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Instruction Manual Plate Heat Exchangers

M3 M6 M10 TS6
T2 T5





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How to contact Alfa Laval:

Contact details for all countries are continually updated on our website.

Please visit www.alfalaval.com and contact your local Alfa Laval Representative.

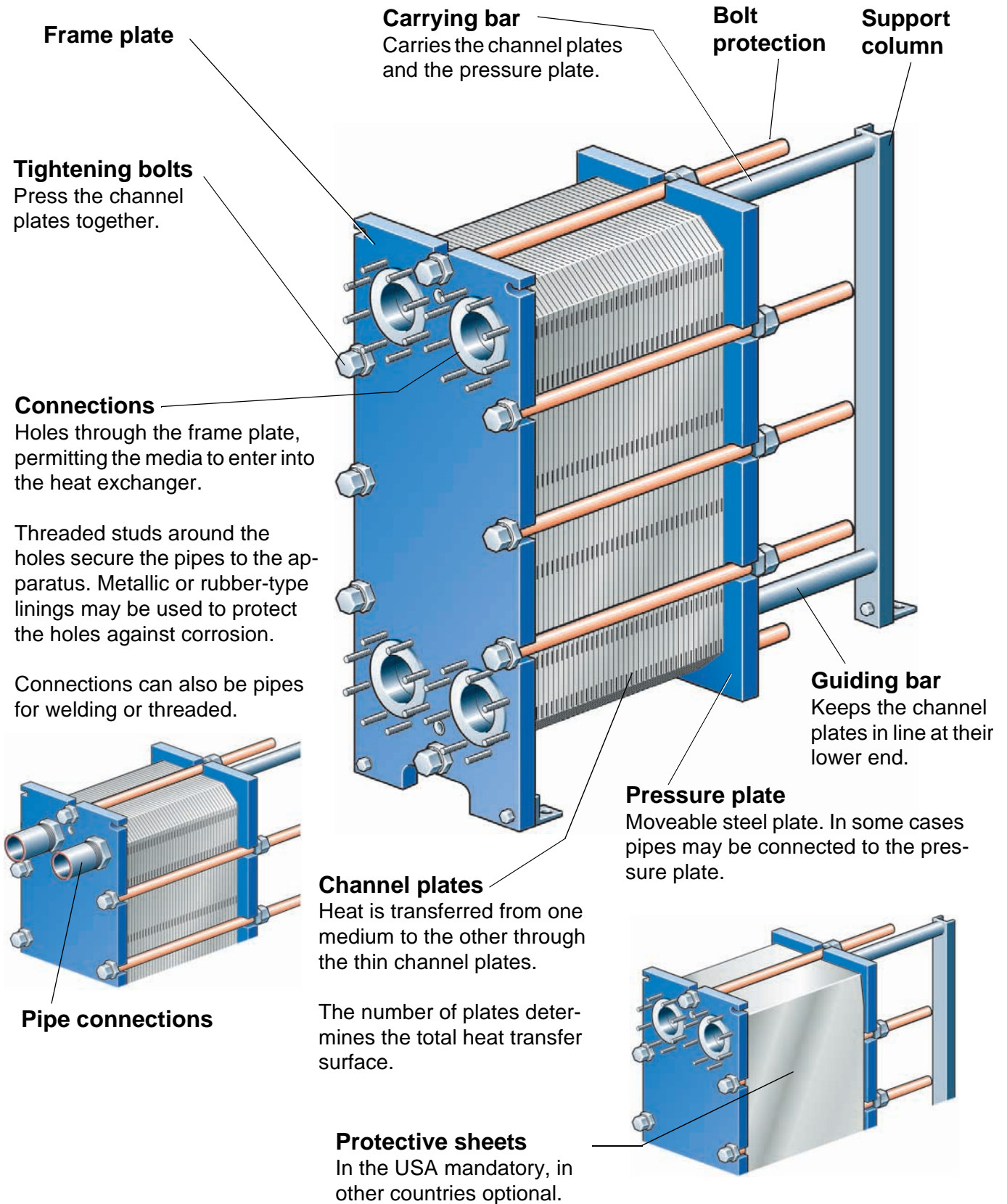
Except for this Instruction Manual, the following documents are also included in this shipment:

- Plate Heat Exchanger (PHE) drawing
- Plate hanging list
- Parts list with exploded view drawing.

