



# Instruction Manual

Control Valve

**CV5**

## Contents

Introduction .....	1
Safety Considerations.....	2
Specifications .....	4
Configuration .....	6
Installation .....	7
Maintenance .....	10
Disassembly/Reassembly.....	11
Troubleshooting.....	16
TLV EXPRESS LIMITED WARRANTY .....	18
Service.....	20

## Introduction

Thank you for purchasing the TLV CV5 control 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.





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.

### Symbols

	Indicates a <b>DANGER, WARNING or CAUTION</b> 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

	<b>DO NOT use this product outside the recommended operating pressure, temperature and other specification ranges.</b> 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.
	<b>Use hoisting equipment for heavy objects (weighing approximately 20 kg or more).</b> Failure to do so may result in back strain or other injury if the object should fall.
	<b>Take measures to prevent people from coming into direct contact with product outlets.</b> Failure to do so may result in burns or other injury from the discharge of fluids.
	<b>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.</b> Disassembling or removing the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.

Continued on the next page

 <b>CAUTION</b>	<p><b>Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way.</b></p> <p>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><b>Use only under conditions in which no freeze-up will occur.</b></p> <p>Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury.</p>
	<p><b>Use only under conditions in which no water hammer will occur.</b></p> <p>The impact of water hammer may damage the product, leading to fluid discharge, which may cause burns or other injury.</p>
	<p><b>Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly.</b></p> <p>If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.</p>
	<p><b>Make sure that wiring work requiring a special license is carried out only by qualified personnel.</b></p> <p>If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.</p>
	<p><b>When using this product, be sure NEVER to stand close to, or leave tools anywhere near, moving parts such as a shaft.</b></p> <p>Contact with moving parts or objects becoming caught in moving parts could lead to injury, damage or other accidents.</p>

## 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.

### Valve

Size (mm)		15	20	25	40	50
Connection		IEC534.3-1 (long face-to-face)				
Flange Standard		JIS10K FF(FC250) / JIS10K RF, JIS20K RF(SCPH2)				
Face-to-	10K FF	184	184	184	222	254
Face Length	20K RF	191	194	197	235	267
Flange Standard		ANSI.JPI150 RF, 300 RF (SCPH2)				
Face-to-	150 RF	184	184	184	222	254
Face Length	300 RF	191	194	197	235	267
Weight (kg) JIS 10K		8.7	9.7	10.7	16	19
Materials of Construction		FC250 / SCPH2 (WCB)				
Maximum Operating Pressure (PMO)		1.0 MPaG				
Maximum Operating Temperature (TMO)		200°C				
Medium of Operation		Steam, hot water, cold water, air (non-hazardous fluids)				
Valve Construction		Single-seat globe valve				
Valve Type		Equal percentage valve				
Stroke (Travel)		15 mm				
Rangeability		50:1				
Cv* Value		5 (2)	7.5 (3)	12 (5)	30 (12)	40 (20)
Valve Material		Metal seal: SUS303 Soft seal: SUS303 + PTFE (Option)				
Valve Seat Material		SUS303 (Sizes 15, 20 and 25 mm) / SUS430F (Sizes 40 and 50 mm)				
Valve Leakage Rate		Rated Cv value capacity x %: Metal valve: 0.01% or less (ANSI B16 104-1976 Class IV) PTFE valve: 0.0001% or less (ANSI B16 104-1976 Class VI)				

\* The Cv values represent the maximum value for each size. (1 MPa = 10.197 kg/cm<sup>2</sup>)

### Actuator

Actuator	Pneumatic
Operation	Reverse Action    Air-to-Open Direct Action    Air-to-Close
Pneumatic Connection Screw	G 1/4
Diaphragm Surface Area	120 cm <sup>2</sup>
Diaphragm Material	NBR
Air Supply Pressure	Max. 0.6 MPaG
Ambient Temperature	-10 – 60°C

**Reverse Action (Air-to-Open)**

Size (mm)	Pressure Supplied to Filter / Regulator	Air Pressure Supplied to Positioner	Air Pressure Supplied to Actuator Spring Range
15	0.40 - 0.60 MPaG	0.38 MPaG	0.21 - 0.33 MPaG
20			
25			
40			
50			

