

HISAKA

PLATE HEAT EXCHANGER

INSTALLATION, OPERATION & MAINTENANCE MANUAL



HISAKA WORKS, LTD. HEAT EXCHANGER DIVISION

FOREWORD

Thank you for purchasing the Hisaka Plate 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 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 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	Corrugated fiberboard box with skid base	Fig.1.2
	UX—10			
	LX—00	NP Type	In the case of direct shipping to purchaser factory, bare machine anchored to wooden skid base only	Fig.1.3
	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			
	RX—90			
	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

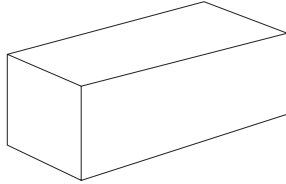


Fig.1.1 Corrugated fiberboard box

Small size

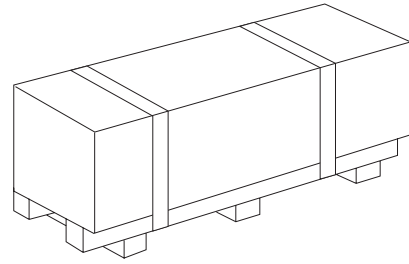


Fig.1.2 Corrugated fiberboard box with skid base

Small size

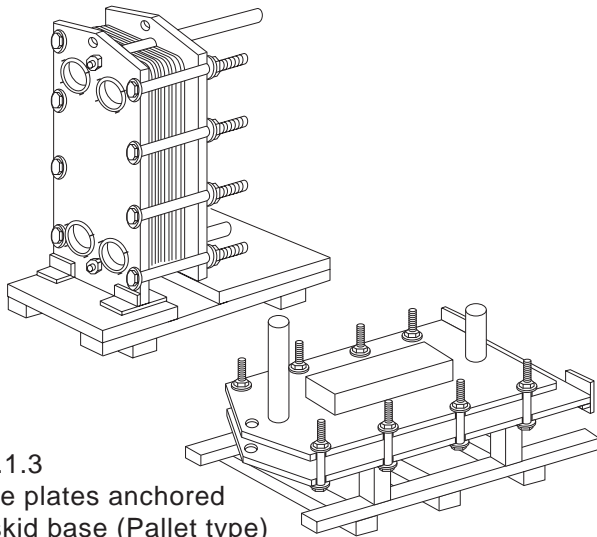


Fig.1.3
Bare plates anchored
to skid base (Pallet type)

Medium size NJ type

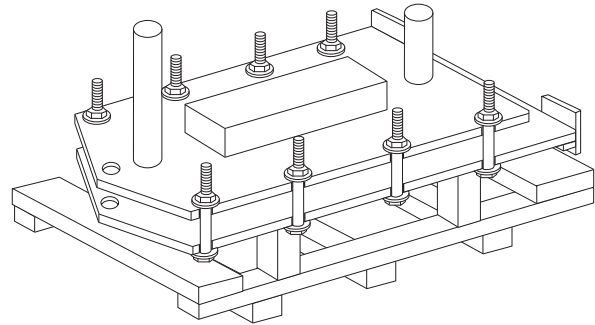


Fig.1.4 Bar plates anchored to skid base
(Pallet type)

Medium size NP Type for less plates

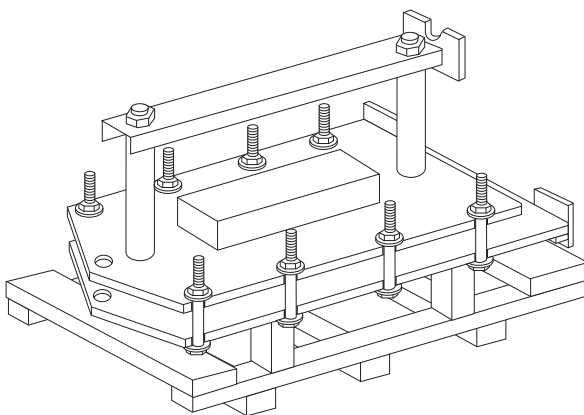


Fig.1.5 Bare plates anchored to skid base
(pallet type)

Medium size NP type for multiple plates

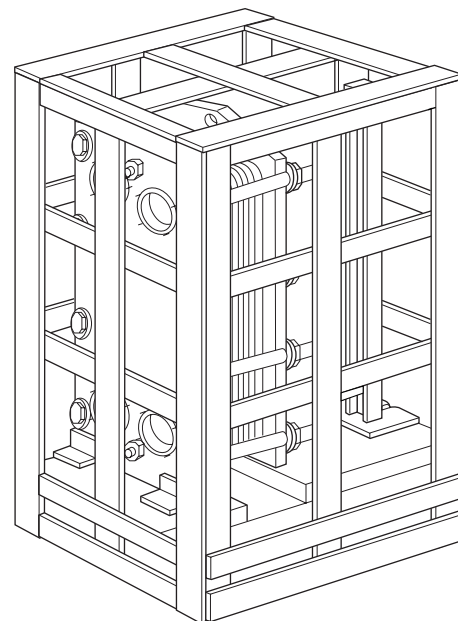


Fig.1.6 Crate

Medium size NP type for multiple plates

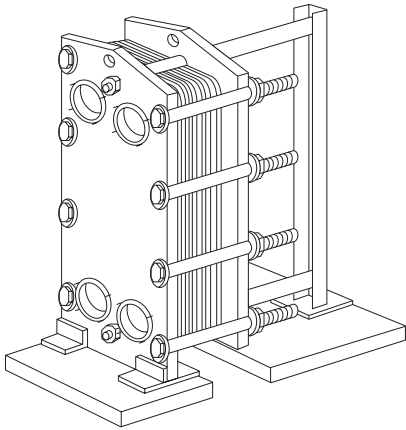


Fig.1.7 Bare plates anchored to skid base

Medium size NP type for multiple plates

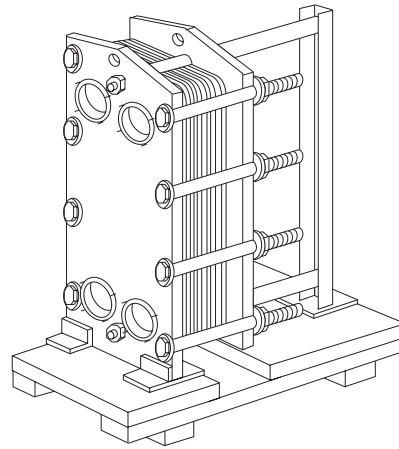


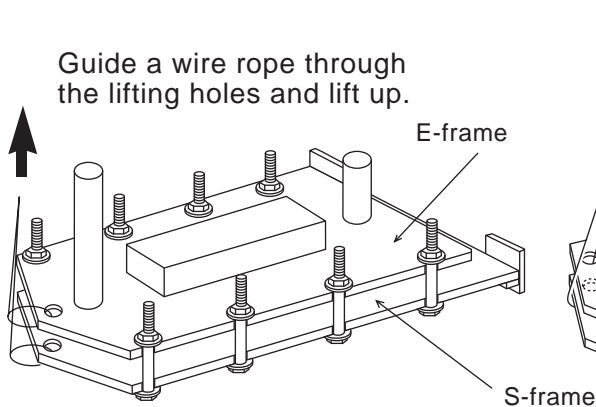
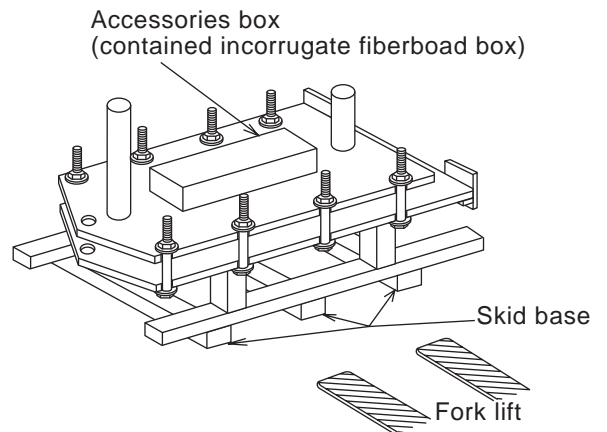
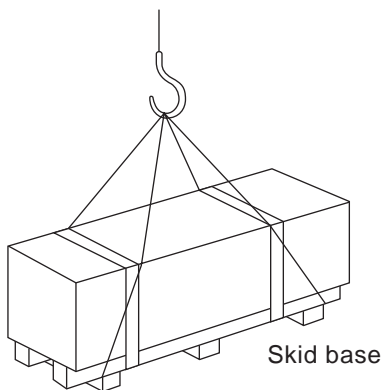
Fig.1.8 Wooden load member with skid base (Pallet type)

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.



Lift up to vertical position.

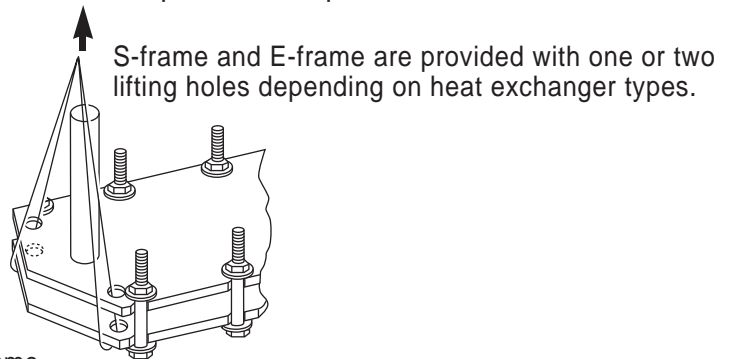


Fig.1.9 Unloading Methods (Case of front side down)

(2) Case of vertical position

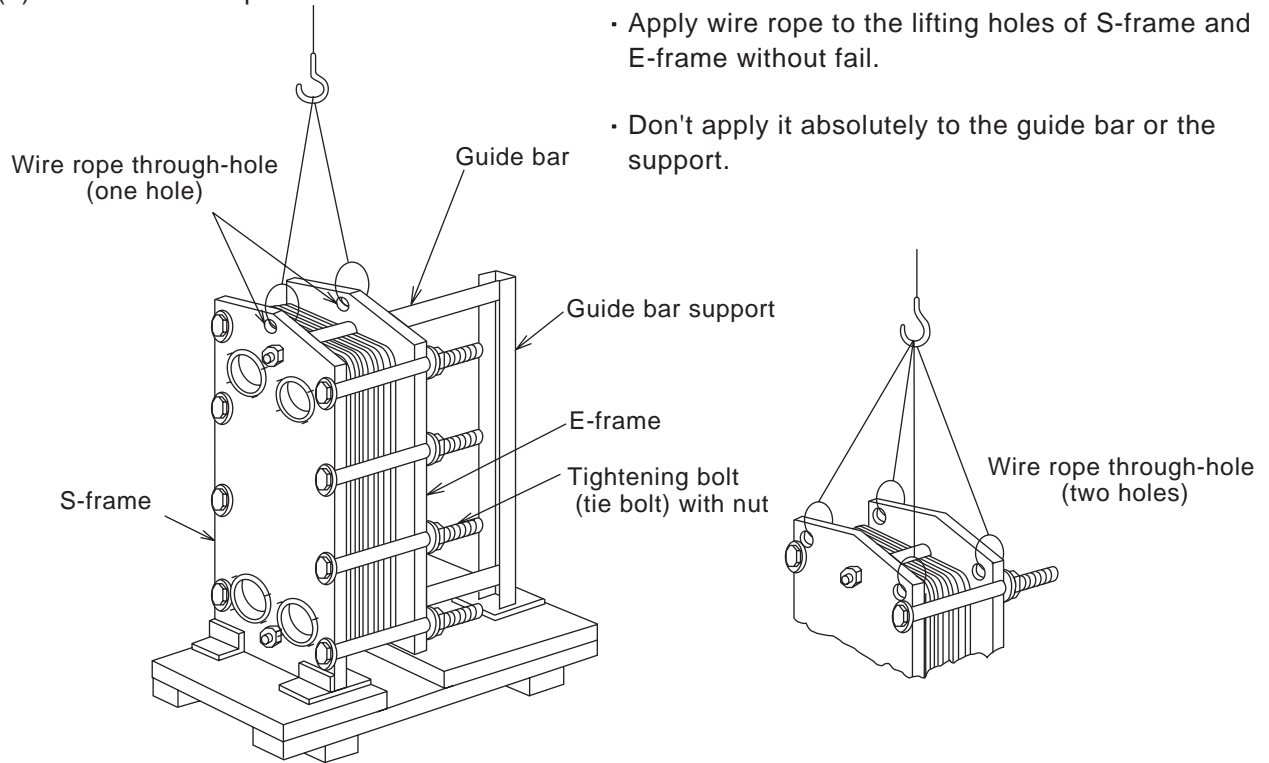


Fig.1.10 Unloading Method (Case of vertical position)

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

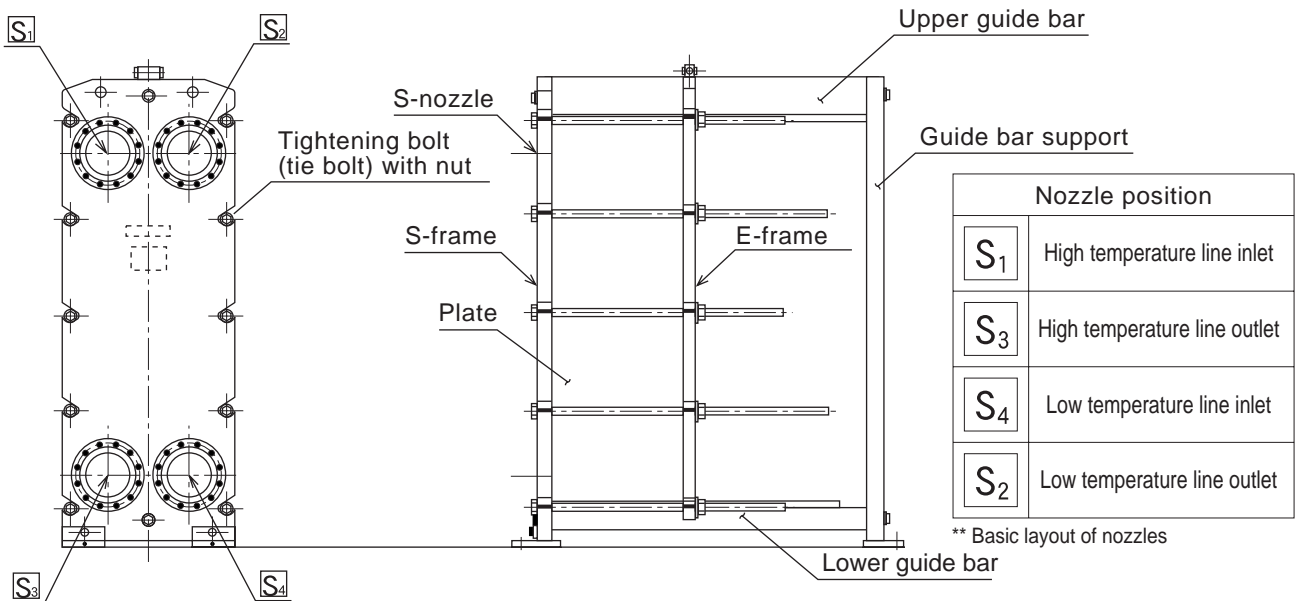


Fig.2.1 Identification of construction parts

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 L_{mm} . 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 L_{mm} 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.

