



HISAKA

PLATE TYPE HEAT EXCHANGERS

INSTRUCTION MANUAL



HISAKA WORKS, LTD. HEAT EXCHANGER DIVISION

FOREWORD

Thank you for purchasing the Hisaka Plate Type Heat Exchanger. The Hisaka Plate Type Heat Exchanger has the excellent features as follows.

1. High performance
2. Compact
3. Easy and perfect cleaning
4. Lightweight
5. Reasonable price

Due to these features, the Hisaka plate type heat exchangers are highly appreciated in all industries. Further, the heat exchangers are designed and manufactured under the qualified and certified quality control system for quality assurance.

Carefully read and follow the instructions given in this manual for the proper operation and longer service life.-----

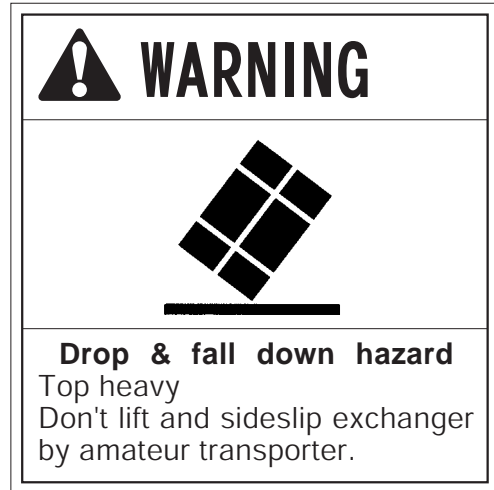
CAUTIONS “SAFETY FIRST” . . .

Follow the cautions given below before the use.

1. Absolutely avoid operation exceeding the design conditions by all means. Even within the design conditions, avoid operation of impact pressure and frequent variation of pressure.
2. When carrying the heat exchanger to the installation site by rolling it (by use of rollers), load it onto a roller carrier and pull the carrier. Directly rolling the heat exchanger will cause collapse accident. Therefore, absolutely avoid direct rolling.
3. When handling the plates for maintenance or cleaning, use protective gloves and arm covers to prevent possible injury.
(“RED CAUTION LABEL” is glued to the E-frame inside.)
4. Replace the tightening bolts and nuts with new ones if they are aged and remarkably rusted.
(Low tightening torque and bolt loose will cause fluid leak.)
5. In handling the plate outdoor, have its upper zone (above its center). It is hazardous if the plate swings due to wind pressure and hits the maintenance man when the wind is strong.
6. When heat exchanger handles steam and other fluid of high temperature, it has hazard of burns. Therefore don't touch it while running. Furthermore, don't touch it until complete cool-down to the normal temperature after the shutdown.
7. When the heat exchanger is under running or pressurizing, never unscrew any of the tightening bolts and nuts for replacement, etc.
8. When the heat exchanger is under running or pressurizing, never loosen the connections of thermometer, pressure gauge, liquid discharge valve, etc.
9. When unscrewing the tightening bolts and nuts with a ratchet spanner, be careful lest the hand and the fingers should be caught between the spanner and the frame/bolt. Furthermore, be sure to check the ratchet spanner for complete engagement in the tightening bolts and nuts before tightening or loosening, with good care for fall-down of the tightening bolts.
10. When the heat exchanger handles dangerous fluids of high temperature and high pressure, caustic soda, etc., attach a safety cover, a warning board, etc. to the side face of the plate so as to protect personnel from hazard even if fluid leaks.
11. In such a case a secondary accident caused by leak from the heat exchanger is forecast (e.g. an electrical equipment exists near the heat exchanger), provide a proper safety cover to prevent fluid scattering.
12. When the heat exchanger handles caustic soda and other hazardous fluid, provide a proper protective measure (e.g. safety cover or a warning board, etc.) along the side face of plate to protect the human body from such fluid when it leaks incidentally.
13. Overhaul the heat exchanger periodically (once a year) to check the plates for a pinhole caused by damage, corrosion, cracking, etc. The pinhole may cause mixing of two liquids.
14. Do not use any detergent that may corrode the plate or deteriorate the gasket. Please contact us to check whether or not a specific detergent may be used. In particular, detergents containing hydrochloric acid may cause pinhole in the plate.
15. When Ordering the gaskets, be sure to confirm the gasket material with reference to the Drawing of Plate Arrangement.
Wrong selection of the material would cause leak trouble during running. Further, don't use any gasket other than supplied by us.
16. Do not burn any used gasket (fluorine resin, rubber, etc.), because it may generate toxic gas. Ask an industrial waste disposal contractor to collect and dispose of it.
17. When operating the equipment after a new installation or after replacement of gasket, the smell of the gasket or adhesive may get into the liquid. Remove the smell of the gasket and adhesive by washing with warm water.
18. If sake is prepared with newly installed equipment or after installation of a new plate, the sake may be colored. It is necessary to flush the equipment with lactic acid or sake beforehand.



(glued to the E-frame outside.)



(glued to the both E-frame and packing case outside.)



(glued to the E-frame inside.)



(glued to the package Instruction manual is inside.)

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1

TRANSPORTATION AND UNPACKING

1. Packing Style

Classification	Model	Packing style		Refer to
Miniature size	UX—005	J Type	Exclusive corrugated fiberboard box, one set per box	Fig.1.1
Small size	UX—01	NJ Type NP Type	Corrugated fiberboard box with skid base In the case of direct shipping to purchaser factory, bare machine anchored to wooden skid base only	Fig.1.2 Fig.1.3
	UX—10			
	LX—00			
	LX—10			
	RX—00			
	RX—10			
Medium size	EX—11	NJ Type	anchored to wooden skid base, front side down in flat position	Fig.1.4
	EX—15			
	EX—16	NP Type	Limited to less plates and overall length 1,100mm max	Fig.1.5
	UX—20			
	UX—30			
	UX—40	NP Type	For multiple plates and overall length of over 1,100mm Packed in vertical position in crate or anchored to skid base only or to wooden load member	Fig.1.6 Fig.1.7 Fig.1.8
	LX—20			
	LX—30			
	LX—40			
	LX—50			
	RX—30			
	SX—40			
	GX—20			
	FX—01			
Large size	UX—60	NP Type	Packed in vertical position in crate or anchored to wooden skid base, divided into several block	
	UX—80			
	RX—70			
	SX—70			
	SX—90			
	SX—90M			
	SX—90L			
	UX—90			
	UX—100			
	UX—130			
	FX—03			
	FX—05			
	YX—80			

(Note) The standard accessories (ratchet spanner, anchor bolts with nuts, nuts for stud bolts) are packaged in a corrugated fiberboard box, which is then banded to the heat exchanger body.

Miniature size

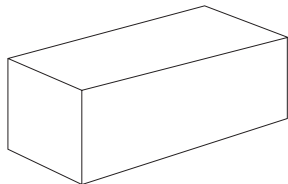


Fig.1.1 Corrugated fiberboard box

Small size

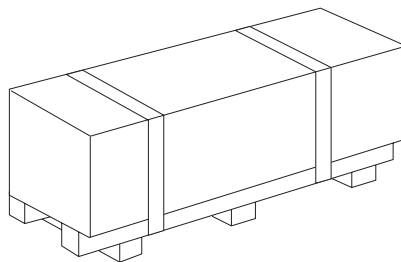


Fig.1.2 Corrugated fiberboard box with skid base

Small size

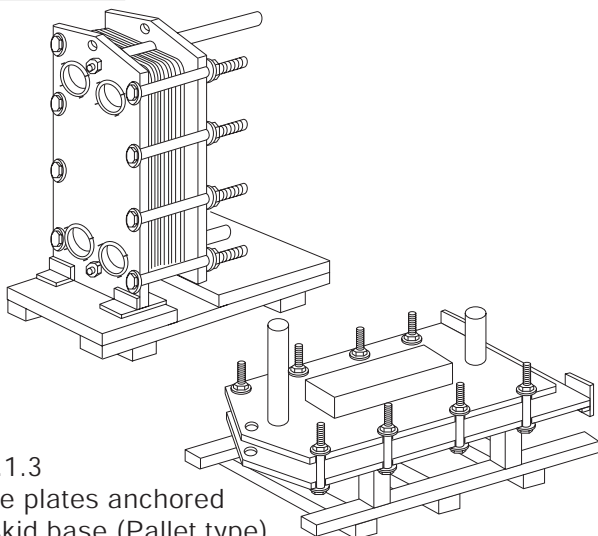


Fig.1.3
Bare plates anchored
to skid base (Pallet type)

Medium size NJ type

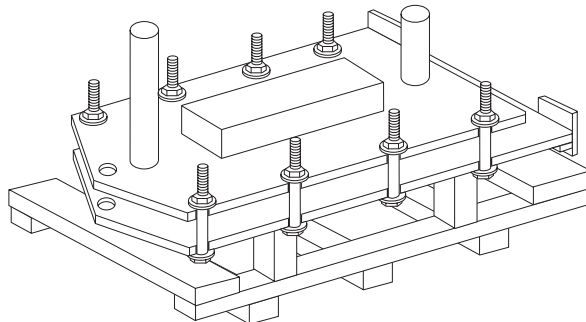


Fig.1.4 Bar plates anchored to skid base
(Pallet type)

Medium size NP Type for less plates

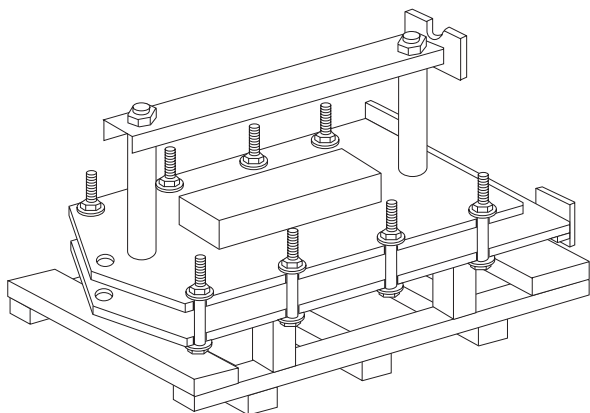


Fig.1.5 Bare plates anchored to skid base
(pallet type)

Medium size NP type for multiple plates

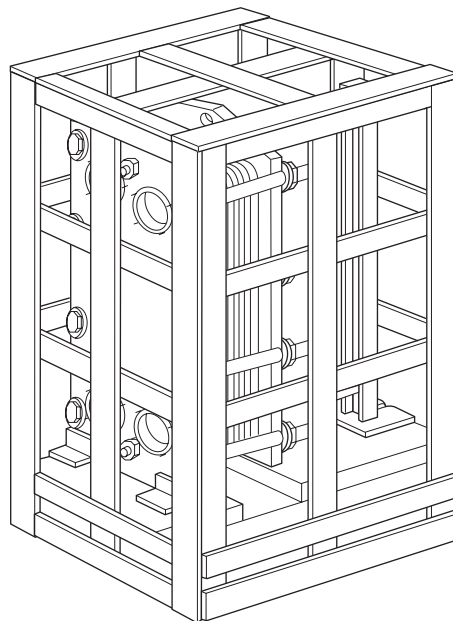


Fig.1.6 Crate

Medium size NP type for multiple plates

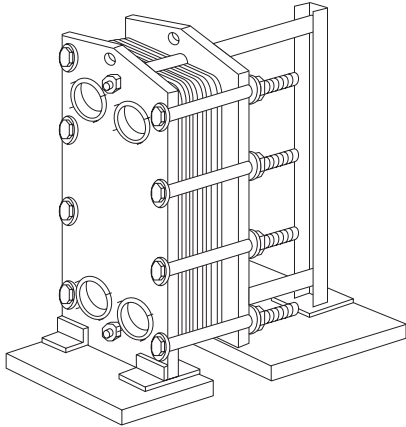


Fig.1.7 Bare plates anchored to skid base

Medium size NP type for multiple plates

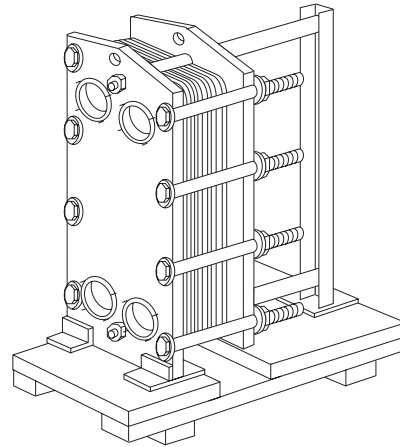


Fig.1.8 Wooden load member with skid base (Pallet type)

2. Unloading Procedure

Unloading by wrecker, crane, fork lift, etc.

(1) Case of frontside down (flat position)

Hoist up using two wire ropes or belts as illustrated.

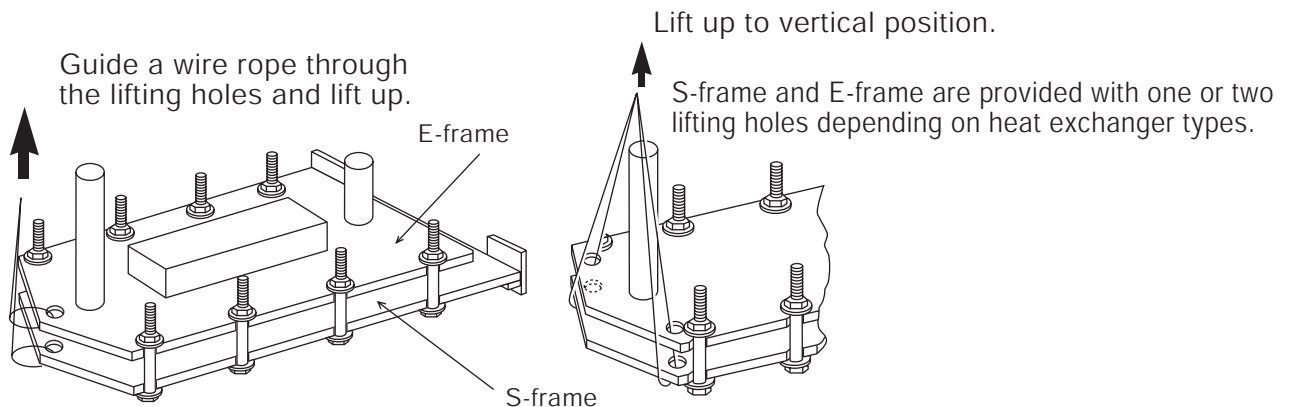
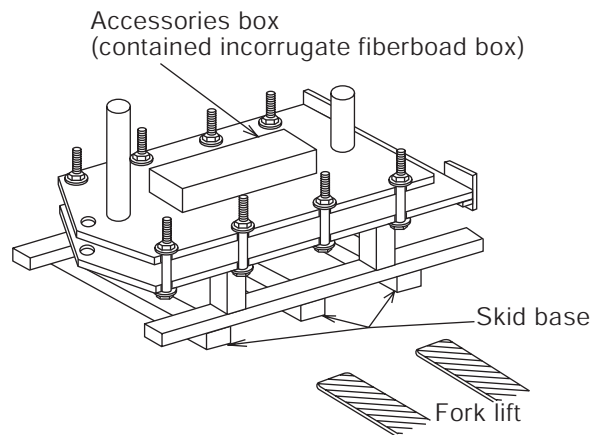
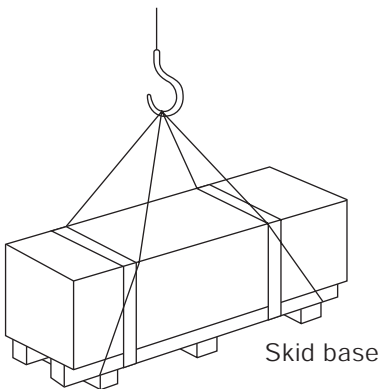


Fig.1.9 Unloading Methods (Case of front side down)

(2) Case of vertical position

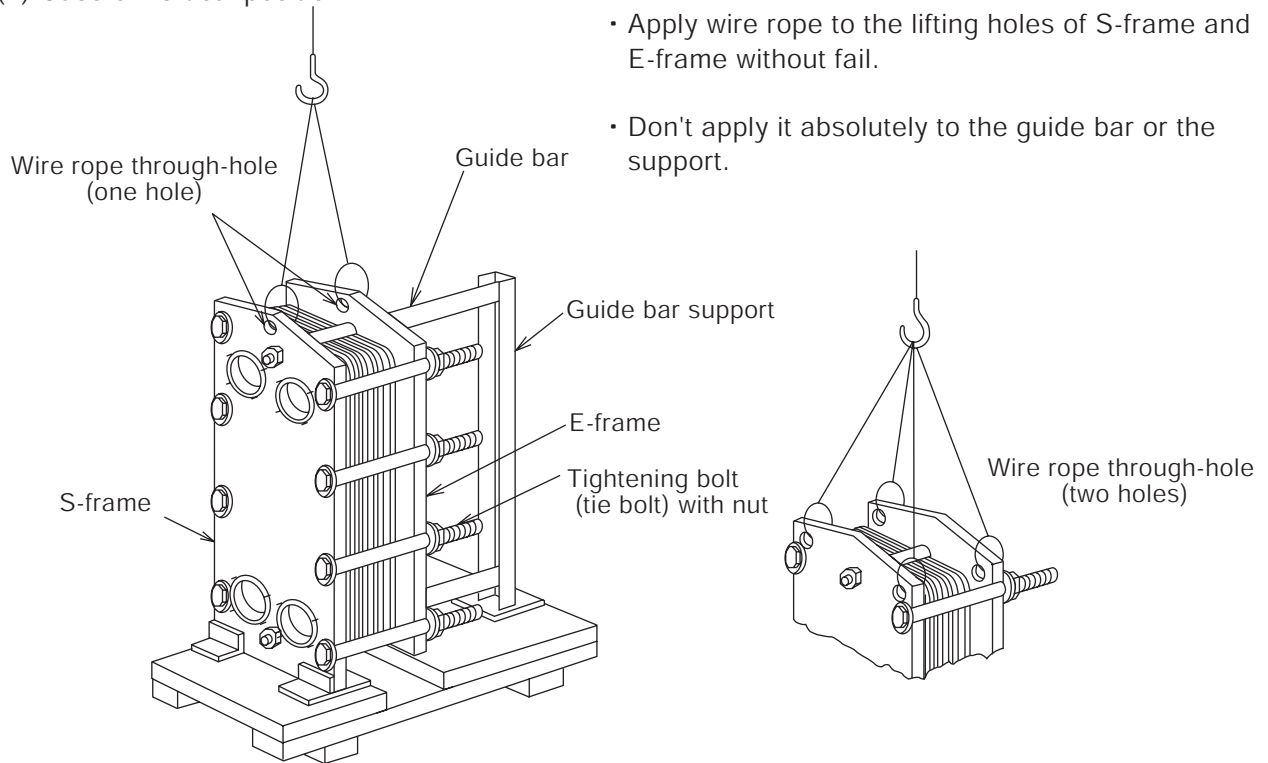


Fig.1.10 Unloading Method (Case of vertical position)

3. Unpacking

The following standard accessories are contained in a corrugated fiberboard box, which is then banded to the exchanger body.

