Thermal Leverage

MAINTENANCE AND OPERATING MANUAL PLATE AND FRAME

Thermal Leverage

INDEX

	PAGE
Introduction	4
Use / warranty	4
Name plate	6
Safety instructions	7
Handling	8
Storage	9
Installation	9
Start-up	10
Operation	14
Interruption in operation for short periods	15
Maintenance	16
Replacement of plates and gaskets	20
Re-assembling of the PHE	20
Cleaning of the frame	21
Problem solving	21

Thermal Leverage

1. Introduction

First of all it is recommended to keep the present Manual always near the Plate heat exchanger.

It is moreover of the highest importance that the plate heat exchanger will be used exactly according to the thermal programm calculated at the time of the purchase of the PHE. It is therefore important and reccommended to keep a copy of the technical specification as well as the Declaration of Conformity toghether with this manual. Using the PHE at different conditions as those established on the technical specification, may be the cause of important differences in the performance or not function as it should.

The installation of the PHE as well as future maintenance operations should be carried out by qualified and instructed personnel only.

If the PHE needs special maintenance or structural changes, in that case please contact the manufacturer.

2. Use/Warranty

The TL Thermal Leverage Plate & Frame PHE must be installed and used respecting the technical specification thermal calculation, paying special attention to the following:

- Avoid excessive temperatures which may dammage the gaskets (install safety thermostats)
- Avoid "water hammers" which may both dammage plates and gaskets. It is recommended to install a security valve.
- Do not use different fluids as those indicated in the technical specification, other fluids than those choosen in the design of the PHE may not be suitable for the choosen materials, i.e. plates and gaskets.
- Do not use the PHE at higher pressures than the maximum allowed pressure (PS) or the maximum allowed temperature (TS) as indicated in the technical specification and on the label attached to the PHE.
- The PHE must be used in accordance to the European Directive 97/23/CE (P.E.D.)

If changes to the PHE are required, please contact TL Thermal Leverage for the necessary approval.

Important Notice:

TL warrants its equipment for the duration of 18 months as from the invoice date on the condition that the equipment has been installed within 6 months of shipment and used correctly according to the submittal datasheets established in the documents part of the order.

WARRANTY. Company hereby warrants the equipment manufactured by it and bearing its nameplate in the respects set forth herein and exclusively for the benefit of those users described herein. THIS LIMITED WARRANTY SHALL EXTEND SOLELY TO THOSE PERSONS WHO ARE OWNERS OF THE EQUIPMENT DURING THE WARRANTY PERIOD HEREINAFTER DEFINED AND WHO USE SUCH EQUIPMENT IN THE PROJECT AND FOR THE PURPOSES FOR WHICH SUCH EQUIPMENT WAS ACQUIRED FROM COMPANY.

EXCLUDED FROM ANY COVERAGE UNDER THIS WARRANTY ARE DEFECTS IN EQUIPMENT FROM DAMAGE IN SHIPMENT, FAULTY INSTALLATION, FAILURE TO PROPERLY MAINTAIN, MISUSE, ABUSE, NEGLECT, ACCIDENT OR NEGLIGENCE. If any person becomes entitled to a claim under this warranty, such person shall, as a condition precedent to securing warranty performance, return the equipment to Company's plant, 70 Lambert Avenue, Copiague, New York 11726 USA, transportation prepaid. If the equipment thus returned is found by Company to be defective for a cause and within a time covered by this Warranty, such equipment shall be repaired or replaced without charge and returned to its owner or job site at Company's cost for transportation and handling.

Equipment which is repaired or replaced shall carry a warranty equal to the unexpired portion of the original warranty. Company will commence inspection of any equipment returned to it for warranty claim within seven (7) working days after the arrival of such equipment at Company's plant, and shall complete any repairs required under this warranty within sixty (30) days after such arrival, unless Company shall sooner notify said owner of reasonable cause for delay beyond control of Company. Warranty obligations hereunder will be performed only between the hours of 9:00 a.m. and 4:00 p.m. Monday through Friday and excluding holidays. Any person believing himself entitled to warranty performance hereunder is required to notify the Warranty Claims Department, 70 Lambert Avenue, Copiague, New York 11726 USA, prior to return of any Warranted Equipment for repair hereunder.

IN ALL EVENTS, COMPANY WILL NOT BE LIABLE FOR AND WILL NOT REIMBURSE ANY LABOR, MATERIAL, OR OTHER REPAIR CHARGES INCURRED BY ANYONE OTHER THAN COMPANY ON ANY EQUIPMENT UNLESS SUCH CHARGES HAVE BEEN SPECIFICALLY AUTHORIZED IN ADVANCE IN WRITING BY COMPANY. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. COMPANY WILL NOT IN ANY EVENT BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING WITHOUT LIMITATION, LOST PROFITS, RESULTING FROM OR ATTRIBUTABLE TO THE EQUIPMENT OR ANY AGREEMENT BETWEEN THE PARTIES. IN NO EVENT SHALL COMPANY'S AGGREGATE LIABILITY ARISING OUT OF OR RELATED TO THE EQUIPMENT, ANY RELATED SERVICES OR ANY AGREEMENT BETWEEN THE PARTIES, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE TOTAL OF THE AMOUNTS PAID TO COMPANY FOR THE EQUIPMENT SOLD PURSUANT TO THE APPLICABLE ORDER OR PROPOSAL.