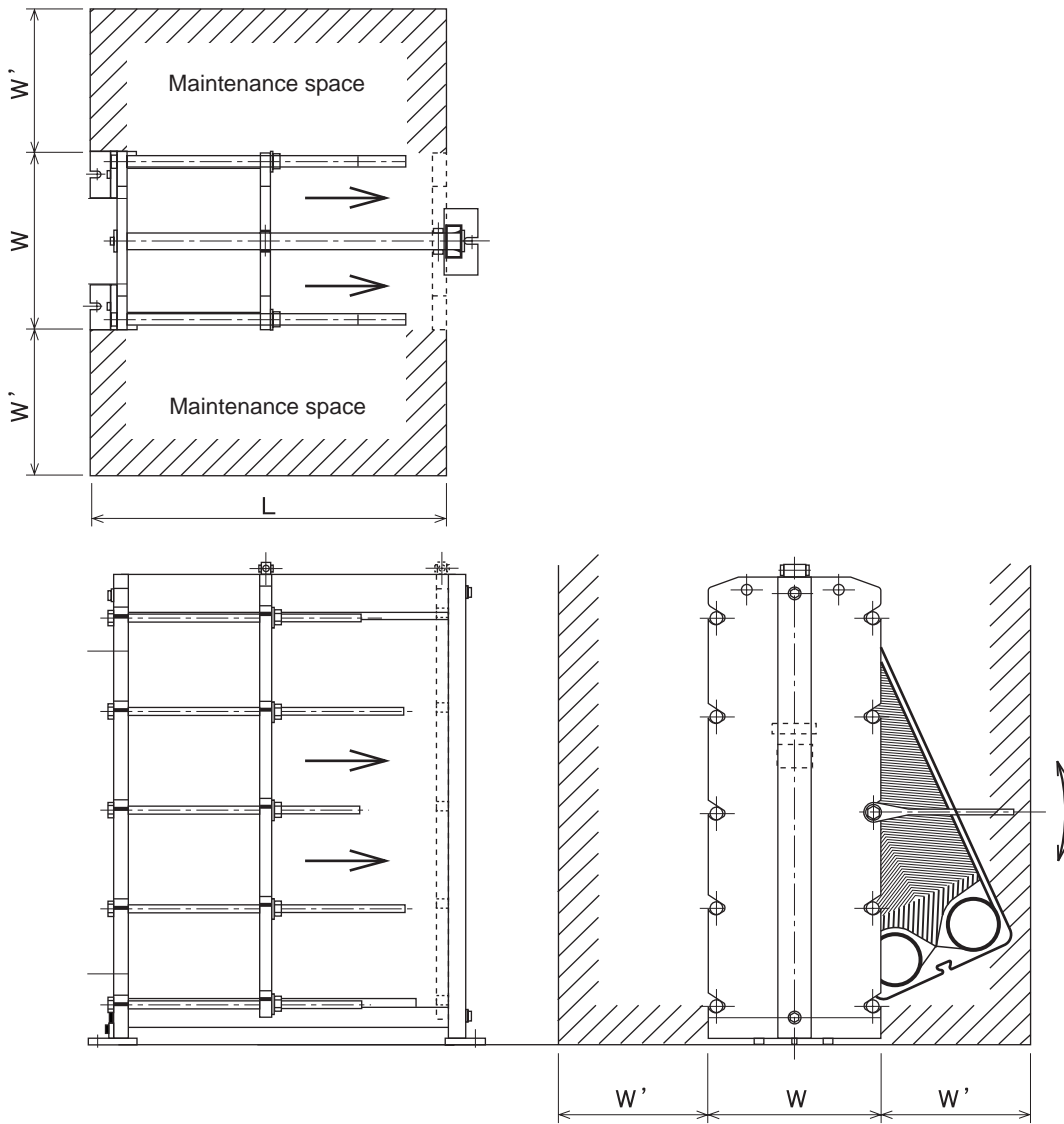


Fig.2.2 Required installation space

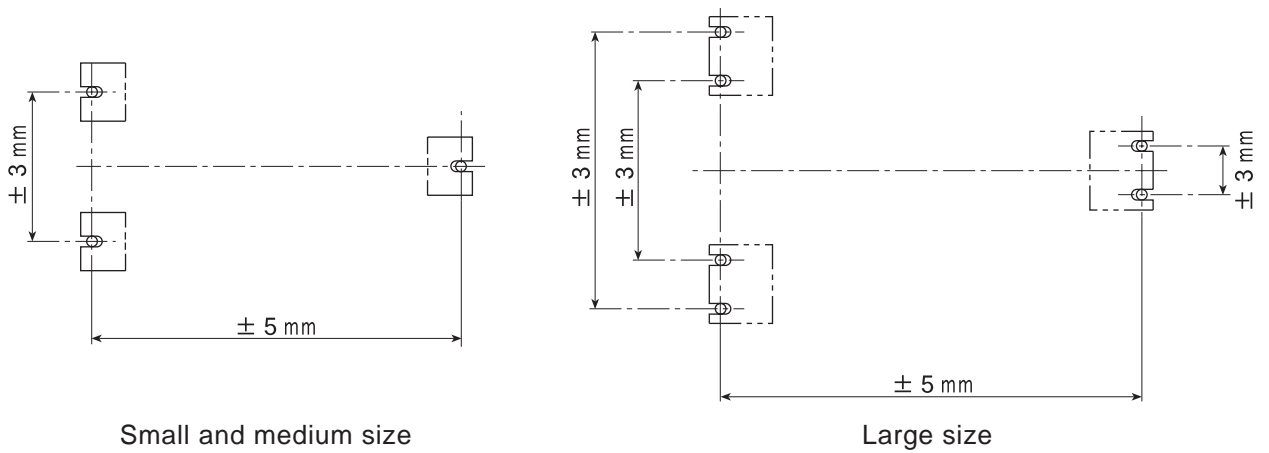


Fig.2.3 Anchor Bolt Pitch and Tolerance

(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.

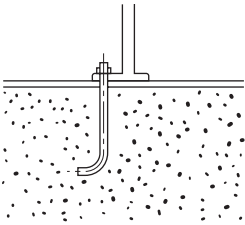
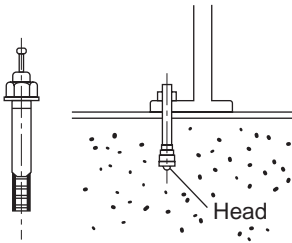
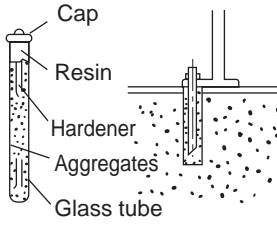
Pre-driving anchor type	Stud anchor bolt		<p>Each anchor bolt is positioned and set properly before placing foundation concrete, being then fixed simultaneously with completion of concrete placing.</p>
	Box anchor		
After-driving anchor type	Hole-in anchor		<p>Anchor hole is drilled in the concrete using 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

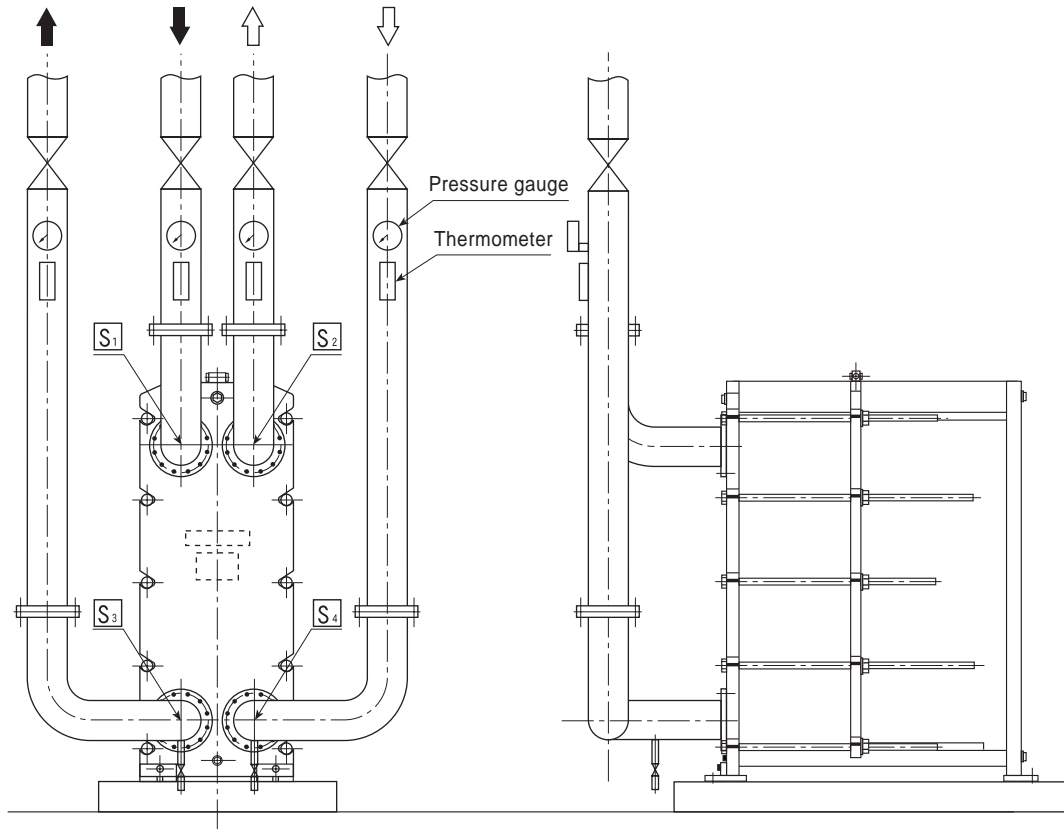


Fig.3.1 Example of basic piping

(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

Maker standard connections are located in S-frame with stud bolts corresponding to flange rating. Directly connect the flange of pipeline to the S-nozzle using stud bolts. Further, don't apply welding to the flange.

(4) Installation of end pipes

In the case of boot type nozzle, joint two or more end pipes (see Fig.3.8) 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 moved either vertically or horizontally because of stud bolt interference. Therefore, first remove the 2nd from the end pipe and then the 1st pipe using the space of the removed 2nd pipe. One piping connection requires two or more end pipes to enable the maintenance of one nozzle.

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

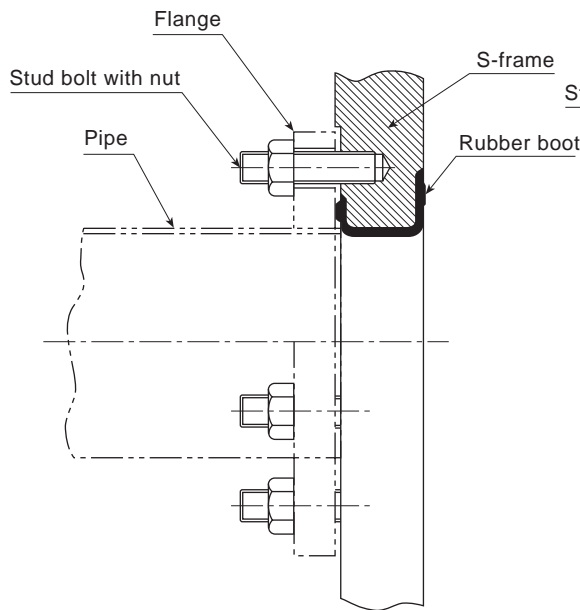


Fig.3.2 Rubber Boot Type

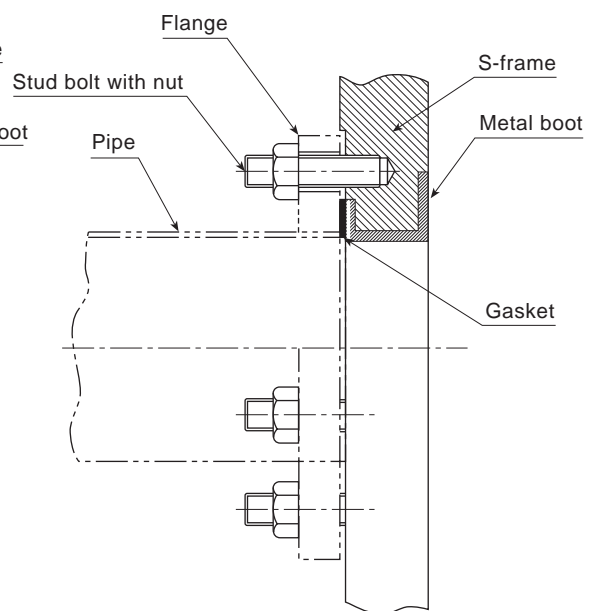


Fig.3.3 Metal Boot Type

(Note) The rubber boot type dose not require a pipe gasket.

(5) Prohibition of fixed piping within overhaul space

Do not install a fixed pipeline within the oblique-lined area (▨) in Figs.3.4 and 3.5. The E-frame must be moved back, and fixed piping within this area would prevent reverse movement of the E-frame for overhaul and inspection.