- * Ratchet spanner used to tighten and loosen the plates
- * Anchor bolts with nuts
- * Nuts for stud bolts

When the heat exchanger includes thermometer, pressure gauge, etc. (options), they are contained in another corrugated fiberboard box.

After unpacking, handle and store them with good care not to damage or lose them.

4. Carrying to installation site

Carry the unpacked heat exchanger to a specific installation site using a Dolly, etc.

Directly pulling it without using a dolly will cause it to turn aside. Absolutely avoid doing so.

Use the skid base when lifting by a fork-lift. Never apply rollers to the skid base for rolling.

2 INSTALLATION

1. Identification of construction parts

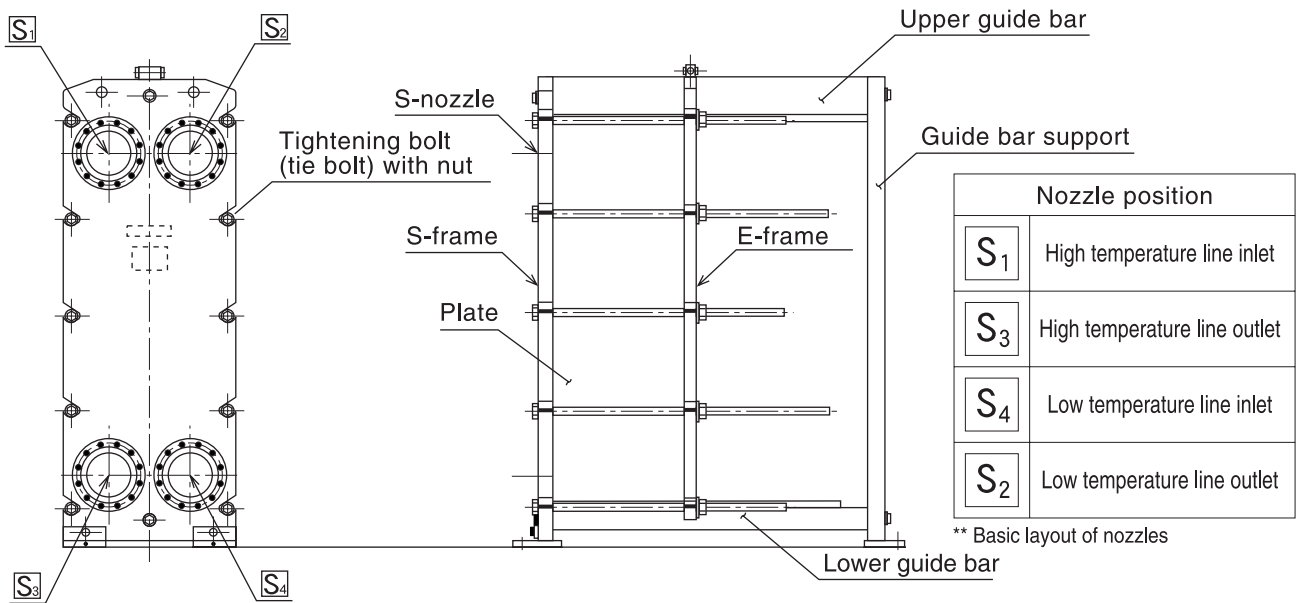


Fig.2.1 Identification of construction parts

2. Required installation space

Reserve the installation space as indicated in Fig. 2. 2

(1) Front (S-frame side)

No maintenance space is necessary because usual maintenance is performed without removing the piping.

(2) Side

The side space is necessary to turn a ratchet spanner for overhauling and reassembling or to pull out the plates in oblique position for the maintenance purpose. Reserve the maintenance space of over 800mm in width (around $W' = W$ mm in the case of the body width of 800mm or less) x overall sidelength Lmm. It is desirable to reserve this space at the both sides. When it is impossible to do so, however, reserve it at either side.

(3) Rear (E-frame side)

In the case of E-frame with nozzle, reserve the overall length Lmm including the nozzle length protruding beyond the E-frame.

3. How to anchor to foundation

(1) Carry the heat exchanger to a specific location and install it horizontally. After complete centering and leveling, anchor the S-frame base plate and the guide support base plate using the supplied anchor bolts.

(2) The standard anchor bolts are of L-shaped SS400, but long bolts, chemical anchors, set bolts, hole-in-anchor, SUS bolts etc. (all options) must occasionally be used, instead of the standard bolts, depending on required strength (e.g. antiseismic structure), work method, foundation structure, etc.

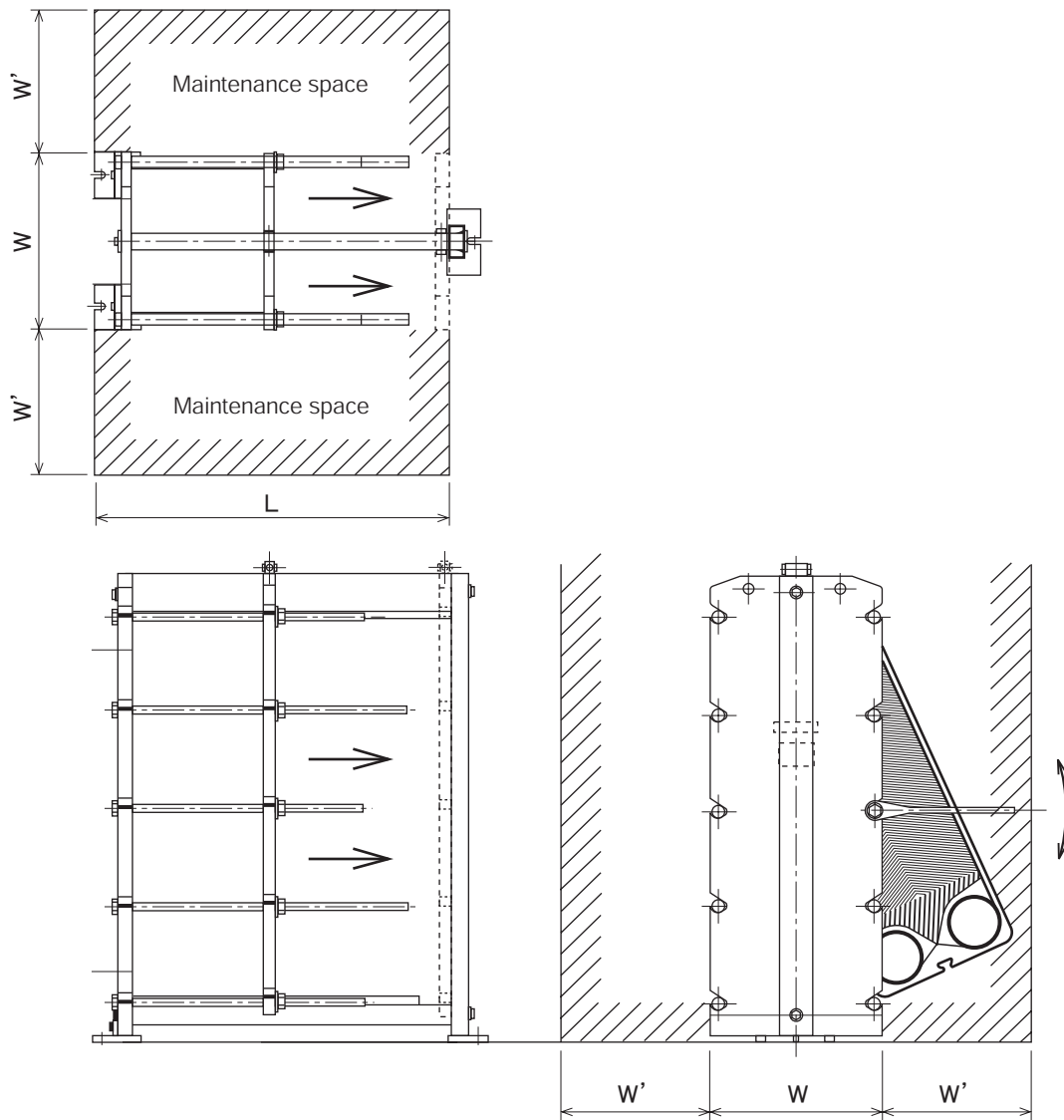


Fig.2.2 Required installation space

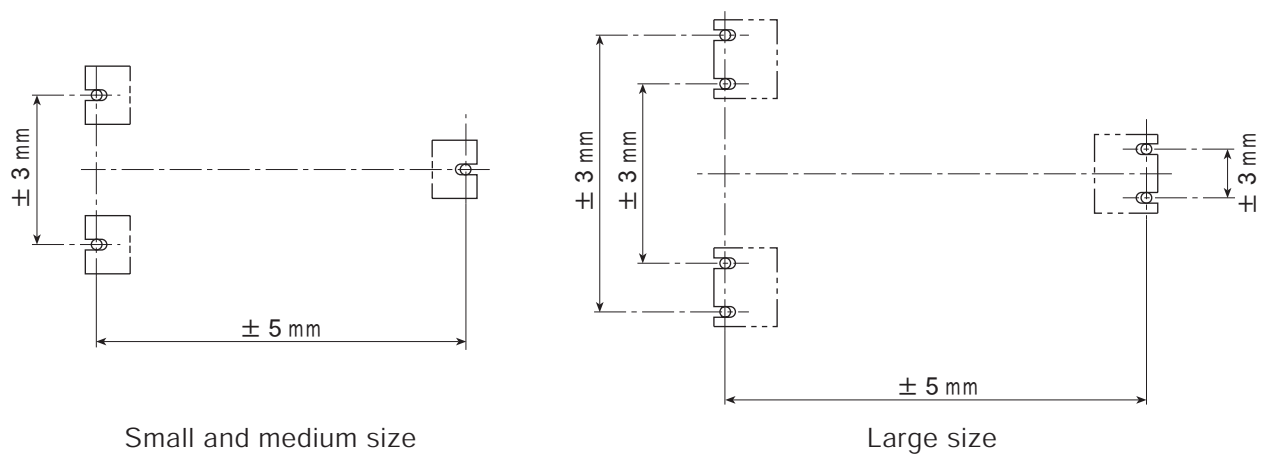


Fig.2.3 Anchor Bolt Pitch and Tolerance

(3) Types of anchor bolt with nut

Pre-driving anchor bolts (recommended bolts) as illustrated in Fig.2.4 are supplied with the heat exchanger.

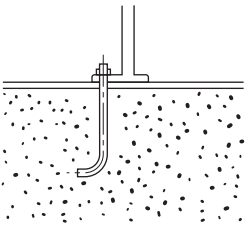
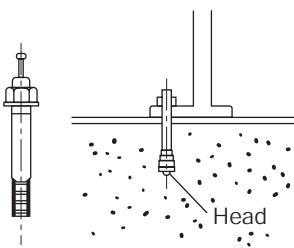
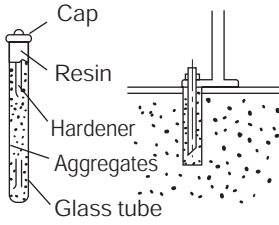
Pre-driving anchor type	Stud anchor bolt		<p>Each anchor bolt is positioned and set properly before placing foundation concrete, being then fixed simultaneously with completion of concrete placing.</p>
	Box anchor		
After-driving anchor type	Hole-in anchor		<p>Anchor hole is drilled in the concrete using a stone drill and, after being inserted in the drilled hole, each anchor end is mechanically expanded and fixed to the concrete by hammering its head pin.</p>
	Chemical anchor		<p>Hole of specific size is drilled in the foundation concrete and a tubular glass capsule (See the sketch) filled up with resin, hardening promoter, aggregate, etc. is inserted in the hole. Thereafter, anchor bolt is driven into the glass tube using rotary impact of an impact drill, etc. and, as the result, resin, promoter, aggregates and crushed glass mix and cure altogether, then there by fixing the anchor bolt.</p>

Fig.2.4 Types of anchor bolt with nut

1. Precautions for piping design and engineering

(1) Example of basic piping

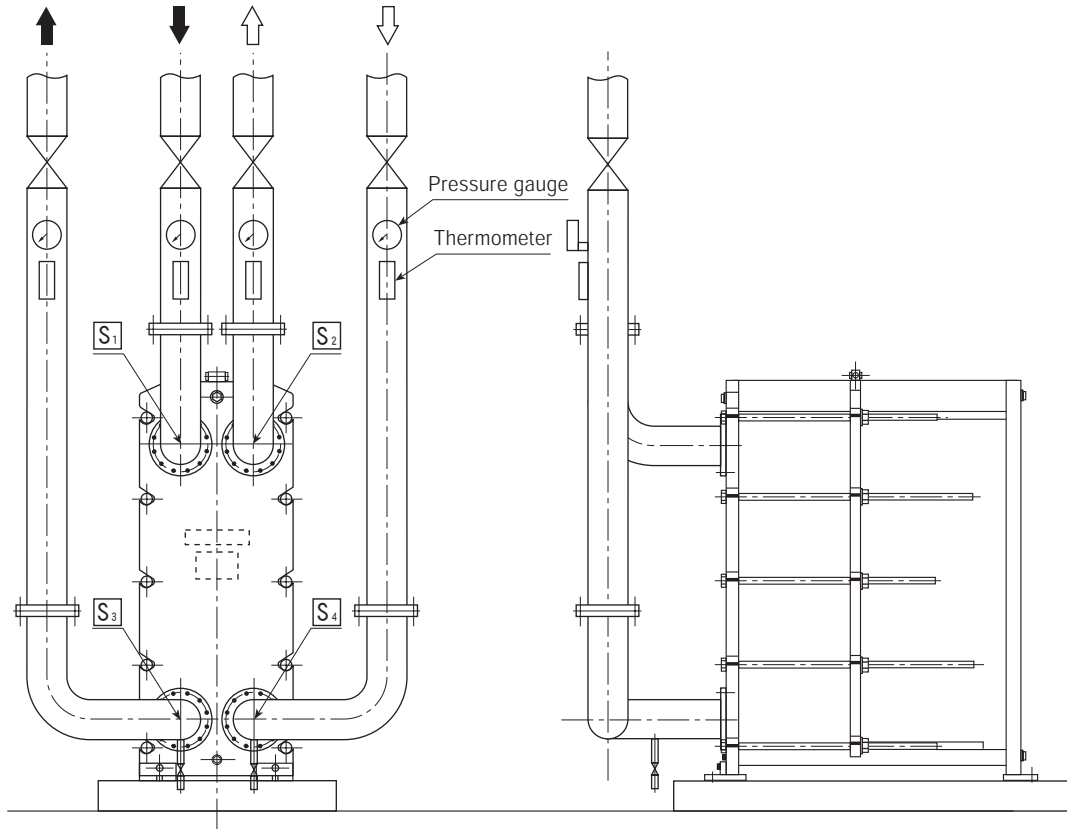


Fig.3.1 Example of basic piping

(2) Nozzle layout

The basic nozzle layout is as illustrated in Fig.3.1, but the righthand and lefthand nozzles or the upper and lower nozzles can be reversed on application. Refer to the assembly drawing of the heat exchanger delivered, for the detail.

- 1) It is impossible to locate each inlet and each outlet in diagonal position.
- 2) In the case of counter flow design, inlet is located on a diagonal line.
- 3) In the case of steam heating specification, the upper nozzle (S1 or S2) can only be designated as steam inlet.

(3) Piping Stud bolts conforming to JIS Flange

Standard are screwed in the S-nozzle of S-frame. Directly connect the mating flange of pipeline to the S-nozzle using stud bolts. Further, don't apply welding to the stud-bolted mating flange.

(4) Installation of end pipes

In the case of boot type nozzle, joint two or more end pipes to the nozzle for maintenance purpose. As illustrated in Figs.3.2 and 3.3, the plate type heat exchangers use stud-bolts for piping connection (stud bolts embedded in the frame). Hence, the 1st end pipe connected with these stud bolts can not be slid both vertically and horizontally because they are interfered with by the stud bolts. Therefore, first remove the 2nd end pipe and then the 1st pipe using the space of the removed 2nd pipe. One piping connection requires two or more end pipes for enabling the maintenance for one nozzle.

