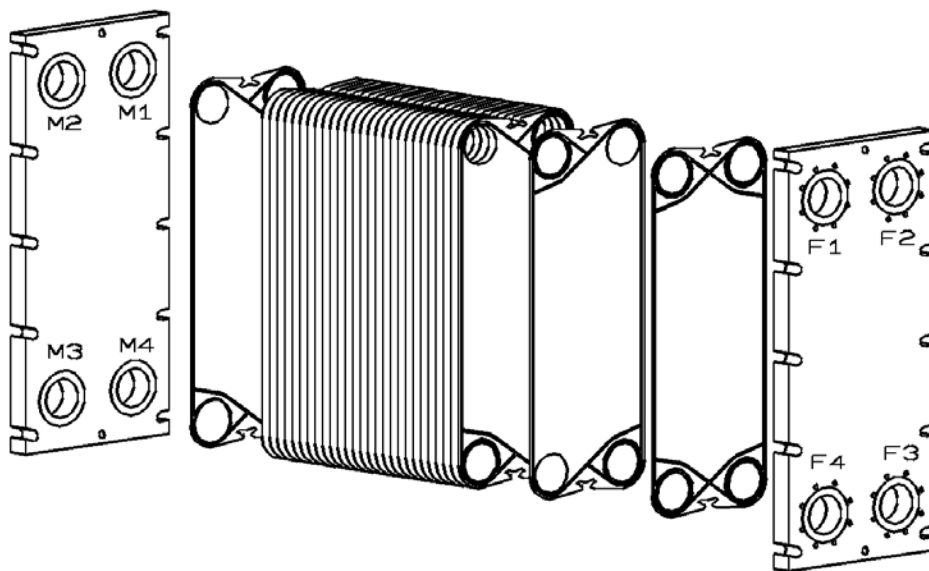


**INSTALLATION AND MAINTENANCE MANUAL
FOR V-RANGE
PLATE HEAT EXCHANGERS**



INSTALLATION AND MAINTENANCE MANUAL

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SUMMARY

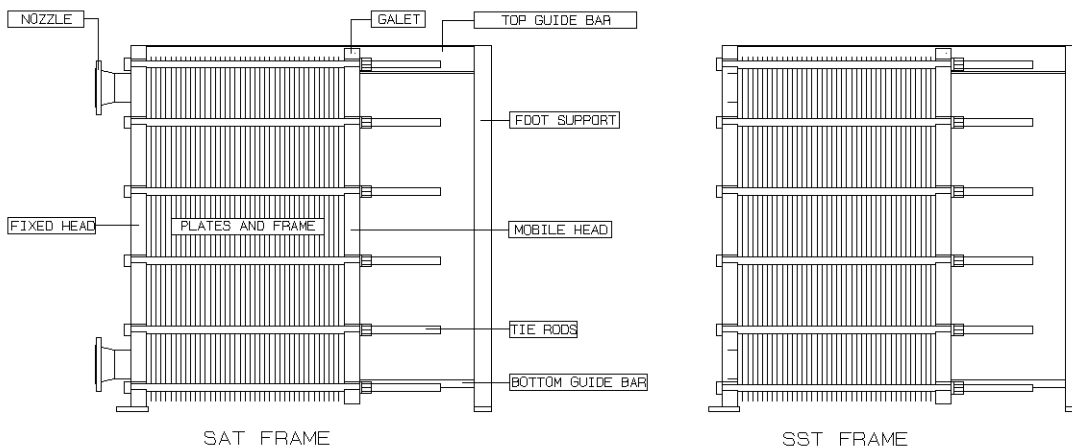
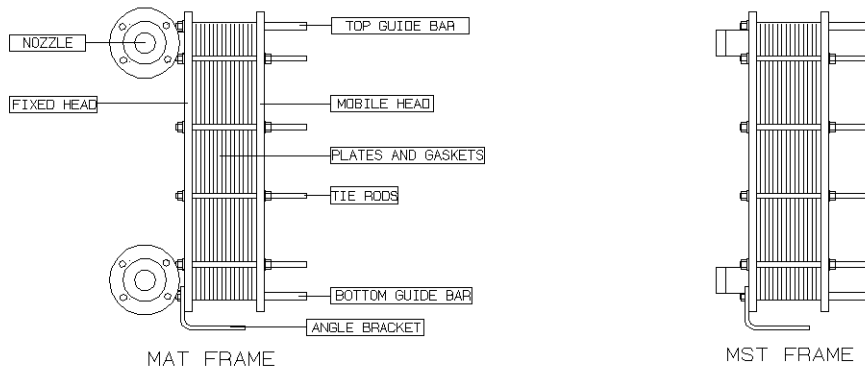
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1. GENERAL DESCRIPTION - TERMINOLOGY



* Note : Frame SAT provided with straight nozzles (models V28 to V280)
Frame SAT provided with elbows (90°) (models V2 to V20)

1.1. MAJOR COMPONENTS

- FIXED and MOBILE HEADS are made of thick, rigid, pressure vessel quality steel plates.
- TOP GUIDE BAR, attached to the fixed head and the foot support. It supports the plate pack and mobile head allowing easy disassembly of the exchanger for maintenance.
- BOTTOM GUIDE BAR, keeps the plates in position and ensures that they are centered.
- TIE RODS are evenly spaced around the periphery of the exchanger to clamp the plate pack between the fixed and mobile heads. Hydraulic cylinders may be used for tightening and loosening of the plate pack.

1.2. TERMINOLOGY

Connection nozzles are designated by a letter and a number. F is for fixed head, M is for mobile head.

