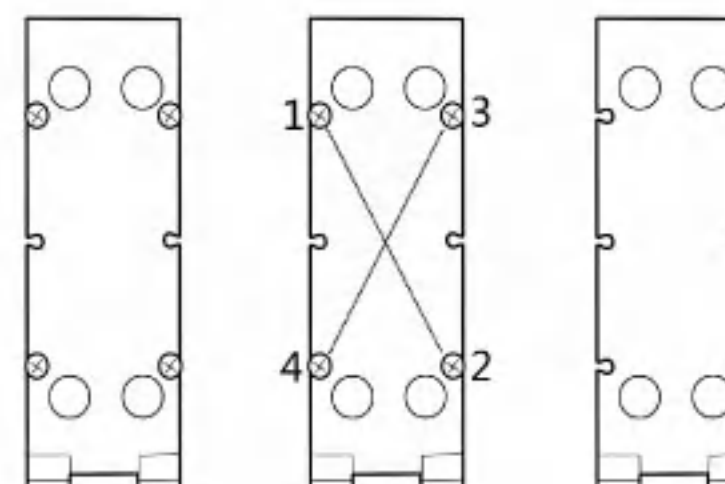


(6-18)

7. If plates are assembled correctly, the edges will form a 'honeycomb' pattern. If the plate pack has been marked on the outside, check the number and ensure they are assembled in sequence.

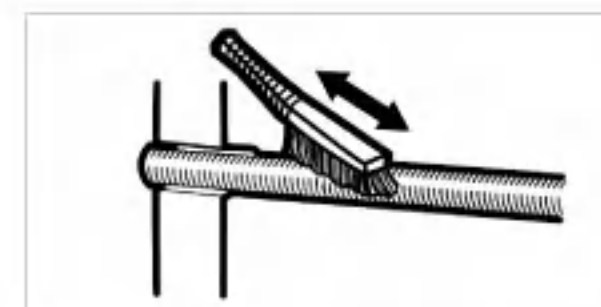


(6-19)

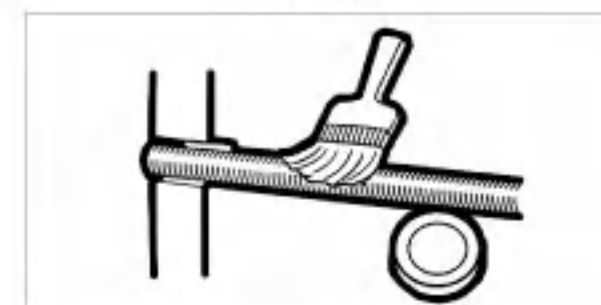


No.	Bolt No.	Dimension
1	1-2-3-4	1.05A
2	1-2 or 3-4	A

(6-20)



(6-21)



(6-22)

8. Place all the bolts fitted with bearing boxed in position.

9. Brush the threads of bolts clean with an iron brush.

10. Lubricate the threads with a thin layer of grease, eg. Gletmo800 or equivalent.

11. Tightening is carried out alternately and diagonally, as shown in the figure above.



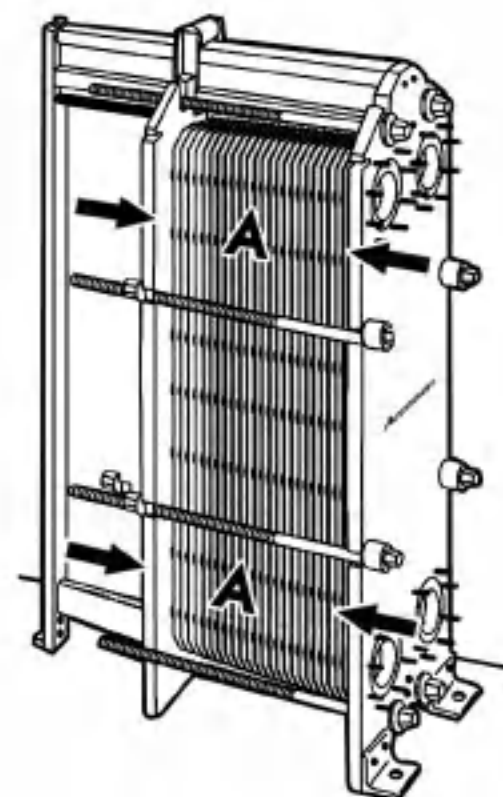
## CHAPTER 6 DISASSEMBLY AND ASSEMBLY

### Assembly

12. Check the dimension A before tightening the bolts.

Skewing of the pressure plate during tightening must not exceed 10mm (2 turns per bolt) in width and 25mm. (5 turns per bolt) Normal length A of plate pack can be exceeded in exceptional cases, the tightening dimensions can be designed as follow.

Plate pack length/plate	Plate pack length
> 4mm	A+1%
> 3mm, < 4mm	A+1.5%
> 3mm	A+2%



( 6-23 )

### Notice

When pneumatic clamp device was used, maximal torque should be designed according following sheet, and dimension A should be measured.

Placed the other bolts in position

-Inspect the washers

-When fully tightened, the bolts should all be stressed equally.

-The dimension difference between the plate pack measured by adjacent bolts should not exceed:

2mm when dimension A<1000mm

4mm when dimension A>1000mm

-The dimension difference between the plate pack measured by adjacent bolts should not exceed more than 1%.

-If the heat exchanger is not sealed completely, the bolts can be tightened to the dimension A-1%, but should not exceed the maximal torque.

If the bolt was screw down by spanner, the torque could be estimated.

If the dimension can not reach A with the maximal torque,

-Check the quantity of plates and dimension A

-Make sure all the nuts and bearing boxes move vivid

If not, please clean, lubricate and change them.

-Install all of the bolts and tighten them alternately.

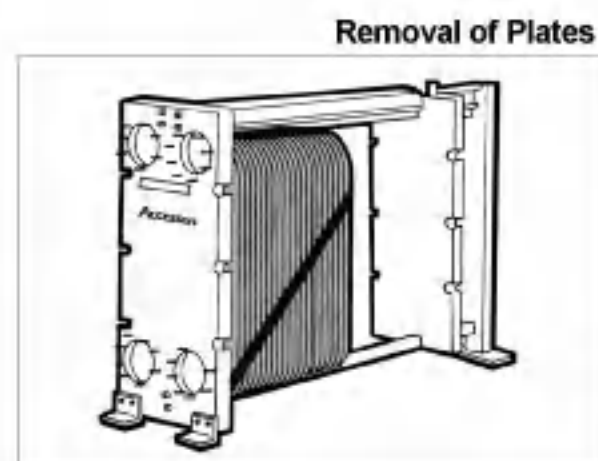
Type of Bolt	Bolt with Bearing Box		Bolt with Gasket	
	N n	K p m	N n	K p m
M24			450	45
M30			900	90
M39	1300	130	2000	200
M48	2100	210	3300	330



