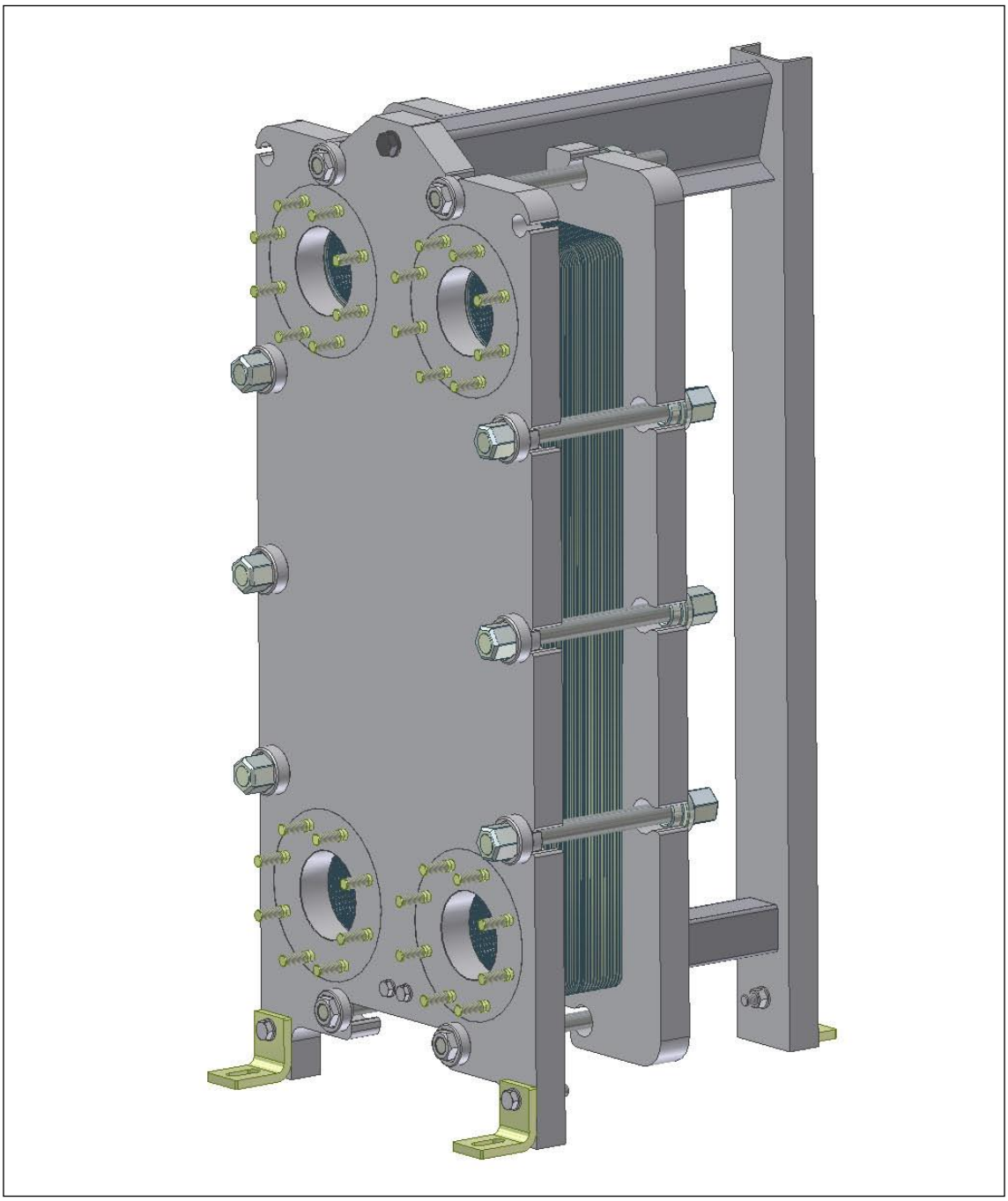
Instruction

XG 65 / 85
Gasketed plate heat exchanger



Safety notes

To avoid injury of persons and damages to the device, it is absolutely necessary to read and observe this instruction carefully.

Necessary assembly, start-up and maintenance work must be performed only by qualified and authorized personnel.

Warning of high pressure and temperature
The maximum operating temperature of the heat exchanger flow media is +150 °C.

The maximum operation pressure of the system is 16 (25) bar.

Be aware of the installation's permissible system pressure.

The risk of equipment and personal accidents will increase dramatically if the recommendations of the maximum operating pressure are ignored.

The heat exchanger installation must be equipped with a safety valve, always according to local requirements.

Warning of hot surfaces
The heat exchanger has hot surfaces, which can cause skin burns. Please observe extreme caution in close proximity to the heat exchanger.