Description

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Main components



Function

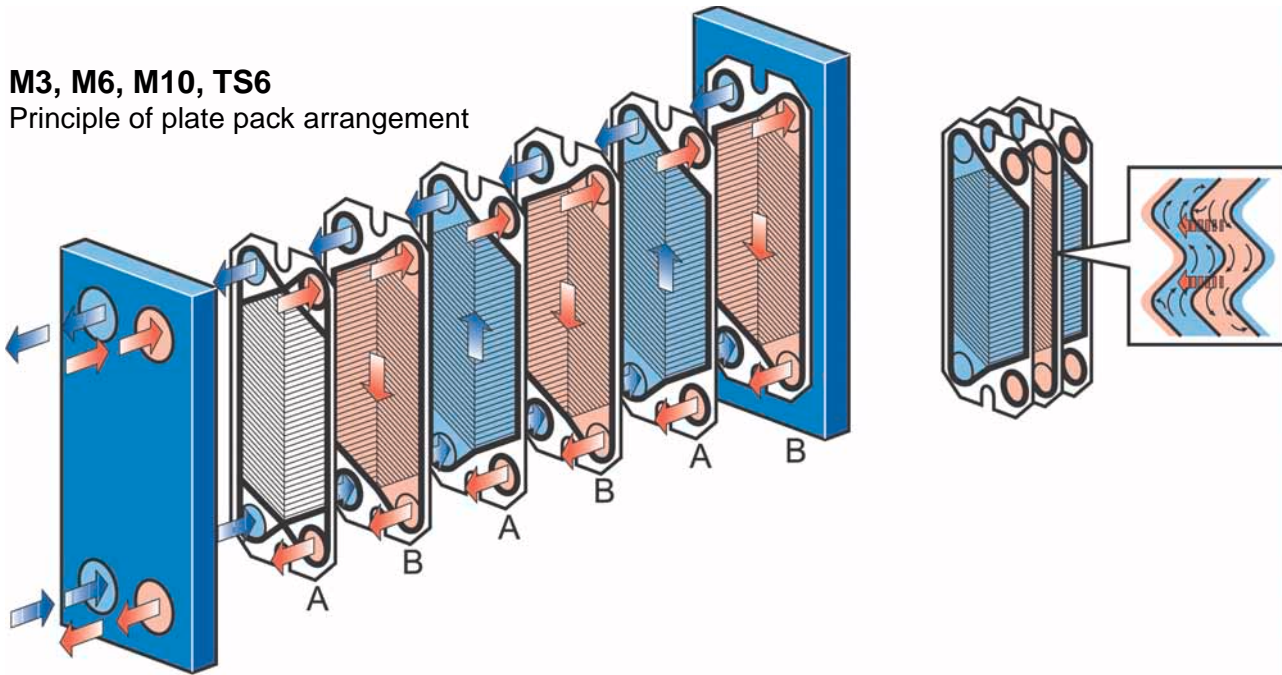
The plate heat exchanger consists of a pack of corrugated metal plates with portholes for the passage of the two fluids between which heat transfer will take place.

The plate pack is assembled between a frame plate and a pressure plate and compressed by

tightening bolts. The plates are fitted with a gasket which seals the channel and directs the fluids into alternate channels. The plate corrugation promotes fluid turbulence and supports the plates against differential pressure.

M3, M6, M10, TS6

Principle of plate pack arrangement



M3, M6, M10, TS6



A

The A-plate is a plate hanging with the chevron pointing downwards.



B

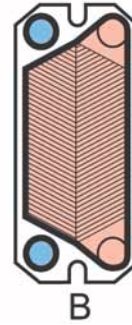
The B-plate is a plate hanging with the chevron pointing upwards.

T2, T5



A

The A-plate is a plate hanging with the chevron pointing upwards.



B

The B-plate is a plate hanging with the chevron pointing downwards.

Semi-welded PHE

For certain plate sizes there are semi-welded plates (Cassettes) available. The function of the semi-welded PHE is the same as that of the conventional PHE. Chapters Installation and Operation of this manual are applicable to full extent. Chapter Maintenance is fully applicable when it

comes to the parts Cleaning-in-Place and Pressure test after maintenance and partially applicable for the remaining part. To cover the specific requirements of the semi-welded PHE a separate additional manual has been made.

Installation

Requirements

Pipes

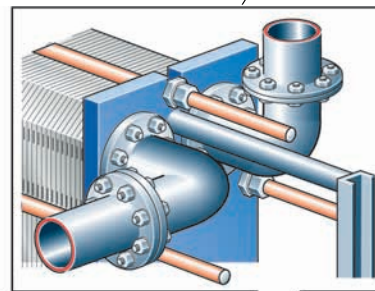


Caution!

Make sure the pipe connections are locked when working on the piping. Turning of the connections will damage the gaskets on the end plate and cause leakage.

Multi-pass units: Connections on the pressure plate

It is important that the plate pack has been tightened to the correct measurement (check against drawing) before the pipe is connected.



Elbow

To make it easier to disconnect the plate heat exchanger, an elbow should be flanged to the connection in the pressure plate, directed upwards or sideways, and with another flange located just outside the contour of the heat exchanger.

Drip tray

Depending on the type of fluid in the PHE and the type of installation, a drip tray (drainage box) may be necessary to avoid damages on personnel and equipment.

Foundation

Install on a flat foundation giving enough support to the frame.

Space

600 mm minimum free space is needed for lifting plates in and out.

Shut-off valves

To be able to open the heat exchanger, shut-off valves should be provided in all connections.

Note!

- Before connecting any piping, make sure all foreign objects have been flushed out of the system.
- When connecting the pipe system make sure the pipes do not subject the plate heat exchanger to stress or strain.
- To avoid water hammer, do not use fast-closing valves.

Safety valves should be installed according to current pressure vessel regulations.

If PHE surface temperature is expected to be hot or cold, the PHE should be isolated.

It is recommended that protective sheets are used to cover the PHE.

For each model, design pressures and temperatures are marked on the identification plate. These must not be exceeded.

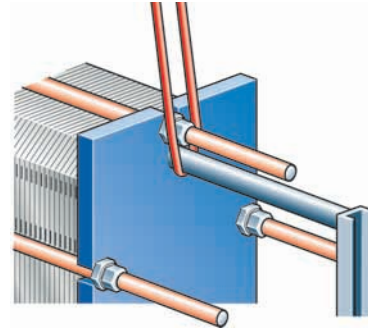
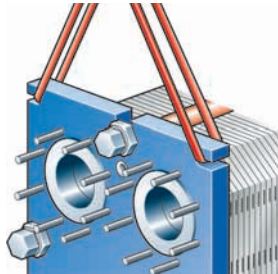
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Lifting



Warning!