## CHAPTER 6 DISASSEMBLY AND ASSEMBLY

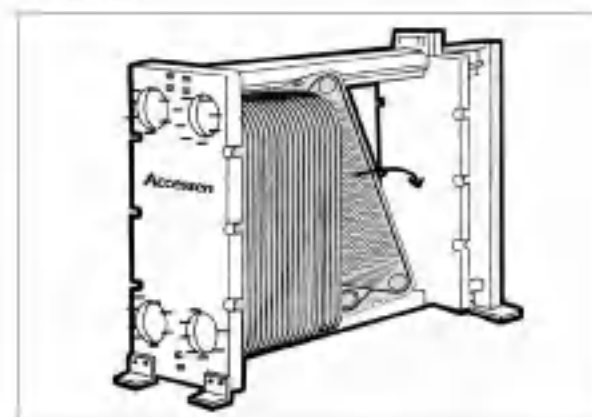
### Removal and Insertion of Plates

1. Push movable end against support column.



( 6-24 )

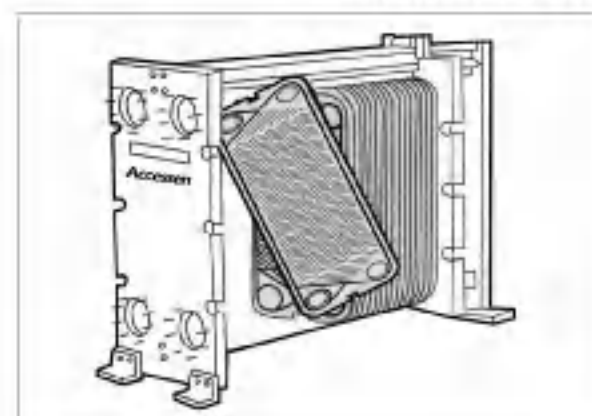
2. Disassemble the plates.



( 6-25 )

### Insertion of Plates

3. Hang the plates with their backs (the side without gasket) towards the movable end.



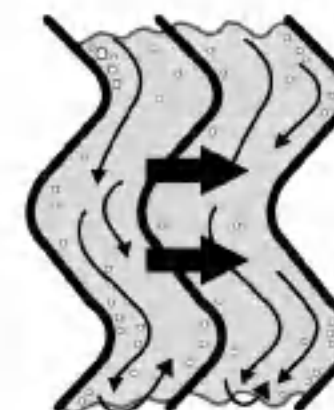
( 6-26 )

## CHAPTER 7 CLEANING

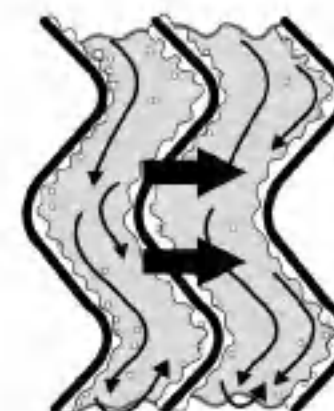
### Plate Fouling

The performance and corrosion preventive capability of plate heat exchanger depends on how long the plate cluster keeps cleaning.

The fouling of plates (picture 7-2) could be removed by proper detergent circulating inside the heat exchanger without disassembling, or disassembling and then cleaning manually.



( 7-1 )



( 7-2 )

### Detergent

With proper detergent, the fouling can be removed without damaging plates and gaskets. It must be noted that the passivation (protective) membrane on the stainless steel should not be removed, which is the main shield to resist corrosion.

### Application Example of Cleaning:

Grease can be removed by oil solution which can emulsify water such as Mobilol 77B or Castrol Solvex Ice 1130.

Organic matter of lipid fouling can be removed by Sodium hydroxide (NaOH). The maximum concentration should be 1.5% and the maximum temperature should be 85°C. Concentration of 1.5% means 3.75L 30% NaOH into 100L water.

The fouling can be removed by Nitric Acid (HNO<sub>3</sub>). The maximum concentration and temperature should be 15% and 65°C (140°F) respectively. Concentration of 1.5% means adding 1.75L 30% HNO<sub>3</sub> into 100L water.

HNO<sub>3</sub> is also favorable for forming passivation membrane on the surface stainless steel.



( 7-3 )





## CHAPTER 7 CLEANING

### Clean-In-Place (CIP)

#### Clean-in-place (CIP)

If fouling on the plates is soluble in detergent and the materials of the cleaning system are corrosion resisting to the detergent, CIP method can be adopted.

A detergent recycling system is required for CIP with detergent (Picture 7-4).

The amount of circulation detergent should at least equal to that of fluid when the heat exchanger works normally. If the fluid has high viscosity, the amount of detergent should be increased by 20% to 30%.

#### Steps for CIP:

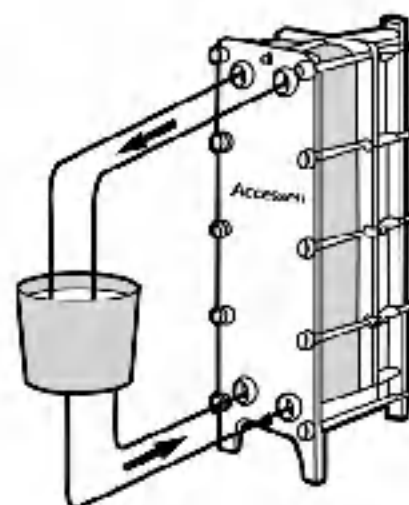
- \* Discharging cooling/heating medium and residual liquid
- \* Flushing with cool water or warm water
- \* Flushing the system circularly with warm clean solution
- \* Flushing with hot water
- \* Flushing with hot water containing softener
- \* Flushing with cool or warm water

Circulating liquid also may not be used but proper detergent is permitted. Refer to section 7.2 of page 35.

Add detergent repeatedly until the fouling is removed.

The detergent can be changed at any time.

Plate heat exchanger should be flushed with clean water after cleaning thoroughly.



(7-4)



- Seaweeds
- Mussels
- Barnacles
- Wood Chips/Fibres

### Gross Fouling

1. Brush softly by running water.

#### Notice

Prevent the Gasket from Damage.

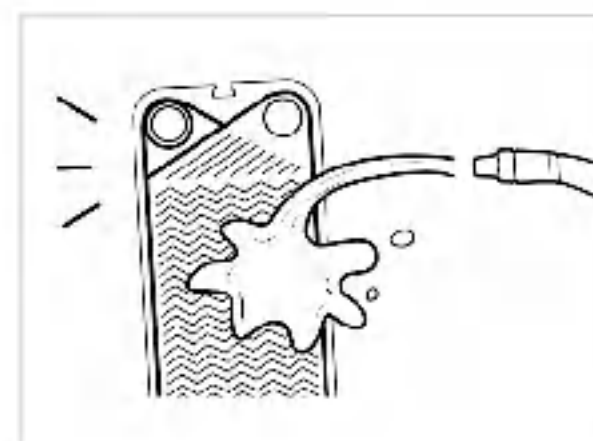
2. High pressure hose

3. Back flushing of the unopened heat exchanger can sometimes be sufficient more effective

#### Notice

In any case, Muriatic acid **can not** be used to clean stainless steel plate. In addition, water with more than 300ppm Chlorine may not be used for preparation of cleaning solution.

It is very important that carrying bars and support columns made of aluminum are protected against chemicals.



