172-65742MA-01 (CT20/CT20D) 7 October 2021

ISO 9001
ISO 14001

Manufacturer
TLV CO., LTD.
Kakogawa, Japan

Instruction Manual

Electro-Pneumatic Control Valve

CT20/CT20D

(for Valve Unit)

Contents

Introduction

Thank you for purchasing the TLV electro-pneumatic control valve CT20/CT20D.

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.

For details of the actuator and the electro-pneumatic digital positioner, refer to the respective instruction manuals issued by the manufacturer.

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.	
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

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 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.
	DO NOT use only the actuator eye bolt when hoisting or lifting the assembled product. Failure to observe this precaution may lead to product damage.
	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.

Continued on the next page

⚠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.
	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.
	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.
	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.
	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.
	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.
	When using this product, NEVER stand close to, or leave tools anywhere near, moving parts, such as the shaft. Contact with moving parts or objects becoming caught in moving parts could lead to injury or damage or other accidents.

Specifications

⚠CAUTION

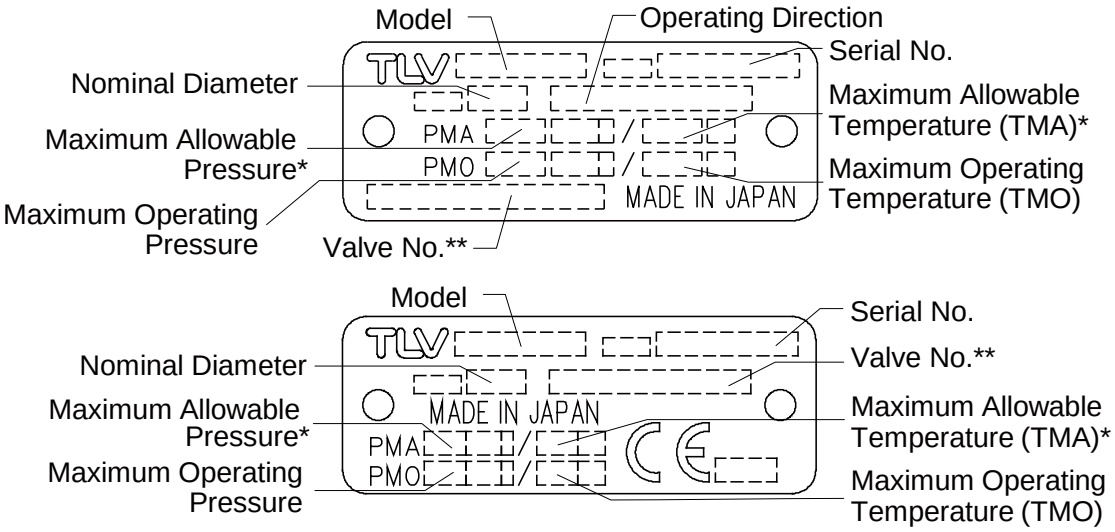
Install properly and DO NOT use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions which may lead to serious accidents. Local regulations may restrict the use of this product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

⚠CAUTION

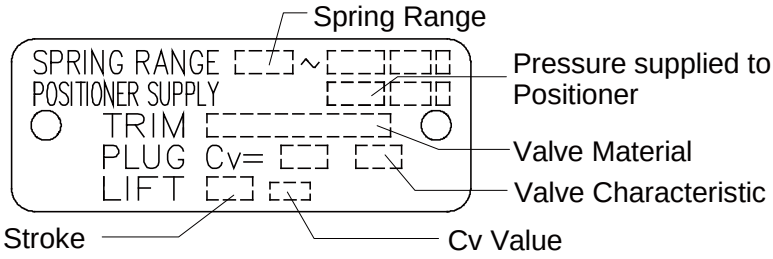
Use only under conditions in which no freeze-up will occur. Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury.

Refer to the product nameplate for detailed specifications.