. This warranty shall not apply should the defects of the Products be caused by:

natural wear and tear;

unauthorised repairs or modifications;

unsuited use or application;

thermal overexposure, also when occasional;

electrical or mechanical over-stress;

3. Identification label

Each PHE leaves our production plant with an identification label applied to the frame of the PHE.

On the label the max. allowed pressure is written, the minimun and maximum allowed temperatures, the PED classification, the kind of fluids (Group I or Group II) as well as the year of construction and serial number. These are the informations that are necessary in your comunication with the manufacturer in case of requests of spare parts in order to easily trace and identify the unit.

4. Safety instructions

Plate heat exchangers are equipment operating under pressure and must therefore be handled and maintained by adequately instructed and qualified personnel only. National and international regulations (EC 97/23/EG) must strictly be followed:

In case the PHE is operating with fluids of Group 1 or dangerous fluids or gases, it is necessary to apply special safety measures foreseen by the classification of dangerous fluids in Group I.

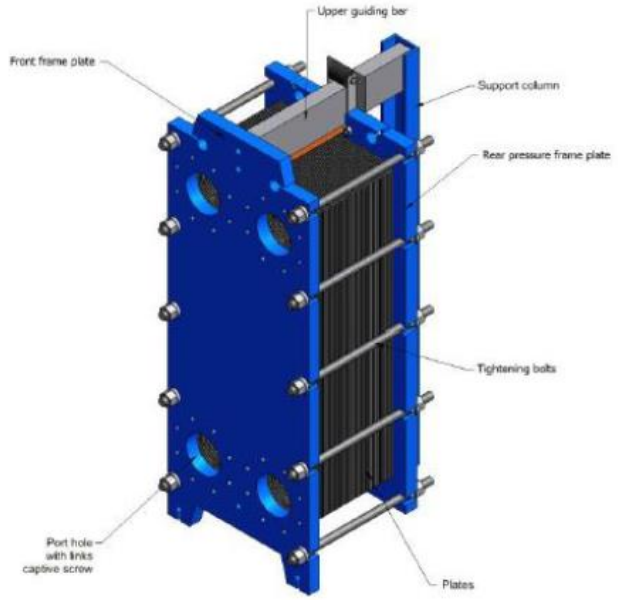
Before carrying out any kind of work /maintenance on the PHE please make sure that:

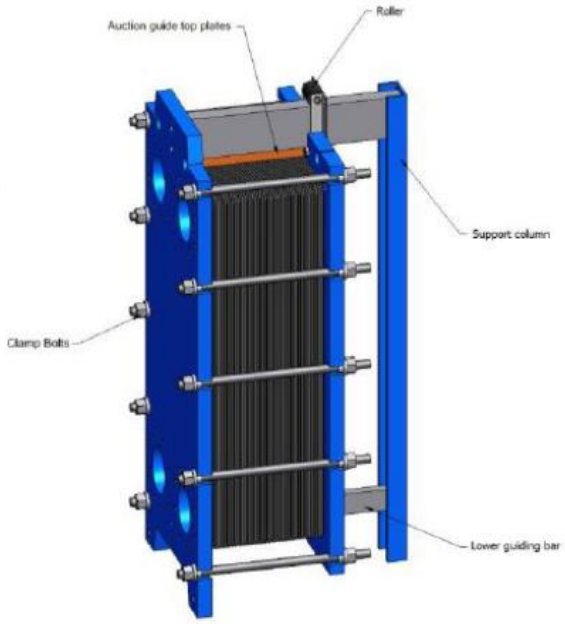
- Both circuits have been emptied
- The PHE is not under pressure
- The temperature is not above 40°
- The operator wears protective gloves

In case the PHE is operating with temperatures >90° the PHE should be equipped with a heat protection cover avoiding thus the risk of fluid projection in case of leakage. Single plates should be handled **always** wearing protective gloves since the plates have very sharp edges.