(7-5)



## CHAPTER 7 CLEANING

### Microbe-Mucilage

- Bacteria
- Nematodes
- Protozoa

#### Mechanical Cleaning After Opening

1. Brush softly by running water.

##### Notice

Prevent the gasket from damage.

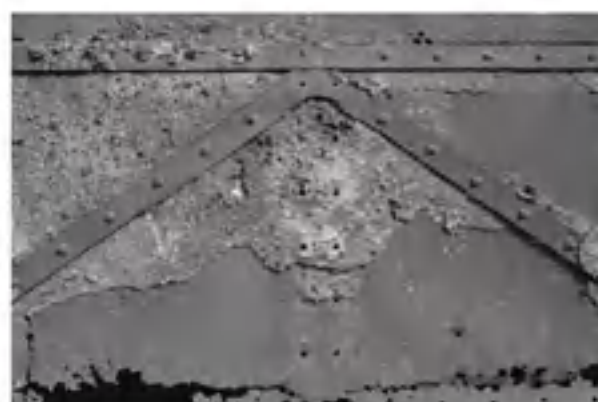
2. High pressure hose
3. Cleaning by alkaline detergent

- NaOH
- $\text{Na}_2\text{CO}_3$
- If a little hypochlorite which can create combo and surfactant could be better.
- Maximum concentration: 4%, Maximum temperature: 80°C.

##### Notice

In any case, Muriatic acid **can not** be used to clean stainless steel plate. In addition, water with more than 300ppm Chlorine may not be used for preparation of cleaning solution.

It is very important that carrying bars and support columns made of aluminum are protected against chemicals.



( 7-6 )

### Incrustation-Water

- $\text{CaCO}_3$
- $\text{CaSO}_4$
- Silicates

#### Mechanical Cleaning after Opening

1. Brush softly by running water.

##### Notice

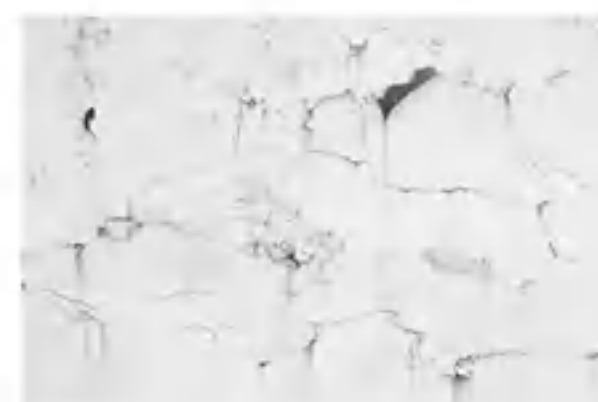
Prevent the gasket from damage.

2. High pressure hose
  3. Chemical cleaning
- Nitric Acid
  - Sulfamic Acid
  - Citric Acid
  - Phosphoric Acid
  - Compound Agent
  - Sodium polyphosphates
  - Maximum concentration: 4%, Maximum temperature: 60°C.

##### Notice

In any case, Muriatic acid **can not** be used to clean stainless steel plate. In addition, water with more than 300ppm Chlorine may not be used for preparation of cleaning solution.

It is very important that carrying bars and support columns made of aluminum are protected against chemicals.



( 7-7 )



## CHAPTER 7 CLEANING

### Sediment

- Corrosion Products
- Sinter
- Silt
- Alumina
- Diatomic Organisms

#### Mechanical Cleaning after Opening

1. Brush softly by running water.

##### Notice

Prevent the gasket from damage.

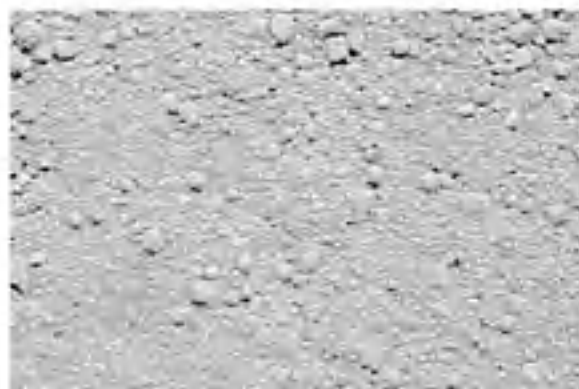
2. High pressure hose.
3. Chemical cleaning of opened unit by using:

- Nitric Acid
- Sulfamic Acid
- Citric Acid
- Phosphoric Acid
- Compound Agents (EDTA, NTA)
- Sodium Polyphosphates
- Maximum concentration: 4%,
- Maximum temperature: 60°C .

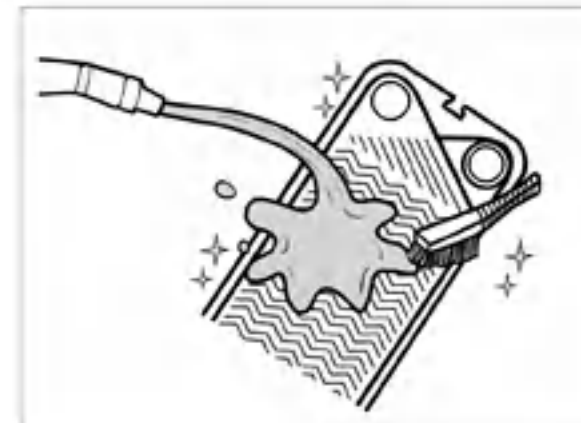
##### Notice

In any case, Muriatic acid **can not** be used to clean stainless steel plate. In addition, water with more than 300ppm Chlorine may not be used for preparation of cleaning solution.

It is very important that carrying bars and support columns made of aluminum are protected against chemicals.



( 7-8 )



( 7-9 )

### Oil Residues/Asphaltum and Adipose

- Oil Residues
- Asphaltum
- Adipose

#### Mechanical Cleaning after Opening

1. Hydrocarbon-based deposits may be removed by PARAFFINIC or NAPHTHA-BASED solvent (e.g. KEROSENE) with a soft brush.

##### Notice

Gaskets in natural, butyl and EPDM rubber expand in these media. Contact time should be limited within 0.5 hour.

#### The Following Solvents SHOULD NOT be Used:

- Ketones (e.g. Acetone, Methyl ethyl ketone, Methyl isobutyl ketone)
- Esters (e.g. Ethylacetate, Butylacetate)
- Halogenated hydrocarbons (e.g. Chloroethene, Carbon tetrachloride, Freons)
- Aromatics (e.g. Benzene, Toluene)

2. Dry with a cloth or rinse with water.

##### Notice

In any case, Muriatic acid **can not** be used to clean stainless steel plate. In addition, water with more than 300ppm Chlorine may not be used for preparation of cleaning solution.

It is very important that carrying bars and support columns made of aluminum are protected against chemicals.





## CHAPTER 7 CLEANING

### Manual Cleaning

After disassembling, the plates can be cleaned by high pressure cleaner with brush (possibly cleaner with rotating brush) (Picture 7-10) or soft brush and detergent or water. Sands or other friction producing substance should not be used when using high pressure cleaner.

Flush with clean water after cleaning, especially for lower part of the plate and gasket, which likely to accumulate dust and therefore needs carefully cleaning.