Warning of hot water
District heating water can be very hot and under high pressure. Consequently, the station must be emptied of water prior to dismounting.

Warning of transportation damage
Before the heat exchanger is taken into use, please make sure that the heat exchanger has not been damaged during transportation.

Description / application

Gasketed plate heat exchanger is designed for use with district heating and cooling systems.
- Operating temperature: from 0°C to +150 °C
- Max. operating pressure: 16 (25) bar
- Test pressure: 22,9 (35,8) bar
- Working flow media: water / glycolic water up to 50%

The heat exchanger working in temperature below +2 °C, must be filled with flow media, which in those temperatures does not congeal or freeze, glycolic water for instance.

Approvals:
- Certificate of quality system approval (module H) acc. to PED n° 97/23/EC
- Certificate of approval acc. to ISO 9001 and ISO14001

Construction
Main components

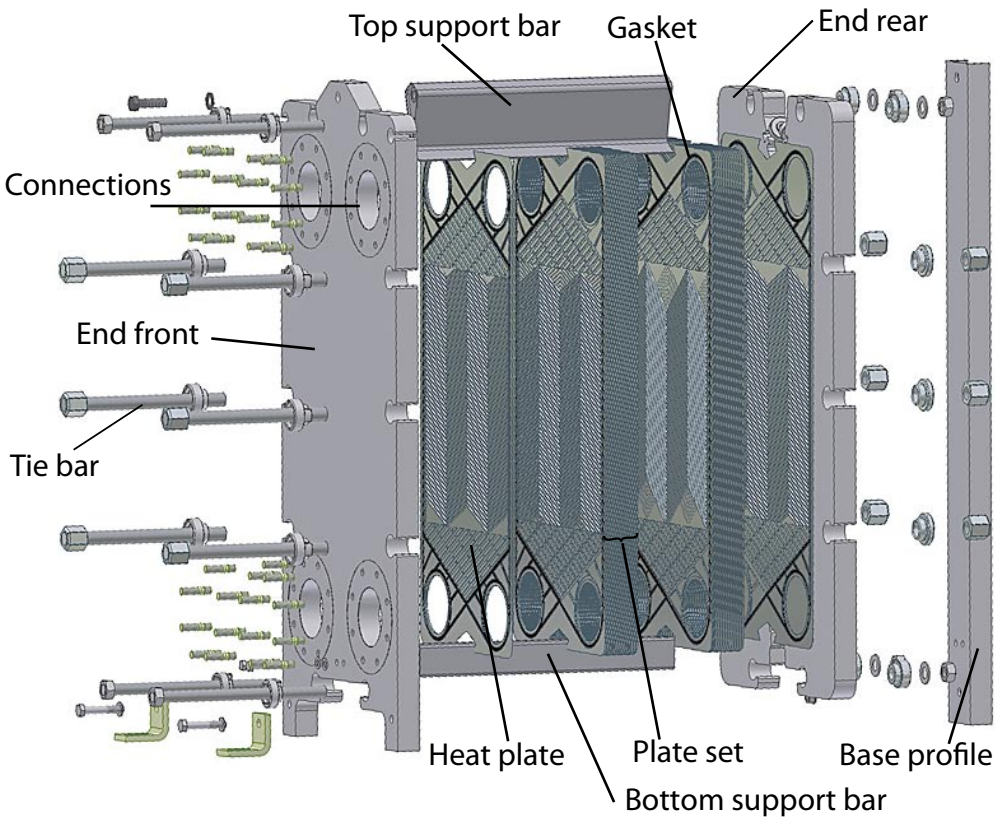
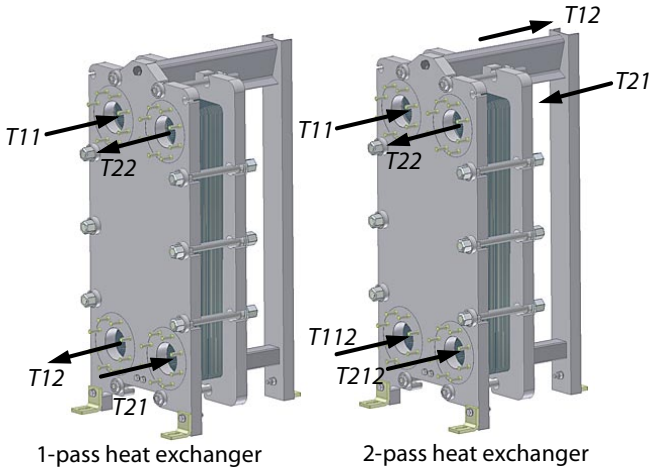


Figure 1

Design and function



T11 - Primary side in
T12 - Primary side out
T112 - Primary side second inlet (2-pass)
T21 - Secondary side in
T22 - Secondary side out
T212 - Secondary side second inlet (2-pass)

Figure 2

Design and function, continues

The heat exchangers are made of shape-pressed heat exchange plates, between which the flow channels are created . Gaskets between the plates separate the flow channels from each other so that the flows do not mix. The heavy turbulence and counterflow principle enable efficient heat transfer. The function of the heat exchanger is to transfer heat from the primary to secondary flow through the heat transfer plate thus preventing the flows from mixing with each other (Figure 3, Figure 4).