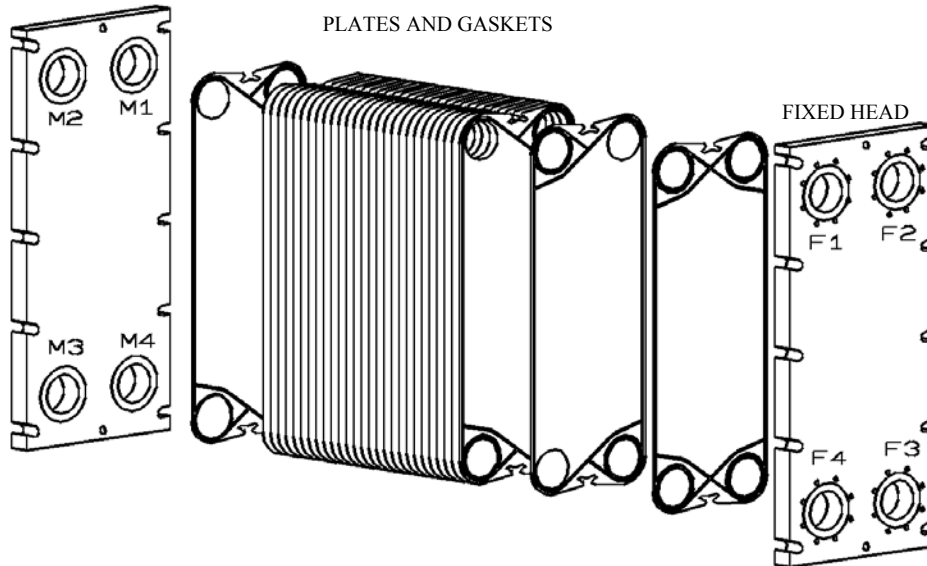
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2. POSITION OF UPSTREAM FLOW FLUIDS INLET AND OUTLET

MOBILE HEAD

FIGURE 2



- There are 4 possibilities to connect the primary and secondary fluids. Anyway natural flow has to be respected (for example steam flows from the top to the bottom).
- Inlets and outlets positions are defined on specification sheets.

V2 to V20 INCLUDED						
	1 PASS / 1 PASS		NB OF EVEN PASSES		NB OF ODD PASSES	
	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET
1) Circuit 1	F1	F4	F4	M3	F1	M3
Circuit 2	F3	F2	M4	F3	M4	F2
2) Circuit 1	F2	F3	F3	M4	F2	M4
Circuit 2	F4	F1	M3	F4	M3	F1
3) Circuit 1	F3	F2	M4	F3	M3	F1
Circuit 2	F1	F4	F4	M3	F2	M4
4) Circuit 1	F4	F1	M3	F4	M4	F2
Circuit 2	F2	F3	F3	M4	F1	M3

V28 to V280 INCLUDED						
	1 PASS / 1 PASS		NB OF EVEN PASSES		NB OF ODD PASSES	
	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET
1) Circuit 1	F1	F3	F4	M3	F1	M4
Circuit 2	F4	F2	M4	F3	M3	F2
2) Circuit 1	F2	F4	F3	M4	F2	M3
Circuit 2	F3	F1	M3	F4	M4	F1
3) Circuit 1	F3	F1	M4	F3	M3	F2
Circuit 2	F2	F4	F4	M3	F1	M4
4) Circuit 1	F4	F2	M3	F4	M4	F1
Circuit 2	F1	F3	F3	M4	F2	M3

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3. MARKING OF LATERAL AND DIAGONAL FLOW PLATES

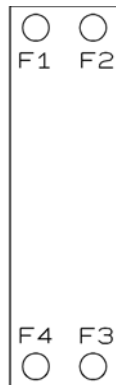


FIGURE 3



FIXED HEAD

Marking seen by an observer placed in front of the exchanger facing the fixed head

MOBILE HEAD

Marking seen by an observer placed behind the exchanger facing the mobile head

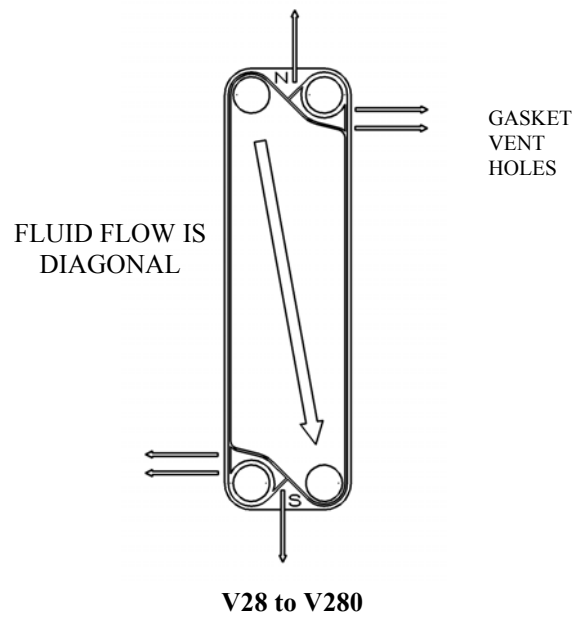
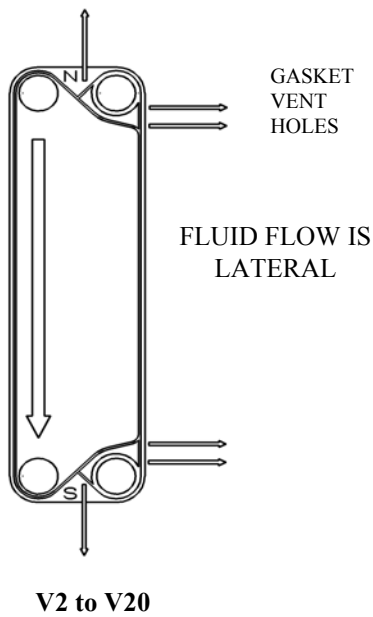


FIGURE 4

CONVENTION

- The plates are mounted with gaskets facing to the fixed head.
- The ends of the plates are labeled N (North) and S (South).
- The plates are numbered from the fixed head to the mobile head, the first plate is assembled with the 4 corners gasket.
- The first plate is usually mounted with North at the top and then South at the top alternatively, etc...

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4. MARKING OF GASKETS ON LATERAL AND DIAGONAL FLOW PLATES

4.1. DISPOSITION OF 4 CORNER GASKETS FOR V2 TO V280

- The first plate is equipped with a special 4 corners gasket which isolates 4 openings of the plates and prevents fluid passage between the fixed head and the first plate. No fluid flows to this space.
- All the other plates are equipped with standard gaskets.

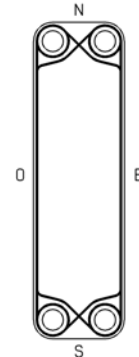


FIGURE 5

FIRST PLATE
4 CORNER GASKET

4.2. STANDARD GASKETS ORIENTATION FOR V2 TO V20

The gaskets are always fitted on the same side, ports isolated are NE-SE.

