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UNEX HEAT EXCHANGERS

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INSTRUCTIONS FOR

PLATE HEAT EXCHANGERS

UniGasket

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1) PRINCIPLE AND CONSTRUCTION

1.1) PRINCIPLE OF THE PLATE HEAT EXCHANGER

A plate heat exchanger consists of an edge clamped frame within which a number of cold pressed plates are compressed. These are made with special corrugations which ensures turbulent flow and high heat transfer coefficients.

1.2) CONSTRUCTION OF THE PLATE HEAT EXCHANGER

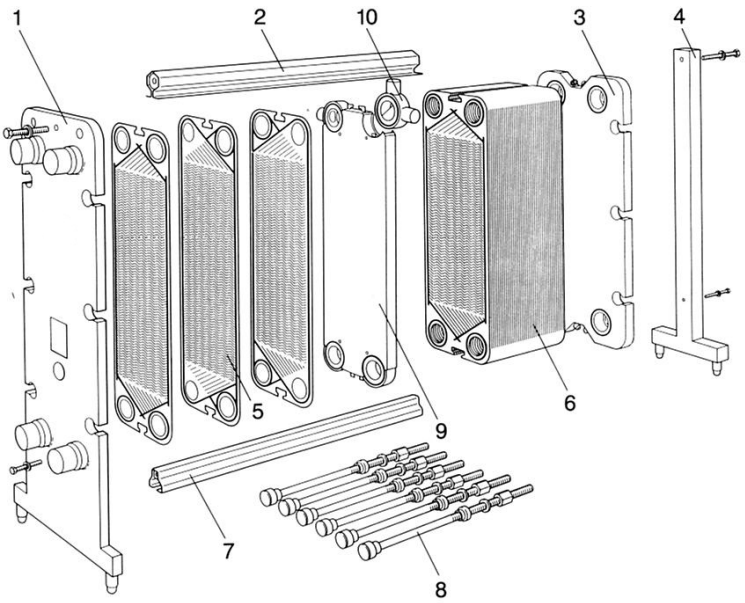

Fig. 1

1. Head
2. Top bar
3. Follower
4. End support
5. Flow plate
6. Plate pack
7. Bottom bar
8. Tie bolts
9. Connector grid
10. Connector boss

Example of plate heat exchanger coated with stainless steel. Connector grid (9) and connector bosses (10) are only used in plate heat exchangers with two or more sections.

2) FUNCTION

2.1) FUNCTION OF THE PLATE HEAT EXCHANGER

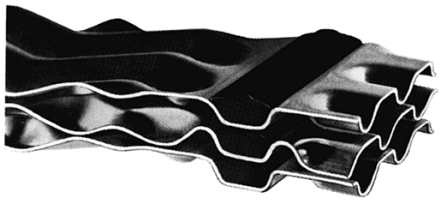

Fig. 2

2.1.1) PLATES

After clamping of the plate pack, the plates – which are fitted with gaskets – ensure, an effective seal between fluids and atmosphere (fig. 2).
In addition, intermixing of the fluids is eliminated by a double gasket seal around the inlet ports (fig. 3). Every second plate is turned through 180 degrees. This means that the double gasket seal occurs around every second inlet to the channels between the plates.
The plate pack now forms a series of parallel flow channels in which the fluids flow in a counter current regime (fig. 4).

2.1.2) CONNECTOR GRIDS

Connector grids must be inserted in a plate heat exchanger operating simultaneously with several media.

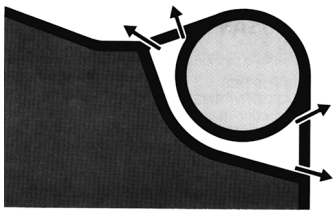

Fig. 3

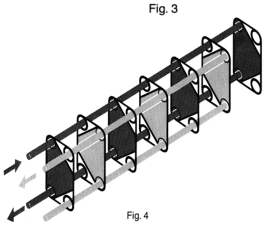

Fig. 4

late
ons.
The connector grids are equipped with exchangeable connector bosses (fig. 5).
The connector bosses form the connecting link between the respective sections of the plate heat exchanger and/or connections for pipes. Two connecting branches can be provided in the same connection boss with connection to their respective section.

2.1.3) SEPARATING PLATES

Plate heat exchangers with more than one section requiring no inlet/outlet branches in the separation can be equipped with separating plates (strong sheet, 2-10 mm) or flow plates equipped with reinforced blankings.

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2.2) ASSEMBLY DRAWING

Normally, an assembly drawing will be attached to the plate heat exchanger. This shows all principal dimensions as well a connection specifications and identification. Figures 6 a-b-c show examples of the construction of a plate heat exchanger:

HEAD = Head
G = Connector grid
FOLL. = Follower
H = Horizontal connection
V = Vertical connection

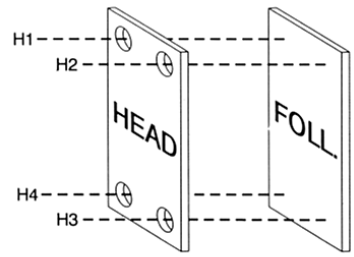


Fig. 6 a

1 section
1 pass

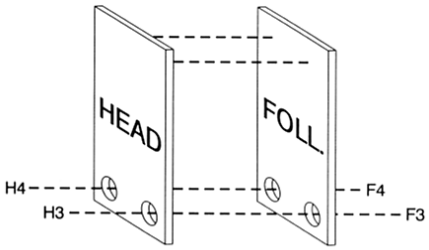


Fig. 6 b

1 section
2 passes

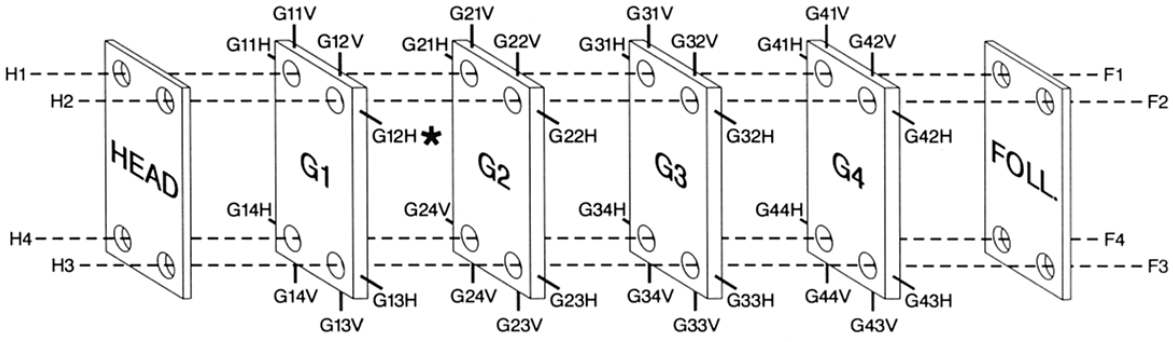
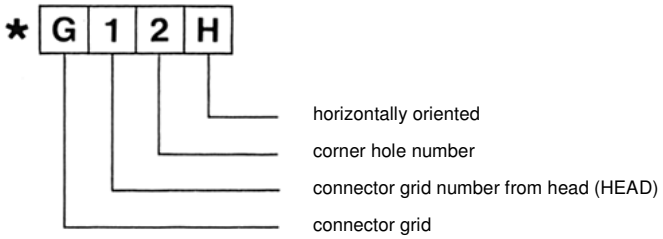