(1 MPa = 10.197 kg/cm<sup>2</sup>)**Direct Action (Air-to-Close)**

Size (mm)	Pressure Supplied to Filter / Regulator	Air Pressure Supplied to Positioner	Air Pressure Supplied to Actuator Spring Range
15	0.4 - 0.6 MPaG	0.35 MPaG	0.04 - 0.14 MPaG
20			
25			
40			
50			

(1 MPa = 10.197 kg/cm<sup>2</sup>)**Electropneumatic Positioner (partial list of standard specifications)**

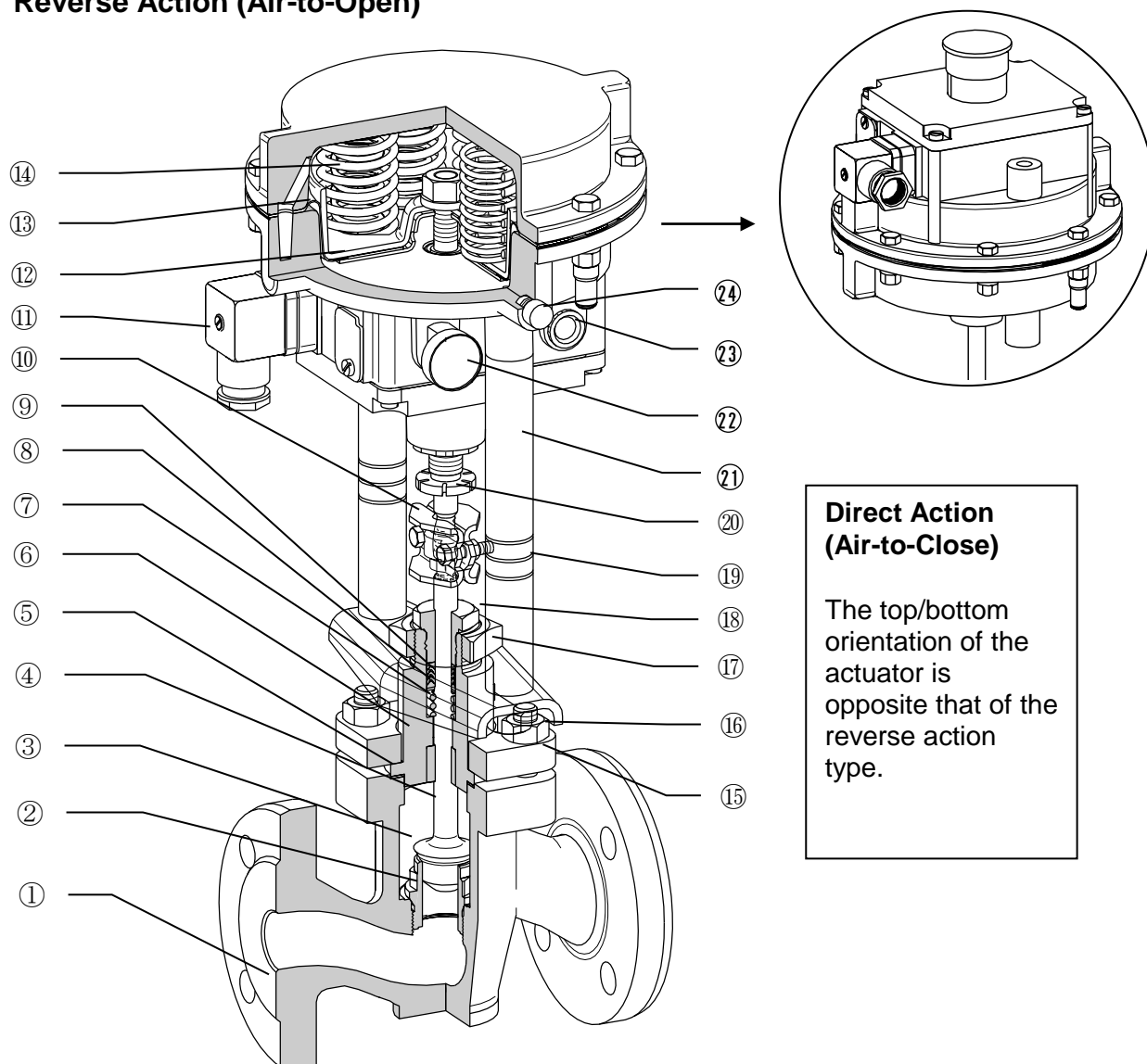
Notes: Pneumatic / Solenoid (partial list of standard specifications)		
Construction	Dust-resistance, rain-resistant construction IP54	
Ambient Temperature	-10 – 60°C	
Materials of Construction	Die cast aluminum / synthetic resin	
Input Current / Resistance	4 - 20mA DC      approximately 300 Ω	
Electrical Line Port	PG11	
Air Connection Port	G 1/4	
Air Pressure Supplied to Filter / Regulator (MPaG)	0.40 - 0.60 MPaG	
Air Pressure Supplied to Positioner (MPaG)	0.38 MPaG Reverse Action (Air-to-Open)	0.35 MPaG Direct Action (Air-to-Close)
Air Consumption (Nm³/h)	At air supply pressure 0.4 MPaG: 0.16 (Nm³/h) At air supply pressure 0.6 MPaG: 0.20 (Nm³/h)	