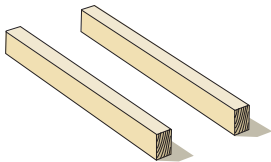
Never lift by the connections or the studs around them.



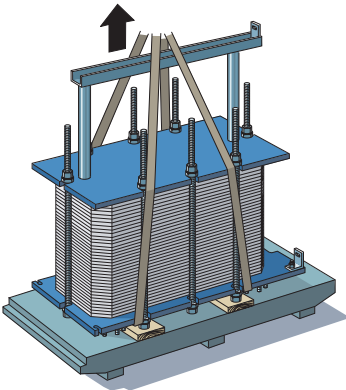
Straps should be used when lifting. Place straps according to picture.

Raising

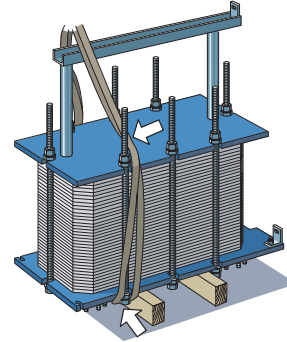
- 1 Place two timber beams on the floor.



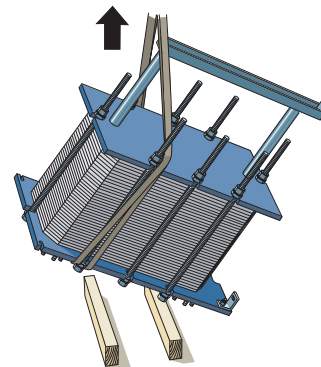
- 2 Lift the heat exchanger off pallet using e.g. straps.



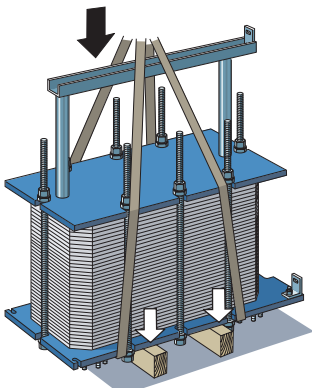
- 4 Place straps around one bolt on each side.



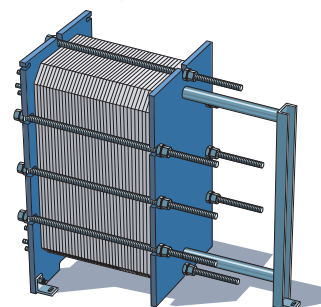
- 5 Lift the heat exchanger off the timber beams.



- 3 Place the heat exchanger on the timber beams.



- 6 Lower the heat exchanger to horizontal position and place it on the floor.



Operation

Start-up

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Note!

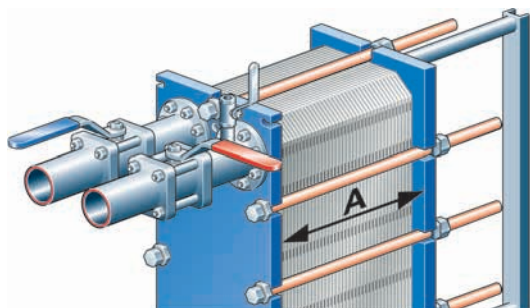
If several pumps are included in the system, make sure you know which one should be activated first.

Note!

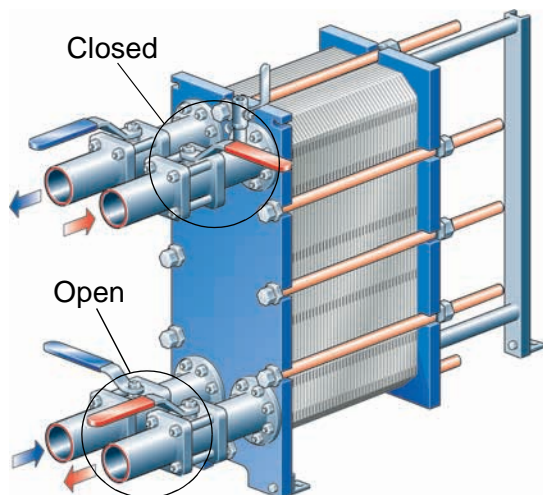
Adjustments of flowrates should be made slowly in order to avoid the risk of **water hammer**.

Water hammer is a shortlasting pressure peak that can appear during start-up or shut-down of a system, causing liquids to travel along a pipe as a wave at the speed of sound. This can cause considerable damage to the equipment.

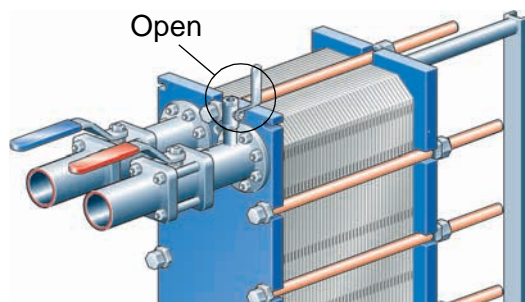
- 1 Check that measurement A is correct. For A, see enclosed PHE-drawing.