To intensify the heat exchange effect, each plate is pressed in herringbone shape .The adjacent plate is turned 180˚ and thus creating a grip of intertwined channels. (Figure 5).

The gasketed plate heat exchanger can be opened up for cleaning purposes and for replacement of plates and gaskets. A stepless output adjustment can be carried out by changing the number of plates.

The choice of heat exchanger is determined by the desired capacity, required temperatures and the allowed pressure losses.

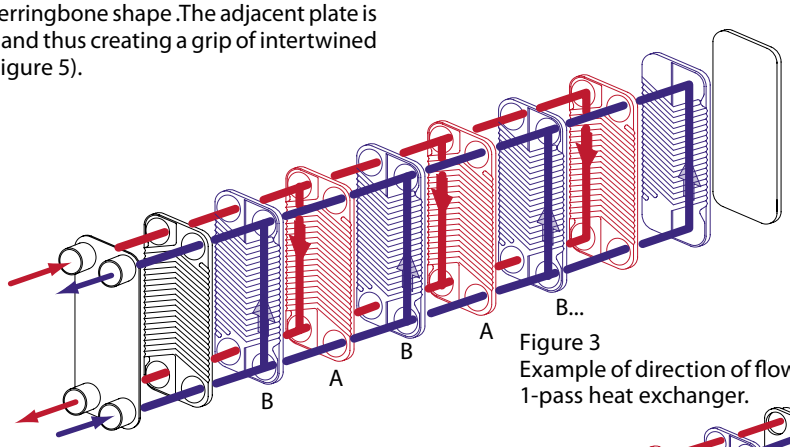


Figure 3
Example of direction of flow, 1-pass heat exchanger.

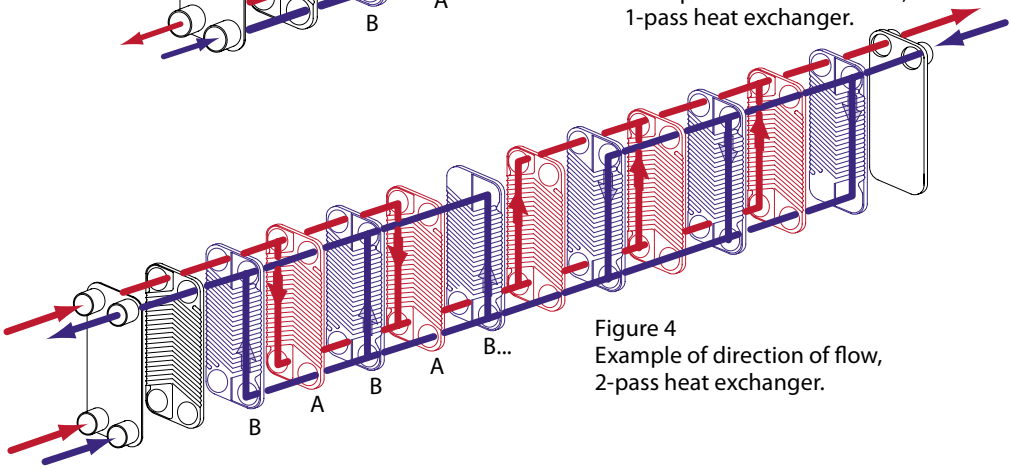


Figure 4
Example of direction of flow, 2-pass heat exchanger.

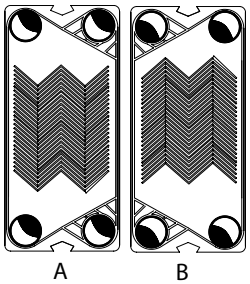


Figure 5
Heat plates are pressed in herringbone shape. Every other plate is turned 180˚.

Sizing

Dimensioning and selection of the heat exchangers can be done by Danfoss Sales Company only. The biggest gasketed heat exchangers are not included in the Danfoss dimensioning program for heat exchangers.

Lifting

The large heat exchangers have to be lifted in horizontal orientation because of their big size and weight.

