



Manufacturer

TLV. CO., LTD.

Kakogawa, Japan

is approved by LRQA LTD. to ISO 9001/14001



Instruction Manual

Steam Condensing
Heat Exchanger
SR-3 / SR-8

Introduction

Thank you for purchasing the **TLV** SR Steam Condensing Heat Exchanger.

This product has been thoroughly inspected before being shipped from the factory. When the product is delivered, before doing anything else, check the specifications and external appearance to make sure nothing is out of the ordinary. Also be sure to read this manual carefully before use and follow the instructions to be sure of using the product properly.

If detailed instructions for special order specifications or options not contained in this manual are required, please contact **TLV** for full details.

This instruction manual is intended for use with the model(s) listed on the front cover. It is necessary not only for installation but for subsequent maintenance and troubleshooting. Please keep it in a safe place for future reference.





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Safety Considerations


- Read this section carefully before use and be sure to follow the instructions.
- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- The precautions listed in this manual are designed to ensure safety and prevent equipment damage and personal injury. For situations that may occur as a result of erroneous handling, three different types of cautionary items are used to indicate the degree of urgency and the scale of potential damage and danger: DANGER, WARNING and CAUTION.
- The three types of cautionary items above are very important for safety: be sure to observe all of them as they relate to installation, use, maintenance, and repair. Furthermore, TLV accepts no responsibility for any accidents or damage occurring as a result of failure to observe these precautions.

Symbols

	Indicates a DANGER, WARNING or CAUTION item.
	Indicates an urgent situation which poses a threat of death or serious injury
	Indicates that there is a potential threat of death or serious injury
	Indicates that there is a possibility of injury or equipment / product damage

	Install properly and DO NOT use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions that may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.
	Use hoisting equipment for heavy objects (weighing approximately 20 kg or more). Failure to do so may result in back strain or other injury if the object should fall.
	Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.
	When disassembling or removing accessories used with the product, wait until the internal pressure equals atmospheric pressure and the surface of the product has cooled to room temperature. Disassembling or removing accessories from the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.

Safety considerations continued on next page.

 CAUTION	<p>Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way. Failure to observe these precautions may result in damage to the product and burns or other injury due to malfunction or the discharge of fluids.</p> <p>Do not use excessive force when connecting threaded pipes to the product. Over-tightening may cause breakage leading to fluid discharge, which may cause burns or other injury.</p> <p>In case of unexpected steam flow, connect piping from the exhaust outlet to a safe area. Unexpectedly high steam volumes may cause high-temperature condensate to be discharged through the exhaust outlet, which may in turn cause burns or other injury.</p> <p>Operate valves slowly and carefully. Opening or closing valves too quickly may cause water hammer to occur, the impact of which could cause damage to equipment.</p> <p>Use only under conditions in which no freeze-up will occur. Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury. If the water seal or inside of the tube freeze, the inside of the product may be pressurized which could cause problems on equipment or devices that are connected to the product.</p>
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Product Description

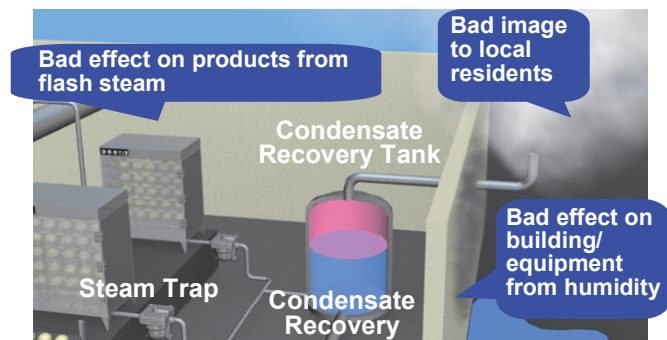
Intended Use

The SR-3/SR-8 is an atmospheric indirect heat exchanger for recovering heat energy from waste or flash steam for applications where the steam cannot otherwise be utilized. By using this product for waste heat recovery or steam condensation, system energy efficiency, work environment, and plant scenery can be improved without increasing back pressure on steam-using equipment.

Usages

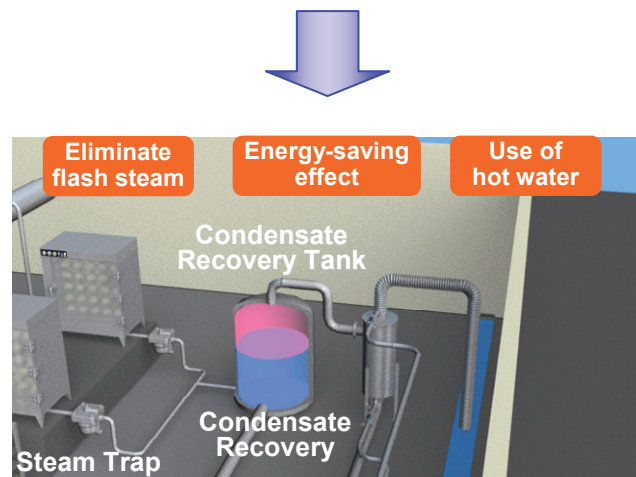
- Flash steam from applications such as steamers, sterilizers and vulcanizers where the steam cannot otherwise be utilized and released to the atmosphere
- Flash steam escaping from hot water/processing tanks
- Flash steam escaping from condensate tanks into the atmosphere

NOTE: Limited to applications in which steam incorporates no air or non-condensable gases.



Improvement effect

- Lower system steam usage by collecting unusable 100 °C steam and employing it in processes such as water heating which previously used main line steam
- Improves work environment and plant scenery by eliminating clouds of steam generated around the plant
- Because waste steam processing can be carried out indoors, it is not necessary to construct outdoor duct piping; further reducing costs



System Principle

Because the SR-3/SR-8 Steam Condensing Heat Exchanger does not have any valve parts on the Waste Steam Recovery side, it does not create any back-pressure on upstream equipment.

For this reason, it can be directly connected to and used with feed water tanks and other vessels that do not meet pressure vessel regulations.