(Figs. 3.6 to 3.10, Fig.3.12, Figs.3.5 to 3.18)

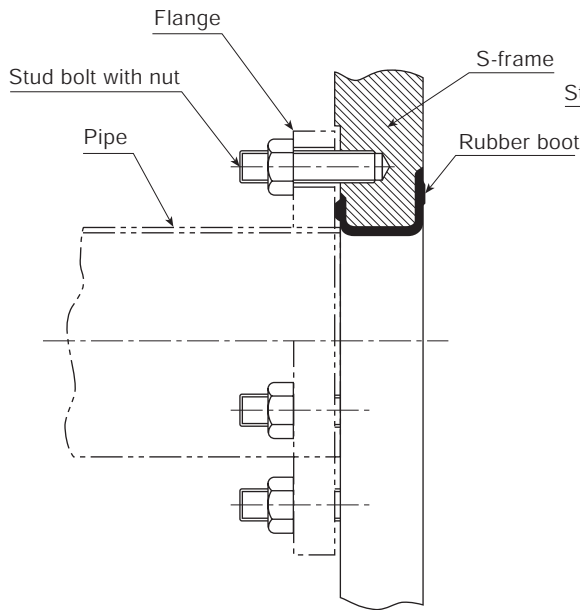


Fig.3.2 Rubber Boot Type

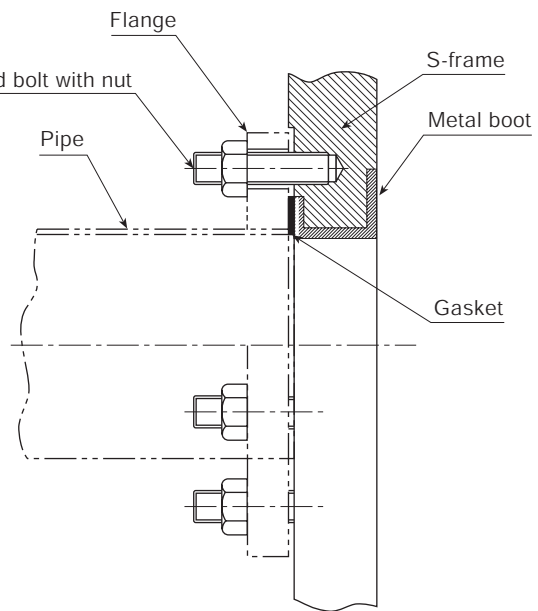


Fig.3.3 Metal Boot Type

(Note) The rubber boot type requires no piping gasket.

(5) Prohibition of fixed piping within overhaul space

Don't install a fixed pipeline within the oblique-lined area (▨) in Figs.3.4 and 3.5. The E-frame must be moved back. Therefore, existence of fixed piping within this moving area disabled to move the E-frame backward for overhaul and inspection.

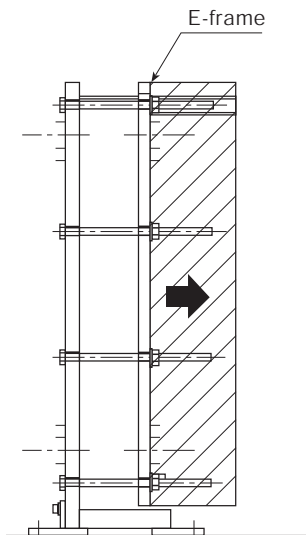


Fig.3.4 NJ Series

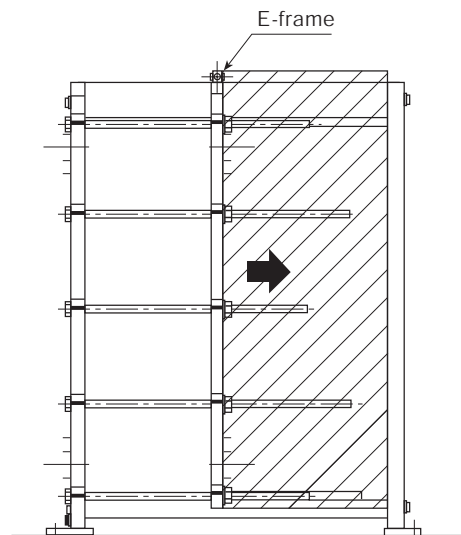


Fig.3.5 NP Series

(6) Expansion joints

Plate type heat exchanger eventually requires retightening of its plates. This retightening is available within the maximum to minimum dimensional range stamped on the nameplate. The E-frame shifts toward the S-frame due to this retightening. Where the piping is installed at E-frame side, hence, it must be equipped with an expansion joint so as to correspond to this shift stroke of the E-frame.

(7) Pipe support

Support the pipelines with pipe hanger and pipe support to prevent piping load from acting on the heat exchanger.

(8) Valves

Connect a gate (stop) valve to each of the inlet and outlet pipes, as illustrated in Fig.3.1, to prevent water dropping during maintenance.

(9) Liquid discharge and air vent

Liquid must be discharged completely out of the heat exchanger when it is shutdown for maintenance or put in long term rest or when freeze preventive treatment is applied to it. For the purpose, connect a liquid discharge pipe to the lower main pipeline at the lowest point and an air vent pipe to the upper main pipeline at the highest point. Furthermore, provide liquid discharge valve and air vent valve on the respective pipes at easy-to-operation position.

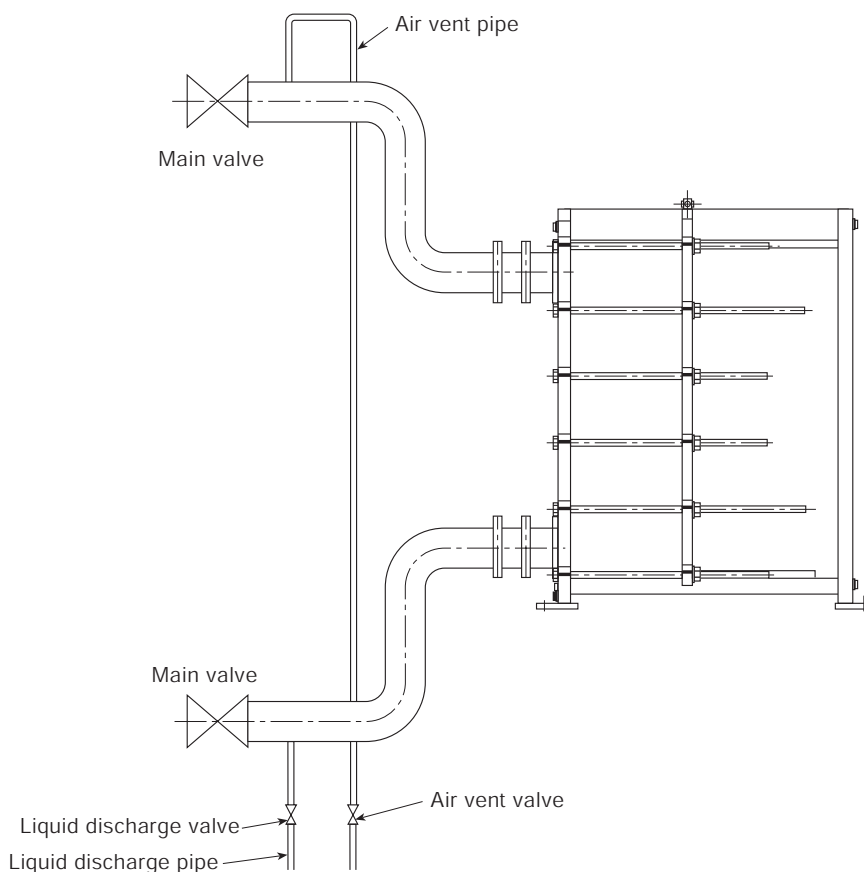


Fig.3.6 Liquid discharge and air vent

(10) Thermometer and pressure gauge

The heat exchanger body does not include thermometer and pressure gauge (These are options.) Hence, connect these to each connecting pipe at user side.

The conventional nozzles were complete with approx. 250mm long projection, to which thermometer and pressure gauge were connected. However, this design was discontinued due to the following reasons.

- Security of piping space and freedom of piping design.
- It is better for maintenance against damage, etc. to use thermometer and pressure gauge common to the entire system line.

(11) After completion of the piping work, apply internal cleaning and flushing to each pipeline for complete removal of solid matters (e.g. stone, sand, welding slag, etc.) from the pipes, prior to startup of heat exchanging operation. Method of removing the end pipe nearest heat exchanger and method of using strainer are available for flushing. In the latter case, the recommended mesh sizes of strainers are as shown in Table 3.1. Further, where fluid used contains solid matters such as stone, sand, etc., this strainer method is recommended to avoid plate damage or blocking caused by such solid matters.

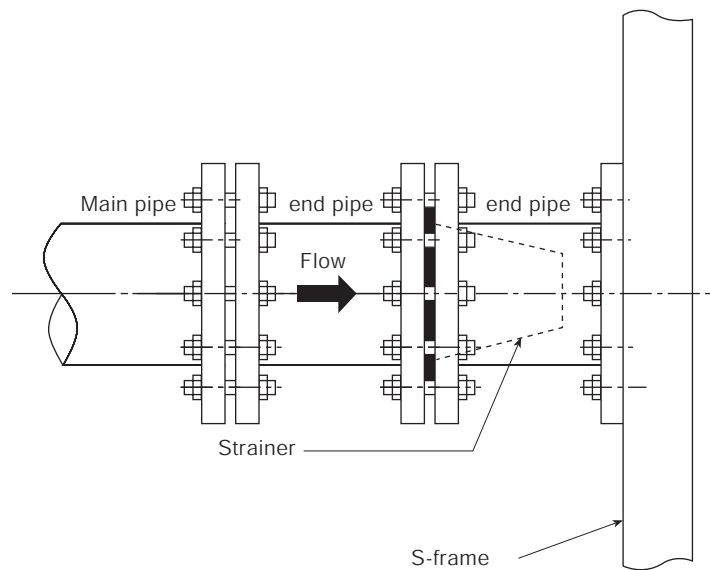


Fig.3.7 Strainer

(12) Safety valve

Installation of a safety valve is recommended for occasional abnormal rise of the fluid pressure.


(13) Use the oblique-lined zone  in Figs.3.4 and 3.5 as a work passage. But be careful of possible collision against the tightening bolts.

Table 3.1 Recommended Mesh Sizes of Strainers

Type	Mesh size(mm)	Type	Mesh size(mm)
EX-11	2.8 or smaller	RX-00	1.8 or smaller
EX-15	2.9 or smaller	RX-30	2.1 or smaller
EX-16	2.8 or smaller	RX-11, 19, 12	1.8 or smaller
UX-005	1.4 or smaller	RX-13, 18, 14	1.9 or smaller
UX-01	1.8 or smaller	RX-70	2.9 or smaller
UX-10	1.5 or smaller	SX-41, 47, 44	1.7 or smaller
UX-20	1.9 or smaller	SX-43, 48, 45, 49	1.1 or smaller
UX-30	1.8 or smaller	SX-70	1.6 or smaller
UX-40	2.5 or smaller	SX-90, 90S, 90M, 90L	2.4 or smaller
UX-60	3.6 or smaller	GX-20H	3.6 or smaller
UX-80	3.3 or smaller	GX-20L	8.0 or smaller
UX-90	3.1 or smaller	GX-20M	4.0 or smaller
UX-100, 130	3.1 or smaller	WX-50	2.5 or smaller
LX-00	2.5 or smaller	WX-90	3.1 or smaller
LX-10	2.9 or smaller	FX-01	1.8 or smaller
LX-20	3.6 or smaller	FX-03	1.8 or smaller
LX-40	4.0 or smaller	FX-05	2.7 or smaller
LX-30, 50	3.3 or smaller	YX-80 A/B	1.7/2.0 or smaller

2. Examples of Piping Installation

(1) Straight piping to S-frame

Connect two more end pipes to each nozzle.

Note) X-mark...Improper piping

O-mark...Proper piping

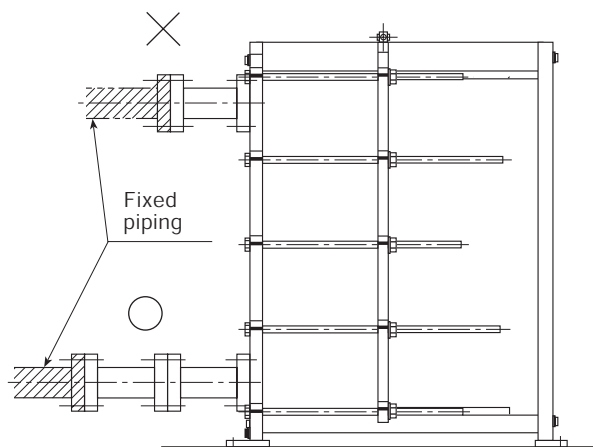


Fig.3.8 Straight Piping (1)

(2) Straight piping to E-frame

Connect two or more end pipes to each nozzle. Don't install a fixed piping within the E-frame shift area. (Refer to Fig.3.4, 3.5)

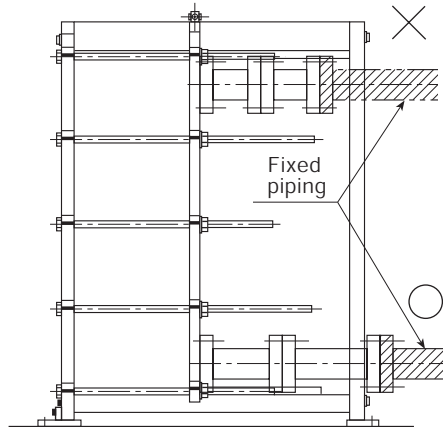


Fig.3.9 Straight Piping (2)

(3) Upward piping (Even one end pipe is removable by sliding.)

Don't install a fixed piping within the E-frame shift area. (Refer to Fig.3.4, 3.5)

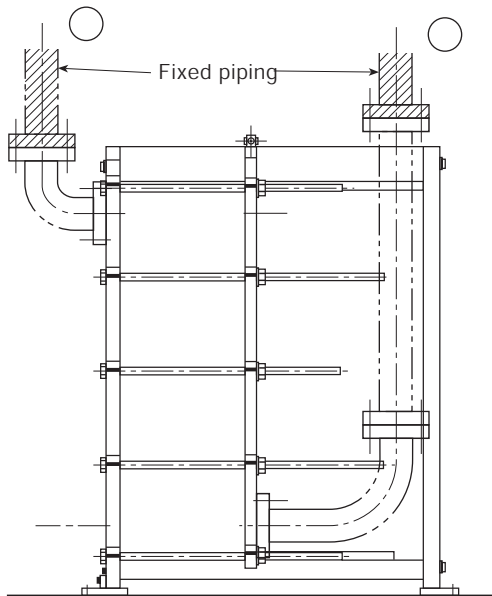


Fig.3.10 Upward Piping (1)

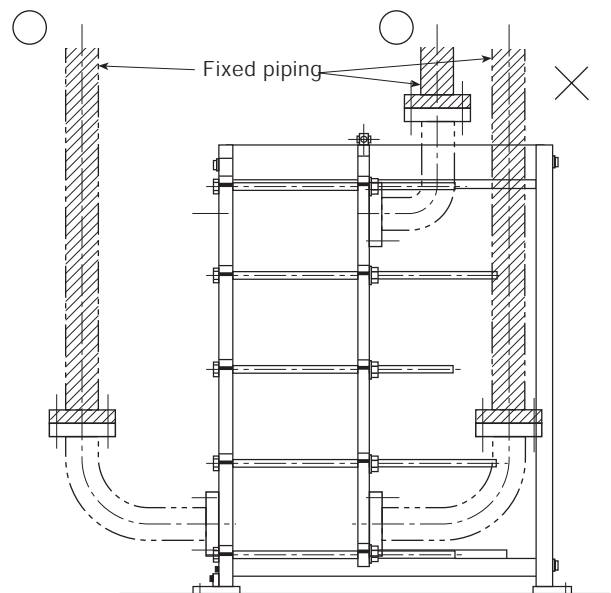


Fig.3.11 Upward Piping (2)

(4) Downward piping (Even one end pipe is removable by sliding.)

Don't install a fixed piping within the E-frame shift area. (Refer to Fig.3.4, 3.5)

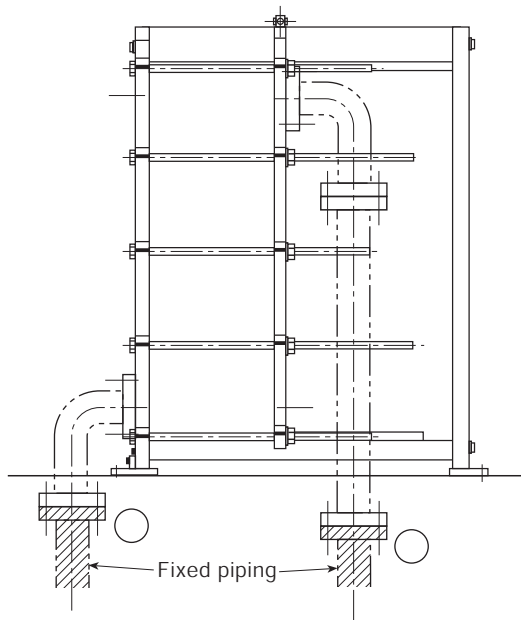


Fig.3.12 Downward Piping (1)

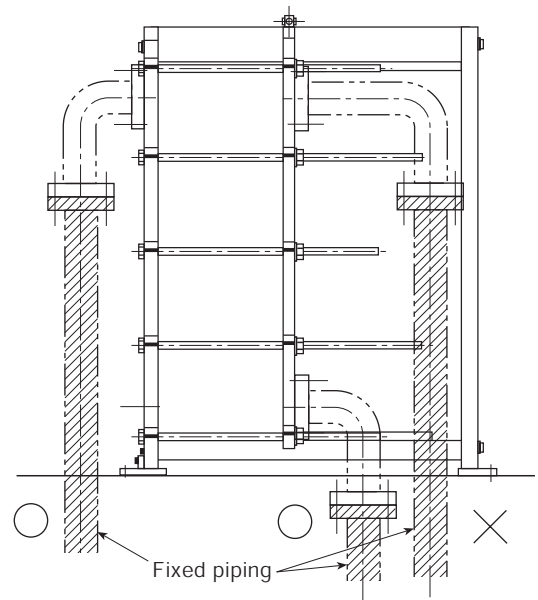


Fig.3.13 Downward Piping (2)

(5) Horizontal piping (even one end pipe is removable by sliding.)