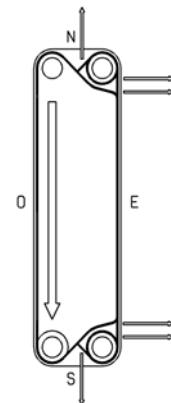


FIGURE 6

FLUID FLOW
IS LATERAL

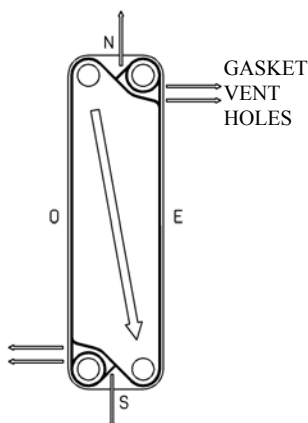
GASKET
VENT
HOLES

4.3. STANDARD GASKETS ORIENTATION FOR V28 TO V280

The gaskets are alternatively fitted on one side then on the other, therefore determining even and odd plates according to their order numbers in the exchanger.

Usually the following rule is applied :

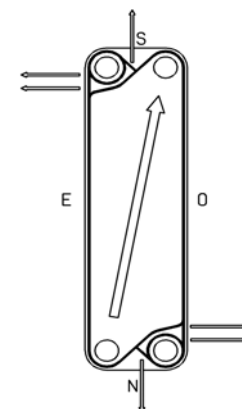
- Gasket on odd plate : ports isolated NE and SO (openings in 1-3)
- Gasket on even plate : ports isolated NO and SE (openings in 2-4)



ODD PLATE
STANDARD GASKET

FLUID FLOW IS DIAGONAL

FIGURE 7



EVEN PLATE
STANDARD GASKET

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5. SPECIAL PLATES DEFINITION

A standard plate has 4 openings. All the plates with shuttings are called special plates in the nomenclature at the back of the drawing.

Plates are named with their blankings (refer fig. 8).

EXAMPLES

- 4 F = 4 blankings
- 2 FN = 2 blankings North
- FNO = 1 blanking North-West
- 2 FN-FSO = 2 blankings North + 1 blanking South-West

NOTE : Special plates are usually odd plates

DESIGNATION OF THE PLATES

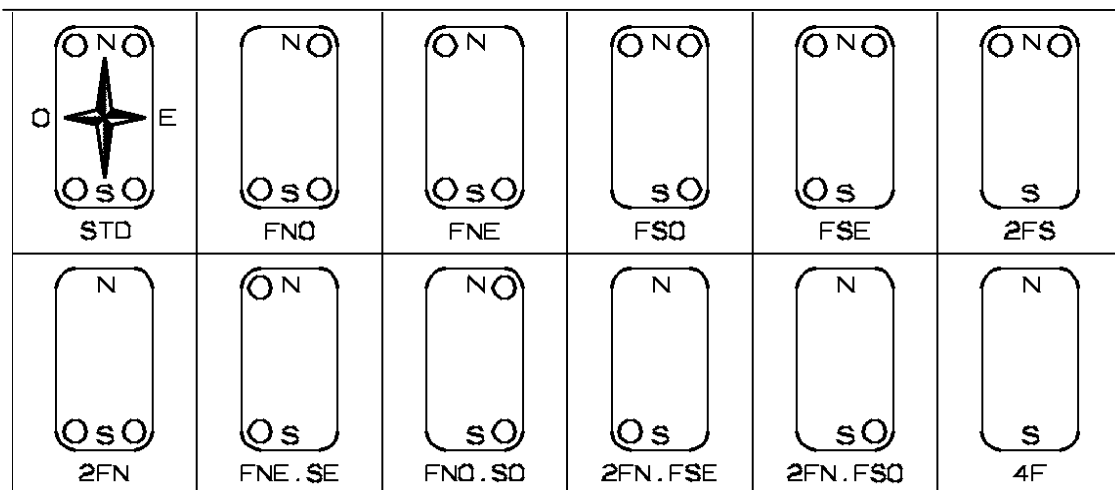


FIGURE 8

Plates may be either reinforced or not. Reinforced plates are provided for high pressures. Reinforcement of a plate is made by welding corrugated strips-crenels (of the same metal as the plate) into the gasket groove where there is no gasket near the openings.

The designation of the reinforced plates in the drawing nomenclature is as follows :

Plate 4F Cr = 4 blanks - crenels (corrugated strips).

NOTE FOR V28 TO V280 ONLY :

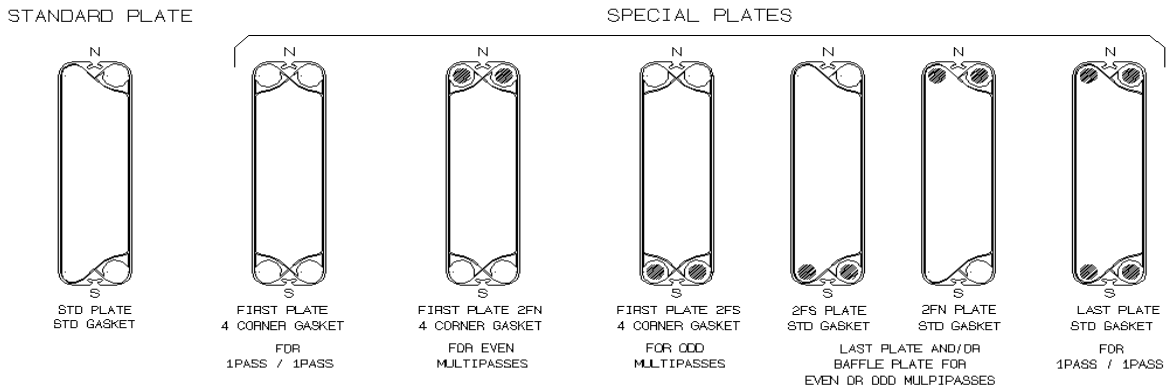
Odd and even plate without crenels are identical, reinforced even plates are different from odd plates due to the presence of these strips.