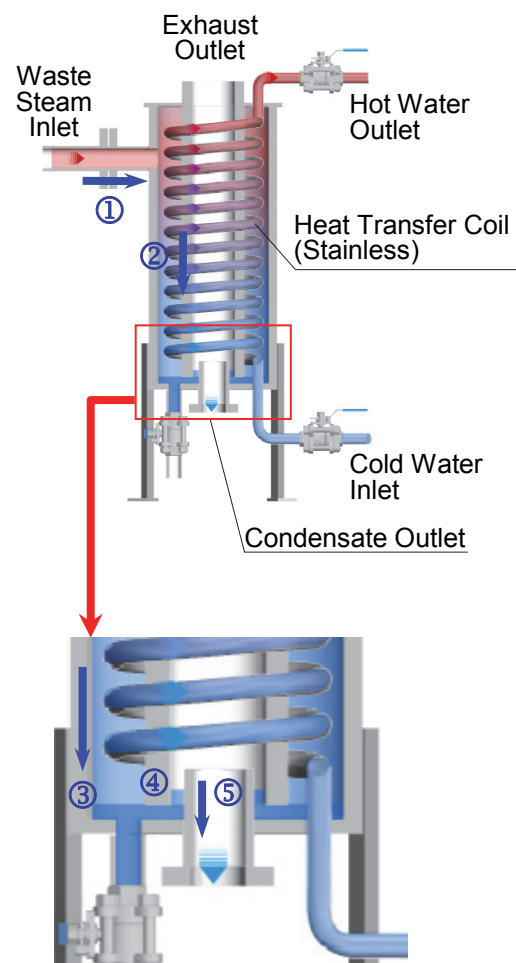
Concerning the construction of the unit, there is a condensate outlet in the base of the heat exchanger. This allows a water seal to be maintained which directly prevents steam leakage. Thus, with a similar construction to closed type heat exchangers, it can ensure an equivalent level of high efficiency heat exchange.

<Operation flow of Steam Condensing Heat Exchanger SR-3/SR-8 (hereafter, SR)>

- ① Waste steam flows into the SR from equipment connected to the steam inlet.
- ② Waste steam which has flowed into the SR (shell side) transfers heat to cold water inside the heat transfer coil.
- ③ Upon transferring heat the waste steam condenses and drips down to collect in the base of the SR.

Furthermore, since condensing steam inside an airtight space produces a fall in pressure, the inside of the SR is maintained at atmospheric pressure or a very slight vacuum (-0.5 kPaG) which ensures a smooth influx of waste steam.

- ④ Condensate accumulated in the base of the tank seals the outlet, and it becomes similar in structure to a pseudo closed type heat exchanger
- ⑤ Furthermore, after waste steam transfers heat away and becomes condensate, it overflows and is discharged to the outside
- ⑥ If the cold water flow rate decreases, or else the ability of the cold water to absorb heat is surpassed causing an influx of waste steam; even if waste steam accumulates inside the SR and the pressure begins to rise; the instant that the pressure rises above 0.5 kPaG (a water seal with 50mm of head pressure) the water seal will be broken and waste steam will be discharged to the atmosphere through the exhaust outlet.
(pressure will not accumulate inside the unit)



Specifications



Install properly and **DO NOT** use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions which may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.



Use only under conditions in which no freeze-up will occur. Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury. If the water seal or inside of the tube freeze, the inside of the product may be pressurized which could cause problems on equipment or devices that are connected to the product.

Refer to the product nameplate or submitted drawings for detailed specifications. Do not install valves or orifices at the exhaust outlet, since the SR is an atmospheric type heat exchanger.

Specifications

Model	SR-3	SR-8
Maximum Heat Recovery Capacity	Approx. 670 MJ/h	Approx. 1,800 MJ/h
Maximum Steam Flow Rate	300 kg/h	800 kg/h
Heat Transfer Surface Area	Approx. 2.0 m ²	Approx. 5.4 m ²
Standard Material	Body	Stainless Steel SUS304 (ASI304)
	Heat Transfer Coil	
Max. Operating Pressure (PMO)	Body (Shell Side)	0 MPaG
	Coil (Tube Side)	1.0 MPaG
Max. Operating Temp. (TMO)	Body (Shell Side)	100 °C
	Coil (Tube Side)	
Max. Allowable Pressure (PMA)*	Body (Shell Side)	0.5. MPaG
	Coil (Tube Side)	2.0 MPaG
Max. Allowable Temp. (TMA)*	Body (Shell Side)	158 °C
	Coil (Tube Side)	180 °C
Maximum Operating Water Pressure	1.0 MPaG	
Maximum Operating Water Temperature	100 °C	

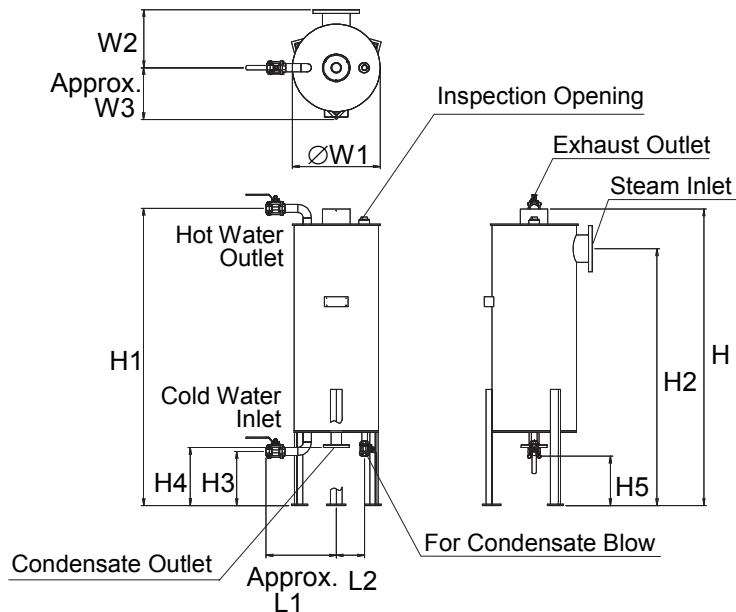
*Maximum Allowable Pressure (PMA) and Maximum Allowable Temperature (TMA) are PRESSURE SHELL DESIGN CONDITIONS, NOT OPERATING CONDITIONS.

