SCAMBIATORE DI CALORE A PIASTRE

PLATE HEAT EXCHANGER

MANUALE DI INSTALLAZIONE, USO E MANUTENZIONE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

COMPANY WITH
QUALITY SYSTEM
CERTIFIED BY DNV GL
= ISO 9001 =

COMPANY PED CERTIFIED
BY DNV GL
= 2014/68/UE MODULE H/H1 =

Ed.01/20

Il prodotto è stato realizzato in conformità con la normativa PED 2014/68/UE.
The product has made according to the PED 2014/68/UE.

Techno System si riserva il diritto di modificare, senza obbligo di preavviso, le caratteristiche tecniche e costruttive ivi riportate.
Techno System reserves the right to modify, without notice obligation, technical and constructive features of every product mentioned in this work.

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-DATA SHEET-

DATASHEET

MISURE DI SERRAGGIO *– Tigthening* **F = (np x S) + Z** (vedi pag.2 - *see pag.2*)

Scambiatori a piastre lisce - *Smooth plate heat exchangers*

Modello *Model*	**Z**	**Guarnizioni** *Gaskets* **NBR**		**Guarnizioni** *Gaskets* **EPDM**		**Guarnizioni** *Gaskets* **FKM**	
		S1 (mm)	S2 (mm)	S1 (mm)	S2 (mm)	S1 (mm)	S2 (mm)
TS 125	0	2,50	2,40	2,50	2,40	2,65	2,40
TS 501	0	2,50	2,40	2,60	2,40	2,65	2,40
TS 1001	0	3,75	3,60	3,80	3,70	3,85	3,70
TS 1401	0	3,75	3,60	3,80	3,70	3,85	3,70
TS 3001	0	3,75	3,60	3,80	3,70	3,85	3,70
TS 4201	0	3,75	3,60	3,80	3,70	3,85	3,70

Scambiatori a piastre corrugate *– Corrugated plate heat exchangers*

Modello *Model*	**Piastre** *Plate*	**Z**				**PN6** **Guarnizioni** - *Gaskets* **NBR/EPDM/FKM**		**PN10** **Guarnizioni** - *Gaskets* **NBR/EPDM/FKM**		**PN16** **Guarnizioni** - *Gaskets* **NBR/EPDM/FKM**	
		Z1	**Z2**	**Z3**	**Z4**	**S1** (mm)	**S2** (mm)	**S1** (mm)	**S2** (mm)	**S1** (mm)	**S2** (mm)
TSC 510/511	**Inox** – *Stainless steel*	2	8	0	-	2,65	2,55	2,65	2,55	2,55	2,45
	Titanio - *Titanium*	2	8	0	-	2,55	2,45	2,55	2,45	2,45	2,35
TSC 910/911	**Inox** – *Stainless steel*	2	8	0	-	2,65	2,55	2,65	2,55	2,55	2,45
	Titanio - *Titanium*	2	8	0	-	2,55	2,45	2,55	2,45	2,45	2,35
TSC 1410/1411	**Inox** – *Stainless steel*	2	8	0	2	3,50	3,40	3,50	3,40	3,40	3,30
	Titanio - *Titanium*	2	8	0	2	3,50	3,40	3,50	3,40	3,60	3,50
TSC 1420/1421	**Inox** – *Stainless steel*	2	8	0	2	2,95	2,85	2,95	2,85	2,85	2,75
	Titanio - *Titanium*	2	8	0	2	2,85	2,75	2,85	2,75	2,95	2,85
TSC 2610/2611	**Inox** – *Stainless steel*	2	8	0	2	2,95	2,85	2,95	2,85	2,85	2,75
	Titanio - *Titanium*	2	8	0	2	2,85	2,75	2,85	2,75	2,95	2,85
TSC 2410/2411	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	3,00	2,90	3,00	2,90	3,10	3,00
TSC 4810	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 4510	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 8110	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 4410	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 7110	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 9910	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 4450	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 7150	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00
TSC 9950	**Inox** – *Stainless steel*	0	-	-	2	3,10	3,00	3,10	3,00	3/3,10	2,90/3,00
	Titanio - *Titanium*	0	-	-	2	-	-	3,00	2,90	3,10	3,00

F = Quota di serraggio - *Tigthening dimension*

S1 = Primo serraggio effettuato in officina - *First tightening dimension*

S2 = Serraggio max. - *Maximum*

np = Numero di piastre - *Number of plates*

Z = Sovraspessore - *Superior thickness*

Z1 = Scambiatori con connessioni STD - *Plate heat exchangers with STD connection*

Z2 = Scambiatori con connessioni in polipropilene - *Plate heat exchangers with polypropilene connection*

Z3 = Scambiatori con connessioni flangiate o tronco di tubo - *Plate heat exchangers with flange or welding connection*

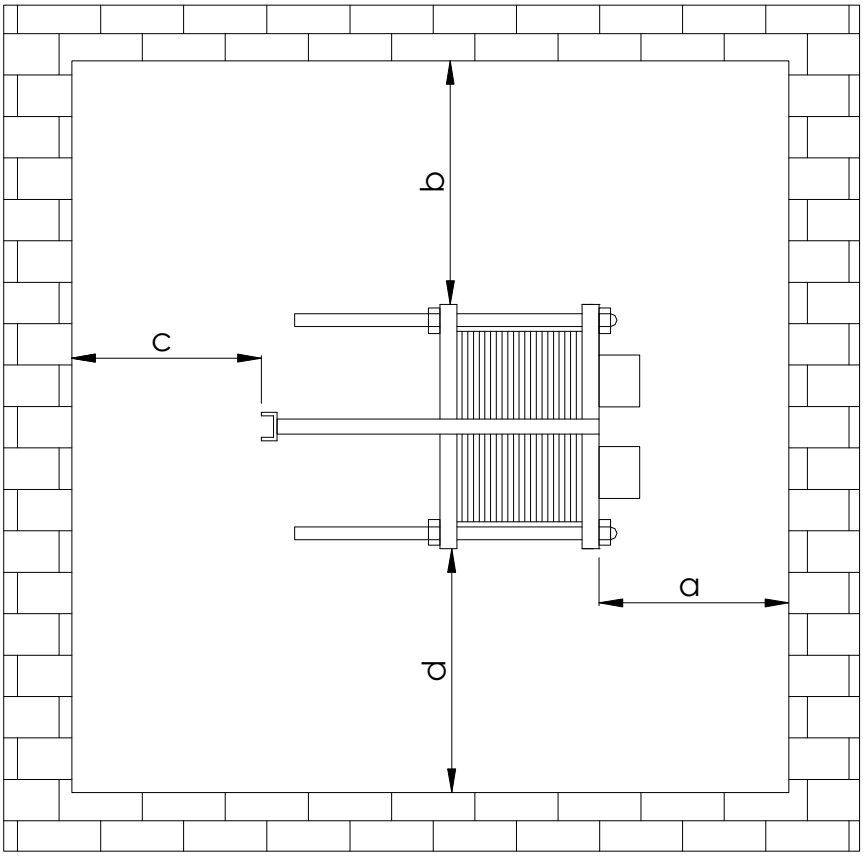
Z4 = Scambiatori con connessioni flangiate rivestite inox - *Plate heat exchangers with coated stainless steel flange connection*

ATTENZIONE: Serraggi esasperati danneggiano le guarnizioni e potrebbero portare alla *rottura del tirante stesso con possibile ferimento degli operatori.*
ATTENTION: Higher tightening could damage gaskets and cause breaking clamping bolts and hurting workers.