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6. TYPICAL PASS ARRANGEMENT - LATERAL FLOW

ORDINARY SPECIAL PLATES UTILISATION V2 TO V20 FOR CONFIGURATION 1 PASS / 1 PASS
 EVEN / EVEN - ODD / ODD



TYPICAL PASS ARRANGEMENT
 MODELS V2 TO V20

FIGURE 9

1PASS
 1PASS

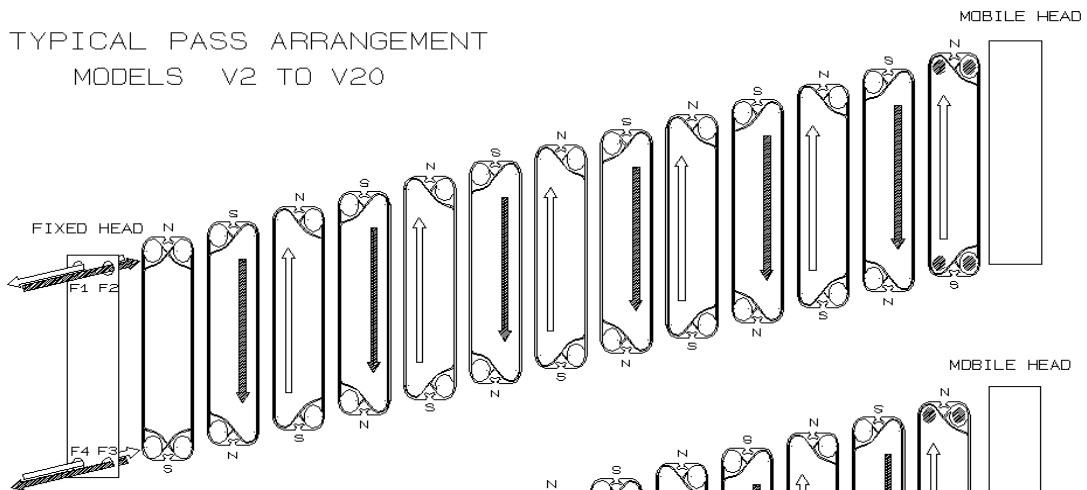


FIGURE 10

EVEN PASSES

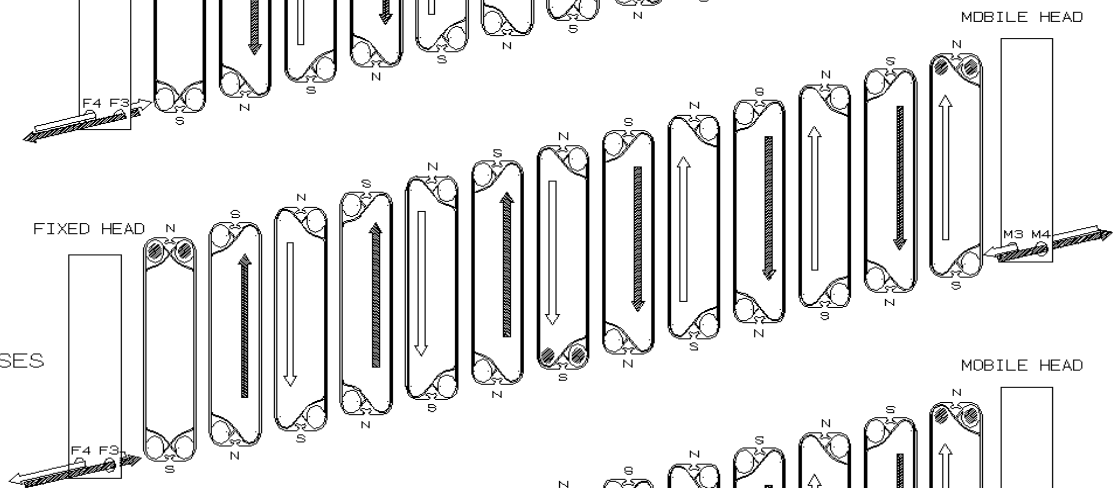
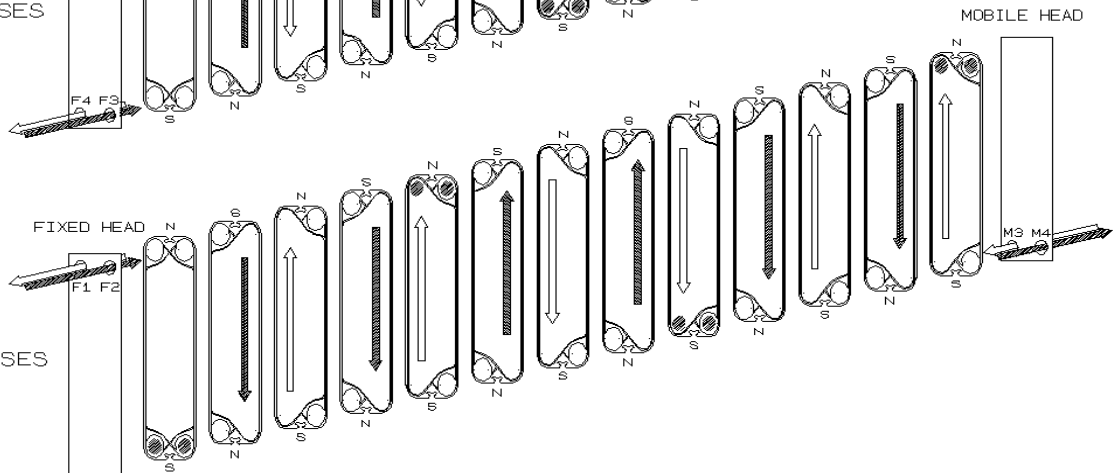