Thermal Leverage

Components of the Plate heat exchanger

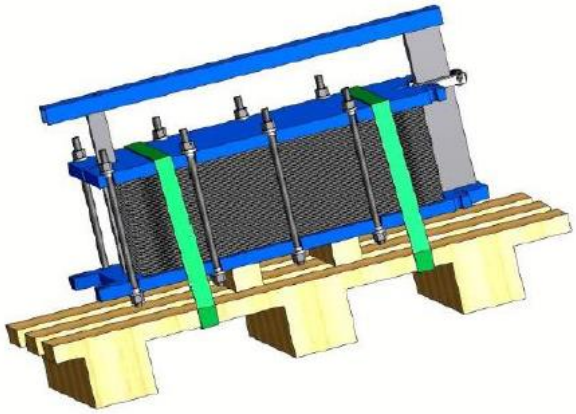




5. Handling

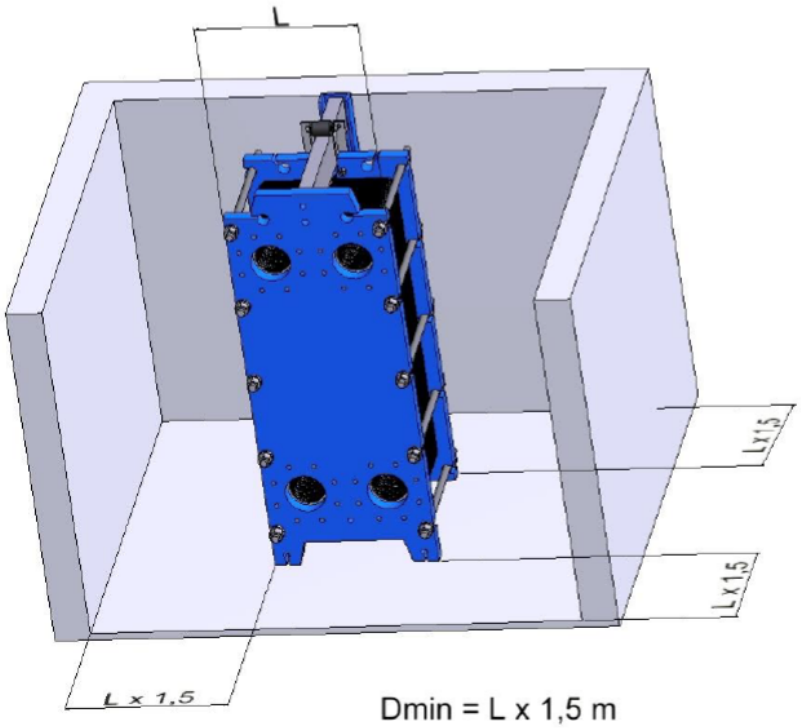
Small and medium sized PHE's are delivered usually fixed to a pallet, allowing handling and lifting by a forklift. PHE's of large dimensions and heavy weight must be handled using slings (in order not to dammage the PHE never use metal chains) and be taken by the forks of the forklift or crane. Ones the PHE is installed at its final destination it should be anchored to the ground or inside the plant, taking care to respect a minimum distance from walls or other machinery of 1,50/2.00 m. in order to facilitate handling of the PHE in case of maintenance.

N.B: Never lift the PHE at connections or flanges!



6. Storage

If the PHE will not be installed immediately after delivery, take care to store the PHE in a dry environment, protected from bad weather conditions at a temperature not <5° and not > to 60°. If the PHE is stored outdoors, avoid direct sunlight and protect the PHE with an adequate cover isolating it from umidity and freezing. Under these conditions foresee the greasing of the tightening bolts and studs against rusting.



Dmin = L x 1,5 m

7. Installation

- Install vent valves at the highest points of the connections, allowing the air to leave the PHE during the filling of the unit;
- In case of multipass PHE's avoid the obstruction with fixed piping of the opening space betwee the mobile (rear) frame plate and rear support enabling an easy opening of the PHE during maintenance;
- Check the correct tightening meassure of the plate pack (np x ...mm)
- In order to avoid water hammers or sudden pressure variations install shock absorbers between the feeding pipes and PHE; Do not install quick-closing- and opening valves.
- Install closing and opening valves on the pipes enabling the isolation of the PHE during maintenance.

The PHE is designed for normal indoor installation at room temperature. If an outdoor installation is required where it could be subject to extreme climatic conditions, is it necessary to provide the PHE with an adequate isolation. Isolation must be ordered toghether with the PHE.

The PHE must be installed on perfectly a flat ground in a vertical position

8. Start-up of the PHE

Primary circuit:

a. Feed valve between pump and PHE remains closed
b. Open the outlet valve (if installed) on the connection completely
c. Open the vent
d. Start the pump
e. Make sure the feed valve is opened slowly
f. Make sure the air has completely escaped the PHE and close the vents.

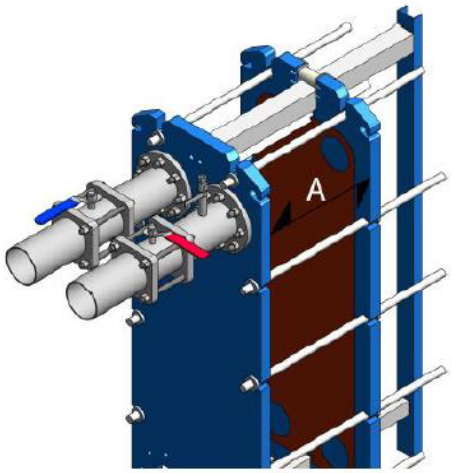
Secundary circuit:

Repete the same procedure as above.