When heat exchanger is lifted up from the pallet in order to place it in upward position do as follows:

1. Place the straps as indicated in the picture around the tie bars (Figure 6) .
2. Lift the heat exchanger from the pallet very carefully and let the heat exchanger gradually shift to upward position (Figure 7).
3. Place the heat exchanger onto its base on an even floor in upward position (Figure 8).

Never lift by the connections.

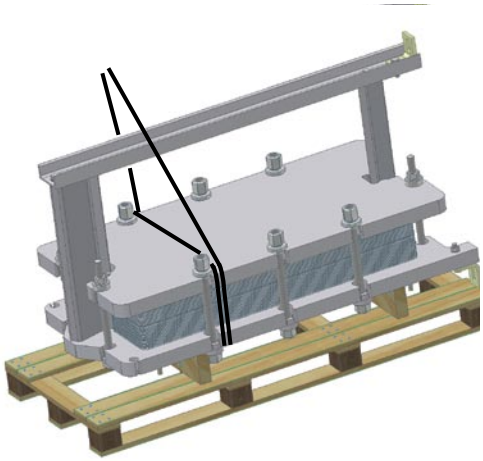


Figure 6

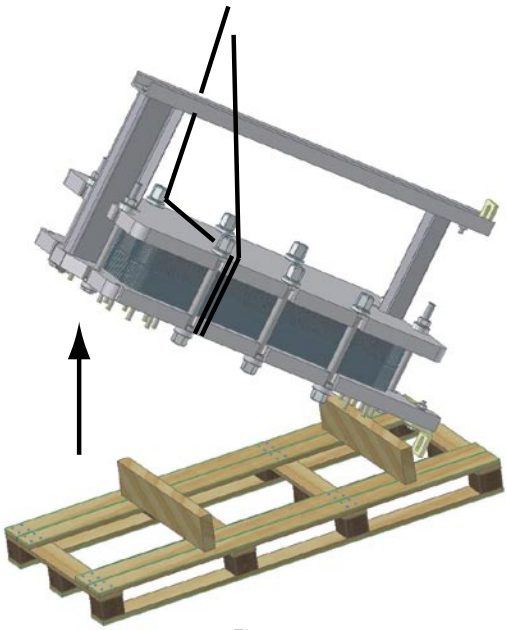


Figure 7

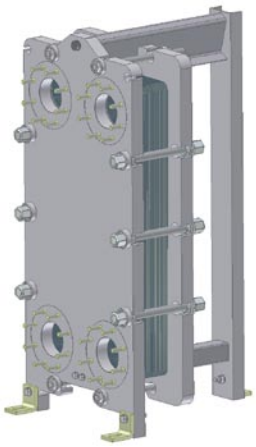


Figure 8

Mounting requirements

Leave adequate space around the heat exchanger for mounting and maintenance purposes. The distance from the nearest partition, e.g. a wall, must be at least 1000 mm and comply with local standards (Figure 9, 1). The recommendable distance between parallel heat exchangers is 1000 mm (Figure 9, 2).

The heat exchanger is mounted on its own base without foundation and it needs no bolting on the floor. The heat exchanger should be mounted in vertical position.

All pipes connected to the heat exchanger are recommended to be equipped with shut-off valves so the heat exchanger can be removed for maintenance. Also they should be equipped with strainer.

On at least one side of the 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 heat exchanger.

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. The end rear must be free to move along the full length of the top support bar (Figure 9, 3)

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

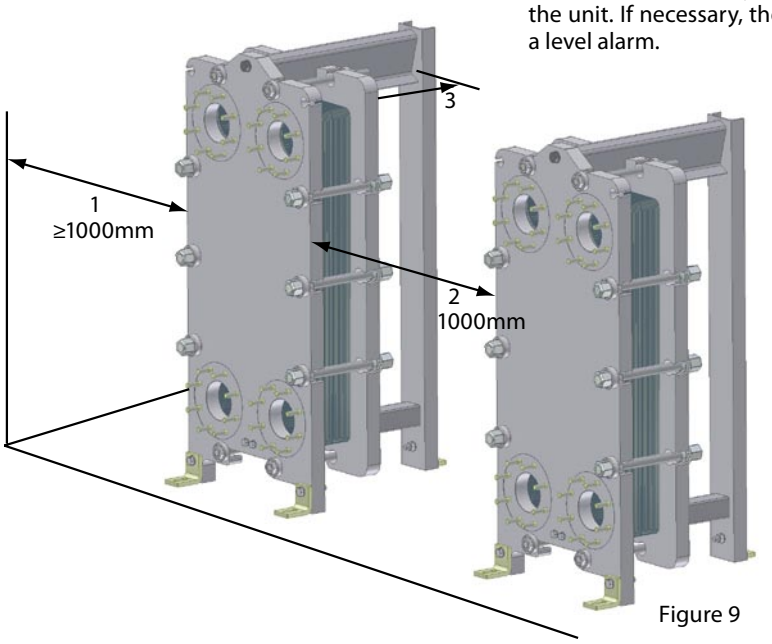


Figure 9

Pipe connections

The heat exchanger must be connected according to the designs.