FIGURE 11

ODD PASSES

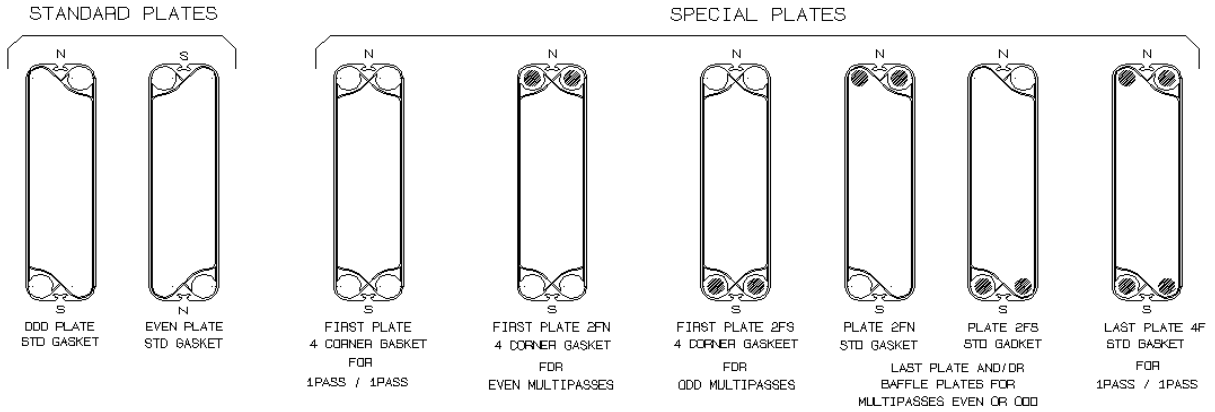


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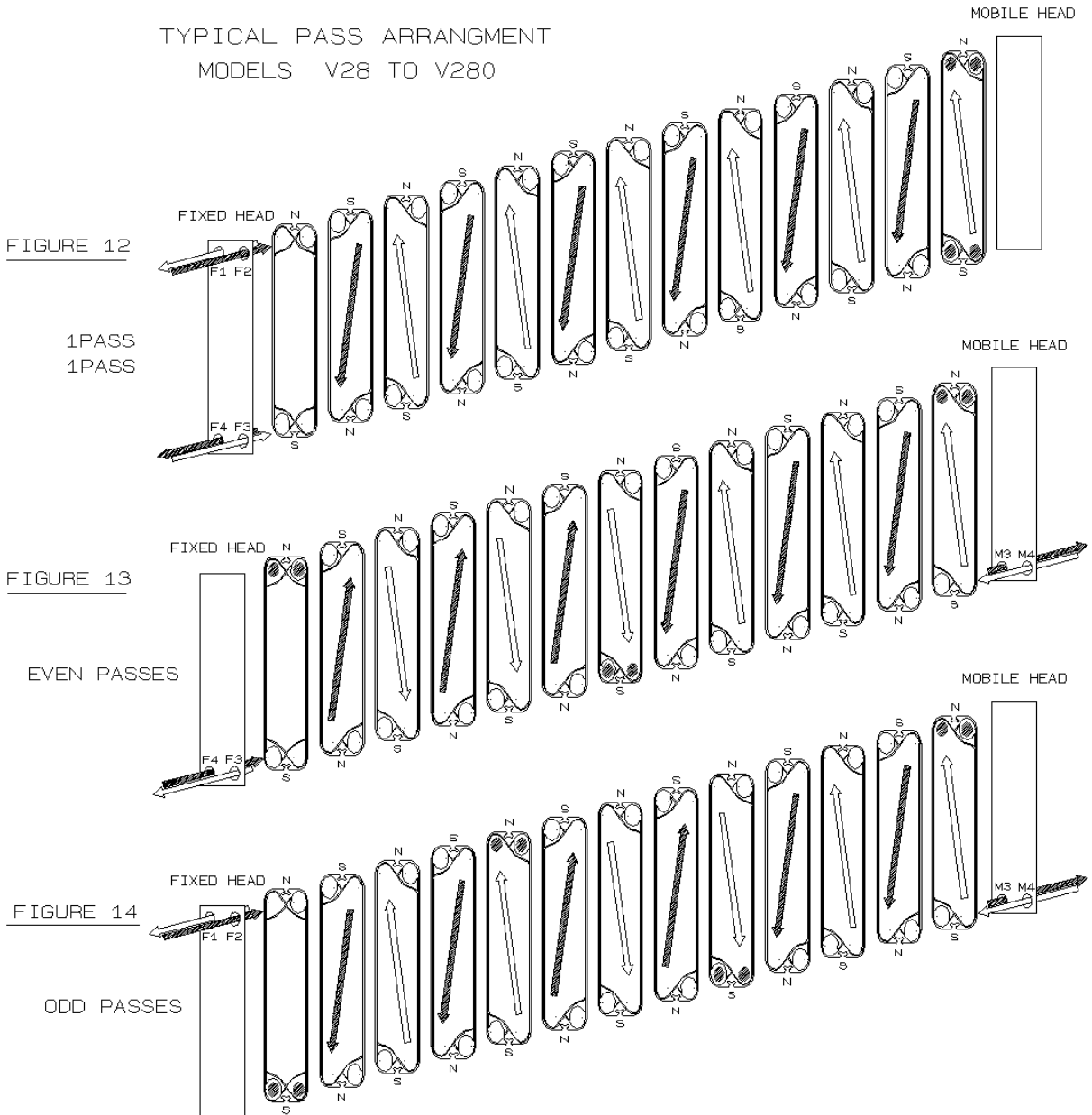
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7. TYPICAL PASS ARRANGEMENT - DIAGONAL FLOW

ORDINARY SPECIAL PLATES UTILISATION V28 TO V280 FOR CONFIGURATION 1 PASS / 1 PASS EVEN /
 EVEN - ODD / ODD



TYPICAL PASS ARRANGMENT
 MODELS V28 TO V280



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8. PLATE MOUNTING

POSITIONING OF PLATES

Plates must be correctly installed to ensure a uniform plate pack and proper gasket seating.