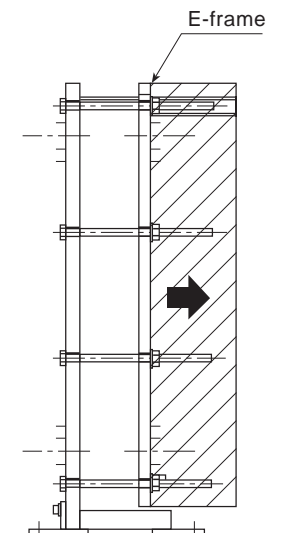


Fig.3.4 NJ Series

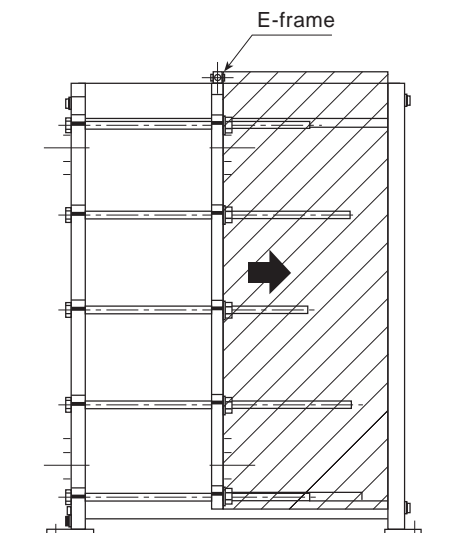


Fig.3.5 NP Series

(6) Expansion joints

The plate type heat exchanger will eventually require retightening of its plates. This retightening is available within the maximum to minimum dimensional range stamped on the nameplate. The E-frame moves toward the S-frame due to this retightening. Where the piping is installed at E-frame side, hence, it must be provided with an expansion joint so as to allow this movement of the E-frame.

(7) Pipe support

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

(8) Valves

Connect a gate (stop) valve to the inlet and outlet pipes, as illustrated in Fig.3.6, 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 prevention treatment is applied. For this 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 highest point. Furthermore, provide liquid discharge valve and air vent valve on the respective pipes at easy-to-operate positions.

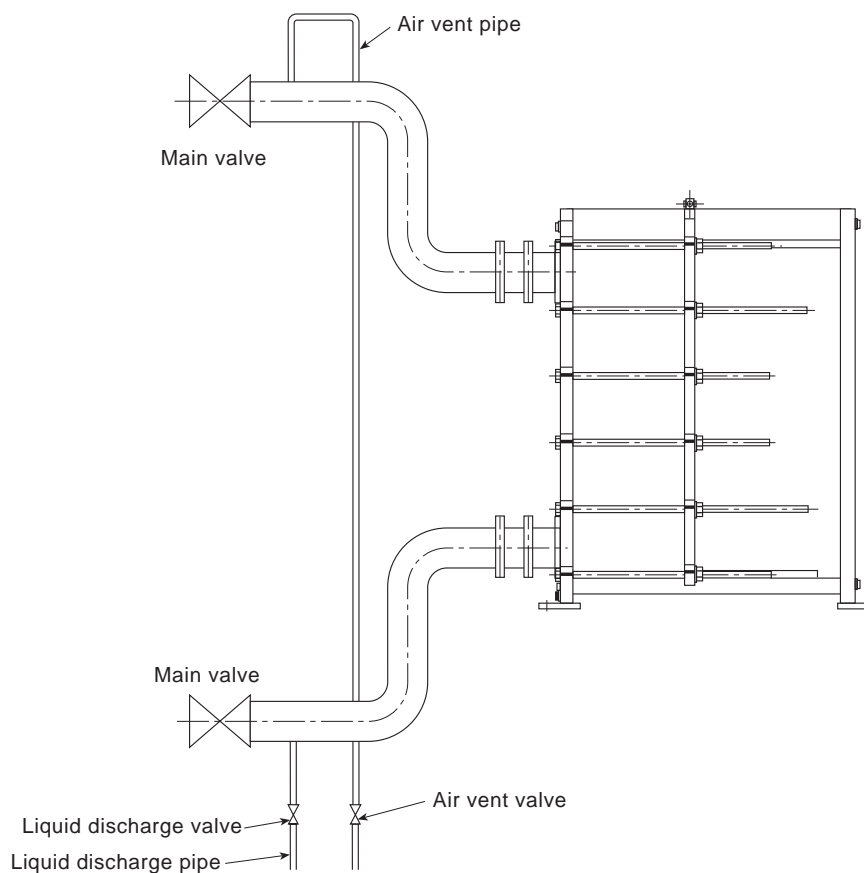


Fig.3.6 Liquid discharge and air vent

(10) Thermometer and pressure gauge

The heat exchanger body does not include thermometer and pressure gauge (These are options.) and therefore should be installed in pipework on the users side.

The conventional nozzles previously had an approx. 250mm long projection, to which a thermometer and pressure gauge were connected. However, this design was discontinued due for 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 the heat exchanging operation. Removal of the end pipe nearest the heat exchanger or the use of a strainer are available alternative 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 blockage caused by such solid matters.

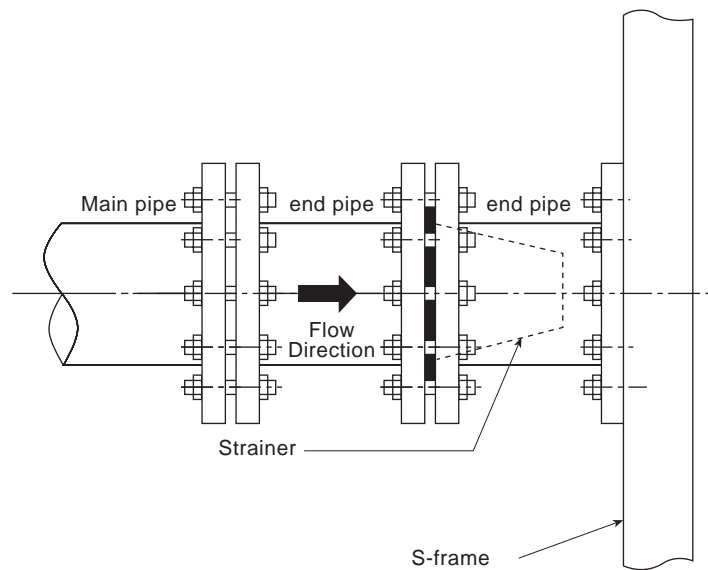


Fig.3.7 Strainer

(12) Safety valve

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

(13) Do not use the oblique-lined zone  in Figs.3.4 and 3.5 as a work passage. Be careful of accident by contact with 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	RX-90	2.6 or smaller
UX-20	1.9 or smaller	SX-41, 47, 44	1.7 or smaller
UX-30	1.8 or smaller	SX-43, 48, 45, 49	1.1 or smaller
UX-40	2.5 or smaller	SX-70	1.6 or smaller
UX-60	3.6 or smaller	SX-90, 90S, 90M, 90L	2.4 or smaller
UX-80	3.3 or smaller	GX-20H	3.6 or smaller
UX-90	3.1 or smaller	GX-20L	8.0 or smaller
UX-100, 130	3.1 or smaller	GX-20M	4.0 or smaller
LX-00	2.5 or smaller	WX-50	2.5 or smaller
LX-10	2.9 or smaller	WX-90	3.1 or smaller
LX-20	3.6 or smaller	FX-01	1.8 or smaller
LX-40	4.0 or smaller	FX-03	1.8 or smaller
LX-30, 50	3.3 or smaller	FX-05	2.7 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) ×-mark...Improper piping

○-mark...Proper piping

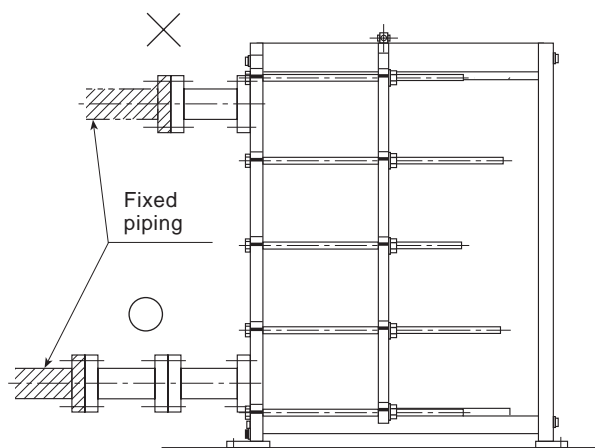


Fig.3.8 Straight Piping (1)

(2) Straight piping to E-frame

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

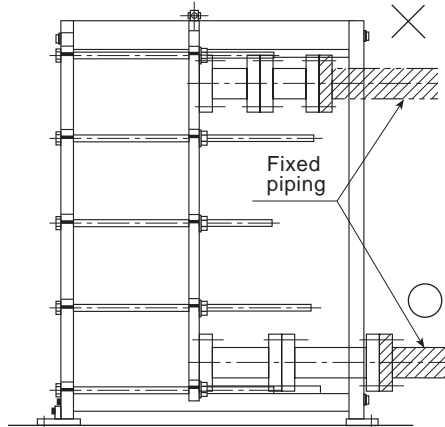


Fig.3.9 Straight Piping (2)

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

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

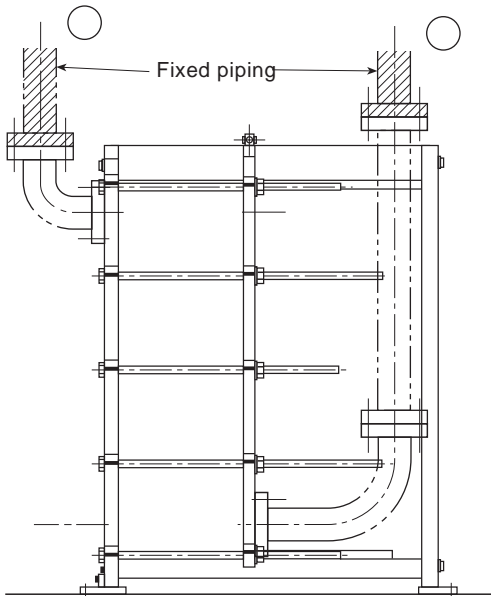


Fig.3.10 Upward Piping (1)

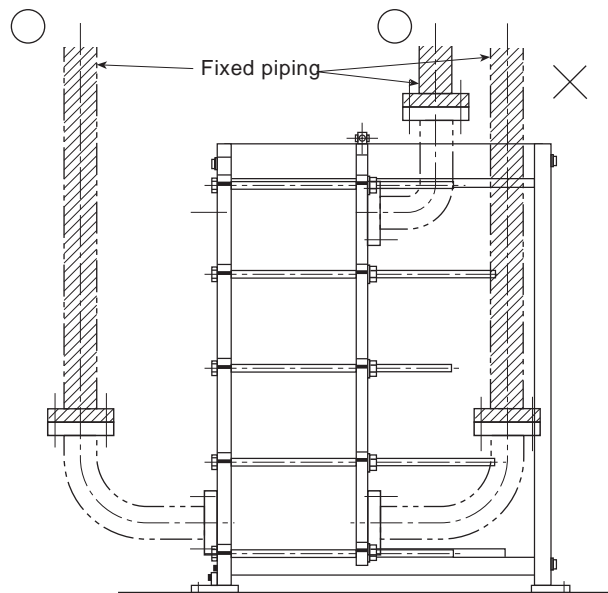


Fig.3.11 Upward Piping (2)

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

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

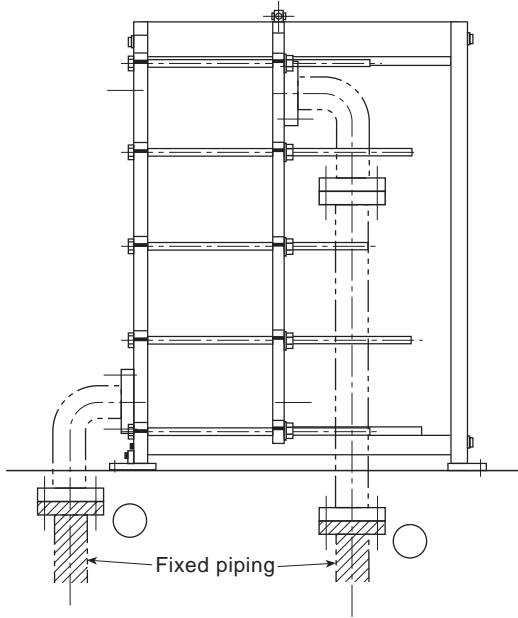


Fig.3.12 Downward Piping (1)

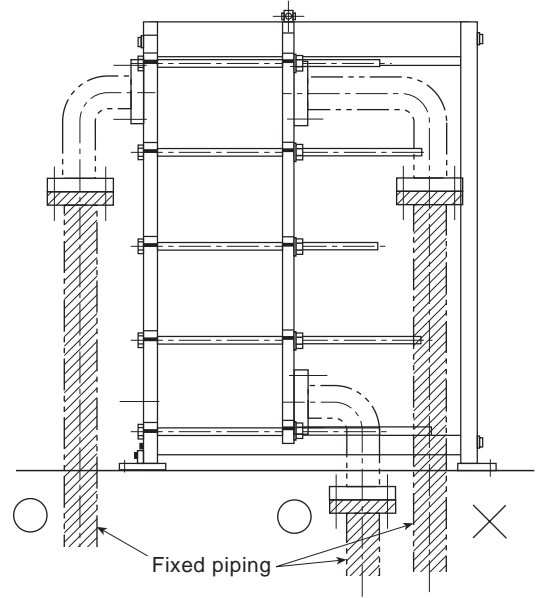


Fig.3.13 Downward Piping (2)

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

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

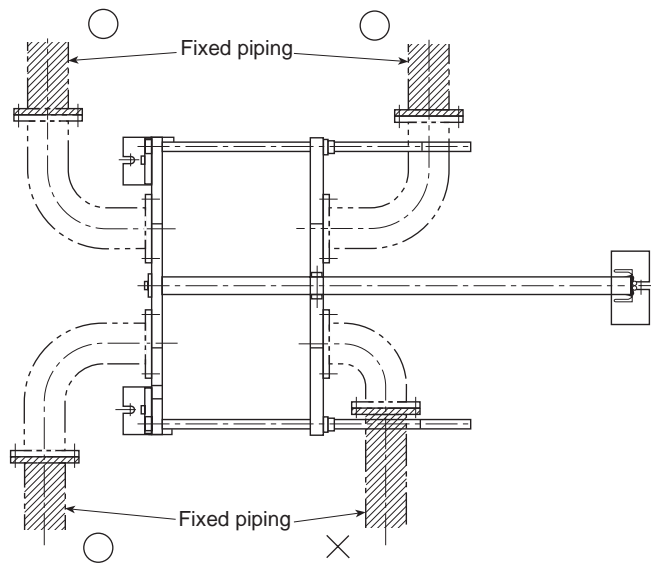


Fig.3.14 Horizontal Piping

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

When a pipeline is connected to the E-frame of large size heat exchangers, the pipe size is larger than the tightening bolt distance C as illustrated below and this prevents the installation of horizontal piping. Therefore install straight or upward/downward piping. (In this case, two or more end pipes must be connected considering the removal area of the E-frame, as in smaller heat exchangers.)