Connections

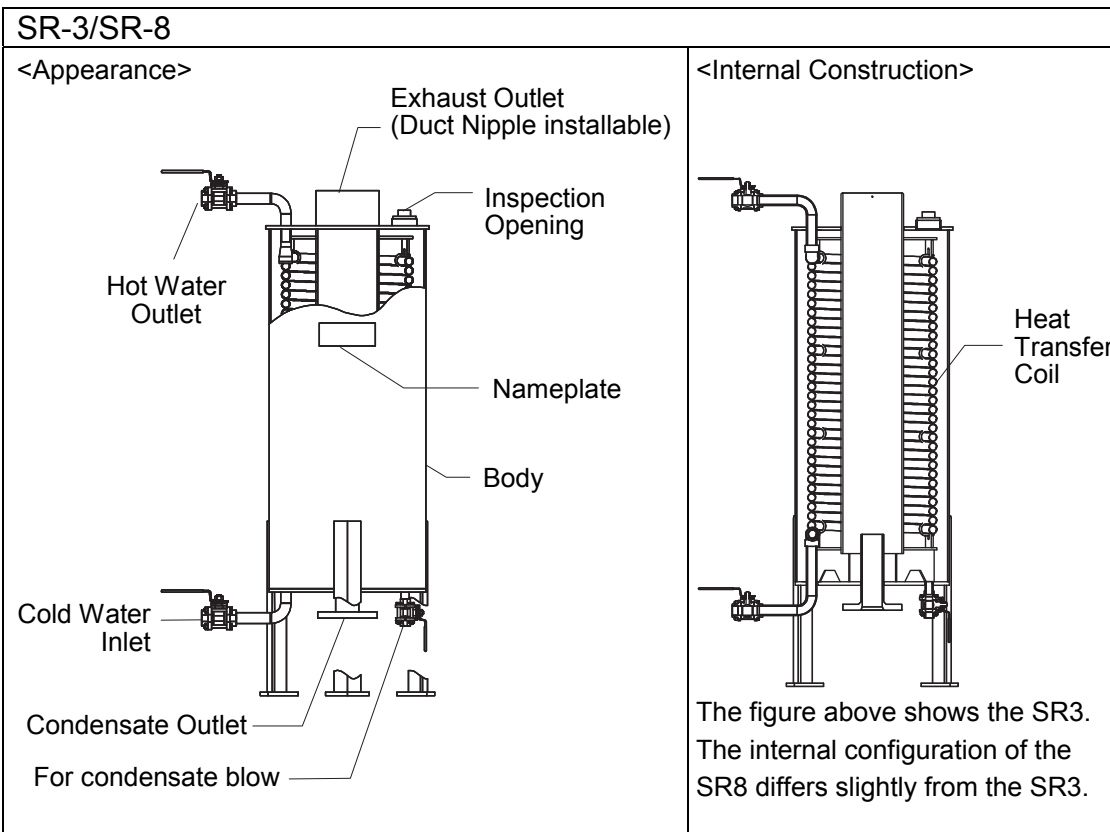
Model	Pipe Diameter (mm) / Connections					Weight (kg)	
	Steam Inlet	Condensate Outlet	For Condensate Blow	Cold/Hot water Inlet/Outlet	Exhaust Outlet	Tank empty	Tank full
SR-3	80 JIS10KFF ASME150RF	50 JIS10KFF ASME150RF	15 Rc(PT) ¹ / ₂ NPT ¹ / ₂	20 Rc(PT) ³ / ₄ NPT ³ / ₄	150 Duct nipple installable	Approx. 140	Approx. 160
SR-8	150 JIS10KFF ASME150RF		25 Rc(PT)1 NPT1	40 Rc(PT) ¹ / ₂ NPT ¹ / ₂			

Dimensions (Unit: mm)

Mode I	L1	L2	H	H1	H2	H3	H4	H5	W1	W2	W3
SR-3	370	150	1300	1280	1100	200	200	180	426	300	260
SR-8	420	170	1800	1790	1550	320	350	300	528	350	310



Configuration



Installation



Install properly and **DO NOT** use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions which may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.



In case of unexpected steam flow, connect piping from the exhaust outlet to a safe area. Unexpectedly high steam volumes may cause high-temperature condensate to be discharged through the exhaust outlet, which may in turn cause burns or other injury.



Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.



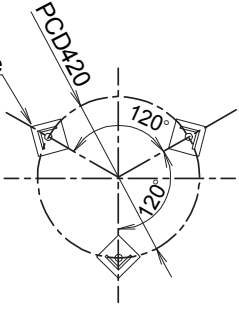
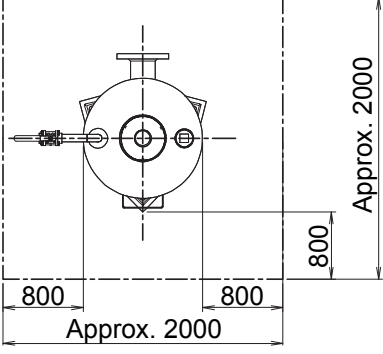
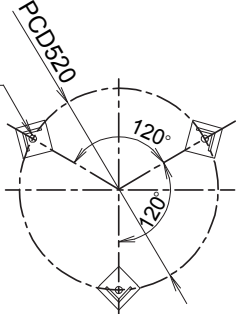
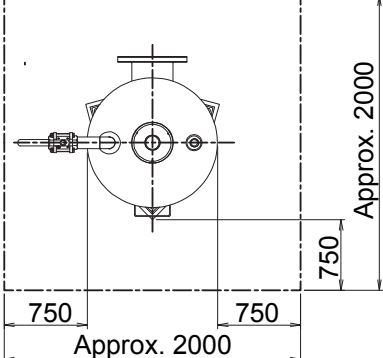
Do not use excessive force when connecting threaded pipes to the product. Over-tightening may cause breakage leading to fluid discharge, which may cause burns or other injury.

Precautions before Installation

Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.

For the specific installation location of the SR, carefully consult the user. Confirm the following items for the installation.