Valve Section



Actuator Section

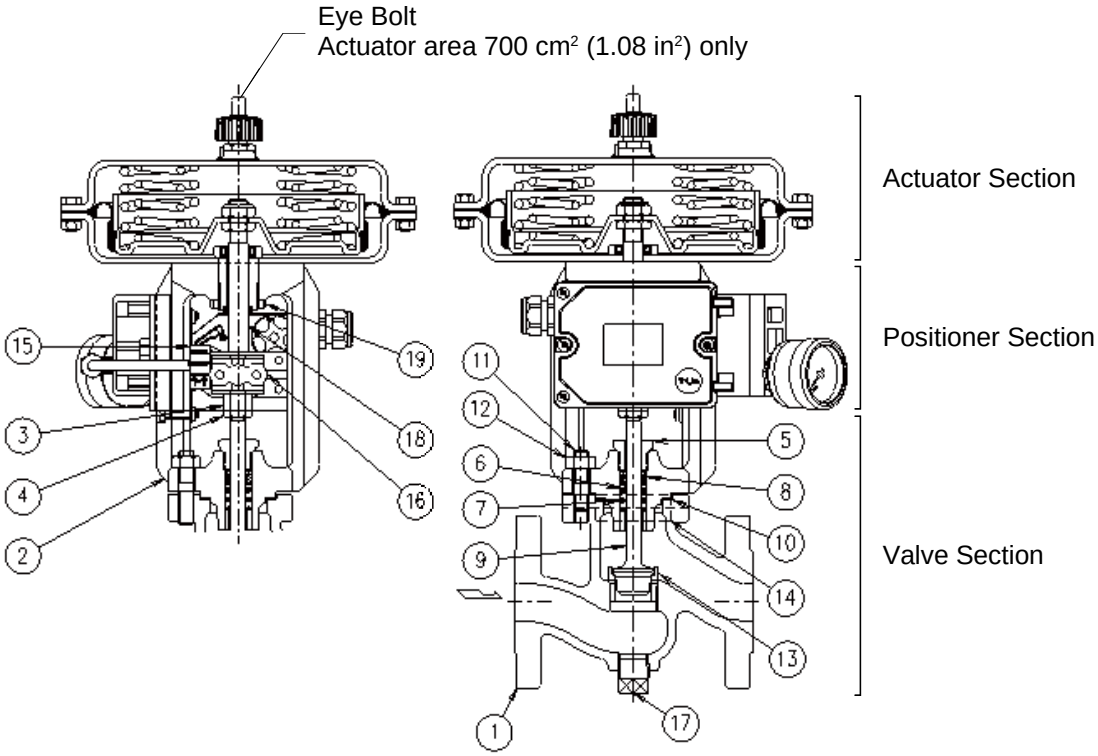


*Maximum allowable pressure (PMA) and maximum allowable temperature (TMA) are PRESSURE SHELL DESIGN CONDITIONS, **NOT** OPERATING CONDITIONS.