MISURE DI RISPETTO
Installation clearances

Durante l'istallazione è necessario prevedere per eventuali manutenzioni, uno spazio libero intorno agli scambiatori, per esempio :
The head exchanger must be installed with clearence on both sides , for example:

Modello *Model*	**Distanza (mm)** *Distance (mm)*			
	a	**b**	**c**	**d**
TS 125	250	500	250	500
TS 501	300	500	300	500
TS 1001	900	900	900	900
TS 1401	900	900	900	900
TS 3001	1200	1200	1200	1200
TS 4201	1500	1500	1500	1500
TSC 510	300	500	300	500
TSC 910	300	500	300	500
TSC 1410	900	900	900	900
TSC 1420	900	900	900	900
TSC 2610	900	900	900	900
TSC 2410	1500	1500	1500	1500
TSC 4810	1500	1500	1500	1500
TSC 4510	1500	1500	1500	1500
TSC 8110	1500	1500	1500	1500
TSC 4410	1500	1500	1500	1500
TSC 7110	1500	1500	1500	1500
TSC 9910	1500	1500	1500	1500



- GENERAL SECTION -

INTRODUCTION AND GENERAL INFORMATION

Dear Customer, thanks for choosing a Plate Heat Exchanger designed and manufactured by TECHNO SYSTEM.
Before using the plate heat exchangers, please read carefully this book and refer to it each time you need any support for operation and maintenance.
Do not hesitate calling our Authorized Technical Service for periodical maintenance; they will offer their full expertise.
Please remark the following:

- The product is been made on the basis of PED 2014/68UE.
- TECHNO SYSTEM S.r.l. reservs the right of modifying their products technically and/or mechanically , in the aim of improving the products , without obligation of advance information.
- This document is exclusive property of TECHNO SYSTEM S.r.l.; any reproduction of all or part of it at any title is forbidden.
- This Manual of Installation, Operation and Maintenance is an integral part of the product and has to be at any time of easy availability for all the plate heat exchangers users.
- TECHNO SYSTEM S.r.l. reservs the right of modifying this manual, without obligation of advance information.
- Before unpacking the plate heat exchangers check that materials (case, container and plate heat exchangers itself) don't show any remarkable damage. If not, immediately report to the transport responsible and inform TECHNO SYSTEM S.r.l. After completing unpacking carefully, check the goods; should it not be in satisfactory conditions, do not operate the equipment and report to the Supplier.
- The plate heat exchanger is to be used only for the service for which it was expecially designed for and manufactured by TECHNO SYSTEM S.r.l. . TECHNO SYSTEM S.r.l. is not responsible for any consequence and/or damage, both contractual or extra-contractual , to people , animals or goods , deriving from improper installation , maintenance and operation .
- If occurs a problem that cannot be solved by consulting the manual contact the manufacturer's technical service.
- All operations necessary for installation and maintenance have to be done only by skilled people or authorized by TECHNO SYSTEM S.r.l.

WARNING: It is strictly forbidden to make any operation before having carefully read this instruction book.

IN CASE OF NON OBSERVANCE OF THIS NOTICE AND/OR ANY IMPROPER HANDLING OF PLATE HEAT EXCHANGERS, TECHNO SYSTEM S.r.l. WILL NOT BE RESPONSIBLE NOR LIABLE FOR ANY ACCIDENT CAUSING INJURY, LOSS ETC. TO PEOPLE OR DAMAGE TO GOODS AND/OR TO THE PLATE HEAT EXCHANGERS .

GUARANTEE

The guarantee validity is 24 months from the delivery , unless otherwise reported within the purchase contract.
In case of operation problems, please contact the nearest after-sale assistance center authorized by TECHNO SYSTEM S.r.l. or directly to TECHNO SYSTEM S.r.l.
The fault of compliance with the instruction and notices constitutes a condition of improper use of the equipment both for operation and for the safety of the personnel authorized and non-authorized, thus release TECHNO SYSTEM S.r.l. from any responsibility for any accident causing injury, loss etc. to people and/or damage to goods, including the plate heat exchangers and furthermore causes the immediate expiration of the guarantee.

ASSISTANCE CENTERS

To know the nearest after-sale assistance center authorized by TECHNO SYSTEM S.r.l. please phone at +39571/667229

ALLOWED SERVICE & OPERATING CONDITIONS

The plate heat exchangers are to be used for heat exchange duties between two liquids or low pressure steam and liquid, as indicated in the manual or in the technical datasheet, by carefully following the instructions provided in this manual.
Attention, do not exceed the maximum and minimum temperature and pressure indicated on the machine's tag.
The plate heat exchangers is to be used only for the service it was expecially designed for and manufactured by TECHNO SYSTEM S.r.l. . TECHNO SYSTEM S.r.l. is not responsible for any consequence and/or damage , both contractual or extra-contractual , to people , animals or goods , deriving from improper installation , maintenance and operation .

NOT ALLOWED SERVICE & OPERATING CONDITIONS

Any other condition and service not indicated at the previous point.

BASIC NOTICES FOR SAFETY

Be careful not to touch the plate heat exchangers for services with high temperature or hazardous fluids.

TECHNO SYSTEM HEAT EXCHANGERS' MAIN COMPONENTS (SMOOTH PLATES WITH TURBOLATORS)

Main parts are plates, frames, clamping bolts, gaskets and nozzles. Plates are usually flat with a turbulator. For dirty fluids and for some specific purposes embossed plates (without turbulators) are adopted. Two large external plates (one fixed and one removable) form the frame enclosing the internal heat exchanging plates. The two external plates are clamped together, compressing the rubber gaskets and ensuring a perfect leak-free seal. Two alternating fluid circuits are formed in the internal heat exchanger plate pack by the gaskets with the result that heat from one channel is transferred to the two adjacent channels. The countercurrent flow of the two circuits increases heat transfer.