Don't install a fixed piping within the E-frame shift area. (Refer to Fig.3.4, 3.5)

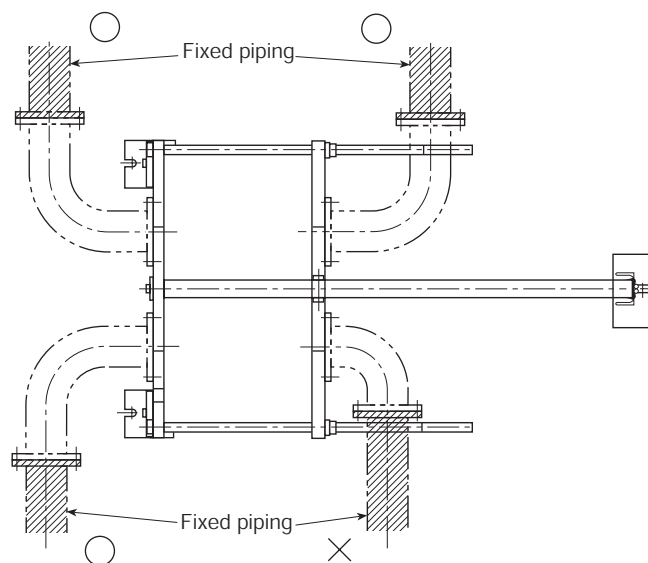


Fig.3.14 Horizontal Piping

(6) Piping to large size heat exchangers (UX-60, UX-80, UX-100, SX-70, SX-90, etc.)

When pipeline is connected to the E-frame of large size heat exchanger, the pipe size becomes larger than the tightening bolt distance C as illustrated below and this disables to install horizontal piping. Hence, apply straight piping or upward/downward piping. (In this case, two or more end pipes must be connected considering the shift area of the E-frame, similarly to other types.)

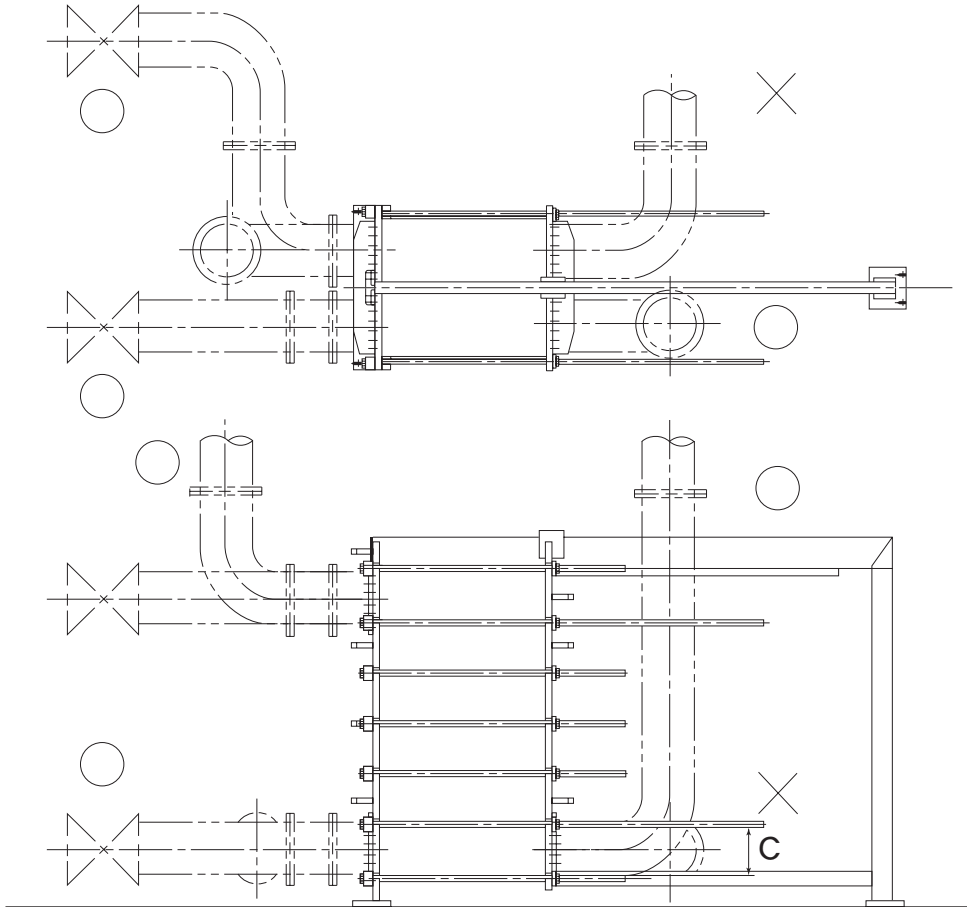


Fig.3.15 Large Size Piping (1)

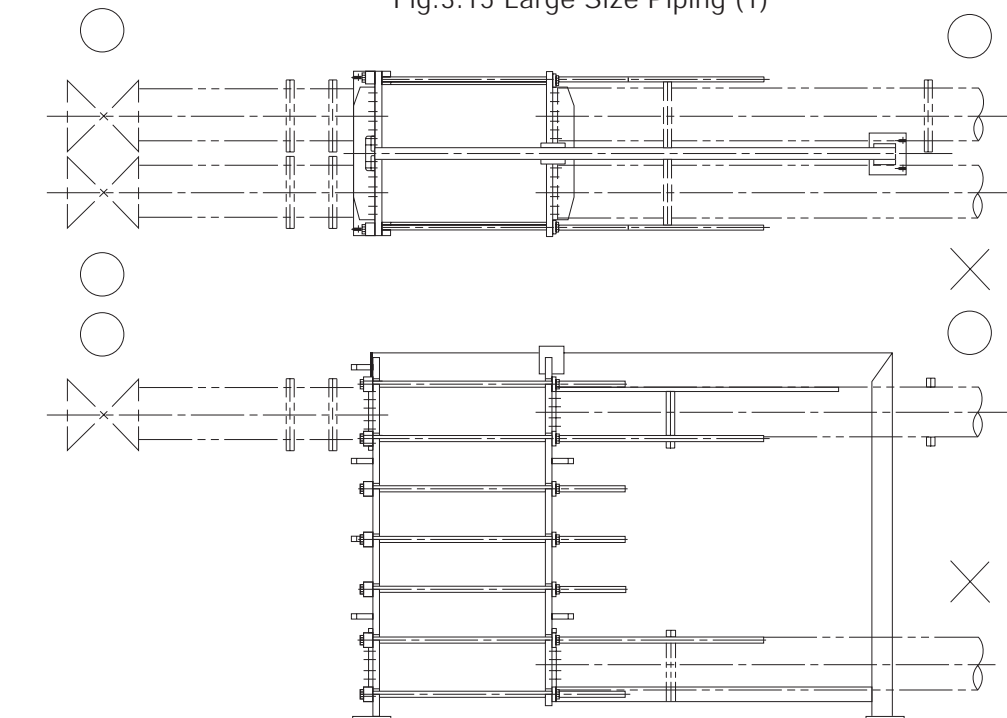


Fig.3.16 Large Size Piping (2)

(7) Special piping

Where pipe size is larger than the nozzle size of heat exchanger and interference of flange to flange must be avoided;

Where pipe size is smaller than the nozzle size of heat exchanger;

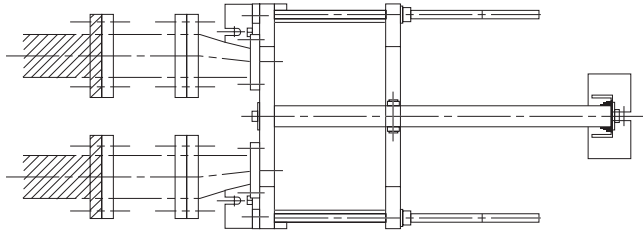


Fig.3.17 Reducing Piping (1)

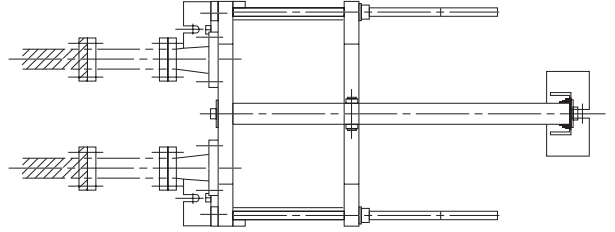


Fig.3.18 Reducing Piping (2)

4 OPERATION

1. Final check items prior to test run

- (1) The S-frame to E-frame distance to be bolted is stamped on the nameplate on any of plate type heat exchangers. Ensure to check if these frames are bolted to the specific dimension (distance) with equal tightening dimension at each bolt position.
- (2) Try to turn the nuts by hand to check the tightening bolts for loose.
- (3) Verify the nozzle orientation with that indicated in the relevant drawing.
- (4) Check that each control valve (e.g. diaphragm valve, etc) is properly mounted and the check valves are mounted correct direction.
- (5) When thermometer and pressure gauge are supplied with the heat exchanger, check the type, gradations range, material, etc.
- (6) Check that each valve is fully closed.

2. Starting sequence

- (1) Fully close the fluid inlet valve and fully open the outlet valve.
- (2) Open the fluid outlet air vent valve.
- (3) Switch the pump on.
- (4) Slowly open the fluid inlet valve to feed the fluid into heat exchanger.
Usually the fluid is first feed from the low temperature line. In the cases of refrigerant (0°C or less) heat exchanging and fluorine rubber gasket (VITON) are used, feed the fluid from the high temperature line.
(When FPM or □-FPM is specified in the gasket material column of the element composition drawing which is attached to Specification, comply with the above requirement.)
- (5) If fluid overflows out of the air vent pipe, close the air vent valve and, thereafter, adjust the opening of the inlet and outlet valves respectively.
- (6) When heat exchanger has reached steady running condition for both fluids, ensure to check the leakage between the plates.

(Note) When using steam as heat source, completely drain out before feeding steam into the heat exchanger. Otherwise, residual drains will make steam hammer phenomenon, then causing damage and other trouble.

3. Shutting down

- (1) Fully close the high temperature fluid inlet and outlet valves and the low temperature fluid inlet and outlet valves in sequence.
Close the outlet valve only after making sure that the liquid inside the equipment has been cooled down sufficiently so that no thermal expansion of the liquid occurs.
- (2) Switch the pump off.
- (3) Before putting the heat exchanger in long term rest or after operating in a cold district, completely discharge residual from the body and each pipeline or otherwise overhaul it. The plates will be damaged by freezing of residual.

5 OVERHAUL

For overhaul (disassembly) of plate type heat exchanger, follow the procedure given below.

1. Shifting the E-frame

- (1) In the case of heat exchanger with E-frame, remove the end pipe(s) from the E-nozzle.
- (2) Unscrew the tightening bolts and nuts in the sequence below using a ratchet spanner.
 - (a) First unscrew the top and bottom nuts ①②③④ in sequence.
 - (b) Then loosen and unscrew other remaining bolt nuts ⑤⑥⑦⑧⑨⑩ alternately, e.g. in the order of ⑤→⑥→⑧→⑦→⑨→⑩→⑤, similarly to unscrewing and tightening of the flange bolts.
 - (c) After unscrewing of all the tightening bolts and nuts completely, shift the E-frame up to the guide bar support. (For the NJ type, shift it up to the upper guide bar stopper.)

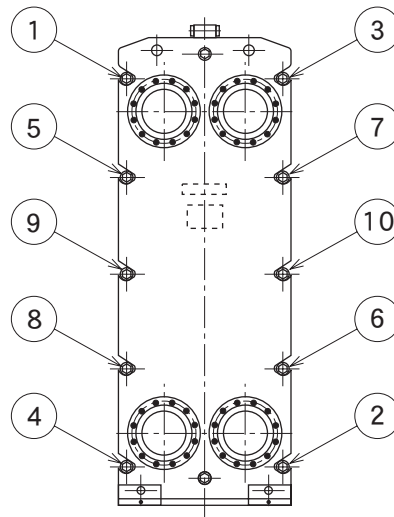


Fig.5.1 Tie Bolt Nuts Unscrewing Sequence

2. Removal of the plates

In the case of heat exchanger with E-nozzle, the plate pack includes the plates with different port hole positions. Hence, the plates must be assembled the specified correct order. For this, it is recommended to number the plates, before removing, to avoid restoring in wrong order. For example, give No.1,2,3...to the plates in the order from the S-frame side. And these Nos. match the Plate No. shown in the Element Composition Diagram and are convenient to check the plate configuration when assembling the plates.

- (1) Separate the plates from each other.

In case of separating the plates is difficult due to sticking, pull the upper corner of plate with fingers. In case of they can not be separated even after that, strongly insert a screwdriver or the like in the clearance between the plate corners/centers to thereby separate the plates. (Be careful not to damage the plates.)

(2) Plate removal from the frame

1. For the UX-01, UX-005 and RX-00 type with no hunger, turn aside the plates, one by one, toward the E-frame and take them out horizontally. (Fig.5.2-(a))
2. For the heat exchanger type with hanger and round upper guide bar, push down the hunger for removal while taking up the plate. Thereafter, remove the plate from the upper guide bar. (Fig.5.2-(b))
3. For the heat exchanger type with hanger and with rail type upper guide bar, remove each plate from the lower guide bar (rail) and, thereafter, turn it outward. (Fig.5.2(c)-(d))

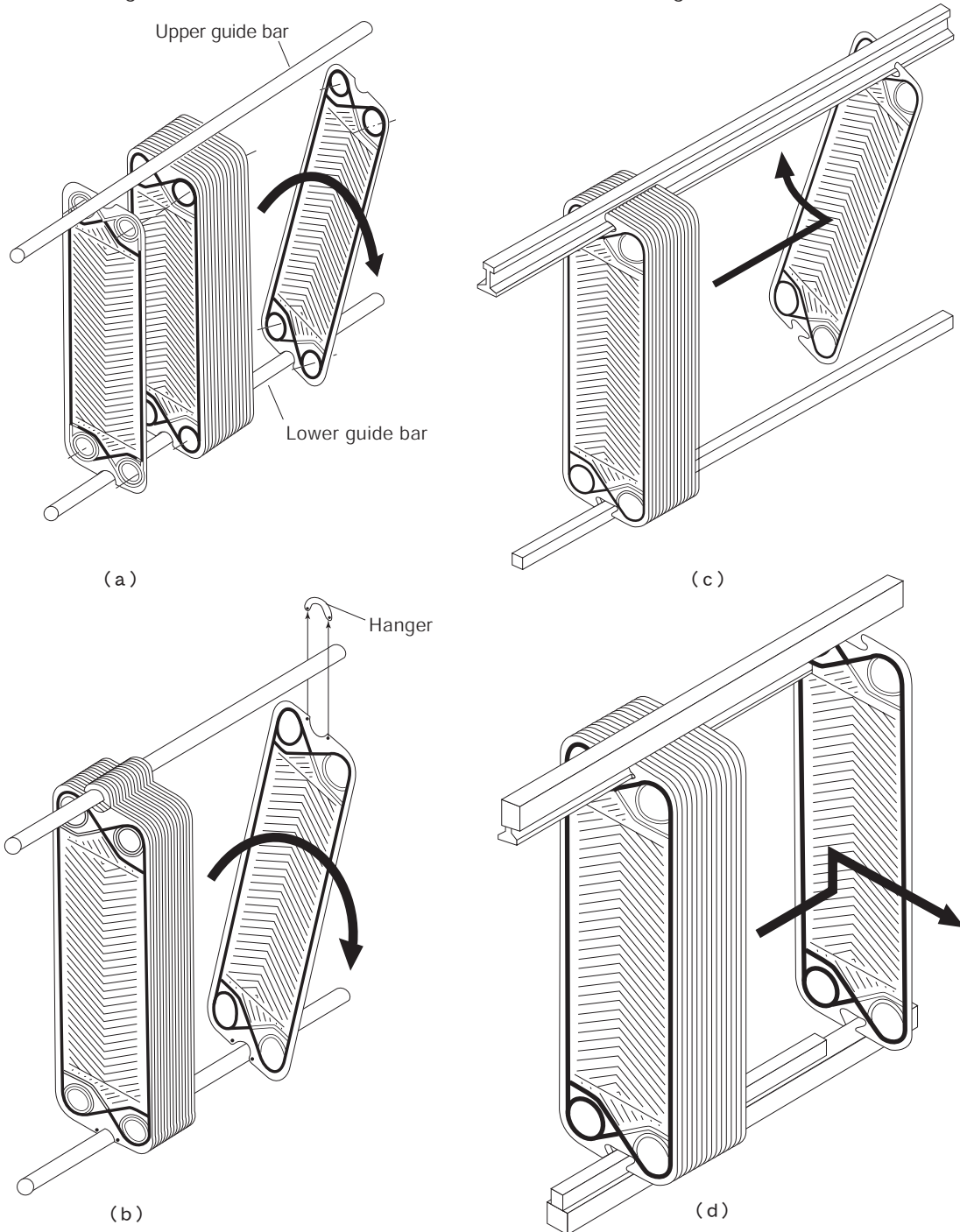


Fig.5.2 How to Remove the Plates

6

MAINTENANCE

It is recommended to perform the maintenance and check as instructed hereunder at the opportunity of overhauling.