If there is fouling or thick organic matter on plate, remove the plate from frame, take off the gasket and put the plate in detergent. (Page 35)

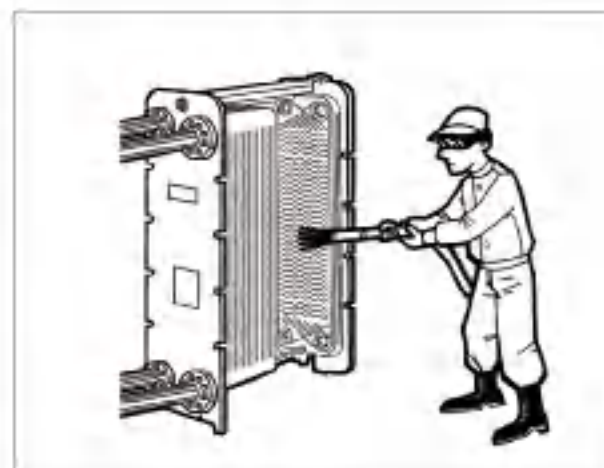
After fouling is dissolved, the plate should be flushed and dried and then put new gasket on.

Should you have any question, please contact Accessen.

### Notice

As a kind of growth simulator, chorine is usually used in cooling system, which would reduce the ability of stainless steel (include nickel-based alloy, nickel chrome, inconel and SMD) to resist corruption.

Chorine would reduce protective layer function of these steels and make the plate easy



( 7-10 )



( 7-11 )

corrupted, which is just the matter of time and concentration.

You must discuss with Accessen if you must use chorine in equipment made of non-Titanium materials.

### Notice

Titanium can not be corrupted by chorine!

## CHAPTER 8 CHANGING PLATE AND GASKET

### Imprinting

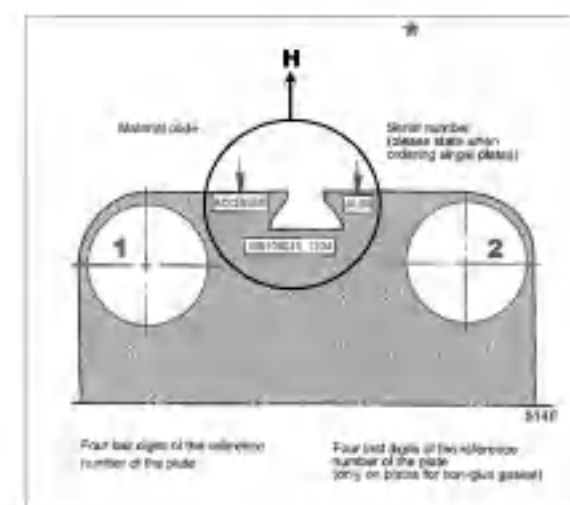
There are material code, part code and in-adhesive gasket code on the plate, which marks as 'H' in the picture. (Refer to picture 8-1). Looking from one side of gasket, if H is on upper part, it is 'right side plate'. If H is on lower part, it is 'left side plate'.

The inlet and outlet of 'left side plate' is Hole 1 and Hole 4.

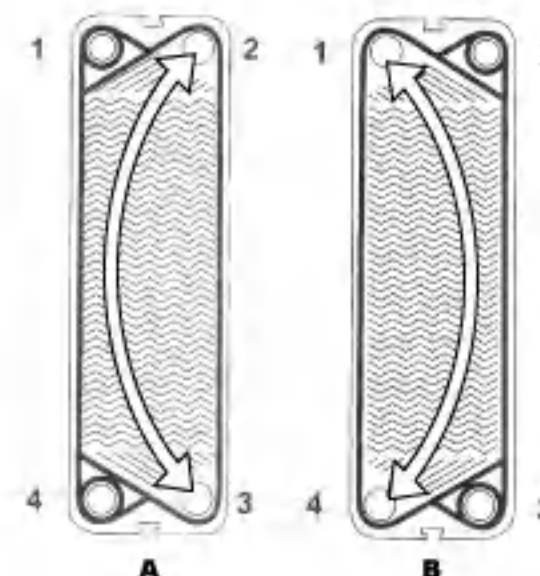
The inlet and outlet of 'right side plate' is Hole 2 and Hole 3 (picture 8-2).

H= right plate

Only multiple pass heat exchangers have numbers.



( 8-1 )



( 8-2 )

### Changing Plate

When substituting the defected plate with the spare plate, check whether the hold and letter H is the same as the original plate.

Take the defected 4-hole plate out from the plate cluster, if the adjacent 4-hole plate is also taken out, there is no need to insert the spare plate. Then the plate quantity is s-2.





## CHAPTER 8 CHANGING PLATE AND GASKET

### Changing Gasket

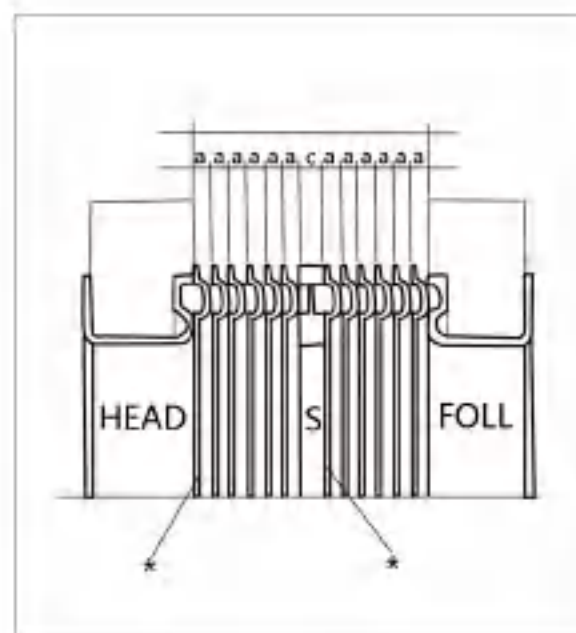
Before removing the old gasket, record the flow pattern formed by the gasket on the plate (picture 8-4).

Gasket should be installed on No.1 plate (picture 8-3) contacting the fixed head or the partition plate(s). Thus after the plates are installed on the frame, there will be gaskets in every gasket groove.

