

ISO 9001
ISO14001



Manufacturer

TLV CO., LTD.

Kakogawa, Japan

is approved by LRQA Ltd. to ISO 9001:2001



Instruction Manual

Clean Steam Direct-Acting Pressure Reducing Valve

Featured Models: DR8-3P/DR8-3EP/DR8-6P/DR8-6EP

172-65613M-08

Publication date 8 November 2023

Copyright © 2023 TLV CO., LTD.

Table of Contents

Introduction	3
Safety Considerations	4
Specifications	6
Acceptable Operating Range	7
Correct usage of the product	8
Configuration	11
Installation	13
Adjustment	16
Maintenance	17
Disassembly	18
Reassembly	23
Troubleshooting	24
TLV EXPRESS LIMITED WARRANTY	27
Service	29

Introduction

Thank you for purchasing the TLV DR8 clean steam direct-acting pressure reducing valve.

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.

The TLV DR8 clean steam direct-acting pressure reducing valve has been developed especially for the food, beverage and pharmaceutical industries. This product has an angle type structure with special polishing applied to internal parts to minimize areas for condensate to accumulate, and prevent contamination inside the product. Additionally this product has a structure that is easily disassembled to make internal cleaning convenient.

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 needed not only for installation, but also for subsequent maintenance, disassembly/reassembly and troubleshooting. Please keep it in a safe place for future reference.

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.

Cautionary items and definitions



Danger

Indicates an urgent situation which poses a threat of death or serious injury



Warning

Indicates that there is a potential threat of death or serious injury



Caution

Indicates that there is a possibility of injury or equipment/product damage

Safety considerations for the product



Caution

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.



Caution

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.



Caution

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.



Caution

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.



Caution

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.



Caution

Use only under conditions in which no water hammer will occur. The impact of water hammer may damage the product, leading to fluid discharge, which may cause burns or other injury.

Specifications

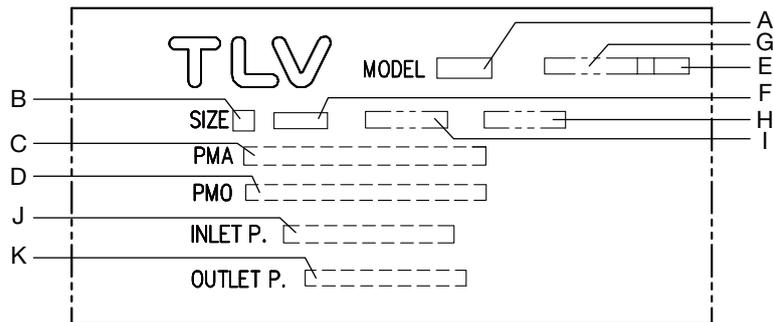


Caution

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 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.

Refer to the indications on the spring housing for detailed specifications.



A	Model
B	Nominal Diameter
C	Maximum Allowable Pressure (PMA)/Maximum Allowable Temperature (TMA) ⁰¹
D	Maximum Operating Pressure (PMO)/Maximum Operating Temperature (TMO)
E	Production Lot No.
F	Connection Standard
G	CNo. ⁰²
H	Inner Diameter
I	Connection Standard No.
J	Primary Pressure Range
K	Secondary Pressure Adjustable Range

⁰¹Maximum allowable pressure (PMA) and maximum allowable temperature (TMA) are PRESSURE SHELL DESIGN CONDITIONS, **NOT** OPERATING CONDITIONS.

⁰²CNo. (Charge/Mill No.) is displayed for products with options. This item is omitted when there are no options.

Acceptable Operating Range

Model	DR8-3P/DR8-3EP	DR8-6P/DR8-6EP
Primary Pressure Range	0.2 to 0.4 MPaG	0.4 to 0.8 MPaG
Adjustable Pressure Range	0.018 to 0.3 MPaG	0.27 to 0.6 MPaG
	Secondary pressure must not exceed 75% of primary pressure	
Minimum Adjustable Flow Rate	Steam: 20 kg/h or more	

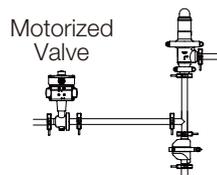
Correct usage of the product



Caution

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.

1. The product should be operated only within its specifications.
2. Installing an ON/OFF valve (solenoid valve or motorized valve)



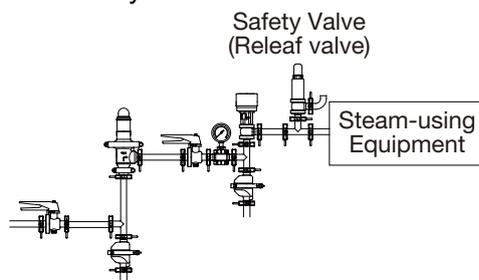
If an on-off valve is required to stop supply of steam or air to the equipment, install it at the inlet side of the product. If a solenoid valve is installed at the outlet of the product, it will cause heavy chattering and may lead to damage of the product. (When the on-off valve opens, the secondary pressure of the product changes from zero to the set pressure. Passing through an area of the reducing ratio of less than 30:1 where adjustment is impossible, chattering occurs momentarily.) To save energy, install the on-off valve as near to the boiler, or compressor, as possible.



Note

To prevent water hammer, it is recommended that a slow-acting motorized on-off valve be used. If a fast-acting on-off solenoid valve is used for frequent temperature control, the potential water hammer effect can damage the steam-using equipment and the product.

3. Installing a control valve and a safety valve



A control valve (i.e. for temperature control) installed between the product and the steam-using equipment (downstream of the product) may raise the pressure between the product and the control valve when the control valve is closed, depending on their proximity. Therefore, the control valve should be installed closed to the steam-using equipment. Also, a safety valve should be installed downstream of the control valve.



Note

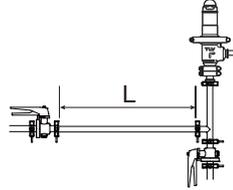
When installing a safety valve to protect steam-using equipment, be sure to install it on, or directly before, the inlet of the steam-using equipment. If the safety valve is installed between the product and a control valve, an eventual pressure rise could activate the safety valve.