1 MPa = 10.197 kg/cm<sup>2</sup>**Filter/Regulator and Mist Separator (Optional)****SMC Corporation**

- AW2000-02DG (5μ filter, manual condensate drainage)  
Air Connection Port Rc(PT) 1/4
- AW3001-02DG (5μ filter, automatic condensate drainage)  
Air Connection Port Rc(PT) 1/4
- AFM2000-02 (0.3μ filter, manual condensate drainage)  
Air Connection Port Rc(PT) 1/4
- AFM3000-02 (0.3μ filter, automatic condensate drainage)  
Air Connection Port Rc(PT) 1/4

## Configuration

### Reverse Action (Air-to-Open)



No.	Name	No.	Name
1	Body	13	Bellowphragm
2	Valve Seat	14	Coil Spring
3	Valve	15	Bonnet Flange
4	Plug and Stem	16	Stud Bolt and Nut
5	Gasket	17	Fixing Nut
6	Bonnet	18	Gland Retainer
7	Coil Springs (Stuffing Box Spring?)	19	Stroke Indicator
8	Washer	20	Zero Adjustment Dial
9	Stuffing Box V-Ring	21	Yolk
10	Stem Bracket	22	Exhaust Tap
11	Wiring Connector	23	Air Supply Port
12	Bellowphragm Holder	24	Pressure Gauge Mounting Port

## 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.



Use hoisting equipment for heavy objects (weighing approximately 20 kg (44 lb) 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.

Installation, inspection, maintenance, repairs, disassembly and adjustment should be done only by trained maintenance personnel.

Check to make sure that the piping where the product is to be installed is constructed properly.

If the piping is not correctly constructed, the valve may not perform optimally.

1. When installing the product, in order to facilitate installation and removal of the actuator, leave a space of at least 110 mm (reverse action), 210 mm (direct action) above the top of the actuator.
2. Make sure that the temperature of the flow medium and the ambient temperature of the installation location do not exceed the valve and actuator ambient temperature limits.
3. Before installing the product, blow out the inlet piping to remove any piping scraps, dirt and oil.
4. This valve is a control valve.  
Though it adequately performs the function of a cutoff valve at start-up, frequent use as a cutoff valve causes a drop in performance. Be sure to install a cutoff valve or self-operating valve at inlet and outlets.
5. Do not install the valve in locations in the piping where foreign matter accumulates or where impact from water pressure (water hammer) occurs.
6. Wherever possible, install the valve in horizontal piping, making sure that the actuator is in a position as perpendicular to the piping as possible.
7. Be sure to install the valve so that the arrow showing on the body is pointing in the direction of flow.
8. Be careful that the piping gaskets do not protrude outside the inner bore of the flange.  
The type of medium being used and the temperature must be taken into account in order to select a gasket of a suitable material.
9. Make sure that the valve is not bearing excessive weight from the piping and avoid uneven tightening by making sure that all the bolts on the flange connection are tightened evenly.
10. The control valve is extremely heavy. Make sure that the piping is securely supported.