1. Plates

Fouling of the plate will cause performance reduction and corrosion of the plate, etc. Therefore, clean the plates adequately for complete removal of such fouling.

(1) Disassembling and cleaning

1. Plate cleaning is available with the plates suspended from the guide bar or after removal of them from the frame.
2. Use a fiber brush, when brushing applied. The use of a metal brush will damage the plate surface, then causing corrosion trouble.
3. During cleaning, be careful not to damage the plate gaskets.
4. After cleaning, rinse the plates by clean water.
5. After finishing of the above cleaning work, dry the plates and the gaskets and, thereafter, wipe the gasket surface and the backside surfaces of its groove by cloth. Solid particle on the gasket surface and backside surface of gasket groove will make gasket damage and leak through damaged gasket.
6. Tighten the tightening bolt nuts in the reverse sequence of the disassembly.

(2) Cleaning in place

1. Discharge the fluid from the heat exchanger.
2. Feed hot water at flow rate higher than usual. Continue this water feed until this water contains fluid no longer.
3. Feed the detergent (e.g. acid, alkali) into the heat exchanger for cleaning in place.
4. Flush the heat exchanger by clean water fully.

(3) Jet cleaning

1. When cleaning the plates by water jet, apply the jet pressures per Table 6.1.

Table.6.1 Allowable pressure of water jet

Plate thickness mm	Plate material	Max pressure of water jet MPa
0.5	Titanium	3
0.6	Titanium	5
0.8	Titanium	10
1.0	Titanium	15
0.5	Stainless steel	5
0.6	Stainless steel	8
0.8	Stainless steel	15
1.0	Stainless steel	20

2. Cleaning the plates with gasket by water jet will eventually damage the gaskets. Therefore, remove the gaskets before jet cleaning.
3. Cleaning distance
Jet spray distance keep the spray gun to plate distance at 200mm or more.
4. Plate setting
Place the plate in vertical position and protect its backside by a board with smooth surface like vernier board and high compressive strength, as illustrated in Fig.6.1

(Note) Cleaning the plate in direct contact with floor will result in damage of the plate seal surface.

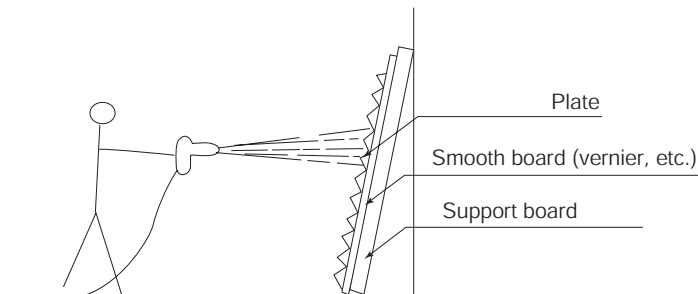


Fig.6.1 Plate Setting

After cleaning;

- check plate deformation
- check plate surface for metallic glossiness. In case of glossless and rough surface, general corrosion must be checked.
- check plate to plate contact points and crevice between gasket and plate for localized corrosion.

If deformation and corrosion are found, replace the plate with new one.

2. Gaskets

- Check gaskets as permanent set, crack, swelling, carbonizing, sticking, sponging, etc.
- Replace deteriorated or abnormal gasket with new gasket.

3. Frames

Repair the surface, in case of a paint peeling off.

Apply proper coat of grease to the threaded zone of each tightebing bolt for rust prevention.

4. Replacement of plate gaskets

Replacement of gaskets (For replacement of PTFE cushion gasket and slit-in gasket, refer to the individual instruction manual.)

(1) Removal of the gasket from plate

Insert a screw driver or the like between the gasket and the groove. Separate this portion to such an extent that fingers can be inserted by levering, and peel off the gasket from the plate by fingers.

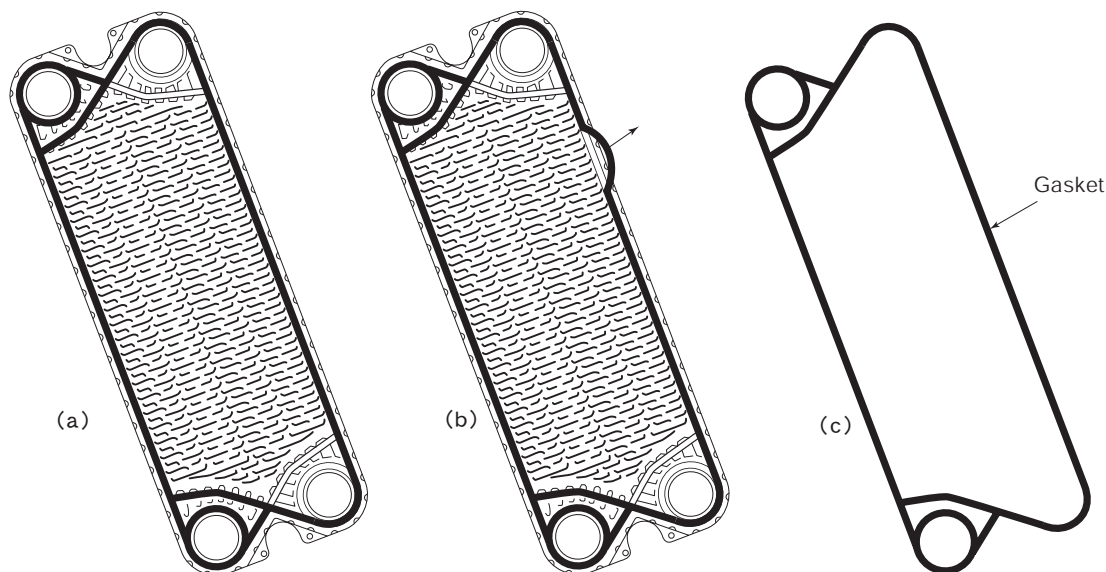


Fig.6.2 Removal of Gaskets

(2) Cleaning the gasket groove of the plate.

Wipe off residual adhesive from the gasket groove using proper solvent (e.g. methyl ethyl ketone) and, thereafter, clean the groove adequately for complete removal of dust, oil, etc.

(3) Preparation of new gaskets

Prepare new gaskets and check that they are free from adhesion of dust, oil, etc. Such materials on the gasket will result in damage of gasket and leak through a damaged portion. If such materials is found, lightly wipe off the gasket with a solvent-wetted cloth.

(4) Apply specific adhesive to the gasket.

The following adhesives are available for the use. Select the optimal one according to gasket material used. Because the adhesives S-1 and F-2 contain organic solvents, do not use them in ill-ventilated locations.

Table 6.2 Types of Adhesive

Type of Adhesive		Gasket material applied
Adhesive	S-1	General materials such as NBR, EPDM, etc.
	F-2	For food application
	Silicone adhesive	Exclusive for silicone gasket
Double-side tape		For PTFE cushion gasket, etc.

These are hardened at room temperature. Use only adhesives specified by manufacturer. Use of any adhesive not specified may cause plate corrosion.

1. Application of adhesive

Apply uniform layer of adhesive to the bottom of the gasket groove.

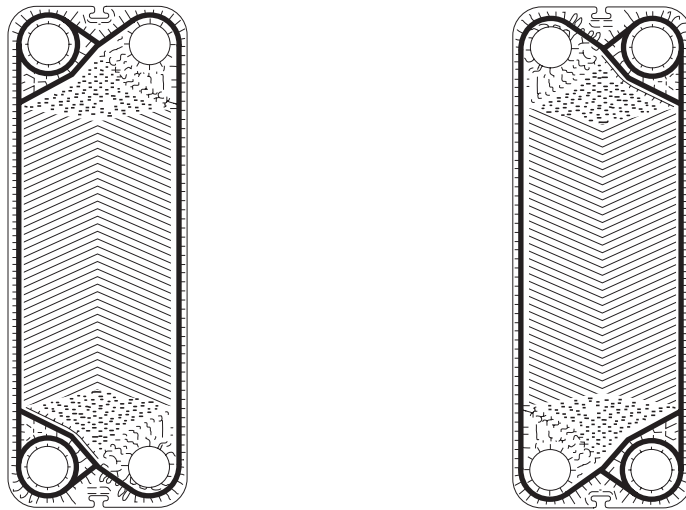
Coat to such an extent that adhesive does not protrude beyond the gasket when it is fitted in the groove. And place it as is for 3 to 5 minutes.

2. Application of double-side tape

Glue double-side tape on the straight area of the groove in the plate, in length as long as possible.

Apply the same tape to the corners so that tape to tape seam laps in width of 3mm or less.

(*) The gasket groove of the plate is the concaved shape along the rim of the front surface of the plate. Refer to Fig.8.7 on Page 30.



A-plate

B-plate

Fig.6.3 Application of Adhesive and Gluing Area (Black thick line)

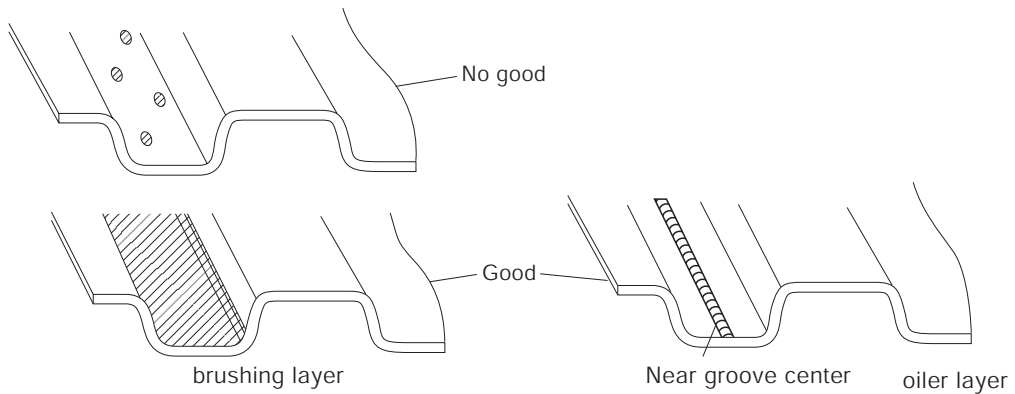


Fig.6.4 Application of Adhesive

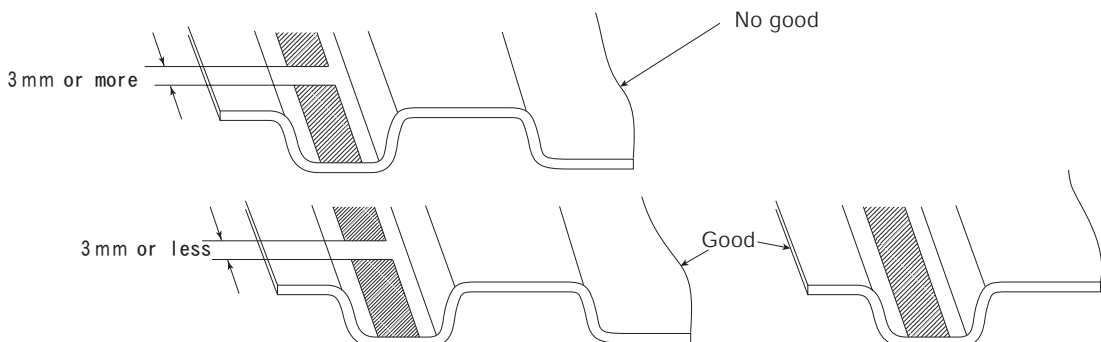


Fig.6.5 Application of Double Side Tape

(5) Setting gasket

Carefully set a gasket in the gasket groove of the plate. The seal surface of gasket should be upped. The gasket is provided on its surface with notch (recess) for double sealing. (Fig.6.6). Exactly glue the gasket while pressing it down lightly and equally by the hands.

After laying, check that the gasket is free from overriding, blister, etc.

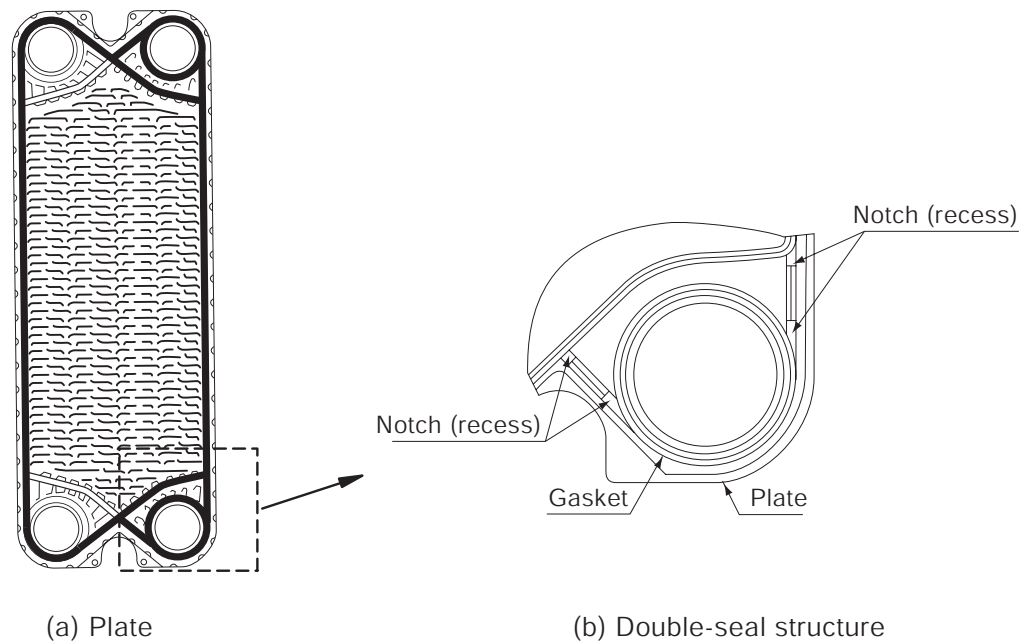


Fig.6.6 Double Seal Structure of Gasket

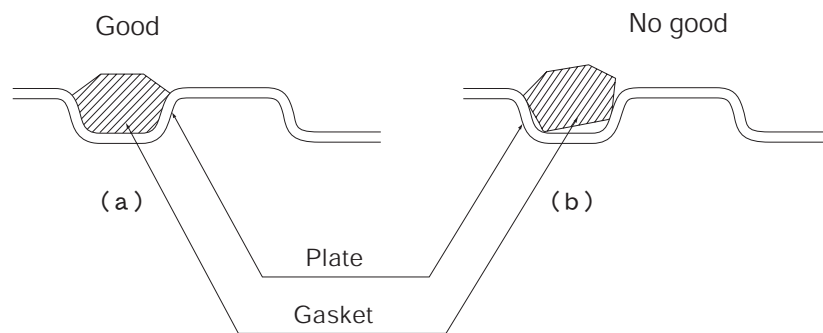


Fig.6.7 Gasket Setting

(6) Pressing

After laying the gasket correctly in the groove, stack the plated on a surface table and put a flat board, which is a little larger than the plate, on the top of the stacked plates. Thereafter, put a weight (about 5kg) on the board for pressing down. Longer press-down time is better. It is recommended to keep the stacked plates pressed down for, at least, 15minutes or more than 10hours if possible.

For pressing limit to Max. 50 plates is recommended because of preventing to slip down of the plates.

After pressing down, remove excessive adhesive from the gasket using a proper solvent and, thereafter, wipe of adhesive layer with a dry clean cloth.

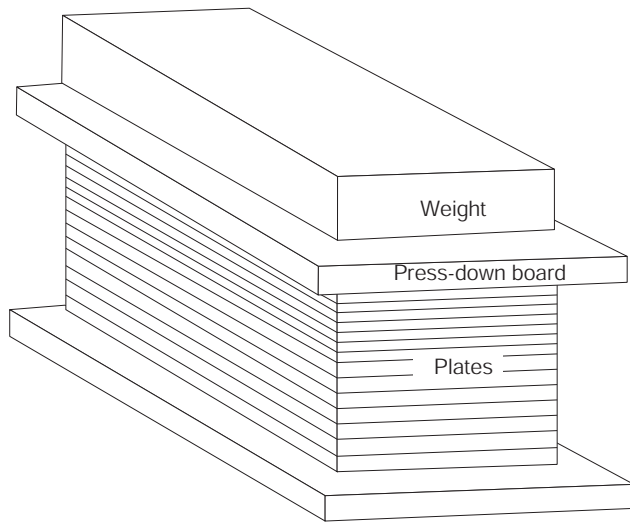


Fig.6.8 Gasket Press-down

5. Replacement of D-plate gasket

D-plate gasket is intended to seal D-plate (No.1 plate) and S-frame. The way of gasket replacement is identical to the way of other plate gaskets replacement, but note that D-plate has two types of gaskets A and B as below.