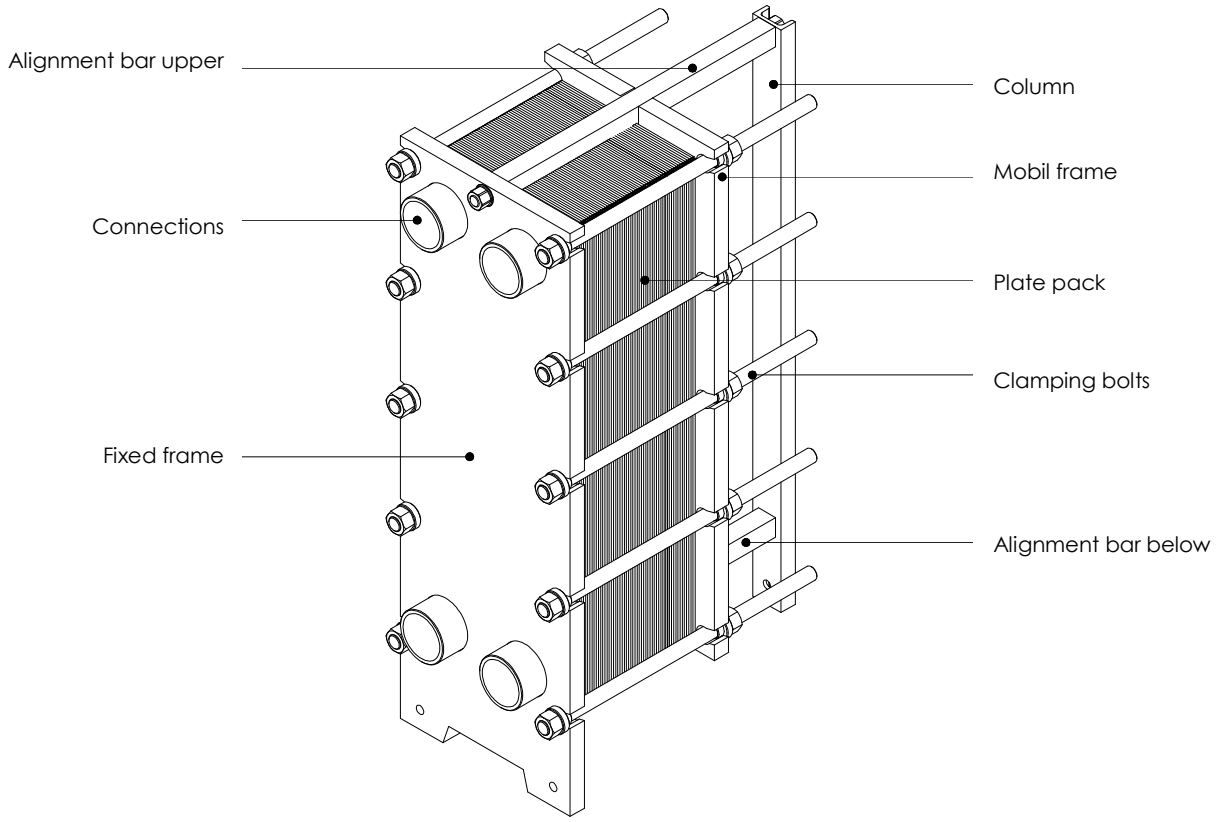


Fig. 18 – Smooth plate exchanger with turbolato

TECHNO SYSTEM HEAT EXCHANGERS' MAIN COMPONENTS (CORRUGATED PLATES)

The corrugated plate heat exchanger consists of a structure based on a fixed head plate (or frame), a moveable head plate, a support column, an upper and lower alignment bar, clamping bolts and exchange plates put together in the plate pack between the head plates.
Each plate is provided with a gasket, so the complete set of plates builds a closed double channel system in which the fluids flow separately without coming in contact.
Gaskets are not glued on the plates. The mixing impossibility between the two fluids is assured by a double seal around the holes of the exchange plates, provided with proper intermediate drain areas.
Each plate in the pack is rotated by 180° regarding the adjacent ones, allowing the fluids to flow alternatively between plate and plate. (See Fig. 31)
When the exchanger has to work contemporarly with more than two fluids, it is necessary to insert other intermediate structure plates (with connections) in the plate pack.

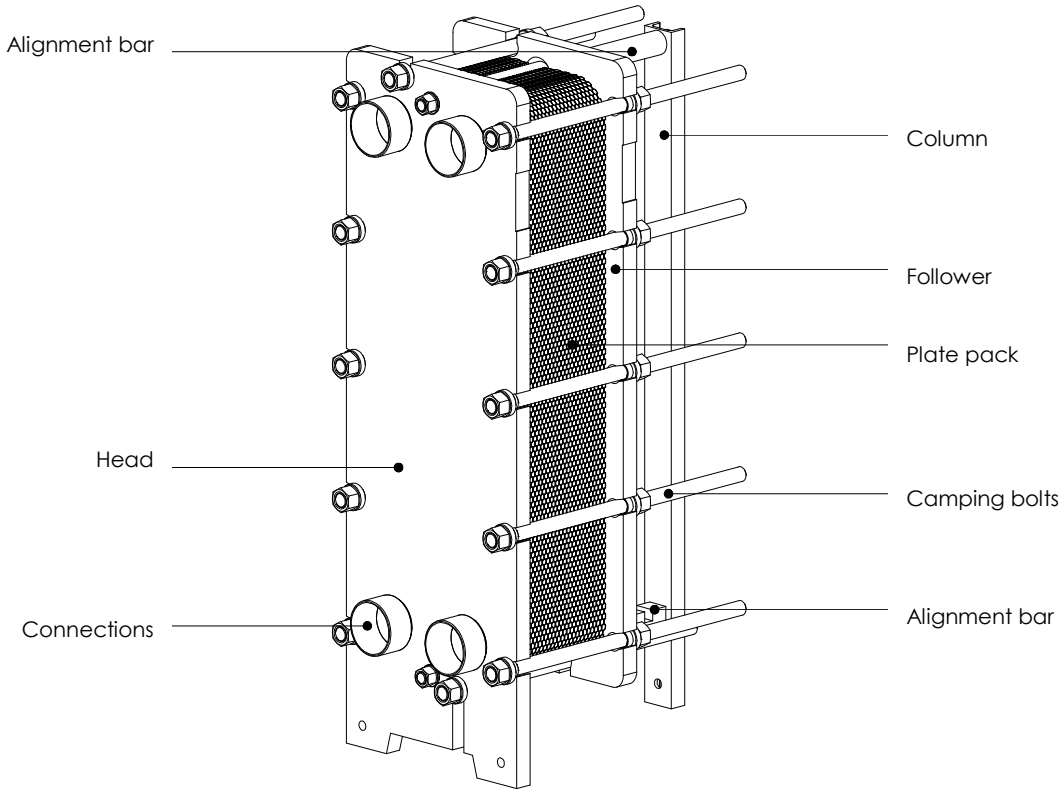


Fig. 19 – Corrugated plate exchangers

FLOW ARRANGEMENTS

Usually symmetrical with channels running parallel. Can be in series or combined series/parallel (see Fig. 20 e Fig. 22). Flow system chosen will be determined by heat transfer requirements. The number of passes for primary and secondary circuits are shown in the table on page 2 for all three flow pattems. In case of parallel flow arrangement, primary fluid enters at the top nozzle connection and flows through the parallel channels, dividing the flowrate in equal parts for each channel (see Fig. 20 e Fig. 22). The fluid leaves the exchanger from the nozzle at the bottom. Secondary fluid, on the other hand, enters through the nozzle at the bottom and flows out through the one at the top. Primary and secondary fluids are thus moving in counter-flow, in order to maximize heat transfer. Serial flow arrangement (SeeFig. 21 e Fig. 23) is used only when a greater thermal length is necessary (that is when there is to be a greater fluid temperature jump). Nozzles are fitted onto both the external plates.