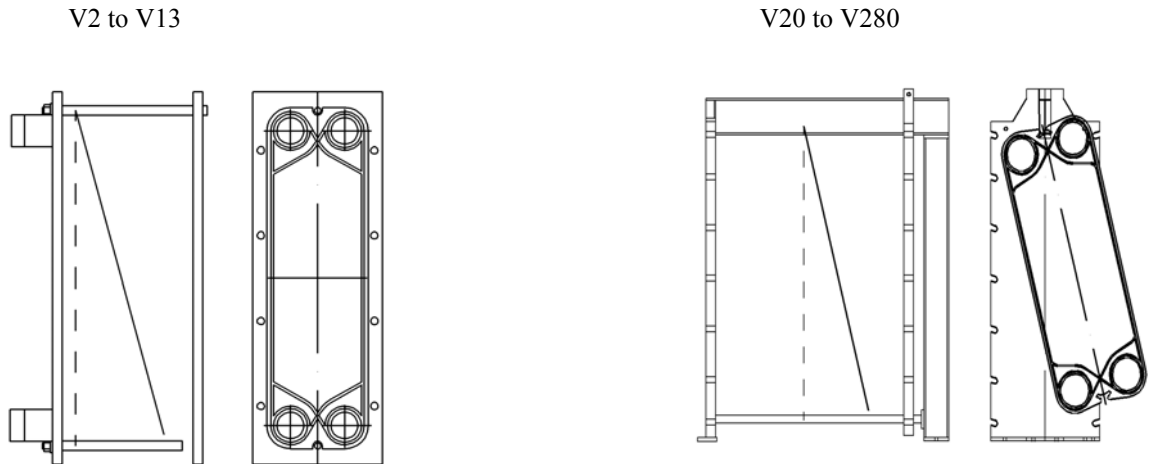


PLATE ASSEMBLING

FIGURE 15

HANGING OF PLATES ON FRAME

Plates are hung in 3 steps (figure 15)

1. Engagement on upper guide bar with plate tipped to one side and towards rear of exchanger.
2. Rotation of plate inward to hanging position, plate still tipped towards rear of exchanger.
3. Rotation of plate bottom forward, to engage lower guide bar.

The middle figure shows a plate hung correctly on the upper guide bar.

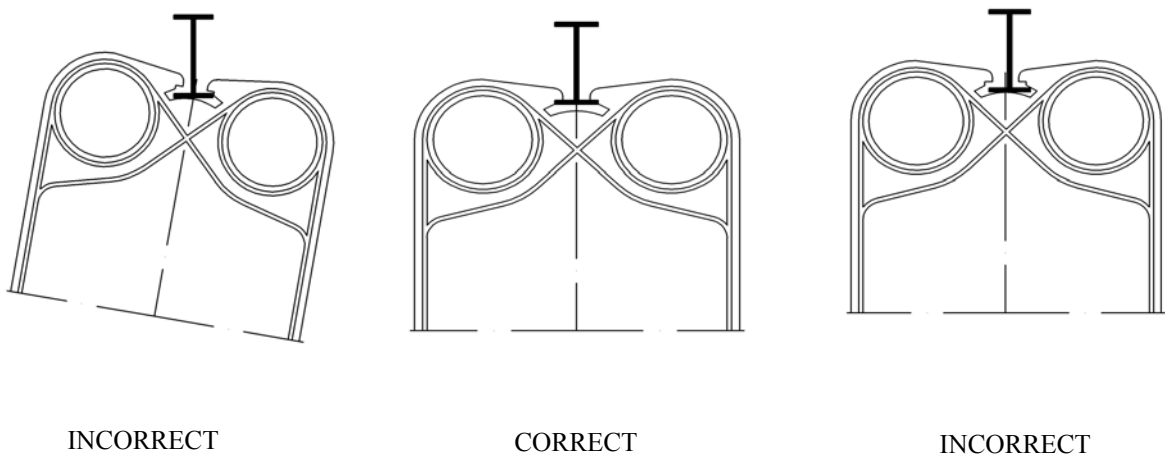


FIGURE 16

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9. MANUAL TIGHTENING OF THE PLATE PACK

The plate pack is mounted against the fixed head. Each plate is moved along the upper guide bar and is pressed against the preceding plate.

The mobile head is then pushed into contact with the plate pack. Tightening is made on 4 tie rods. The last but one tie rod will be chosen from the top to the bottom for models V28 to V280.

For models V2 to V20, the 4 end tie rods will be chosen (refer page 2).

By tightening the tie rods successively, the plate pack dimension indicated on the assembly drawing shall be reached.

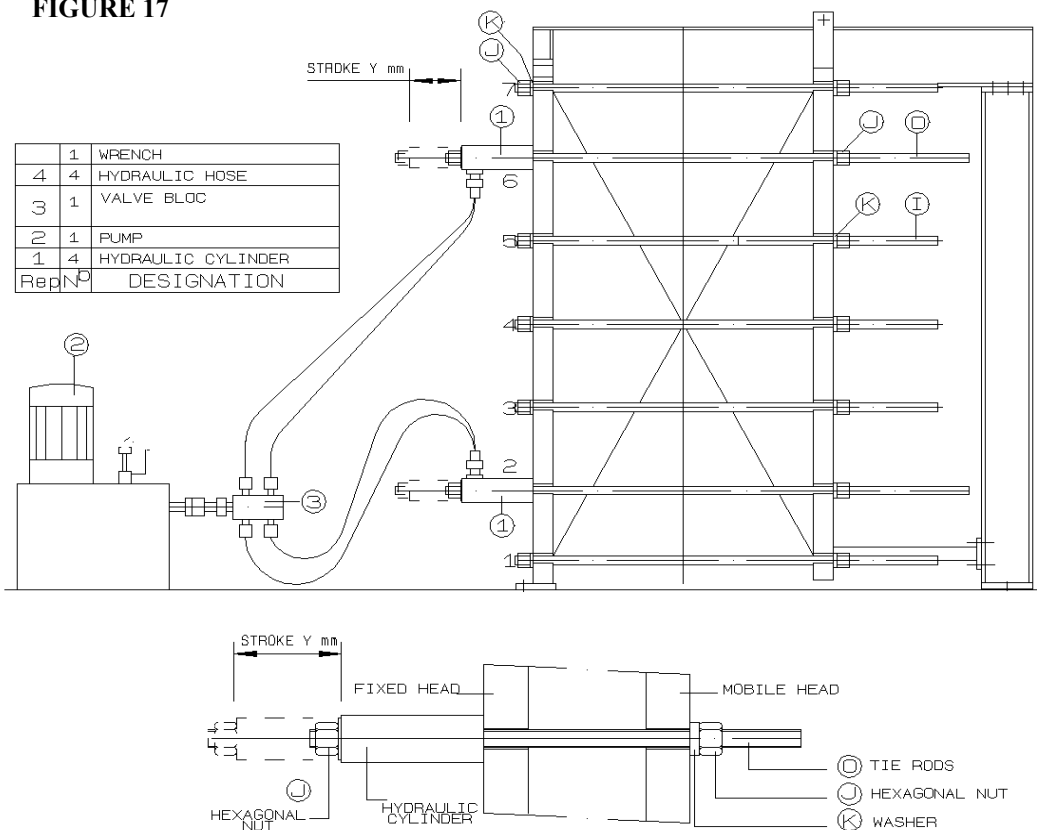
Never exceed the minimum tightening dimension, otherwise the plates will be damaged. It is recommended to tighten the exchanger at the average dimension with new gaskets to maintain gasket elasticity. At the minimum dimension, the plates are in contact with each other. Then the remaining tie rod assemblies are installed and tightened to ensure an even pressure around the perimeter of the plate pack. Refer table of tightening dimension (page 15).