Flanged connections must be removable. Thermometers, pressure gauges etc. should be used according to local requirements for monitoring the performance of the heat exchanger .

All existing sediment should be rinsed and cleaned before connecting the heat exchanger with the pipelines. Also the pipes to be connected must be mounted so that the stress caused by e.g., thermal expansion, does not harm the heat exchanger.

The pipes must be equipped with brackets in order to prevent any torsional stress concentrated on the heat exchanger's pipe connections.

The pipe joints on the end rear 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 end rear must be flexible. This can be achieved by the using expansion joints.

Pumps and other equipment must not transfer pressure pulsations/vibrations to the heat exchanger as this may cause fatigue fracture in the plates.

The heat exchanger is sensitive to liquid hammering. This can occur during regulation, change-over, pump start-up etc. 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.

Start-up

Before start-up, check if:
- pipes are connected according to the circuit diagram,
- shut off valves are closed,
- expansion vessel is connected with compact substation,
- threaded and flanged connections are tightened.

Sudden surges and drops in pressure and temperature must be avoided, as they might damage the plates and gaskets and cause leakages. First the pumps should be started against the closed valves. After that the valves can be gradually opened until the desired flow rate is achieved.

Fill the substation with liquid and raise the pressure slowly to working pressure.

It is recommended to fill the heat exchanger with water from return side, first from secondary side and then from primary side. In case of lack of flow media on the secondary side, it is recommended to fill it.

When filled with water the heat exchanger should be vented. After that the shut-off valves should be opened and the operation of the heat exchanger must be observed (e.g. temperatures, pressure, thermal expansion, and leakages). If the heat exchanger operates according to designed parameters, it can be taken into continuous use.



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

By start-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.



The gasketed plate heat exchanger can be dismantled only by Danfoss LPM authorized service.



All Danfoss heat exchangers and substations have been pressure tested according to PED 97/23/EC (module H).



If the fault in pipes (pumps or controller) connection has been noticed, it is necessary to contact with the device assembler. If the fault has not been located after going through the Check points mentioned below, it is necessary to contact with Danfoss Sales Company or sales representative.

After taking the equipment into use please check the following points if you have trouble getting enough heating capacity out.

Check points		Action
✓	Are the pipes connected according to the circuit diagram?	Check the circuit diagram
✓	Are the flow directions correct?	Check the product data label on heat exchanger
✓	Check the pressures on primary and on secondary side	Check the designed values
✓	Are the pipes filled with flow media?	
✓	Check the temperatures on primary and on secondary side	Check the product data label on heat exchanger or the designs
✓	Check the flow and compare the pressure losses	
✓	Do the pumps work properly and is the rotating direction correct?	
✓	Are the flows according to the plans?	Check the filter
✓	Are the controllers working properly?	Check the instruction of controller
✓	Does the heat exchanger have a leak?	Pls refer to the section Leakages

Putting out of operation

1. Close the heat exchanger's shut-off valves slowly.
2. Stop the circulation pumps.
3. Do not drain the heat exchanger, even if the heat exchanger will be shut down for several days or longer.

Drain the heat exchanger if shut down would cause a danger of freezing.

Dismantling

Proceeding in case of dismantling the gasketed heat exchanger for cleaning purposes:

- Close the shut-off valves which are placed in between the district heating network and internal installation;
- Reduce the temperature of the 2-pass heat exchanger below 40 °C by letting the temperature of circulating water cool down by max. 10°C per minute. This is done by adding cold water into the circuit. 1-pass heat exchangers are closed down slowly so that the temperature decreases by max. 10°C per minute. The pressure drop must not exceed 10 bar per minute.
- Drain the heat exchanger;
- Mark the order of the heat plates by drawing a diagonal line to the heat exchanger (Figure 10);
- Measure and note the measurement A (Figure 10);
- Loosen and detach the tie bars using the order shown in Figure 10, from center to outwards;
- Loosen the heat exchanger seal by displacing the end rear along the support bars as far as possible;
- Divide the heat plates very carefully and be careful not to detach gaskets from the heat plates;
- Dismantle the heat plates which need to be checked or replaced;
- Mark the order of dismantled heat plates.