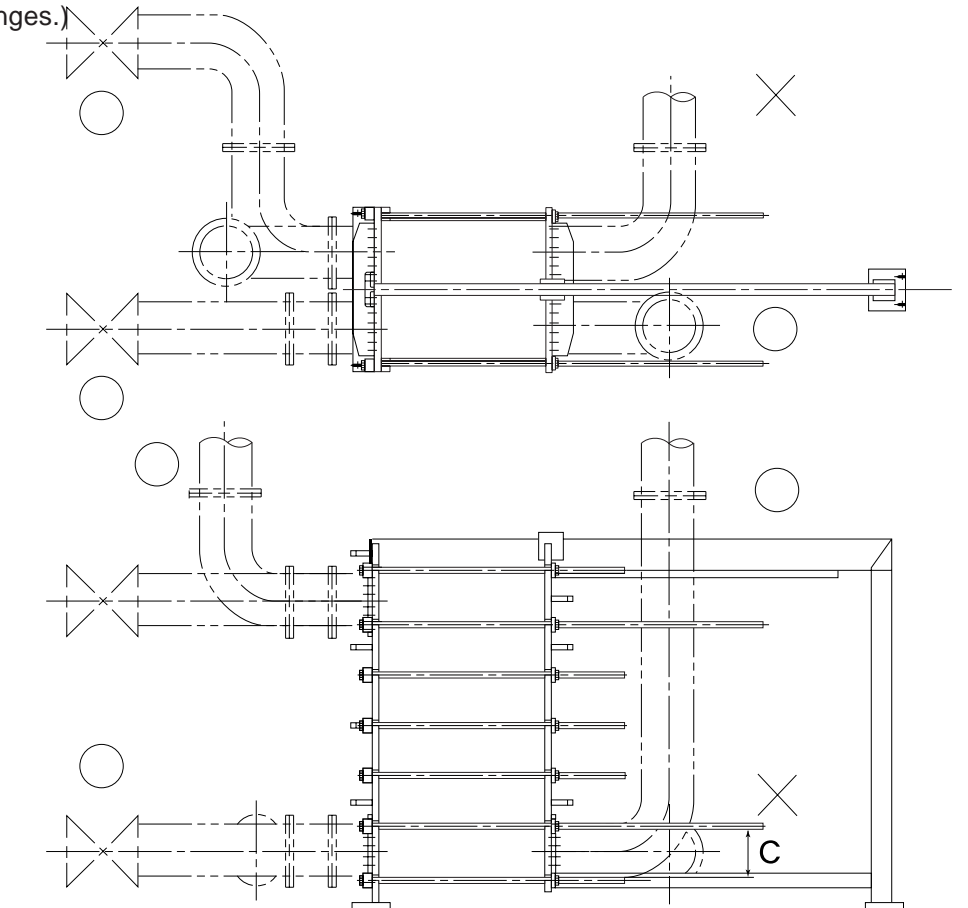


Fig.3.15 Large Size Piping (1)

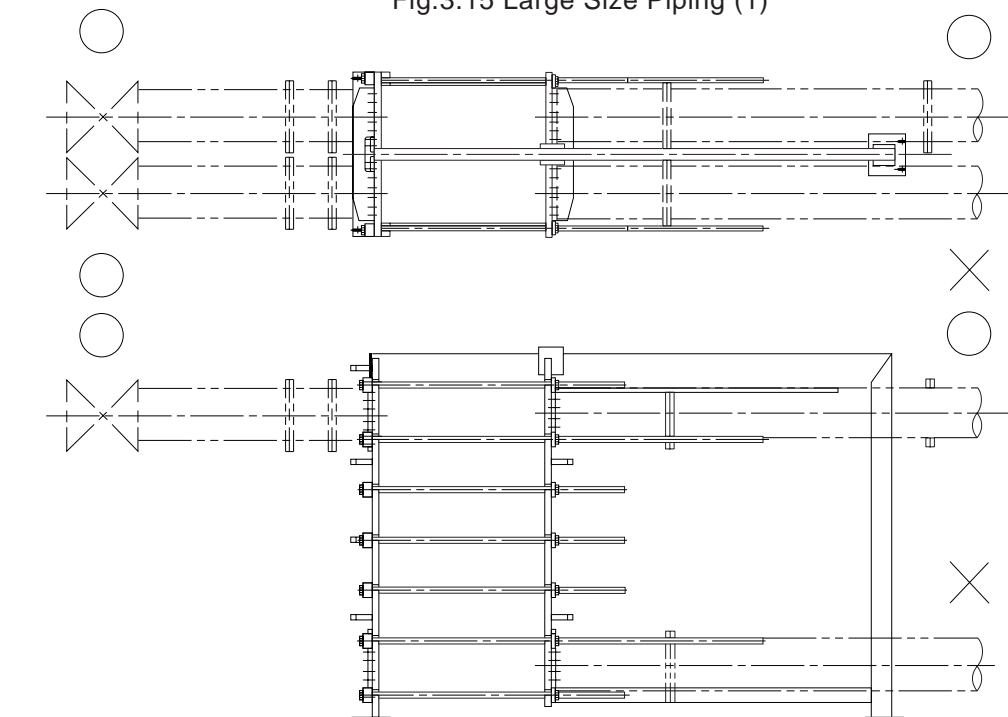


Fig.3.16 Large Size Piping (2)

(7) Special piping

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

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

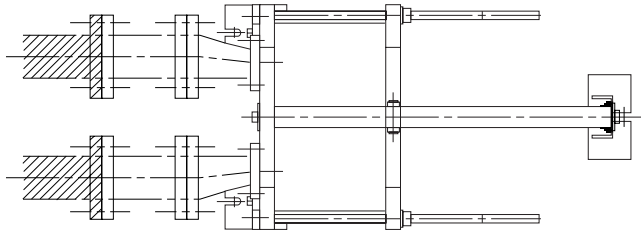


Fig.3.17 Reducing Piping (1)

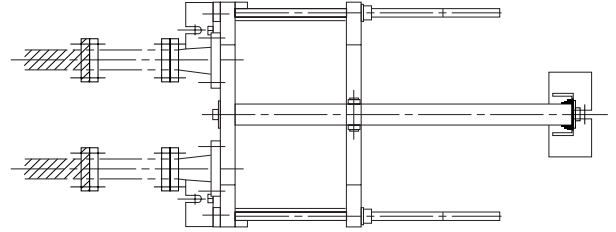


Fig.3.18 Reducing Piping (2)

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 of all plate type heat exchangers. Be sure to check that these frames are bolted to the specific dimension (distance) with equal tightening torque at each bolt position.
- (2) Try to turn the nuts by hand to check the tightening bolts for looseness.
- (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 in the correct direction.
- (5) When thermometer and pressure gauge are supplied with the heat exchanger, check the type, graduation 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 the heat exchanger.
Usually the fluid is first fed from the low temperature line. In the case of refrigerant (0°C or less) heat exchanging and fluorine rubber gaskets (FPM) 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 the Specification, comply with the above procedure.)
- (5) If fluid overflows from the air vent pipe, close the air vent valve and, thereafter, adjust the opening of the inlet and outlet valves respectively.
- (6) When the heat exchanger has reached a steady running condition for both fluids, check for leakage between the plates.

(Note) When using steam as the heat source, completely drain the heat exchanger before opening the steam inlet valve as, residual drains could cause a steam hammer phenomenon, to occur causing damage and other troubles.

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 the residual fluids from the body and the pipelines or overhaul the unit, otherwise the plates will be damaged by the freezing of the residual fluids.

5 DISASSEMBLY

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

1. Moving the E-frame

- (1) In the case of the heat exchanger with an 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 the unscrewing and tightening of the flange bolts.
(Limit to max. 10mm per tightening stroke to prevent bolt & nut galling.)
 - (c) After unscrewing all the tightening bolts and nuts completely, move the E-frame up to the guide bar support. (For the NJ type, move it up to the upper guide bar stopper.)

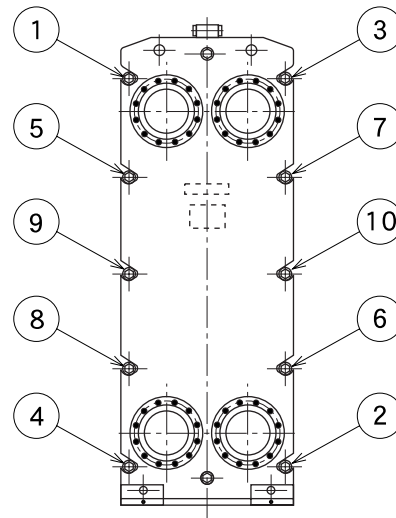


Fig.5.1 Tightening Bolt Nuts Unscrewing Sequence

2. Removal of the plates

In the case of the heat exchanger with an E-nozzle, the plate pack includes the plates with different port hole positions. Hence, the plates must be assembled in the specified correct order. For this, it is recommended to number the plates, before removal, to avoid restoring in the wrong order. For example, give No.1,2,3...to the plates in that order from the S-frame side. And these Nos are to 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 the case of separating the plates if it is difficult due to sticking, pull the upper corner of plate using your fingers. If they still cannot be separated even after that, strongly insert a screwdriver or the like in the clearance between the plate corners/centers to 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 without hanger, 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 a hanger and round upper guide bar, push down the hanger 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 a 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))

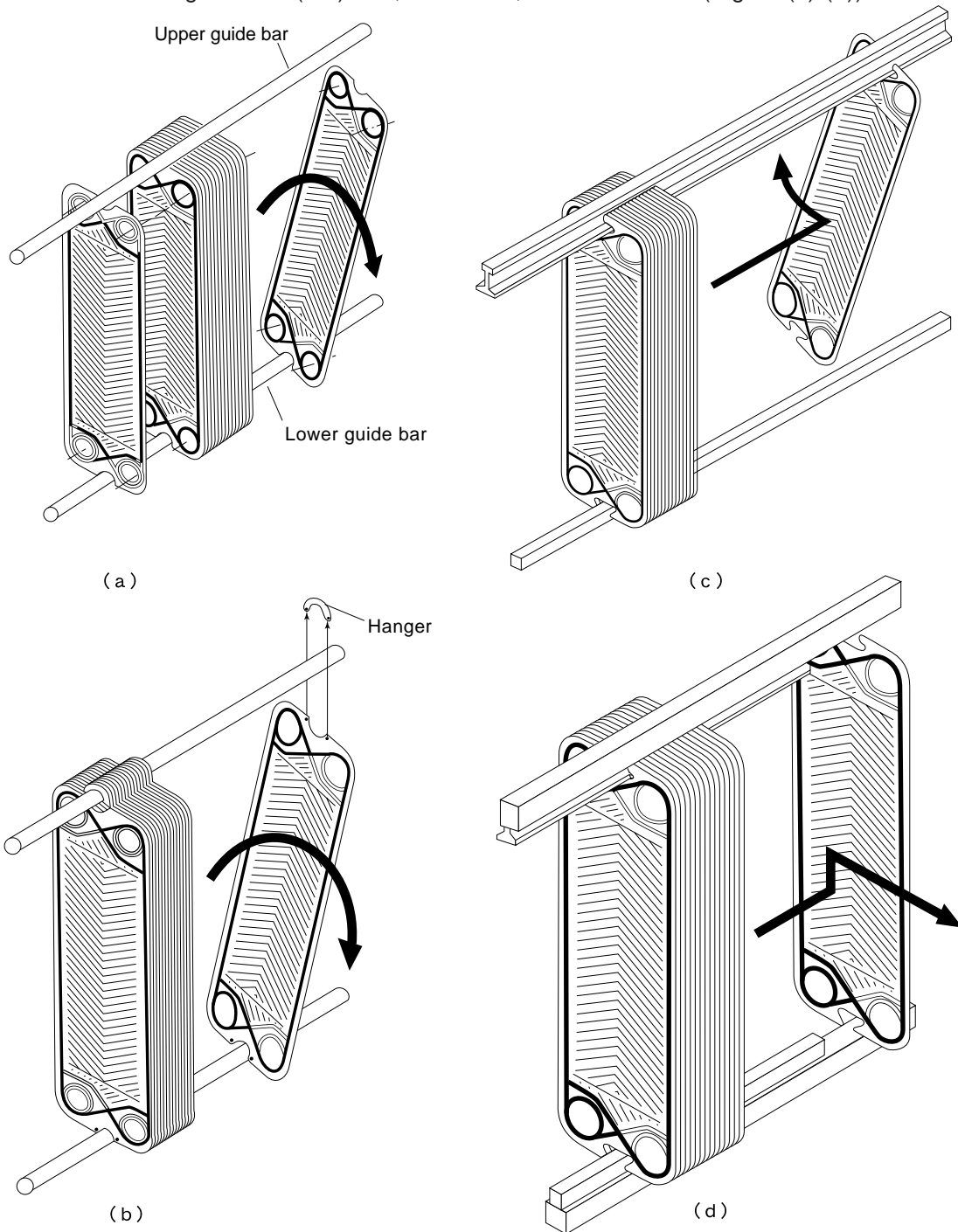


Fig.5.2 How to Remove the Plates

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

(2) Cleaning in place

1. Discharge the fluid from the heat exchanger.
2. Feed hot water at a flow rate higher than usual. Continue this water feed until the outflow no longer contains the residual fluid-dirt, debris or other impurities.
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 and gasket together 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 a vertical position and protect its backside by a board with smooth surface, such as vernier board with high compressive strength, as illustrated in Fig.6.1

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

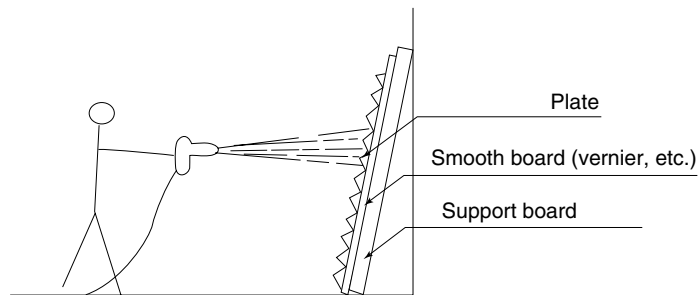


Fig.6.1 Plate Setting

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 the crevice between the gasket and the plate for localized corrosion.

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

2. Gaskets

- Check the gaskets for permanent set, crack, swelling, carbonizing, sticking, sponging, etc.
- Replace a deteriorated or defective gasket with a new one.

3. Frames

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

Apply a proper coat of grease to the threaded zone of each tightening 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 relevant instruction manual.)

(1) Removal of the gasket from the 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, then remove the gasket from the plate by hand.