11. Before connecting the air lines for the air that is to be piped to the positioner/actuator, blow out the air in the lines to remove any dirt, foreign matter, oil or water from inside of the piping.

NOTE: Supply to the instrumentation only air that does not contain water, oil or foreign matter. To prevent malfunction due to contamination of the air supply, install the optional air filter / regulator (5 $\mu$ ) + mist separator (0.3 $\mu$ ) as a set. (If air quality results in operation failure, the entire positioner / actuator unit must be replaced.)

After having fulfilled the above conditions, if there is a problem subsequent to the supply of air and the initiation of operation, determine the cause using the "Troubleshooting" section in this manual.

## Electrical Wiring



**CAUTION** Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.



**CAUTION** Make sure that wiring work requiring a special license is carried out by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.

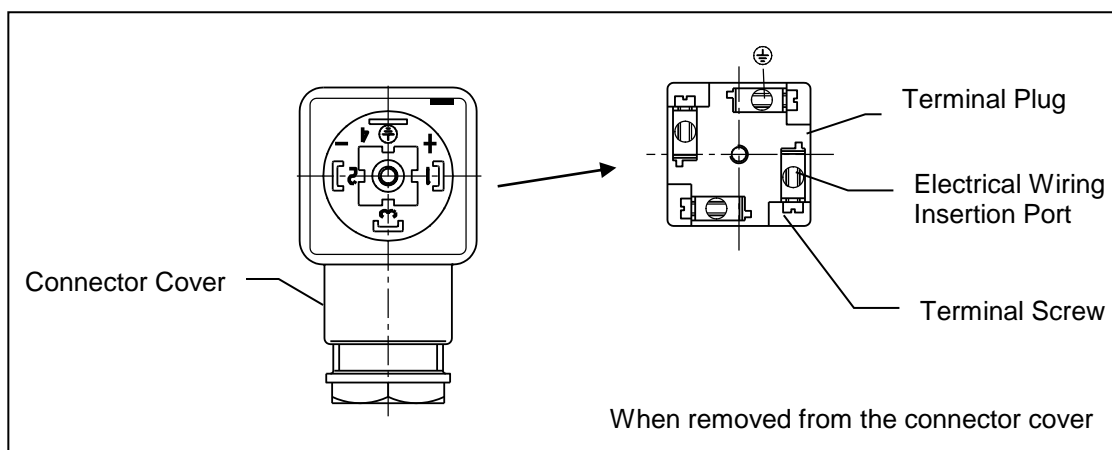
### Connecting the Electrical Plug Connector

1. Loosen the screw in the center section of the electrical wiring plug connector by using a screwdriver.
2. Pull the entire connector out of the actuator.
3. Pull the terminal plug out of the back of the connector cover.
4. Insert the terminal wiring through the wiring insertion port and securely tighten the terminal screw.
5. Reassemble in reverse order of disassembly, and then reinsert into the actuator.

The insertion port pins may not be pointing in the desired direction, so check the orientation of the pins before inserting.

At this time, insert the rubber gasket between the connector and the actuator. (The orientation of the terminal plug can be altered by 90° increments when inserting it into the connector cover, to alter the outfeed direction of the electrical wiring.)

6. Tighten the screw in the center of the electrical wiring plug connector by using a screwdriver.



## 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.



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.

## Operational Check

A visual inspection of the following items should be done on a daily basis to determine whether the product is operating properly or has failed. Periodically (at least biannually) the operation should also be checked.