Recommended straight pipe runs

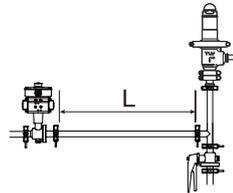
If the product is installed either directly before or after an elbow or control valve, unevenness in flow may result in chattering and unstable pressure. To ensure a stable flow, it is recommended that the product be installed on straight runs of piping, as illustrated below. (d = pipe diameter)

1. Inlet (primary) side

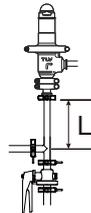
- Maintain a straight piping run of **10d or more** (L) when a manual valve, a strainer or an elbow, etc. is installed. (Example: if nominal size is 25 mm, have 250 mm or more)



- Maintain a straight piping run of **30d or more** (L) when an automated valve (on-off valve) is installed. (Example: if nominal size is 25 mm, have 750 mm or more)

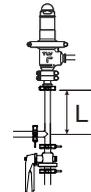


- Maintain a straight piping run of **10d or more** (L) at a product inlet side. (Example: if nominal size is 25 mm, have 250 mm or more)

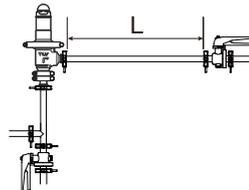


2. Outlet (secondary) side

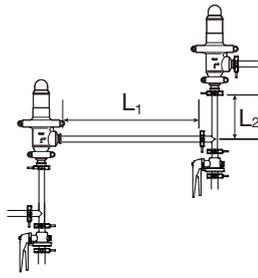
- Maintain a straight piping run of **15d or more** (L) when a manual valve, a strainer or an elbow, etc. is installed. (Example: if nominal size is 25 mm, have 375 mm or more)



- Maintain a straight piping run of **30d or more** (L) when a safety valve is installed. (Example: if nominal size is 25 mm, have 750 mm or more)

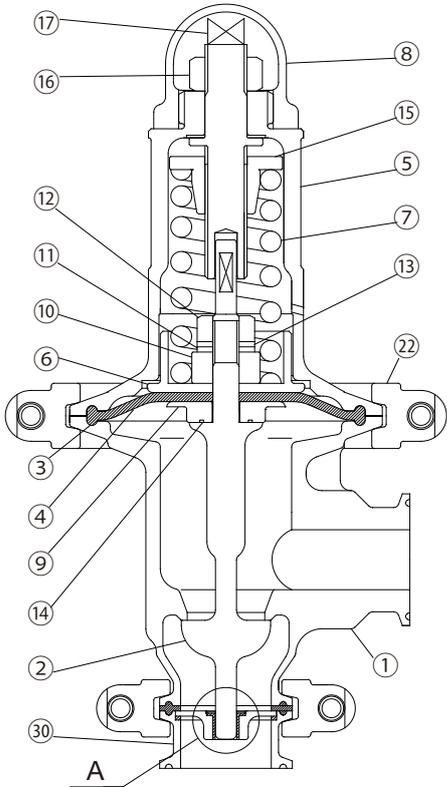


- Maintain a straight piping run of **30d or more** (L) when another pressure reducing valve is installed. (Two-stage pressure reduction) (Example: if nominal size is 25 mm, have 750 mm or more)

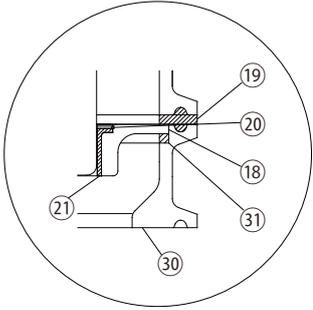


Configuration

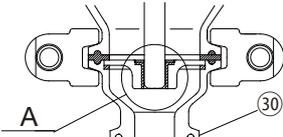
Sizes 38, 40 mm



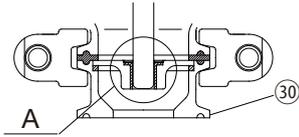
Enlarged view: A



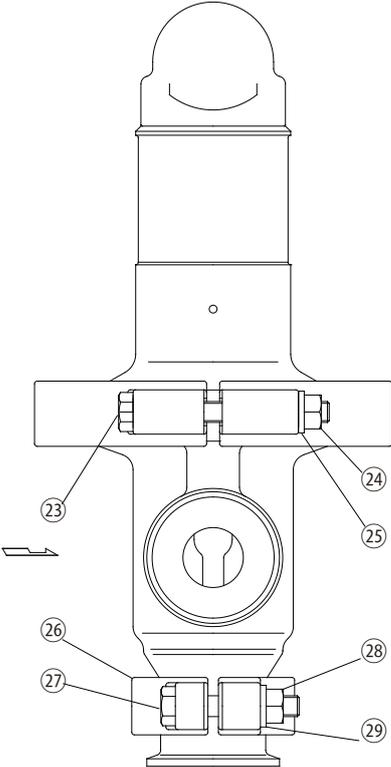
Sizes 15, 20 mm



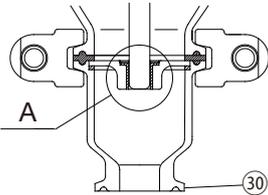
Size 25 mm



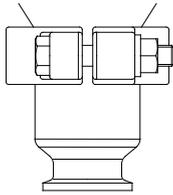
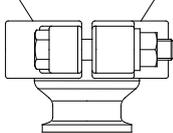
Sizes 25, 38, 40 mm



Option:
Sizes 15, 20 mm



Sizes 15, 20 mm



No.	Part Name	A ⁰¹	B ⁰¹	C ⁰¹	D ⁰¹
1	Body				
2	Valve			✓	
3	Diaphragm		✓		
4	Protective Sheet		✓		
5	Spring Housing				
6	Upper Diaphragm Retainer				
7	Coil Spring				
8	Cap				
9	Lower Diaphragm Retainer				
10	Spacer				
11	Spring Washer				
12	Locknut				
13	Plain Washer				
14	Retainer Gasket	✓	✓	✓	
15	Spring Retainer				
16	Locknut				
17	Adjustment Screw				
18	Valve Guide				✓
19	Inlet Clamp Gasket	✓		✓	✓
20	Snap Ring				✓
21	Slide Bearing				✓
22	Body Clamp				
23	Body Clamp Bolt ⁰²				
24	Body Clamp Nut ⁰²				
25	Spring Washer ⁰²				
26	Inlet Clamp ⁰²				
27	Inlet Clamp Bolt ⁰²				
28	Inlet Clamp Nut ⁰²				
29	Spring Washer ⁰²				
30	Adapter				
31	Valve Guide Gasket	✓		✓	✓

⁰¹A: Maintenance kit, B: Repair kit for diaphragm, C: Repair kit for valve, D: Repair kit for valve guide

⁰²Number of parts: 2 pieces



Note

The face-to-face length for the sizes 15 and 20 mm (optional) is 18 mm longer than the standard size.

Installation



Caution

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.

