

PLATE HEAT EXCHANGER

Type Sxx-xx-xx

Serie-No.:

xxxxx/xx/x

Operating & maintenance instructions

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The design and function

Plate heat exchangers

The plate heat exchanger consists of a frame, which consists of a head, follower, column, carrying bar, guiding bar, and a number of clamping bolts. In between head and follower a varying number of pressed plates are clamped together.

Each plate is supplied with a gasket, so that the plates form a closed system of parallel flow channels, through which the medias flow alternately at every second interval. (Fig. 1)

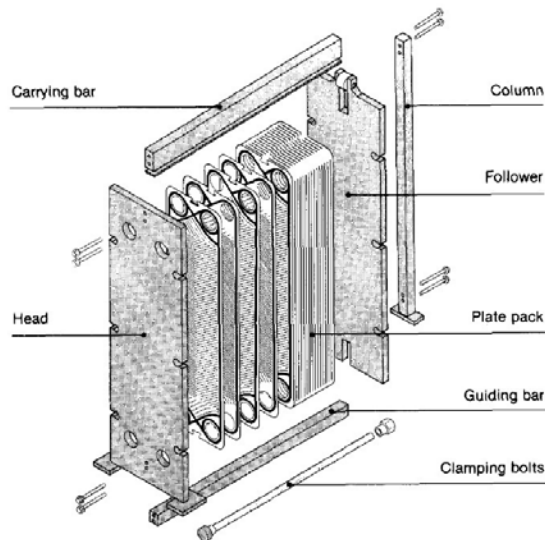


Fig. 1

The plate stack-media

The gaskets are glued on the plates, securing tightness between medias and the atmosphere. Between the different medias there are double gaskets, which have intermediate drain areas, meaning that mixing of the two medias is impossible.

Every second plate in the stack has to be turned 180°, so that the plates form a closed system of parallel flow channels, through which the medias flow alternately at every second interval. (Fig. 2)

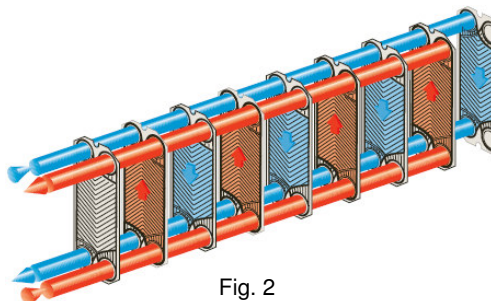


Fig. 2

Intermediate frames

If the plate heat exchanger works with several medias at the same time, it can be necessary to insert intermediate frames.

The intermediate frames are equipped with corner blocks, forming connections between the different sections. Two connections can be placed in the same corner block, having a connection to two different sections in the plate heat exchanger. (Fig. 4)

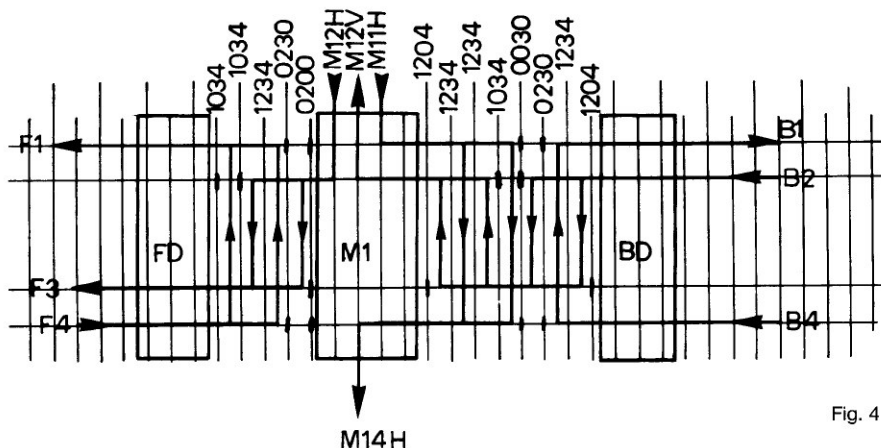


Fig. 4

The plates



Code-label

The plates are designed so they can be used both as right and as left plates. The plates just have to be turned 180°.

Right and left plates: On a right plate the flow runs from hole 2 to hole 3 or reverse from hole 3 to hole 2. On a left plate the flow runs from hole 1 to hole 4 or reverse from hole 4 to hole 1. (Fig. 3.)

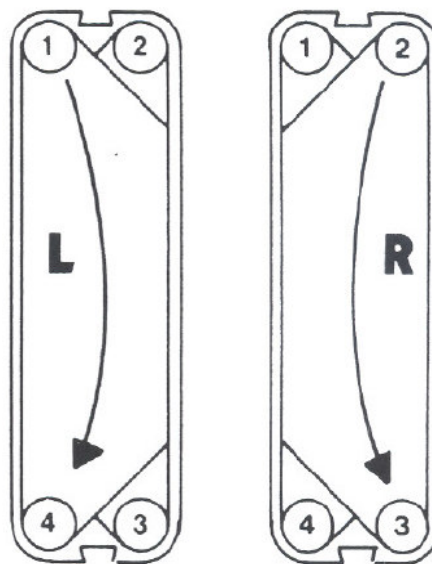


Fig. 3

The corner holes of the plates

Depending on the required liquid flow in the plate heat exchanger the 4 corner holes have to be opened. The corner holes named with numbers starting left side on the top of the plate (to be seen from the gasket side) as no. 1 after that continues no. 2, 3 and 4 clockwise. The corner holes are opened as you see on the diagram drawings, describing the liquid flow in the plate heat exchanger. (Fig. 4)

The opening of the corner holes are described in a code. For instance: 1234 means that all the corner holes are opened. Code 0204 means that hole 2 and hole 4 are open, and the holes 1 and 3 are closed.