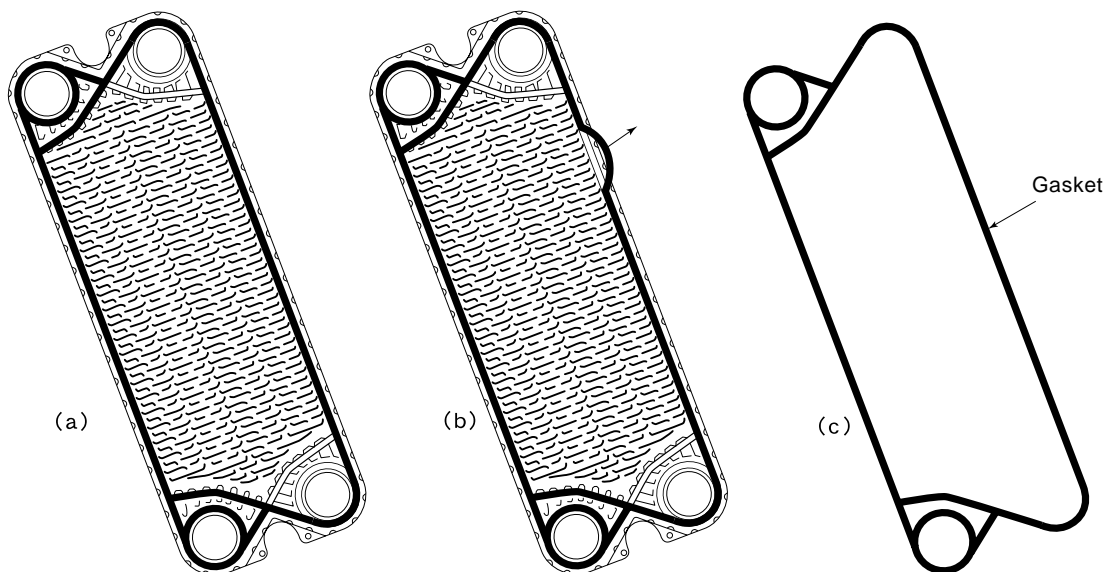


Fig.6.2 Removal of Gaskets

(2) Cleaning the gasket groove of the plate.

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

(3) Preparation of new gaskets

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

(4) Apply the specific adhesive to the gasket.

The following adhesives are available for the use. Select the optimal one according to the gasket material used. As the adhesives S-1 and F-2 contain organic solvents, do not use them in a badly 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. please use the manufacturer's recommended adhesive. 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.

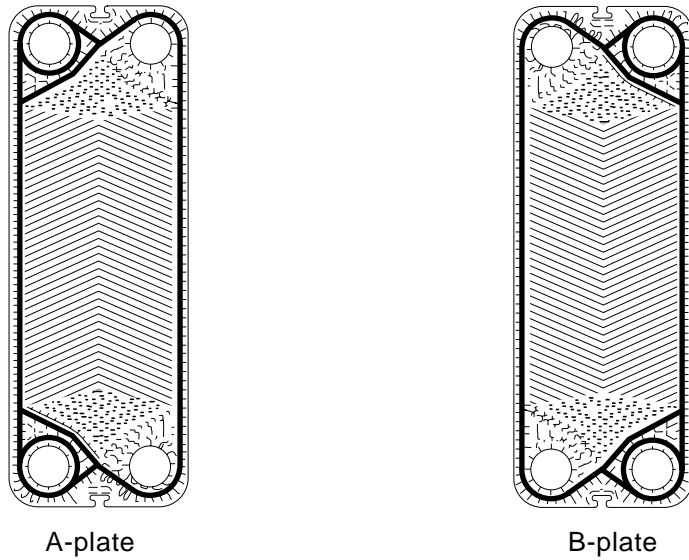


Fig.6.3 Application of Adhesive and Gluing Area (Black thick line)

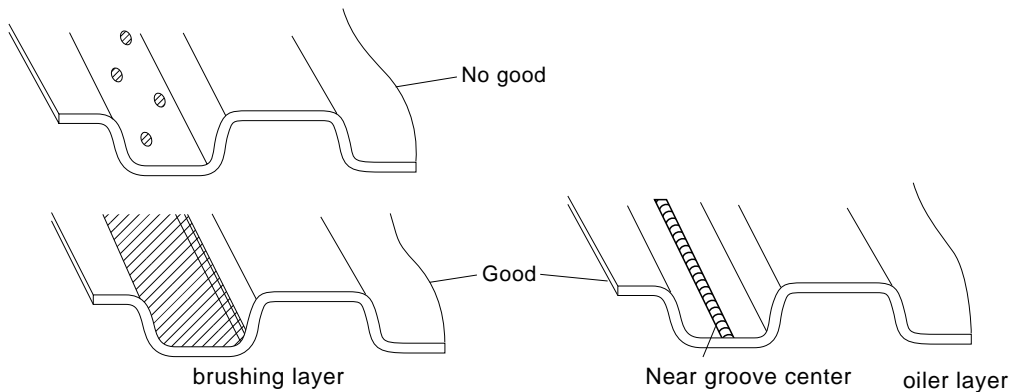


Fig.6.4 Application of Adhesive

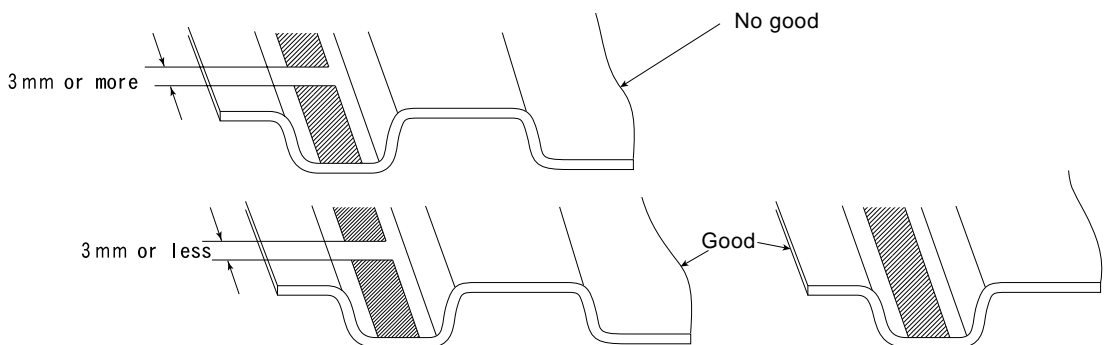


Fig.6.5 Application of Double Side Tape

(5) Setting gasket

Carefully set a gasket in the gasket groove of the plate. The seal surface of gasket should be faced up. 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.

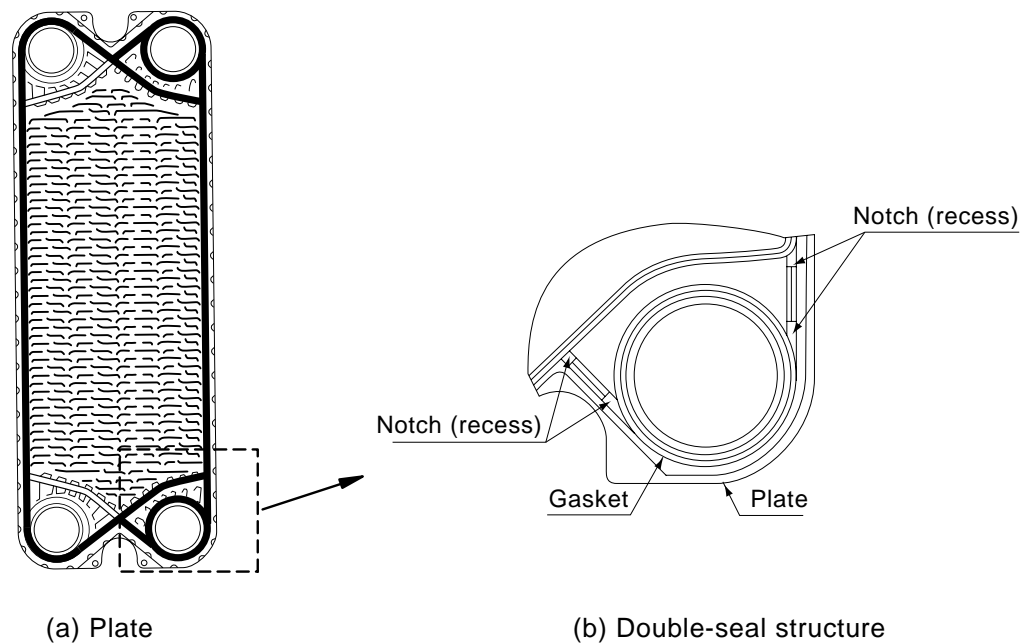


Fig.6.6 Double Seal Structure of Gasket

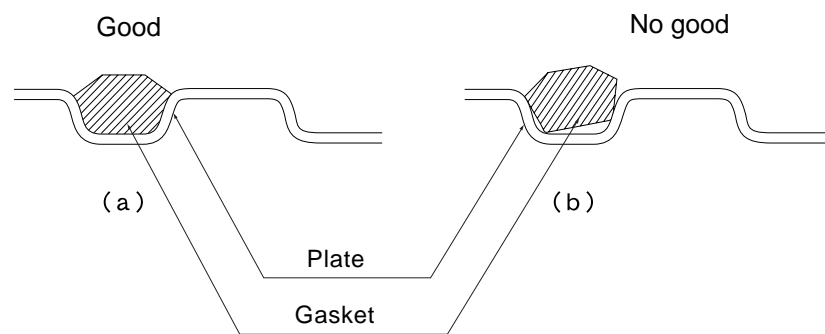


Fig.6.7 Gasket Setting

(6) Pressing

After laying the gasket correctly in the groove, stack the plates 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.

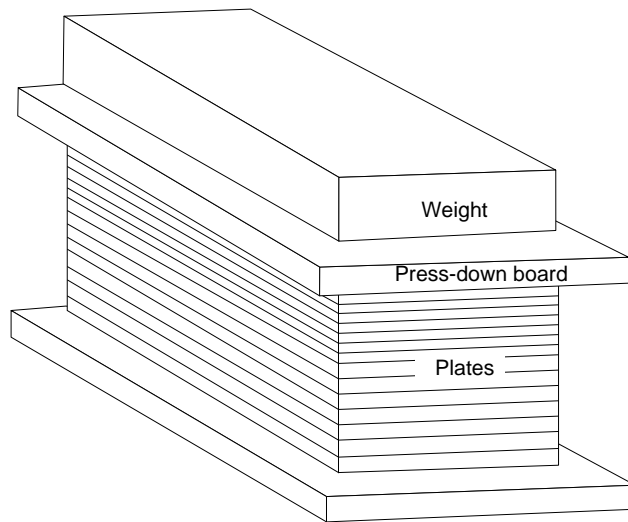


Fig.6.8 Gasket Press-down

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.

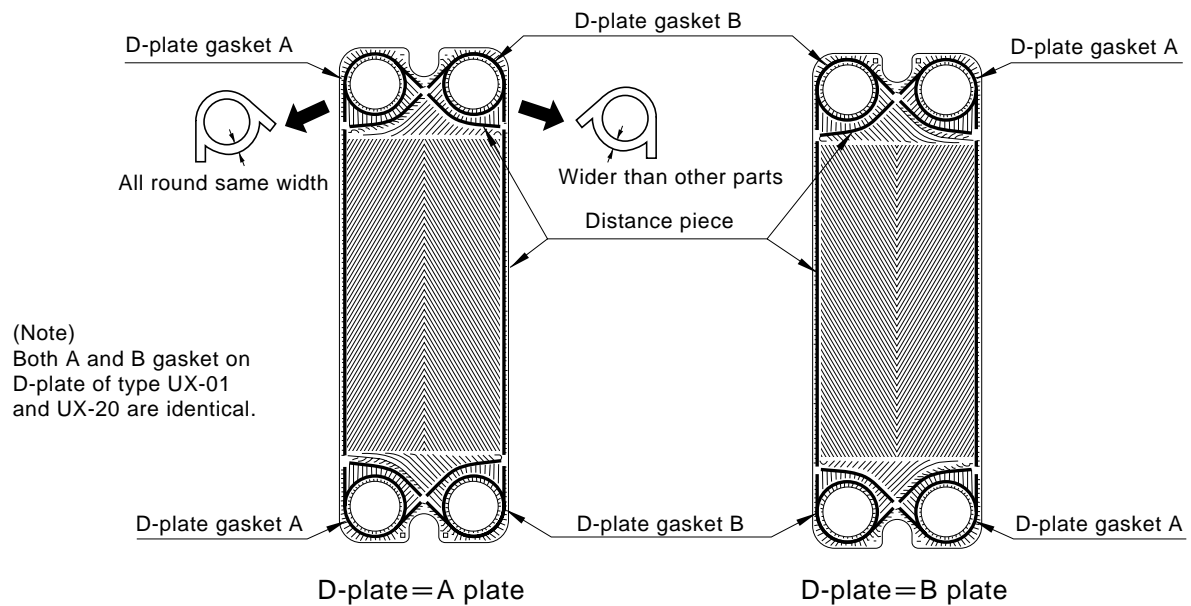


Fig.6.9 UX and SX Series

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

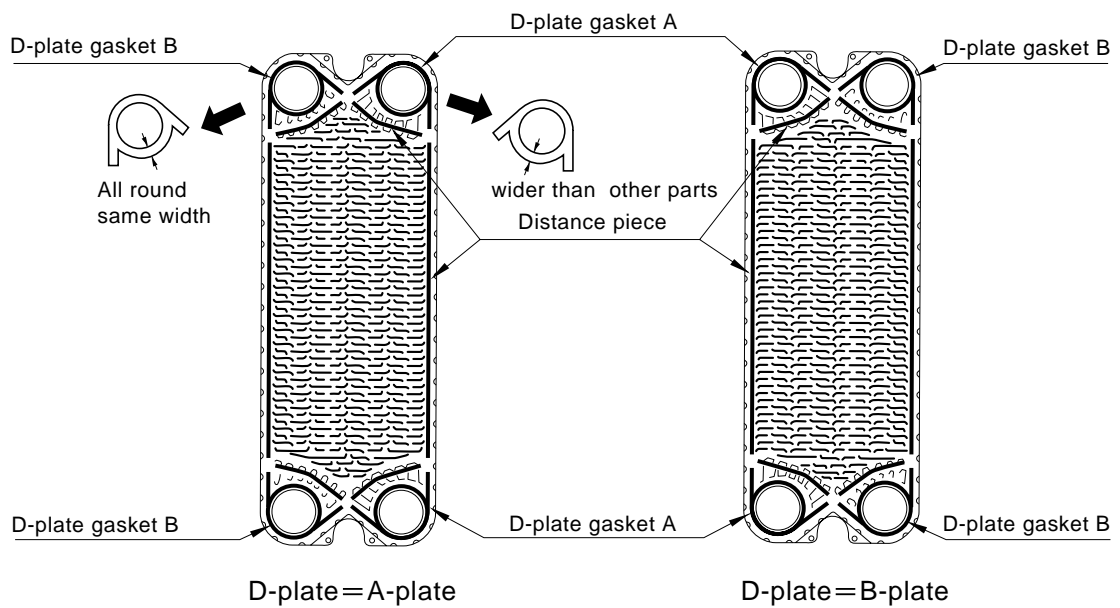


Fig.6.10 EX Series

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.