**Valve No. is displayed for products with options. This item is omitted from the nameplate when there are no options.

Configuration

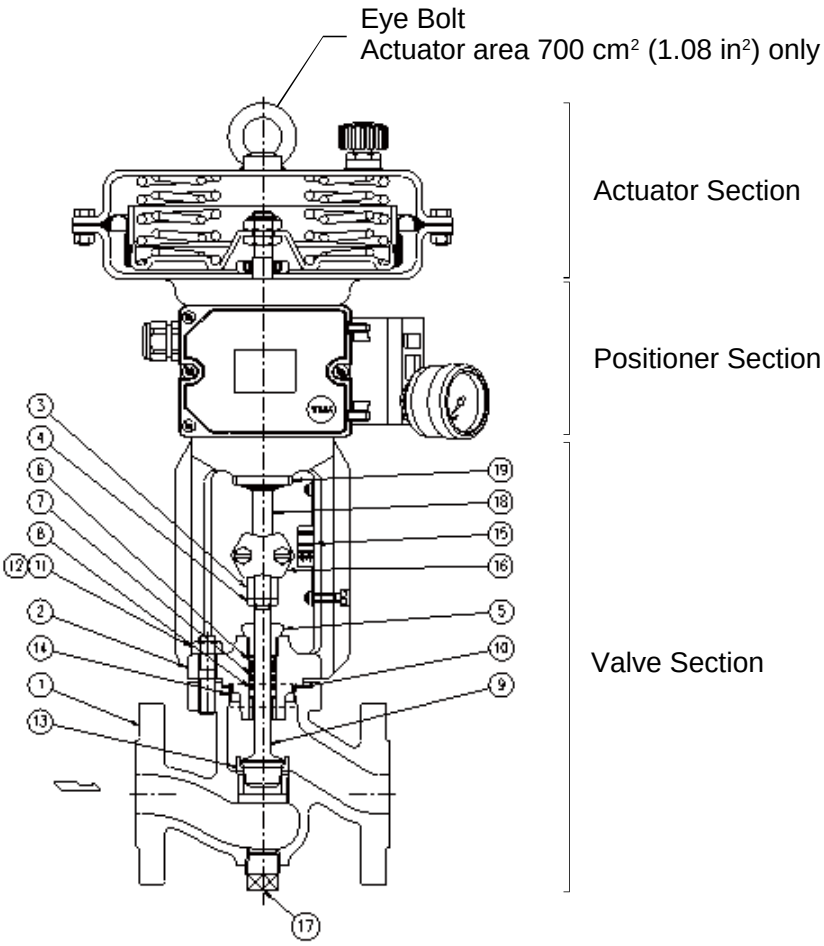
CT20



No.	Part	M*	R*
1	Body		
2	Valve Bonnet		
3	Stem Connector Nut		
4	Locknut		
5	Guide Bushing		
6	Stuffing Box V-ring Packing		✓
7	Stuffing Box Washer		✓
8	Stuffing Box Spring		✓
9	Valve Plug & Stem		✓
10	Valve Bonnet Gasket	✓	✓
11	Bolt		
12	Nut		
13	Valve Seat		✓
14	Nameplate (Valve Section: front / Actuator Section: back)		
15	Travel Indicator Scale		
16	Stem Bracket Clamps		
17	Drain Plug		
18	Actuator Stem		
19	Fixing Nut		

*Replacement parts are available only in the following kits:
M = Maintenance Kit
R = Repair Kit

CT20D (Option)



No.	Part	M*	R*
1	Body		
2	Valve Bonnet		
3	Stem Connector Nut		
4	Locknut		
5	Guide Bushing		
6	Stuffing Box V-ring Packing		✓
7	Stuffing Box Washer		✓
8	Stuffing Box Spring		✓
9	Valve Plug & Stem		✓
10	Valve Bonnet Gasket	✓	✓
11	Valve Bonnet Bolt		
12	Valve Bonnet Nut		
13	Valve Seat		✓
14	Nameplate (Valve Section: front / Actuator Section: back)		
15	Travel Indicator Scale		
16	Stem Bracket Clamps		
17	Drain Plug		
18	Actuator Stem		
19	Fixing Nut		

*Replacement parts are available only in the following kits:
M = Maintenance Kit
R = Repair Kit

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 which may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.**

⚠CAUTION **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.**

⚠CAUTION **DO NOT use only the actuator eye bolt when hoisting or lifting the assembled product. Failure to observe this precaution may lead to product damage.**

⚠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 **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.**

Installation, inspection, maintenance, repairs, disassembly and adjustment and valve opening/closing should be carried out 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. Blowdown
   Before installing 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.
2. Installing the actuator section
   The eye bolt welded onto the upper part of the diaphragm housing is for mounting and removing the actuator. Do not lift the assembled product using only the eye bolt.
   (See Fig. 1)
3. Installing the control valve
   Lift the assembled product using hoisting equipment such as cranes and forklifts. Do not lift the assembled product using only the eye bolt.
   (See Fig. 2)
4. Removing protective caps and seals
   Before installation, be sure to remove all protective seals and caps.
   (Found in two locations, on the product inlet and outlet.)