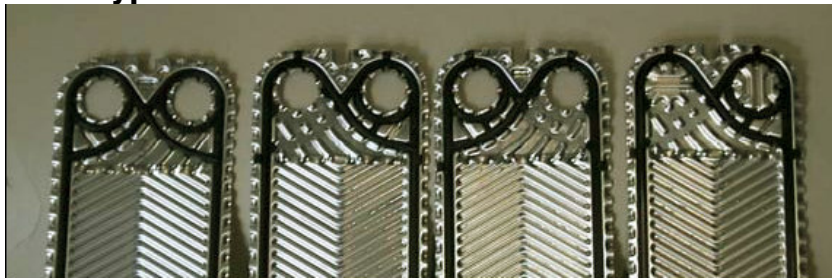
Changing of plates

Changing and mounting of new plates can be done after disconnection and removal of the assembling bolts. Before mounting of spare plates check if the plates are identical with the ones you want changed. Reduction of the number of plates is possible, but it is a condition that the plates are removed two by two so that the plate stack after reduction is still mounted by turns right and left plates. The removed plates have to have all 4 corner holes open. It is necessary to correct the minimum tightning measure after a possible reduction.

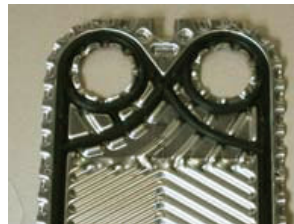
Note!

A reduction of the number of plates means that the transmission area of the plate heat exchanger is reduced corresponding to the plates being removed. A removal of plates will cause a rise of the pressure drop over the plate heat exchanger.

Plate types:



Start plate with gasket



Left hand flow plate with gasket



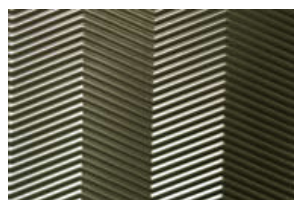
Right hand flow plate with gasket



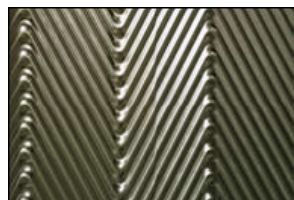
End plate with gasket



Thermal long plate



Thermal short plate



Drawings and name plate

On the last pages of this book of instruction you find 2 drawings of the plate heat exchanger - an assembly drawing and a diagram.

Assembly drawing

The assembly drawing indicates the measure of the plate heat exchanger, height, width, length and connection.
(Fig. 5)

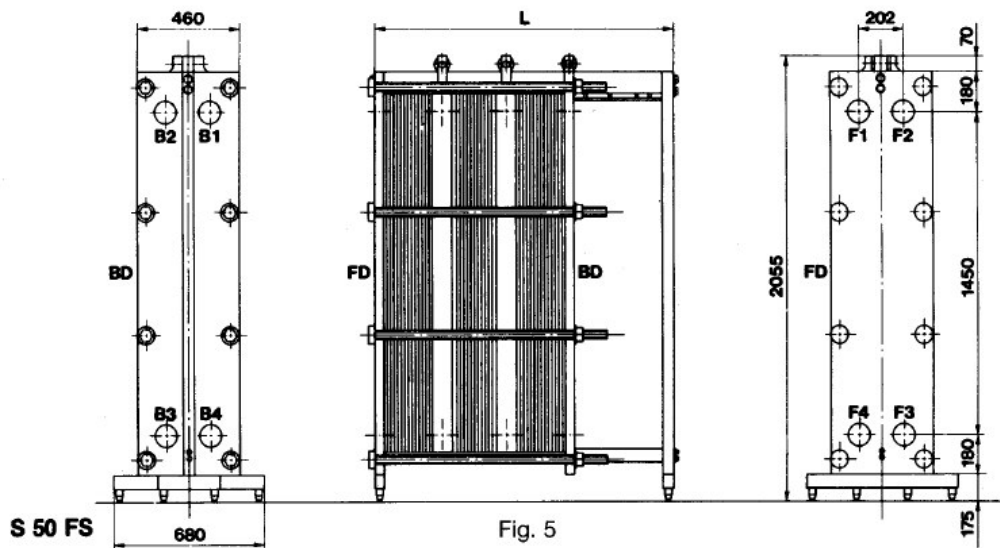
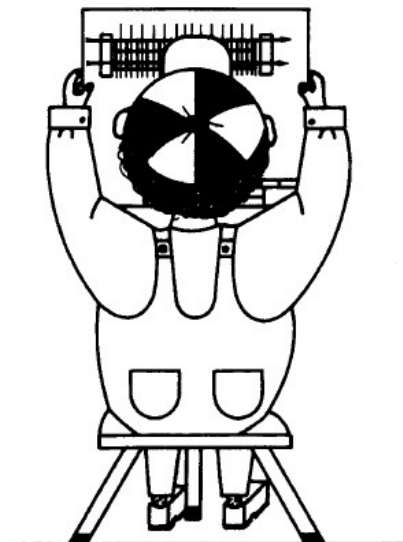