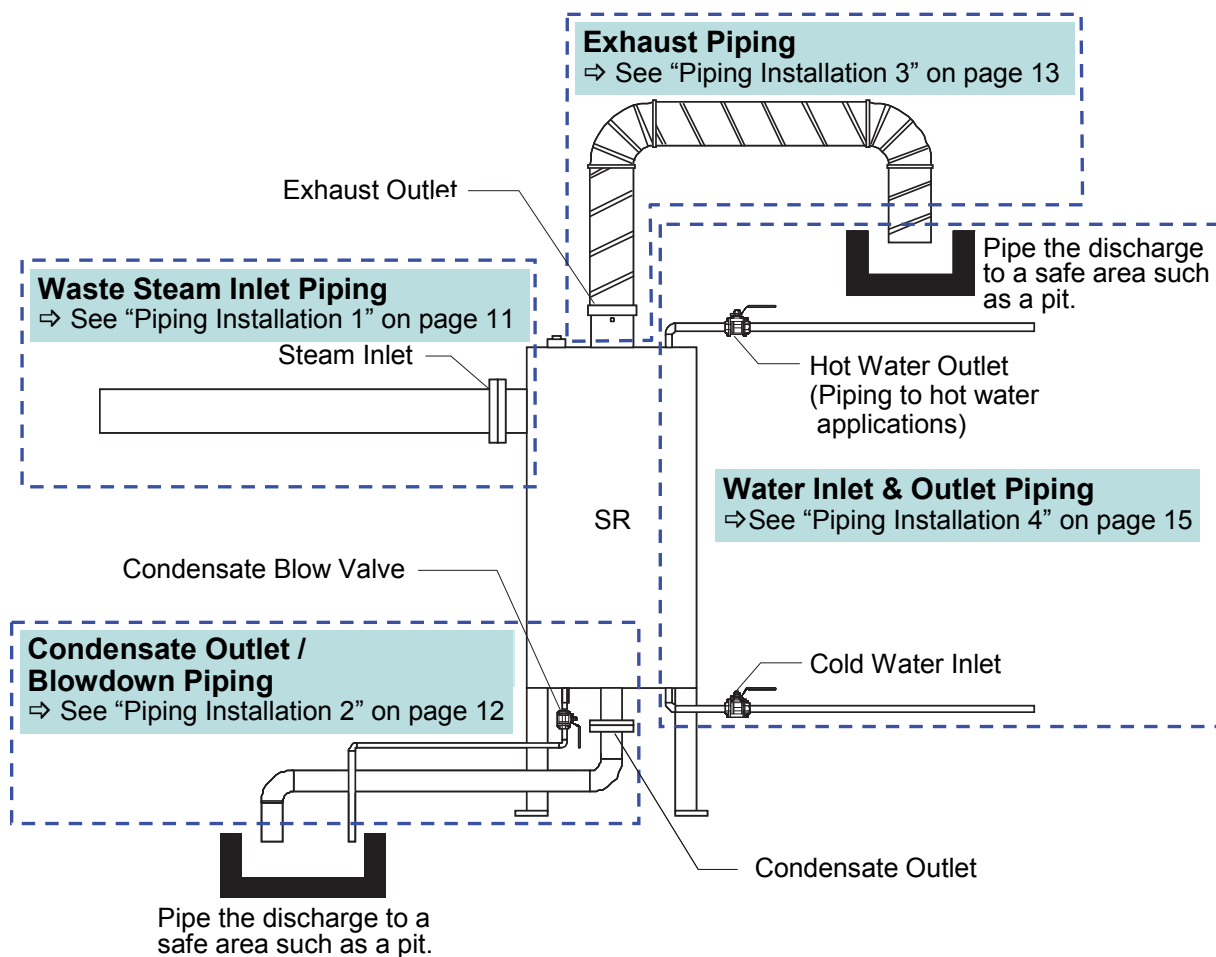
1. Before installing the SR, carefully discuss and ensure the installation and piping method.
2. Do not install the SR near a stairway or emergency exit.
3. The surface for installation of the SR should be sturdy and horizontal.
As the SR is heavy equipment, anchor the legs securely on a strong and horizontal foundation using the anchor bolts. (Dimension of anchor bolts: M16) (Refer to the illustration on the next page regarding the position for anchor bolts and number of anchor bolts required.)
4. For cases where people or products may come in contact with the SR unit, any safety measures, such as insulation or isolation, should be implemented to prevent injury.
Even if such contact is unlikely, it is recommended that the SR unit be as well insulated as possible to increase heat efficiency.
5. Maintenance space should be secured.
Although the SR cannot be disassembled, maintenance space should be secured for valves, etc.
(Refer to the illustration on the next page regarding maintenance space.)
6. If the SR is installed at height, make sure to install the SR such that there is enough space to carry out maintenance work etc. with anti-drop measures such as handrails having been implemented. We may not be able to perform technical support service in a location where work cannot be safely carried out.

	Position for anchor bolts	Maintenance Space (mm)
<p>SR-3</p>	 <p>3 - ø19 bolt hole</p> <p>PCD420</p> <p>120°</p> <p>120°</p> <p>Anchor bolts: M16 Total length: 80 mm 3 pcs.</p>	 <p>Approx. 2000</p> <p>800</p> <p>800</p> <p>Approx. 2000</p>
<p>SR-8</p>	 <p>3 - ø19 bolt hole</p> <p>PCD520</p> <p>120°</p> <p>120°</p> <p>Anchor bolts: M16 Total length: 220 mm 3 pcs.</p>	 <p>Approx. 2000</p> <p>750</p> <p>750</p> <p>Approx. 2000</p>

Anchor bolts are selected with standard seismic intensity: 1, and horizontal seismic coefficient: 1.

Installation example for piping to/from the SR unit

Please carefully refer to the "Piping Installation" section described on pages 11 – 15 for important points regarding piping arrangements.

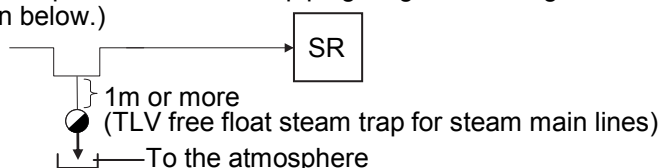


Piping Installation 1. Waste Steam Inlet Piping:

Make sure that the steam piping to the SR is installed with no condensate accumulation points (places where piping rises or falls). (This may cause water hammer or an increase in back pressure due to the water seal.)