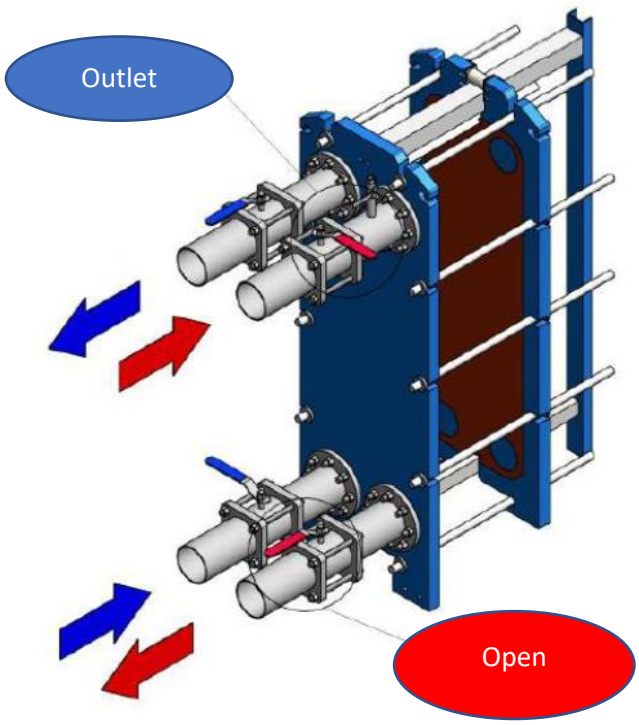
START-UP

During start-up, check that no visible leakages appear from the plate pack, vlaves or piping system.

1 Before start-up check that all tightening bolts are firmly tightened and that the dimension A is correct. Refer to PHE dimensioning sheet.

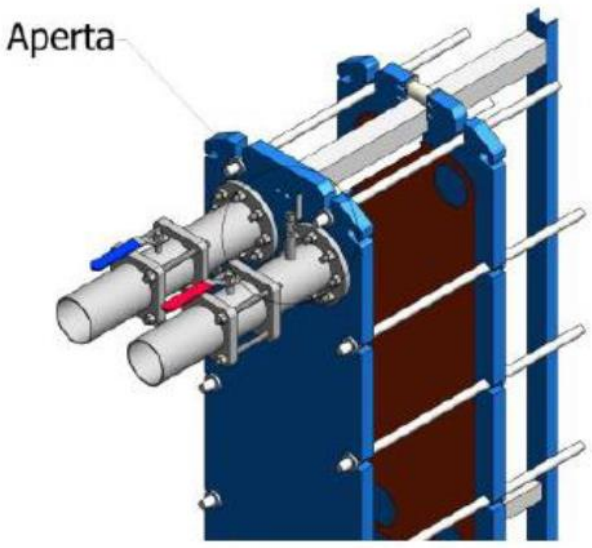


2 Check that the valve is closed between the pump and the unit controlling the system flow rate.

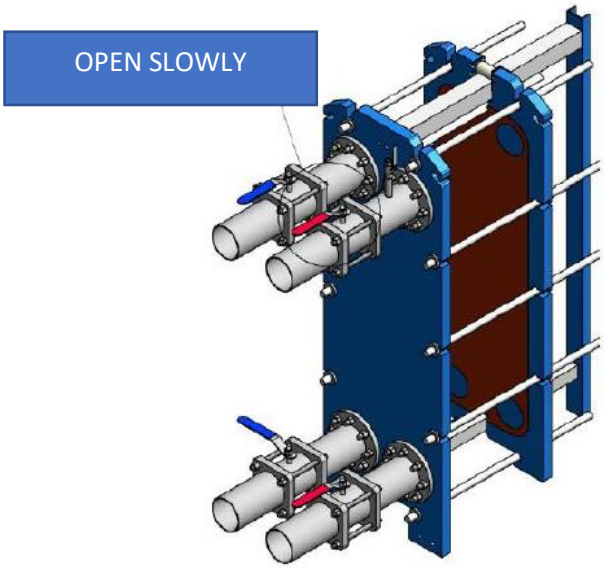


3 If there is a valve at the exit, make sure it is fully open.

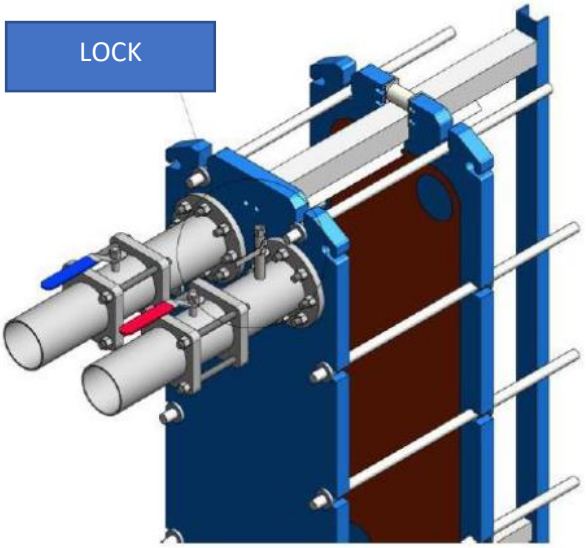
4 Open the air vent and start the pump.



5 Open the valve slowly.



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



7 Repeat steps 1-6 for the second media.

Pressure test

If during a test it is noticed that there is a pressure variation between the two circuits it is just matter to wait 2-3 min and the pressure will stabilize.

The reason is due to plates internal movements which create small channels volume variation.