Fig. 5

Diagram

The diagram contains the following information:

- schematic flow diagram
- placing of connection
- dimension of connections
- plate heat exchanger type
- manufacturing number
- minimum assembling measure
- working pressure / testing pressure
- gasket specification (Fig. 6)

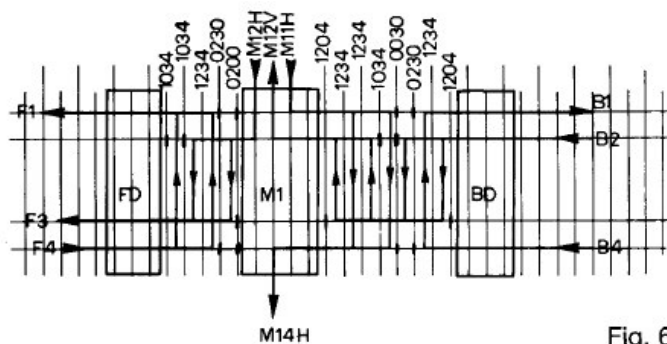


Fig. 6

Schematic flow diagram

The diagram shows the plate heat exchanger from the side, fig. 6. It shows the plate composition and the liquid flow in the plate stack. There are 4 lines going horizontal, showing the 4 corner holes. The long vertical lines show left plates. The short vertical lines show right plates.

On the diagram a left and a right plate are shown. On the left plate the flow runs from hole 1 to hole 4 or from hole 4 to hole 1. On the right plate from hole 2 to hole 3, or from hole 3 to hole 2.

The numer codes over the vertical lines show the corner holes which are open in the plates, to give the liquid flow wanted in the plate heat exchanger. This is de-scribed on Page no. 3 - about plates.

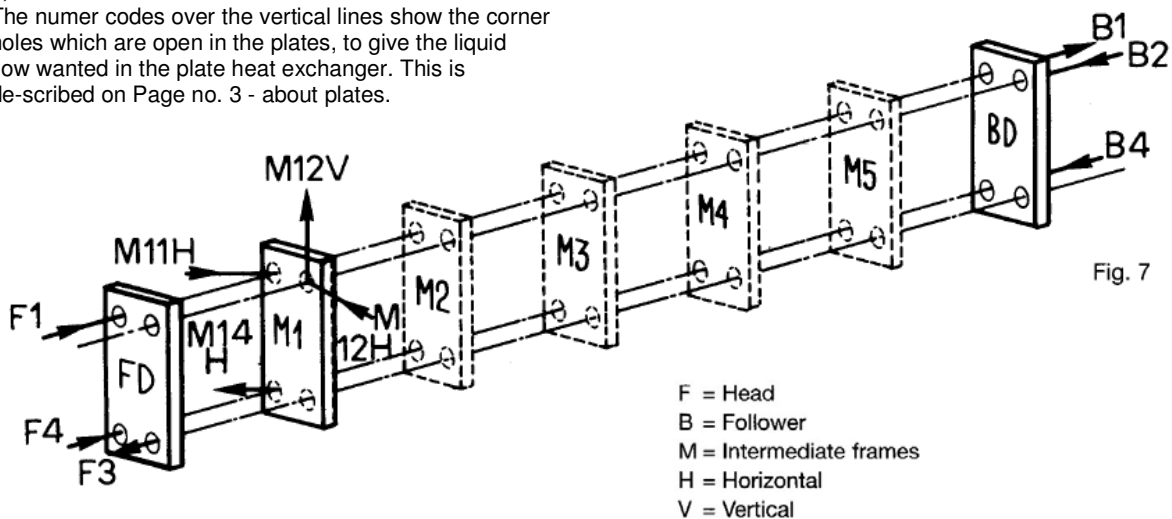
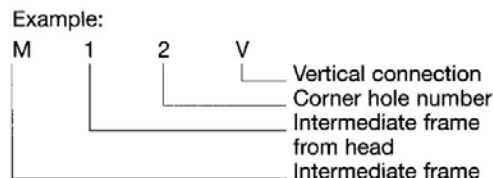


Fig. 7

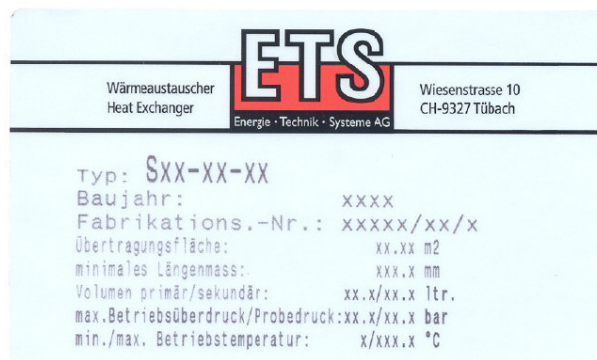
Placing of connections

On the symmetrical drawing under the flow diagram, the placing of the connections is shown. (Fig. 7) The dot-and-dash intermediate frames are drawn up according to the number of the intermediate frames in the plate heat exchanger. The connections are marked with a letter and a number code.