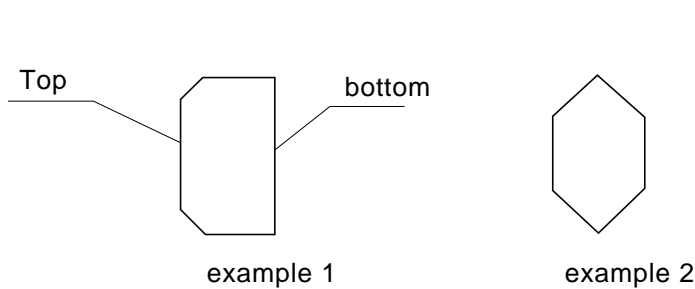


Fig.6.11 Cross sectional. drawing of E-nozzle gasket

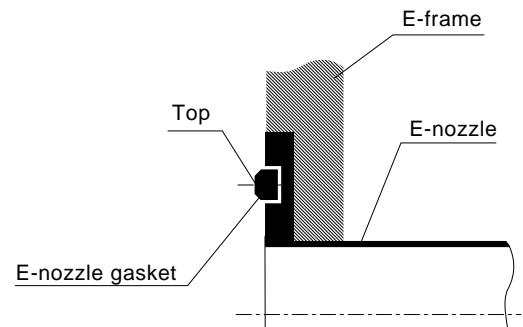


Fig.6.12 E-nozzle gasket

(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 plated 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 & nut galling.)

(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.

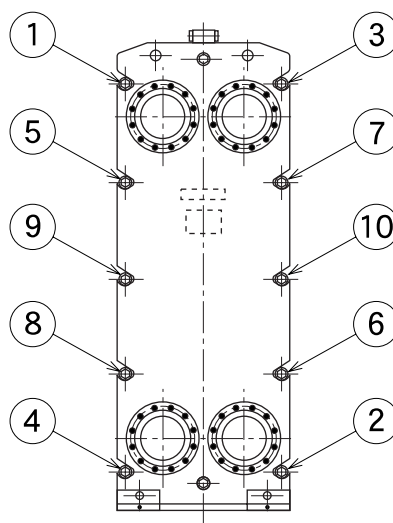


Fig.7.1 Tightening sequence

8 CONSTRUCTION

1. Plates

The plates for Hisaka Plate 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.

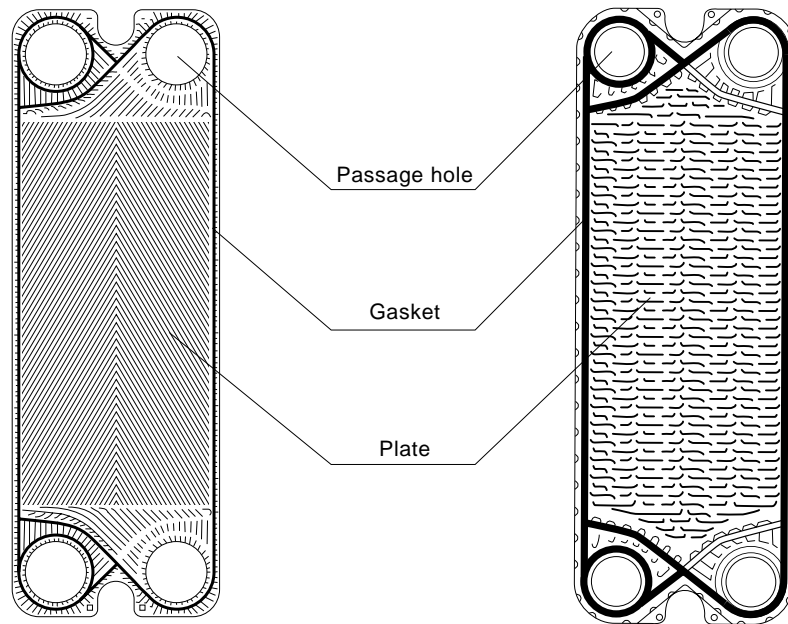


Fig.8.1 Herringbone Pattern Plate

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.

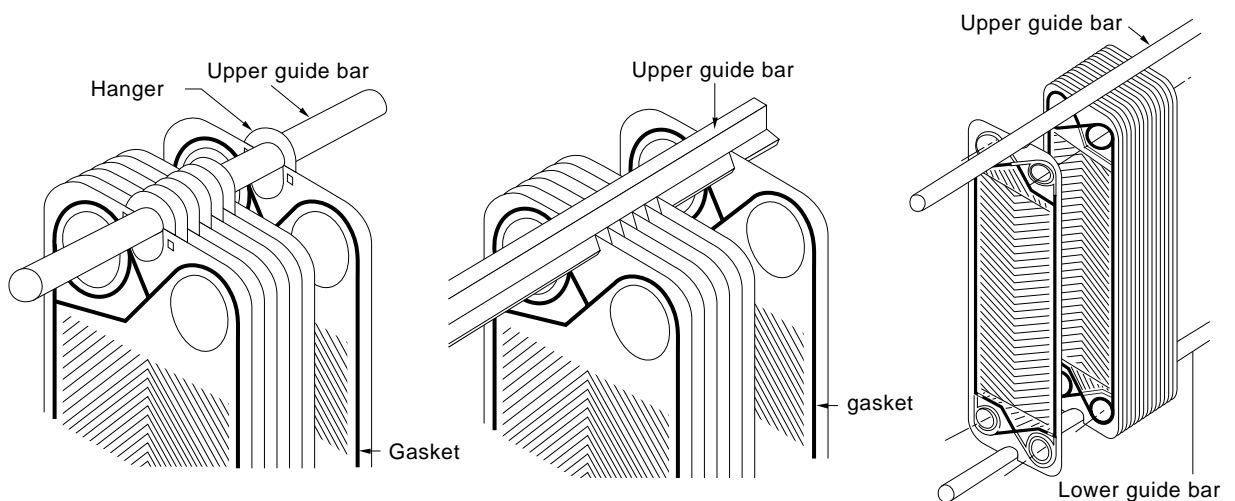


Fig.8.3 Plate with Hanger

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.

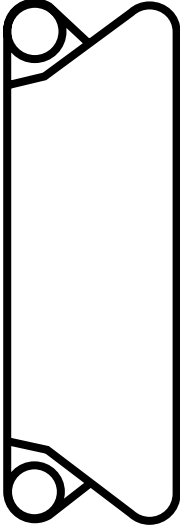
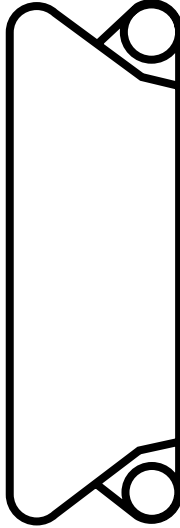
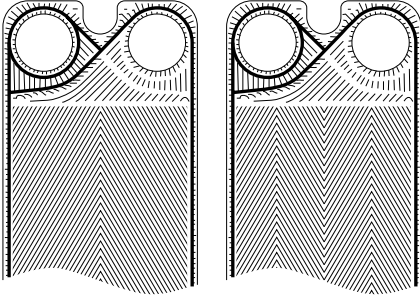
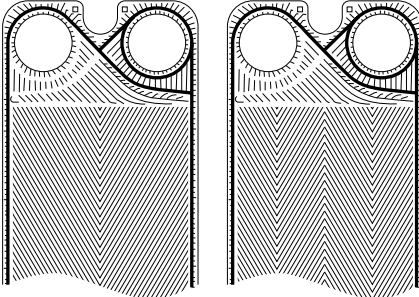
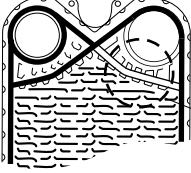
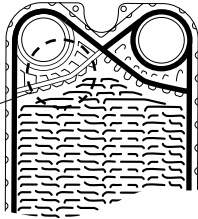
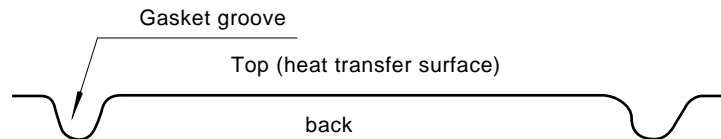
	A-plate	B-plate
Gasket orientation		
Heat transfer surface of herringbone pattern plate (Sketch from gasketed side)		
Heat transfer surface of corrugated pattern plate (Sketch from gasketed side)		
	Combed pattern on right side	Combed pattern on left side

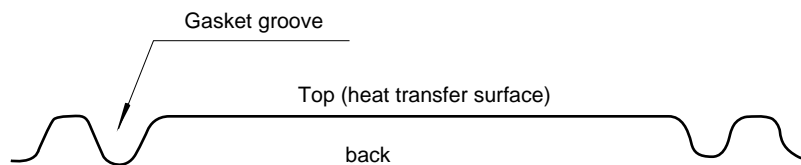
Fig.8.6 Identification of A-plate and B-plate

Identify A-plate and B-plate from Fig.8.6. The easiest way is to see the gasket orientation. But in the case of identifying the plates without a 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

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

(3) Corrugated pattern plates

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

Furthermore, an A-plate can be used as a B-plate by turning it upside down and a B-plate can be used as an A-plate by turning it upside down. However, the above dose not apply to the A-plate and B-plate in the GX-23 Type.

4. Channel arrangement

The channel arrangement of the Hisaka Plate 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.

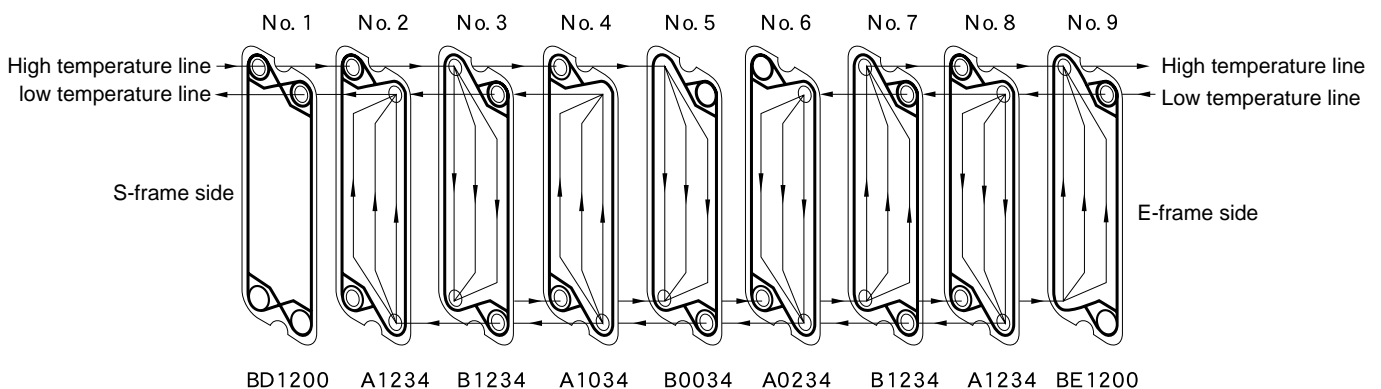


Fig.8.8 Example of flow pattern in plate channel

The two fluids never mix together even in the case of fluid leak, due to a structure wherein each fluid flows through different gaskets on each plate surface. An example of the 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 a vertical line within the rectangular area in Fig.8.9, wherein the gasketed surface of the plate is always facing 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 is located at the 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 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 the gasketed side. And “no hole” is shown by a 0.

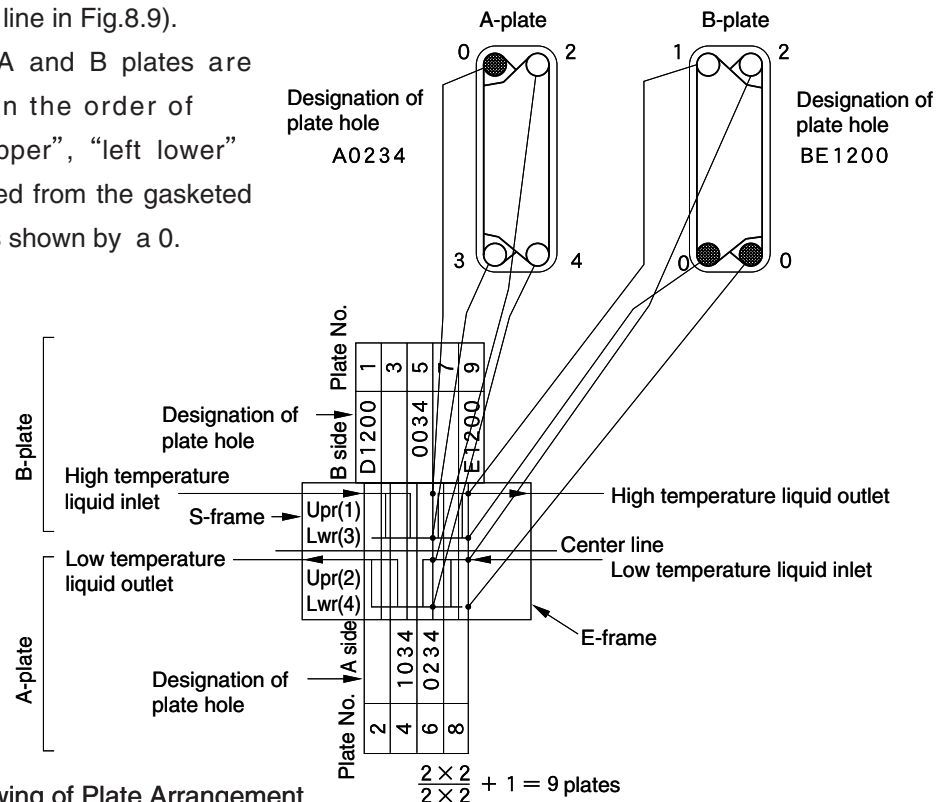


Fig.8.9 Drawing of Plate Arrangement

- (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 the case of a 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 by 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

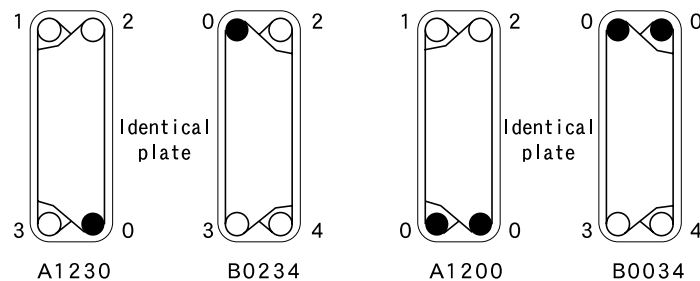


Fig.8.10 Example of A and B...identical plates ●showing "No hole" .