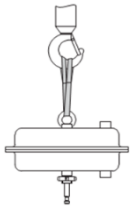


Fig. 1
Hoisting the actuator

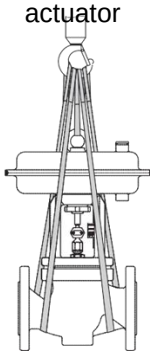
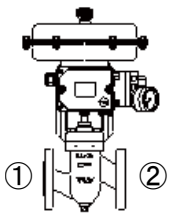


Fig. 2
Hoisting the control valve



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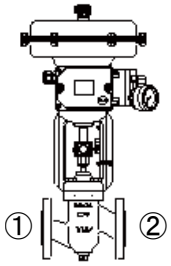
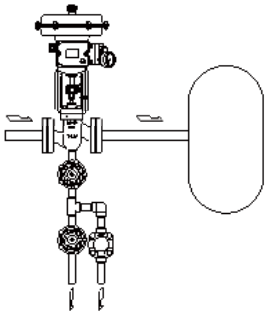
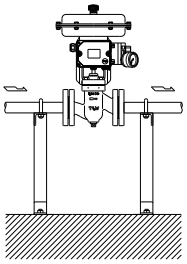


CT20D

5. Installation angle
   Install the product so that the arrow mark on the valve body points horizontally in the direction of steam flow, and it should be installed horizontally in the piping with the actuator at the top. Allowable inclination is 10 degrees in the fore-aft direction and 15 degrees in the plane perpendicular to the steam flow line.



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



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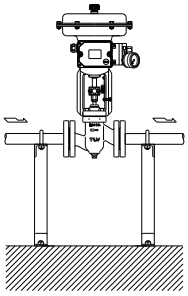
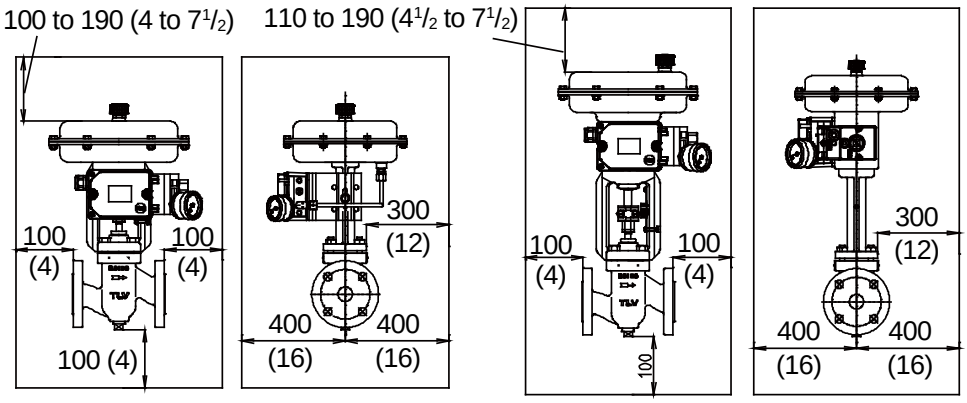


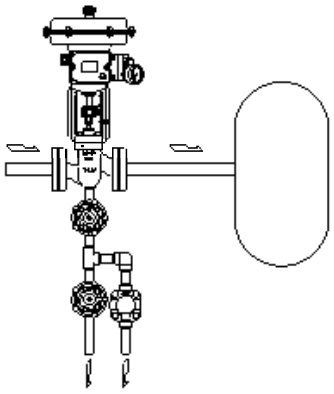
CT20D

7. Maintenance space
   Leave sufficient space for maintenance, inspection and repair. (Units: mm (in))



CT20 CT20D

8. Drainage port usage example
   The threaded condensate drainage port at the bottom of the body makes possible installation of a blow valve or steam/air trap. Because the condensate drainage port is located on the primary side of the product, condensate flowing in the primary side piping can quickly be eliminated, contributing to prevention of valve seat erosion and rapid start-up of the equipment.



Pit

If there is a problem in operation, determine the cause using the “Troubleshooting” section in this manual.

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.**

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

Operational Check

An 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.
In the event of failure (malfunction), also refer to the "Troubleshooting" section for remedies.