If the heat exchanger is over 5 years old and it has not been dismantled on regular basis, it might be difficult to dismantle it without breaking the gaskets and even the heat plates. The plates stick to each other very tightly.

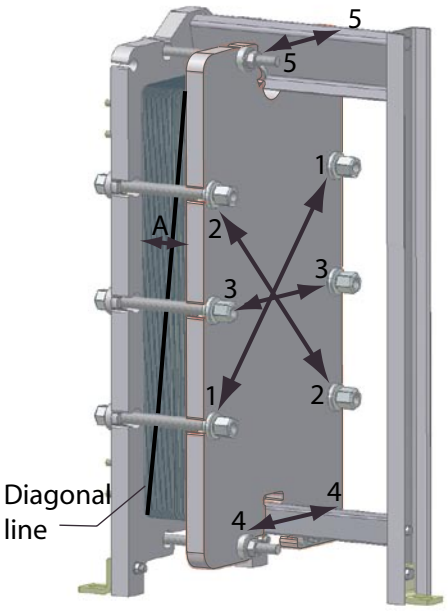


Figure 10

Reassembling the heat exchanger

Before reassembly, check that the sealing surfaces are clean and the gaskets are securely attached to the heat plates.

- Mount the plates in the opposite order from that used in dismantling, with the gasket side of the plate towards the front end plate. Make sure that the order of the heat plates does not change by keeping eye on diagonal line drawn when dismantling the heat exchanger (Figure 10).
- Check that adjacent plate profiles are in opposite directions (Figure 5).
- Press the plates against each other and start the tensioning of the plate pack by tightening the tie bars evenly according to the numbering in Figure 10 (start tightening from center to outwards). Ensure that the end front and the end rear are parallel at all times.
- Continue tightening until the heat exchanger's measurement A (tightening measurement) is achieved (Figure 10).
- The tightening measurement is correct when the crests of the plates are in metal contact with each other. Excess tightening can cause changes in the plate profiles.

Replacing heat plates

In case of changing capacity, it is recommended to replace all the heat plates with new ones. In case of serious leakage all the heat plates should be replaced with new ones.

Clip-on gaskets

In XG65/XG85 heat exchangers the gaskets are attached to the plates by clips. The gaskets do not need gluing. The clips in the gaskets are turned aside and the gaskets stay in correct place.

The signs of fouling in the heat exchanger

Fouling of the plate surface decreases the heat transfer from the primary to the secondary side. If the temperature level of returning district heating water rises during a long period of time, it can be caused by fouling accumulated on the plate surfaces.

The temperature in the district heating return side should be only 5˚C higher than the return temperature in the secondary side.

Other signs of the fouling are the rising pressure losses in the heat exchanger. The proper action is to wash the heat exchanger.

Cleaning

Before starting the washing process do as follows:
- Stop the circulation pumps.
- Close the ball valves in the circuits you are planning to wash.
- Drain flow media from the heat exchanger on the return side of the heating circuit.
- Do not cool the heat exchanger down because the cleaning fluid operates best around 50˚C.
- Open the connection you have planned to use for washing (pls refer Figure 12).

Counterflow cleaning
The washing can be done with equipment according to the circuit diagrams for cleaning (Figure 12). The equipment can be built by yourself or you can buy one. With the equipment you can wash one exchanger circuit at the time or the whole substation by connecting the primary and secondary sides with each other by intermediate piping. The washing procedure has to be chosen according to the size and the structure of the substation.

If you have located the dirty side of a heat exchanger, it is recommendable to clean it separately. The possible places for connecting the flexible hose into the system can be found out in the circuit diagrams for counterflow cleaning (Figure 12).

The counterflow removes the humic matter that has contaminated the surface of the plate. Clean water is flushed with high speed into the primary and / or secondary side in the opposite direction from the flow used during normal operation. The heat exchanger can also be washed with cleaning compound, approved by Danfoss (e.g. Kaloxi® or Radiner FI liquid cleaner concentrate), which is non-toxic and can be disposed through normal sewer. The compounds are most effective in 50˚C temperature.

Cleaning the heat plates by hand
Do not damage the heat plates during cleaning.

Detach the heat plates from the heat exchanger for cleaning as described in section Dismantling. Make sure to mark the order and position of the plates before dismantling it.