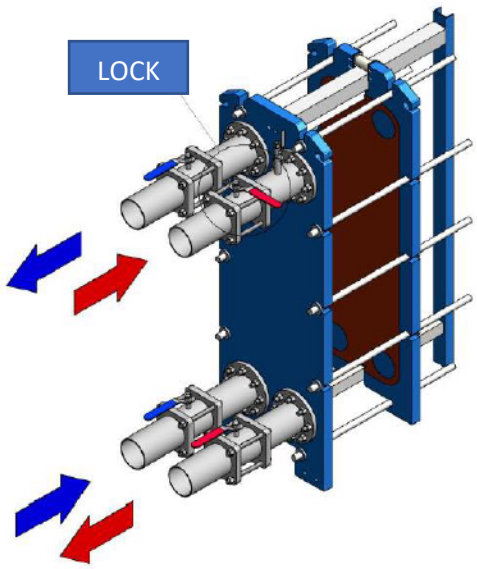
Thermal Leverage

Guidelines for the pressure test

	PN-10		PN-16	
	F1-F2 [barg]	W1-W2 [barg]	F1-F2 [barg]	W1-W2 [barg]
STEP-1	4		4	
STEP-2		4		4
STEP-3		16		21
STEP-4	16		21	
STEP-5	Wait 2 -3 min for pressure stabilization			
STEP-6	Circuits pressure adjustment (if needed)			
STEP-7	Circuits pressure recording			

SHUT-DOWN

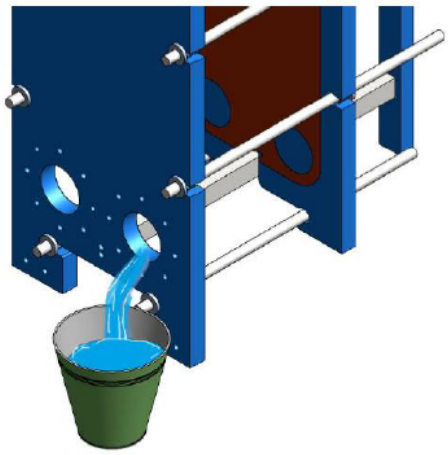
1 Slowly close the valve controlling the flow rate of the pump you are about to stop.

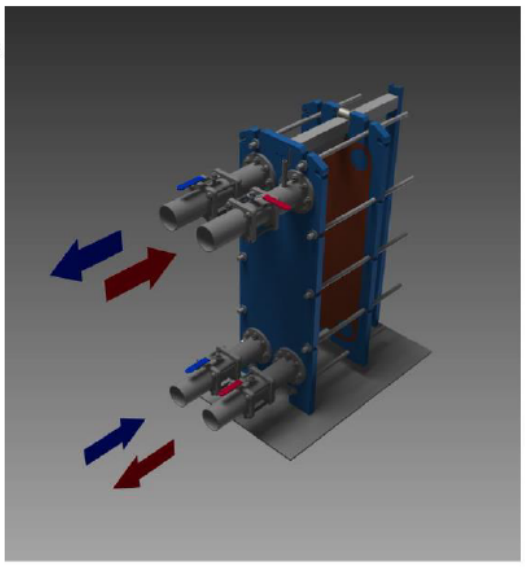


2 When the valve is closed, stop the pump.

3 Repeat steps 1-2 for the other side for the second media.

4 If the PHE 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 room temperature is below the freezing temperature of the media. Depending on the media processed, it is also recommended to rinse and dry the PHE plates and connections.





