Instruction Manual
Plate Heat Exchangers

M15  TL10  T20  TS20
MX25  M30  MA30  TL35
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Except for this Instruction Manual, the following documents are also included in this shipment:

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

How to contact Alfa Laval:

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

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

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

Unpacking

Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.

- Wood and cardboard boxes can be reused, recycled or used for energy recovery.
- Plastics should be recycled or burnt at a licensed waste incineration plant.
- Metal straps should be sent for material recycling.

Maintenance

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

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

Scrapping

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

**Main components**

**Carrying bar**
Carries the channel plates and the pressure plate.

**Frame plate**

**Tightening bolts**
Press the channel plates together.

**Connections**
Holes through the frame plate, permitting the media to enter into the heat exchanger.

Threaded studs around the holes secure the pipes to the apparatus. Metallic or rubber-type linings may be used to protect the holes against corrosion.

**Support column**

**Bolt protection**

**Guiding bar**
Keeps the channel plates in line at their lower end.

**Pressure plate**
Moveable steel plate. In some cases pipes may be connected to the pressure plate.

**Channel plates**
Heat is transferred from one medium to the other through the thin channel plates.

The number of plates determines the total heat transfer surface.

**Protective sheets**
Supplied on request.
**Function**

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

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

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

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

Requirements

Multi-pass units:
Connections on the pressure plate
It is important that the plate pack has been tightened to the correct measurement (check against drawing) before the pipe is connected.

Space
1500 mm minimum free space is needed for lifting plates in and out.

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

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

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

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

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

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

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

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

**Warning!**
Never lift by the connections or the studs around them. Straps should be used when lifting. Place straps according to picture.

M15, TL10, T20, TS20

MX25, M30, MA30

TL35
Raising

1. Place two timber beams on the floor.

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

3. Place the heat exchanger on the timber beams.

4. Place straps around one bolt on each side.

5. Lift the heat exchanger off the timber beams.

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

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

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

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

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

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

3. If there is a valve at the exit, make sure it is fully open.

4. Open the vent and start the pump.

5. Open the valve slowly.

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

7. Repeat steps 1–6 for the second media.
**Unit in operation**

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

During operation, check that:
- Media temperatures and pressures are within the limits stated on the PHE-drawing
- No leakages appear due to faulty tightening of the plate pack or to defective or damaged gaskets
- Carrying bar and guiding bar are kept clean and greased
- The bolts are kept clean and greased.

Always consult your local Alfa Laval office for advice on:
- New plate pack dimensions if you intend to change the number of plates
- Selection of gasket material if operating temperatures and pressures are permanently changed, or if another medium is to be processed in the PHE.

**Shut-down**

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

1. Slowly close the valve controlling the flow-rate of the pump you are about to stop.
   
   ![Close](image)

2. When the valve is closed, stop the pump.

3. Repeat steps 1–2 for the other side.

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

![Clean and greased](image)