Fig. 6 c

5 sections



2.3) DIAGRAM (FIG. 8)

2.3.1) CONFIGURATION OF THE DIAGRAM

The plate pack is suspended between the head and the follower. The gasket side of the plates must always face towards the head. On the right-hand side of fig 8. can be seen a single plate viewed from the gasket side. The corner holes of the plate are designated 1-4.
Inter-connecting lines have been drawn from the plate pack to the four corner holes of the plate. The flow channels for each fluid are marked with a thick or a thin line to ease identification.

2.3.2) EXAMPLE

Figs. 7, 8 and 9 show the same plate heat exchanger with a heating and cooling section separated by a connector grid G1. The cold fluid enters the heating section via H1 in the head and flows through two parallel channels in one pass before entering the cooling section via hole 4 in the connector grid. From here the fluid is cooled in two passes, each with two parallel channels, before leaving the plate heat exchanger through F4 in the follower.

The heating medium enters through head (H3 in HEAD) and leaves again through head (H2 in HEAD).
The cooling medium enters through follower (F3 in FOLL.) and leaves through the connector boss of the connector grid (G13H).

2.3.3) REFERENCE NUMBER AND PUNCH CODE

The material quality and the four first digits of the reference number of the plate are stated in the top left-hand corner of the diagram fig. 8 (No. 1075). The four last digits of the eight-digit reference number are placed on the plate together with a punch code. The code indicates which corner holes are open to allow fluid flow. For example: 1204* means that this plate is open in corners 1, 2, and 4, whereas corner 3 (marked with 0) is closed.
The letter H at the top is explained in section 5.4.1.

2.3.4) SERIAL NUMBERS

The numbers of the diagram – under the plates – are serial numbers, i.e. indication of the placing of the plates in the plate heat exchanger.

Serial numbers start with number 1 for the head and after that continuous numbers for each plate , connector grid, or separating plate. When extending the plate pack, the existing numbers are used, but the new plates are marked with an extra figure, e.g. 16, 17, 18, 18-1, 18-2, 18-3, 18-4, 19, 20 etc.

2.3.5) REFERENCE NUMBERS AND GASKETS

The diagram gives the reference number of gaskets for each section in the plate heat exchanger as well as quantity and reference numbers for glue and cleaning fluid for a complete replacement of all gaskets.

2.3.6) CAPACITY

The data list on the diagram gives the capacities and other criteria used for the design of the plate heat exchanger.

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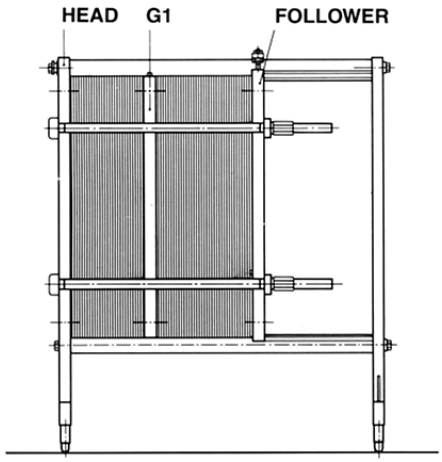

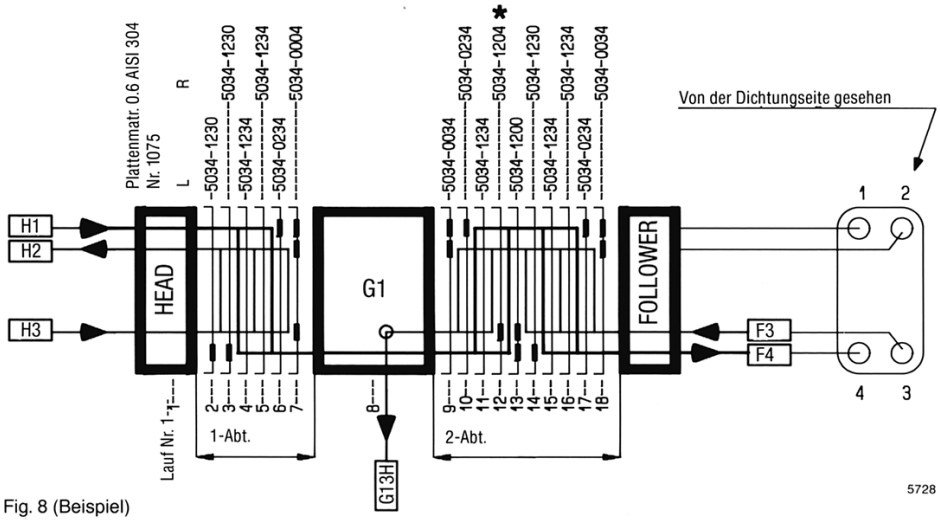

Fig. 8 (Beispiel)

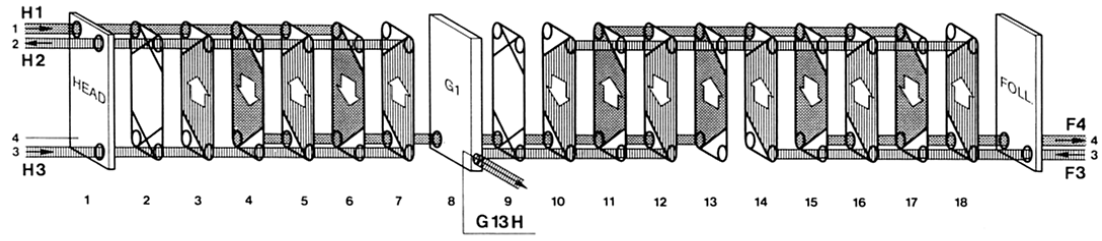

Fig. 9 (Beispiel)

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3) MOUNTING INSTRUCTION

3.1) ASSEMBLING OF EDGE-CLAMPED FRAME

3.1.1) Start by erecting the head (HEAD). Secure the bottom bar (E) to the head by bolts and block it up (1), bolt the end support (2) on the bottom bar (E).

