

Instruction Manual Plate Evaporator

AlfaVap 350, 500, 650, 700

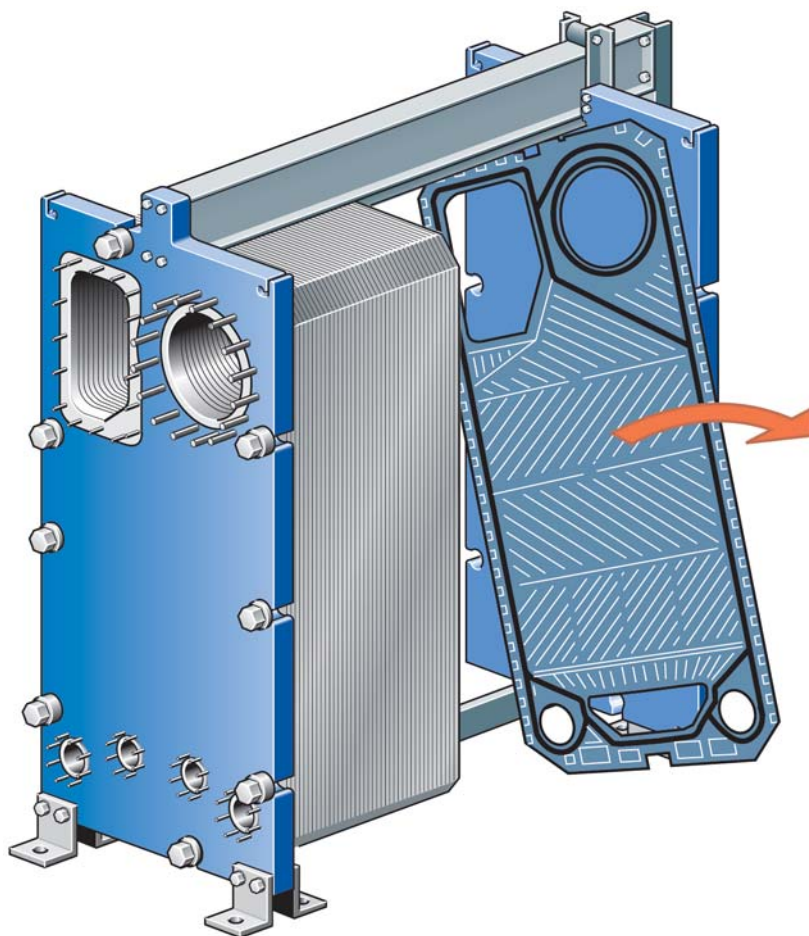




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How to contact Alfa Laval:

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 Evaporator drawing
- Plate hanging list
- Parts list with exploded view drawing.



Environmental compliance

Alfa Laval endeavours to perform its own operations as cleanly and efficiently as possible, and to take environmental aspects into consideration when developing, designing, manufacturing, servicing and marketing its products.

Unpacking

- Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.
- Wood and cardboard boxes can be reused, recycled or used for energy recovery.
- Plastics should be recycled or burnt at a licensed waste incineration plant.
- Metal straps should be sent for material recycling.

Maintenance

During maintenance oil and wear parts in the machine are replaced.

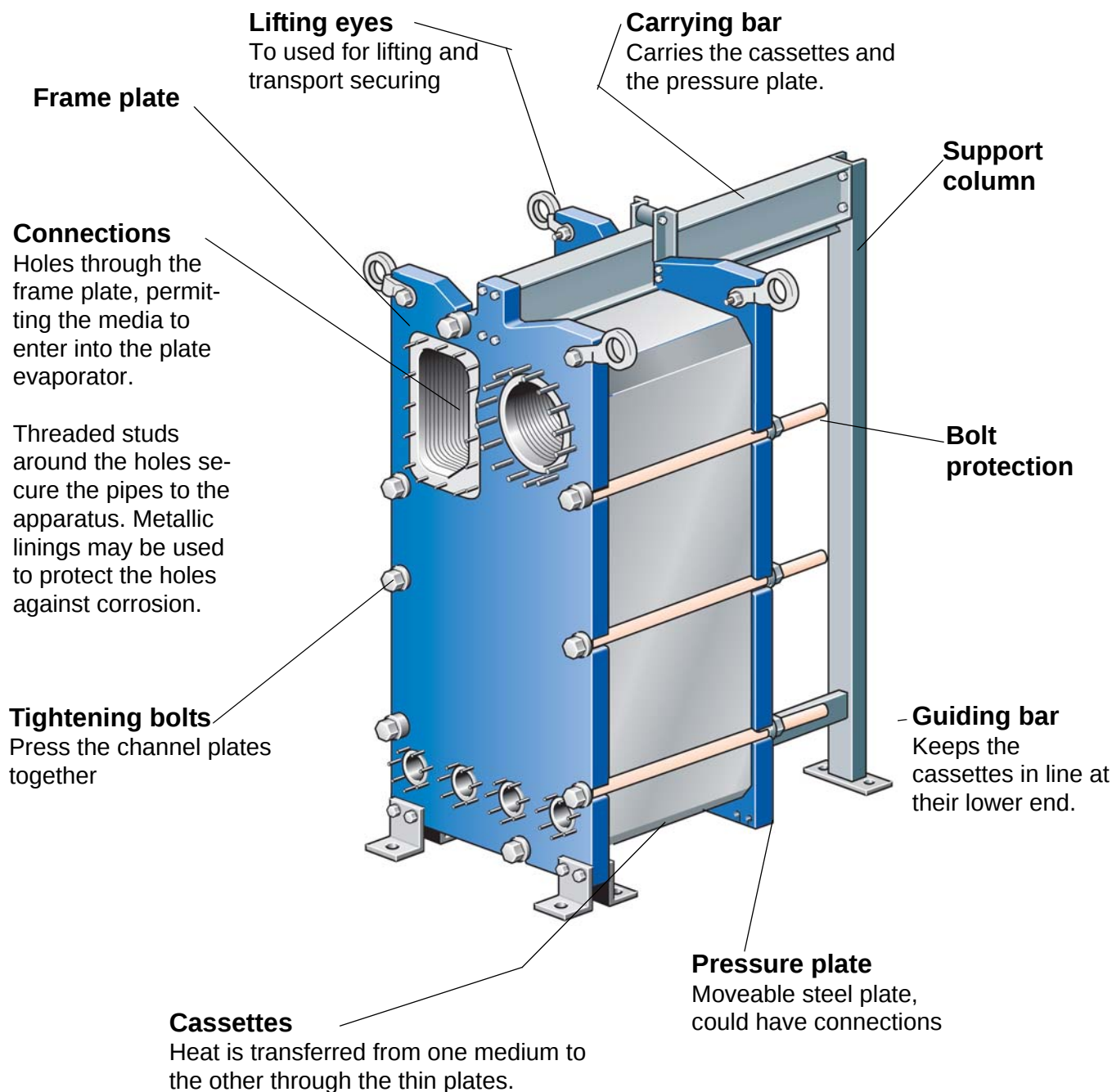
- All metal parts should be sent for material recycling.
- Worn out or defective electronic parts should be sent to a licensed handler for material recycling.
- Oil and all non metal wear parts must be taken care of in agreement with local regulations.