If condensate accumulates because of the piping shape, install a steam trap at the point that condensate accumulates. Do not allow a rise in the piping at the trap outlet and direct the outlet to the atmosphere.

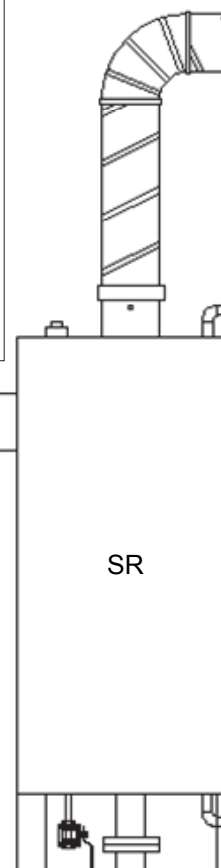
(To allow head pressure to discharge condensate in the absence of differential pressure, construct piping length according to the illustration below.)



Steam Inlet

If the steam recovery source is a feed water tank or other "non pressure vessel", do not install valves, check valves, etc. on the steam piping. (Influenced by pressure vessel regulation.)

(This does not apply if the steam recovery source is a pressure vessel.)



Other cautions

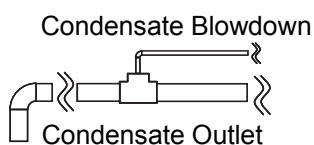
The piping diameter should be sized so that the flow velocity of steam is approximately 20 m/sec.

To handle steam without applying back pressure on steam-using equipment, it is recommended that the piping be of the same diameter as the SR steam inlet (SR-3: 80 mm, SR-8: 150 mm). Suggested diameters for the steam inlet piping are as follows:

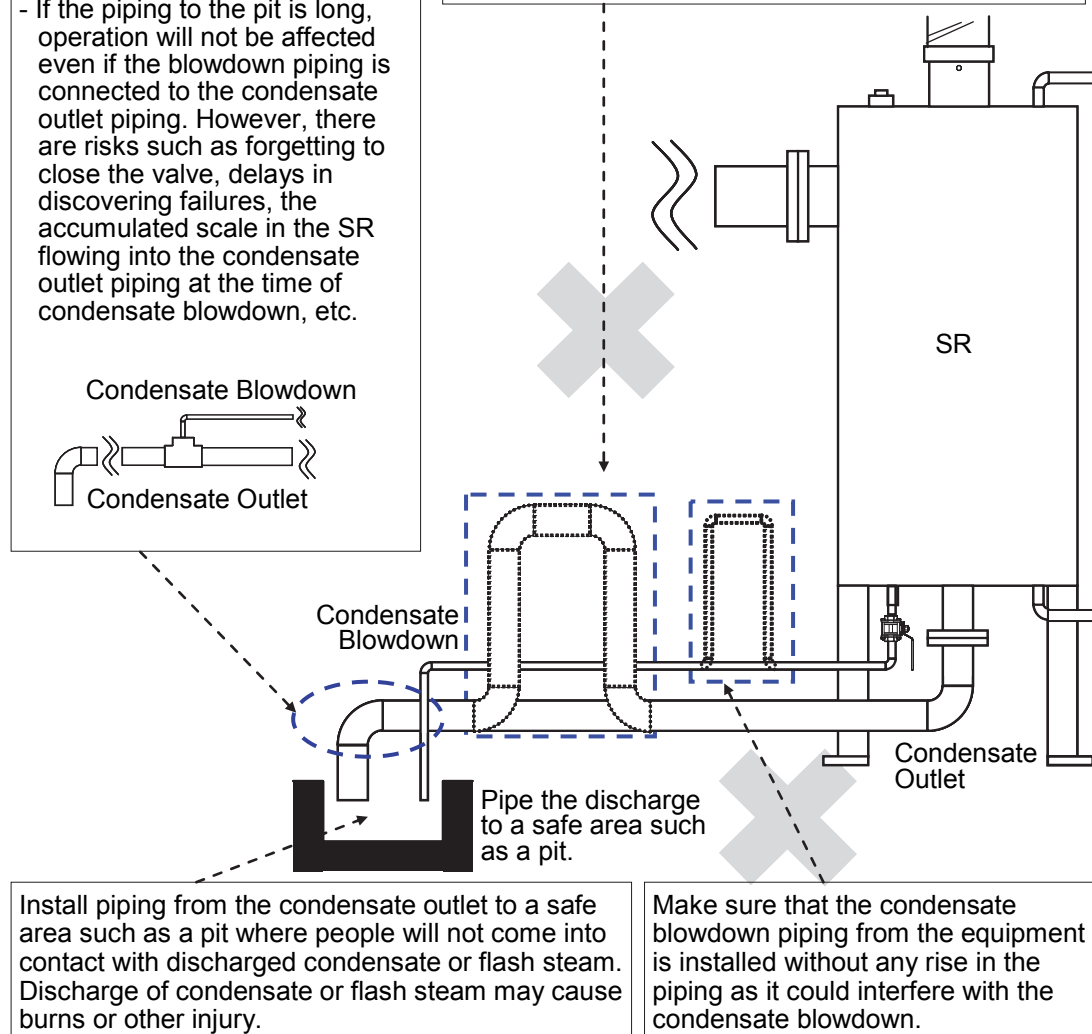
Steam Flow (kg/h)	50	100	150	200	300	400	500	600	800
Pipe Diameter (mm)	40	50	50	80	80	100	100	125	150

Piping Installation 2. Condensate Outlet/Blowdown Piping:

- Install separate condensate outlet piping and condensate blowdown piping leading to a safe area such as a pit .
- If the piping to the pit is long, operation will not be affected even if the blowdown piping is connected to the condensate outlet piping. However, there are risks such as forgetting to close the valve, delays in discovering failures, the accumulated scale in the SR flowing into the condensate outlet piping at the time of condensate blowdown, etc.



Make sure that the condensate outlet piping from the equipment is installed without any rise in the piping as the back pressure could interfere with the normal operation of the SR.



Install piping from the condensate outlet to a safe area such as a pit where people will not come into contact with discharged condensate or flash steam. Discharge of condensate or flash steam may cause burns or other injury.