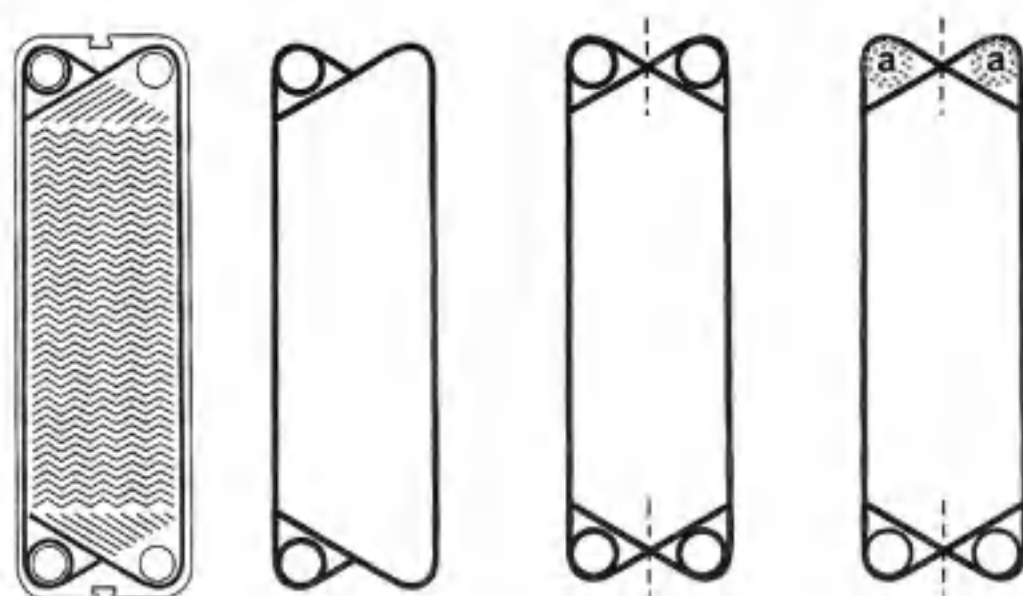
The two gaskets must be divided according to picture 8-5. The ring-shape part on 'a' corner of the gasket on the fixed head or partition plate should be cutoff.

#### Attention:

If the four connection pipes are all installed on the fixed head, there is no need to change the gasket (position of picture 8-3). The function is only to fill the gasket groove so as to press other plates of the cluster.



( 8-3 )



( 8-4 )

( 8-5 )

#### Take off the Old Gasket:

Detach the buckle according to the requirement and take off the gasket, you must prevent the buckle from rupture.

#### Cleaning:

You can use some solvent such as degreaser, which can effectively get rid of grease, to move gasket hardly stuck to the plate. For example,  $C_2H_4Cl_2$ , CHLOROTHENE V6, acetone, butanone or acetate can be used.

The solvent must completely finish its complete volatilization before the glue was laid on the plate, which is a very important thing. Usually use sand paper but not degreaser to clear the surface of gasket when the temperature is 20°C.

#### Notice:

Please abide the local rules about glue and detergent.

**Cementing:** Pliobond 25, a kind of glue, which is a kind of 25% solid Chroma solvent, could be laid on the back of the gasket, then dried in the place where is not too much dust

exist. Then lay on layer of glue in the groove of the plate, stick the gasket in the groove. Gasket should be put into the groove beginning from the two ends of the gasket, and following is the straight part.

#### Changing Bonding Gasket

It is most to put the plate and gasket on the table for bonding. Once the gasket is bonded to the plate, superpose the plates.

Hang the plates with gaskets to the frame and slightly press it. For rubber gasket, compress it to the minimum dimension plus 0.2mm compression for each piece.



## CHAPTER 8 CHANGING PLATE AND GASKET

### Changing Glue-Free Gasket (Clip-On Gasket)



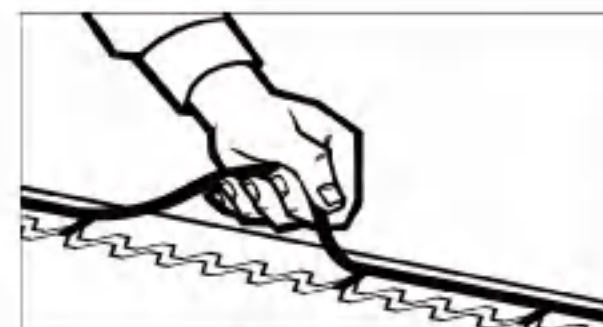
( 8-6 )

Clip-on gasket is a kind of glue-free gasket. It has special elasticity and clamping function, which makes it firmly bonded in groove of the plate.

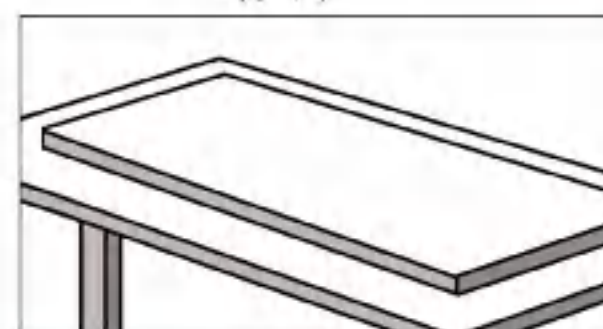
When changing clip-on gasket, the old one should be taken off totally. Before installing new gasket, examine whether the gasket is clean and whether there is any residual rubber, especially at the position of tightening cavity.

Then carefully clean the plate and groove and put on new gasket. (The new gasket can be put on without tools.)

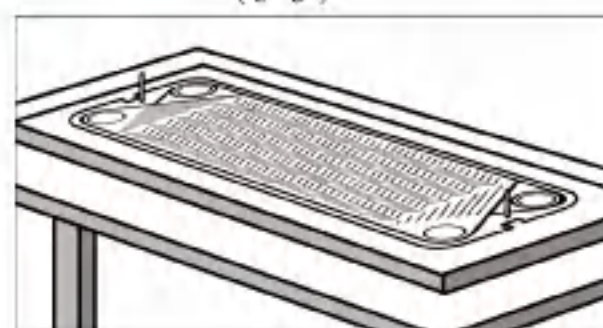
Silicone oil should be painted on the ethylene-propylene rubber with cloth so as to prevent the separation of the gasket and plate when disassembling.



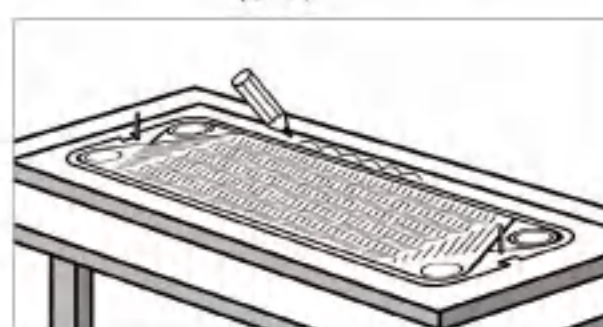
( 8-7 )



( 8-8 )



( 8-9 )



( 8-10 )

Procedures 2-7 are not necessary when the quantity of plates is small. These procedures will be speed when the quantity is large.

1. Take the old gasket off and clean the groove, if necessary.

2. Place a flat wooden board (somewhat larger than PHE plate) on table.

3. Place the PHE plate on the board firmly with gasket groove upwards and place cylindrical pins in the board at two hanging grooves.