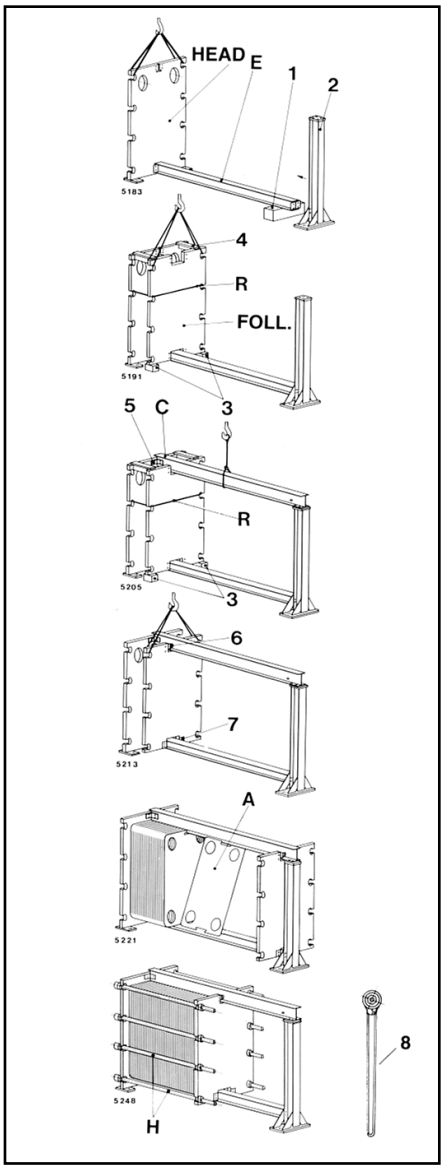
3.1.2) Place the follower (FOLL.) on two blocks (3) approx. 200 mm from the head (HEAD). Place two spacer blocks (4) at the top between the head and the follower. Retain the follower (FOLL.) with a rope (R), and remove the scotching (1).

3.1.3) Bolt the top bar (C) on the end support and the head with the fittings (5).

3.1.4) Fit the fittings with rollers (6) on the follower (FOLL.) so that the rollers are exactly opposite each other. Mount the bottom bar fitting (7) on the follower. Adjust the height of the follower by means of the roller fittings. Remove the blocks (3 and 4) and the rope (R).

3.1.5) Push the follower to the end support. Worm the plates (A) on. The top bar one by one, turn thern over the bottom bar, and push thern towards the head. Insert the plates in serial-numerical order as stated in the diagram. The serial numbers must be upwards and the gasket side must face towards the head.

3.1.6) When all the plates have been correctly assembled, push the follower against the plate pack – mount the tie bolts (H) – apply a high pressure lubricant to the threaded ends of the tie bolts. Clamping should be carried out using a ratchet spanner (8) or a similar suitable tool. Start clamping with two tie bolts diagonally opposite each other. These tie bolts can be tightened almost to the minimum plate pack dimension. Continue by clamping all the tie bolts in a diagonal manner. Keep the head and the follower as parallel as possible during clamping and check at all tie bolts! (max. deviation 10 mm per m distance between the tie bolts). The minimum clamped plate pack dimension is shown on the machine plate on the head.



3.2) MOUNTING REQUIREMENTS

The plate heat exchanger should be placed in such a way that service and inspection can easily be effected.

3.2.1) SPACE REQUIRED

On a least one side of the plate heat exchanger there must be sufficient space to unhook the plates from the top bar by a slight tilt away from the vertical. At the same time it must be possible to tighten or remove the tie bolts and inspect the plate heat exchanger (fig. 11).
It must be possible to take off the spray screen or insulating jacket, if any, without having necessarily to remove the connecting pipes. This must be considered when installing the unit. All engagements are carried in a straight pipe section without thermometer, manometer or draw off taps at a distance of 100 mm from the unit (more in case of increased insulating thickness). The distance to finish-insulated pipes should be 100 mm from the insulating jacket/spray screen. The follower must be free to move along the full length of the top bar as shown in fig. 10. See dimensions for exactly your plate heat exchanger at the back of this manual.

3.2.2) PIPE CONNECTIONS

The plate heat exchanger must be connected up according to the enclosed assembly drawing.

Threaded connections should be mounted with unions or flanges with plane tightening to facilitate removal – alternatively with conical tightening connected to bends.
Flanged connections must be removable. Fig. 12 shows a correctly connected unit. If necessary, a suitable filter should be installed on the fluid inlet. Insulating valves are also recommended on all connections. Thermometers, pressure gauges etc. should be used as required for monitoring the plate heat exchanger performance.

3.2.3) CORRECT PIPE MOUNTING (Fig. 12)

To prevent undue strain on the plate heat exchanger frame, all pipes must be unloaded by suitable pipe holders.
The pipe joints on the follower (FOLL.) 1 and 2 must be removable in order to enable the plate heat exchanger to be opened for cleaning and inspection.
For re-tightening of the plate pack, the pipes onto the follower and any connector grids must be flexible. This can be achieved by the use of expansion joints.
During opening, it must be possible to move the follower 3, without hindrance, along the full length of the top bar. For CIP (cleaning in place), without opening, piping material and layout must be chosen accordingly.

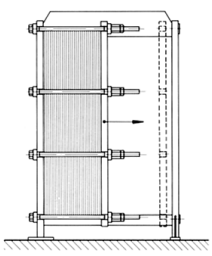


Fig. 10

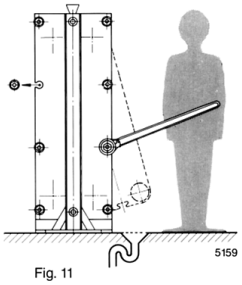


Fig. 11

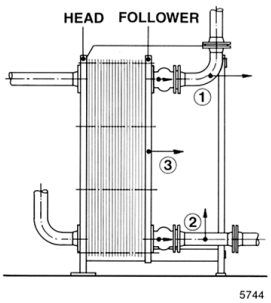


Fig. 12

3.2.4) PRESSURE PUL-SATIONS/VIBRATIONS

Piston pumps, gear pumps, dosing devices etc. must not be able to transfer pressure pulsations/vibrations to the plate heat exchanger as this may cause fatigue fracture in the plates.

3.2.5) EXCESS PRESSURE PROTECTOR

Excess pressure protector must always be mounted (fig. 13), if the plant is likely to develop a higher pressure than that stated on the machine plate. This condition may arise during pump start up, expansion or valve change-over etc.