Make sure that the condensate blowdown piping from the equipment is installed without any rise in the piping as it could interfere with the condensate blowdown.

Other cautions

When back pressure is applied to the SR, it also affects the upstream equipment from which waste steam is recovered.

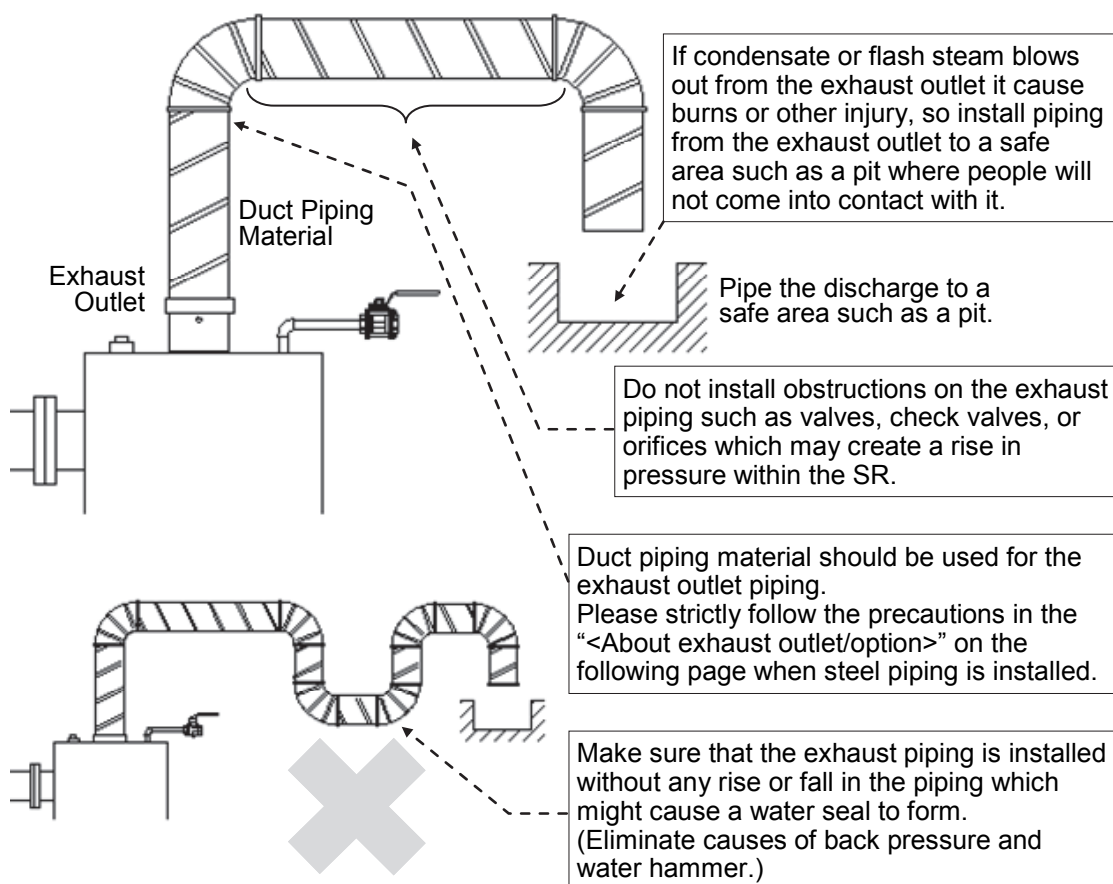
Even though piping with the same diameter as the condensate outlet piping of the SR is recommended to prevent back pressure from being applied to the SR, it is possible to use a smaller pipe diameter depending on the length of the pipe to the pit or discharge destination.

Suggested diameters for the condensate outlet piping are as follows:

When the condensate outlet valve is installed, make sure to use either a full-bore ball valve or a gate valve so that back pressure does not interfere with the operation of the SR.

Pipe Length to Pit or Recovery Destination	Less than 10 m	10 m to 50 m	Greater than 50 m
Outlet Pipe Diameter	25 mm	40 mm	50 mm

Piping Installation 3. Exhaust Piping:



Other cautions

Be certain to connect exhaust piping to protect against instances of unexpectedly high-volume waste steam flow into the SR, which may cause waste steam/hot water to be discharged.

When back pressure is applied to the SR, it also affects the upstream equipment from which waste steam is recovered.

To prevent putting back-pressure on upstream equipment, make exhaust piping as large in diameter, short, and with as few bends as possible.

Even though piping with the same diameter as the exhaust piping of the SR is recommended to prevent putting back pressure on the SR, it is possible to use a smaller pipe diameter depending on the length of the pipe to the pit or recovery destination.

Suggested diameters for the exhaust piping are as follows:

Model	Length & Diameter of Exhaust Piping			
	Less than 10 m	10 m to 20 m	20 m to 30 m	Greater than 30 m
SR-3	50 mm	80 mm	100 mm	150 mm
SR-8	80 mm	100 mm	150 mm	

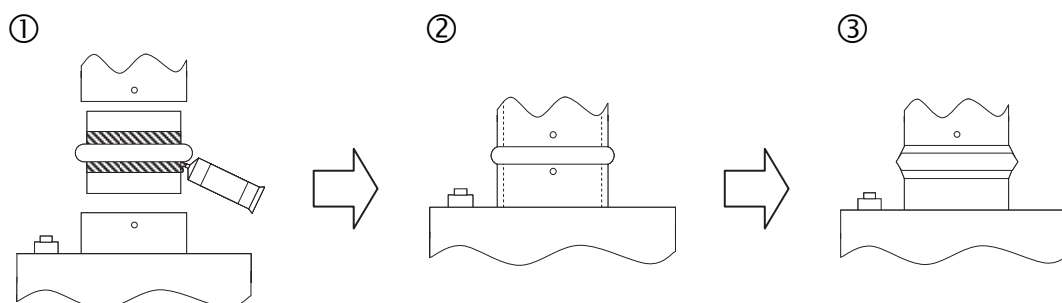
<Connecting the duct piping to the exhaust outlet>

The standard connection specification of the exhaust outlet for the SR is “duct piping installable”.

Nipple fittings should be used to connect the SR and the piping, making sure that there is no leakage.