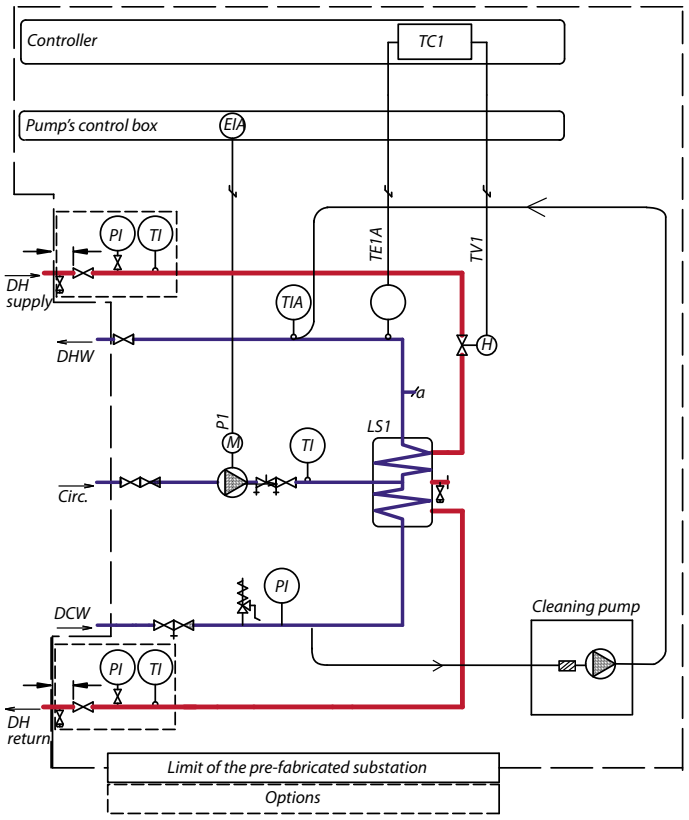
Clean the plates with a soft brush and running water. Usually fouling on the plate surface is very tight and it does not come off easily. In that case, cleaning compound can be used. After use of cleaning compound, the heat plates must be rinsed completely with clean running water.

The heat exchanger should be thoroughly rinsed after washing procedure.

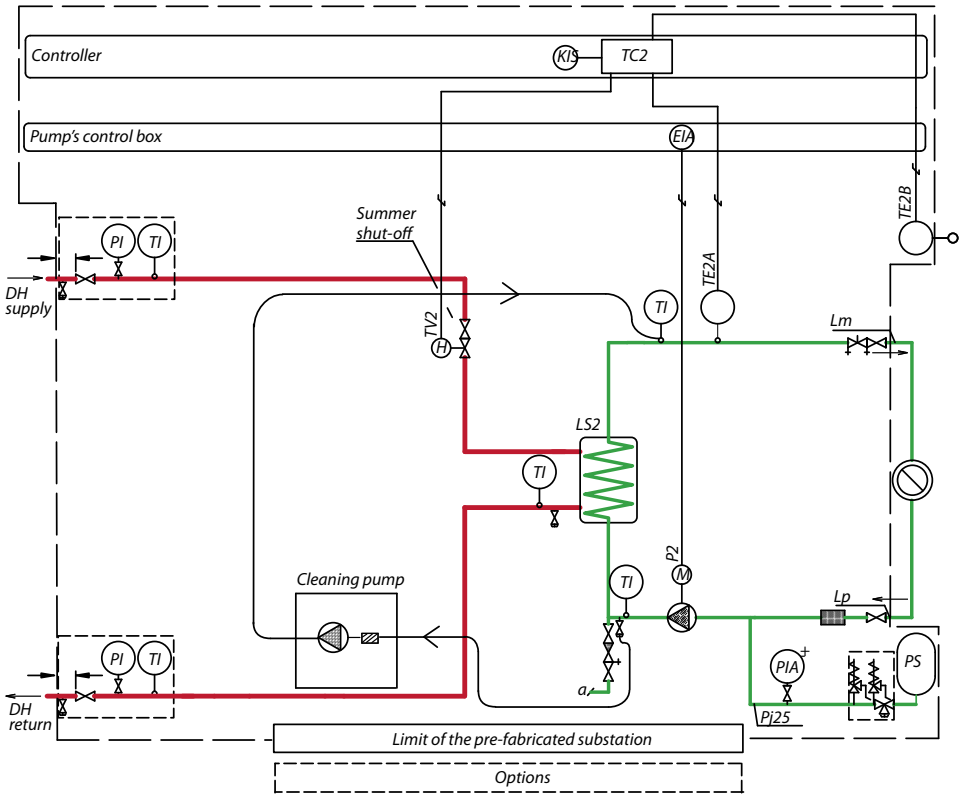


Figure 11

Circuit diagram for counterflow cleaning



Cleaning of a heat exchanger for domestic hot water.



Cleaning of a heat exchanger for heating.