4. Marks in the board at all locations for gasket 'Clip-on'.

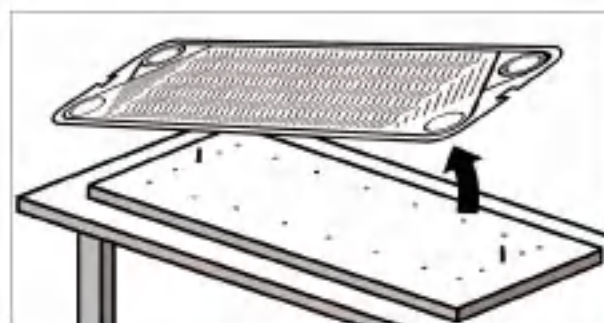




## CHAPTER 8 CHANGING PLATE AND GASKET

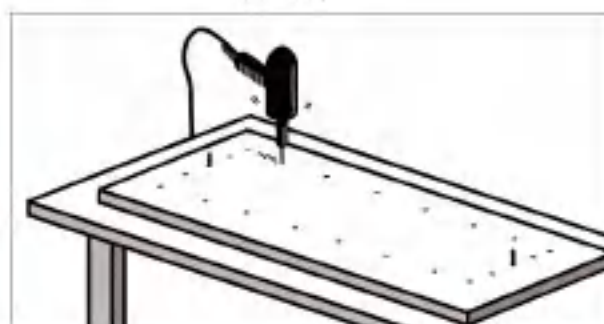
### Changing Glue-Free Gasket (Clip-on Gasket)

5. Remove the plates.



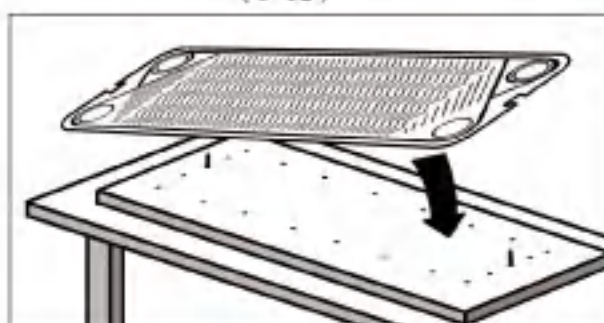
(8-11)

6. Drill holes of approx. 7mm dia., 10mm deep in the board at the marked spots. The board now becomes a practical tool for changing gaskets of larger numbers of plates.



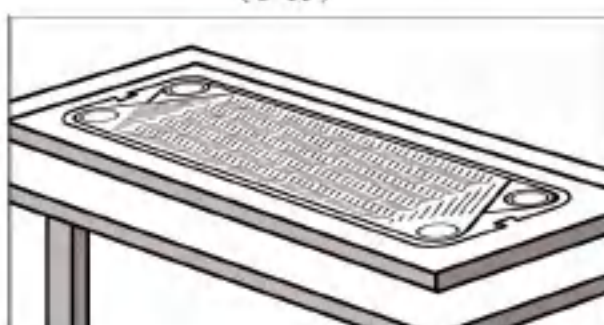
(8-12)

7. Replace PHE plate on the board exactly the same location as 3 above.

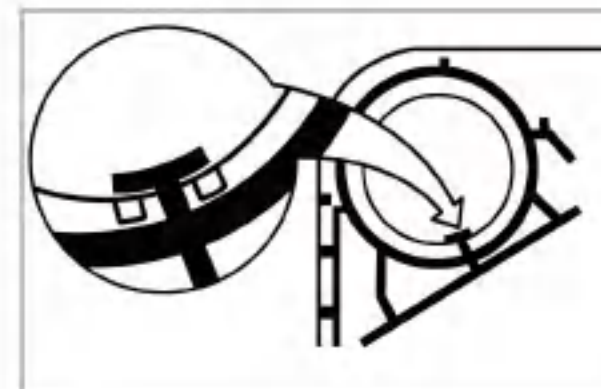


(8-13)

8. Place the gasket, with convex side down in the gasket groove.

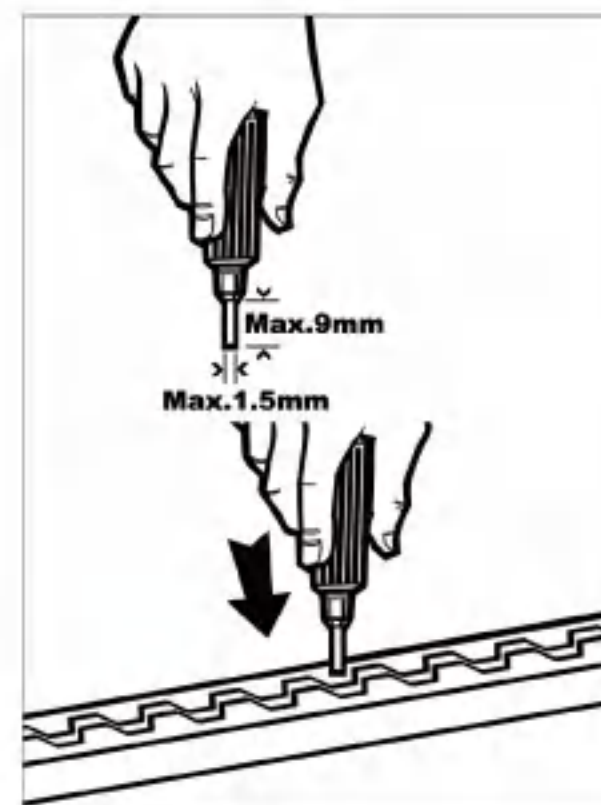


(8-14)



(8-15)

9. Place ring gaskets in the groove and fix them with T-pins.



(8-16)

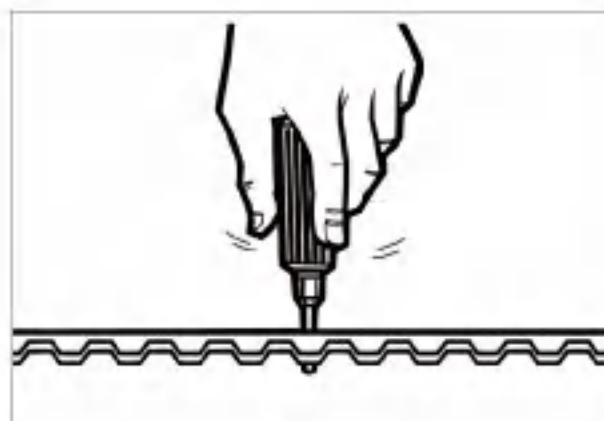
10. Insert tool point into the notches of the projection.



## CHAPTER 8 CHANGING PLATE AND GASKET

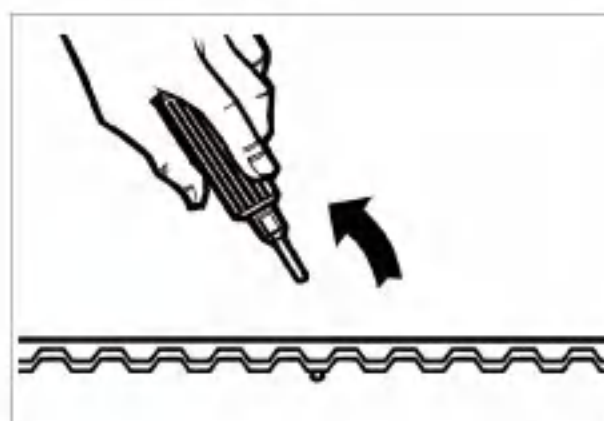
### Changing Glue-Free Gasket (Clip-On Gasket)