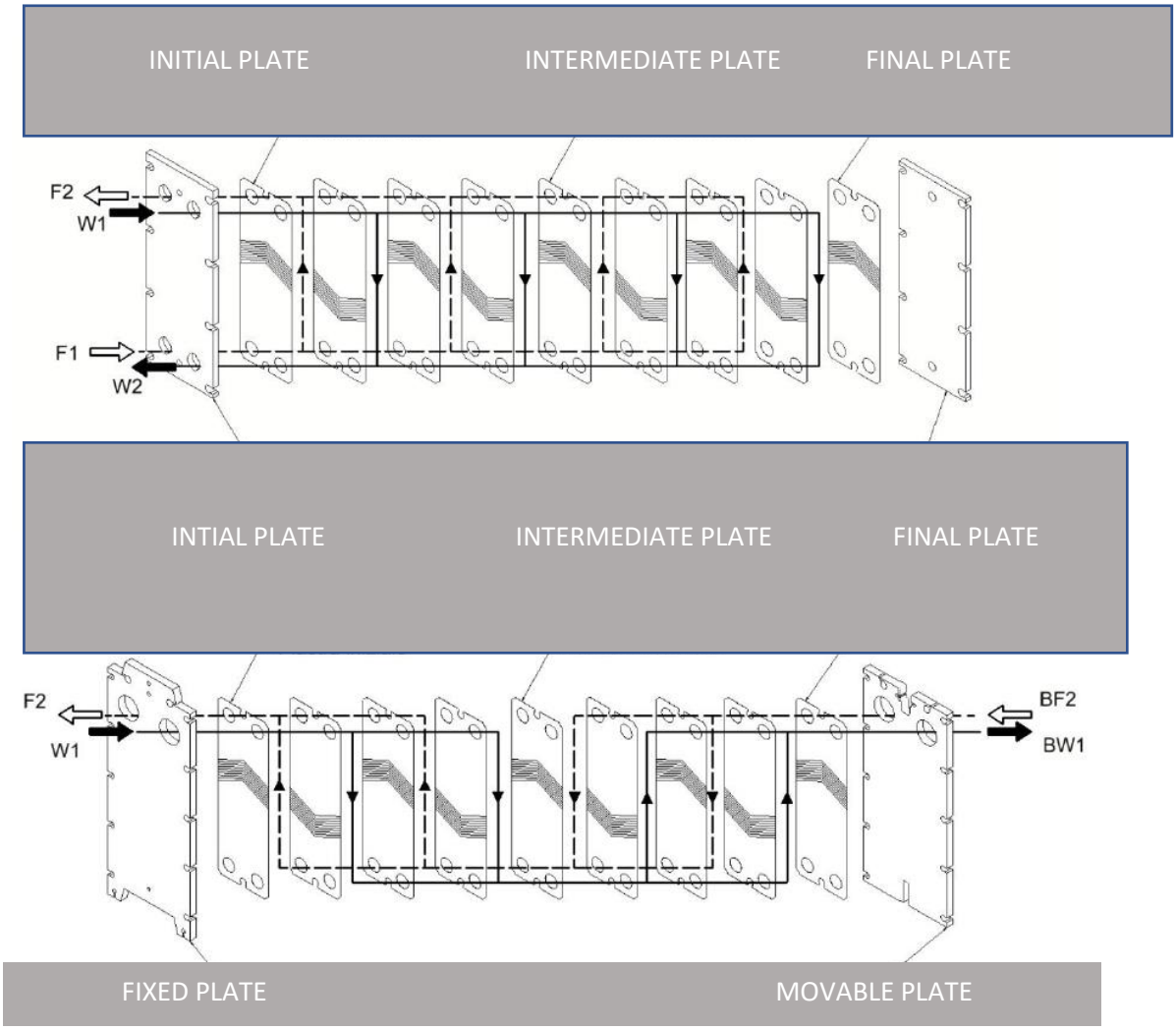
9. Operation

During operation the design pressure and design temperature, indicated on the lable and the technical specification of the PHE must be respected and in no case be exceeded.

It is mandatory to avoid sudden temperature exceeding as well as water hammers.

These circumstances may severely dammage the PHE's components and will automatically cancel the validity of the warranty, and Onda may not be held liable for any dammages or consequential dammage.

In case a temperature exceeding or waterhammer occurs, the PHE must be put out of operation in order to eliminate the cause of the defect. Under normal operating circumstances it is recommended to check the perfect functioning of the PHE in the plant at least ones a year and to check the functional parameters such as pressure, temperatures and pressure drop on a monthly basis. Variations in these parameters may be the sign of fouling inside the PHE.



10. Interruption in operation for short periods:

1) Gradually close the feeding valves with priority to the circuit with the highest pressure;
2) Switch of the pumps
3) Close the valves on the outlet pipes

For longer interuptions add the following procedure to the points above:

1. Let the PHE cool-off untill room temperature
2. Completely drain both circuits and vent the heatexchanger
3. Rinse the plate package with water and eliminate eventual dirt

4. Unscrew the nuts of the tightening bars in order to loosen the plate package increasing the tightening dimension by 10% approx

5. For longer periods tightening bars and nuts should be treated with a rust resisting grease.

11. Maintenance

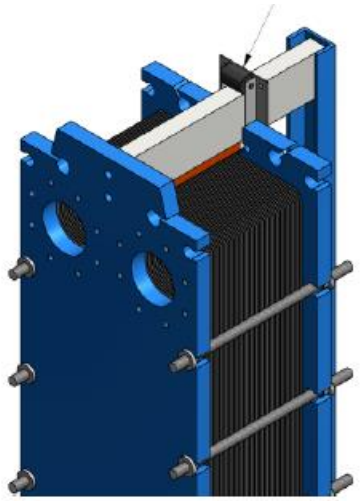
Normal maintenance frequency depends on the application and kind of fluids entering the PHE.

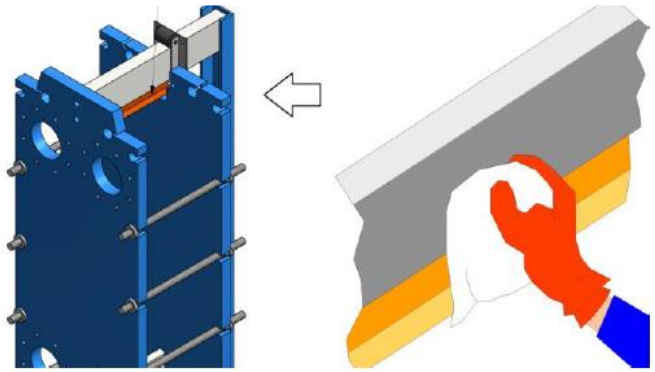
We recommend to do one yearly maintance during which the PHE should be completely opened and checked according to pt. 9.

Moreover is it important to check the gaskets which may have lost some of their spring back: This might require small adjustments in the tightening measure of the plate pack, which may be tightended until the minimum allowed value Please check the label on the PHE where min and max thightening dimensioni s mentioned.