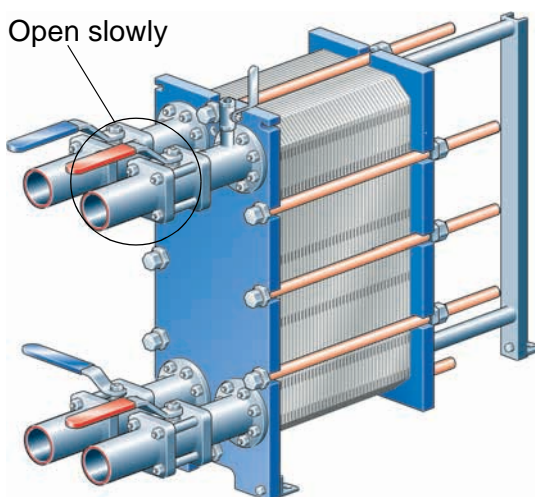
- 2 Check that the valve is closed between the pump and the unit controlling the system flowrate.



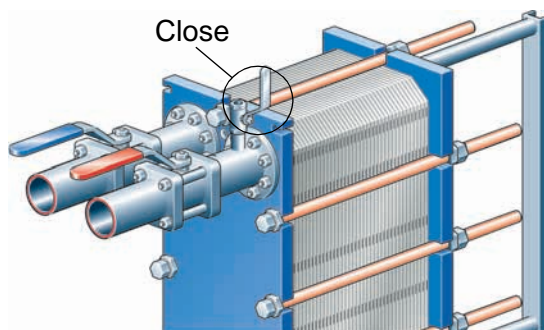
- 3 If there is a valve at the exit, make sure it is fully open.
- 4 Open the vent and start the pump.



- 5 Open the valve slowly.



- 6 When all air is expelled, close the vent.







- 7 Repeat steps 1– 6 for the second media.

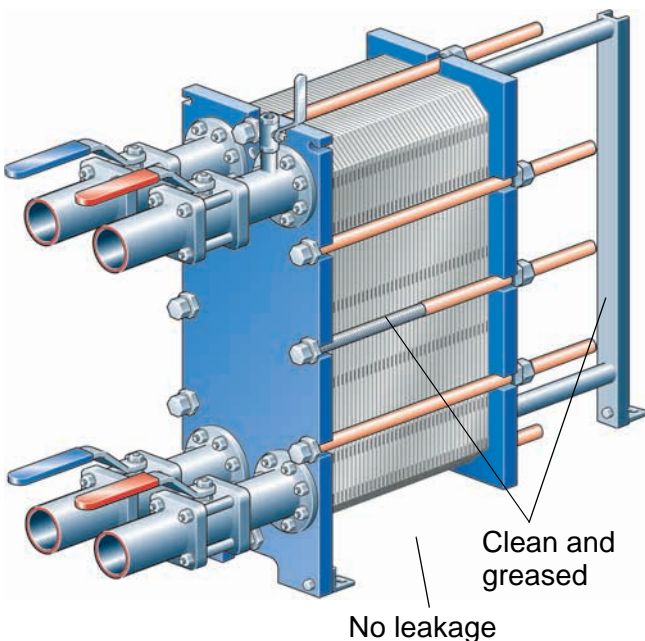
Unit in operation

Note!

Adjustments of flowrates should be made slowly in order to protect the system against sudden and extreme variations of temperature and pressure.

During operation, check that

-  media temperatures and pressures are within the limits stated on the PHE-drawing
-  no leakages appear due to faulty tightening of the plate pack or to defective or damaged gaskets
-  support column, carrying bar and guiding bar are kept clean and greased
-  the bolts are kept clean and greased.



Always consult your local Alfa Laval Representative for advice on

- new plate pack dimensions if you intend to change number of plates
- selection of gasket material if operating temperatures and pressures are permanently changed, or if another medium is to be processed in the PHE.

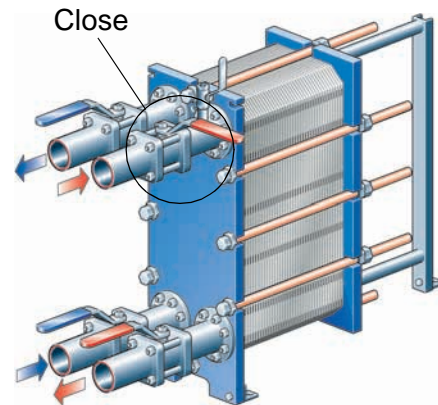
Shut-down

Note!

If several pumps are included in the system, make sure you know which one should be stopped first.

1

Slowly close the valve controlling the flow-rate of the pump you are about to stop.



2

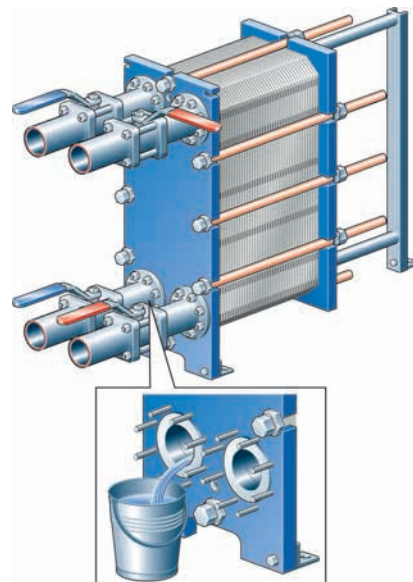
When the valve is closed, stop the pump.

3

Repeat steps 1–2 for the other side.

4

If the heat exchanger is shut down for several days or longer, it should be drained. Draining should also be done if the process is shut down and the ambient temperature is below freezing temperature of the media. Depending on the media processed, it is also recommended to rinse and dry the heat exchanger plates and connections.