11. Push the gasket into groove of the plate.



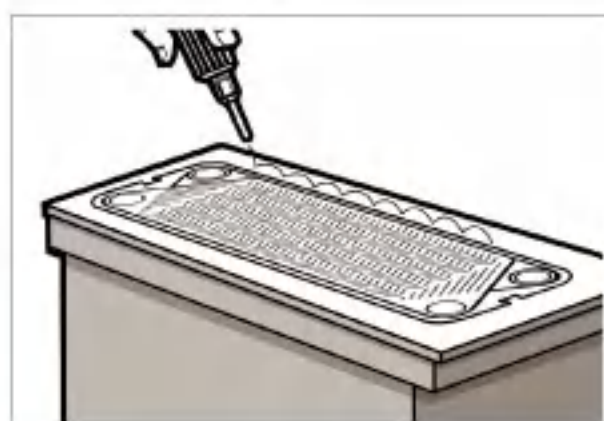
( 8-17 )

12. Clip T-pins on the plate.



( 8-18 )

13. Repeat for all projections so that the gasket is 'clipped'.



( 8-19 )

#### Notice

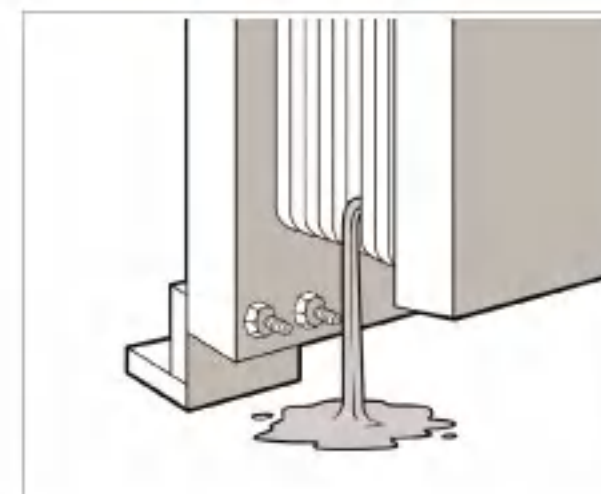
Before locking bolt, check T-pins are in correct position.

## CHAPTER 9 TROUBLE SHOOTING

### Leakage Between Plates and Fixed Head

#### Action

Mark the area where leakage seems to be and then open the heat exchanger.



( 9-1 )

1. Investigate the gasket condition of the end plate and the connection if applicable, check if there is any dislocation, foreign objects, scars and other damage.
2. Check if there is uneven pressure or foreign objects on plate, which might spoil the joint between gasket and adjacent surface.
3. Check if there are cracks or holes on the plate.

#### Corrections:

1.
  - Relocate gasket.
  - remove foreign matter
  - remove damaged gasket
  - replace connection lining if applicable
2. Remove foreign matters damaging the joint between gasket and movable end.
3. A perforated or creviced end plate must be replaced.





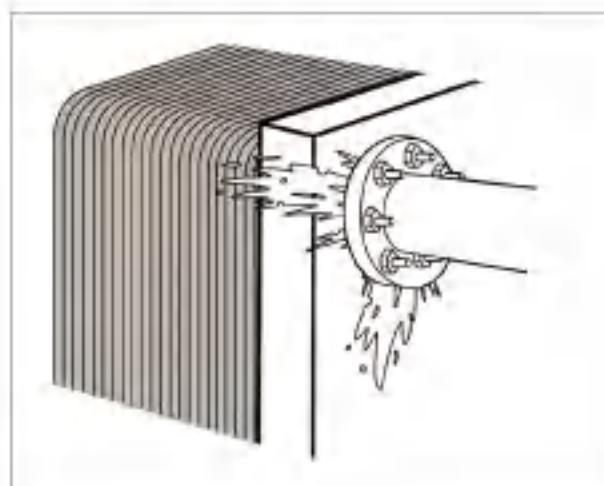
## CHAPTER 9 TROUBLE SHOOTING

### Leakage Between Flange and Frame

#### Action

Disconnect the flange and then check if there is:

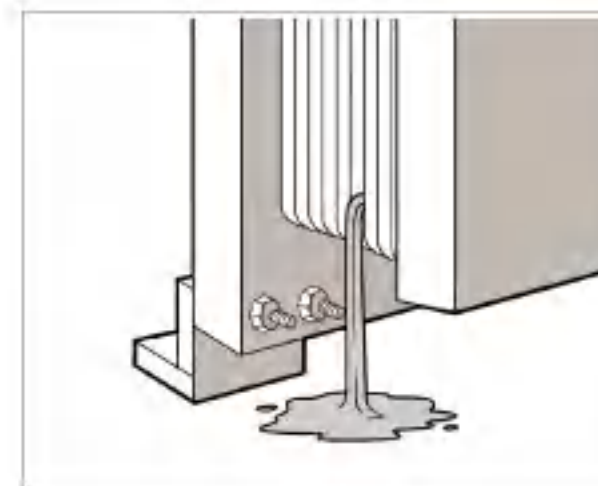
1. Misalignment
2. Dislocated or damaged gasket
3. Foreign matters



( 9-2 )

#### Corrections

- Rearrange the pipe in order to eliminate stress and correct alignment.
- Relocate gasket
- Replace connection lining if applicable
- Remove foreign matters from flange and gasket
- Reassemble, taking care of avoiding misalignment.



( 9-3 )

#### Notice

For plate heat exchanger especially designed for high temperature duties, extreme and sudden temperature drops may sometimes cause a temporary leakage. A typical example is a sudden shutting-off of the hot medium flow. The heat exchanger will normally seal again, as soon as the temperatures of the equipment is stable.

#### Action

Mark the leakage area with a felt tip marker on the two plates next to the leakage, check and note the length of the plate pack between inside fix head and movable end and then open the heat exchanger.

1. Check for loose, dislocated or damaged gasket.
2. Check for plate damage in the area, and also check plate pack length against the drawing to see if possible plate or gasket damage could be caused by over tightening of the pack, or if the leakage itself may simply be caused by insufficient tightening.

### Medium Leakage Between Plates

3. Check hanger recess at both plate ends for deformations, which could cause misalignment between the plates.
4. Make sure that the plates are hanging correctly as A-B-A.
5. Check for perforation of the plate (corrosion).

#### Corrections

1.
  - Relocate gasket
  - Re-cement loose gasket, if applicable.
  - Replace damaged gasket.
2. A damaged plate must in most cases be taken out for repair or replacement. If it is a regular plate with 4-hole plate just in front or just behind it out of the plate pack. The heat exchanger can now be reassembled and put back in service provided the plate pack is tightened to a new measurement, which is equal to the one on the drawing, reduced by two times the space required per plate, contact Accessen for assistance in the recalculation if necessary. The small reduction of the heat transfer area is normally of no importance, at least not for a short period of time.
  - Insufficient tightening must be corrected, see the drawing.
3. Damaged hanger recesses must be repaired if possible, or the plate replaced. For temporary arrangement with reduced number of plates-see paragraph 2 above.
4. Incorrect sequence of plates must be corrected F(A-B-A-B<sub>1</sub>-) make sure that no plate has been damaged, before reassembling the plate pack!
5. Perforated plates must be replaced. For temporary solution, see paragraph 2.