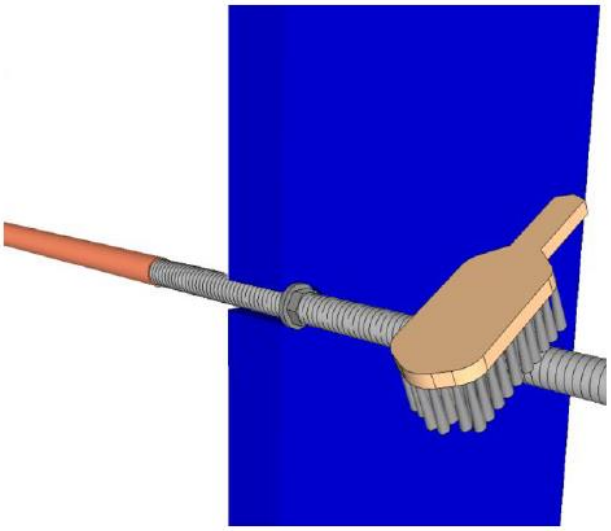
Before opening the PHE the following operations are recommended:

- Clean the plate pack externally, the roller of the guiding bar, uper and under guiding bar and lubrificate the roller;





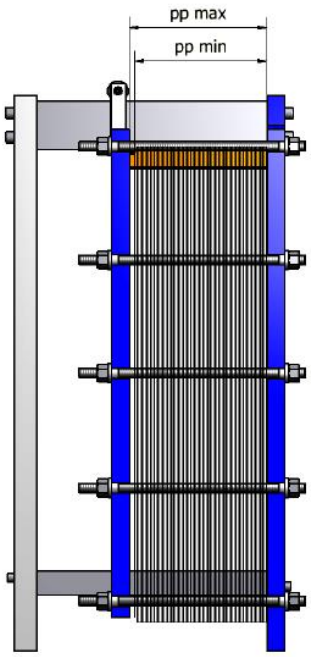
- Clean and lubrificate the tightening nuts



- Colour a diagonal line accross the side of the plate pack, this will help the operator to recompose the plate pack easily after maintenance. Before opening take care to write down the thightening dimension value before the opening of the PHE.

Dissassembling of the tightening nuts and opening of the PHE:

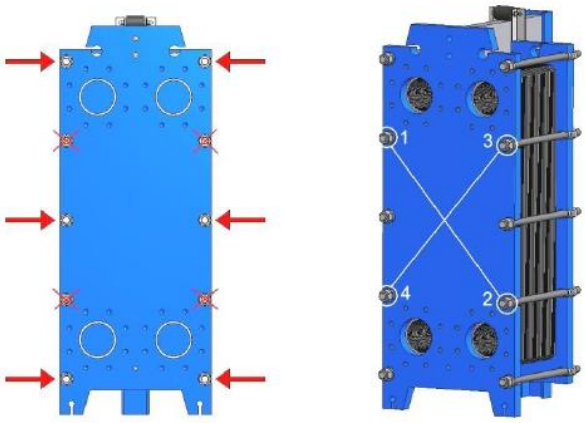
Tightening measure of the plate package



The nuts nr. 5-6-7-8-9 may be removed without a special order, while nuts nr. 1- 2- 3- 4 will be unscrewed afterwards, diagonally 1-2 / 3-4, repeating the same operation until the plate pack is completely free of pressure. At the end of this operation the rear frame plate may be moved towards the rear support, leaving the plate pack completely free.

To remove the plate from the guiding bar, move the lower part of the plate towards the rear frame plate, removing it from the lower guiding bar, turn it towards the outside and

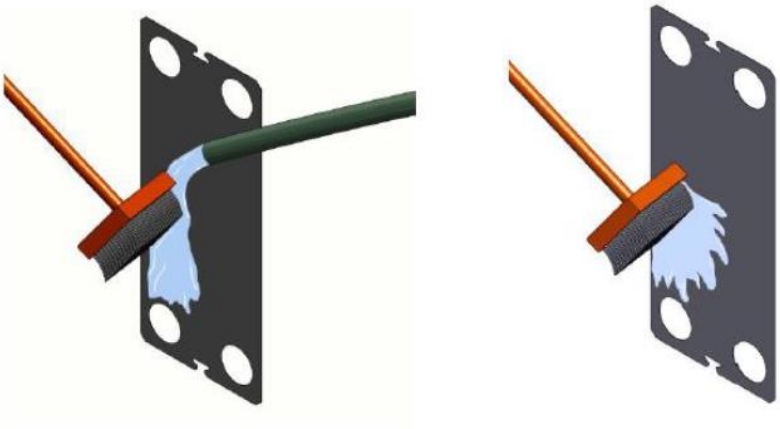
take the plate away from the pack. During all operations with the plates the operator should always where protective gloves while the edges are very sharp.



Cleaning of the plates:

If the plate pack is not too dirtty, the plates may be cleaned while the pack is open and using a soft brush and warm water. If the plates have f.e. incrustations a high pressure cleaner may be used, taking care not to use metallic brushes or abrasive products.

Take care to avoid the gaskets with the high pressure water jet sothat the gaskets will not be damaged and remain in place in their seat. Especially resisting deposits may be removed in a chemical bath.



Recommended detergents: (check that detergents are suitable for plate and gasket materials)

- Calcar/calcium and incrustations: Phosforic acid at max. 20°, concentrazione max. 5% for approx. 1 hour

- Oils, greases: Caustic soda solution at 85° , concentrazione max. 4%

For approx 24 hrs.

• Mud and metal oxides: Nitric acid at 60°, concentration max. 8% or citric acid, concentration of 4% at max. 60°.