10. HYDRAULIC TIGHTENING AND DISASSEMBLY OF THE PLATE PACK

TOOLING

Tightening and disassembly of the plate pack is accomplished with an hydraulic pump and cylinders which allow a quick and uniform movement of the mobile head. Refer to fig. 17 below.

FIGURE 17



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DISASSEMBLY

- Prior to disassembly, measure and record the plate length between the fixed and mobile heads.
- With a wrench, loosen the hex nuts (Item J) from the 4 tie rods (Item O) (N° 2-2', 6-6').
- Unscrew by hand the nuts (Item J) of X mm corresponding to the length of the hydraulic cylinders + Y their stroke.
- Push the 4 tie rods (Item O) to the fixed head so that they protude by X + Y mm.
- Mount the 4 hydraulic cylinders with their rods out from Y-5 mm, and put the nuts item J.
- Put the 4 hydraulic cylinders under pressure to tighten the plate pack slightly. This operation will give an extra tightening of 5 mm.
- Hold the cylinders under pressure and remove the tie rods 1-1', 4-4', 7-7', when their number is greater than 12 or remove central tie rods if their number is lower or equal to 12.
- Unscrew by hand the nuts (Item J) of the tie rods 3-3', 5-5' by 145 mm, or the nuts 1-1', 3-3' when the number of tie rods is lower or equal to 12.
- Release the pressure from the cylinders to allow a loosening of Y-5 mm.
- Repeat the above operations until the plate pack is fully opened.
- Y stands for the hydraulic cylinders travel (100 or 150 mm).

TIGHTENING

- The plate pack is mounted against the fixed head. Each plate is moved along the upper guide bar and pressed against the preceding plate.
- Install the 4 tie rods (Item O). These 4 tie rods must protude by X mm from the fixed head approximately.
- Mount the 4 hydraulic cylinders, with rods in, on the tie rods (Item O).
- Mount the hexagonal nuts and screw them by hand.
- Put the nuts J in contact with washers K. Ensure that the fixed and mobile heads are parallel to within 1 mm. Put the hydraulic cylinders under pressure to compress the plate pack by Y mm.
- Install the remaining tie rods (Item I) and their nuts and washers (Item J and K).
- Release the pressure from hydraulic cylinders and screw the nut (Item J) of tie rods item O with a wrench so that the rods of the cylinder get in by Y mm.
- Put the hydraulic cylinders under pressure again until the exchanger is tightened to a dimension between the maximum and minimum plate pack thickness indicated on the general drawing and name-plate.

Never exceed this dimension.

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- Finish tightening the tie rods with a wrench. The fixed and mobile head must be parallel to 0.5 mm.
- If a slight defect of parallelism is noticed, it must be corrected by moving the nuts (Item J) with a wrench.
- Remove the hydraulic cylinders and mount the nuts (Item J).
- Tighten slightly (approximately 15 m daN) the nuts of the remaining tie rods (Item O).

11. HYDRAULIC TEST AND STARTING UP

HYDRAULIC TEST

After each disassembly, it is necessary to perform an hydraulic test to the pressure indicated on the name-plate.

Hydraulic tests are performed to detect gasket leaks. A drop by drop leak can be eliminated by clamping within the limit of the authorized allowance indicated on the name plate. A significant leak is a result of a defective assembling, in this case do not clamp the exchanger.

The gasket leakage will be outside where it happened or through gasket vent holes. In order to make the operation easier, color the spot where it happened; It is not possible for one fluid to enter the opposite circuit due to the double corner of the gasket in the opening parts, except if one plate is defective.

Hydraulic test of one circuit (i.e. A) enables detection of defective plate.

A hole in a plate would allow leakage between circuits. This is visible by water draining into the open circuit (B). When the plate pack is open, the defective plate would be 1 of the 2 which are constituting the wet channel of circuit B.

STARTING UP

A heat exchanger should be brought on line gradually with the least severe circuit being opened first : lower pressure or temperature, etc. ...

Water-hammers may cause a permanent deforming of plates which would make their utilization difficult or even impossible.

Start up and stop will be performed without shocks.

Regulation valves will be equipped with temporisters.

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12. MAINTENANCE

MANUAL CLEANING

Loosen the plate pack, take the tie rods off, translate the mobile head against the foot, and slide the plates apart so that they hang separately to allow cleaning by brush or pressurized water.

When using high pressure water, the plates have to be laid flat to avoid damage.

- Never use metallic brush which might cause beginning of corrosion on the plates.
- Be careful not to damage the tightness gaskets and ensure they are good before tightening the frame.

CHEMICAL CLEANING

Cleaning the plates without disassembling the exchanger is possible. Connect a cleaning system on the holes of the exchanger, and make the suitable liquid circulate in each circuit. Make sure of the good withstanding of the plate materials, connections and gaskets.