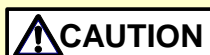
Inspection Item	Inspection Method	Remedy for Failure (Malfunction)
Leakage from Valve (when valve is closed)	Visual Inspection or Stethoscope Inspection: Is the outlet side pressure or temperature elevated?	Adjust the zero/span; replace with a new valve and/or new valve seat
Leakage from Gland Area	Visual Inspection: Is liquid leaking from the slit between the gland and the valve stem?	Coat the gland and the valve stem thoroughly with grease; thoroughly grease the V-ring slot; or replace with a new V-ring
Leakage from Actuator	Visual Inspection: Is air leaking from the actuator area or the exhaust tap during stable actuator operation?	Replace with a new actuator unit
Leakage from Gasket between Body and Bonnet	Visual Inspection: Is fluid leaking from the body or bonnet?	Apply additional tightening (consult stipulated torque) or replace with a new gasket
Leakage from Pressure-bearing Parts such as Body and Bonnet	Visual Inspection: Is fluid leaking from the body or bonnet?	Replace pressure-bearing parts
Operating Conditions	Visual Inspection: Is the valve opening (travel) undergoing frequent change? Is the valve closing and opening in response to the signal?	Readjust the controller and positioner

## Parts Inspection

When parts have been removed, or during periodic inspections, use the following table to inspect the parts and replace any that are found to be defective.

Procedure
Gaskets: check for warping or scratches (must be replaced with new gasket when product is disassembled)
V-ring (Gland): check for warping or damage
Valve, Valve Seat: check for damage or scratches
Body, Bonnet: check for corrosion or damage

## Disassembly/Reassembly



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.

Use the following procedures to remove components. Use the same procedures in reverse to reassemble. (Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.)

Consult the Exploded View and Table of Tightening Torques for disassembling/reassembling the actuator.

NOTE: Be sure to coat all threaded portions of the valve seat and bolts.

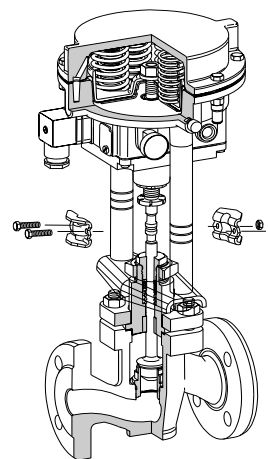
Perform the following procedure before beginning disassembly:

1. After connecting the air line, adjust the air regulator to 0.38 MPaG (only reverse action).
2. Connect a 4-20mA current generator or a controller (only reverse action).

NOTE: For direct action, remove both the air line and signal wiring.

### Removing/Reattaching the Stem Bracket

Part	During Disassembly	During Reassembly
Screw	Remove by using a Phillips screwdriver	Consult the table of tightening torques and tighten to the proper torque
Stem Bracket	The bracket separates into two (2) pieces	<p>After placing the plates up against the stem, align the two plates with each other</p> <p>After aligning the plates, tighten, while making sure the left and right gaps in between the ends of the plates are even</p>

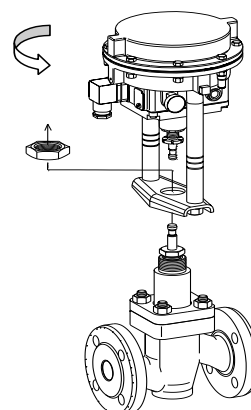


Be careful that fingers do not get pinched in the stem area.

## Disassembling/Reassembling the Valve Body and Actuator

Part	During Disassembly	During Reassembly
—	For reverse action (air-to-open), the force of the spring is holding the valve tightly closed; supply a 12a (50%) signal to open the valve  For direct action (air-to-close), the force of the spring is holding the valve open: there is no need for a signal or air	For reverse action, input a 12A (50%) signal to open the valve before reassembling (because the force of the spring is holding the valve tightly closed) Adjust the regulator pressure to the rated pressure (refer to the name seal) Reverse action (air-to-open): 0.38 MPaG Direct action (air-to-close): 0.35 MPaG
Hex Nut	Remove by using a wrench	Consult the table of tightening torques and tighten to the proper torque

Direction may be changed in 90° increments as desired.

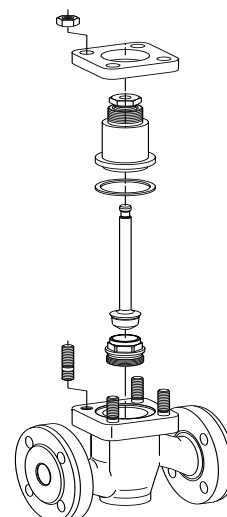


**WARNING**

Be careful that fingers do not get pinched in the stem area.