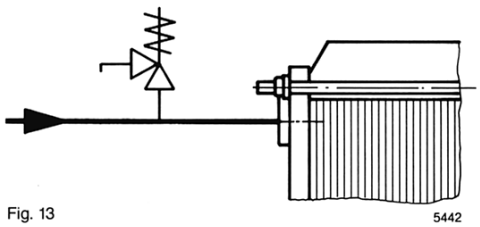


Fig. 13 5442

3.2.6) LIQUID HAMMERING

The plate heat exchanger is sensitive to liquid hammering. This can occur during regulation, change-over, pump start-up etc., see section 4.4.1. In order to avoid this situation, the use of throttling of air-operated valves, damping relays in electrical control gear, automatic pump start with closed valves etc. is recommended.

3.2.7) SHIELDING

The plate pack must be shielded, when:

- possible splashes may cause damage
- corrosive media are being used
- the working temperature may cause scalding
- required by the local authorities

Spray screens for all plate heat exchanger types can be supplied.

When thermal shielding is desirable or required, an insulating jacket can be supplied. This jacket fits the heat exchanger exactly and can be taken off without removing the connecting pipes.

3.2.8) DRAIN

Ideally a drain should be located close to the plate heat exchanger. If the drain leads to public sewage system, the possible risk of pollution should be considered. If either fluid cannot run directly to drain, suitable spill trays should be placed beneath the unit. If necessary, these should be fitted with a level alarm.

4) START-UP

4.1) PROCEDURE FOR START UP

Before the initial start-up, check that the clamped plate pack dimension is as specified on the machine plate on the plate heat exchanger.

4.1.1) START-UP

Sudden surges and drops in pressure and temperature must be avoided, as these may damage the plates and gaskets thereby causing leakage. Pumps should be started against closed valves which can then be gradually opened until the desired flow rate is achieved.

NOTE!!!
***The initial* start-up of plate heat exchangers with new EPDM gaskets must be effected by increasing the temperature slowly, max. 25°C (77°F) per hour.**

By restart-up and stop,* the following must be observed: Pressure surge/drop must not exceed ±10 bar per minute. Temperature increase/drop must not exceed ±10°C per minute. *If the above precautions are not observed, the guarantee will no longer apply.

In a plate heat exchanger using steam as the heating media, the cold fluid should be introduced to the plate heat exchanger before the steam is turned on. The potential damage possible due to the incorrect start-up increases proportionally with increased liquid flows and the length of connecting pipework!

For start-up of plate heat exchangers with grafoseal gaskets, see section 5.1.3.

4.1.2) LEAKAGE DURING START-UP

During the initial start-up, minor leaks may occur until the plates and gaskets have reached their design working temperature and all sections are correctly pressurised.

4.1.3) VENTING

When correct working temperature and working pressure have been reached, the system must be vented.
The air in the plate heat exchanger is driven out by the liquid flow, provided that the capacity is as stated in the diagram.
Air in a plate heat exchanger reduces the heat transmission and increases the pressure drop, thus increasing the risk of corrosion!

4.1.4) PERMISSIBLE PRESSURE

Working, and testing pressures are given on the machine plate.

WORKING PRESSURE = the highest pressure to which the plate heat exchanger may be subjected during operation!

TESTING PRESSURE = the pressure at which the plate heat exchanger may be tested!

Pressure testing is made as a differential pressure i.e. warm and cold side separately.

For plate heat exchangers with several sections, the stated working, testing, and differential pressures only apply if all sections are pressurised.
If each section operates at different pressures, or one of the sections is not under pressure, leaks may occur in the lower pressure section.
The maximum permissible difference in pressure between two sections separated by a connector grid or a separating plate is in general 6 kp/cm² . If the two sections are not equal in size, the permissible difference is reduced. The maximum difference in pressure depends on the number of plates in the other section/s.

4.2) PROCEDURE DURING OPERATION

During operation, temperatures and pressure drops must be regularly checked. Increased pressure drop and/or failing temperatures indicate that there are coatings on the plates. The plate heat exchanger now needs cleaning.
During operation, the same precautions against rises of pressure must be observed as during start-up!

4.2.1) LEAKAGE DURING OPERATION

See section 4.4) TROUBLE-SHOOTING.

4.3) PROCEDURE FOR STOP

In plate heat exchangers for pasteurising, the steam is shut off, the hot-water pump is stopped, and the cooling fluids are shut off.

Finally, the product pump is stopped.

If the plate heat exchanger is to be opened, it must be cooled below 40°C by letting the product pump re-circulate and lowering the temperature of the circulating water by max. 10°C per minute. This is done by opening for the cooling water or adding cold water to the circuit. Plate heat exchangers with 1 section are closed down slowly so that the temperature decreases by max. 10°C per minute.
If there is no other possibility of cooling, the plate heat exchanger can be cooled with corporation water below 40°C.
Normally, the plate heat exchanger can be unpressurised by shutting off the fluid inlets and outlets. The temperature will gradually decrease to the ambient temperature.
For long working breaks, see procedure in section 5.2.3.

4.4) TROUBLE-SHOOTING

In case of damage to plates or gaskets, it will often be necessary to replace them.
First examine very carefully the external conditions around the plate heat exchanger
in order to localise the cause of the damage!
In case of fatigue fracture, this will normally necessitate a replacement of all plates and
gaskets – as there may be a risk of fatigue fracture in all the material. In case of corrosion, all plates must be examined carefully!

4.4.1) VISIBLE LEAKAGE

Type of irregularity:	Possible cause:	Remedy of irregularity:
Leakage	The pressure is too high	Reduce the pressure to the correct working pressure, which can be found on the machine plate.
Leakage (Phase 1)	Insufficient tightening	Tighten up the plate heat exchanger (section 5.1) – however, not below the minimum dimensions and never, when the plate heat exchanger is under pressure or over 40°C. If the plate heat exchanger is still leaking proceed with phase 2.
Leakage (Phase 2)	Fouled or deformed plates Inelastic or deformed gaskets.	Separate the plate heat exchanger (section 5.1) and check if the plates are deformed or fouled. Check the gaskets are elastic and non-deformed, and that the faces of the joints are clean. Replace deformed plates and gaskets, if any, see ordering procedure (section 6.1). Before assembling, clean all plates and gaskets very carefully (section 5.2). Assemble the plate heat exchanger (section 5.3) and start it up again (section 4.1). Note!!! Even tiny impurities such as sand grains may cause leakage.
Leakage (Even after tightening of the plate heat exchanger to minimum dimension).	Gaskets	Separate the plate heat exchanger (section 5.1). Clean the plates very carefully (section 5.2). Replace the gaskets. Assemble the plate heat exchanger (section 5.3) and start it up again (section 4.1).
Leakage (Through the drain holes of the gaskets).	Defective gasket or badly corroded plate.	Separate the plate heat exchanger (section 5.1). Replace defective plates and gaskets, if any. Assemble the plate heat exchanger (section 5.3) and start it up again (section 4.1).