**No leakage**
**Maintenance**

**Cleaning-In-Place (CIP)**

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

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

CIP performs

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

**Cleaning liquids**

<table>
<thead>
<tr>
<th>Cleaning liquid</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlfaCaus</td>
<td>A strong alkaline liquid, for removing paint, fat, oil and biological deposits.</td>
</tr>
<tr>
<td>AlfaPhos</td>
<td>An acid cleaning liquid for removing metallic oxides, rust, lime and other inorganic scale.</td>
</tr>
<tr>
<td>AlfaPass</td>
<td>An alkaline liquid for passivation (inhibition of corrosion).</td>
</tr>
<tr>
<td>AlfaNeutra</td>
<td>A strong alkaline liquid for neutralization of AlfaPhos before drainage.</td>
</tr>
<tr>
<td>Alfa P-Scale</td>
<td>An acidic cleaning powder with a corrosion inhibitor particularly effective for removing of calcium carbonate and other inorganic scale.</td>
</tr>
<tr>
<td>Alfa P-Neutra</td>
<td>An alkaline powder for neutralization of used Alfa P-Scale prior to disposal.</td>
</tr>
<tr>
<td>AlfaAdd</td>
<td>A neutral cleaning strengthen to be used with AlfaPhos, AlfaCaus and Alfa P-Scale. Provides better cleaning results on oily, fatty surfaces and where biological growth occurs. AlfaAdd also reduces any foaming.</td>
</tr>
<tr>
<td>Alpacon Descalent</td>
<td>An acidic, water based, non-hazardous cleaning agent designed for removal of scale, magnetite, algae, humus, mussels, shellfish, lime and rust. Containing BIOGEN ACTIVE, a biological mixture made from renewable materials, as an active ingredient.</td>
</tr>
<tr>
<td>Alpacon Degreaser</td>
<td>A neutral degreaser to be used with Alpacon Descalent. Effectively removes oil, fat or grease layers, but also reduces foaming. Containing BIOGEN ACTIVE, a biological mixture made from renewable materials, as an active ingredient.</td>
</tr>
</tbody>
</table>

Follow the instructions of the CIP equipment.

The following CIP models can be used: CIP75, CIP200, CIP400 and CIP800.
Manual cleaning

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

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

1. Drain the plate heat exchanger.

2. Inspect the sliding surfaces of the carrying bar and wipe clean.
Mark the plate assembly on the outside by a diagonal line.

Measure and note down the dimension A.

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

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Bolt No.</th>
<th>To dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1–2–3–4</td>
<td>1,05A</td>
</tr>
<tr>
<td>2</td>
<td>1–2 or 3–4</td>
<td>Opening</td>
</tr>
</tbody>
</table>

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

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

Step 2: Loosen the two diagonal pairs of bolts are loosened alternately, as shown in the figure below.
Open the plate pack by letting the pressure plate glide on the carrying bar.

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

Plates need not to be removed if cleaning is done using only water, i.e. without cleaning agent.
Manual cleaning of opened units

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

**Note!**
Be careful not to damage the gasket during manual cleaning.

Deposits removable with water and brush

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

1. Remove deposits using a soft brush and running water.
2. Rinse with water using a high pressure hose.

Deposits not removable with water and brush

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

1. Brush with cleaning agent.
2. Rinse with water.
Cleaning agents – Incrustation, scaling  
**Concentration max 4 %**  
**Temperature max 60 °C (140 °F)**

<table>
<thead>
<tr>
<th>Incrustation – Scaling</th>
<th>Sediment</th>
<th>Cleaning agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium carbonate</td>
<td>Corrosion products</td>
<td>Nitric acid</td>
</tr>
<tr>
<td>Calcium sulphate</td>
<td>Metal oxides</td>
<td>Sulfamic acid</td>
</tr>
<tr>
<td>Silicates</td>
<td>Silt</td>
<td>Citric acid</td>
</tr>
<tr>
<td></td>
<td>Alumina</td>
<td>Phosphoric acid</td>
</tr>
<tr>
<td></td>
<td>Diatomic organisms and</td>
<td>Complexing agents (EDTA, NTA)</td>
</tr>
<tr>
<td></td>
<td>their excrement of various colours</td>
<td>Sodium polyphosphates</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Biological growth – Slime</th>
<th>Cleaning agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>Nematodes</td>
<td>Sodium carbonate</td>
</tr>
<tr>
<td>Protozoa</td>
<td>Cleaning effect can be considerably increased by the addition of small quantities of hypochlorite or agents for the formation of complexes and surfactants.</td>
</tr>
</tbody>
</table>

Cleaning agents – Oil residues, asphalt, fats

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Cleaning agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil residues</td>
<td>Paraffinic naphta-based solvent (e.g. kerosine).</td>
</tr>
<tr>
<td>Asphalt</td>
<td></td>
</tr>
<tr>
<td>Fats</td>
<td></td>
</tr>
</tbody>
</table>