Scrapping

At end of use, the equipment shall be recycled according to relevant, local regulations. Besides the equipment itself, any hazardous residues from the process liquid must be considered and dealt with in a proper manner. When in doubt, or in absence of local regulations, please contact the local Alfa Laval sales company.

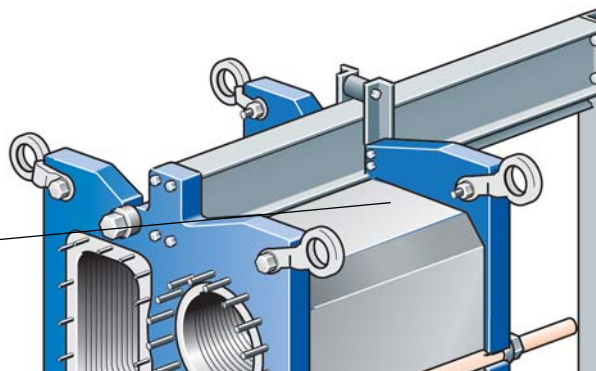
Description

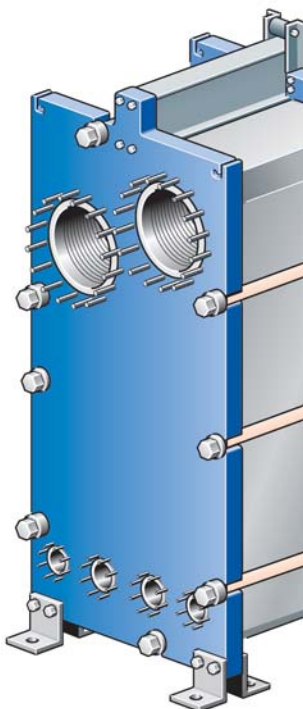
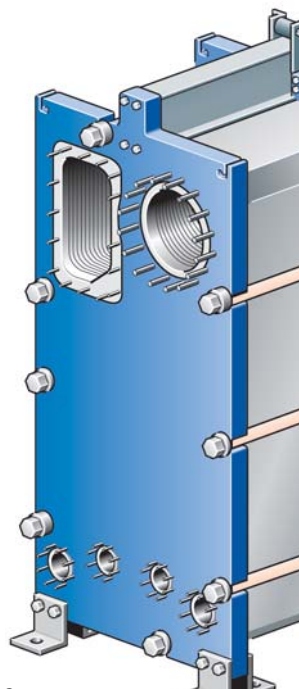
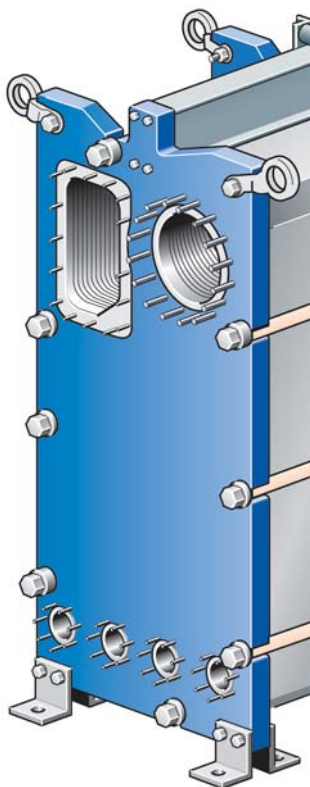
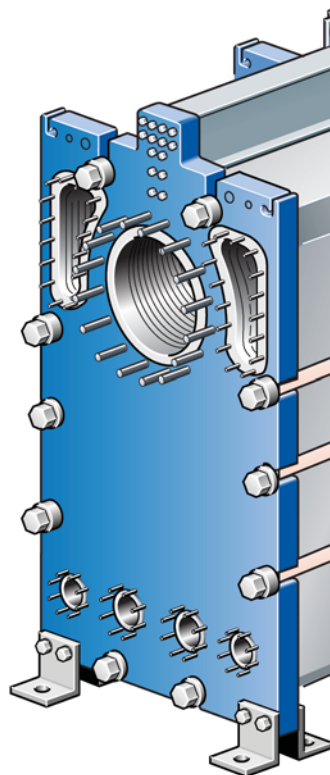
Main components



The number of cassettes determines the total heat transfer surface.

Protective sheets
Supplied on request.



*AlfaVap 350**AlfaVap 500**AlfaVap 650**AlfaVap 700*

Function

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AlfaVap consists of a plate pack with plates welded together in pairs forming so-called cassettes.

The cassette concept gives rise to two different type of channels - gasketed channels used for the evaporated media and welded channels used for the heating steam.

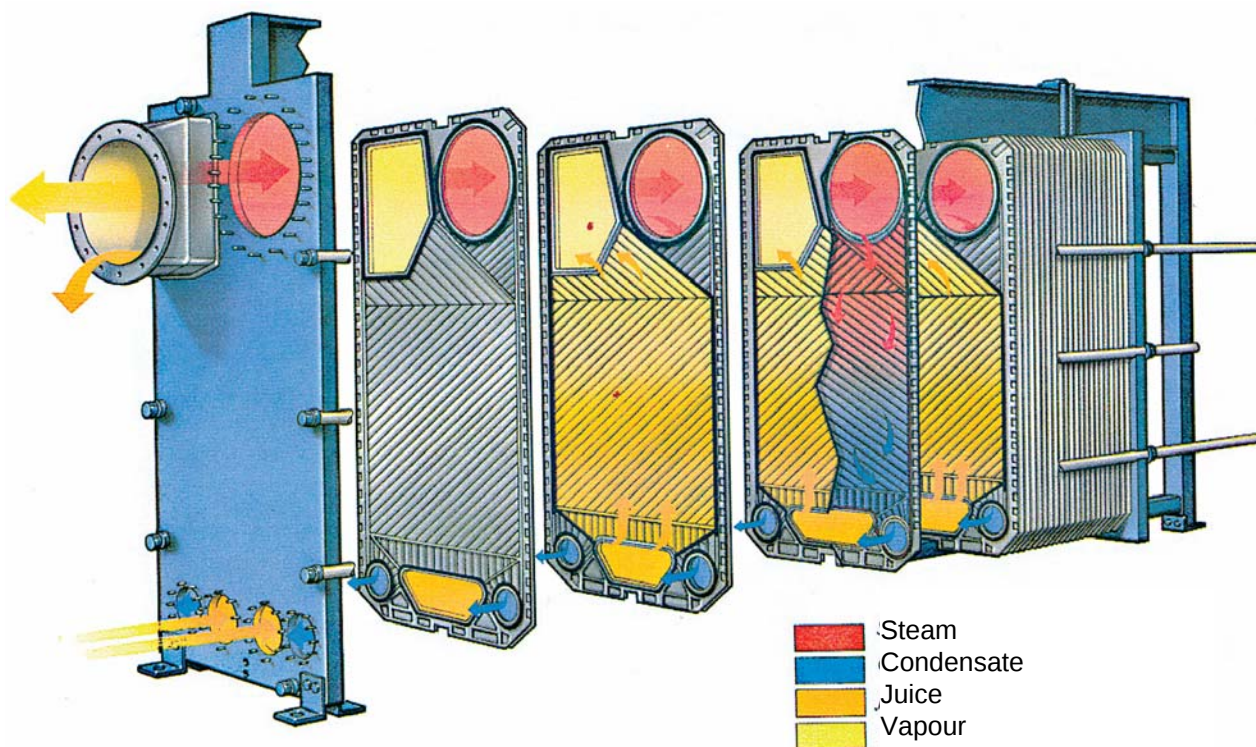
The plate pack is assembled between a frame plate and a pressure plate and compressed by tightening bolts.