Name plate

On the head a name plate is mounted. The concerned plate is stamped with important information about the plate heat exchanger. (Fig. 8)



Gasket construction

New gaskets

On the enclosed diagram an order list for the gaskets is shown.

The first plate after the head and intermediate frames is to be mounted with a gasket in all the gasket grooves. These gaskets are cut out of ordinary gaskets. Therefore please note the cutting out of the old gaskets before removing them. (See fig. 9)

Glue less or glued gaskets

Some plate heat exchangers are delivered with glue less "Sonder Snap" gaskets. In these units it is possible to change the gaskets without using glue. However, the gasket on the first plate after the head and intermediate frame should be glued on as shown in fig.9.



Clip-on Gasket



Sonder Lock Gasket

Glue type

PLIOBOND 25 / SCOTCHGRIP 847 are nitrile rubber glues on soluble basis (25% solid materials).

The glues are partly thermoplastic so that old gaskets can be unsticked by boiling-water heating.

Detergent

For cleaning and degreasing new gaskets and gasket grooves use „ACETONE“. It is very important that every detergent is evaporated before putting glue on.

Caution:

Solvents are dangerous to inhale!

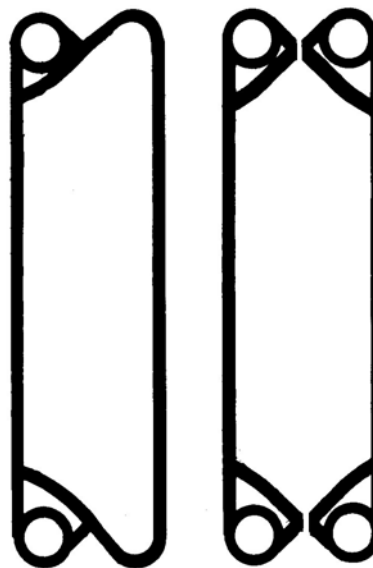


Fig. 9

Glueing

After wiping gaskets and gasket grooves with a cloth moistened with degreasing substance the glueing itself can begin. The glueing areas must be quite clean - free from fingerprints etc. The gaskets are covered by a brush with a thin coat of glue on the glueing area and are placed on a clean and dry place in order to dry.

The gasket grooves, too, are supplied with a thin coat of glue, after which the gaskets are pressed down equally all over in the groove. The glueing starts in the plate ends and then continues along the straight edges.

The glueing process is done easiest on a solid table. After the gaskets have been put into the plate gasket grooves the plates are stacked.

When the glueing is finished the plates are hung into the frames again and the plate heat exchanger is clamped together. See description „Opening and Assembling“ The plate heat exchanger can be warmed up by hot water if the glue is to dry quickly - but without pressure on the water!

Drying time:

Approximately 2 hours at 80-100°C (194-212°F)

Approximately 24 hours at 40-50°C (104°F)

Approximately 48 hours at room temperature.

If it is not possible to heat the plate heat exchanger it must be placed as warmly as possible and in order to let off glue vapour from the plate heat exchanger the connections are to be dismantled.

Installation of the plate heat exchanger

By installation of a plate heat exchanger there are 2 important things to observe:

- space requirements
- pipe installations



Space requirements

The plate heat exchanger requires space enough for it to be opened for inspection or repairs without problems. (fig. 10)

It is necessary for the plates and the assembling bolts to have so much space that they can be mounted and dismantled without problems. The follower has to be pulled back to the column before opening for service can be done without problems. (Fig. 11)

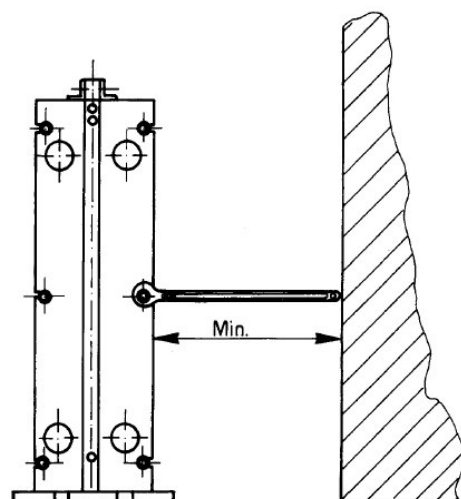


Fig. 10

Pipe installation

To make the plate heat exchanger yield the specified duty the pipe installation has to be mounted according to the attached diagram.

By construction of the pipe installation it must be considered that the rubberliners in the head of the plate heat exchanger can be removed.

The pipe connection always has to be mounted in a way, preventing the plate heat exchanger from being overloaded. The pipe connection must be so flexible that an extra tightening of the plate heat exchanger can be made.