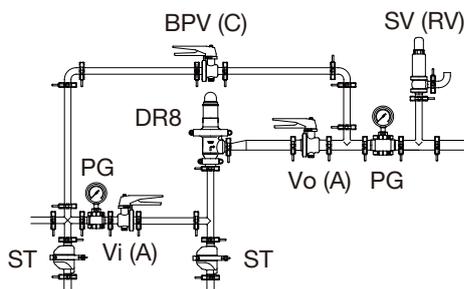
Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.

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

1. Blowdown

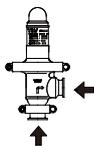
Before installing the product or supplying steam to the product, be sure to blow down all piping thoroughly. If this is not possible, perform a blowdown using the bypass valve. Blowdown is especially important for newly installed piping or after the system has been shut down for a long period of time. This will reduce operation failure caused by condensate or foreign matter.

The bypass valve should not be opened too quickly. If a safety valve (or relief valve) is installed, perform blowdown staying clear of pressurized blow-out. To perform blowdown, close the inlet valve (A) first, then the outlet valve (B), and open the bypass valve (C). Do not open valves too quickly.



2. Removing protective caps and seals

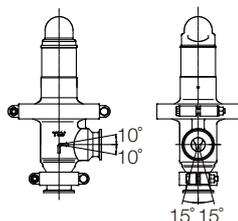
Before installation, be sure to remove all protective seals and caps. (Found in 2 locations, on the product inlet and outlet(s).)



3. Installation angle

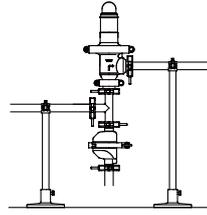
Install the product vertically, so that the arrow mark on the body points horizontally in the direction of flow.

Allowable inclination is 10 degrees in the fore-aft direction and 15 degrees in the plane perpendicular to the flow line.



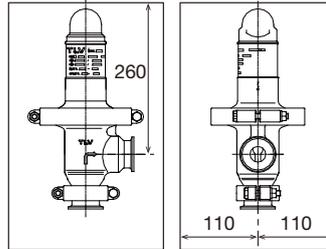
4. Piping support

Install the product, paying attention to avoid excessive load, bending and vibration. Support the inlet and outlet pipes securely.



5. Maintenance space

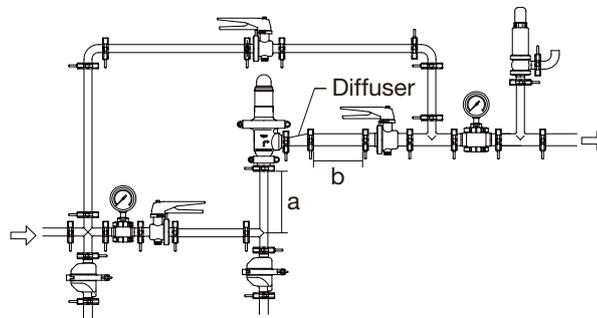
Leave sufficient space for maintenance, inspection and repair.



6. Piping size/diffuser

If it is expected that the secondary steam flow velocity will be more than 30 m/s (100 ft/s), install a diffuser in order to keep the flow velocity below 30 m/s (100 ft/s). If the distance between the product and the steam-using equipment is great, a possible drop in pressure should be taken into consideration when selecting the piping size.

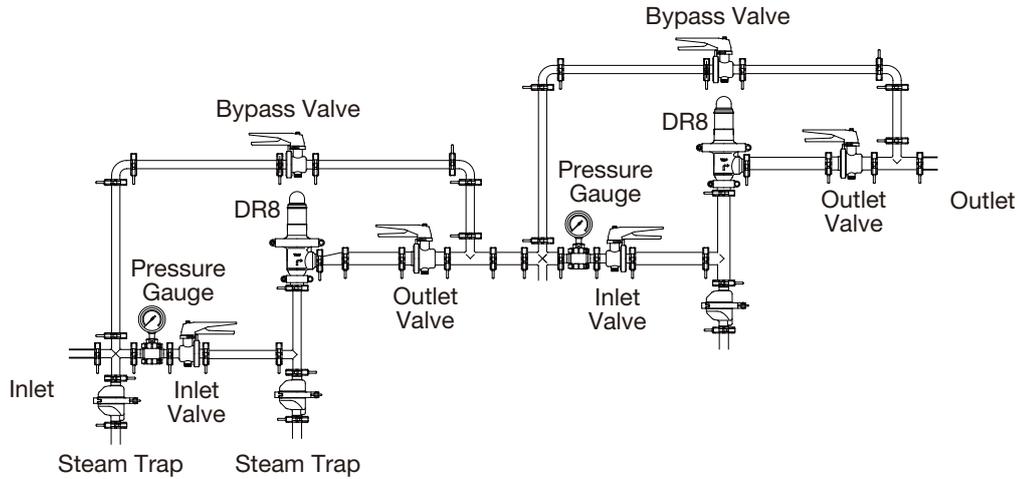
If the secondary steam flow velocity is expected to be more than 30 m/s (100 ft/s), install a diffuser in order to keep the flow velocity below 30 m/s (100 ft/s). If the distance between the product and the steam-using equipment is great, a possible drop in pressure should be taken into consideration when selecting the piping size.



Straight piping (d = pipe diameter)	
a	10d or longer upstream
b	15d or longer downstream

7. Two-stage pressure reduction

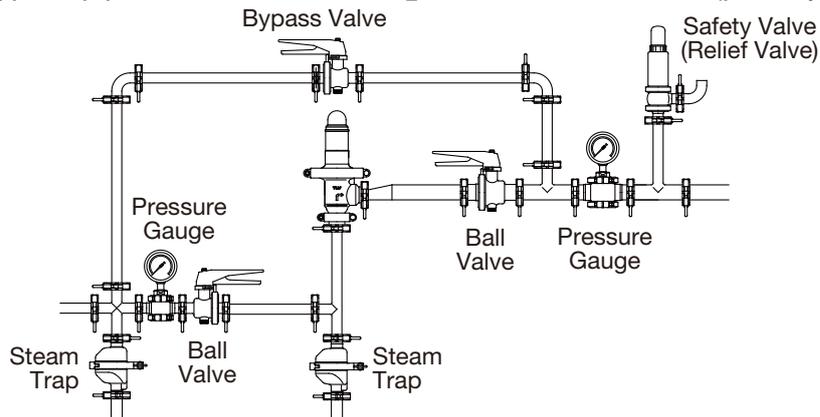
Employ two-stage pressure reduction if the required reduction is not possible due to product operating range limitations (when it is not possible to reduce to the desired pressure using a single pressure reducing valve).