Inspection Item	Inspection Points	Remedy for Failure (Malfunction)
Leakage from valve (when the valve is closed)	Visual inspection or stethoscope inspection; is the outlet side pressure or temperature elevated, or is there the sound of the medium flowing?	Adjust the zero/span; if that does not solve the problem, replace with a new valve plug & stem and valve seat
Leakage from gland section	Visual inspection; is fluid leaking from the gap between the guide bushing and the valve stem, or are there signs it has leaked previously?	Coat the guide bushing and the valve stem with grease; if that does not solve the problem, replace with new V-ring packing
Leakage from the gaskets between any pressurized parts	Visual inspection; is fluid leaking from the gasket areas on pressurized parts?	Apply additional tightening (refer to recommended torque) or replace with new gaskets
Leakage from pressurized parts such as body and valve bonnet	Visual inspection; is fluid leaking from pressurized parts such as the body or valve bonnet?	Replace any pressurized parts at leak locations

Parts Inspection

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

Inspection Item
Gasket(s): Check for warping and damage (Graphite gaskets MUST be replaced if disassembled)
Stuffing Box V-ring Packing: Check for warping or damage
Valve Plug & Stem, Valve Seat: Check for damage or scratches
Body, Valve Bonnet: Check for damages or corrosion

Disassembly/Reassembly

⚠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.**

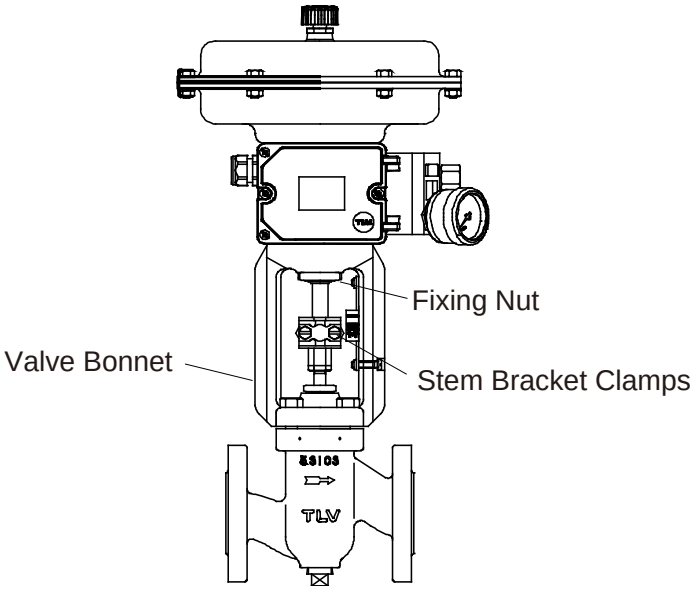
⚠CAUTION **Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way. Failure to observe these precautions may result in damage to the product or burns or other injury due to malfunction or the discharge of fluids.**

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.)
For details of the actuator and the electro-pneumatic digital positioner, refer to the respective instruction manuals issued by the manufacturer.

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

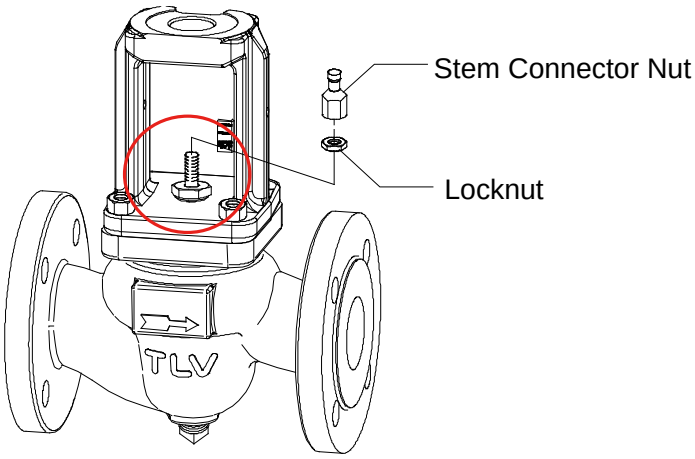
Removing/Reattaching the Actuator (Positioner)