4.4.2) NON-VISIBLE LEAKAGE

Type of irregularity:	Possible cause:	Remedy of irregularity:
Reduced heat transmission and/or increasing pressure drop.	Fouled plates or choked plate channels.	Separate the plate heat exchanger (section 5.1) and check if the plates are fouled. Clean the plates very carefully (section 5.2). Assemble the plate heat exchanger (section 5.3) and start it up again (section 4.1).
Leakage. (The fluids get mixed). (Phase 1).	Corrosion or fatigue fracture.	A suspected leakage can be localised in the following way: Remove one of the lower pipe connections. Then put the opposite side under pressure. If the medium continues to run out of the lower pipe connections – after the pressure has stabilised – one or several plates are leaking. Close down the plate heat exchanger (section 4.3). Separate the plate heat exchanger (section 5.1) and check the plates very carefully. Check suspected plates with a dye penetrant. Check defective plates and gaskets, see ordering procedure (section 6.1). Before assembling, clean all plates and gaskets (section 5.2). Assemble the plate heat exchanger (section 5.3) and check to find more defective plates, if any, by putting one side under pressure. Start up again (section 4.1).
Leakage. (The fluids get mixed). (Phase 2).	Holes in plates. Corrosion or fatigue fracture.	Close down the plate heat exchanger (section 4.3). Separate the plate heat exchanger (section 5.1). Put all plates to dry. Suspend the plates in the plate heat exchanger again and tighten it (section 5.3). Circulate medium at full capacity on one plate side (every second plate channel). Keep the other plate channels unpressurised and free from liquid! Stop the circulation after some minutes of operation and open the plate heat exchanger again. Take care to avoid water spraying onto the dry plate side! By a careful study of the plates it will be possible to find moist areas, if any, on the otherwise dry plate sides. Check these areas with a dye penetrant! Replace defective plates and gaskets, see ordering procedure (section 6.1). Before assembling, clean all plates and gaskets (section 5.2). Assemble the plate heat exchanger (section 5.3) and check to find more defective plates, if any, by putting one side under pressure. Start up again (section 4.1). If the unit is still leaking, check all plates with a dye penetrant!

5) MAINTENANCE AND CLEANING

5.1) SEPARATION

5.1.1) COOLING AND PRESSURE RELIEF

Before opening the plate heat exchanger, it must be cooled down to below 40°C (104°F), and it must not be pressurised! Cooling must not exceed 10°C per minute. The pressure drop must not exceed 10 bar per minute.
If these standards are disregarded, the guarantee will no longer apply!

5.1.2) SEPERATION OF EDGE-CLAMPED FRAME

On completion of the procedure in section 5.1.1, separate the frame by keeping two, perhaps four diagonally placed tie bolts clamped. Dismount the rest of the tie bolts.
NOTE. Take care that the follower does not keel over!
Loosen the last tie bolts uniformly (max. 10 mm per m distance in difference), then push the follower towards the end support (fig. 14).
NOTE. When using plate heat exchangers on board ships, the follower must be secured in order to avoid danger during the movements of the ship.

5.1.3) PLATE HEAT EXCHANGERS WITH GRAFOSEAL GASKETS

When plate heat exchangers fitted with grafoseal gaskets are separated, these gaskets should normally be replaced by new ones. However, if the plate heat exchanger is opened, cleaned and tightened with care so that the plate sequence is unchanged and no graphite material is removed from the plate behind, the gasket can be used again. The maximum pressure will, however, be reduced somewhat.

In case of replacement of a plate, the gasket in the plate behind this plate must be replaced as well.

Grafoseal gaskets should always be handled with great care to avoid damage of the gasket surface.

NOTE. Never bend a grafoseal gasket!

5.2) CLEANING

The capacities and resistance to corrosion of plate heat exchangers depend on the plate pack being kept clean.
Fouling on the plates can be removed manually or by CIP (cleaning in place).

5.2.1) MANUAL CLEANING

Clean the plates with a soft brush and a suitable detergent (section 5.2.4).
In case of thick layers of scale or organic materials, the plates must be put in a bath of detergent (section 5.2.4).
NOTE. Never use steel brush, metal scraper or the like.
A high-pressure cleaner can be used with care – however, never with sand or other abrasives added.

5.2.2) CIP-CLEANING

A circulation system, in which a suitable detergent can be circulated is established. If the product to be flushed out has a high viscosity, the circulating quantity must be big enough to reach a sufficient speed for flushing out the product.
If the product pump is volumetric, it may be necessary to insert a pump for the detergent parallel to the former. It is assumed that the fouling on the plates are soluble in a detergent which does not attack plates and gaskets.

Example of CIP-cleaning:

- Drain off product residues and cooling and heating media.
- Rinse with cold or lukewarm water.
- Circulate with warm cleaning fluid solution.
- Rinse with warm water. Rinse with warm water with softener added to it.
- Rinse with cold or lukewarm water.

Cleaning can also be effected without circulation by pouring a cleaning fluid solution into the system.
After some time of standing, wash out the detergent with clean water.

5.2.3) CONTROL OF CLEANING

The plate heat exchanger must be opened for inspection at regular intervals. This is necessary especially during the running-in period, until experience has been gained on the effectiveness of the cleaning process.
With these inspections, it will gradually be possible to determine circulation times, temperatures, and chemical concentrations with great certainty!
Insufficient cleaning is most often due to:

- too small circulation quantity.
- too short cleaning period.
- too small chemical consumption in relation.
- too the fouling on the plates.
- too long periods of operation.

If the plate heat exchanger is out of operation for a long time, it is advisable to empty it, separate the plates, and clean the unit.
Clamp the plate heat exchanger lightly together, and leave it covered in order to protect the gaskets against dirt and the effect of light!

5.2.4) DETERGENTS

The definition of a suitable detergent is brief and to the point. Coatings on the plates must be removed without damaging plates and gaskets. It is important not to decompose the passivating (protective) film of stainless steel – the film contributes to preserving the resistance of the steel to corrosion.
Do not use chlorine-containing agents such as hydrochloric acid (HCl)!!!

EXAMPLES:

- OIL AND FATS are removed with a water emulsifying oil solvent, e.g. BP-SYSTEM CLEANER.
- ORGANIC AND GREASY COATINGS are removed with SODIUM HYDROXIDE (NaOH) – max. concentration 1.5% - max. temperature 85°C (185-F). 1.5% concentration corresponds to 3.75 litre 30% NaOH per 100 litre water.