8. Accessories

Always install a bypass line. At the inlet and outlet, install a pressure gauge and a shut-off valve.

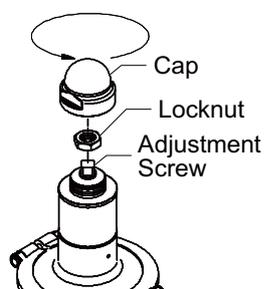
Ball valves, which will not retain condensate, are recommended for inlet and outlet shut-off valves. The bypass pipe should be at least 1/2 of the size of the inlet (primary side) pipe.



Adjustment

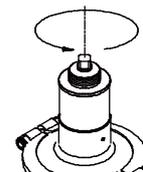
To avoid problems such as water hammer and to protect steam-using equipment, the product should be correctly adjusted.

1. It is necessary to blow down all pipe lines thoroughly. The blowdown is especially important if the line is new or has been shut down for a long period of time. Take particular care to ensure that matter such as condensate and dirt does not remain inside the equipment. (Stay clear of any pressurized blow-out from the safety valve.)
2. Make sure that the shutoff valve and the bypass valve located upstream and downstream of the product are completely closed.
3. Remove the spanner cap, loosen the locknut and turn the adjustment screw counterclockwise to reduce tension on the coil spring. Remove the cap and loosen the locknut, then turn the adjustment screw counterclockwise to free the coil spring.



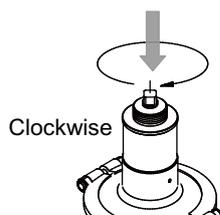
Loosen the cap and locknut

Counterclockwise

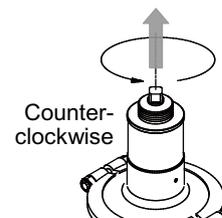


Fully raise the adjustment screw

4. Slowly, fully open the shutoff valve at the inlet of the product.
5. Slightly open the shutoff valve at the outlet of the product.
6. Turn the adjustment screw clockwise until the desired outlet pressure is obtained. Wait several minutes.



Clockwise to increase pressure



Counter-clockwise to decrease pressure

7. Slowly, fully open the shutoff valve at the outlet of the product.
8. After setup, tighten the locknut.
9. (If the inlet shut-off valve is closed first, the safety valve may be tripped.)

Maintenance



Caution

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 and burns or other injury due to malfunction or the discharge of fluids.

Operational check

To ensure long service life of the product, the following inspection and maintenance should be performed regularly.

Part Name	Inspection and Maintenance Frequency
Diaphragm	If hunting or chattering takes place, premature wear may result.
Protective Sheet	Check for cracks.
Body (Seat section)	If there is chattering or dirt, premature wear may result.
Valve (Seat section)	If there is chattering or dirt, premature wear may result.
Valve Guide (Slide Bearing)	If hunting or chattering takes place, premature wear may result.
Gaskets	Check for deformation or scratches.

Disassembly



Caution

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.

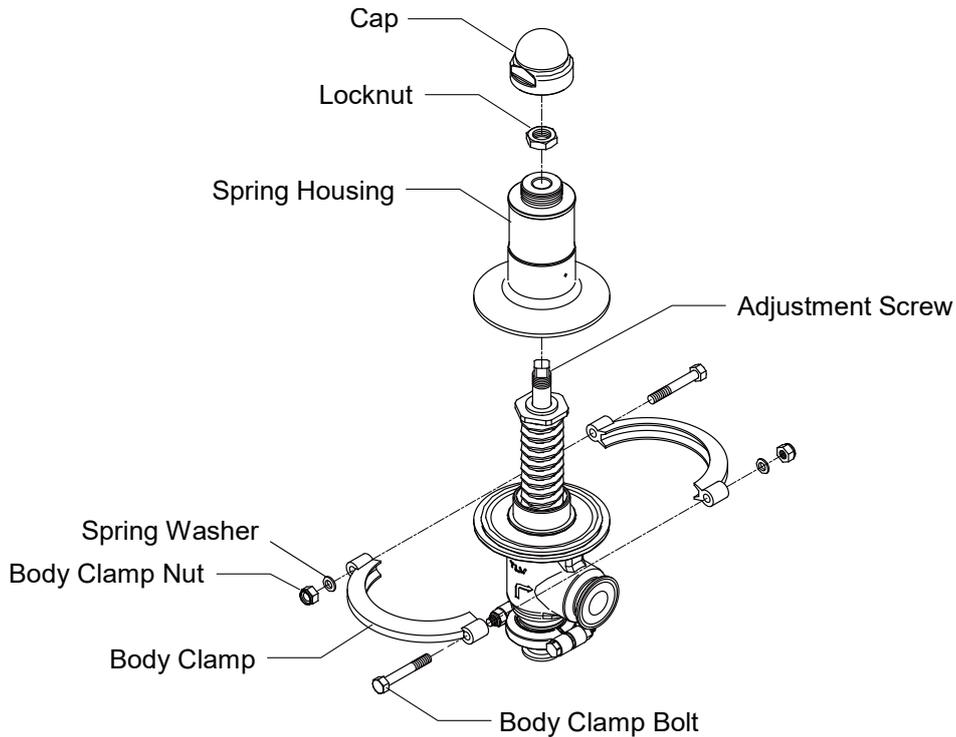
It is a recommended practice to dismantle and inspect the product once a year for preventive maintenance purposes. It is especially important to perform an inspection immediately after the initial run of a new line or before or after equipment that is out of service for a long period of time.

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

Remove all steam from the piping (both upstream and downstream). Wait for the body to cool before attempting to remove the product from the line. Then remove the product from the piping, and secure it in a vise to perform the inspection.

Disassembling the adjustment section

Loosen the cap and the locknut first. Loosen the adjustment screw completely and remove the body clamp.

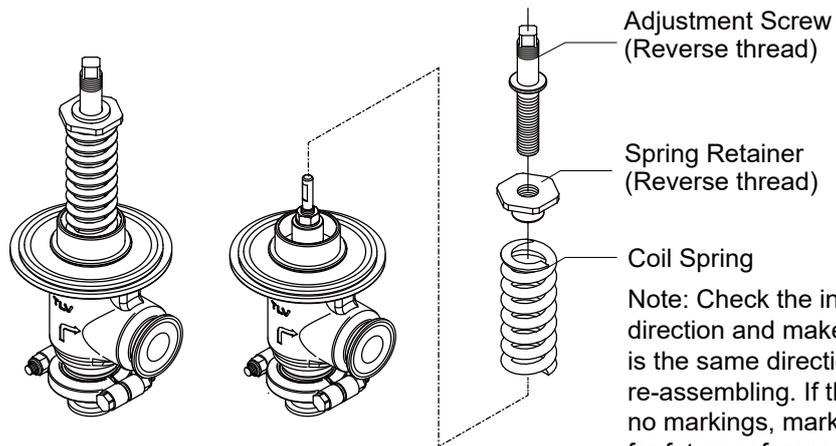


After removing the spring housing, remove the adjustment screw, spring retainer, and coil spring.