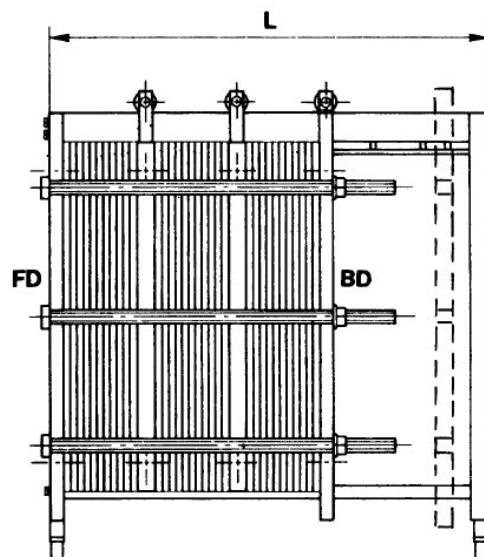


Fig. 11

Starting up and running instruction



By starting up and running of the plate heat exchanger the following points must be observed:

- working pressure
- pump start
- pressure pulsation and vibrations
- leakage during start up
- airing
- pressure rise and temperature change
- leakage during running
- longer working pauses

Working pressure

On the head of the plate heat exchanger a name plate is mounted. The maximum working pressure is stated and it must not be exceeded.

Pump start

Pump start always has to be done with closed valves. After that the maneuvering of the valves must take place slowly in the order to avoid liquid and pressure chocks.

Pressure pulsations and vibrations

No pressure pulsations and vibrations must be transferred from positive pumps or equipment like that. If these are transferred to the plate heat exchanger fatigue fracture in the plates can arise.

Leakage during start up

Leakage during start up can arise. This stops when gaskets and plates have obtained running temperature and when the pressure has equalized in the whole plate heat exchanger.

Airing

Air in the plate heat exchanger reduces the heat transmission and increases the pressure drop. Therefore the plate heat exchanger has to be aired.

Pressure rise and change of temperature

During running the pressure and the temperature have to be controlled frequently. A rising pressure drop and a falling heat transmission indicate that some scalling has deposited on the plates. The scalling has to be removed, see page 10 concerning cleaning the plate heat exchanger.

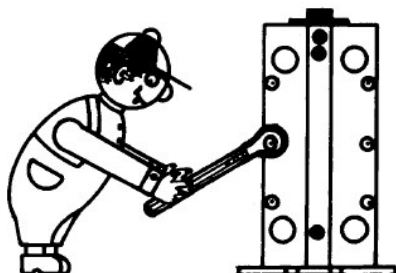
Leakage during running

See fault location on page 11.

Longer working pauses

A plate heat exchanger, which is out of work for a longer period, ought to be emptied and cleaned. After emptying and cleaning the plate heat exchanger is tightened gently and covered with black plastic to prevent the gaskets from being damaged by daylight. Before the plate heat exchanger is put to work again it must be tightened according to minimum measure. See page 9 under „Mounting and Assembling“

Opening and assembling



By opening and assembling the plate heat exchanger the following things have to be observed:

- without pressure and cooled
- opening and dismantling
- mounting and assembling

Without pressure and cooled

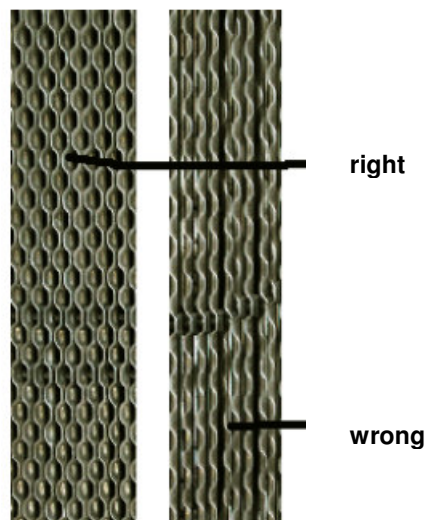
Before opening the plate heat exchanger be sure that there is no pressure in it and that the temperature is cooled down to 35°C. If the plate heat exchanger is opened at a temperature higher than 35°C, the gaskets can get loose from the plates.

Opening and dismantling

By opening the plate heat exchanger the bolts have to be loosened equally. (I.e. that the follower shall have a straight moving by opening). The last distance of the opening can be made by 2 bolts. After that, the follower is pulled back towards the column. If the plate heat exchanger is installed onboard a ship the follower has to be fastened to the column.

Mounting and assembling

The plates and the gaskets are checked carefully before mounting - the plates have to be clean and the gaskets have to be without fatty substance and other uncleanness. A grain or sand on the gasket can cause leakiness during running and damage of gaskets. The plates are being mounted according to the diagram - the gaskets always have to be turned towards



the head of the plate heat exchanger. If the gaskets have been changed or the plate heat exchanger has just been delivered the plate heat exchanger is assembled according to the minimum measure stated on the name plate and the enclosed drawings + 0.1 mm per plate.