- FURRINGS AND SCALE DEPOSITS are removed with NITRIC ACID (HN03) – max. concentration 1.5% - max. temperature 65°C (149°F). 1.5% concentration corresponds to 1.75 litre 62% HN03 per 100 litres water. Nitric acid has an important constructive effect on the passivating film of stainless steel.

5.2.5) CONTROL OF CLEANING FLUID CONCENTRATION

SODIUM HYDROXIDE (NaOH) solution is titrated with 0.1 n HYDROCHLORIC ACID (HCI) with methyl orange or methyl red as indicator.
NITRIC ACID (HN03) solution is titrated with 0.1 n SODIUM HYDROXIDE (NaOH) with phenolphtalein as indicator.
The concentration of the cleaning fluid in % can be calculated from the titration result according to the following formula:

$$\text{CONCENTRATION} = \frac{b \times n \times m}{a \times 10} \ \%$$

a = ml cleaning fluid taken out for titration
b = ml titration fluid used for change of colour
n = normality of titration fluid
m = molecular weight of cleaning fluid (NaOH) molecular weight 40 – HN03 molecular weight 63.

In order to use the correct quantity of chemicals for CIP cleaning, the cleaning fluid should be checked immediately before flushing. If the concentration is too low, <0.5%, the plate heat exchanger is probably not clean. If the concentration is too high, >1%, the chemical consumption can be reduced.

ASSEMBLING

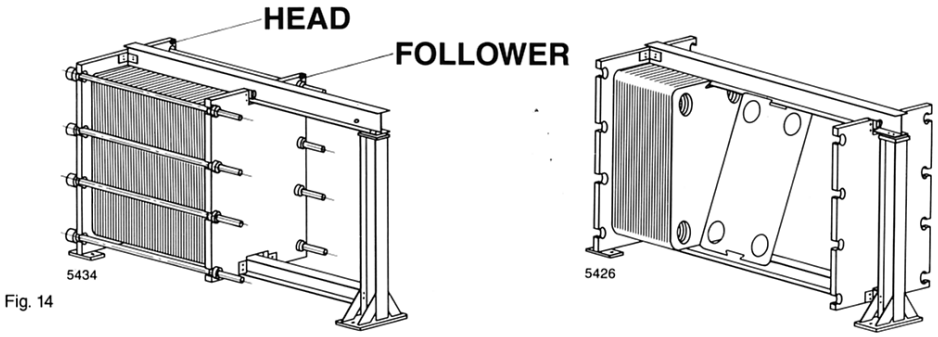


Fig. 14

5.3.1) ASSEMBLING

If the plates have been dismounted, they must be correctly inserted according to serial numbers!
The head has No. 1, and the serial numbers of the following plates and the connector grids, if any, are 2, 3, 4, 5 etc.
The serial number is marked in the top right-hand corner of the plates – do not forget that the gasket side must face towards the head.
In the case of single pass non-food PHEs the serial number is not stamped on to the plate.

5.3.2) CLAMPING

The maximum and minimum dimension for clamping is stated on the machine plate, which is placed on the head.
The plate heat exchanger must be clamped to dimension between max. and min. dimension.
The final clamping to minimum dimension is recommended after approx. one month's operation – alternatively, immediately after installing new plate heat exchangers/new gaskets.
New gaskets in EPDM quality are clamped step-wise the first time:

1. Minimum dimension +15% - 2 hours' interval or more.
2. Minimum dimension +7.5% - 12 hours' interval or more.
3. A dimension between max. and min. dimension as stated on the machine plate, alternatively min. dimension.

The head and the follower must be exactly parallel. Therefore, clamping must be measured at the top, in the middle, and the bottom on both sides.

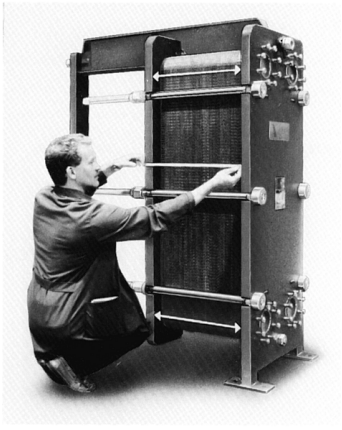


Fig. 15

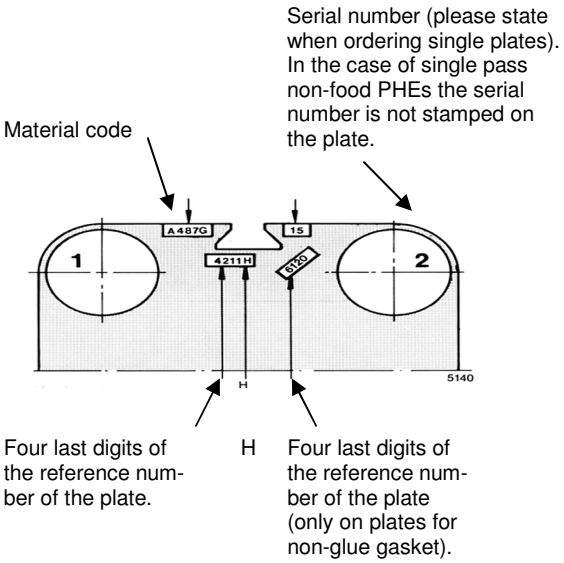
Plate heat exchangers with Grafoseal gaskets, see section 5.1.3.

5.4) REPLACEMENT OF PLATES AND GASKETS

5.4.1) MARKING

The plates are marked with material codes and reference number plus codes for non-glue gasket, if any, and also have the letter H (fig. 16). Looking towards the gasket side, the plate is designated a right plate when the H is upwards and a left plate when the H is downward.

Left plates have inlet and outlet via corner holes 1 and 4, respectively (fig. 17).



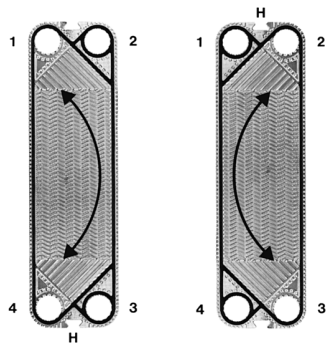


Fig. 17

Right plates have inlet and outlet via corner holes 2 and 3, respectively.
H = right plate.

5.4.2)REPLACEMENT OF PLATES

Before inserting a spare plate in the plate pack, it must be checked that the spare plate is identical with the defective plate – the same corner holes open, and the mark H must face right.
If the width of new plates is not the same as that of the plates they are to replace – or of those of the plate pack being extended, the widest plates are to be fitted at the back of the plate pack, if possible; adjacent to the grid, separator plate or follower. New plates always differ from old plates. Therefore, new plates are to be grouped together, if possible.