Important

Check for seizure or any damaged screw threads.



Note

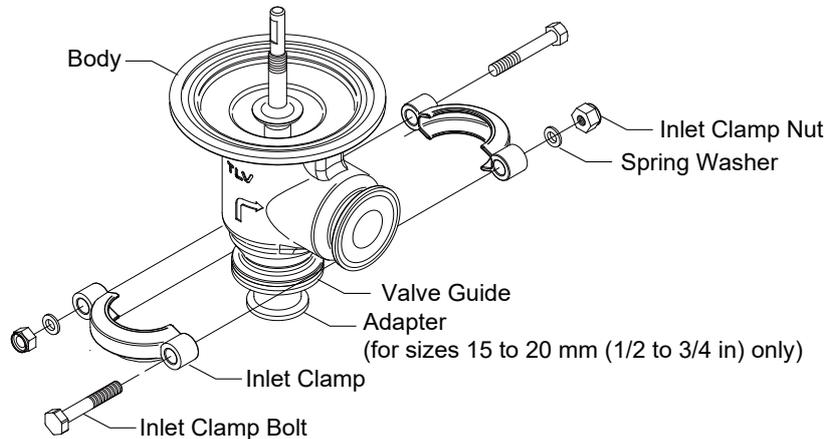
The spring retainer and coil spring guide cannot be removed individually as they are incorporated with the coil spring.

Disassembling the Diaphragm Section

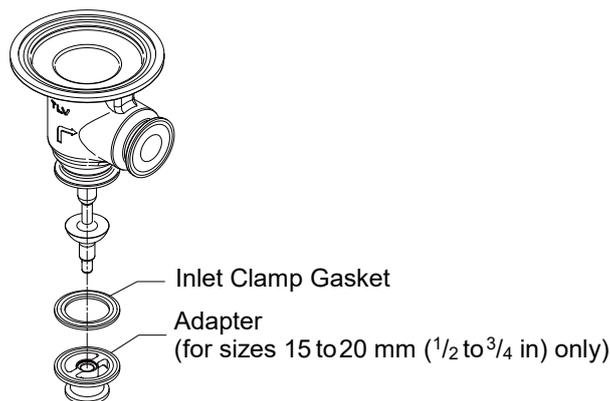
Hold the valve in place with an adjustable wrench across the flats on the upper part of the valve and use another wrench to remove the locknut. After removing the locknut, remove the plain washer, the upper diaphragm retainer and the diaphragm.

Disassembling the Valve Section

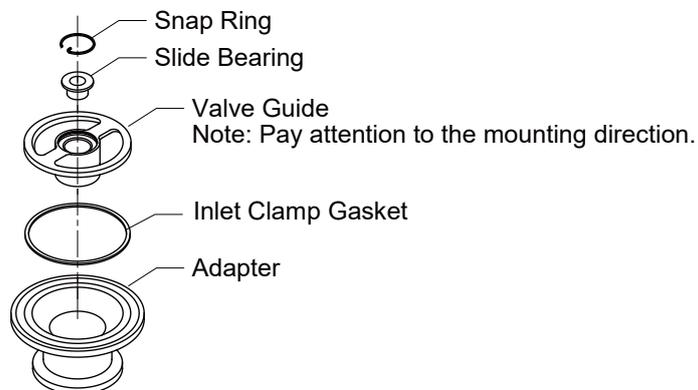
Remove the inlet clamp(s) holding the body, valve guide and adapter (for sizes 15 to 20 mm ($1/2$ to $3/4$ in) only).



Separate the valve guide from the body. The valve comes off with the valve guide.



Disassembling the Valve Guide Section



The slide bearing and snap ring cannot be removed individually as they are incorporated with the valve guide and must be replaced as a set with the valve guide.

Cleaning

After inspection and removal of any abnormality, clean and reassemble the parts. The following parts will require cleaning before reassembly:

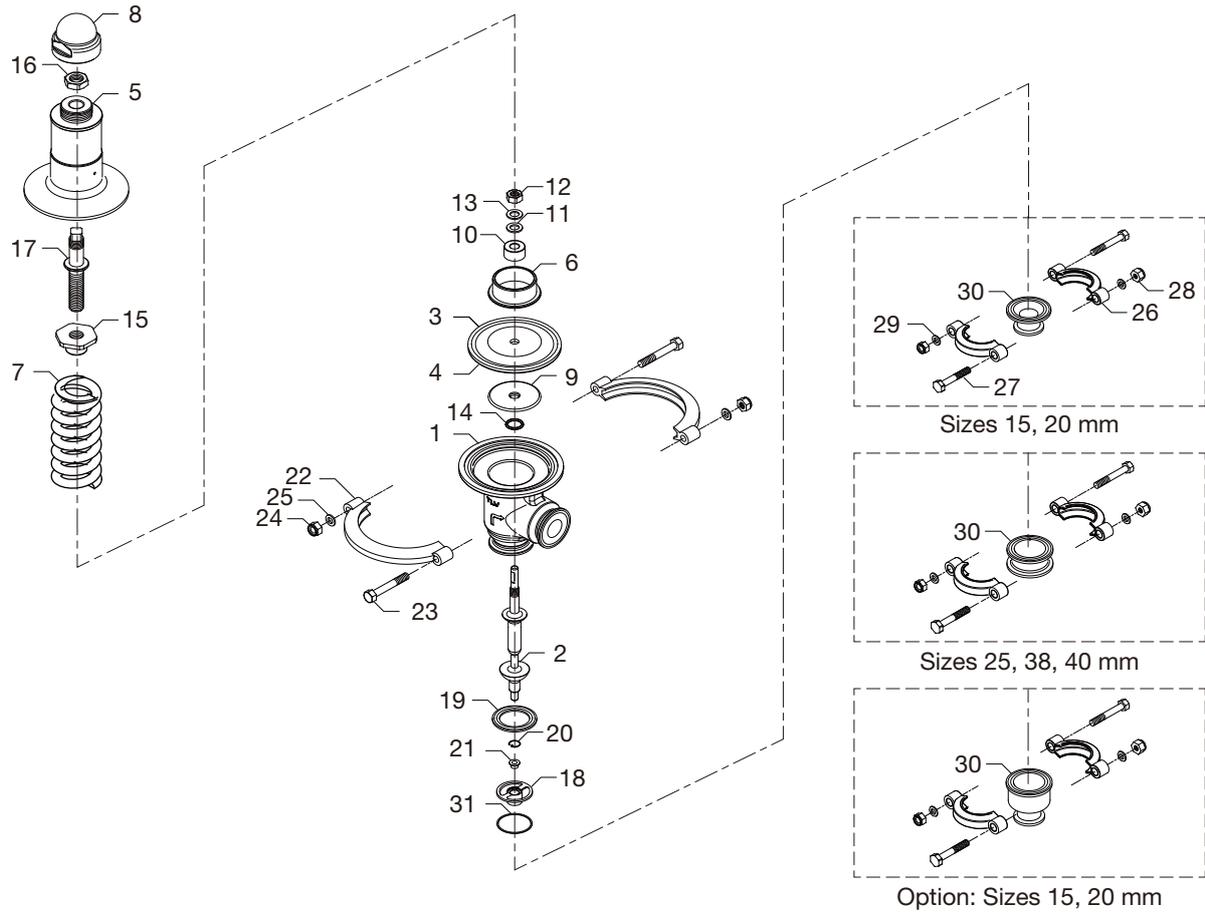
Diaphragm, Protective Sheet, Valve, Valve Guide, Retainer Gasket, Body, Lower Diaphragm Retainer, Adapter (for sizes 15 to 20 mm ($\frac{1}{2}$ to $\frac{3}{4}$ in) only)