During the assembling the head and the follower have to be parallel. It is therefore necessary to measure the assembling on the top and the bottom on both sides. (Fig. 12)

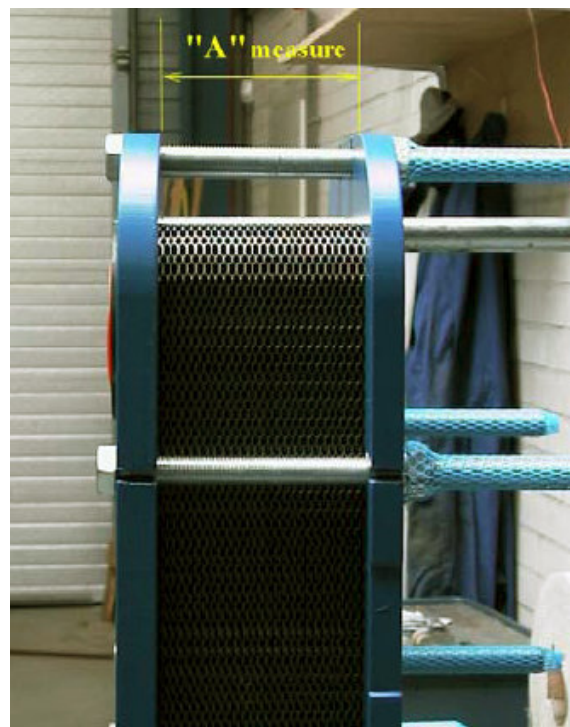


Fig. 12

Cleaning

As well the capacity as the corrosion resistance of the plate heat exchanger are depending on the cleaning of the plate heat exchanger.

- manual cleaning
- cip cleaning
- cleaning materials
- control of cleaning



Manual cleaning

The plate heat exchanger is separated and the plates are pulled from each other. Use a soft brush and a qualified cleaning material for cleaning the plates. If the cover is thick, from scale or organic material the plates are put in a vat with a qualified cleaning material. Wire brush, sandpaper, metalscraper etc. must not be used. Neither the plates nor the gaskets can bear heavy-handed / robust treatments. A high-pressure-cleaner can be used but with absolute care, and never add abrasives.



CIP cleaning

To use CIP cleaning (cleaning in place) it is a condition that the scalling on the plates is soluble. All materials in the whole circulation system of course have to be resistant to the cleaning material. The cleaning can be done without circulation, too. This is done by filling up the plate heat exchanger with a qualified cleaning material. After some time the cleaning material is washed out with clean water.

Example CIP cleaning:

- product rests arid cooling/heating liquids are drawn off
- rinse with cold or tepid water
- warm cleaning fluid circulates
- rinse with cold or tepid water
- rinse with water added a chemical
- rinse with cold or tepid water

Cleaning materials

A qualified cleaning material can shortly be defined as scalling on the plates is being removed without damaging plates and gaskets.

Stainless steel has a passivated (protecting) film. This film must not be destroyed, as the film assists in preserving the resistance of the stainless steel.

Fitted cleaning materials

Oil and grease is removed with a water emulsifying oil solvent i.e. BP system cleaner.

Organic and grease cover is removed with sodium hydroxide (NaOH) maximum concentration 1.5% - max. temp. 85°C. Concentration = 5.00 ltr. 30% NaOH per 100 ltr. water.

Stone - and limestone is removed with nitric acid (HNO₃) - max concentration 1.5% - max. temp. 65°C. 1.5% concentration = 2.4 ltr. 62% (HNO₃) per 100 ltr. water.

Nitric acid also has an effective build up effect on the passivation film of stainless steel!

Control of cleaning

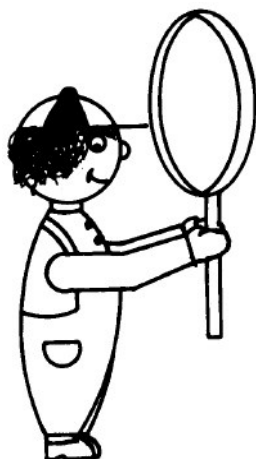
Cleaning is an important part, influencing on the effectiveness of the plate heat exchanger. Therefore the plate heat exchanger has to be separated for inspection - and especially in the commissioning period. You will obtain important experience concerning circulation times, temperatures, and chemical concentrations.

Reasons for insufficient cleaning often have to be looked for among the following:

- too low circulation quantity
- too short cleaning period
- too low chemical consumption compared to the scalling of the plates
- too long running intervals between the cleanings

Fault locations

- reduced capacity
- external leakage
- inside leakage



Reduced capacity

If a reduction of the heat transmission and / or a rising pressure drop is maintained, the plate heat exchanger has to be cleaned.

External leakage

- Maybe the plate heat exchanger is running with a higher working pressure than mentioned on the name plate. In that case the pressure has to be controlled and if too high it has to be reduced immediately to what is written on the name plate.

- Tighten the plate heat exchanger to the minimum measure which is mentioned on the name plate. It goes without saying that the plate heat exchanger has to be pressureless before tightening.

- The plate heat exchanger is separated for inspection. Check that the plates are without scalling and undeformed. Check the gaskets. They have to be elastic, undeformed and to have a clean surface. All gaskets and plates are cleaned carefully - even a grain of sand on the gasket surface can cause a leak.