Important:

Do not use hydrochlorcic acid (HLC) or water with chloride to clean stainless steel plates;

Do not use phosforic asid on titanium plates

N.B. Always check and keep strictly to the safety instructions from the detergent manufacturer.

12. Replacement of plates and gaskets

The gaskets are fixed easily into their seat, without the need of glues inside the groove. Before fixing the new gasket to the plate, acccurately clean the groove.

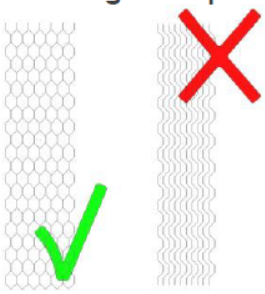
13. Re-assembling of the PHE

• Check that both plate sand gaskets are perfectly clean. The smallest impurity may be the cause of a leakage.

• Lubrificate the upper guiding bar.

• Re-arrange the plates back into the PHE frame according to the assembly scheme, in reverse order. Pay attention to the first and final plate which are in direct contact to the front and rear frame plate. The gasket of the first plate must be placed against the rear (fixed) frame plate. Check the correct plate pack assembly by observing the coloured diagonal line applied before the disassembling. Moreover if the plate pack is correctly assembled the external side of the plate pack form a regular honeycomb design. Small plate heat exchangers may be re-assembled in a horizontal position lying on the rear (fixed) plate.

Correct assembling of the plate package

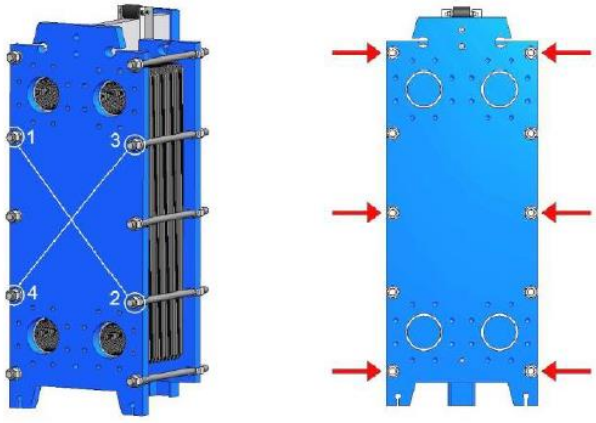


• Slowly return the front plate back to the plate pack.

• Introduce the tightening bolts 1 – 2 – 3 – 4 from the side and fix the counter nuts tightly to the rear (fixed) plate.

• Fasten the tightening bolts 1-4 uniformly and in rotation (alternating and diagonal 1-2 and 3-4). During tightening always check the tightening dimension. During the tightening the angle should not exceed 10 mm over the width and 20 mm over the diagonal.

• Tighten the plate package to the same tightening measure from before the opening of the PHE. Tighten the remaining bolts to the same tightening measure as bolts 1-2-3-4.



Important notice:

If the PHE is leaking during the pressure test, the plate pack may be tightened slowly taking care not to exceed with more then some mm the tightening measure of before the opening and indicated on the PHE label. Exceeding further may seriously dammage both plates and gaskets which may cause other leakages. If the leakages proceed, contact the manufacturer.

In order to allow easy maintenance and opening of the PHE take care to regulary lubrificate all moving parts of the PHE (nuts, washers, bolts, roller and guiding bars).

14. Cleaning of the frame:

The frame in painted carbon steel may be cleaned with a sponge, cloth or brush, using a slightly alcaline solution. In case the painting of the frame is dammaged it is recommended to repair the painting as soon as possible.

15. Problem solving

Fluid leakage between connections and fixed plate (leakage from connections at frame plate):

May be due to:

- Mechanical stresses on the connections
- Faulty ring gasket, connection or flange
- Material fatigue or wear

Solutions:

- Check correkt tightening of the bolts
- Check eventual mechanical stresses from the piping system on the gasket
- Check the correct allignment of the piping and flanges and eventually correct if necessary

Fluid leakage between plate package and fix/mobile frame plate (leakage from the bottom)

May be due to:

- Faulty gasket between plate and inside area of the frame plate
- Faulty gasket or fault in the groove of the first gasket
- Material fatigue or wear

Solutions:

- Identify and sign with a marker place of leakage
- Open the PHE following the procedure at pt. 11
- Check whether the first gasket is correctly seated in its groove and touching the frame plate;

Externa Leakage from the platepackage

May be due to:

- Exceeding of the allowed temperature/pressure
- The mobile frame plate is not tightened plane-parrallel
- Wrong tightening measure
- Faulty or dammaged gaskets
- Wear of the gaskets

Solutions:

- Correct pression and temperature to design values
- If necessary, tighten the frame plate until perfect plane-parallel position. If necessary correct tightening dimensions (increasing of diminuishing) very carefully taking care not to exceed the tightening dimensions more than some milimeters. The difference between the tightening measure between single bolts should not exceed more than 2 mm.
- If after the above solutions no resulti is obtained, open the PHE and check the correct positioning of all gaskets it the groove, replace eventual dammaged gaskets.

Internal leakage / mixture of the fluids

May be due:

- Corrosion on the plate
- Crack in the plate

Thermal Leverage