(EX.) In Table 8.1

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

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

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

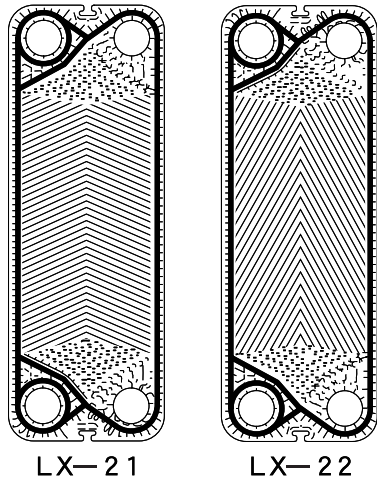


Fig.8.11 Example of different herringbone angle

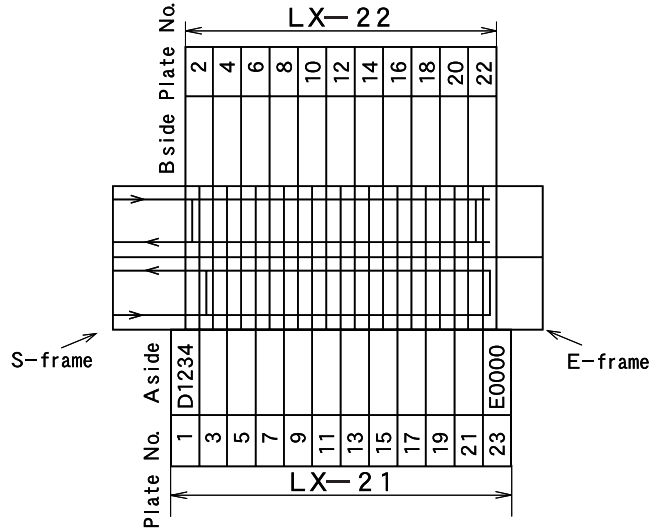


Fig.8.12 Mixed arrangement

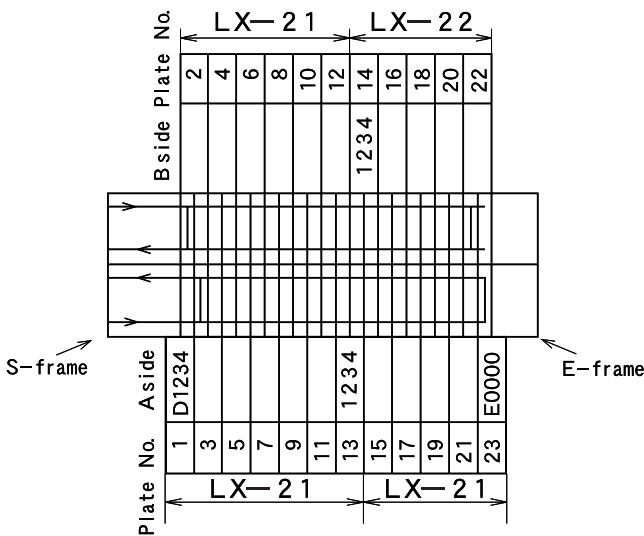


Fig.8.13 1 series and mixed arrangement

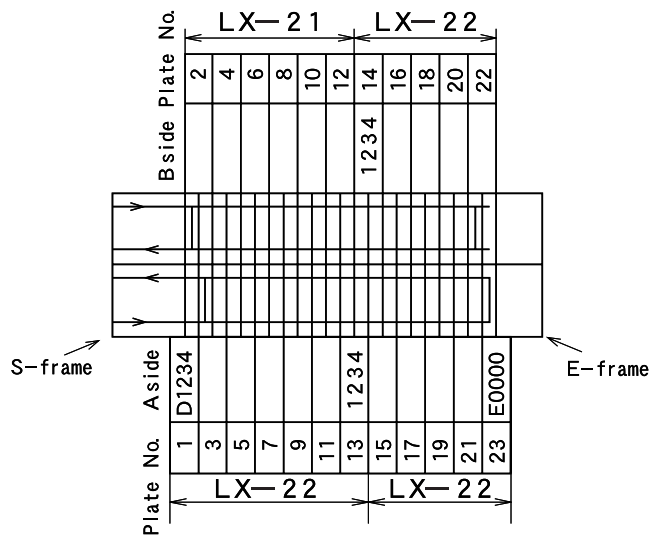


Fig.8.14 Mixed and 1 series arrangement

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	RX-97	RX-93, RX-94
UX-29	UX-21, UX-22	LX-19	LX-11, LX-12	RX-98	RX-92, RX-94
UX-39	UX-31, UX-32	LX-29	LX-21, LX-22	SX-47	SX-41, SX-44
UX-49	UX-41, UX-42	LX-49	LX-41, LX-42	SX-48	SX-43, SX-41
UX-69	UX-61, UX-62	LX-59	LX-51, LX-52	SX-49	SX-43, SX-45
UX-89	UX-81, UX-82	RX-09	RX-01, RX-02	SX-77	SX-71, SX-74
UX-88	UX-83, UX-84	RX-18	RX-13, RX-14	SX-87	SX-83, SX-84
UX-99	UX-91, UX-92	RX-19	RX-11, RX-12	SX-88	SX-84, SX-82
UX-107	UX-103, UX-104	RX-39	RX-31, RX-32	SX-99	SX-91, SX-92
UX-108	UX-104, UX-102	RX-59	RX-51, RX-52	SX-98	SX-94, SX-92
UX-137	UX-133, UX-134	RX-79	RX-71, RX-72	SX-97	SX-93, SX-94
				SX-96	SX-91, SX-93

9

TROUBLE SHOOTING

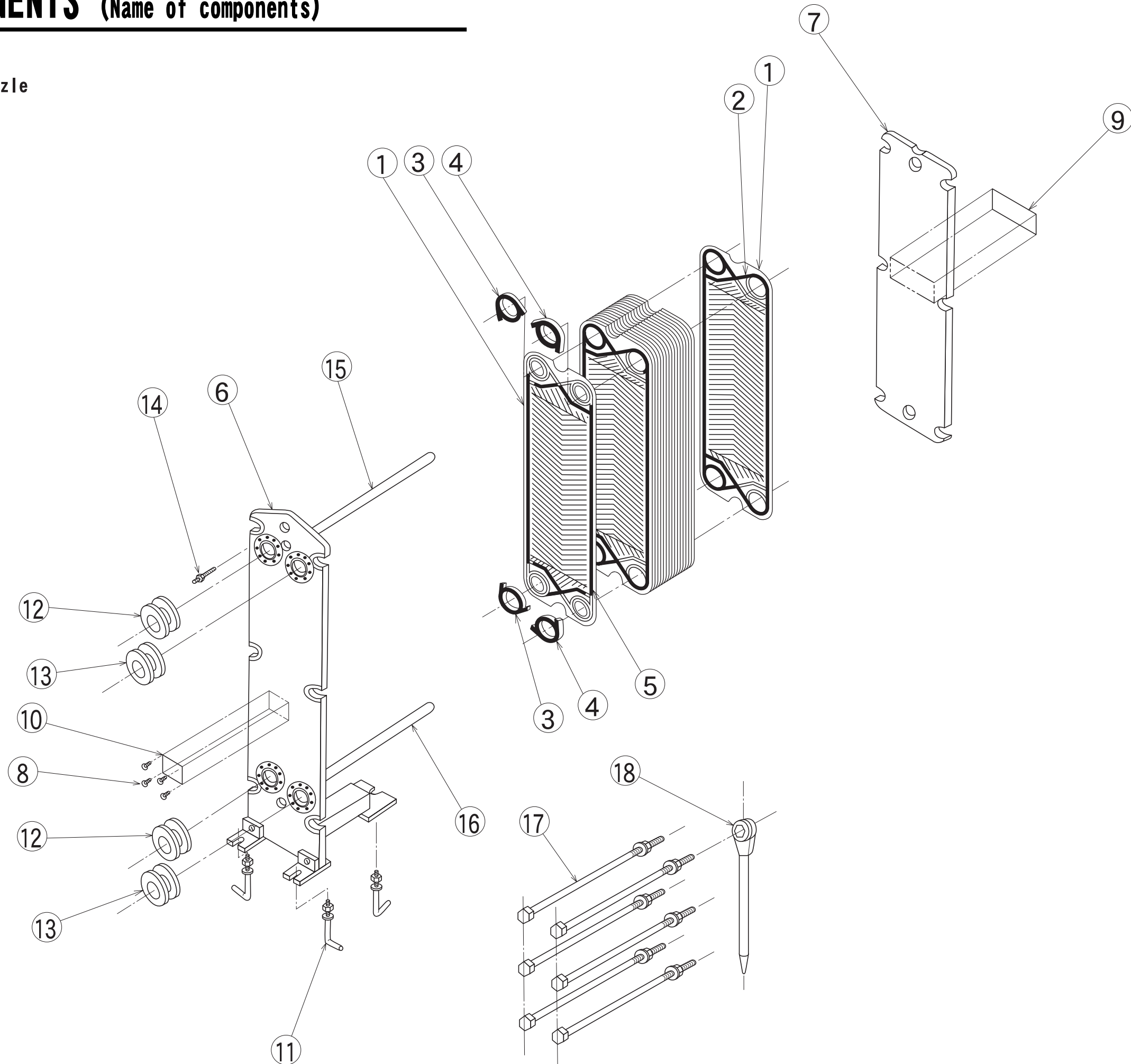
Fault detection	Possible causes	Actions	Pages to be referred
Lower heat transfer performance	Fouling on heat transfer surface	Clean the plates for removal of scales.	2 0
Lower flow performance	Blockage of port hole and fouling on heat transfer surface		2 1
Leakage from between the plates	(1) Inadequate 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 plates are assembled upside down.	Rearrange the wrong plates in the correct order. In this case, check each plate for gasket 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 on the gasket seal surface.	Wipe off the seal surface with a clean cloth.	2 0
	(6) Gasket overriding	Glue the gasket.	2 4
Leakage between plate and S-frame	(1) Damaged D-plate gasket	Replace the gasket.	2 1 2 5 · 2 6
	(2) Damaged rubber boot	Replace the rubber boot.	9 3 6~3 8
	(3) Damaged D-plate	Replace the damaged plate.	2 1 2 5 · 2 6
	(4) Damaged S-nozzle mount	In the case of metal boot, replace the complete S-frame 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 the gasket.	2 1 2 6																																																																																																																																																										
	(2) Damaged rubber boot	Replace the rubber boot.	9 3 6~3 8																																																																																																																																																										
	(3) Damaged E-plate	Replace the damaged plate.	2 1~2 4																																																																																																																																																										
	(4) Damaged E-nozzle mount	In the case of metal boot, replace in complete E-frame set.	9 3 6~3 8																																																																																																																																																										
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 in the below table. (Removal of only damaged plate disables.) Correct plate arrangement.	2 1 2 7~3 3 3 5																																																																																																																																																										
				<table border="1"> <thead> <tr> <th>Type</th> <th>Equivalent length to two removed plates</th> <th>Type</th> <th>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>RX-90</td><td>9mm</td></tr> <tr><td>UX-10</td><td>6mm</td><td>SX-40</td><td>6mm</td></tr> <tr><td>UX-20</td><td>7mm</td><td>SX-70</td><td>6mm</td></tr> <tr><td>UX-30</td><td>6mm</td><td>SX-90</td><td>8mm</td></tr> <tr><td>UX-40</td><td>8mm</td><td>SX-90M</td><td>8mm</td></tr> <tr><td>UX-60</td><td>11mm</td><td>SX-90L</td><td>8mm</td></tr> <tr><td>UX-80</td><td>10mm</td><td>FX-01</td><td>8mm</td></tr> <tr><td>UX-90</td><td>10mm</td><td>FX-03</td><td>8mm</td></tr> <tr><td>UX-100/130</td><td>10mm</td><td>FX-05</td><td>9mm</td></tr> <tr><td>LX-00</td><td>8mm</td><td>YX-80</td><td>12mm</td></tr> <tr><td>LX-10</td><td>9mm</td><td>GX-20</td><td>22mm</td></tr> <tr><td>LX-20</td><td>11mm</td><td>WX-50(per cassette)</td><td>8mm</td></tr> <tr><td>LX-30</td><td>10mm</td><td>WX-90(per cassette)</td><td>10mm</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	RX-90	9mm	UX-10	6mm	SX-40	6mm	UX-20	7mm	SX-70	6mm	UX-30	6mm	SX-90	8mm	UX-40	8mm	SX-90M	8mm	UX-60	11mm	SX-90L	8mm	UX-80	10mm	FX-01	8mm	UX-90	10mm	FX-03	8mm	UX-100/130	10mm	FX-05	9mm	LX-00	8mm	YX-80	12mm	LX-10	9mm	GX-20	22mm	LX-20	11mm	WX-50(per cassette)	8mm	LX-30	10mm	WX-90(per cassette)	10mm	LX-40	12mm			LX-50	10mm			<table border="1"> <thead> <tr> <th>Type</th> <th>Equivalent length to two removed plates</th> <th>Type</th> <th>Equivalent length to two removed plates</th> </tr> </thead> <tbody> <tr><td>RX-00</td><td>7mm</td><td></td><td></td></tr> <tr><td>RX-10</td><td>7mm</td><td></td><td></td></tr> <tr><td>RX-30</td><td>7mm</td><td></td><td></td></tr> <tr><td>RX-70</td><td>9mm</td><td></td><td></td></tr> <tr><td>RX-90</td><td>9mm</td><td></td><td></td></tr> <tr><td>SX-40</td><td>6mm</td><td></td><td></td></tr> <tr><td>SX-70</td><td>6mm</td><td></td><td></td></tr> <tr><td>SX-90</td><td>8mm</td><td></td><td></td></tr> <tr><td>SX-90M</td><td>8mm</td><td></td><td></td></tr> <tr><td>SX-90L</td><td>8mm</td><td></td><td></td></tr> <tr><td>FX-01</td><td>8mm</td><td></td><td></td></tr> <tr><td>FX-03</td><td>8mm</td><td></td><td></td></tr> <tr><td>FX-05</td><td>9mm</td><td></td><td></td></tr> <tr><td>YX-80</td><td>12mm</td><td></td><td></td></tr> <tr><td>GX-20</td><td>22mm</td><td></td><td></td></tr> <tr><td>WX-50(per cassette)</td><td>8mm</td><td></td><td></td></tr> <tr><td>WX-90(per cassette)</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	RX-00	7mm			RX-10	7mm			RX-30	7mm			RX-70	9mm			RX-90	9mm			SX-40	6mm			SX-70	6mm			SX-90	8mm			SX-90M	8mm			SX-90L	8mm			FX-01	8mm			FX-03	8mm			FX-05	9mm			YX-80	12mm			GX-20	22mm			WX-50(per cassette)	8mm			WX-90(per cassette)	10mm		
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10 MAIN COMPONENTS (Name of components)