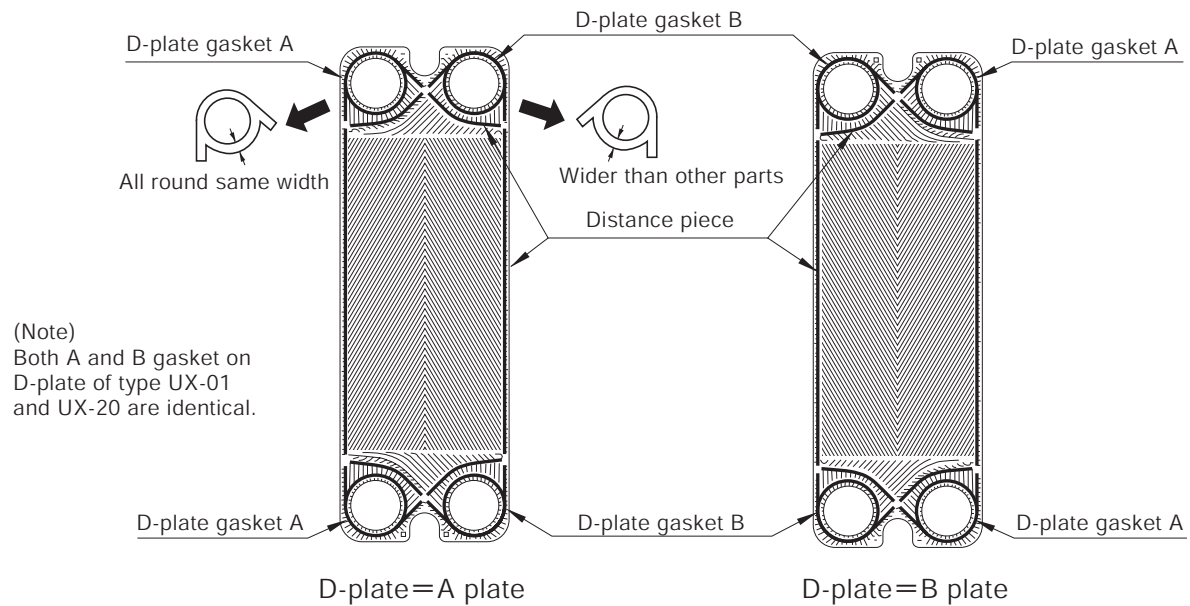


Fig.6.9 UX and SX Series

Please contact us in case of uncertainty, because there are special D-plate gaskets in other models.

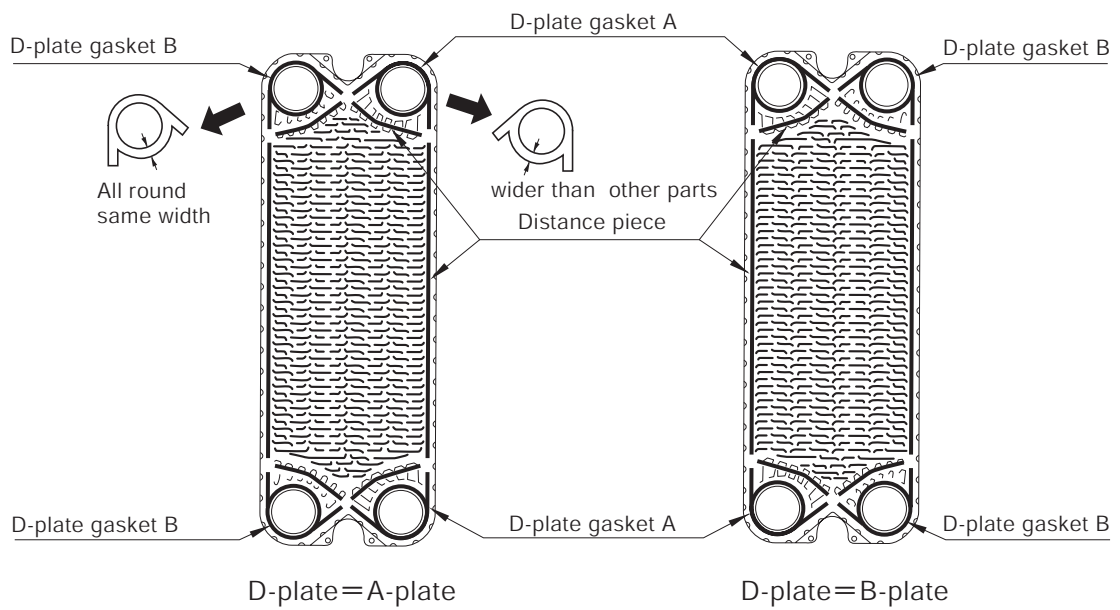


Fig.6.10 EX Series

6. Replacement of E-nozzle gasket (In case of the models with E-nozzle)

E-nozzle gasket is fitted in the nozzle groove of the E-frame. It is not glued.

Remove and replace the deteriorated gasket with new one.

When setting E-nozzle gasket as example 1, ensure top and bottom of the E-nozzle gasket as Fig.6-12.

Example.2 shows identical shape for top and bottom.

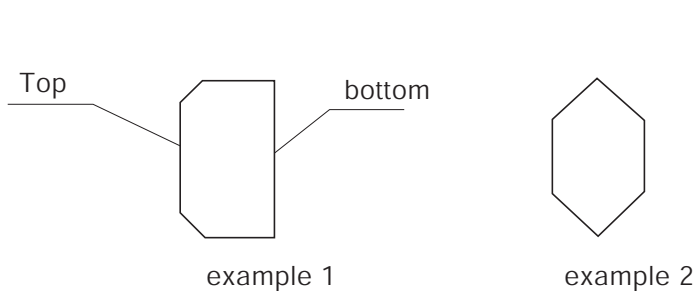


Fig.6.11 Cross sectional. drawing of E-nozzle gasket

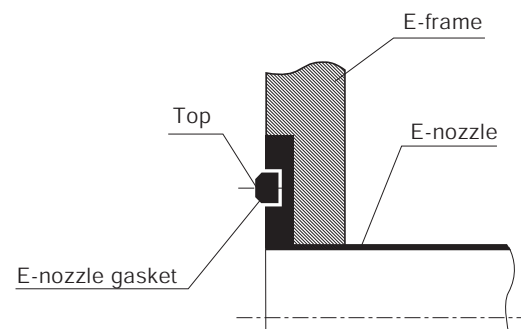


Fig.6.12 E-nozzle gasket

(Note) Please contact us in case of uncertainty, because sealing may be performed without using E-nozzle gaskets in some cases.

7 ASSEMBLY

1. Suspend the plates from the guide bar. The gasket side should be faced to the S-Frame.
2. Assemble the plates in the order of D-plate, middle plates and E-plate from the S-frame side, as indicated in the drawing of plate arrangement.
3. Where the E-frame has nozzles, ensure that the E-nozzle gasket is not dislocated from the E-frame.
4. After assembling, check that the plates are properly assembled up as indicated in the drawing of plate arrangement and each gasket is free from adhesion of solid matter.
(Incorrect arrangement of the plates will cause fluid leakage, less performance of the heat transfer and flow trouble.)
5. Move the plates and E-frame toward the S-frame. At the same time, check that each plate is not deviated from its correct position in both vertical and horizontal directions. Tighten the tightening bolts and nuts by a ratchet spanner in the sequence given below so that S- and E-frames keep as parallel as possible.
 - (1) Tighten the middle bolt nuts ⑨⑩ alternately. (Fig.7.1).
 - (2) When it becomes hard to tighten them, tighten other middle bolt nuts ⑤⑥⑦⑧ alternately, including the top and bottom bolt nuts ①②③④.
(Limit to max. 10mm per tightening stroke to prevent bolt hunting.)
 - (3) Measure the clamped frame to frame distance at each tightening point and, if necessary, adjust the nut tightening so that the correct tightening length is achieved at all the tightening points.

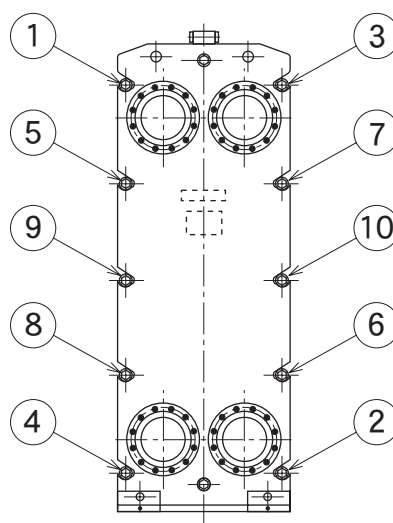


Fig.7.1 Tightening sequence

1. Plates

The plates for Hisaka Plate Type Heat Exchangers are divided into the herring bone pattern plates for UX, LX, SX, and GX series and the corrugated pattern plates for EX Series by the pattern of heat transfer plate. These plates are further classified into heat transfer plate, D-plate and E-plate both in contact with the frames.

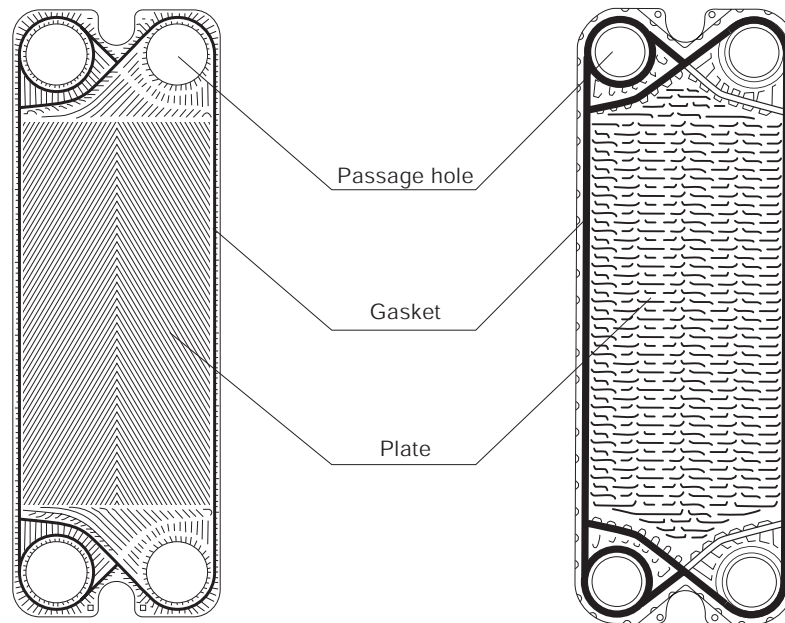


Fig.8.1 Herringbone Pattern Plate

Fig.8.2 Corrugated Pattern Plate

2. Component for plate

The plate consists of two components, which is gasket to seal fluid and hanger to suspend the plate from the guide bar. But some plate types have no hanger. Further, the D-plate consist of D-plate gasket and distance piece. The frame with E-nozzle requires E-nozzle gasket.

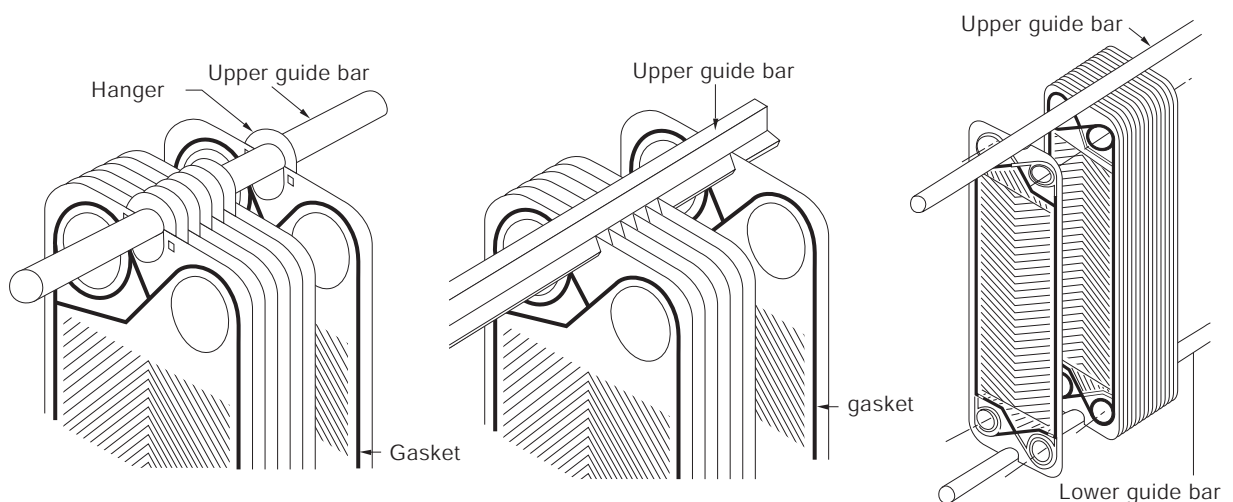


Fig.8.3 Plate with Hanger

Fig.8.4 Plate without Hanger (1)

Fig.8.5 Plate without Hanger (2)

3. Identification of A-plate and B-plate

refer to following features of A-plate and B-plate for identification.

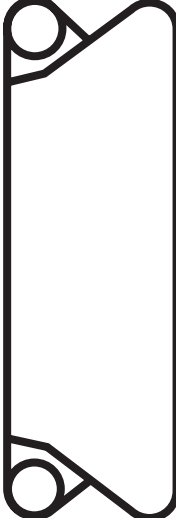
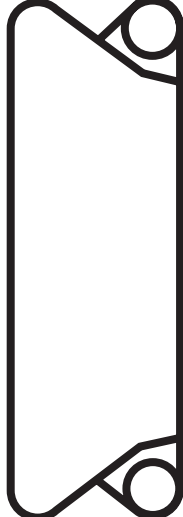
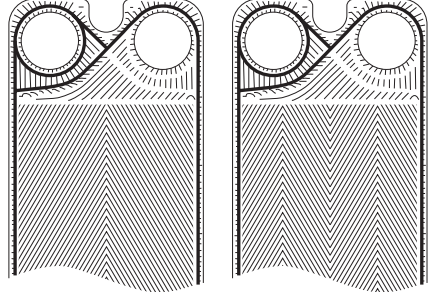
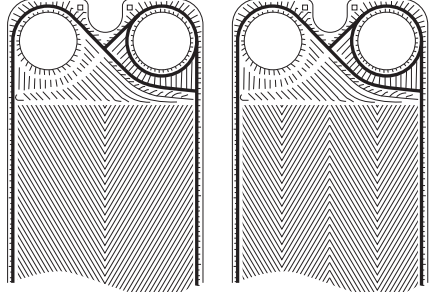
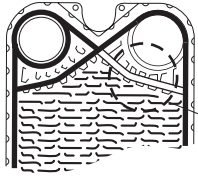
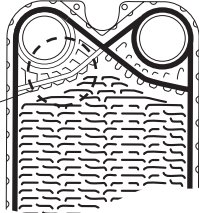
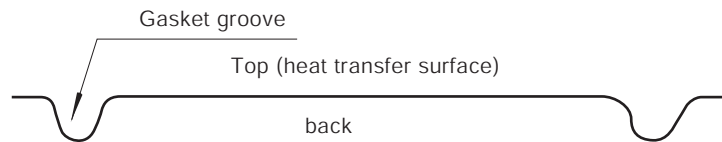
	A-plate	B-plate
Gasket orientation		
Heat transfer surface of herringbone pattern plate (Sketch from gasketed side)		
Heat transfer surface of corrugated pattern plate (Sketch from gasketed side)		
	Combed pattern on right side	Combed pattern on left side

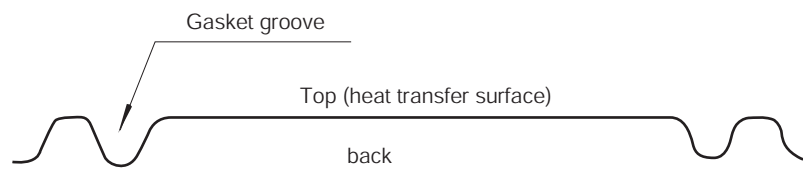
Fig.8.6 Identification of A-plate and B-plate

Identify A-plate and B-plate by Fig.8.6. The easiest way is to see the gasket orientation. But in case of identifying the plates without gasket, follow as below.

(1) Place the plate with its top upside by finding the stamp of its lot number.



Herringbone and New corrugate (FX). Lot number is stamped on backside (except for UX-005)



Corrugate...Lot number is stamped on top

Fig.8.7

(2) Herringbone pattern plates

They can be identified by the pattern of heat transfer surface. (Fig.8.6)

(3) Corrugated pattern plates

A-plate or B-plate can be discriminated by seeing whether the combed pattern near the port hole is located on right side or left side.

Furthermore, A-plate can be used as B-plate by turning it upside down and B-plate be used as A-plate by turning it upside down. However, don't interchange A-plate and B-plate in the GX-23 Type by turning them upside down.

4. Channel arrangement

Channel arrangement of Hisaka Plate Type Heat Exchangers is as follows.

Fluid flowing over the A-plate surface always flows over the same plate surface, while fluid flowing over the B-plate always flows over the correct plate surface. Hence, fluid flowing through the right side channel of each plate always flows through the right side holes (including the inlet and outlet nozzles), while fluid flowing through the left side hole flows through the left side holes only.