The plate pattern is specifically designed for optimal evaporation, with higher pressure drop in the beginning of the evaporation channel thus securing the start of the evaporation process. This maximizes the heat transfer efficiency and minimizes fouling.

Two feed connections are located centrally in the bottom of the frame plate. A double compartment system in the cassettes ensures an even distribution of feed to every single channel also in very long plate packs.

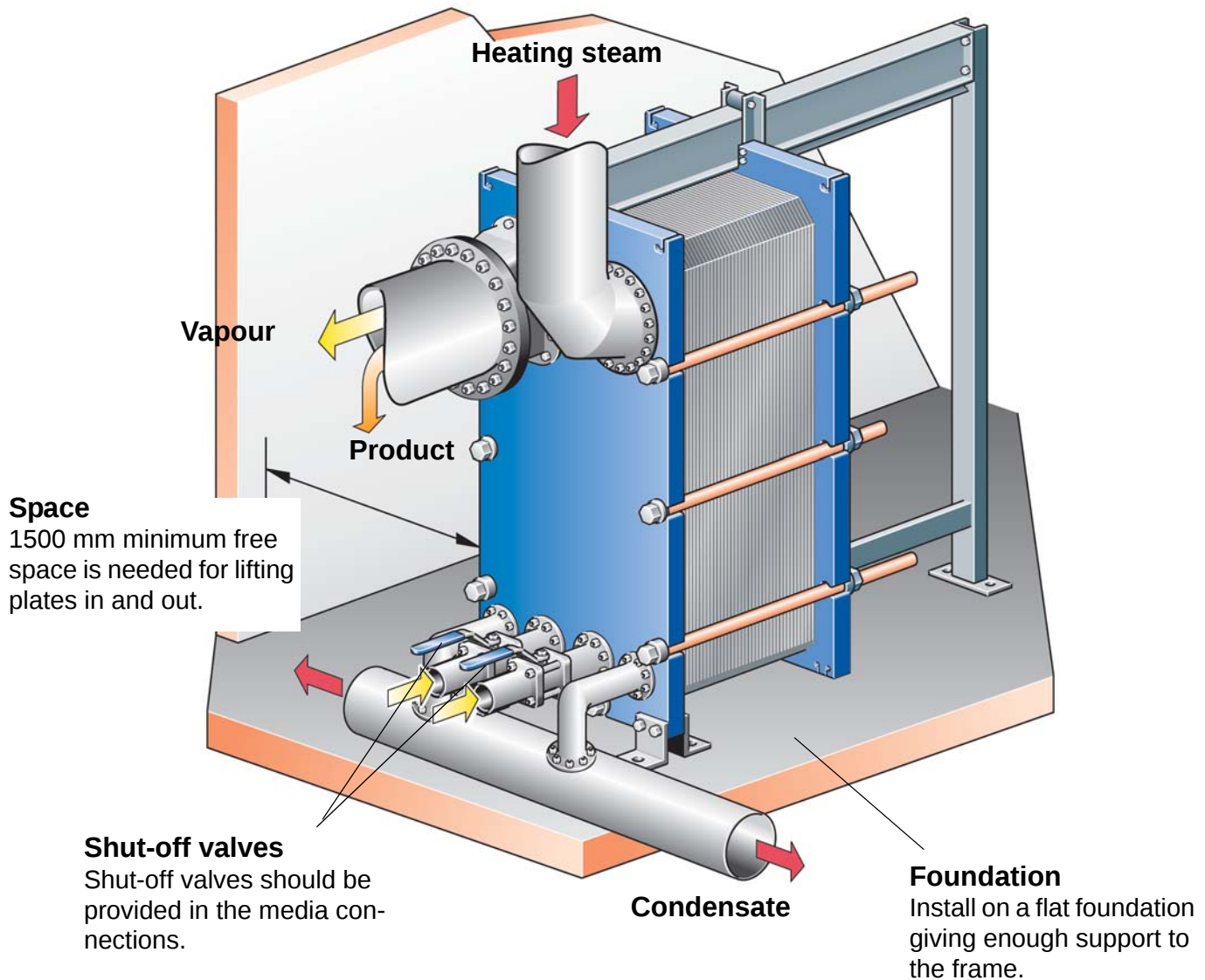
Evaporation takes place on the gasketed side of the cassette and the concentrated product along with evaporated vapour leaves the evaporator through a centrally placed connection in the upper part of the frame.

The heating steam enters two connections in the upper part of the frame and condenses on the welded side of the cassettes. Condensate is taken out in the two outer connections in the bottom.



AlfaVap 500

Installation Requirements



Note!

- Before connecting any piping, make sure all foreign objects have been rinsed out of the system.
- When connecting the pipe system make sure the pipes do not subject the plate evaporator to stress or strain.
- To avoid water hammer, do not use fast-closing valves.
- Before start-up, check that all tightening bolts are properly tightened.

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

If the plate evaporator surface temperature is expected to be hot or cold, the evaporator should be insulated.