A plate stack, assembled to a minimum measure after cleaning, has to be tight. If a leakage is still present the gaskets normally have to be changed. If there is a leakage through the drain holes of the gaskets the reason can be a defective gasket in the drained zone or a corroded plate in the drained zone.

Inside leakage

If the liquid is mixed it is due to holes in one or more plates. The leaks can only be repaired by changing the defective plates.

A suspected leakage can be located in one of the following ways:

- Remove a pipe on one of the bottom pipe connections
- then put the opposite side under pressure.

After the pressure is stabilized the liquid must not run off from the removed pipe connection. If the liquid continues to run off there is a leak on one or more plates. The plate stack is demounted and every single plate is examined carefully.

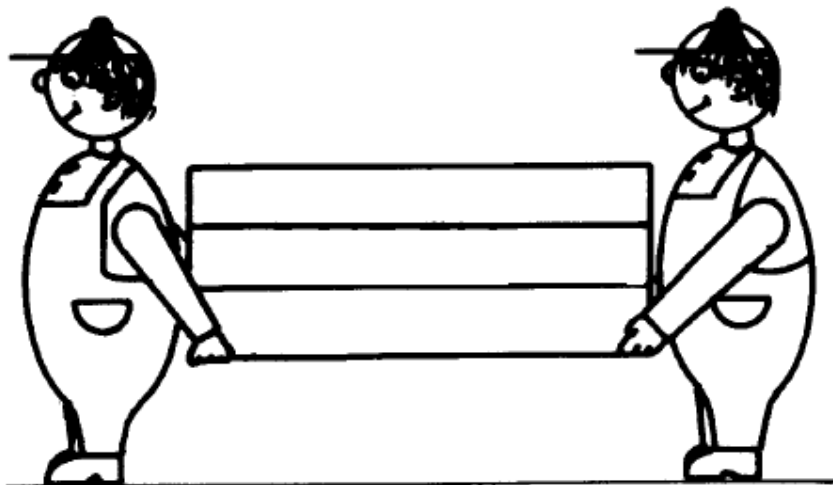
- The plate heat exchanger is separated and all the plates are dried. After drying the plates are put into the plate heat exchanger and assembled. Now the liquid is circulated with full capacity but only on one side (every second plate interval). The other half of the plate interval is kept without pressure and without liquid.

The circulation is stopped after a few minutes and the plate heat exchanger is opened carefully so that no water is sprayed on the dry plate side.

The plates are examined carefully and thus it is possible to find the wet areas on the dry plates. The areas have to be controlled with capillary liquid.

- The plate heat exchanger is separated and all plates are controlled with the capillary liquid.

Spare parts



The type designation of the plate heat exchanger and the manufacture number (is on the name plate which is placed on the head cover) ought to be mentioned by ordering spare parts. This to prevent fault delivery.

-ordering single gaskets it is important mention the correct quality.

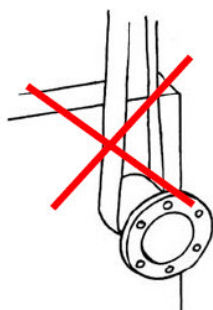
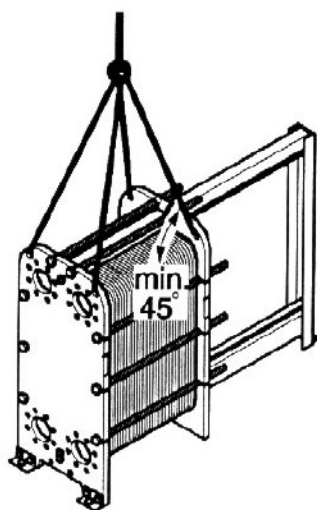
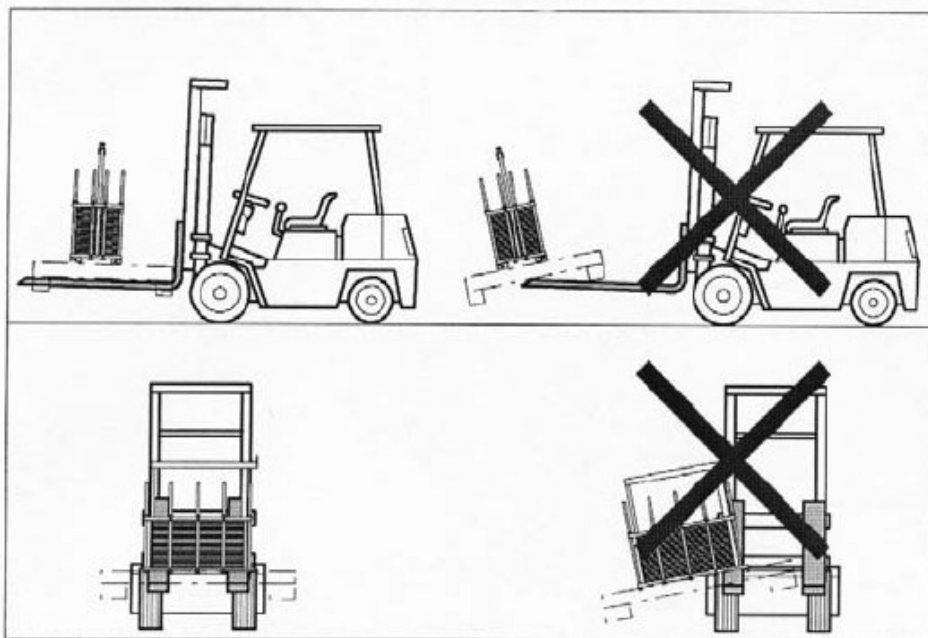
The quality appears from the diagram and the colour marks on the gasket.