<Piping example>

- ① All duct piping should withstand high temperatures of 100 °C.
Coat the nipple with duct sealant.
- ② Insert the nipple into the SR, then the duct piping into the nipple.
After everything is set in place, fix with screws (screw holes on the SR: M3 × 2 places).
- ③ After fixing with screws, wrap with two or three layers of tape that can withstand the required heat.

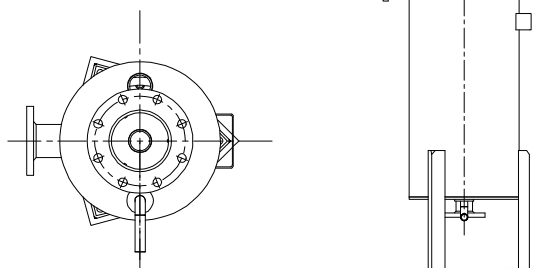


<About exhaust outlet / options>

The exhaust outlet of the SR can be produced with a flange connection as an option. However, specification changes after delivery cannot be accepted.

The exhaust piping should be **supported firmly, making sure to avoid excessive force on the SR.** (Excessive force may lead to damage to the SR.)

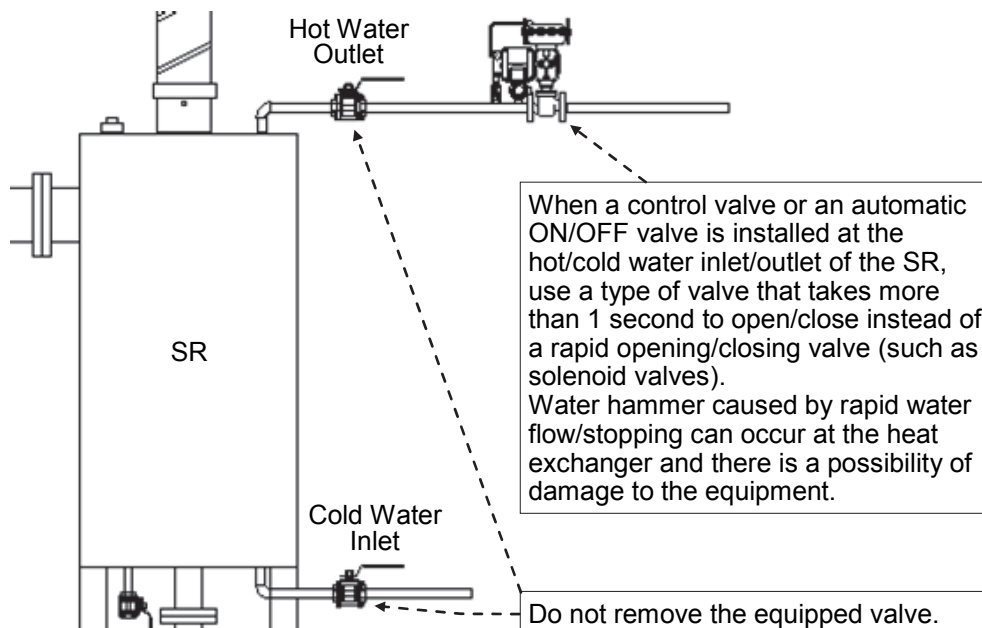
<Flange shape diagram>
SR-3/SR-8
Nominal diameter: 150



<In cases where the piping is welded directly to the exhaust outlet>

C3 chamfering has been performed on the exhaust outlet. When welding is performed on the exhaust outlet, the connecting tube should be also chamfered and butt welded. Furthermore, when SUS304 is used for the SR, the piping thickness of the exhaust outlet will be “Sch40”.

Piping Installation 4. Water Inlet and Outlet Piping:



Other cautions

Connect the cold water piping to the cold water inlet, and connect return piping from the hot water outlet to an area where the hot water can be utilized. To secure an adequate amount of cold feed water, make sure that the hydraulic pressure differential (pressure differential between inlet and outlet) is at least equal to the values in the following table. However, the water pressure must not exceed the maximum operating water pressure of 1.0 MPaG.

Required Cold Water (t/h)		1	2	3	4	5	6	8	10	12	14
Hydraulic Pressure Differential (MPa)	SR-3	0.03	0.11	0.23	0.40	0.62	—	—	—	—	—
	SR-8	—	—	0.03	0.05	0.07	0.10	0.17	0.27	0.38	0.60

(1 MPa = 10.197 kg/cm²)

The diameter of the pipe before and after the SR varies with the required amount of cold water, and it should be sized so that the velocity of cold water is 2 to 3 m/sec.

Suggested diameters for the cold water inlet and hot water outlet piping are as follows:

Water Flow (t/h)	1	2	3	4	5	6	7	8	10
Pipe Diameter (mm)	15	15	20	25	25	32	32	32	40

Operation



Install properly and **DO NOT** use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions which may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.



Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.



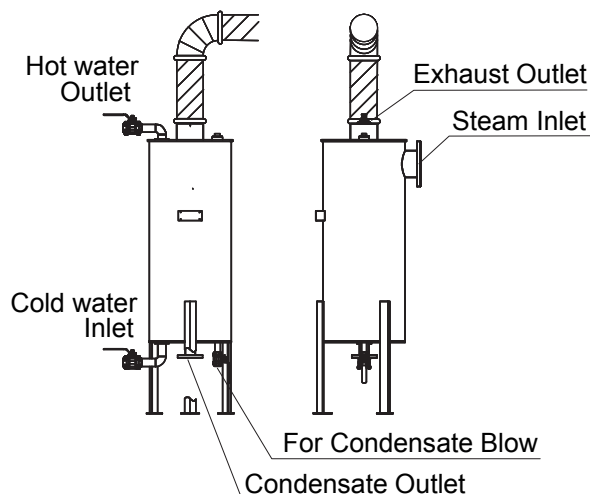
Operate valve slowly and carefully. Opening or closing valves too quickly may cause water hammer to occur, the impact of which could cause damage to equipment.

<To be performed after installation and before initial operation>

- Make sure to flush the piping to remove welding slag, metal powder and filings.
- Make sure that flange bolts etc. are securely tightened before passing steam/water through the SR.
- When conducting the test operation, start with a low steam and water flow rate and gradually increase the load to normal operating conditions. If you start with a normal operating load at the outset and there is a leak somewhere in the piping, there is a risk of steam or water blowing out.