**Note!**  
Gaskets in EPDM rubber qualities swell in these media. Contact time should be limited to 30 minutes.

**Caution!**
The following solutions should not be used:  
- Ketones (e.g. Acetone, Methylethylketone, Methylisobutylketone)  
- Esters (e.g. Ethylacetate, Butylacetate)  
- Halogenated hydrocarbons (e.g. Chlorothene, Carbon tetrachloride, Freons)  
- Aromatics (e.g. Benzene, Toluene).
Closing

1. Check that all the sealing surfaces are clean.

2. Brush the threads of the bolts clean, using a steel wire brush. Lubricate the threads with a thin layer of grease, e.g. Gleitmo 800 or equivalent.

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

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

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Bolt No.</th>
<th>To dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1–2 or 3–4</td>
<td>1,10A</td>
</tr>
<tr>
<td>2</td>
<td>1–2–3–4</td>
<td>A</td>
</tr>
</tbody>
</table>

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

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

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

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

<table>
<thead>
<tr>
<th>Bolt size</th>
<th>Bolt with bearing box</th>
<th>Bolt with washers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N·m</td>
<td>kpm</td>
</tr>
<tr>
<td>M24</td>
<td>450</td>
<td>45</td>
</tr>
<tr>
<td>M30</td>
<td>900</td>
<td>90</td>
</tr>
<tr>
<td>M39</td>
<td>1300</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>200</td>
</tr>
<tr>
<td>M48</td>
<td>2100</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td>3300</td>
<td>330</td>
</tr>
</tbody>
</table>

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

If dimension A cannot be reached
• Check the number of plates and the dimension A.
• Check that all the nuts and bearing boxes are running freely. If not, clean and lubricate, or replace.

The dimension A can be exceeded in exceptional cases. The following plate package lengths could then be accepted:

<table>
<thead>
<tr>
<th>Plate package length/plate</th>
<th>Plate package length (dimension A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;4 mm</td>
<td>A + 1 %</td>
</tr>
<tr>
<td>3–4 mm</td>
<td>A + 1,5 %</td>
</tr>
<tr>
<td>&lt;3 mm</td>
<td>A + 2 %</td>
</tr>
</tbody>
</table>

Place the other bolts in position.

• Inspect the washers.
• When fully tightened, the bolts should all be equally tensioned.
• The difference between the plate package lengths (the dimension A) measured at adjacent bolts should not exceed:
  – 2 mm when A < 1000 mm
  – 4 mm when A > 1000 mm.

• The plate package length at all bolts must not differ more than 1 %.
• If the unit does not seal fully, it can be tightened to give dimension A – 1 %. The maximum tightening torque must not, however, be exceeded.

If the plates are correctly assembled, the edges form a “honeycomb” pattern, see picture below.
Pressure test after maintenance

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

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

The recommended test time is 10 minutes.

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

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

**Clip-on gaskets**

1. Open the plate heat exchanger according to page 9, and remove the plate that is to have a new gasket.

2. Remove the old gasket.

3. Assure that all sealing surfaces are dry, clean and free of foreign matters.

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

**Clip-AD gaskets (MX25)**

1. Open the plate heat exchanger according to page 9, and remove the plate that is to have a new gasket.

2. Remove the old gasket.

3. It is not necessary to remove old tapes as the film is very thin. Make sure, however, that the gasket groove is clean and dry.

4. Adhere tape, using the pistol.

**Note!**

Make sure the two gasket prongs are in correct position.

Proceed with the next plate to be regasketed until all plates in need of regasketing are done with.

Close the plate heat exchanger according to page 14.
5 Attach the gasket to the plate. Slip the gasket prongs under the edge of the plate.

6 Close the plate heat exchanger according to page 14.

Glued gaskets
Separate gluing instructions will be delivered together with the glue.