Fig. 20 - PARALLEL (LOOPED) FLOW ARRANGEMENT FOR SMOOTH PLATE EXCHANGERS

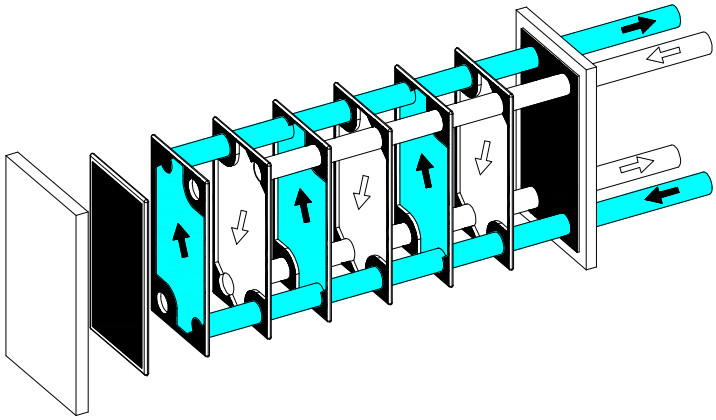


Fig. 21 - SERIES ARRANGEMENT FOR SMOOTH PLATE EXCHANGERS

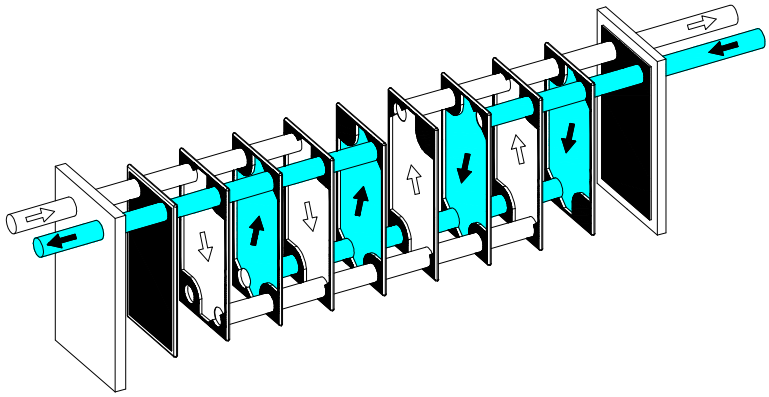


Fig. 22 - PARALLEL FLUX DIAGRAM FOR CORRUGATED PLATE EXCHANGERS

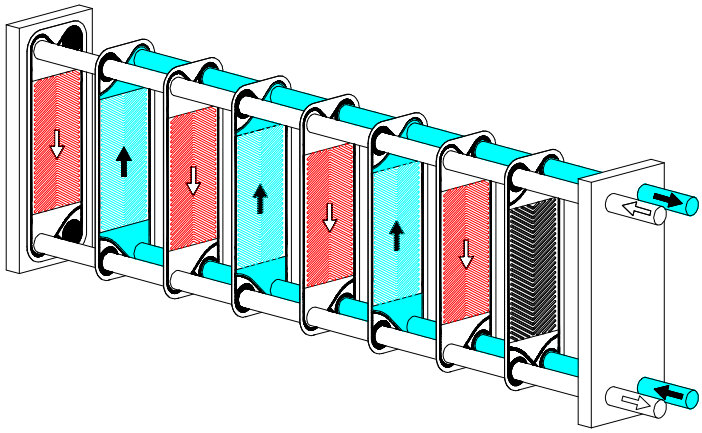
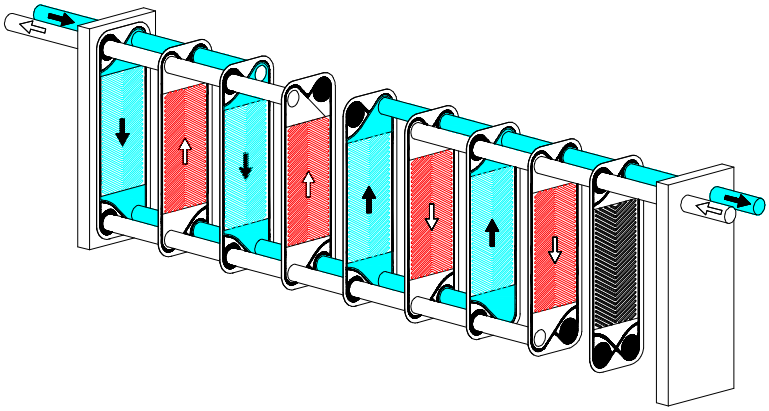


Fig. 23 - SERIAL FLUX DIAGRAM FOR CORRUGATED PLATE EXCHANGERS



SMOOTH PLATES WITH TURBULATORS

Heat exchanging plates are right-sided and left-sided (see Fig. 24 and Fig. 25). Gasket interplay sets up alternating channel flow. Fig. 26 shows the end plate at the bottom of the internal plate pack. It is adjacent to the removable external plate and serves to close the circuit but takes no other part in the transfer of heat. Fig. 27 shows the initial gasket to be placed between plates and the fixed frame plate. Fig. 28 and Fig. 29 shows the central heat exchanging plates. These have only two holes and are part of a series flow system. In flat plates, standard turbulators are of three types:
H denoting high pressure drops and efficiency; S for medium pressure drops and efficiency; L for low pressure drops and efficiency. Different heat exchanging plates together with turbulators adopted are shown in the table on page 2, both for primary and secondary circuits.