Maintenance

Cleaning-In-Place (CIP)

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The Cleaning-In-Place (CIP) equipment permits cleaning of the plate heat exchanger without opening it.


If CIP cannot be done, cleaning must be performed manually, see section “Manual cleaning”.

CIP performs

- cleaning of fouling and descaling of lime deposits
- passivation of cleaned surfaces to reduce susceptibility to corrosion
- neutralization of cleaning liquids before draining.

Follow the instructions of the CIP equipment.

CIP equipment

CIP model	Maximum number of plates						
	M3	M6	M6-M	M10-B	M10-M	TS6-M	
	CIP 20	90	89	62	40	27	56
	CIP 40	–	178	124	81	53	110

Cleaning liquids

Cleaning liquid	Description
AlfaCaus	A strong alkaline liquid, for removing paint, fat, oil and biological deposits.
AlfaPhos	An acid cleaning liquid for removing metallic oxides, rust, lime and other inorganic scale.
AlfaPass	An alkaline liquid for passivation (inhibition of corrosion).
AlfaNeutra	A strong alkaline liquid for neutralization of AlfaCarbon or AlfaPhos before drainage.



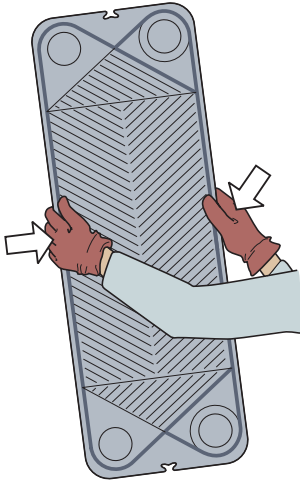
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Manual cleaning



Warning!

To avoid hand injuries owing to sharp edges, protective gloves should always be worn when handling plates and protective sheets.

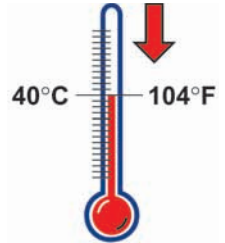


Opening



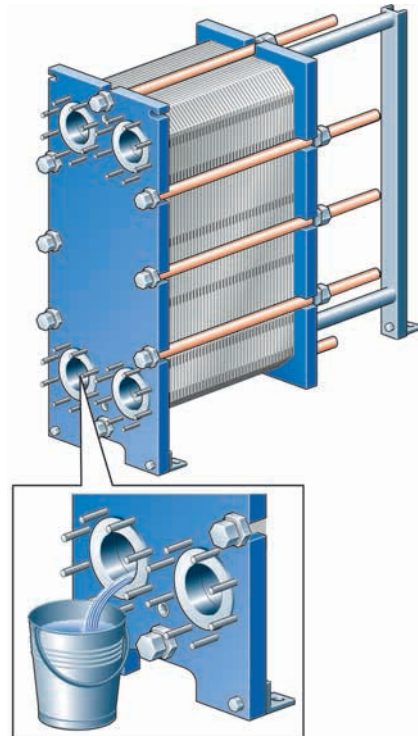
Warning!

If the heat exchanger is hot, wait until it has cooled down to about 40 °C (104 °F).



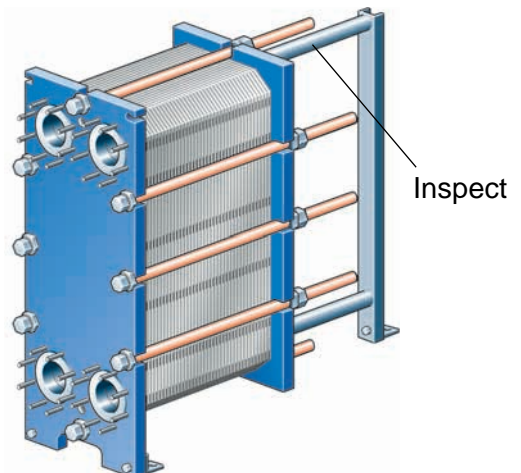
1

Drain the plate heat exchanger.

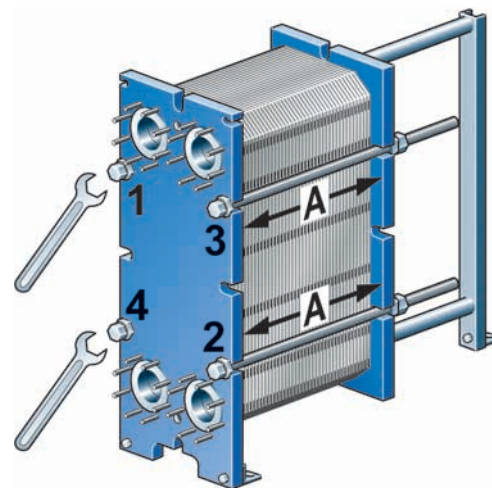
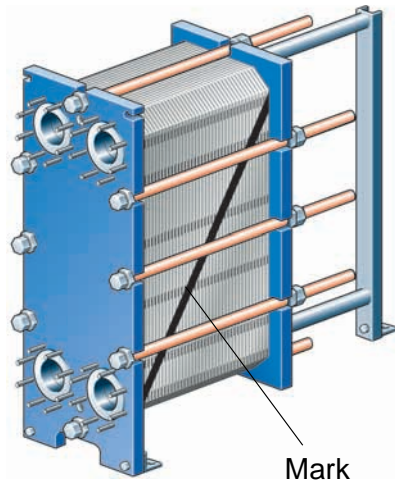


2

Inspect the sliding surfaces of the carrying bar and wipe clean.