## CHAPTER 9 TROUBLE SHOOTING

### Mixture of Medium

#### Action

1. Check the pipe is connected to the heat exchanger at correct locations.
2. Open the lower connection on one side, raise pressure on the other side and by looking into the open connection try to detect any liquid from the pressurized side leaking in, and if so, approximately how far into the plate pack the leakage is located. If no leakage is detected, the reason for the mixing of media must be sought elsewhere. See paragraph 5.
3. If a leakage was detected, note the position of the leakage along the plate pack and then open the plate heat exchanger.
4. Before starting on the plates themselves, check the corner area between the ring and the field gaskets are clear, that the leakage slots are open. This ensures that any leakage is out of the plate heat exchanger and is to atmosphere. Therefore no pressure can build up to force the media across the gasket sealing off the other liquid.
5. If it has not been possible to locate the leakage as described in par.2 above, it will be necessary to check each single plate for possible perforations, using any of the following methods:
  - Put a strong light behind the plate and watch for light coming through fine holes or cracks.
  - Use a magnifying glass to check suspect area.
  - Use a chemical penetrant, after having cleaned the plates well.

#### Correction

1. Relocate piping to correct connections.
2. No
3. No
4. All deposits or material which can block the free exit from the area must be removed. If the leak channels of the gasket have been destroyed, they must be reopened with a suitable tool, or the gasket replaced.
5. Plates with holes must be replaced. The PHE may be temporarily operated with a reduced number of plates. See 'LEAKAGE between plates'.

### Pressure Drop Problems -Increased Pressure Drop

#### Action

Check that all valves including check valves are opened.

Measure the pressure just before and just after the heat exchanger, and the flow rate. For viscous media, a membrane manometer with a diameter with a diameter of at least 30 millimeters should be used. Measure or estimate the flow rate if possible. A bucket and a watch showing seconds may be sufficient for small flow rates for large low rate.

1. If the pressure drop is higher than specified, the temperature program should also be checked:

(1) If the thermometer readings correspond to those specified, the heat transfer surface is probably clean enough, but the inlet to the heat exchanger may be clogged by some objects.

(2) If the thermometer readings are NOT corresponding to those specified, heat transfer is obviously dropping below specifications, because of deposits on the heat transfer surface, which at the same time also increase the pressure drop, since the passage becomes narrower.

2. If the pressure drop corresponds to the specifications, there is lower than specified, the pump capacity is too small or the observation is wrong.

3. If the pressure drop is lower than specified, the pump capacity is too small or the observation is wrong.

#### Correction

1. See below:

(1) Open PHE and take out whatever is clogging the passage, or use the back-flush system, if there is any, to rinse out the clogging.

(2) If a 'cleaning-in-place' system is available, follow the instruction and use it to wash out the deposits. If not, open the PHE and clean the plates.

2. No

3. See pump instruction manual.





## CHAPTER 9 TROUBLE SHOOTING

### Heat Transfer Problem -Inefficiency of Heat Exchanger

#### Action

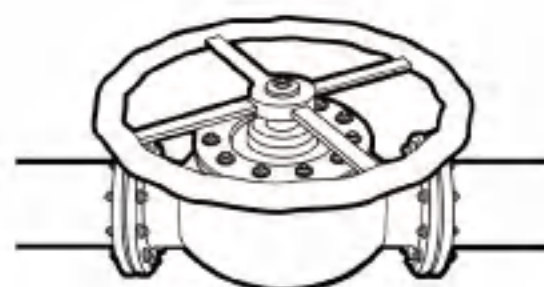
If possible, measure temperatures and flow rates of both media at inlet and outlet. At least on one of the media, both temperatures and the flow rate must be measured.

Check if the transferred amount of heat energy corresponds to the specifications.

If great precision is important, it will be necessary to use laboratory, it will be necessary to use laboratory thermometers with an accuracy of 0.1°C and also to use the best equipment available for flow measurements.

#### Correction

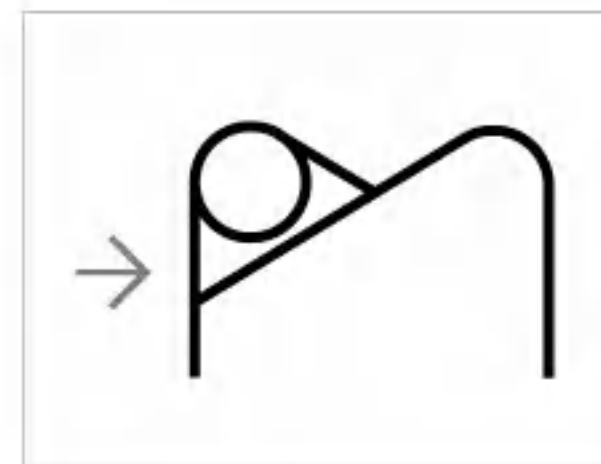
If the heat exchanger capacity of the equipment has dropped below specified values, the heat transfer surface must be cleaned. Either use the 'cleaning-in-place' arrangement if provided or open the heat exchanger for visual inspection and manual cleaning.



## CHAPTER 10 SPARE PARTS

### Spare Parts Ordering Procedures

When ordering spare parts, please specify the model and serial number of the plate heat exchanger, which are indicated on the product nameplate on the fixed end. Or please specify the model of the heat exchanger and code of the plate or the color code and number of the gasket.



10-1

### Gasket

The complete set of gasket includes all kinds of gaskets used for the plate, ring-shaped gaskets for connecting pipes and sometimes also includes the rubber pipes for connecting pipes.

#### Material code

The rubber type of the gasket can be identified with color marks. The number code of the gasket should be marked near color marks.

#### Instance of order

A set of gaskets bonding agent and cleaning liquid for plate heat exchanger of AU10L1 (Serial number: AK01861).

#### Instance of gasket order

Gaskets and ring-shaped for the fixed pressure plate should be used for the 6 middle plates, plate heat exchanger model: AU10L1 and series number: AK01942



## CHAPTER 10 SPARE PARTS

### Plate

We can supply plates with gaskets. All the holes in corners will be barricaded to equal the original plate. For multiple pass heat exchanger (page 7), serial numbers have been marked.

When ordering, please indicate the hold code, such as 0230 (picture 3-7, page7). For multiple-pass heat exchanger, please indicate the serial number of the plate (page 7).



#### Instance of order, single pass:

Please order according to H Indicate part (page 43 picture 8-1)

The gasket is adhesive, the plate heat exchanger model is AU10L1 and the serial number is AK01042.

#### Instance of order, multiple pass:

6 plates, serial number 2-7, with adhesive gaskets, plate heat exchanger model AU10L1 and serial number is AK01830.

If the plates are damaged due to corrosion or endurance crack, please change them.

#### Instance of order for all plates

A set of order with adhesive gaskets, plus gaskets for connecting pipes, plate heat exchanger model AU10L1 and series number AK01942.

#### Material code:

The material code of the plate is identified with the printing codes (picture 8-1, page 43)

AISI304	1
AISI316	3
Titanium	4
Hastelloy	5
SMO254	6