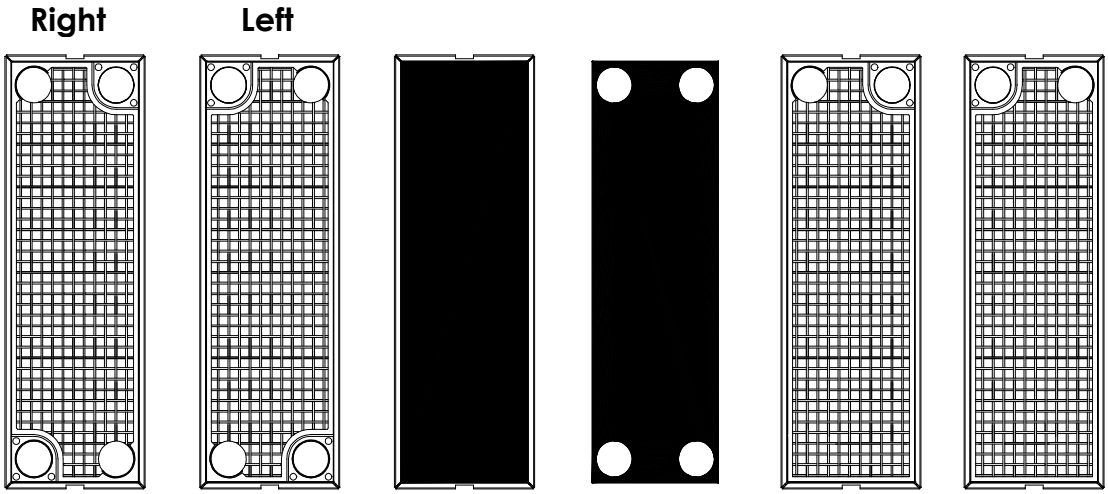
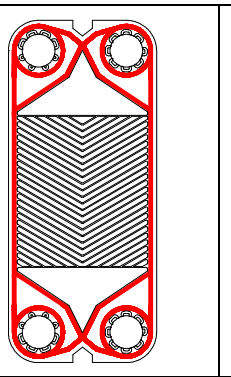
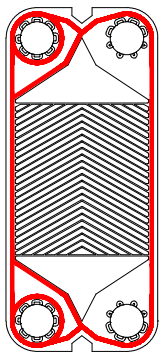


Fig. 24 **Fig. 25** **Fig. 26** **Fig. 27** **Fig. 28** **Fig. 29**

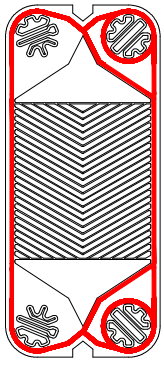
CORRUGATED PLATES



a) Initial plate



b) Exchange plate



c) Final plate

Fig. 30

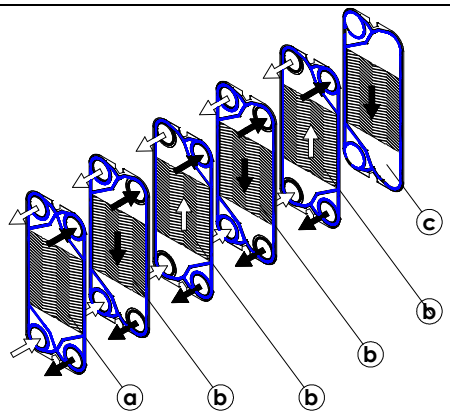


Fig. 31

TECHNO SYSTEM's corrugated plates are designed to be used either as "right" than "left" plate: you have only to rotate them by 180°C.
Right and left plates are define in the following way:

- On the right plate the fluid folws from connection 2 to 3, or from 3 to 2 (Fig. 32).
- On the left plate the flow is from 1 to 4 or from 4 to 1(Fig. 32).

The 4 corner holes of the plates are open and closed according to the flux diagram which has to be obtained.
Note: The four holes are identified by numbers, starting from the upper left one of the plate, which has to be seen by the gasket side.
This hole is the number 1, and the others are clockwise 2, 3 and 4.

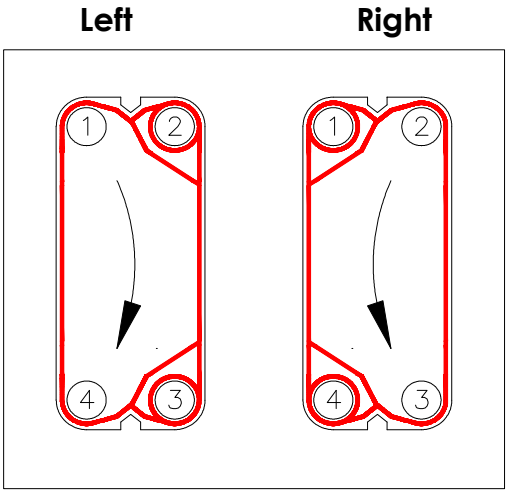


Fig. 32

RESIDUAL RISK

WARNING DANGER OF BURNING: In the case that there is no insulation and depending on the operating conditions, the external surface of the plate heat exchangers can be at high temperature.

WOUNDING DANGER: if, voluntarily or involuntarily, the heat exchanger is locked in exasperated way, boltings could be broken off with danger for operators and bystanders. Therefore, don't stand in front of boltings during locking.

WOUNDING DANGER: be careful while handling parts of the heat exchangers (turbolators, plates, gaskets, etc.), operating with idoneous protection equipment, like gloves, accident-prevention shoes, overalls, etc.

DANGER CAUSED BY CONTAMINATION BETWEEN THE TWO FLUIDS: in case of corrosion breaking of the plates, contamination of one of the fluids might happen. Please contact immediately the assistance service not using the contaminated fluid.

TOXIC GAS INHALATION DANGER : in case of toxic fluids, pay attention not to inhalate their exhalations.

FLAMMABLE GAS/EXPLOSION DANGER : in case of flammable fluids take appropriate precautions. Foresee the installation of the heat exchanger outdoor or in a suitably ventilated room according to the regulations in force.

WOUNDING AND/OR BURNING DANGER: if the connections (mainly if in PTFE or PP) are voluntarily or involuntarily tightened more than allowed, they could brake causing danger for the operators and the bystanders.

DANGER OF GASKET ACCIDENTAL BREAKING: To avoid risks, in case of accidental breakage of the gaskets, and use of hazardous fluids (acids or similar, hot liquids or steam), provide a containment casing of the exchanger.

DANGER OF LEAKAGES OF THE GASKETS: avoid thermical shocks and then slowly increase or decrease the temperatures.

DELIVERY

Assembled
Heat exchanger will be delivered once in a stocklot.

Receipt
When receiving a heat exchanger, we ask you to check out delivery correctness:

- Is there any damage due to transport?
- Is the delivery in conformity with the order?

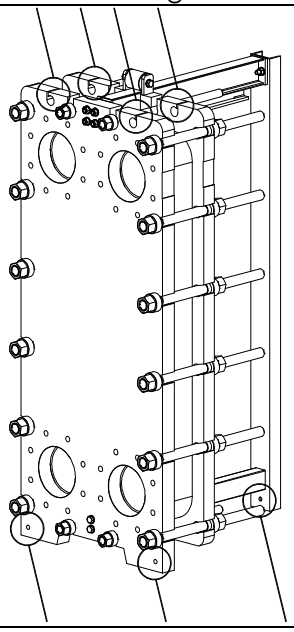
In case of a non conforming delivery, We ask you to deal with our offices to immediately solve the checked non conformities, reporting data imprinted on the name plate or in the transport documents.