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

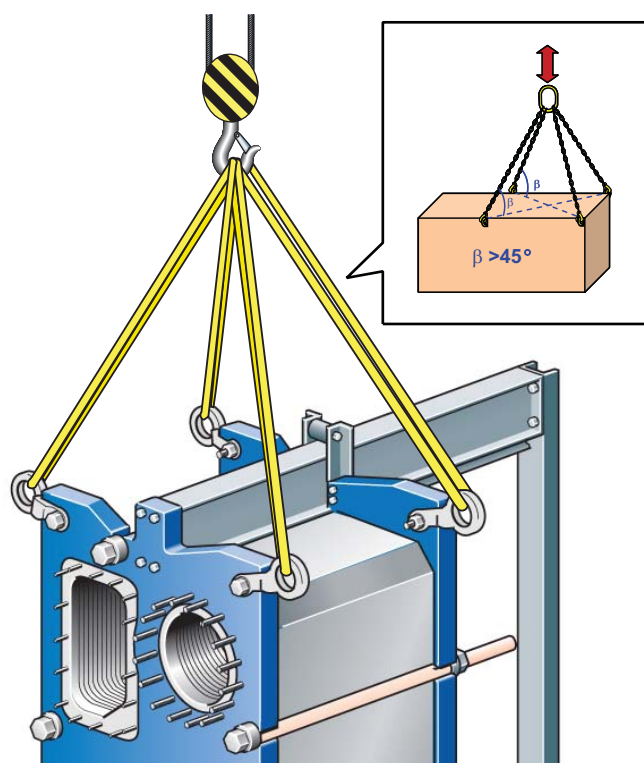
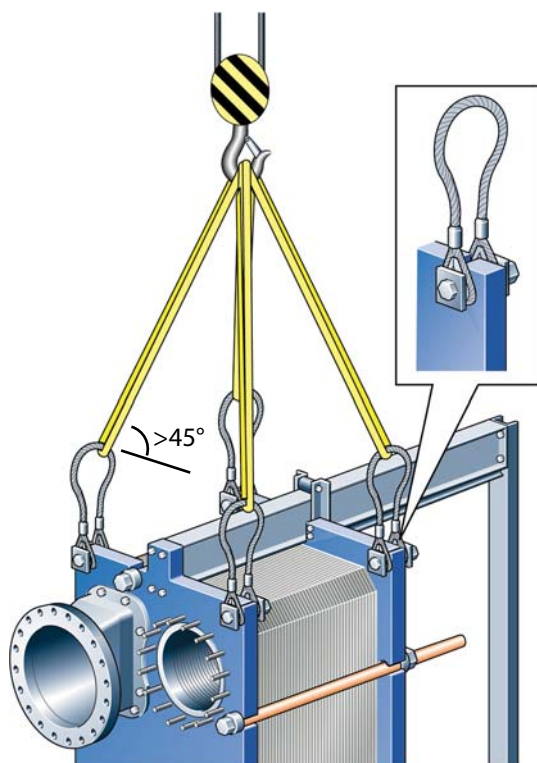
For each model, design pressures and temperatures are marked on the identification plate. Those must not be exceeded.

Lifting



Warning!

Never lift by the connections or the studs around them. Straps should be used when lifting and transport securing.

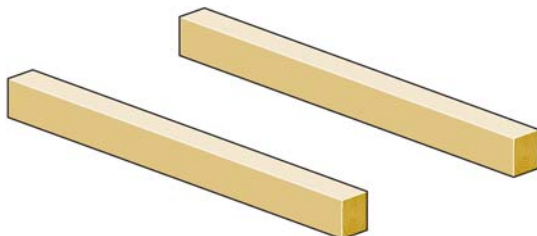


For detailed information contact Alfa Laval Sales representative for document "Cargo Securing Instructions" (3490003791, 3490003792 and 3490003793).

Raising

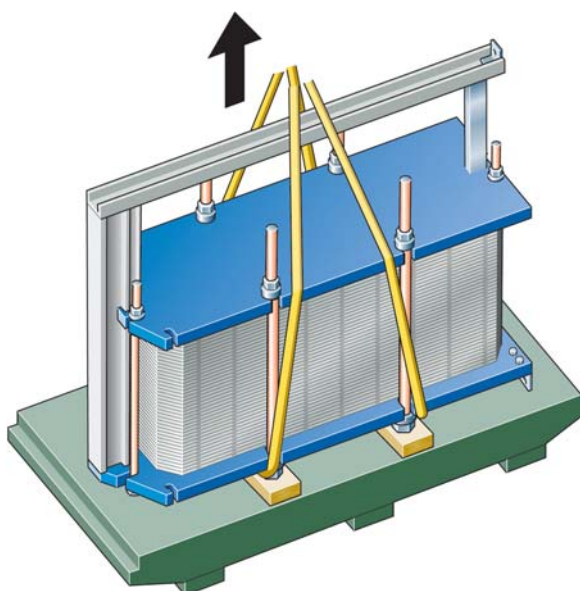
1

Place two timber beams on the floor.



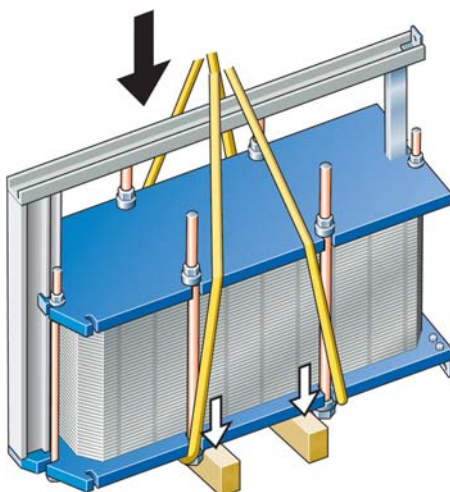
2

Lift the plate evaporator off pallet using e.g. straps.



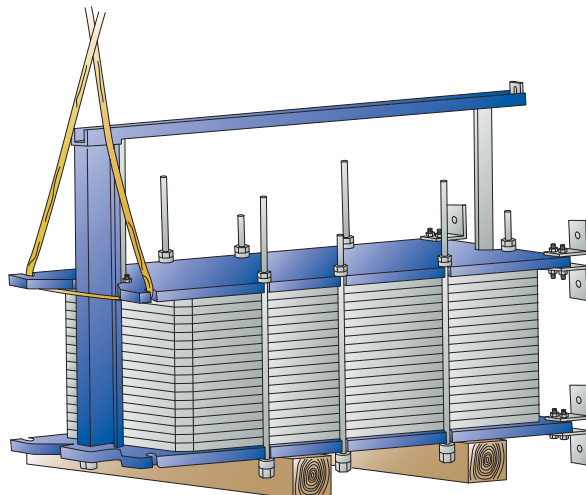
3

Place the plate evaporator on the timber beams



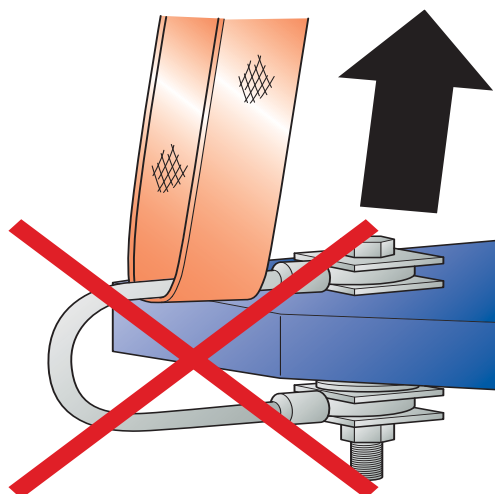
4

Place a strap into the notches as shown in the illustration. Only use a strap approved for the weight of the plate evaporator!