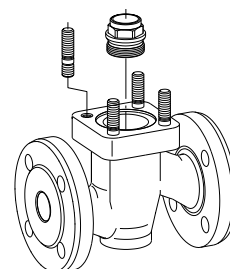
## Detaching/Reattaching the Valve Body

Part	During Disassembly	During Reassembly
Nut	Remove by using a socket wrench	Consult the table of tightening torques and tighten to the proper torque; make sure to tighten evenly
Bonnet Bonnet Flange	Pull up and off, taking care not to damage the valve or valve seat	Take care not to damage the valve or valve seat; insert the bonnet securely and without tilting into the gasket housing; <u>tighten the nuts evenly, while checking to make sure that there is no catching or biting when the valve is seated in the valve seat;</u> after tightening to the rated torque, check to make sure that the stem moves up and down smoothly; consult the table of tightening torques and tighten to the proper torque
Gasket	Remove the gasket, making sure to thoroughly remove all pieces	Be sure to replace with a new gasket; make sure that the gasket does not protrude from the housing in the body; <u>do not coat with anti-seize</u>



## Removing/Reinserting the Valve Seat

Part	During Disassembly	During Reassembly
Valve Seat	For sizes 40 mm and larger, a special socket (thin wall) is required; a power wrench can facilitate the replacement of a valve seat of 40 mm or larger ; if using a power wrench , be sure follow the manufacturer's instructions	Over-tightening could result in damage to the valve seat or body; consult the table of tightening torques and tighten to the proper torque

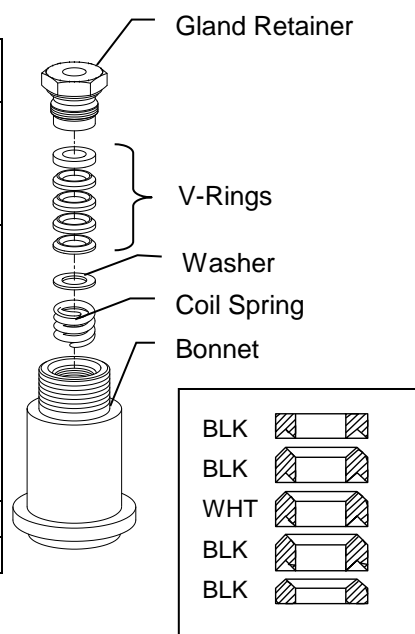


## Disassembling/Reassembling the Gland and its Components

In the procedure below, first partially loosen only the gland retainer, and then remove the stem before removing the other parts.

(The procedure is most easily performed if the gland retainer is loosened while it is attached to the valve body.)

Part	During Disassembly	During Reassembly
Gland Retainer	Remove by using a socket wrench	Consult the table of tightening torques and tighten to the proper torque
V-Rings	Pull up and off	Make sure to reassemble the V-rings in the proper orientation; coat the groove with heat-resistance grease (silicon grease); reattach the V-rings with their <u>grooves facing downward</u>
Washer	Pull up and off	—
Coil Spring	Pull up and off	—



V-Ring Cross-sectional View

## Adjusting the Zero/Span

Preparations before adjusting (NOTE: See the diagram on the following page.)

1. After connecting the air line, adjust the air regulator to 0.38 MPaG (reverse action); 0.35 MPaG (direct action).
2. Connect a 4 - 20mA current generator or a controller.
3. Loosen the cover plate screw and open the cover.
4. Pull out the jumper pins. (Be sure not to lose it.)