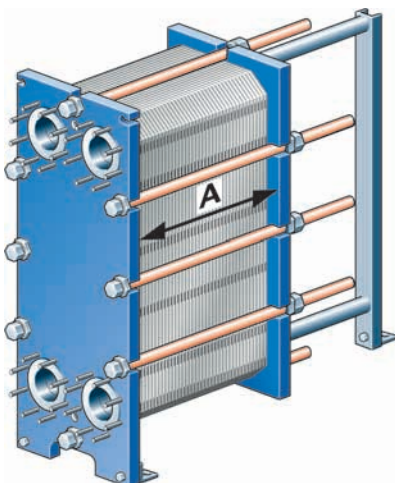


3 Mark the plate assembly on the outside by a diagonal line.



See also point 5 under part "Closing".

4 Measure and note down the dimension A.



6 Open the plate pack by letting the pressure plate glide on the carrying bar.

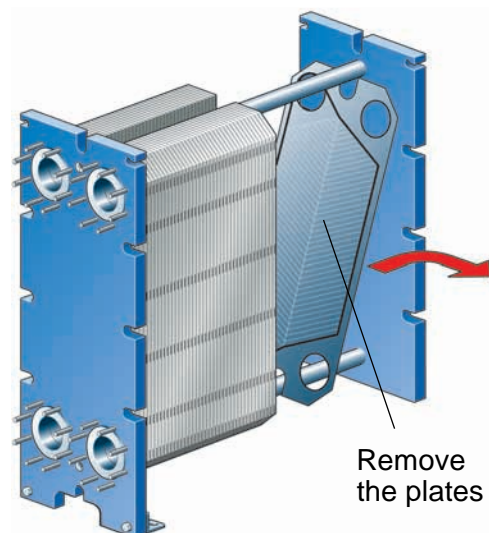
If plates are to be numbered, do this before removing the plates.

Plates need not be removed if cleaning is done using only water, i.e. without cleaning agent.

5 Loosen and remove all bolts except the 4 at the positions indicated below. Use these remaining 4 bolts to open the plate pack according to the following scheme.

Step	Bolt No.	To dimension
1	1-2-3-4	1,05A
2	1-2 or 3-4	Opening

Be careful so that the plate and pressure plate are always in parallel. Skewing of the pressure plate during opening must not exceed 10 mm (2 turns per bolt) across the width and 25 mm (5 turns per bolt) vertically.



Warning!

The plate pack may still contain a small residual amount of liquid after draining. Depending on the type of product and type of installation special arrangements, e.g. drainage box, may be necessary to avoid damages on personnel and equipment.

Manual cleaning of opened units



Caution!

Never use hydrochloric acid with stainless steel plates. Water of more than 330 ppm Cl may not be used for the preparation of cleaning solutions. It is very important that carrying bars and support columns in aluminium are protected against chemicals.

Note!

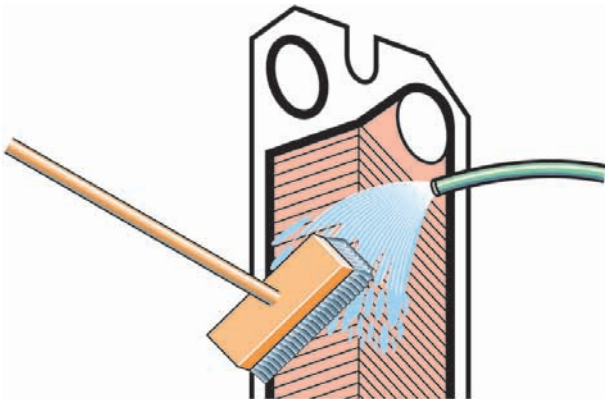
Be careful not to damage the gasket during manual cleaning.

Deposits removable with water and brush

Plates need not to be removed from the plate heat exchanger during cleaning.

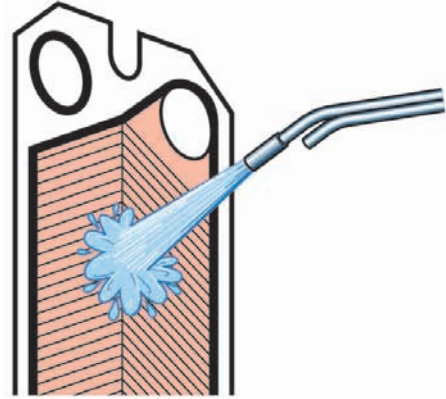
1

Remove deposits using a soft brush and running water.



2

Rinse with water using a high pressure hose.

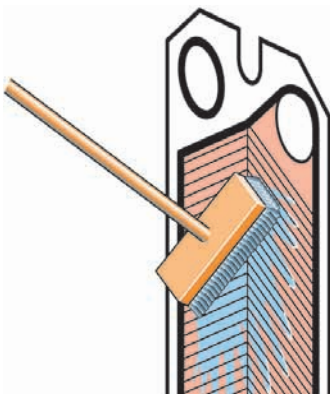


Deposits not removable with water and brush

Plates must be removed from the plate heat exchanger during cleaning.