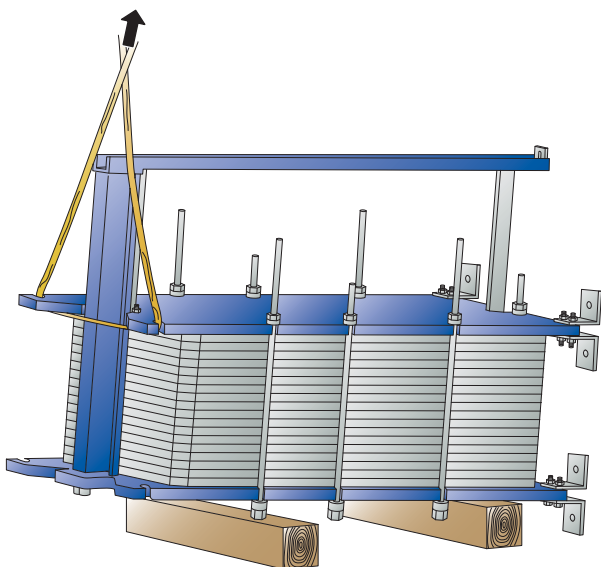
Warning!

Do NOT use the in the delivery included lifting device to raise the plate evaporator.



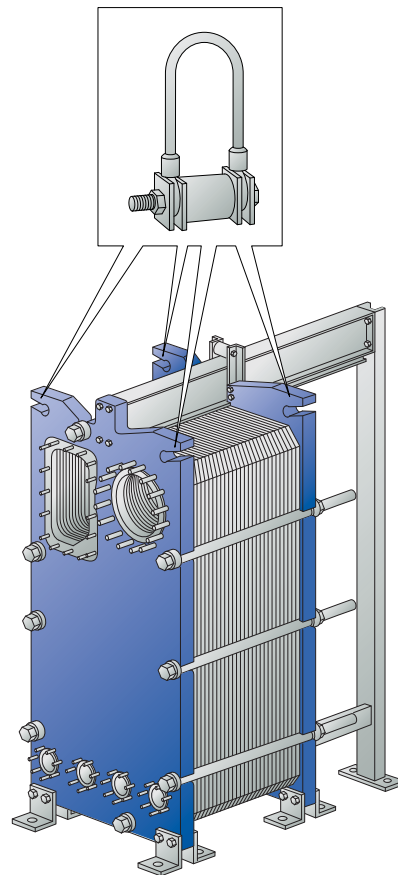
5

Lift the plate evaporator off the timber beams. Keep the strap stretched during the whole lifting procedure. Make sure the strap stays in place. Protect the feet of the plate evaporator from damaging.



6

Lower the plate evaporator to horizontal position and place it on the floor. Mount the enclosed lifting devices.



EN



Operation

Start-up

Note!

The following instructions are general and apply only to the Plate Evaporator – not to the installed system.

Note!

If several pumps and valves are included in the system, make sure you know which ones should be opened first.

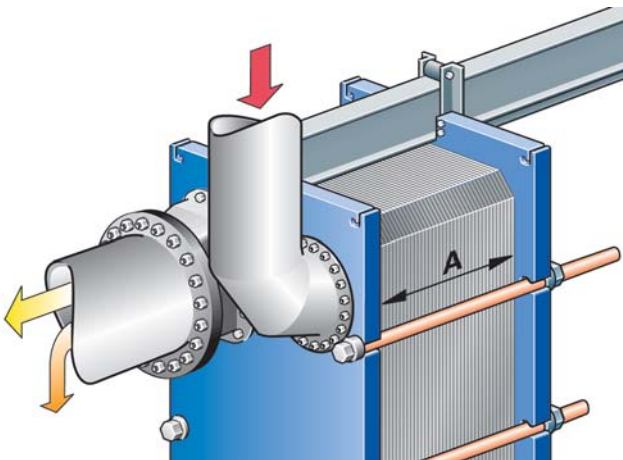
Note!

Adjustments of cooling water flow rate 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.

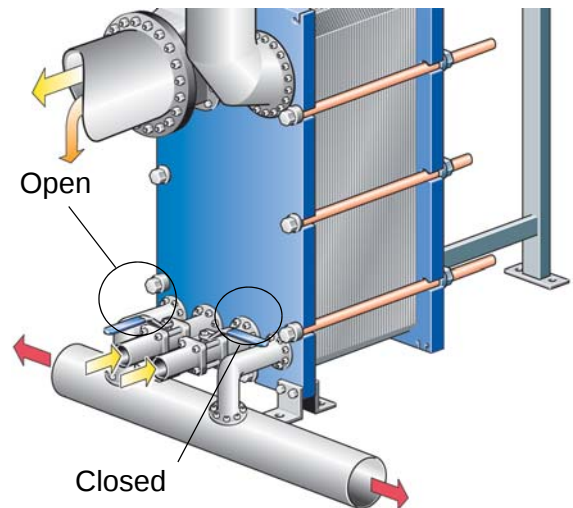
1

Before start-up, check that all tightening bolts are properly tightened and that measurement A is correct. For A, see enclosed Plate Evaporator drawing.



2

Check that the Plate Evaporator is fully isolated, i.e. all valves in connected pipework should be closed.



3

Open all valves in the condensate lines. This will allow non-condensable gases to leave the heat exchanger.

4

On the product side, check that the valve is closed between the pump and the unit controlling the system flow rate.

5

If there is an airvent valve at the exit, make sure it is fully open.

6

Start the product supply pump and open the supply valve/s slowly.

7

When all air is out, close the air vent valve.

8

Open the steam valve gradually.

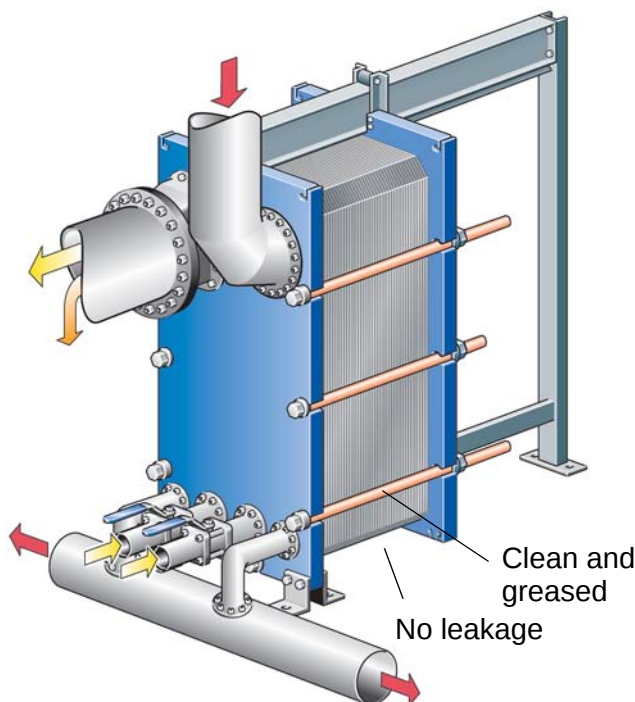
Unit in operation

Note!