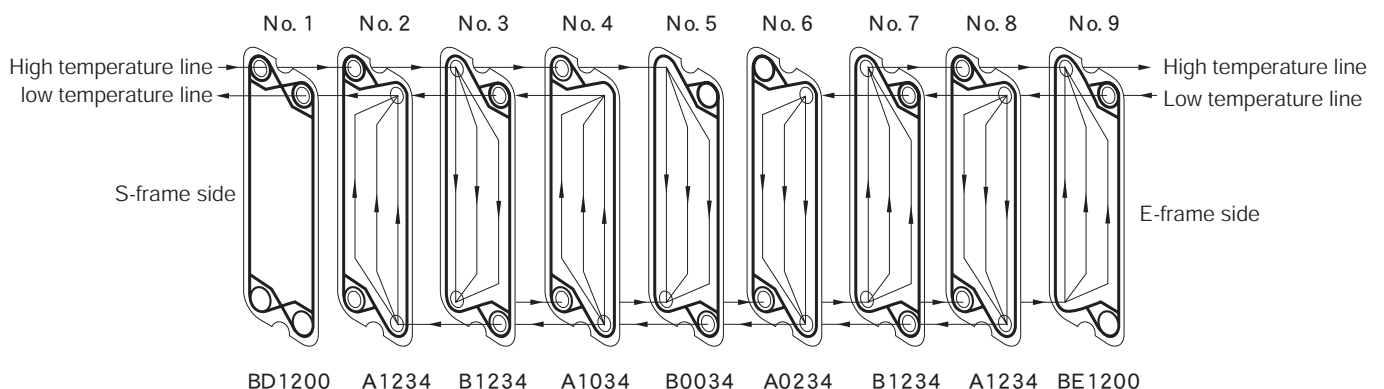


Fig.8.8 Example of flow pattern in plate channel

Both fluids never mix together even in the case of fluid leak, due to such a structure wherein each fluid flows through different gaskets on each plate surface. An example of fluid flow pattern is shown in Fig.8.8. Wherein high temperature flows in from the S-frame inlet and outflows to the E-frame outlet. When flowing through the plate channel from the left upper port holes of No.3 and No.5 plates, the fluid is branched into two parallel flows and it is repeated twice. On the other hand, low temperature flows in through the right upper port hole of No.9 plate and further flows into No.8 and No.6, diverted into two parallel flows and it is repeated twice respectively.

Such a flow pattern is called two-parallel x two-stage flow, which is expressed in “2parallel x 2 stages” or “2 parallel x 2 passes” .

5. Drawing of Plate Arrangement

The Drawing of Plate Arrangement shows the plate arrangement. For example, Fig.8.8 can be shown as Fig.8.9. (Please refer to individual instruction manual for YX, GX and WX type.)

- (1) Plates are shown by vertical line within the rectangular area in Fig.8.9, wherein the gasketed surface of plate is always in face to the S-frame side.
- (2) The “designation of plate hole” is entered to the “hole designation column” which is formed by extension of a vertical line indicating the adjacent plate.
- (3) The description of A-plate is entered to the lower area from the center line, while that of B-plate is entered to the upper area from the center line.
- (4) The plate hole locates at an intersecting point of a vertical line indicating the plate and a line indicating the channel. And fluid flowing over the B-plate surface always flows through the left side hole of the plate (upper side from the center line in Fig.8.9), while fluid flowing over the A-plate surface always flows through the right side hole of the plate (lower side from the center line in Fig.8.9).
- (5) The each hole position of A and B plates are shown by 1, 2, 3, 4 in the order of “left upper”, “right upper”, “left lower” and “right lower” viewed from gasketed side. And “no hole” is shown by 0.

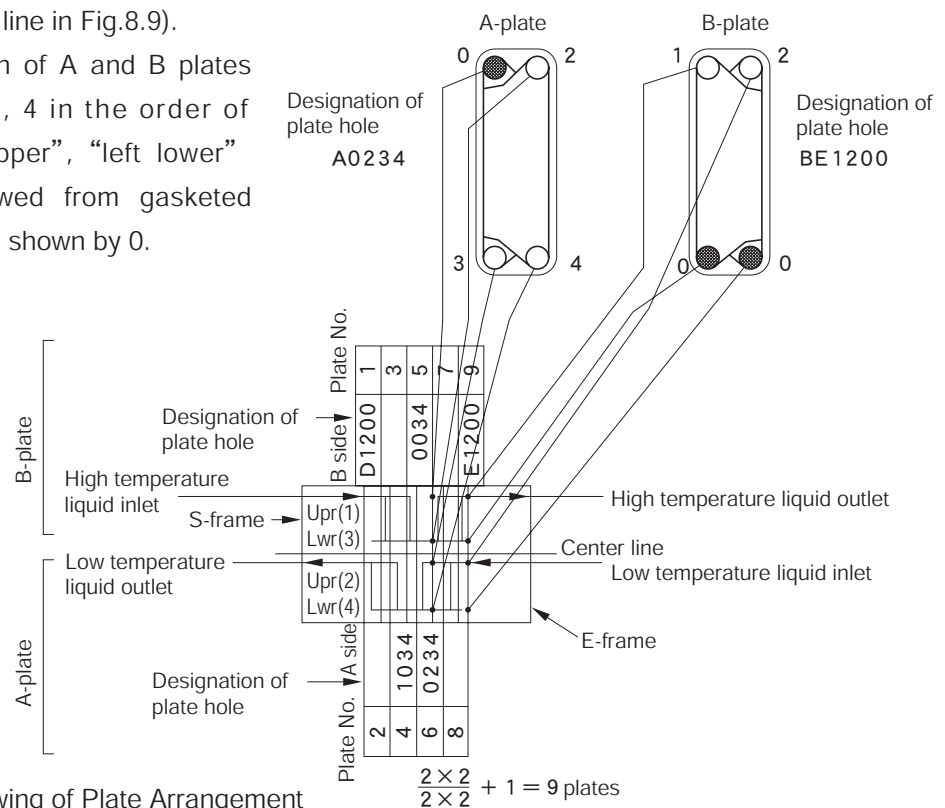


Fig.8.9 Drawing of Plate Arrangement

- (6) Plate hole position is determined for an optional passage plan by defining the holes as stated above. And the designation of hole 1, 2, 3, and 4 is defined. However, in case of the plate with 4 holes (i.e.1.2.3.4), designation of plate hole is omitted and shown as blank.
- (7) Plates (No.1, No.9 in Fig.8.8) adjacent to the S-frame and E-frame are slightly different from other plates, their designation of plate hole is shown as adding D an E symbols thereto.

Table 8.1 and Fig.8.10 show plate interchangeability relationships (A-plate=B-plate).

Table 8.1 Identical plate table

<u>A-plate</u>	<u>B-plate</u>	<u>A-plate</u>	<u>B-plate</u>
1 2 3 4	1 2 3 4	1 0 0 4	1 0 0 4
1 2 3 0	0 2 3 4	1 0 3 0	0 2 0 4
1 2 0 4	1 0 3 4	0 2 0 4	1 0 3 0
1 0 3 4	1 2 0 4	1 0 0 0	0 0 0 4
0 2 3 4	1 2 3 0	0 2 0 0	0 0 3 0
1 2 0 0	0 0 3 4	0 0 3 0	0 2 0 0
0 0 3 4	1 2 0 0	0 0 0 4	1 0 0 0
0 2 3 0	0 2 3 0	0 0 0 0	0 0 0 0

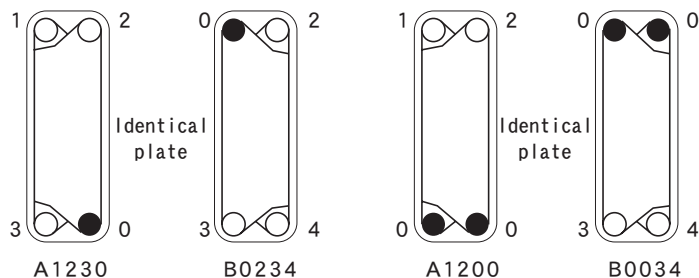


Fig.8.10 Example of A and B...identical plates ● showing "No hole" .

(EX.) In Table 8.1

A1230 is identical to B0234: A1230 becomes B0234 by turning its upside down.

A1200 is identical to B0034: A1200 becomes B0034 by turning its upside down.

In case of wrong plate arrangement in Mixed, it might be less heat transfer performance and exceeding pressure drop for the duty. When assembling the plates after maintenance, ensure the drawing of plate arrangement.

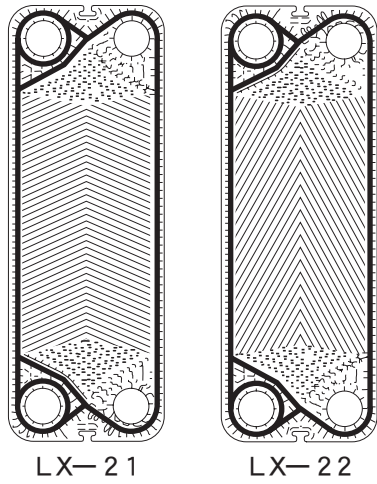


Fig.8.11 Example of different herringbone angle

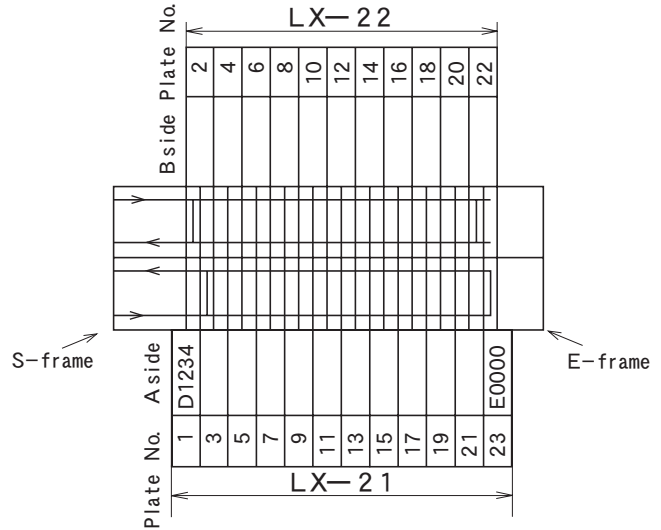


Fig.8.12 Mixed arrangement

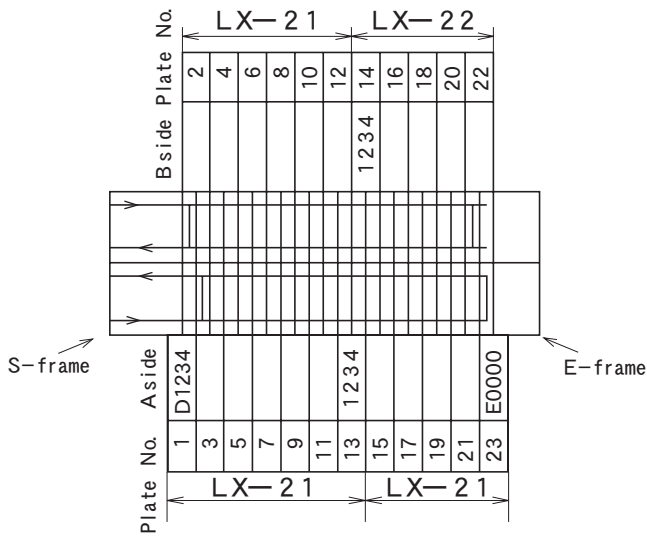


Fig.8.13 1 series and mixed arrangement

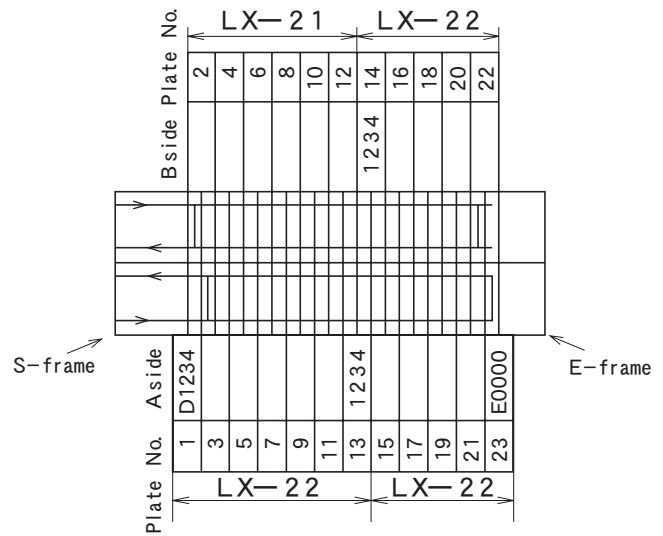


Fig.8.14 Mixed and 1 series arrangement

Fig.8.2 Mixed name and plate arrangement

Mixed name	Plate arrangement	Mixed name	Plate arrangement	Mixed name	Plate arrangement
UX-19	UX-11, UX-12	LX-09	LX-01, LX-02	SX-47	SX-41, SX-44
UX-29	UX-21, UX-22	LX-19	LX-11, LX-12	SX-48	SX-43, SX-41
UX-39	UX-31, UX-32	LX-29	LX-21, LX-22	SX-49	SX-43, SX-45
UX-49	UX-41, UX-42	LX-49	LX-41, LX-42	SX-77	SX-71, SX-74
UX-69	UX-61, UX-62	LX-59	LX-51, LX-52	SX-99	SX-91, SX-92
UX-89	UX-81, UX-82	RX-09	RX-01, RX-02	SX-98	SX-94, SX-92
UX-88	UX-83, UX-84	RX-18	RX-13, RX-14	SX-97	SX-93, SX-94
UX-99	UX-91, UX-92	RX-19	RX-11, RX-12	SX-96	SX-91, SX-93
UX-107	UX-103, UX-104	RX-39	RX-31, RX-32		
UX-108	UX-104, UX-102	RX-79	RX-71, RX-72		
UX-137	UX-133, UX-134				

9

TROUBLE SHOOTING

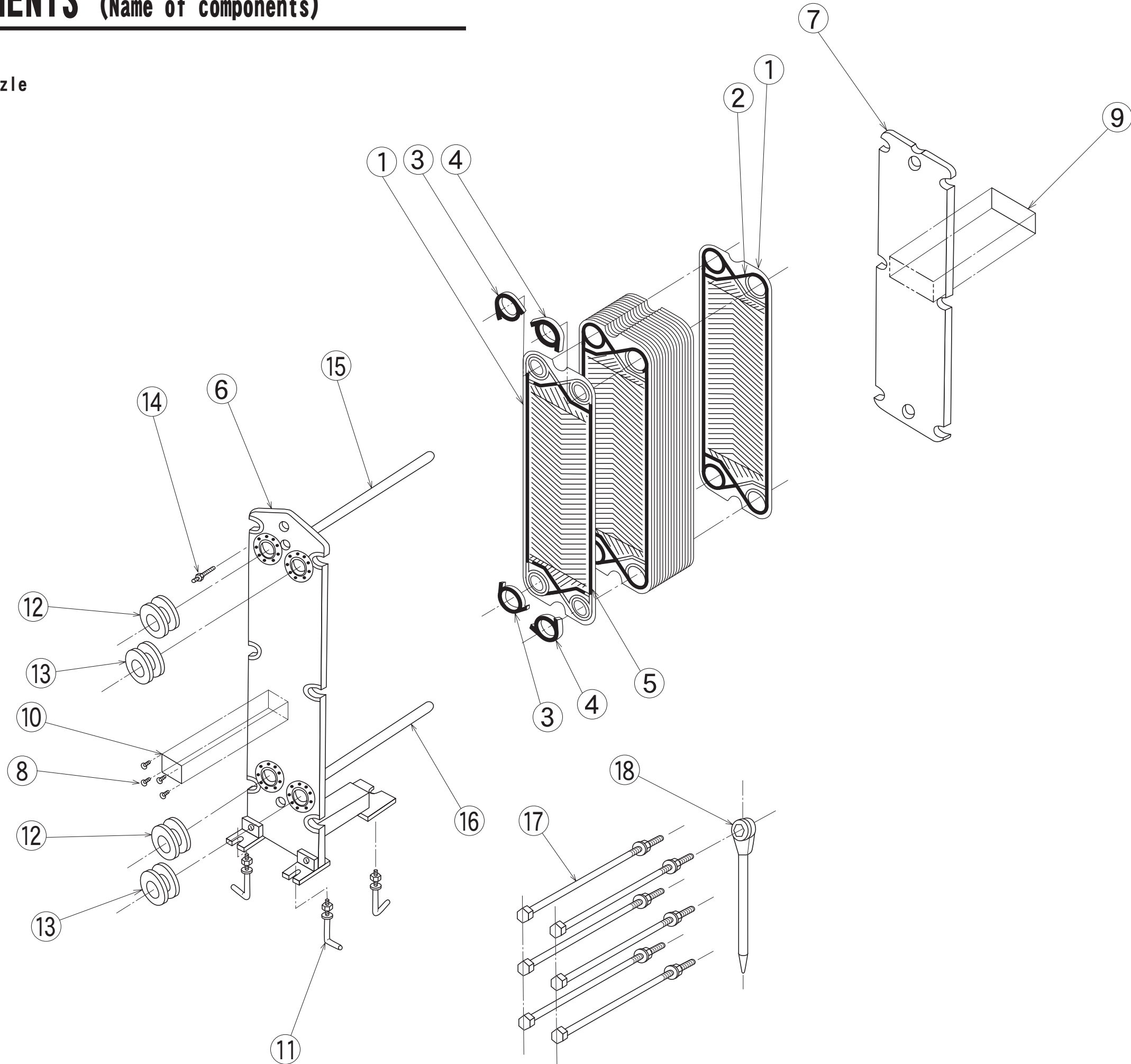
Fault detection	Possible causes	Actions	Pages to be referred
Less heat transfer performance	Fouling on heat transfer surface	Clean the plates for removal of scales.	2 0
Less flow performance	Blockage of port hole and fouling on heat transfer surface		2 1
Leakage from between the plates	(1) Inadequate tightening	Tighten the plates (But avoid over-tightening, in excess to minimum tightening length).	2 7
	(2) Damaged and deteriorated gasket.	Replace the damaged gasket	2 1~2 6
	(3) The gasket groove or double seal of plate is corroded into pinholes.	Replace the corroded plate	1 8~2 7
	(4) The plates are not arranged in the order of A,B,A,B,... The plate are assembled in with it upside down.	Rearrange the wrong plates in the correct order. In this case, check each plate with gasket for damage. (It is correct if the projections of the plates are at opposite side alternately, viewed from the side)	2 2 2 5~3 3
	(5) Solid particle in the gasket seal surface.	Wipe off the seal surface with a clean cloth.	2 0
	(6) Gasket overriding	Glue gasket.	2 4
Leakage between plate and S-frame	(1) Damaged D-plate gasket	Replace it.	2 1 2 5 · 2 6
	(2) Damaged rubber boot	Replace it.	9 3 6~3 8
	(3) Damaged D-plate	Replace it.	2 1 2 5 · 2 6
	(4) Damaged S-nozzle mount	In the case of metal boot, replace the S-frame in complete set.	9 3 6~3 8