As an example, the current, nominal width of K-range plates is 483 mm. Previously it was smaller. A defective 4-hole plate can be removed from the plate pack without inserting a spare plate, if the adjoining 4-hole plate is also removed. The new number of plates will then be = S-2. This changes the clamping measure of the plate pack to M1 which will be:

$$M1 = \frac{M\,(S-2)}{S}$$

M = The original clamping dimension stated on the machine plate.
S = The original number of plates in the plate pack.

The transmission area of the plate heat exchanger is reduced in relation to the original number of plates. At the same time, the pressure drop will increase. As to corrosion and fatigue fracture of plates, see section 4.4 trouble shooting. Ordering procedure for plates can be found in section 6.1.

5.4.3) REPLACEMENT OF GLUED GASKETS

The first plate after the head and the connector grid must have a gasket in all groves. These gaskets are, in fact, two "normal" gaskets cut in half and glued in place around all grooves. You should carefully note how the old gaskets are assembled before removing them!

5.4.4) REMOVAL OF OLD GASKETS

PLIOBOND glued gaskets can be loosened by heating in water at 100°C (212°F).
The plates are cleaned, and coatings, if any, are removed.
See section 5.2.4.

5.4.5) CLEANING

New gaskets and the gasket grooves of the plates are cleaned with a cloth moistened with degreasing agent. The gluing surfaces must be absolutely clean – without finger prints etc.
As degreasing agent use what is stated on the enclosed diagram.
Alternatively, use:
TRICHLOROETHYLENE, CHLOROTHENE VG, ACETONE, METHYL ETHYL KETONE or ETHYL ACETATE.
It is important that all the degreasing agent has evaporated, before the glue is applied. This will normally take approx. 15 min. at 20°C (68°F).
It is advisable to clean the gluing surfaces of the gaskets with fine-grain sandpaper instead of degreasing agent.

5.4.6) GLUING

PLIOBOND 25, which is a nitrile rubber glue on solvent basis (25% solids), is applied with a brush in a thin layer on the backs of the gaskets.

The gaskets are put to dry in a clean and dust free place! The gasket grooves of the plate are now coated with a thin layer of glue, and the gaskets are cemented into the grooves. The insertion of gaskets starts at both ends of the plate – and continues with the straight sections along the edges.
The gluing process is most easily effected by laying the gaskets and the plates on a table – as the gaskets are cemented into the grooves of the plates, the plates should be stacked.
The plates with the gaskets are now suspended in the frame which is clamped lightly, for rubber gaskets e.g. to the minimum dimension indicated on the machine plate plus 0.2 mm per plate.

The plate heat exchanger is heated to 90-100°C (194-212°F) by means of water or steam – the temperature must be kept for 1 ½ - 2 hours!
The liquid pressure must be kept as low as possible. On the plate heat exchangers for food, pipe branches which are not connected to water / steam must be kept free, in order to permit glue vapours to escape!
If there is no possibility of heating the plate heat exchanger, it must stand at a place as warm as possible with dismounted connections.
The drying time will at 20°C (68°F) be approx. 48 hours. At e.g. 40°C (104°F), the drying time is reduced to approx. 24 hours.
When the glue vapours have vaporized, the plate heat exchanger can be clamped again as stated in section 5.3.

5.4.7) NON-GLUE PARACLIP GASKETS

PARACLIP is a non-glue gasket designed as a conventional gasket. It is designed with a special clip-on feature which locks it into recesses in the gasket groove on the plate.

When replacing PARACLIP gaskets, the old gasket is removed completely. Before fitting the new PARACLIP gasket, check that the plate gasket groove is clean and free from residual rubber, particularly in the clip-on pockets. New gaskets can be fitted without using tools.

The first plate after the head and the connector grids, which have no physical contact with the product, are equipped with a glued gasket as described, see section 5.4.6.

Fig. A

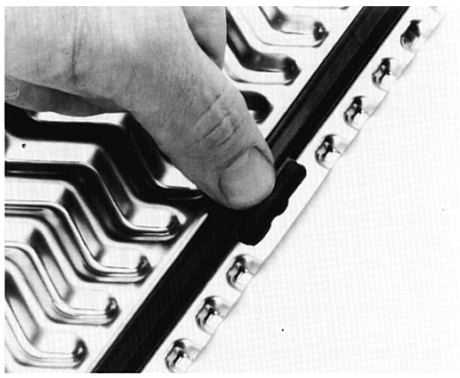


Fig. B

Fig. C

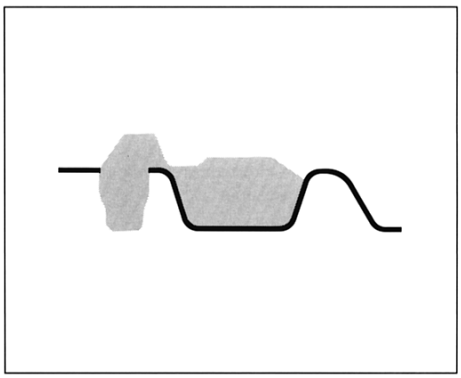


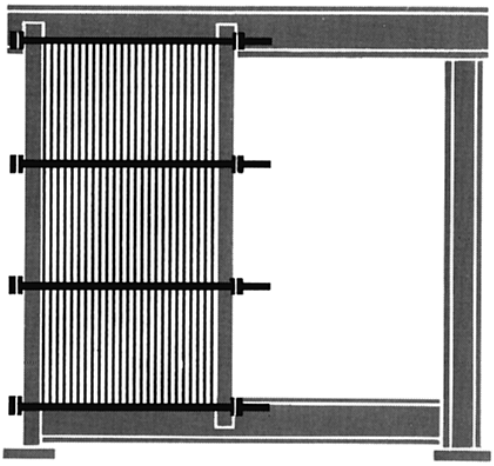
Fig. D

However, it will seldom be necessary to change these as their only purpose is to fill out the gasket groove thereby supporting the rest of the plate pack.

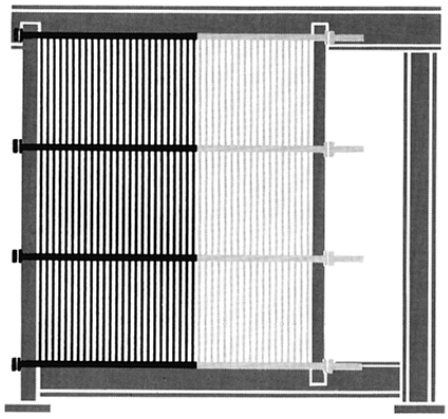
The PARACLIP gasket is available for food as well as non-food purposes. When assembling, the EPDM quality gasket should be wiped with a cloth wetted with silicone oil to facilitate the separation from the connecting plate when disassembling the plate pack.