Storage
If a heat exchanger has to be storaged before assembling, assure that the store-room is properly dry and warm.

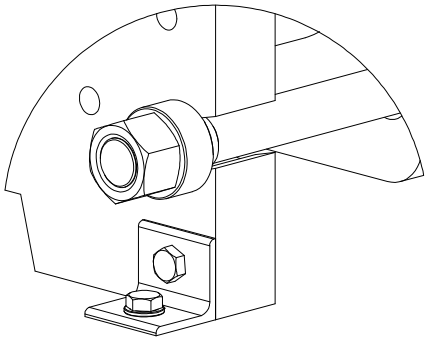
Transport
Lift the heat exchanger using the appropriate couplings (in provided models only) in order to transport it to the installation or store room.

Attention: for lifting use only idoneous material, equipment and machinery suiting the heat exchanger weight requirements.

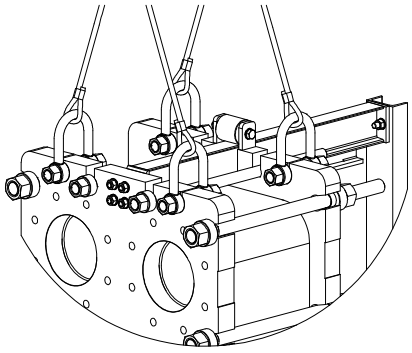
Hooks for lifting and moving the exchanger.



Holes for fastening to the floor or to foundation blocks.



Example of fastening the exchanger to the floor using an L-shaped profiled clamp (material not supplied)



Example of moving the exchanger with lifting eyelets(material not supplied)

IN THE EVENT OF DANGEROUS AND/OR POLLUTING FLUIDS WE RECOMMENDED PLACING A DRAINAGE BOX WITH A CAPACITY GREATER THAN THE CONTENTS OF THE EXCHANGER UNDERNEATH THE SAME.

- INSTALLATION SECTION -

(section exclusively dedicated to professionally qualified and / or TECHNO SYSTEM authorized personnel)

INSTALLATION

1. Install heat exchanger vertically (see Fig. 33) leaving sufficient space for the purposes of maintenance operations, especially in front of the removable external plate.
   Note: To avoid the risk of air bubbles or other unventable uncondensables (which reduce the exchange performance and increase the pressure drops), we advise against the positioning of the exchanger as shown in Fig. 33b) and Fig. 33c) (especially the last one for corrugated plate heat exchangers with parallel – flow connections).
   For maintenance facilities we advise agaist the positioning of the exchanger as shown in Fig. 33d).
2. To connect primary and secondary circuit nozzles see sketch on page 2.
3. Fit suitable isolation valves onto all pipes leading to and from the heat exchanger.
4. Fit a suitable circulation pump onto the primary circuit.
   Note: For hot water production (if water is not treated), the heat exchanger must remain reasonably cold when not in use. Possible solutions to this problem are to fit a thermostat which will stop the pump and a check valve to eliminate spontaneous circulation. If there is a recirculation pump fit a modulation valve on the primary circuit controlled by a probe on the secondary circuit so that fluid temperature does not exceed 50 degrees centigrade in this circuit.
5. If fluids are very dirty, it is better to fit filters. These should be placed before entry into the heat exchanger.
6. If you do not wish to install filters, all piping should be washed.
7. Make sure the presence of opportune drainages close to the heat exchangers to avoid floodings in case of fluid spillages.
8. Do not overload the nozzles of the exchanger with excessive weights (fix and anchor the pipings appropriately to walls and similar).
9. Before to starting up the exchanger check if any of the tie rod nuts aren't completely tight (it can happen due to vibrations during transport and / or installation). If it is, tighten it slightly to restore the contact with the plate. When the heat exchanger will go under pressure all the tie rods will be regularly loaded and safe.

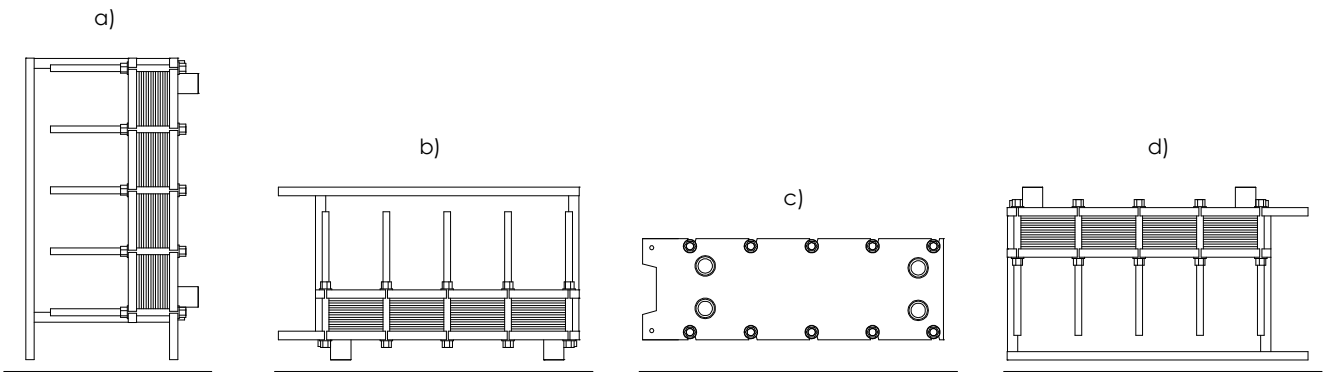


Fig. 33

STARTUP UP AND RUNNING INSTRUCTIONS

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

Working pressure, maximum and minimum temperatures
On the head of the plate heat exchanger a name plate is mounted, indicating maximum and minimum temperature as well as the maximum operating pressure. Those values must not be exceeded.

Control
That all control valves, if present, are set correctly.

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

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

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

Pressure rise and change of temperature
During running the pressure and the temperature have to be controlled frequently.
A rising pressure drop and a falling heat transmission indicate that some scalling has to be removed (see paragraph *MAINTENANCE*).

Leakage during running
see paragraph *FAULTS*.

Long time service stops
Be sure to empty and clean the late heat exchanger before stopping it for a long time. After emptying and cleaning, the exchanger must be slightly tightened and covered with a black plastic cover, to avoid the sun rays to damage the gaskets (only for corrugated plates)nger it is necessary to restore the tightening to the correct(see chapter MANTENANCE).

ATTENTION : in case of toxic, flammable, dangerous fluids, install the heat exchanger in airy rooms or in the open.