### 1. Reverse Action (Air-to-Open)

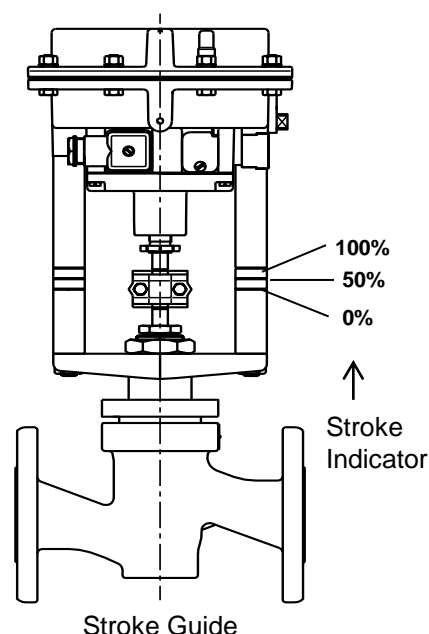
1. If using an electrical current generator, adjust the output to 4mA; if using a controller, adjust to 0%.
2. Turn the zero adjuster slowly until the valve just begins to open (the actuator pressure gauge just begins to move). (The valve must NOT be open.)

NOTE: Turning counterclockwise causes the valve to begin to open earlier.

3. Change the signal to 4.1 mA (1%) and check to make sure the valve begins to open.
4. Change the signal to 4 mA (0%) and check to make sure the valve is completely closed (the actuator pressure gauge is completely at zero).
5. Change the signal to 20 mA (100%), and make sure that the stroke indicator shows in the vicinity of 100%. If it does not, use a precision flat-blade screwdriver to turn the span potentiometer until the indicator shows close to 100%.

NOTE: Turning clockwise increases the travel.

6. Each modification of the span results in a zero shift. Repeat the above correction procedure until both values are correct.
7. After completing the adjustment, insert the jumper pins securely into their previous position and close the cover.



### 2. Direct Action (Air-to-Close)

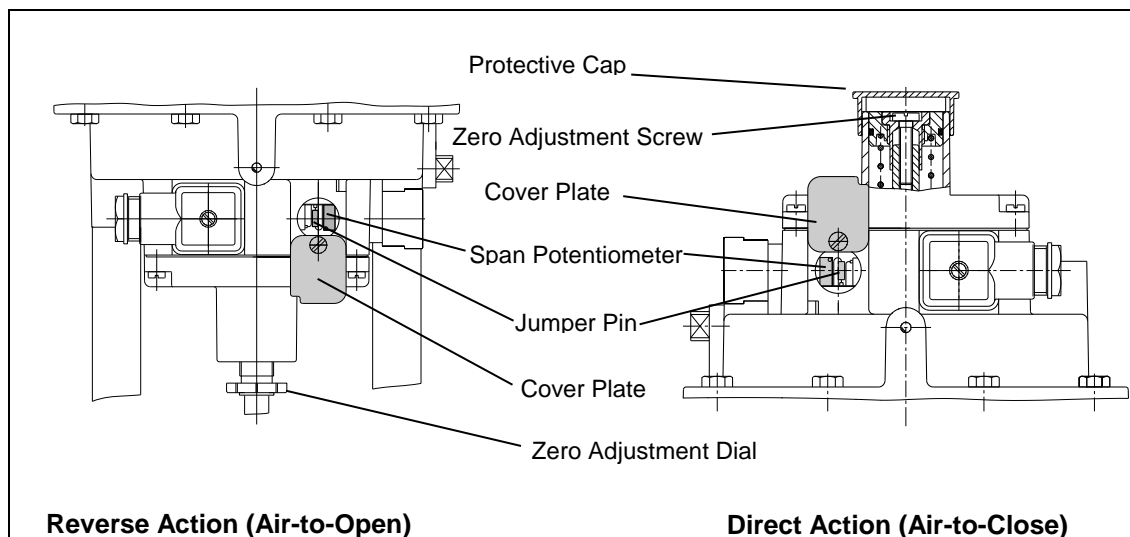
1. If using an electrical current generator, adjust the output to 20mA; if using a controller, adjust to 100%.
2. Remove the protective cap and, using a flat-blade screwdriver, turn the zero adjuster until the valve just begins to open. (The valve must NOT be open.)

NOTE: Turning clockwise causes the valve to begin to open earlier.

3. Check to make sure the valve is completely closed when the signal is 20mA (100%).
4. Change the signal to 4mA (0%), and make sure that the stroke indicator shows in the vicinity of 100%.  
If it does not, use a precision flat-blade screwdriver to turn the span potentiometer until it is close to 100%.