Note

Avoid using solvent to clean these parts as it may accelerate deterioration of the diaphragm, protective sheet, and resin part of the valve guide and retainer gasket.

Exploded view



No.	Part Name	No.	Part Name
1	Body	17	Adjustment Screw
2	Valve	18	Valve Guide
3	Diaphragm	19	Inlet Clamp Gasket
4	Protective Sheet	20	Snap Ring
5	Spring Housing	21	Slide Bearing
6	Upper Diaphragm Retainer	22	Body Clamp
7	Coil Spring	23	Body Clamp Bolt
8	Cap	24	Body Clamp Nut
9	Lower Diaphragm Retainer	25	Spring Washer
10	Spacer	26	Inlet Clamp
11	Spring Washer	27	Inlet Clamp Bolt
12	Locknut	28	Inlet Clamp Nut
13	Plain Washer	29	Spring Washer
14	Retainer Gasket	30	Adapter Valve Guide Gasket
15	Spring Retainer	31	Valve Guide Gasket
16	Locknut		



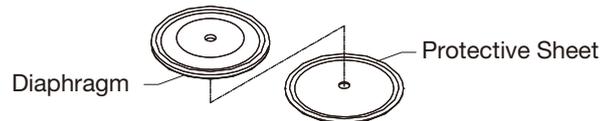
Note

The face-to-face length for the sizes 15 and 20 mm (optional) is 18 mm longer than the standard size.

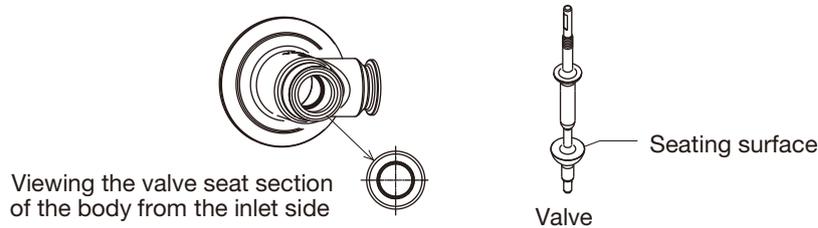
Reassembly

Reassemble the unit using the same procedure as used for disassembly; but in reverse order. In addition, observe the following precautions:

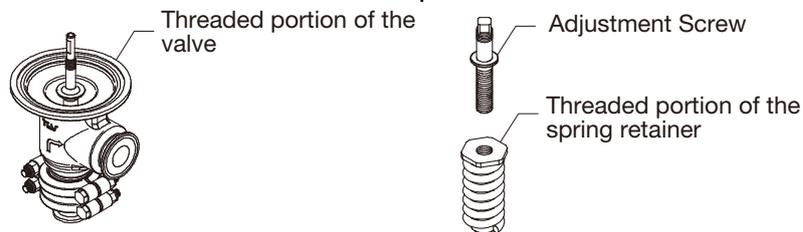
1. The diaphragm and the protective sheet also perform the role of gaskets and may be re-used if free from cracks, deterioration or deformation. If any abnormalities are found, these parts need to be replaced. The protective sheet must fit to the groove of the body. Make sure that the convex portion of the diaphragm faces up.



2. Make sure there are no scratches or erosion on the surface of the valve seat section of the body and seating surface of the valve, as this will lead to leakage. If no abnormalities are found, these parts can be reused. When there are scratches or erosion on these parts, the body and/or valve need to be replaced.



3. The retainer gasket may be re-used if it has no cracks or deterioration. If any abnormalities are found, it needs to be replaced.
4. Applying anti-seize to all non-wetted threaded parts is recommended.



5. Install the coil spring so that the tip of the polished surface marked red faces up and the red mark faces the outlet connection port side. If there is no red mark, install the coil spring so that the tip of the polished surface faces the outlet connection port.

Table of Tightening Torques

Part Name	Torque (N·m)	Distance Across Flats (mm)
Locknut	18	17
Body Clamp Nut, Inlet Clamp Nut	18	16, 17 ⁰¹

⁰¹Size depends on bolt standard



Note

If drawings or other special documentation were supplied for the product, any torque given there takes precedence over values shown here.

Troubleshooting



Caution

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.

This product is shipped after stringent checks and inspection and should perform its intended function for a long period of time without failure. However, should there be any problem encountered in the operation of the product, consult the troubleshooting guide below.

Problems are classified as follows:

1. The secondary pressure does not increase.
2. The secondary pressure cannot be adjusted or increases abnormally.
3. Hunting (fluctuation of the secondary pressure) occurs.
4. Chattering (a heavy mechanical noise) occurs.
5. Abnormal noises.

Major causes for the above problems are usage under non-specified conditions (out of specifications), insufficient pressure or flow rate, and clogs by dirt and scale.