5.5) RECONSTRUCTION

The modular construction of the plate heat exchanger ensures an easy extension or reduction in the capacity.



In case of reconstruction, all the customer has to do is to state the type designation, serial number and the wanted change. **UNEX Systems** has all relevant data in file and can immediately submit a suggestion and a quotation for the reconstruction.



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6) SPARE PARTS AND ACCESSORIES

6.1) ORDERING PROCEDURE

When ordering plates, please state the serial numbers of the plates and the type and serial number of the plate heat exchanger.

The serial numbers of the plates can be found in the top right-hand corner of the plates (fig. 16) – the type and serial number of the plate heat exchanger can be taken from the machine plate!

In the case of single pass non-food PHEs the serial number is not stamped on to the plate.

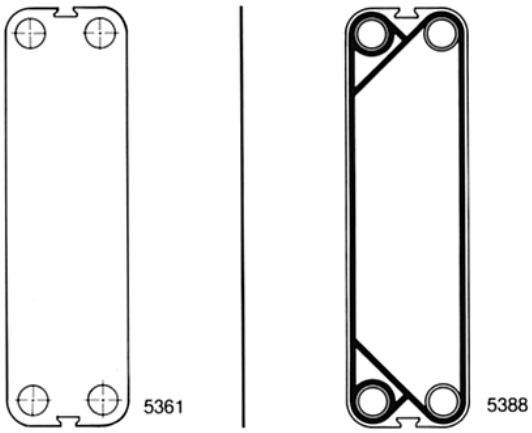
ORDER EXAMPLE:
4 plates with glued-on gaskets, serial numbers 11, 12, 13, and 14 – plate heat exchanger type H17 – serial number 19156.
ORDER EXAMPLE OF A COMPLETE SET OF PLATES:
1 complete set of plates with glued-on gaskets – plate heat exchanger type M 107 – serial number 28452.

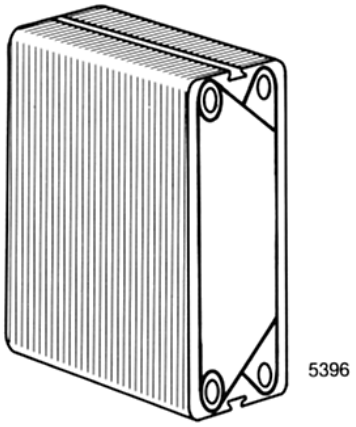
MATERIAL CODE:

CODE	DESIGNATON	PREVIOUSLY USED CODE
A	Stainl. steel AISI 304	C E G J M R
B	Stainl. steel AISI 316	D F H K N P
S	Stainl. steel W 14449 (Avesta 832 SL)	
T	Titanium ASTM B 265 grade 1	
X	Stainl. steel W 14539 (Avesta 254 SLX)	
Y	Stainless steel (Avesta 254 SMO)	
Z	HASTELLOY C 276	
	Monel	U
	Cu-Al	M

ORDER EXAMPLE OF A COMPLETE SET OF PLATES FOR ONE SECTION:
1 complete set of plates with glued-on gaskets for the heat recovery section – plate heat exchanger type K 55 – serial number 32254.
The plates are marked with a material code (fig. 16) symbolizing the steel quality. The four digits after the letter are UNEX's internal press operation number (three-digit number and a letter).

When knowing the material code, **UNEX Systems** can procure a certificate of the plate.





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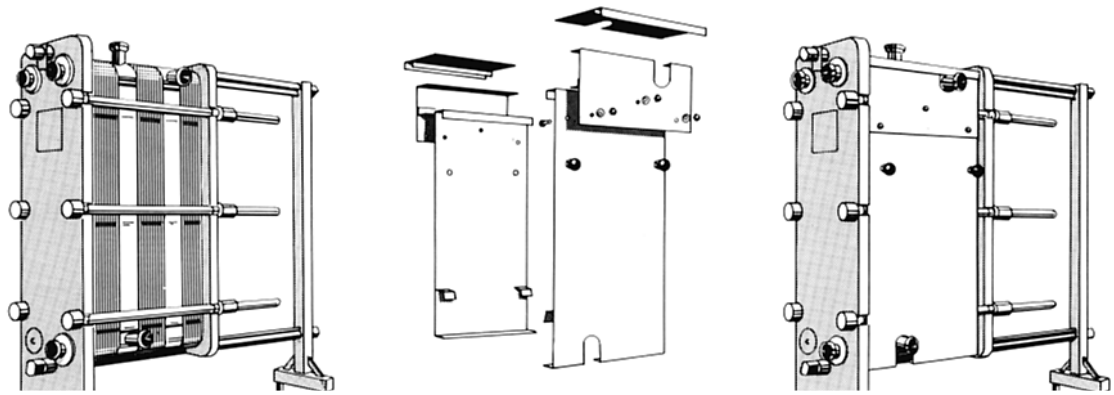
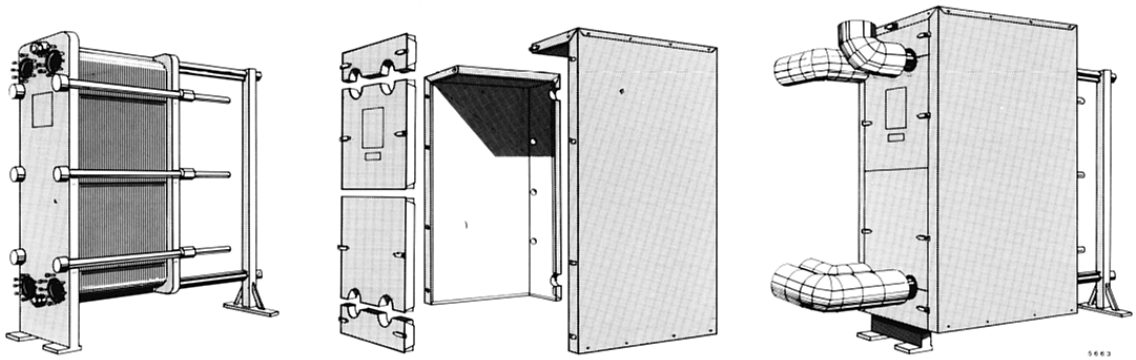
6.2 ACCESSORIES

6.2.1) SPRAY SCREENS



6.2.2) INSULATING JACKET



6.2.3) CLAMPING TOOLS