Part	During Disassembly	During Reassembly
Stem Bracket Bolt	Loosen the stem bracket bolt and remove the stem bracket clamps connecting the actuator stem and stem connector nut	Consult the table of tightening torques and tighten to the proper torque
—	When an input signal is sent to the positioner, the actuator stem will ascend	—
Fixing Nut	Remove the fixing nut connecting the actuator and the valve bonnet while keeping the actuator stem in the raised position	Consult the table of tightening torques and tighten to the proper torque



Detaching/Reattaching the Stem Connector Nut and Locknut

Part	During Disassembly	During Reassembly
Locknut, Stem Connector Nut	Loosen the locknut by holding the stem connector nut with a spanner DO NOT disassemble with the valve plug in contact with the valve seat, make sure that the valve plug is slightly suspended	Do not supply air to the actuator at a pressure of 0.6 MPaG (85 psig, 6 barg) or more. Consult the table of tightening torques and tighten to the proper torque If the instructions given are not followed when reassembly is carried out, malfunctions such as insufficient lift (insufficient flow capacity) and/or insufficient closing force (valve leakage) may result: give the proper attention to the adjustment procedure



Instructions for Reverse Action (Air to Open, Fail Closed) Stroke Adjustment

1. Make sure that the valve plug is securely seated in the valve seat. (Fig. 1)
2. Supply the maximum air pressure (0.33 MPaG (48 psig, 3.3 barg)) of the spring range (e.g. 0.09 to 0.33 MPaG (13 to 48 psig, 0.9 to 3.3 barg)) to the actuator. (Refer to the nameplate, drawing or specification data sheet (SDS) for the spring range.)
   With the actuator stem raised, screw the locknut and stem connector nut into the guide bushing as far as possible without touching the valve stem. (Fig. 2)
3. Supply the lower limit air pressure (0.09 MPaG (13 psig, 0.9 barg)) of the spring range (e.g. 0.09 to 0.33 MPaG (13 to 48 psig, 0.9 to 3.3 barg)) to the actuator. The actuator stem will descend. (Fig. 3)
   NOTE: Be careful not to pinch your fingers.
4. Turn the stem connector nut until it comes into contact with the actuator stem, and turn the stem connector nut a further 1/4 turn to contact the actuator stem. Make sure that the valve plug is seated in the valve seat.
   Hold the stem connector nut with a spanner and tighten the locknut with a proper torque. (Fig. 4)
5. Shut off the air supply to the actuator.
   NOTE: Be careful not to pinch your fingers.
6. Secure the stem connector nut and the actuator stem with the stem bracket clamps. Make sure to adjust the stem bracket clamps to 0% (fully closed) on the travel indicator scale. (Fig. 5)