To ensure performance for a long period of time, it is recommended that the "Acceptable Operating Range", "Correct Usage of the Product" and "Adjustment" sections be reviewed.

It is a recommended practice to dismantle and inspect the product once a year for preventive maintenance purposes. It is especially important to perform an inspection immediately after the initial run of a new line or before or after equipment such as a heater is out of service for a long period of time. (Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.)

Problem	Symptom	Cause	Remedy
The secondary pressure does not rise	The pressure does not increase	No steam is being supplied	Check the primary/secondary piping and valves of the unit
		The valve at the primary side is closed	
		The filter at the primary side is clogged	Clean or blow down or replace with a new filter
		Flow rate exceeds specifications	Check the flow rate; check the model selection, replace with a more suitable unit if necessary ⁰¹
		The secondary pressure exceeds the adjustable range	Check the model selection, replace with a more suitable unit if necessary ⁰¹

Problem	Symptom	Cause	Remedy
The secondary pressure cannot be adjusted or increases abnormally	Adjustment is difficult, and set pressure varies	The flow rate is too low	Check the flow rate; check the model selection, replace with a more suitable unit if necessary ⁰¹
		Pressure fluctuation at the primary side is large	Check the primary pressure; check the model selection, replace with a more suitable unit if necessary ⁰¹
		Flow rate fluctuation is too large	Check the flow rate, re-set the pressure; check the model selection, replace with a more suitable unit if necessary ⁰¹
		The adjustment screw has seized	Replace with a new adjustment screw
		The slide bearing is distorted or damaged	Replace with a new valve guide (when replacing the slide bearing or snap ring, these parts need to be replaced as a set with the valve guide)
		The diaphragm or protective sheet is distorted or damaged	Replace with a new diaphragm and protective sheet
		The selected model is inappropriate for the service conditions (specifications)	Check the model selection, replace with a more suitable unit if necessary ⁰¹
	Upon closing the valves on the secondary side, the secondary pressure abruptly rises as high as the primary pressure	The bypass valve is leaking	Check, clean, and replace with a new valve if necessary ⁰¹
		There is a build-up of dirt on or damage to the pilot valve seat or main valve seat	Clean and align
	Hunting or chattering occurs	Occurs at low steam demand	Flow rate is too low
Hunting never stops			The reduction ratio is too high
Chattering never stops		The selected model is inappropriate for the service conditions (specifications)	Check the model selection, replace with a more suitable unit if necessary ⁰¹
		Condensate is entrained	Check the trap Check the piping
		The selected model is inappropriate for the service conditions (specifications)	Check the model selection, replace with a more suitable unit if necessary ⁰¹

Problem	Symptom	Cause	Remedy
Abnormal noises	Makes a high-pitched noise	The required pressure reduction exceeds specifications	Use two-stage reduction
		Flow rate exceeds specifications	Check the flow rate; check the model selection, replace with a more suitable unit if necessary 01
		The valve installed close to the reducing valve opens/closes too quickly	Install the valve at as great a distance away as possible

⁰¹Contact TLV for model selection and replacement.



Note

When replacing parts with new, use the parts list for reference and replace with parts from the maintenance kit, repair kit, etc. (Please note that replacement parts are only available in pre-packaged kits.)

TLV EXPRESS LIMITED WARRANTY

Subject to the limitations set forth below, TLV CO., LTD., a Japanese corporation ("**TLV**"), warrants that products which are sold by it, TLV International Inc. ("**TII**") or one of its group companies excluding TLV Corporation (a corporation of the United States of America), (hereinafter the "**Products**") are designed and manufactured by TLV, conform to the specifications published by TLV for the corresponding part numbers (the "**Specifications**") and are free from defective workmanship and materials. The party from whom the Products were purchased shall be known hereinafter as the "**Seller**". With regard to products or components manufactured by unrelated third parties (the "**Components**"), TLV provides no warranty other than the warranty from the third party manufacturer(s), if any.

Exceptions to Warranty

This warranty does not cover defects or failures caused by:

1. improper shipping, installation, use, handling, etc., by persons other than TLV, TII or TLV group company personnel, or service representatives authorized by TLV; or
2. dirt, scale or rust, etc.; or
3. improper disassembly and reassembly, or inadequate inspection and maintenance by persons other than TLV or TLV group company personnel, or service representatives authorized by TLV; or
4. disasters or forces of nature or Acts of God; or
5. abuse, abnormal use, accidents or any other cause beyond the control of TLV, TII or TLV group companies; or
6. improper storage, maintenance or repair; or
7. operation of the Products not in accordance with instructions issued with the Products or with accepted industry practices; or
8. use for a purpose or in a manner for which the Products were not intended; or
9. use of the Products in a manner inconsistent with the Specifications; or
10. use of the Products with Hazardous Fluids (fluids other than steam, air, water, nitrogen, carbon dioxide and inert gases (helium, neon, argon, krypton, xenon and radon)); or
11. failure to follow the instructions contained in the TLV Instruction Manual for the Product.

Duration of Warranty

This warranty is effective for a period of one (1) year after delivery of Products to the first end user. Notwithstanding the foregoing, asserting a claim under this warranty must be brought within three (3) years after the date of delivery to the initial buyer if not sold initially to the first end user.

ANY IMPLIED WARRANTIES NOT NEGATED HEREBY WHICH MAY ARISE BY OPERATION OF LAW, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ANY EXPRESS WARRANTIES NOT NEGATED HEREBY, ARE GIVEN SOLELY TO THE INITIAL BUYER AND ARE LIMITED IN DURATION TO ONE (1) YEAR FROM THE DATE OF SHIPMENT BY THE SELLER.