Adjustments of flow rates 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 plate evaporator drawing
-  no leakages appear due to faulty tightening of the plate pack or to defective or damaged gaskets
-  carrying bar and guiding bar are kept clean and greased
-  the bolts are kept clean and greased.



Always consult your local Alfa Laval office 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 plate evaporator.

Shut-down

Note!

The following instructions are general and apply only to the Plate Evaporator – not to the installed system.

Note!

If several pumps and valves are included in the system make sure you know which ones should be closed first.

1

Steam supply

Slowly close the steam supply valves.

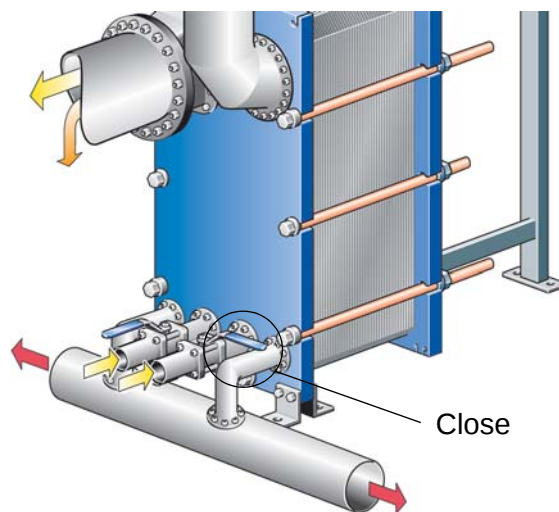
2

Product supply

Slowly close the product supply valve.

3

When the valve is closed, stop the pump.



4

Continue to fully isolate the Plate Evaporator, i.e. all valves in connected pipework should be closed.

5

Adjust the pressure to atmospheric pressure (only when opening the Plate Evaporator).

6

If the Plate Evaporator 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.



Maintenance

Cleaning-In-Place (CIP)

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

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

CIP performs

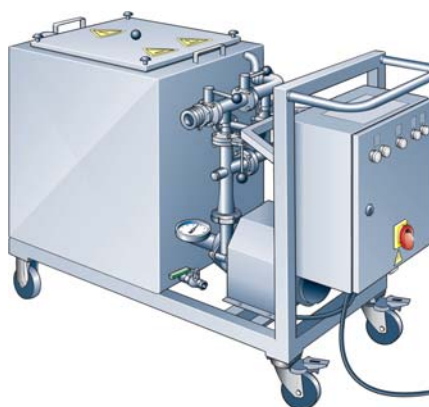
- cleaning of fouling and descaling of lime deposits
- passivation of cleaned surfaces to reduce susceptibility to corrosion
- neutralization of cleaning liquids before draining.

Follow the instructions of the CIP equipment.

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 AlfaPhos before drainage.
Alfa P-Scale	An acidic cleaning powder with a corrosion inhibitor particularly effective for removing of calcium carbonate and other inorganic scale.
Alfa P-Neutra	An alkaline powder for neutralization of used Alfa P-Scale prior to disposal.
AlfaAdd	A neutral cleaning strengthener to be used with AlfaPhos, AlfaCaus and Alfa P-Scale. Provides better cleaning results on oily, fatty surfaces and where biological growth occurs. AlfaAdd also reduces any foaming.
Alpacon Descalant	An acidic, water based, non-hazardous cleaning agent designed for removal of scale, magnetite, algae, humus, mussels, shellfish, lime and rust. Containing BIOGEN ACTIVE, a biological mixture made from renewable materials, as an active ingredient.
Alpacon Degreaser	A neutral degreaser to be used with Alpacon Descalant. Effectively removes oil, fat or grease layers, but also reduces foaming. Containing BIOGEN ACTIVE, a biological mixture made from renewable materials, as an active ingredient.

The following Alfa Laval-CIP models can be used: CIP75, CIP200, CIP400 and CIP800.

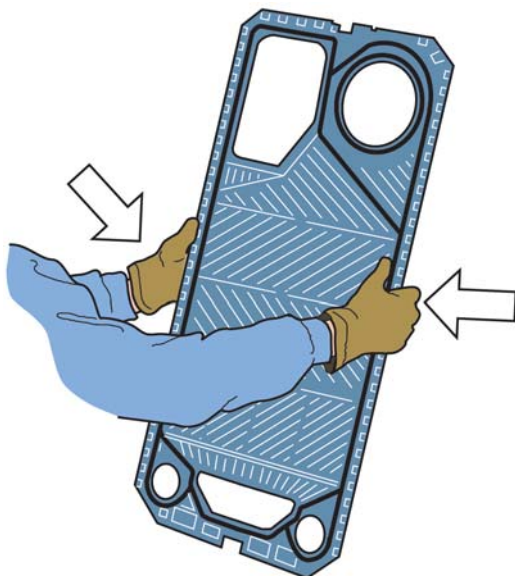


Manual cleaning



Warning!

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

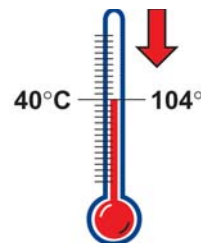


Opening



Warning!

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

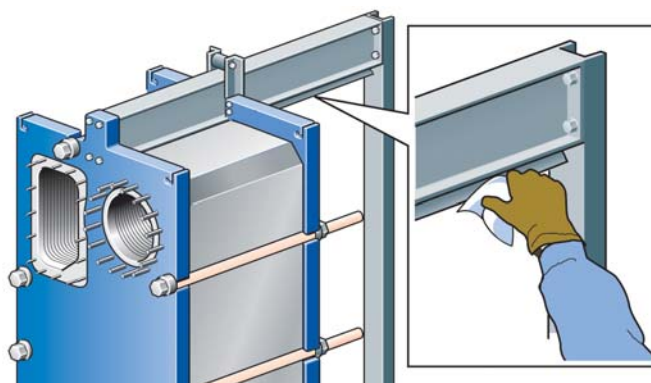


1

Drain the plate evaporator.

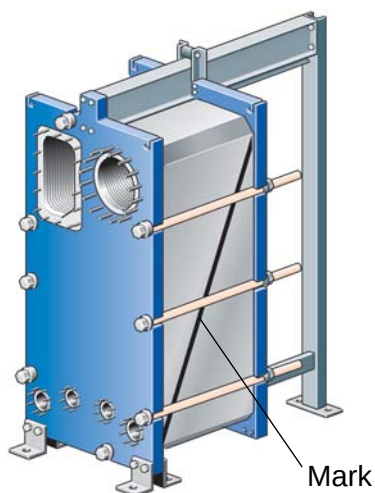
2

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



3

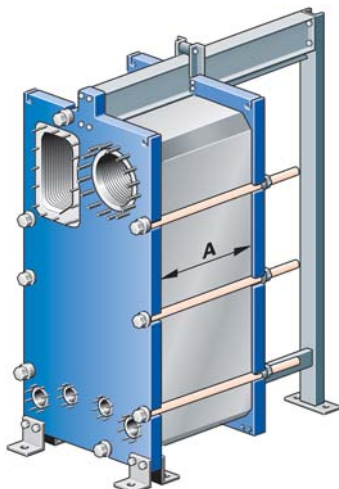
Mark the plate assembly on the outside by a diagonal line.