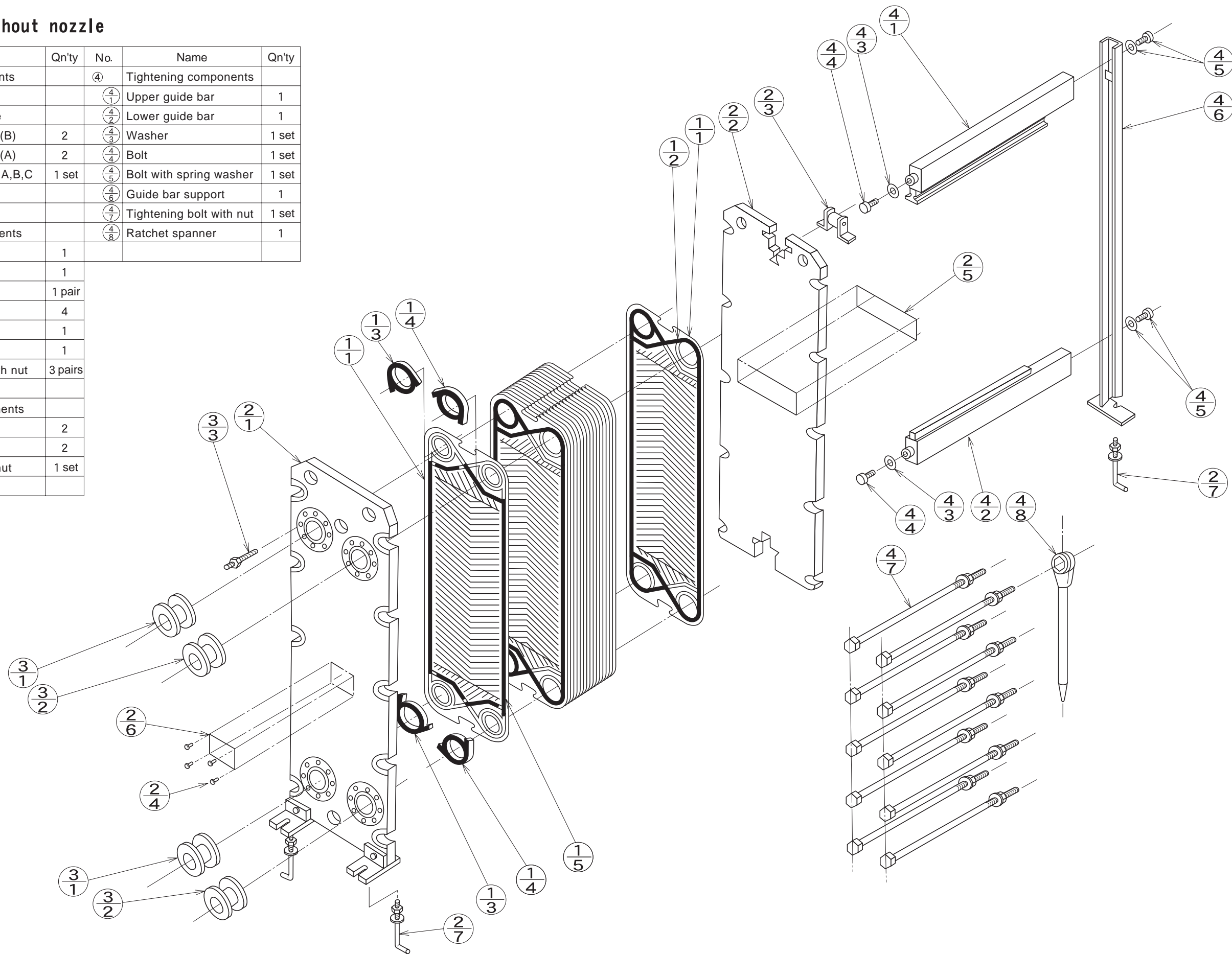
1. NJ Type without nozzle

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



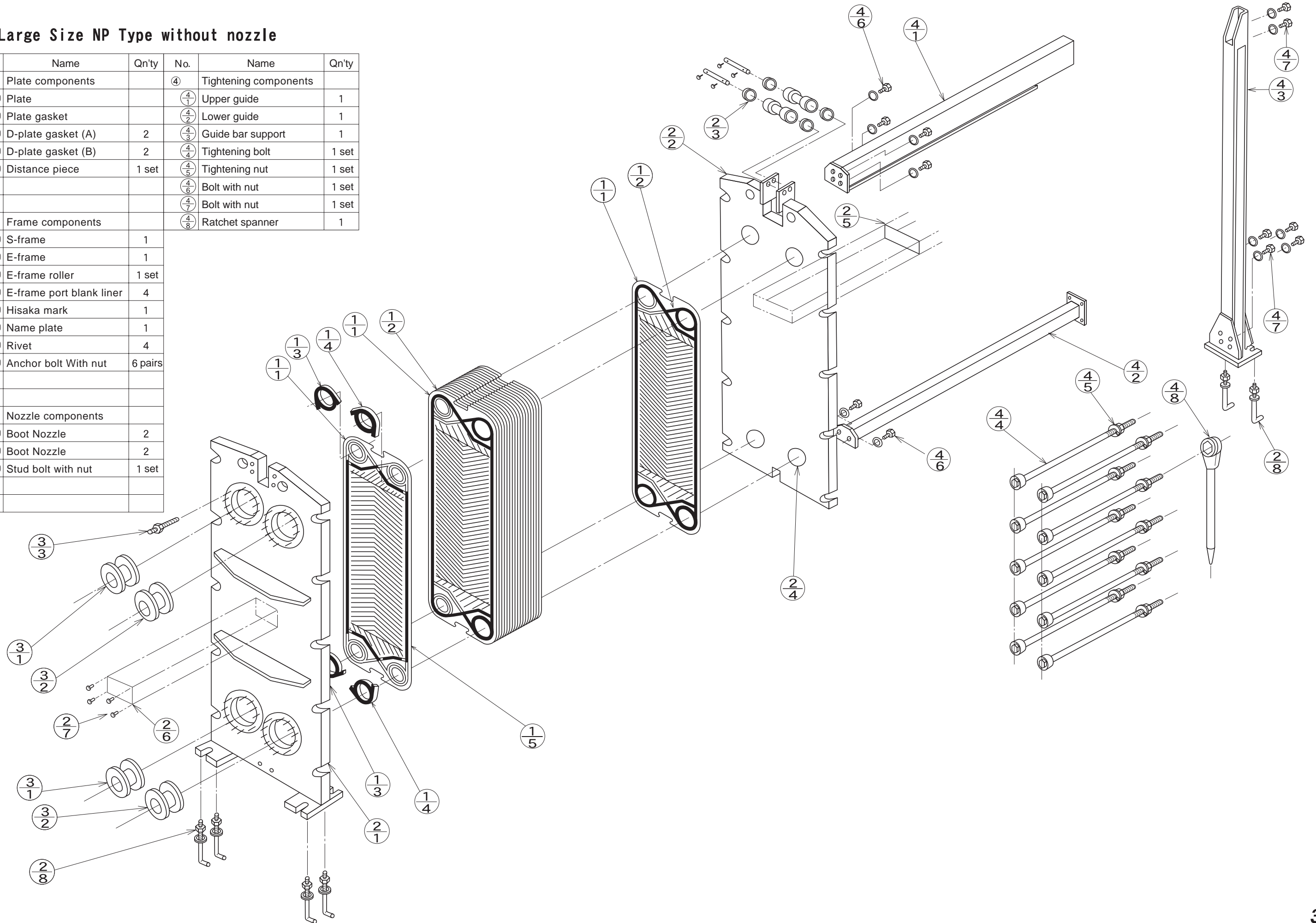
2. NP Type without nozzle

No.	Name	Qn'ty	No.	Name	Qn'ty
①	Plate components		④	Tightening components	
①/1	Plate		④/1	Upper guide bar	1
①/2	gasket for plate		④/2	Lower guide bar	1
①/3	D-plate gasket (B)	2	④/3	Washer	1 set
①/4	D-plate gasket (A)	2	④/4	Bolt	1 set
①/5	Distance piece A,B,C	1 set	④/5	Bolt with spring washer	1 set
			④/6	Guide bar support	1
			④/7	Tightening 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 pair			
②/4	Rivet	4			
②/5	Hisaka Mark	1			
②/6	Name plate	1			
②/7	Anchor bolt With nut	3 pairs			
③	Nozzle components				
③/1	Boot Nozzle	2			
③/2	Boot Nozzle	2			
③/3	Stud bolt with nut	1 set			



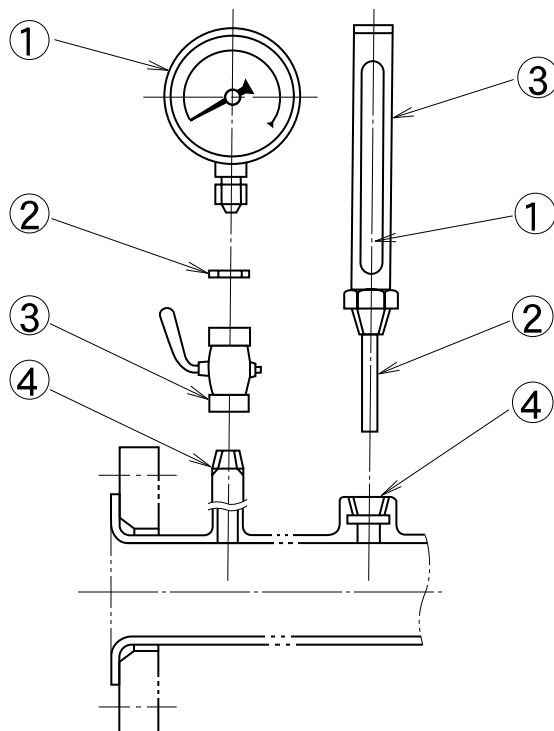
3. Large Size NP Type without nozzle

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)



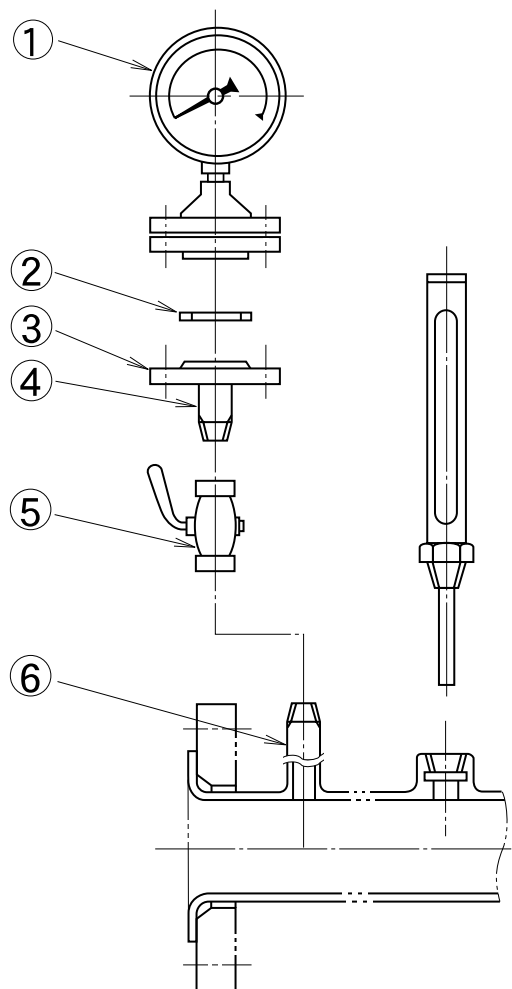
1. Thermometer for standard option

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

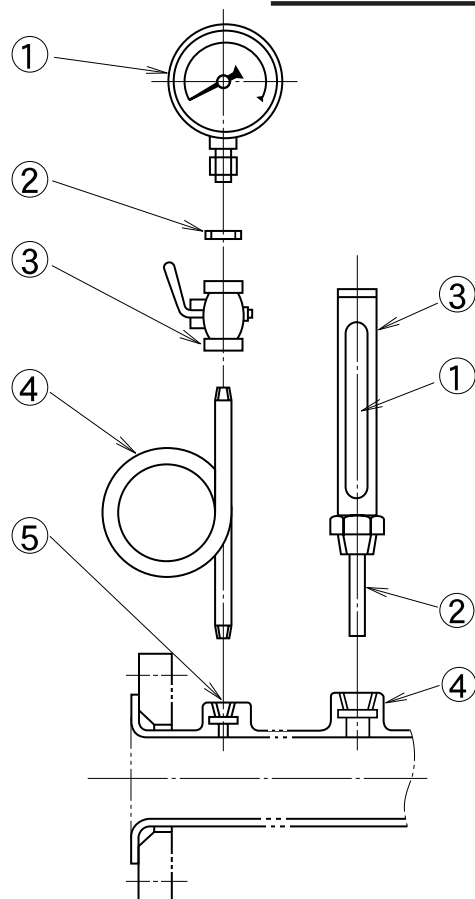
(Note) * Material and gradations range depend on actual service conditions.



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	V / # 6501	φ 14 dia. × φ 6 dia. × t 2
3	Gauge cock	1	C 3600	PF3/8 inside thread
4	Return pipe	1	S G P	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, is ISO9001 certified for its quality management system for all products including plate type heat exchangers.

Hisaka Works, Ltd., is ISO14001 certified for its environmental management system.



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