- by ordering plates it is important to mention the right pattern code and if it is right or left plates-see the plates on page 3.

- by ordering assembling bolts it is necessary to measure the old assembling bolts to secure delivery of the right size of bolts.

- by ordering a complete set of gaskets and the glue for these and the cleaning fluid it is enough to mention the manufacture number or the number of the drawing.

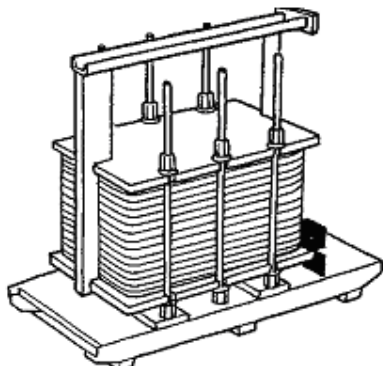
Transport



Warning:
Never lift the heat exchanger by using the connections or studs around them!

Lifting the plate heat exchanger

1.



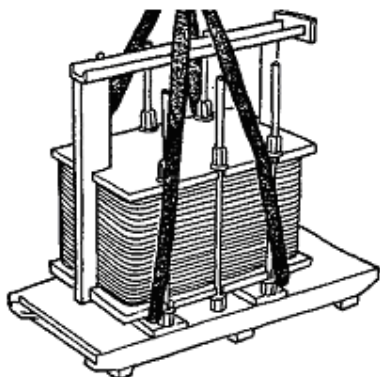
Remove the support feet.

2.



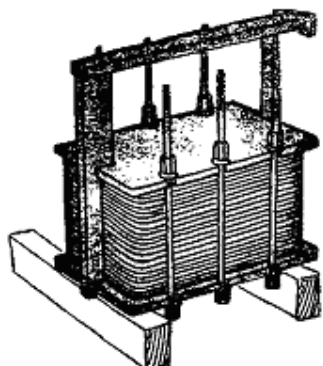
Place two wooden beams on the floor.

3.



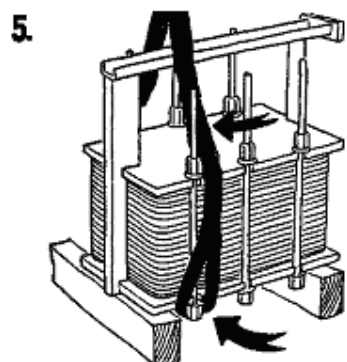
Lift the heat exchanger away from the pallet,
for example using a hoisting belt.

4.

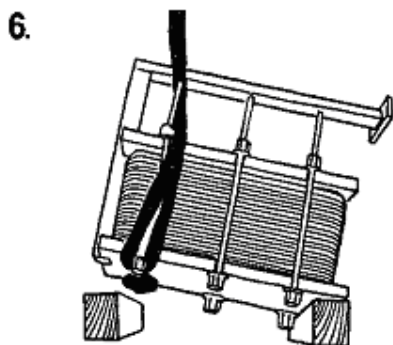


Place the heat exchanger on the wooden
beams.

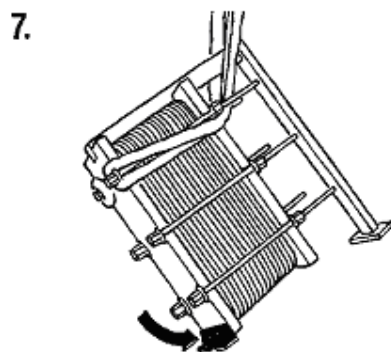
Lifting the plate heat exchanger



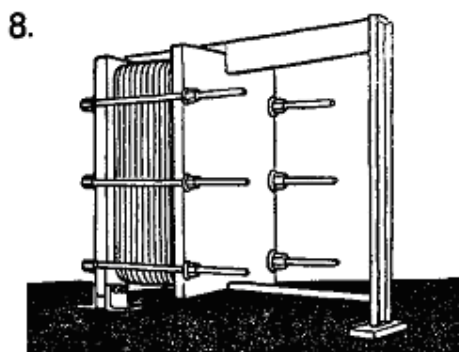
Attach a hoisting belt on each side around one bolt.



Lift the heat exchanger away from the wooden beams.



Screw the support feet on.



Lower the heat exchanger horizontally and place it on the floor.

IMPORTANT:

- **The heat exchanger must not be clamped together below the specified min. length. Please contact ETS AG if leaks occur with the min. length.**

- **The unit may only be pressurised slowly. In the event of fast-changing pressures or pressure surges, the normal warranty will be void.**