- OPERATION AND MAINTENANCE SECTION -

PLATE HEAT EXCHANGER UTILIZATION

The plate heat exchanger does not require any particular care during operation. It is in any case advisable to check periodically that the operating variables do not exceed the design figure and that thare is not any leakage, mainly cold-leakage , during the shut-down. In case of remarkable leaks, close the isolation valves and report as soon as possible to TECHNO SYSTEM Assistance Service or to skilled personnel.
Besides assure that, during their lifetime, surfaces of pressure parts (boldings and frames) will not be corroded by humidity or atmospherical agents.

MAINTENANCE

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

Without pressure and cooled
Before opening the plate heat exchanger be sure that there is no pressure in it and that temperature is cooled down to 35°C.

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

ATTENTION: handle components of heat exchangers (turbulators, plates, boltings, etc.) only with appropriate protection gloves.

PLATE CLEANING

Remove internal heat exchanging plates. If there is dirt or scale proceed as follows:
Without removing gaskets or turbulators (where present) leave plates to soak in a cleansing solution (see Fig. 34). Then rinse thoroughly in running water. Do not leave plates in the solution any longer than is strictly necessary to dissolve dirt and scale.

ATTENTION: to be cleaned with acid or other solutions. Caution must be used wear safety glasses, gloves, mask, etc.,

Manual cleaning
The exchanger is opened and the plates are separated. Use a soft brush and a quality cleaning product for the plates.
In case of organic material, the plates have to be put in a basin with a quality cleaning product. Avoid using metal brushes, abrasive papers, scrapers, etc. Neither the plates nor the gaskets support heavy and energic treatments.
The use of a polishing machine to be executed carefully and without adding abrasive agents.

CIP cleaning
For the Cleaning In Place it is necessary that the dirt on the plates has to be soluble. Moreover, all the materials of the circuit must be resistant to the product used for cleaning.
Cleaning can also be made without circulation, by filling the exchanger with a quality cleaning product. After a certain time the cleaning product is washed away by plenty of clean water.

CIP cleaning cycle example:

- Product residuals and heating / cooling fluids are drained
- Cleaning with hot or warm water
- Hot Circulation of the cleaning product
- Washing with cold or warm water
- Cleaning with water additivated with chemicals
- Washing with cold or warm water

Materials for cleaning
A quality product for cleaning can be defined as capable of removing the deposits on the plates without damaging the plates and the gaskets.
Stainless steel is covered by a passivation film, which has not to be destroyed because it protects the steel material from corrosion.

Specific materials for cleaning
Oils and fat are removed with emulsionable oil – water solvent.
Organic materials and fat substances are removed by NaOH with maximum concentration of 3 % and maximum temperature of 85 °C. The concentration is corresponding to 10 l NaOH 30% solved in 100 l water.
Calk deposits are removed with HNO_3 at max. 6 % and max. temperature of 65 °C. Concentration of 9.6 l HNO_3 62 % solved in 100 l water. The nytric acid has an important aid function for the forming of the passivation film on stainless steel.

Cleaning check
Cleaning is an inportant factor for efficiency and performance of the plate heat exchanger. Therefore plates have to be separated for a careful inspection, especially when there have been some problems during the startup operations. You will get important knowledge and experience about circulation times, temperatures and cleaning product concentrations.

Reasons for a no effective cleaning can be found in the following ones:
- Insufficient circulation flowrate
- Insufficient cleaning time
- Insufficient cleaning product consumption compared with the dirt on the plates
- Insufficient cleaning frequency between two duties

PLATE REPLACING

Replacing and mounting of new plates can be done after disconnecting the circuits and the removal of the clamping bolts. Before mounting the new plates, verify that they are identical to the ones to be substituted. A reduction of the number of plates is possible, but only at the condition that you remove couples of plates, so that the exchanger, after the removal of the plates, has the same arrangement of left and right plates. The removed plates must have 4 open holes. After removing it is necessary to define the new tightening dimension according to the new total amount of plates.

NOTE: A reduction of the amount of plates involves a reduction of the exchanging surface of the exchanger, exactly proportional to the number of plates which have been removed. There will also be an increase of the pressure drops in the exchanger, because the flowrate is divided in less channels, and therefore it is higher with greater velocities.

CLEANING AND GASKET REPLACING

Gasket cleaning
For gasket and their seat cleaning use "ACETONE" (nail varnish remover). It is very important that the cleaning product has completely evaporated before remounting the gaskets on the plates.

ATTENTION : INHALATING SOLVENT SUBSTANCES IS DANGEROUS

Replacement of gaskets
For plates with turbulators:
- take turbulators of internal plates (only for smooth plates with turbolators).
- Take off gaskets.
- Clean the edges of the plates.
- Fit the new gaskets. If it should prove difficult to fit the new gaskets, uses small pallet to raise the curved U-shaped edge of the plate a little.
- When assembling the turbulators be careful that they are inserted in the correct position into gaskets (only for smooth plates with turbolators).

For embossed or corrugated plates: Replacement of gaskets is very simple.

Mounting and assembling

No special equipment (e.g. torgue wrench) is needed. Nor it is necessary to achieve a specific degree of tightness. Bolts on the T.S. plates can be tightened to different degrees. This may depend on how old the gaskets are and what stress the heat exchanger is subject. Tolerance degrees are shown in the table on page 2.

The plates and the gaskets are checked carefully before mounting.

The plates have to be clean and the gaskets have to be without fatty substances and other uncleanness. Grain or sand on the gasket can cause leakness during running and damage of gaskets.

During the assembling the head and follower have to be parallel.

It is therefore necessary to measure the assembling on the top and the bottom on both sides.

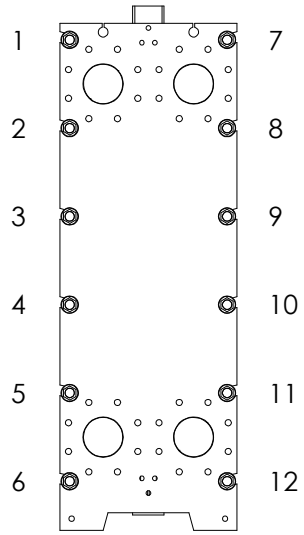
During clamping operations, the following order should be followed (see Fig. 34):

1. Tighten bolts 1 - 12 - 6 - 7
2. Tighten bolts 2 - 8 - 5 - 11
3. Tighten bolts 3 - 9 - 4 - 10

This procedure should be repeated until the required degree of tightness has been achieved.

ATTENTION: Higher tightening damage gaskets and it could cause clamping bolts to break and to hurt workers.

ATTENTION: Don't stand in front of bolting during locking operations.