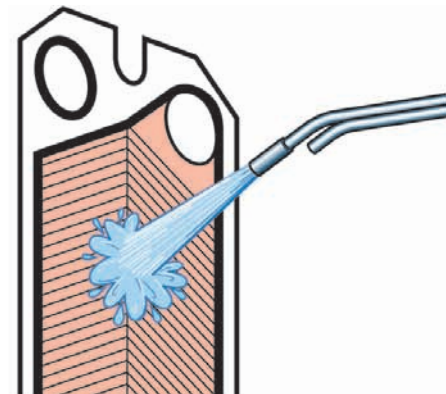
1

Brush with cleaning agent.



2

Rinse with water.



Cleaning agents – Incrustation, scaling
Concentration max 4 %
Temperature max 60 °C (140 °F)

Incrustation – Scaling	Sediment	Cleaning agent
Calcium carbonate	Corrosion products	Nitric acid
Calcium sulphate	Metal oxides	Sulfamic acid
Silicates	Silt	Citric acid
	Alumina	Phosphoric acid
	Diatom organisms and their excrement of various colours	Complexing agents (EDTA, NTA) Sodium polyphosphates

Cleaning agents – Biological growth, slime
Concentration max 4 %
Temperature max 80 °C (176 °F)

Biological growth – Slime	Cleaning agent
Bacteria	Sodium hydroxide
Nematodes	Sodium carbonate
Protozoa	Cleaning effect can be considerably increased by the addition of small quantities of hypochlorite or agents for the formation of complexes and surfactants.

Cleaning agents – Oil residues, asphalt, fats

Deposit	Cleaning agent
Oil residues Asphalt Fats	Paraffinic naphta-based solvent (e.g. kerosine). Note! Gaskets in EPDM rubber qualities swell in these media. Contact time should be limited to 30 minutes.



Caution!

The following solutions should not be used:

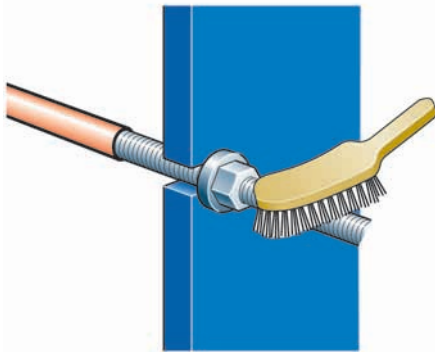
- Ketones (e.g. Acetone, Methyl-ethylketone, Methylisobutylketone)
- Esters (e.g. Ethylacetate, Butylacetate)
- Halogenated hydrocarbons (e.g. Chloro-thene, Carbon tetrachloride, Freons)
- Aromatics (e.g. Benzene, Toluene).



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Closing

- 1** Check that all the sealing surfaces are clean.
- 2** Brush the threads of the bolts clean, using a steel wire brush. Lubricate the threads with a thin layer of grease, e.g. Gleitmo 800 or equivalent.

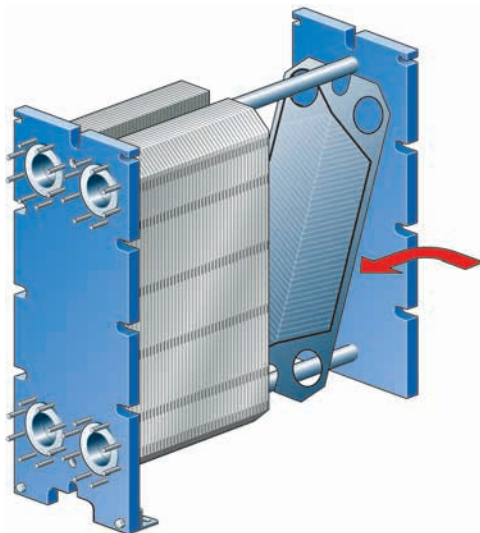


- 3** Attach gaskets to the plates or check that all the gaskets are properly attached.

Note!

If the gasket is wrongly positioned, it will show by the fact that it rises out of the gasket groove or that it is positioned outside the groove.

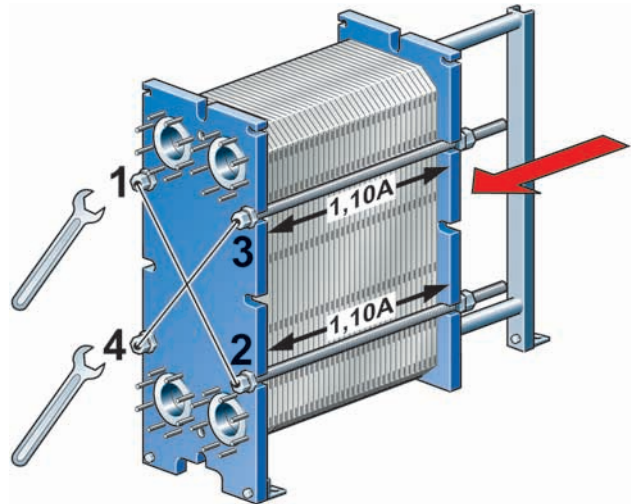
- 4** Insert the plates with the herring bone pattern positioned in alternate directions and with the gaskets turned towards the frame plate.



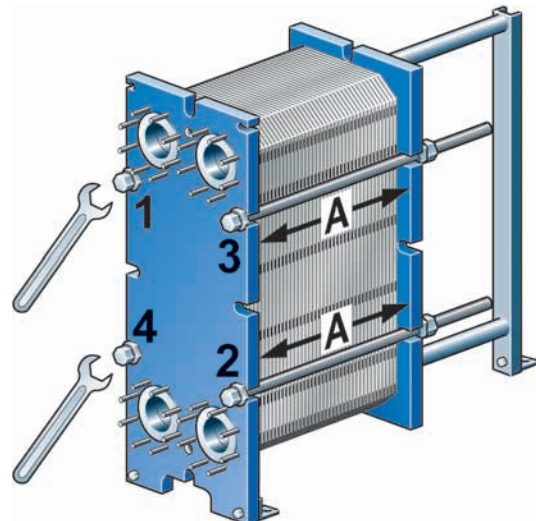
- 5** Press the plate assembly together. Tightening is done in two steps, see figures below. Be careful so that the frame plate and the pressure plate are always in parallel.