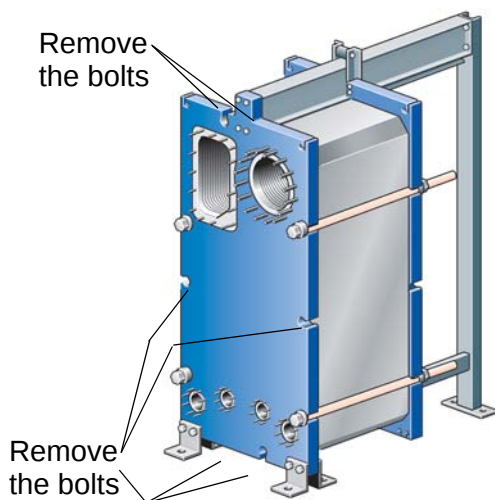
4

Measure and note down the dimension A.



5

Loosen the bolts which are not fitted with bearing boxes and remove them.



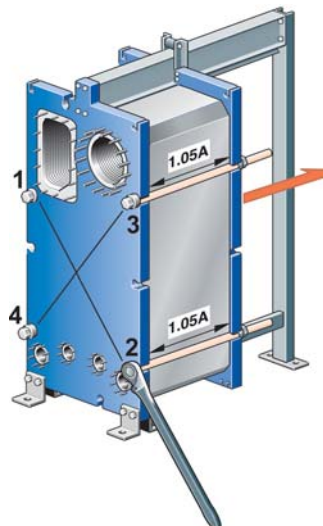
6

The pairs of bolts that are fitted with bearing boxes are opened alternately and diagonally in two steps, see figures below.

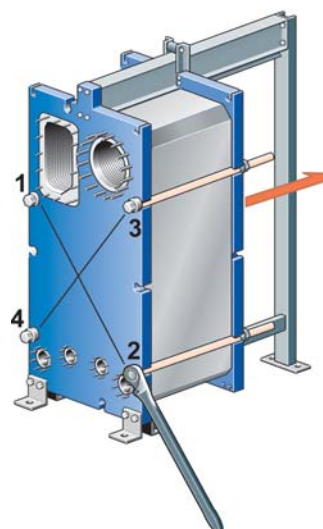
Step	Bolt No.	To dimension
1	1 – 2 – 3 – 4	1,05 A
2	1 – 2 or 3 – 4	Opening

Be careful so that the frame 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.

Step 1: Loosen the four bolts alternately and diagonally until the plate package measures 1,05A.

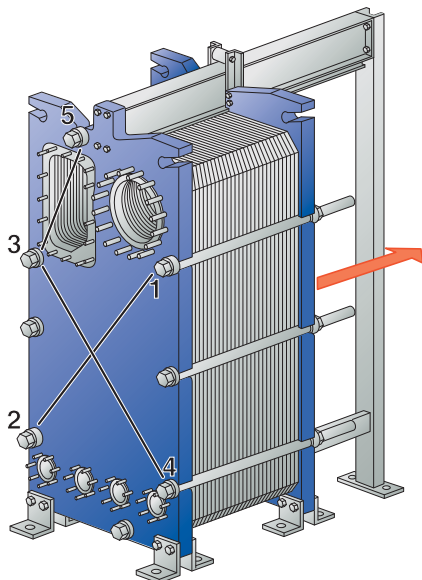


Step 2: Loosen the two diagonal pairs of bolts are loosened alternately, as shown in the figure below.



Note!

AlfaVap 650: Loosen the **five** bolts alternately until the plate package measures 1,05A

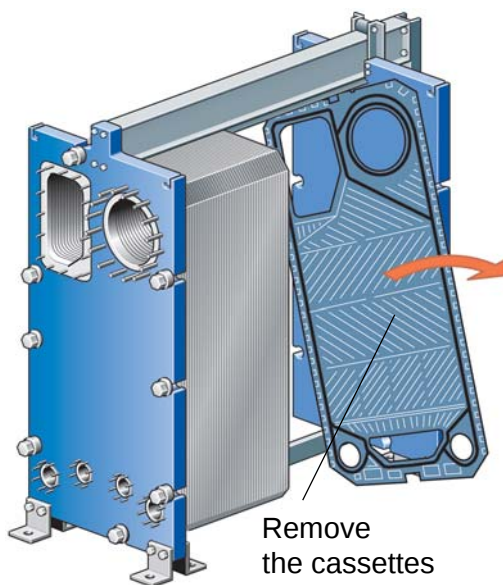


7

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

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

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





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.

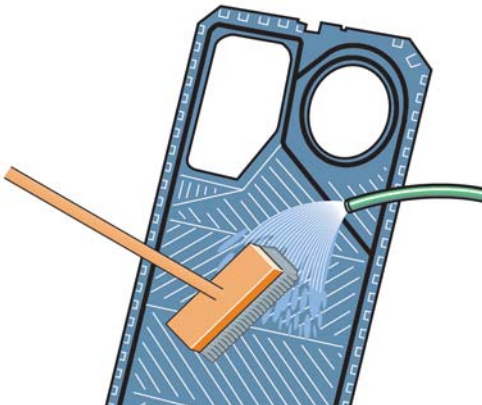
Note!

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 evaporator 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 evaporator 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.

**Caution!**

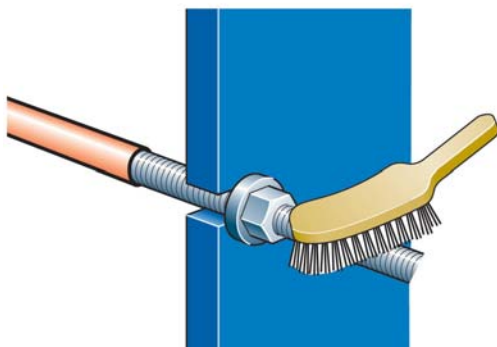
The following solutions should not be used:

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



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.

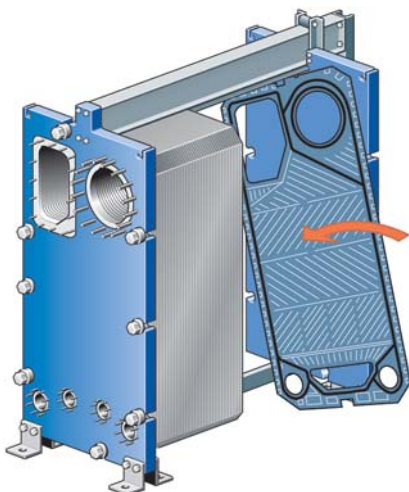


- 3 Attach gaskets to the cassettes or check that all the gaskets are properly attached.

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.