DETERGENTS	SCALES	MUDS
WATER		SOFT
CAUSTIC SODA 3% (NaOH)	ORGANIC MATERIAL	HARD ORGANIC
NITRIC ACID 6% (HNO_3)	INORGANIC MATERIAL	HARD INORGANIC
SULPHAMIC ACID 6% (H_3NO_3S)	INORGANIC MATERIAL	HARD INORGANIC

Fig. 34

Inside leakage

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

- Remove a pipe on one of the buttom pipe connections, then put the opposite side under pressure.
  After the pressure is stabilized the liquid must not run off from the removed pipe connection. If the liquid continues to run off there is a leak on one or more plates. The plate stack is demounted and every single plate is examined carefully.
- The plate heat exchanger Is separated and all the plates are dryed. After dryed the plates are put into the plate heat exchanger and assembled. Now the liquid is circulated with full capacity but only on one side (every second plate interval).
  The other half of the plate interval is kept without pressure and without liquid. The circulation is stopped after a few minutes and the plate heat exchanger is opened carefully so that no water is sprayed on the dry plate side. The plate are examined carefully and thus it is possible to find the wet areas on the dry plates. The areas have to be controlled with capillary liquid.
- The plate heat exchanger is separated and plates are controlled with the capillary liquid.

HYDRAULIC TEST UTILIZING WATER

Sequence of operations:

PRIMARY side:

- Fill in with water primary and secondary side, and close them through blind flanges.
- Slowly increase pressure on primary side up to test pressure.
- Test time: 15 minutes
- Test is positive if there aren't visible leakages and if pressure value remains stable.
- Slowly decrease pressure to return to atmospheric pressure.
- Empty both sides

SECONDARY side:

- Fill in with water primary and secondary side, and close them through blind flanges.
- Slowly increase pressure on secondary side up to test pressure.
- Test time: 15 minutes
- Test is positive if there aren't visible leakages and if pressure value remains stable.
- Slowly decrease pressure to return to atmospheric pressure.
- Empty both sides

Notes: - Heat exchanger must be completely vented before increasing pressure for test.
- Test pressure must never be exceeded.
- During test people must remain at a safe distance.

REBUILDS & REVISIONS

The plate heat exchanger is modular, and therefore flexible regarding enlargements or reductions. I.e. it is easy to change the capacity by respectively enlarging or reducing the number of plates.
TECHNO SYSTEM's archive files contain all data of delivered plate heat exchanger. We gladly forward suggestions/quotations concerning rebuildings of an existing plate heat exchanger, according to the PED 2014/68/UE normative.
TECHNO SYSTEM delivers – with the necessary parts for rebuild – a complete description of the way in which the plate heat exchanger has to be rebuilt. Afterwards the rebuilt plate heat exchanger data will be put into TECHNO SYSTEM's archive to keep it up-to-date.

DISMANTLING AND DEMOLISHMENT

In case of dismantling and demolishment of the exchanger keep laws in force for the disposal of materials which it is composed by (Stainless Steel, rubbers synthetic, Carbon Steel).

ATTENTION: When the plate heat exchangers has not be used for long periods it's important to check that:

- **There is water in the circuits. If so to intercept the valves and keep the plate heat exchangers full to avoid consuming the gasket.**
- **There is processing fluid in the circuits. If so empty and clean the plate heat exchangers. Afterwards to tighten moderate.**

ATTENTION: In case of fast temperature shocks during normal duties (caused for example by sudden duty stops, especially from hot to cold), the exchanger could be subjected to temporary leakage episodes, which generally stop when the duty temperatures will be reached again.

- FAULTS -

FAULT	POSSIBLE CAUSE	ACTION REQUIRED
No heat transfer	Valves are closed	Open valves
	Pump not connected	Connect pump
	Pump connected but not turning	Release rotor
	Filters blocked	Clean filters
	Regulator damaged or incorrectly set	Repair or set the regulator correctly
Reduced heat transfer	Air bubbles in circuits	Open air valve to release air
	Dirt and scale in circuits	Dismantle exchanger and clean plates
	Primary circuit temperature lower than design temperature	Raise primary temperature or increase number of plates
	Flow in primary circuit below that programmed for	Fit adequate pump
	Primary and secondary flows in the same direction	Connect heat exchanger correctly
Increase pressure drop	Encrustation end/or blockage	Dismantle exchanger and clean plates
Low temperature in out secondary circuit	Flowrate is greater than programmed	Tighten valve at cold water entry pipe
Dripping (in general)	Wire turbulator incorrectly fitted (only for smooth plates with turbolators)	Dismantle exchanger and fit turbulator correctly (inside the gaskets)
	Dirt or chalk deposits above or below gasket	Eliminate all dirt and chalk deposits
	Gasket damaged or worn	Replace gasket
	Maximum pressure higher than allowed (see information tag)	Lower the pressure to the level on the tag
	Tightening quote of the exchanger is higher than the advised one. (see pag. 2)	Tighten the plates at the advisable quote. ATTENTION: before tightening the heat exchanger has to be depressurized.
Dripping (especially when cold)	Tightening quote of the exchanger is higher than the advised one. (see pag. 2)	Tighten the plates at the advisable quote. (see pag.1) ATTENTION: before tightening the heat exchanger has to be depressurized.

Over frequent scale (For production sanitary water)	Exchanger always at raised temperature e.g. in central heating system or pump always working. There may be spontaneous liquid circulation	Install exchange correctly so that it can be kept cold or in any case below 48 degrees when not in use. Fit suitable check valves
Fluctuating secondary circuit temperature (For production sanitary water)	Boiler thermostat not sufficiently sensitive. Primary temperature not constant.	Fit a more sensitive thermostat on entry pipe or in boiler (preferably electronic) or fit a small reserve tank
Safety thermostat blocks (For production sanitary water)	Insufficient water in boiler	Set up continuous water circulation in boiler
Pressure increase in one of two circuits due to the communication of they	Wom gasket or corroded or holed plates	Replace gasket and/or plates

- REGISTRO DELLE MANUTENZIONI E DELLE RIPARAZIONI -

MAINTENANCE AND REPARATION REGISTER

Data Date	Operatore Operator	Descrizione intervento effettuato Service description

Data Date	Operatore Operator	Descrizione intervento effettuato Service description

Data Date	Operatore Operator	Descrizione intervento effettuato Service description

Data Date	Operatore Operator	Descrizione intervento effettuato Service description

CATEGORIA D'APPARTENENZA (Direttiva PED 2014/68/UE)
CATHEGORY (Directive PED 2014/68/UE)

☐ **Art.4 par. 3**

☐ **Categoria I**

☐ **Categoria II**

☐ **Categoria III**

☐ **Categoria IV**

CE

PROVA DI TENUTA (bar)
PRESSURE TEST (bar)

8,6	**14,3**	**22,9**	**35,8**	

ACQUA **WATER**
ARIA **AIR**

Il collaudatore .....
Checked by

CONTROLLO FINALE
FINAL CHECK

Data .....
Date

Dimensioni *Dimensions*	**OK**	**NA**
Verniciatura *Painting*	**OK**	**NA**
Pulizia Parti a contatto con fluidi di processo *Cleaning of parts in contact with process fluids*	**OK**	**NA**