Figure 12

Leakages

If the leakage has occurred, it is necessary to check following:
- Has the heat exchanger been damaged during transportation or mounting?
- Is the leakage placed on connection or on pipes?
- Are the tie bars loose (dimension A should be preserved, Figure 10)?
- Is the leakage internal between primary and secondary sides?

Proceed in case of leakage:
- Reduce the heat exchanger temperature below 40 °C;
- If the set of tie bars is not correct, it is necessary to tighten them up (the dimension A should be preserved, Figure 10);
- If the dimension A is correct and the heat exchanger is still leaking, the dimension A should be shortened by tightening screw bars additionally about 2 - 5 mm;
- If the leakage between gasket and channel plate has been noticed, the heat exchanger must be dismantled as described in section Dismantling and leakage place must be checked;
- Section Trouble shooting in the end gives advice in case of leakages.
- In case of any doubts connected to leakage it is necessary to contact with the assembling company, Danfoss Sales Company or sales representative.

Trouble shooting

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 product data label on heat exchanger.
Leakage Phase 1	Insufficient tightening	Tighten up the heat exchanger - however, not below the minimum dimensions and never, when the heat exchanger is under pressure or over 40 °C. If the heat exchanger is still leaking proceed with phase 2.
Leakage Phase 2	Fouled or deformed plates Inelastic or deformed gaskets	• Clean the heat exchanger with counterflow cleaning. That can be done without opening the heat exchanger (section Cleaning, Counterflow cleaning). • If counterflow cleaning does not help in leakage, open the heat exchanger and check if the plates are deformed or fouled (section Dismantling). • The plates can be washed manually (section Cleaning, Cleaning the channel plates by hand). • Check that the gaskets are elastic and non-deformed, and that the faces of the joints are clean. • Replace deformed plates and gaskets with new ones. • Before assembly, clean all plates and gaskets very carefully (section Cleaning, Cleaning the heat plates by hand). • Assemble the heat exchanger (section Reassembling the heat exchanger) and start it up again (section Start-up) . Even tiny impurities such as sand grains may cause leakage.
Leakage Even after tightening of the heat exchanger to minimum dimension	Gaskets	• Separate the plate heat exchanger (section Dismantling). • Clean the plates very carefully (section Cleaning) . • Replace the gaskets (section Gaskets) . • Assemble the plate heat exchanger (section Reassembling the heat exchanger) and start it up again (section Start-up) .
Leakage Through the drain holes of the gaskets	Defective gasket or badly corroded plate	• Separate the plate heat exchanger (section Dismantling) • Replace defective plates and gaskets, if any (section Gaskets). • Assemble the plate heat exchanger (section Reassembling the heat exchanger) and start it up again (section Start-up) .

Trouble shooting

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 heat exchanger (section Dismantling) and check if the plates are fouled. • Clean the plates very carefully (section Cleaning,Cleaning the heat plates by hand). • Assemble the heat exchanger (section Reassembling the heat exchanger) and start it up again (section Start-up) .
Leakage, the fluids get mixed Phase 1	Corrosion or fatigue fracture	A suspected leakage can be located as follows: · Remove one of the lower pipe connections. · Then put the opposite side under pressure. · If flow media continues to run out of the lower pipe connections - after the pressure has settled to stabilised level - one or several plates are leaking. · Close down the heat exchanger (section Dismantling). · Separate the gasketed heat exchanger (section Dismantling) and check the heat plates very carefully. · Check suspected plates with dye penetrant. · Check defective plates and gaskets, replace them with new ones. · Before assembly, clean all the plates and gaskets (section Cleaning, Cleaning heat plates by hand). · Assemble the heat exchanger (section Reassembling the heat exchanger) and check if more defective plates can be found, by putting one side under pressure. · Start up again (section Start-up).
Leakage, the fluids get mixed Phase 2	Holes in plates Corrosion or fatigue fracture	A suspected leakage can be located as follows: · Close down the heat exchanger (section Dismantling). · Separate the plate heat exchanger (section Dismantling). · Dry all the heat exchange plates. · Suspend the plates in the gasketed heat exchanger again and tighten it to correct measurement (section Reassembling the heat exchanger). · Circulate flow media 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 heat exchanger again. Avoid water spraying onto the dry plate side! · By careful study of the plates it will be possible to find moist areas, if any, on the dry plate sides. · Check these areas with dye penetrant! · Replace defective plates and gaskets (section Replacing heat plates and section Gaskets). · Before reassembly, clean all the plates and gaskets (section Cleaning, Cleaning heat plates by hand). · Reassemble the heat exchanger (section Reassembling the heat exchanger) and check if more defective plates can be found, by putting one side under pressure. Start up again (section Start-up). · If the unit is still leaking, check all plates with dye penetrant!

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