Fault detection	Possible causes	Actions	Pages to be referred																																																																															
Leakage between plates and E-frame	(1) Damaged E-nozzle gasket	Replace it.	21 26																																																																															
	(2) Damaged rubber boot	Replace it.	9 36~38																																																																															
	(3) Damaged E-plate	Replace it.	21~24																																																																															
	(4) Damaged E-nozzle mount	In the case of metal boot, replace the E-frame in complete set.	9 36~38																																																																															
Mixing of two liquids	The heat transfer plates are penetrated through due to corrosion or damage.	Replace the damaged plate (s). When no spare plate is in stock and the damage plate has four holes, as a temporary countermeasure, remove the damaged plate and adjacent plate with 4 holes (1,2,3,4 holes). two plates in set. In this case, the heat exchanger should be reassembled and put back to new tightening length reduced by the length as shown below table. (Removal of only damaged plate disables.) Correct plate arrangement.	21 27~33 35																																																																															
				<table border="1"> <thead> <tr> <th data-bbox="419 1261 663 1328">Type</th> <th data-bbox="663 1261 799 1328">Equivalent length to two removed plates</th> <th data-bbox="863 1261 1107 1328">Type</th> <th data-bbox="1107 1261 1315 1328">Equivalent length to two removed plates</th> </tr> </thead> <tbody> <tr><td>EX-11</td><td>10mm</td><td>RX-00</td><td>7mm</td></tr> <tr><td>EX-15</td><td>10mm</td><td>RX-10</td><td>7mm</td></tr> <tr><td>EX-16</td><td>10mm</td><td>RX-30</td><td>7mm</td></tr> <tr><td>UX-005</td><td>5mm</td><td>RX-70</td><td>9mm</td></tr> <tr><td>UX-01</td><td>6mm</td><td>SX-40</td><td>6mm</td></tr> <tr><td>UX-10</td><td>6mm</td><td>SX-70</td><td>6mm</td></tr> <tr><td>UX-20</td><td>7mm</td><td>SX-90</td><td>8mm</td></tr> <tr><td>UX-30</td><td>6mm</td><td>SX-90M</td><td>8mm</td></tr> <tr><td>UX-40</td><td>8mm</td><td>SX-90L</td><td>8mm</td></tr> <tr><td>UX-60</td><td>11mm</td><td>FX-01</td><td>8mm</td></tr> <tr><td>UX-80</td><td>10mm</td><td>FX-03</td><td>8mm</td></tr> <tr><td>UX-90</td><td>10mm</td><td>FX-05</td><td>9mm</td></tr> <tr><td>UX-100/130</td><td>10mm</td><td>YX-80</td><td>12mm</td></tr> <tr><td>LX-00</td><td>8mm</td><td>GX-20</td><td>22mm</td></tr> <tr><td>LX-10</td><td>9mm</td><td>WX-50(per cassette)</td><td>8mm</td></tr> <tr><td>LX-20</td><td>11mm</td><td>WX-90(per cassette)</td><td>10mm</td></tr> <tr><td>LX-30</td><td>10mm</td><td></td><td></td></tr> <tr><td>LX-40</td><td>12mm</td><td></td><td></td></tr> <tr><td>LX-50</td><td>10mm</td><td></td><td></td></tr> </tbody> </table>	Type	Equivalent length to two removed plates	Type	Equivalent length to two removed plates	EX-11	10mm	RX-00	7mm	EX-15	10mm	RX-10	7mm	EX-16	10mm	RX-30	7mm	UX-005	5mm	RX-70	9mm	UX-01	6mm	SX-40	6mm	UX-10	6mm	SX-70	6mm	UX-20	7mm	SX-90	8mm	UX-30	6mm	SX-90M	8mm	UX-40	8mm	SX-90L	8mm	UX-60	11mm	FX-01	8mm	UX-80	10mm	FX-03	8mm	UX-90	10mm	FX-05	9mm	UX-100/130	10mm	YX-80	12mm	LX-00	8mm	GX-20	22mm	LX-10	9mm	WX-50(per cassette)	8mm	LX-20	11mm	WX-90(per cassette)	10mm	LX-30	10mm			LX-40	12mm			LX-50	10mm
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10 MAIN COMPONENTS (Name of components)

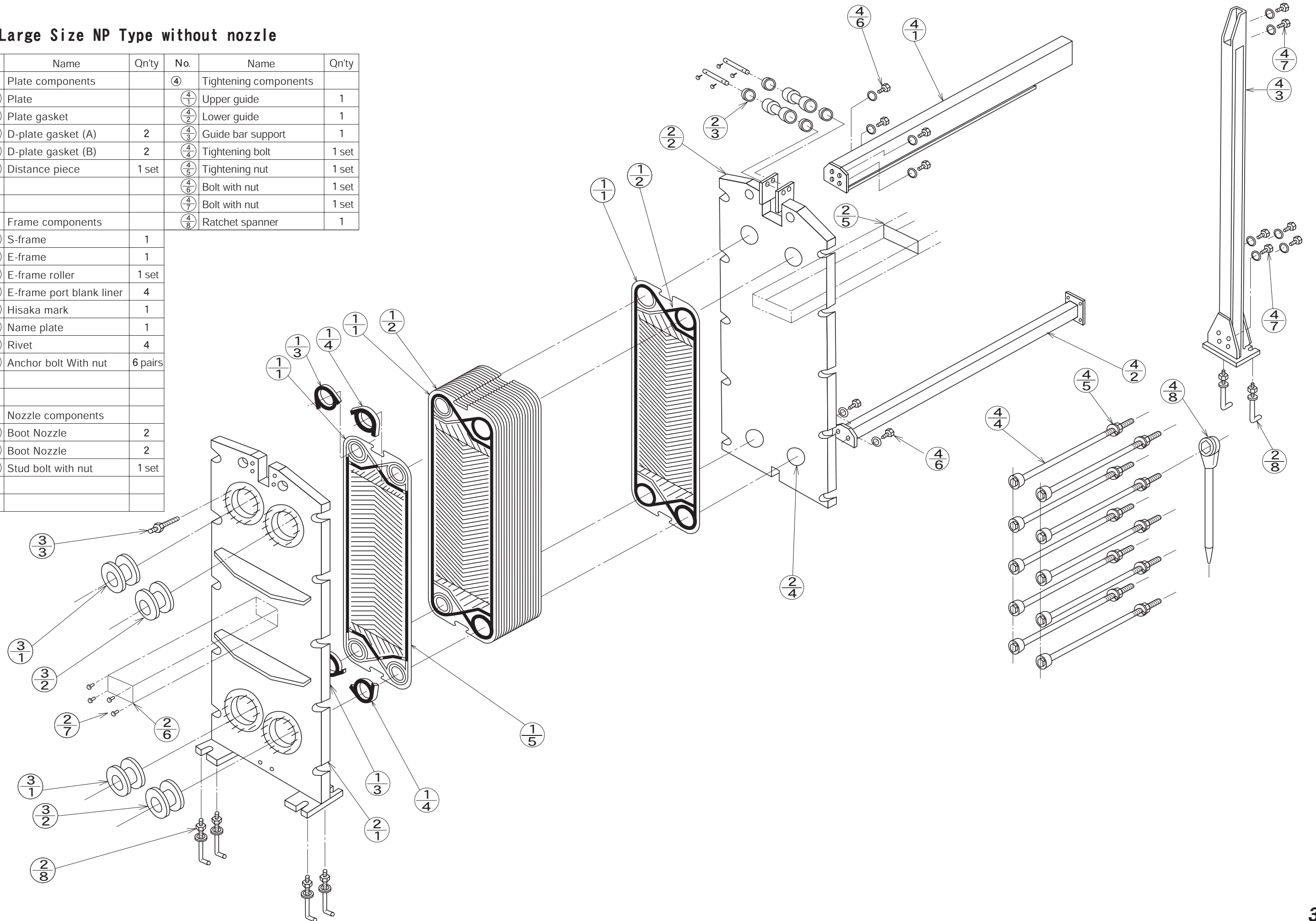
1. NJ Type without nozzle

Part No.	Part name	Qn'ty
①	Plate	
②	Plate gasket	
③	D-plate gasket (B)	2
④	D-plate gasket (A)	2
⑤	Distance piece	1 set
⑥	S-frame	1
⑦	E-frame	1
⑧	Rivet	4
⑨	Hisaka Mark	1
⑩	Name plate	1
⑪	Anchor bolt with nut	3 pairs
⑫	Boot Nozzle	2
⑬	Boot Nozzle	2
⑭	Stud bolt with nut	1 set
⑮	Upper guide bar	1
⑯	Lower guide bar	1
⑰	Tightening bolt with nut	1 set
⑱	Ratchet spanner	1



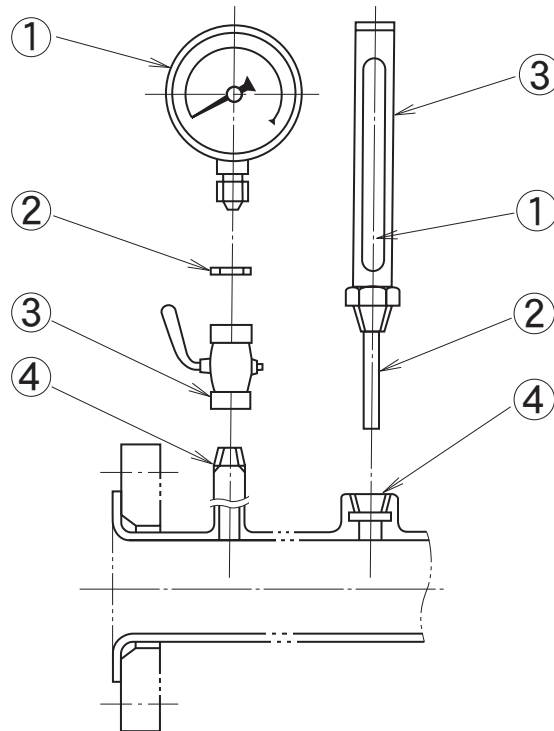
3. Large Size NP Type without nozzle

No.	Name	Qn'ty	No.	Name	Qn'ty
①	Plate components		④	Tightening components	
①/1	Plate		④/1	Upper guide	1
①/2	Plate gasket		④/2	Lower guide	1
①/3	D-plate gasket (A)	2	④/3	Guide bar support	1
①/4	D-plate gasket (B)	2	④/4	Tightening bolt	1 set
①/5	Distance piece	1 set	④/5	Tightening nut	1 set
			④/6	Bolt with nut	1 set
			④/7	Bolt with nut	1 set
			④/8	Ratchet spanner	1
②	Frame components				
②/1	S-frame	1			
②/2	E-frame	1			
②/3	E-frame roller	1 set			
②/4	E-frame port blank liner	4			
②/5	Hisaka mark	1			
②/6	Name plate	1			
②/7	Rivet	4			
②/8	Anchor bolt With nut	6 pairs			
③	Nozzle components				
③/1	Boot Nozzle	2			
③/2	Boot Nozzle	2			
③/3	Stud bolt with nut	1 set			



11

THERMOMETERS, PRESSURE GAUGES (Options)



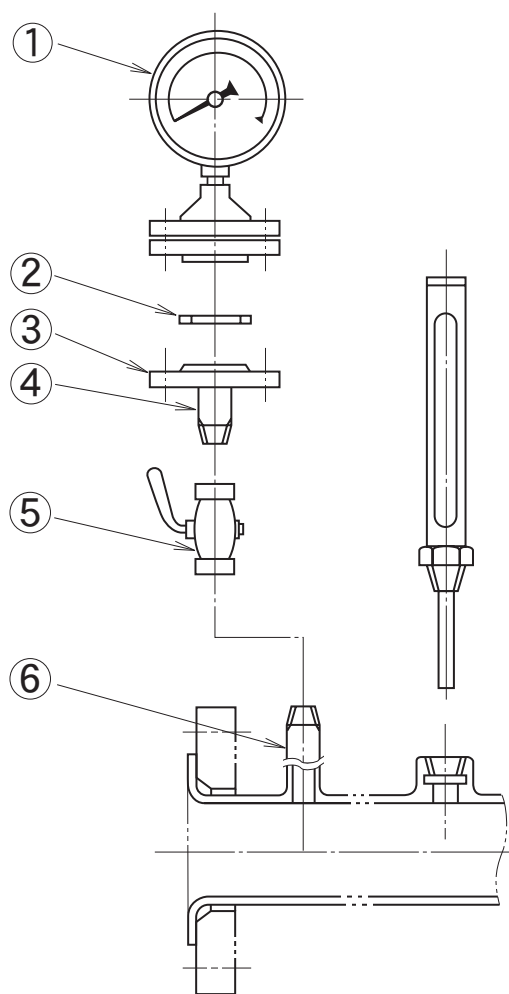
1. Thermometer for standard option

Part. No	Part name	Qn'ty for 1 set	Material	Dimension, remarks
1	Thermometer	1	Alcohol-filled glass	* ~ * °C Length depends on diameter.
2	Well for thermometer	1	*	Connection size PT3/8 outside thread. Length depends on diameter.
3	Case for thermometer	1	* SUS304	φ 22 dia. × 185 L
4	Socket	1	*	Connection size PT3/8 inside thread

2. Pressure gauge for standard option

Part. No	Part name	Qn'ty for 1 set	Material	Dimension, remarks
1	Buordon tube type pressure gauge	1	*	AU3/8 × 75 * ~ * kg/cm ² G. MPa
2	Packing	1	*	φ 14 dia. × φ 6 dia. × t 2
3	Gauge cock	1	*	PF3/8 inside thread
4	Straight pipe	1	*	φ 17.3 dia. × t 3, Connection size PT3/8 outside thread

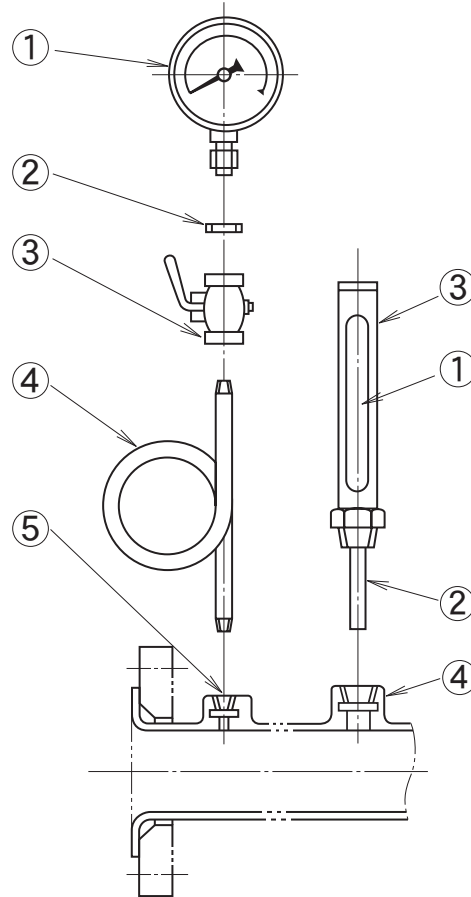
(Note) * Material and gradations range depend on actual service conditions.



3. Diaphragm type pressure gauge parts for standard option

Part. No	Part name	Qn'ty for 1 set	Material	Dimension, remarks
1	Diaphragm type pressure gauge	1	Liquid contact parts * PTFE	AU3 / 8×100 * ~ * kg / cm ² G. MPa
2	Sheet packing	1	*	φ 55 dia. × φ 25 dia. × t 2
3	Free flange	1	*	Equivalent to JIS10K-15A
4	Pipe	1	*	φ 17.3 × t 3
5	Gauge cock	1	*	PF3/8 inside thread
6	Straight pipe	1	*	φ 17.3 dia. × t 3, Connection size PT3/8 outside thread
7	Bolt, nut	4	*	M 12 × 55 L

(Note) * Material and gradations range depend on actual service condition.



4. Thermometer for steam use option

Part. No	Part name	Qn'ty for 1 set	Material	Dimension, remarks
1	Thermometer	1	Alcohol-filled glass	* ~ * °C
2	Well for thermometer	1	SUS 410	Connection size PT3/8 outside thread.
3	Case for thermometer	1	* SUS 304	φ 22 dia. × 185 L
4	Socket	1	SUS 304	Connection size PT3/8 inside thread

5. Pressure gauge for steam use option

Part. No	Part name	Qn'ty for 1 set	Material	Dimension, remarks
1	Buordon tube type pressure gauge	1	C 3600	AU 3 / 8 × 75 * ~ * kg / cm ² G. MPa
2	Packing	1	Asbestos	φ 14 dia. × φ 6 dia. × t 2
3	Gauge cock	1	C 3600	PF3/8 inside thread
4	Return pipe	1	SGP	10A PT3/8 inside thread
5	Socket	1	SUS 304	Connection size PT3/8 inside thread

(Note) * Material and gradations range depend on actual service condition.



Hisaka Works, Ltd., Heat Exchanger Division has obtained an approval under ISO9001 of its quality system for all products, including plate type heat exchangers.



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