IMPORTANT NOTE ! Never use Hydrochloric Acid

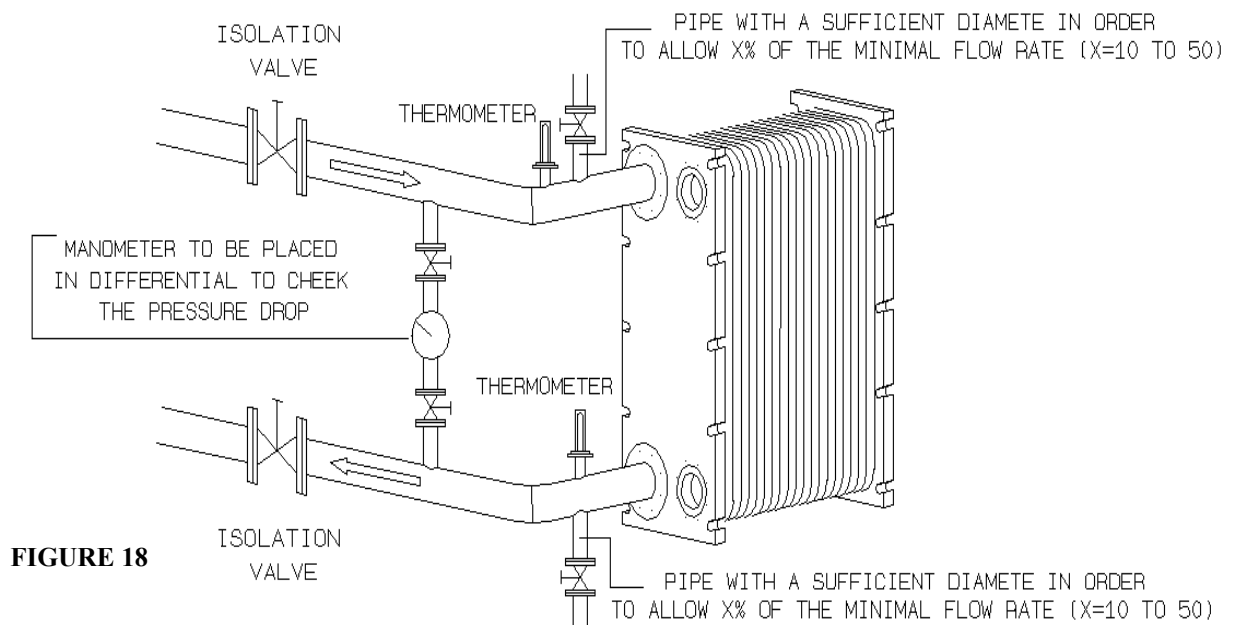


FIGURE 18

The manometer allows to compare the pressure drop with the one noticed when the installation was clean

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13. REPLACING A GASKET OR A PLATE

13.1 CHANGING A GASKET

Remove the plate from the heat exchanger and remove the gasket. If removal the gasket proves difficult, use hot air gun to heat the gasket groove from the back.

Clean the plate completely. Any remaining traces of old adhesive should be removed from the gasket grooves. Once the plate is clean, install a new gasket as described under paragraph 3. Then install the plate in its original position.

13.2 CHANGING A PLATE

Confirm the plate designation (odd or even) and the gasket position. The replacing plate should have the same thickness, pattern, designation and the same gasket material and position as the original.

13.3 INSTALLING NEW PLATES

The number of plates or their position may be changed to make surface or internal configuration change (number of passes).

The VICARB technical support is at your service to determine the new nomenclature of the plates during such changes.

13.4 STORAGE OF SPARE PARTS

PLATES

Spare plates should be stored in their original container or hung up in a protected area.

GASKETS

Gaskets should be stored in an area sheltered from light at a temperature between 0°(32°F) and 20°C(68°F). If gaskets are stored below 0°C they must be warmed above 0°C prior handling.

Gaskets should preferably be stored flat. If space is restricted, gaskets may be stored folded in half but care should be taken to avoid sharp bends which will cause cracks. Wherever possible, gaskets should be stored in their original container.

GLUE

It is necessary to stock the glue for emergency repairs.

Glue should be stored according to the manufacturer's instruction and shelf life (usually 6 months) should not be exceeded. Generally, glue is stored in a cool dry location.

When glue with hardener is used, only the quantity required for the operation should be prepared.

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14. DETERMINATION TABLE

14.1 TIGHTENING WRENCHES

TIGHTENING WRENCH DIMENSIONS - in mm		
Diameter of the TIE RODS	Tightening wrench size	Model concerned
M10	17	V2
M12	19	V4-V8
M16	24	V8
M20	30	V7-V13-V20
M30	46	V28-V45-V60-V100
M42	65	V55-V60-V85-V100-V110-V120-V130
M48	75	V110-V130-V170-V180-V205-V260-V280
M56	85	V170-V180-V205-V280

14.1 AVERAGE TIGHTENING DIMENSION (AT THE DELIVERY OF EXCHANGER)

TIGHTENING DIMENSIONS (mm) A = (X x NP)																				
X stands for = Average THICKNESS of a plate + gasket																				
NP = Number of plates																				
TYPE	V2	V4	V7	V8	V13	V20	V28	V45	V55	V60	V85	V100	V110	V120	V130	V170	V180	V205	V260	V280
X Plate Thick : 0.6	3.1	3.5	4.4	3.5	4.0	4.0	4.4	4.4	6.4	4.4	4.4	4.4	4.0	4.4	4.0	4.5	5.0	4.0	5.0	4.5
X Plate Thick : 0.8	3.3	3.7	4.6	3.7	4.2	4.2	4.6	4.6	6.6	4.6	4.6	4.6	4.2	4.6	4.2	4.7	5.2	4.2	5.2	4.7

Minimum tightening dimension of the exchanger : $a = (X \cdot N_p) - N_p/10$ (mm)

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15. CIRCUITS VOLUME TABLE

VOLUME OF A CIRCUIT $V = Y + Zx (NP - 1) / 2$ in litre																				
VALUE OF Y AND Z																				
(FRAME MST from V2 to V13 - FRAME SST from V20 to V280)																				
TYPE	V2	V4	V7	V8	V13	V20	V28	V45	V55	V60	V85	V100	V110	V120	V130	V170	V180	V205	V260	V280
Y	0.025	0.1	0.4	0.4	0.52	0.5	0.8	0.8	4	2	4.4	2	15	4.6	4.6	33	15	15	33	33
Z	0.05	0.12	0.34	0.25 5	0.45	0.63	1.1	1.7	3.1	2.4	3.4	3.7	4.4	5.0	4.35	8.1	8.48	7.0	13.2	11.8

Y = Volume of the nozzles

Z = Volume between plates