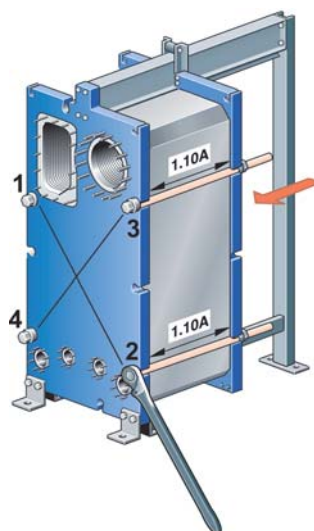
- 4 Insert the cassettes with the gaskets turned towards the frame plate.



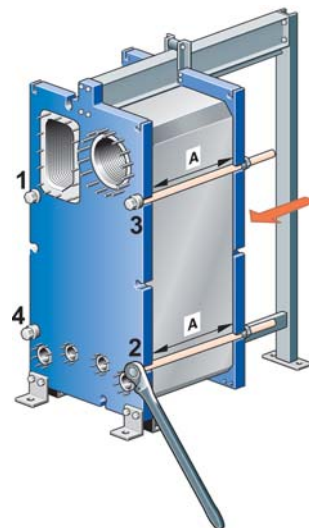
- 5 Press the plate assembly together. Tightening is done in two steps, see figures below. Be careful so that the frame plate and the pressure plate are always in parallel.

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

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

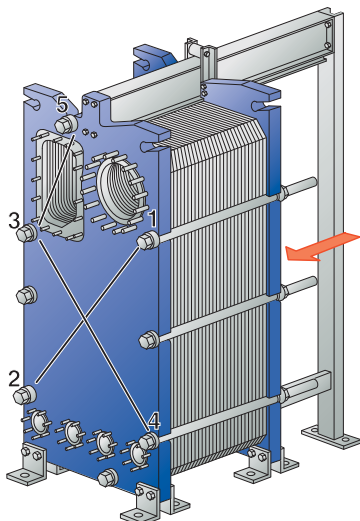


Step 2: After that bolts are tightened alternately and diagonally, as shown in the figure below. Check the dimension A during tightening at the positions of the bolts that are being used.



Note!

AlfaVap 650: Tighten the five bolts alternately until the plate package measures 1,10A.



Max tightening torque

Note!

When a pneumatic tightening device is used, see table below for maximum torque. Measure dimension A during tightening.

Bolt size	Bolt with bearing box		Bolt with washers	
	Nm	Kpm	Nm	Kpm
M39	1300	130	2000	200
M48	2100	210	3300	330

For manual tightening, the tightening torque has to be estimated.

If dimension A cannot be reached

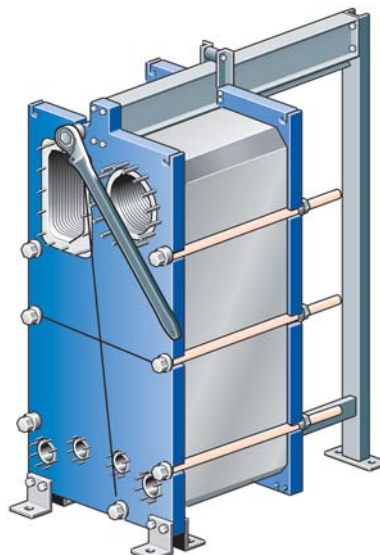
- Check the number of cassettes and the dimension A.
- Check that all the nuts and bearing boxes are running freely. If not, clean and lubricate, or replace.

The dimension A can be exceeded to $A + 1\%$ in exceptional cases.

6

Place the other bolts in position.

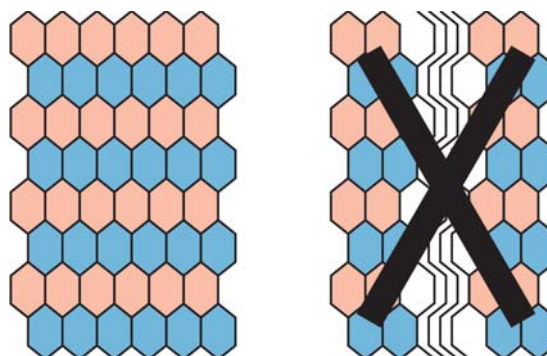
- Inspect the washers.
- When fully tightened, the bolts should all be equally tensioned.
- The difference between the plate package lengths (the dimension A) measured at adjacent bolts should not exceed:
 - 2 mm when $A < 1000$ mm
 - 4 mm when $A > 1000$ mm.
- The plate package length at all bolts must not differ more than 1 %.
- If the unit does not seal fully, it can be tightened to give dimension A - 1 %. The maximum tightening torque must not, however, be exceeded.



7

If the cassettes are correctly assembled, the edges form a “honeycomb” pattern, see picture below.

If the plate pack has been marked on the outside (see step 3 in section “Opening”), check that the cassettes have been assembled in correct order.





Regasketing

1

Open the plate evaporator according to page 8.

Glued gaskets

2

Separate gluing instructions will be delivered together with the glue.

Clip-on gaskets

3

Remove the old gaskets.

4

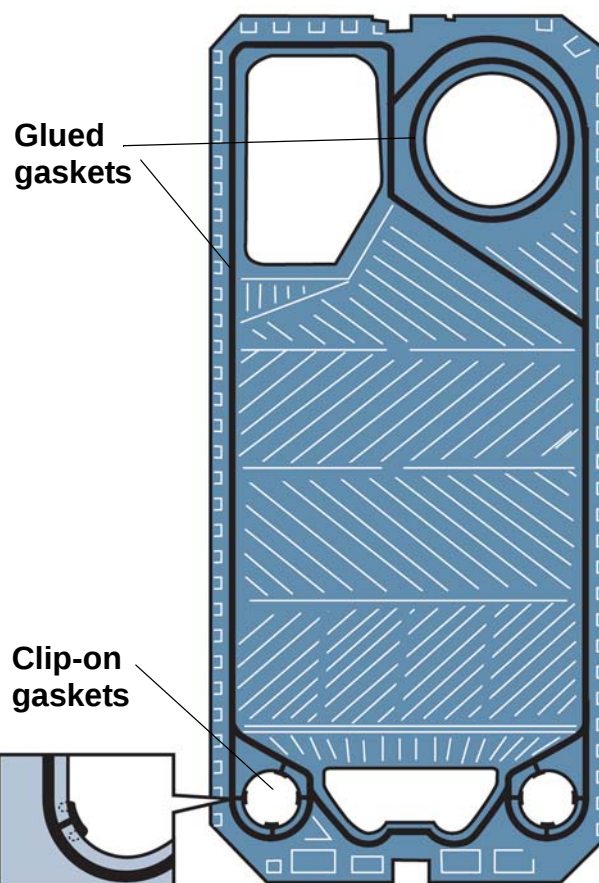
Attach the clip-on gasket to the cassette. Slip the gasket prongs under the edge of the cassette.

Note!

Make sure the two gasket prongs are in correct position.

5

Close the plate evaporator according to page 13.





Pressure test after maintenance

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.



Caution!

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