Step	Bolt No.	To dimension
1	1-2 or 3-4	1,10A
2	1-2-3-4	A

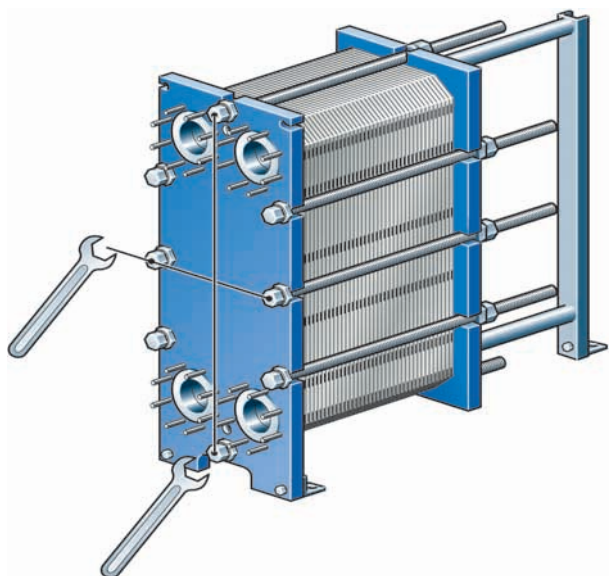
Tighten the two diagonal pair of bolts alternately until the plate package measures 1,10A.



After that bolts are tightened alternately and diagonally, as shown in the figure below.



Finally the middle pair of bolts, and upper and lower bolts are tightened.



Pressure test after maintenance

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Before start-up of production, whenever plates or gaskets have been removed, inserted or exchanged, it is strongly recommended to perform a pressure test to confirm the internal and external sealing function of the PHE. At this test, one media side at the time must be tested with the other side open to the atmosphere.

The pressure testing shall be performed at a pressure equal to the operating pressure of the actual unit but never above the design pressure as stated on the nameplate.

The recommended test time is 10 minutes.

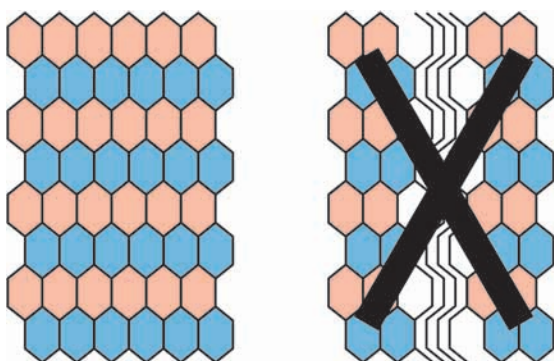
Please note that PHE units for refrigeration applications and units with media not mixable with water must be dried after hydrostatic pressure testing.

Please consult the local office/representative of the supplier for advice on the pressure testing procedure.

Note!

The actual measurement must never be less than the A-dimension.

- 6 If the plates are correctly assembled, the edges form a "honeycomb" pattern, see picture below.





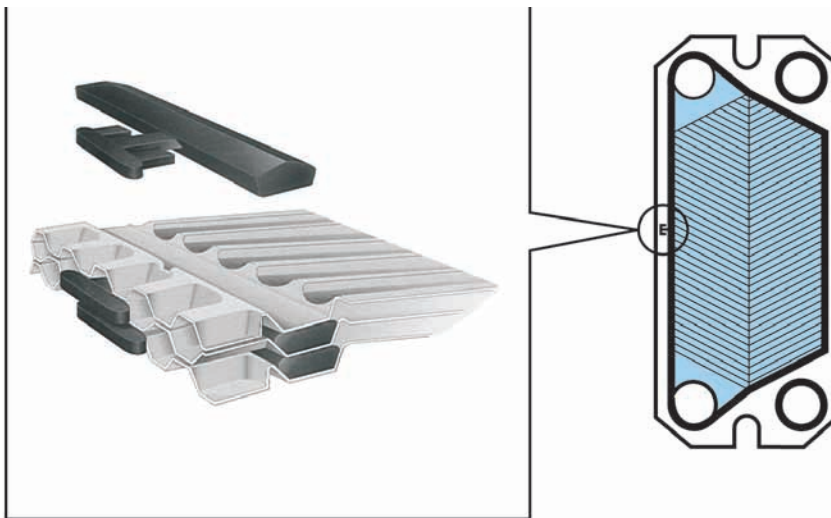
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Regasketing

- 1** Open the plate heat exchanger according to page 8, and remove the plate that is to have a new gasket.
- 2** Remove the old gasket.
- 3** Assure that all sealing surfaces are dry, clean and free of foreign matter.
- 4** Attach the clip-on gasket to the plate. Slip the gasket prongs under the edge of the plate.

Glued gaskets

Separate gluing instructions will be delivered together with the glue.



Note!

Make sure the two gasket prongs are in correct position.

- 5** Proceed with the next plate to be regasketed until all plates in need of regasketing are done with.
- 6** Close the plate heat exchanger according to page 12.