<Startup>

1. Make sure that the blow valve in the base of the SR is closed.
 2. Open the cold water inlet valve and the hot water outlet valve, allowing water to pass through the SR. In cases where either TIC (temperature control of heated water) or FIC (flow control of heated water) is used, start up the controls.
 3. Open the condensate outlet valve, if any.
 4. Open the steam inlet valve, if any.
 5. Startup the equipment to allow waste steam to enter the SR.
- Make sure that there are no abnormal discharges from the exhaust outlet, such as blowing steam or condensate. If there is condensate blowing, or an abnormal sound or vibration, halt operation immediately.
 - The first time you operate the SR, or when operating with the condensate blow valve open, waste steam may be discharged to the atmosphere through the exhaust outlet immediately after initiating operation, due to the lack of pooled condensate in the base to create an airtight water seal over the condensate outlet. (if steam blow stops shortly then everything is normal)



<Shutdown>

1. Stop the equipment, making sure that there is no flow of waste steam.
2. Close the cold water inlet valve and the hot water outlet valve to stop the inflow of cold water. At this point, make sure to close the valve slowly not rapidly. (If the valve is closed rapidly, water hammer will occur, resulting in impacts to the SR and the surrounding piping.)
3. When the SR is to be shutdown for long periods of time, discharge all condensate by opening the blow valve at the bottom of the body.

Inspection and Maintenance



Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.



Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way. Failure to observe these precautions may result in damage to the product or burns or other injury due to malfunction or the discharge of fluids.

As the SR is an atmospheric type heat exchanger, there is no particular need to perform the kind of maintenance inspections required for pressure vessels. However, if the heat exchanging performance declines, verify that the cold water and steam flow quantity are in compliance with the rated capacities. If they are not in compliance, correct the flow quantities. If there are no irregularities with the flow quantities, perform the following inspection:

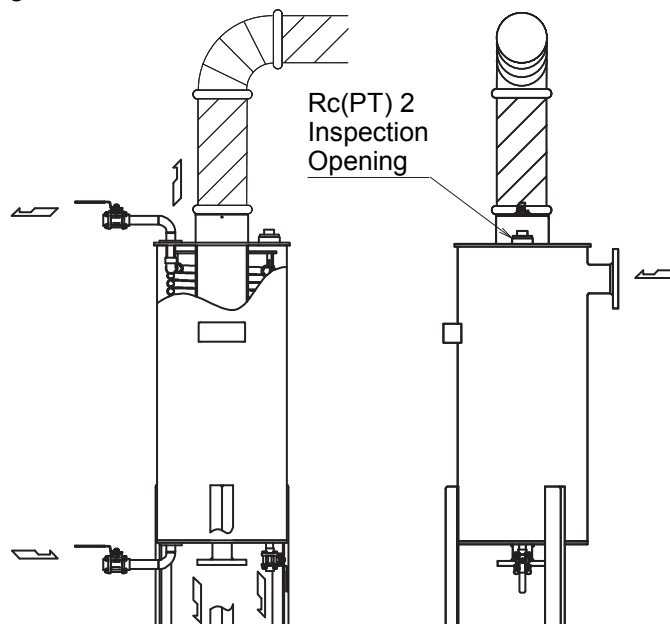
Annual inspection and cleaning is recommended to prolong the product's service life.

<Inspection at cold/hot water side>

1. Perform a reverse-flow chemical cleaning by pouring cleaning solution in through the hot water outlet valve on the SR, then discharging the solution through the cold water inlet valve.

<Inspection at steam side>

1. Remove the plug from the inspection opening and check the condition inside the tank.
2. If the inspection reveals heavy grime, close the condensate outlet and the condensate blowdown outlet and perform chemical cleaning by pouring cleaning solution through the exhaust outlet of the SR.



Troubleshooting



When disassembling or removing the product, wait until the internal pressure equals atmospheric pressure and the surface of the product has cooled to room temperature. Disassembling or removing the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.



Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way. Failure to observe these precautions may result in damage to the product or burns or other injury due to malfunction or the discharge of fluids.

When the product fails to operate properly, use the following table to locate and remedy the cause.

Problem	Cause	Remedy
Steam or condensate blows from the exhaust outlet	Little or no flow of cold water for heat recovery	Correct water flow
	Steam flow exceeds rated capacities	Control the flow or add another heat exchanger
	Accumulation of scale, etc. on the heat transfer coils	Clean
The heat-recovery water does not become hot	Not enough steam flow	Secure the proper steam flow
	Quantity of cold water for heat-recovery is too great	Reduce flow
	Accumulation of scale, etc. on the heat transfer coils	Clean
There is back-pressure on the steam-using equipment, or steam cannot be discharged smoothly	There is a clog in the waste steam inlet piping	Remove the clog Check piping arrangement
	Little or no flow of water for heat recovery	Correct water flow
	Accumulation of scale, etc. on the heat transfer coils	Clean
	Incorrect piping at exhaust outlet	Correct the piping; see page 14 (Piping Installation 3)

Product Warranty

1. Warranty Period
One year following product delivery.
2. Warranty Coverage
TLV CO., LTD. warrants this product to the original purchaser to be free from defective materials and workmanship. Under this warranty, the product will be repaired or replaced at our option, without charge for parts or labor.
3. This product warranty will not apply to cosmetic defects, nor to any product whose exterior has been damaged or defaced; nor does it apply in the following cases:
 - 1) Malfunctions due to improper installation, use, handling, etc., by other than TLV CO., LTD. authorized service representatives.
 - 2) Malfunctions due to dirt, scale, rust, etc.
 - 3) Malfunctions due to improper disassembly and reassembly, or inadequate inspection and maintenance by other than TLV CO., LTD. authorized service representatives.
 - 4) Malfunctions due to disasters or forces of nature.
 - 5) Accidents or malfunctions due to any other cause beyond the control of TLV CO., LTD.
4. Under no circumstances will TLV CO., LTD. be liable for consequential economic loss damage or consequential damage to property.

* * * * *

For Service or Technical Assistance:

Contact your **TLV** representative or your regional **TLV** office.

Manufacturer

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