Exclusive Remedy

THE EXCLUSIVE REMEDY UNDER THIS WARRANTY, UNDER ANY EXPRESS WARRANTY OR UNDER ANY IMPLIED WARRANTIES NOT NEGATED HEREBY (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), IS **REPLACEMENT**; PROVIDED: (a) THE CLAIMED DEFECT IS

REPORTED TO THE SELLER IN WRITING WITHIN THE WARRANTY PERIOD, INCLUDING A DETAILED WRITTEN DESCRIPTION OF THE CLAIMED DEFECT AND HOW AND WHEN THE CLAIMED DEFECTIVE PRODUCT WAS USED; AND (b) THE CLAIMED DEFECTIVE PRODUCT AND A COPY OF THE PURCHASE INVOICE IS RETURNED TO THE SELLER, FREIGHT AND TRANSPORTATION COSTS PREPAID, UNDER A RETURN MATERIAL AUTHORIZATION AND TRACKING NUMBER ISSUED BY THE SELLER. ALL LABOR COSTS, SHIPPING COSTS, AND TRANSPORTATION COSTS ASSOCIATED WITH THE RETURN OR REPLACEMENT OF THE CLAIMED DEFECTIVE PRODUCT ARE SOLELY THE RESPONSIBILITY OF BUYER OR THE FIRST END USER. THE SELLER RESERVES THE RIGHT TO INSPECT ON THE FIRST END USER'S SITE ANY PRODUCTS CLAIMED TO BE DEFECTIVE BEFORE ISSUING A RETURN MATERIAL AUTHORIZATION. SHOULD SUCH INSPECTION REVEAL, IN THE SELLER'S REASONABLE DISCRETION, THAT THE CLAIMED DEFECT IS NOT COVERED BY THIS WARRANTY, THE PARTY ASSERTING THIS WARRANTY SHALL PAY THE SELLER FOR THE TIME AND EXPENSES RELATED TO SUCH ON-SITE INSPECTION.

Exclusion of Consequential and Incidental Damages

IT IS SPECIFICALLY ACKNOWLEDGED THAT THIS WARRANTY, ANY OTHER EXPRESS WARRANTY NOT NEGATED HEREBY, AND ANY IMPLIED WARRANTY NOT NEGATED HEREBY, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DO NOT COVER, AND NEITHER TLV, TII NOR ITS TLV GROUP COMPANIES WILL IN ANY EVENT BE LIABLE FOR, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO LOST PROFITS, THE COST OF DISASSEMBLY AND SHIPMENT OF THE DEFECTIVE PRODUCT, INJURY TO OTHER PROPERTY, DAMAGE TO BUYER'S OR THE FIRST END USER'S PRODUCT, DAMAGE TO BUYER'S OR THE FIRST END USER'S PROCESSES, LOSS OF USE, OR OTHER COMMERCIAL LOSSES. WHERE, DUE TO OPERATION OF LAW, CONSEQUENTIAL AND INCIDENTAL DAMAGES UNDER THIS WARRANTY, UNDER ANY OTHER EXPRESS WARRANTY NOT NEGATED HEREBY OR UNDER ANY IMPLIED WARRANTY NOT NEGATED HEREBY (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) CANNOT BE EXCLUDED, SUCH DAMAGES ARE EXPRESSLY LIMITED IN AMOUNT TO THE PURCHASE PRICE OF THE DEFECTIVE PRODUCT. THIS EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES, AND THE PROVISION OF THIS WARRANTY LIMITING REMEDIES HEREUNDER TO REPLACEMENT, ARE INDEPENDENT PROVISIONS, AND ANY DETERMINATION THAT THE LIMITATION OF REMEDIES FAILS OF ITS ESSENTIAL PURPOSE OR ANY OTHER DETERMINATION THAT EITHER OF THE ABOVE REMEDIES IS UNENFORCEABLE, SHALL NOT BE CONSTRUED TO MAKE THE OTHER PROVISIONS UNENFORCEABLE.

Exclusion of Other Warranties

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED.

Severability

Any provision of this warranty which is invalid, prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such invalidity, prohibition or unenforceability without invalidating the remaining provisions hereof, and any such invalidity, prohibition or unenforceability in any such jurisdiction shall not invalidate or render unenforceable such provision in any other jurisdiction.

Service

For Service or Technical Assistance: Contact your TLV representative or your regional TLV office.

In Europe:

TLV EURO ENGINEERING GmbH

Daimler-Benz-Straße 16-18, 74915 Waibstadt, **Germany**

Tel: [49]-(0)7263-9150-0

TLV EURO ENGINEERING UK LTD.

Units 7 & 8, Furlong Business Park, Bishops Cleeve,
Gloucestershire GL52 8TW, **U.K.**

Tel: [44]-(0)1242-227223

TLV EURO ENGINEERING FRANCE SARL

Parc d'Ariane 2, bât. C, 290 rue Ferdinand Perrier, 69800 Saint
Priest, **France**

Tel: [33]-(0)4-72482222

Fax: [33]-(0)4-72482220

In North America:

TLV CORPORATION

13901 South Lakes Drive, Charlotte, NC 28273-6790, **U.S.A.**

Tel: [1]-704-597-9070

Fax: [1]-704-583-1610

TLV ENGINEERING S. A. DE C.V.

Av. Jesús del Monte 39-B-1001, Col. Hda. de las Palmas,
Huixquilucan, Edo. de México, 52763, **Mexico**

Tel: [52]-55-5359-7949

Fax: [52]-55-5359-7585

In Oceania:

TLV PTY LIMITED

Unit 8, 137-145 Rooks Road, Nunawading, Victoria 3131,
Australia

Tel: [61]-(0)3-9873 5610

Fax: [61]-(0)3-9873 5010

In East Asia:

TLV PTE LTD

36 Kaki Bukit Place, #02-01/02, **Singapore** 416214

Tel: [65]-6747 4600

Fax: [65]-6742 0345

TLV SHANGHAI CO., LTD.

5/F, Building 7, No.103 Caobao Road, Xuhui District, Shanghai,
China 200233

Tel: [86]-(0)21-6482-8622

Fax: [86]-(0)21-6482-8623

TLV ENGINEERING SDN. BHD.

No.16, Jalan MJ14, Taman Industri Meranti Jaya, 47120
Puchong, Selangor, **Malaysia**

Tel: [60]-3-8052-2928

Fax: [60]-3-8051-0899

TLV PRIVATE LIMITED

252/94 (K-L) 17th Floor, Muang Thai-Phatra Complex Tower B,
Rachadaphisek Road, Huaykwang, Bangkok 10310, **Thailand**

Tel: [66]-2-693-3799

Fax: [66]-2-693-3979

TLV INC.

#302-1 Bundang Technopark B, 723 Pangyo-ro, Bundang,
Seongnam, Gyeonggi, 13511, **Korea**

Tel: [82]-(0)31-726-2105

Fax: [82]-(0)31-726-2195

In the Middle East:

TLV ENGINEERING FZCO

Building 2W, No. M002, PO Box 371684, Dubai Airport Free
Zone, Dubai, **UAE**

Email: sales-me@tlv.co.jp

In Other Countries:

TLV INTERNATIONAL, INC.

881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511, **Japan**

Tel: [81]-(0)79-427-1818

Fax: [81]-(0)79-425-1167

Manufacturer:

TLV CO., LTD.

881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511, **Japan**

Tel: [81]-(0)79-427-1800

Fax: [81]-(0)79-422-2277