NOTE: Turning clockwise increases the travel.

5. Each modification of the span results in a zero shift. Repeat the above correction procedure until both values are correct.
6. After completing the adjustment, insert the jumper pins securely into their previous position, close the cover and replace the protective cap.



### Table of Tightening Torques

NOTE: A specialized tool is required for valve seat replacement.

Please contact TLV.

Part	15 – 25 mm		32 – 50 mm	
	Torque	Distance Across Flats	Torque	Distance Across Flats
	N·m	mm	N·m	mm
Valve Seat	170	27	500	55
Nut (for the bonnet flange)	10	17	30	19
Gland Retainer	120	24	120	24
Stem Bracket Bolts and Nuts	7	8	7	8
Valve Body/Actuator Connecting Nuts	150	36	150	36



## 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.

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

Problem	Symptom	Cause	Remedy (Countermeasure)
Valve Leakage	The supply air pressure to the positioner is too high	Check the supply air pressure to the positioner (Confirm product specifications)	Re-set the positioner's supply air pressure; adjust the positioner's zero point
	The positioner's zero point is off	Check the pressure on the positioner's pressure gauge when the input signal is at zero	If the pressure on the pressure gauge attached to the positioner is raised, adjust the positioner's zero point
	The inlet pressure for the control valve is too high	Check the inlet pressure for the control valve	Lower the inlet pressure to 1.0 MPaG or less
	The valve and valve seat are off-center	Move the valve stem up and down and check to see if it catches	Reassemble the bonnet section correctly
	The valve and valve seat are worn	Inspect the valve and valve seat	Replace with a new valve and valve seat
Control valve opening does not move beyond a certain point	The bellowphragm in the actuator is broken	Check to see if air is leaking from the exhaust tap or from the bellowphragm area	Replace with a new positioner / actuator unit [Check to make sure that the valve opening (travel) is not changing frequently and that the ambient temperature is not too high.]
	Positioner's internal parts are broken (the diaphragm is cracked, etc.)	Check to see if any unusual noise is coming from the positioner	Replace with a new positioner / actuator unit [Check to make sure that the valve opening (travel) is not changing frequently and that the ambient temperature is not too high.]
	There is insufficient supply air pressure to the positioner	Check the supply air pressure to the positioner (Confirm product specifications)	Adjust the supply air pressure for the positioner (Confirm product specifications)
	Malfunction of the signal system	Check to make sure the controller is putting out a 4 – 20mA signal and that the wires are not disconnected, etc.	Repair the controller or replace with a new controller; replace with new signal wiring
No movement at all	Air is not being supplied to the positioner	Make sure that the compressor is operating as it should; make sure that the regulator connected to the positioner inlet is set	Initiate the supply of supply air pressure to the positioner (Confirm product specifications)

Continued on the next page

Problem	Symptom	Cause	Remedy (Countermeasure)
No movement at all	The input signal wiring is incorrectly connected	Check the "+" and "-" connection terminals in the positioner; check the controller's connections	Correct the connections
	The input signal is not being input	Check that 4 - 20mA is being output by the connection terminals inside the positioner	Adjust the controller or replace with a new controller
	Positioner's internal parts are broken (the diaphragm is cracked, etc.)	Check to see if any unusual noise is coming from the positioner	Replace with a new positioner / actuator unit [Check to make sure that the valve opening (travel) is not changing frequently and that the ambient temperature is not too high.]
	There is water or oil inside the positioner	Check to see if there is water or oil entrained in the supply air; check to see if the humidity at the control valve piping location is too high	Replace with a new positioner / actuator unit Have the positioner / actuator unit repaired (Improve the quality of the supply air)
Control valve opens and closes too slowly	There is water or oil inside the positioner	Check to see if there is water or oil entrained in the supply air; check to see if the humidity at the control valve piping location is too high	Replace with a new positioner / actuator unit Have the positioner / actuator unit repaired (Improve the quality of the supply air)
	The filter/regulator is clogged	Check the filter	Clean the filter or replace with a new filter
Control valve opening is unstable	The setting of the controller is faulty	Check the set value based on the controller's PID parameters	Change the set values

## 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.

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