Fig. 1

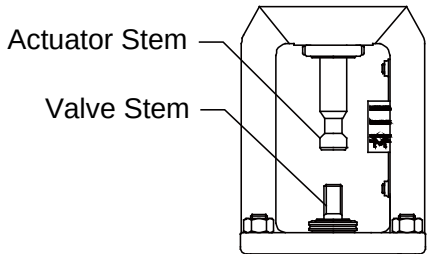


Fig. 2

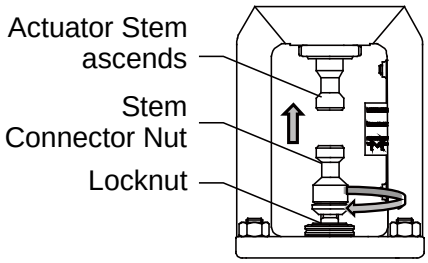


Fig. 3

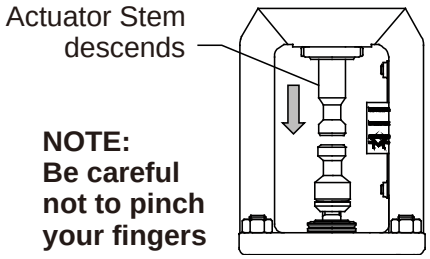


Fig. 4

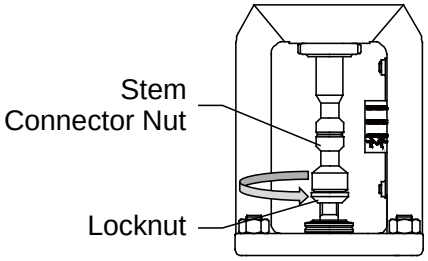
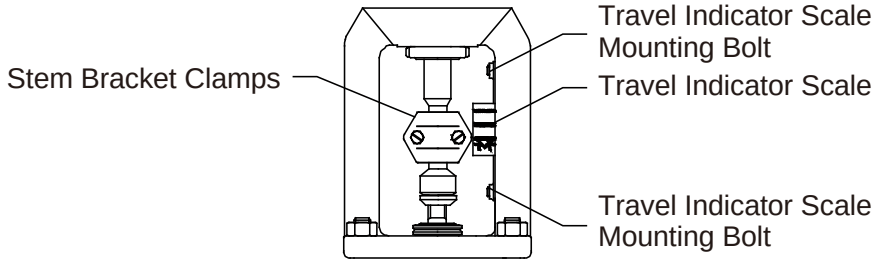


Fig. 5



Instructions for Direct Action (Air to Close, Fail Open) Stroke Adjustment

1. Make sure that the valve plug is securely seated in the valve seat. (Fig. 1)
2. Screw the locknut and coupling nut onto the valve stem until they are just short of coming into contact with the guide bushing. (Fig. 2)
3. Supply the upper limit air pressure (0.1 MPaG (15 psig, 1.0 barg)) of the spring range (e.g. 0.02 to 0.1 MPaG (3 to 15 psig, 0.2 to 1.0 barg)) to the actuator. The actuator stem will descend. (Fig. 3)
   NOTE: Be careful not to pinch your fingers.
4. Turn the stem connector nut until it comes into contact with the actuator stem, and turn the stem connector nut a further 1/4 turn to contact the actuator stem. Make sure that the valve plug is seated in the valve seat. Hold the stem connector nut securely in place with a tool such as a spanner and tighten the locknut. (Fig. 4)
5. Shut off the air supply to the actuator.
   NOTE: Be careful not to pinch your fingers.
6. Secure the stem connector nut and the actuator stem with the stem bracket clamps. Make sure to adjust the stem bracket clamps to 100% (fully open) on the travel indicator scale. (Fig. 5)

Fig. 1

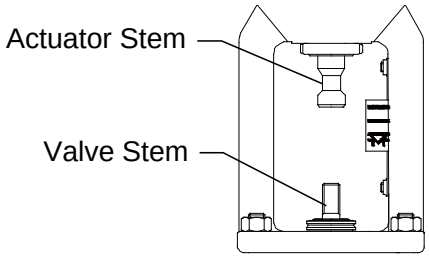


Fig. 2

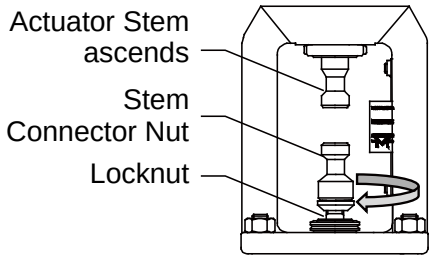


Fig. 3

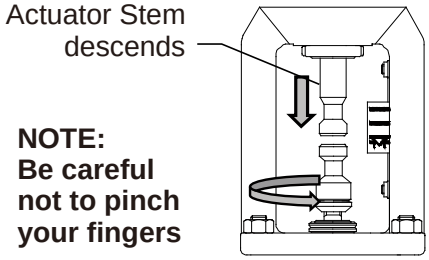


Fig. 4

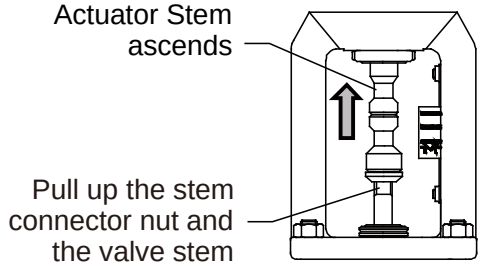
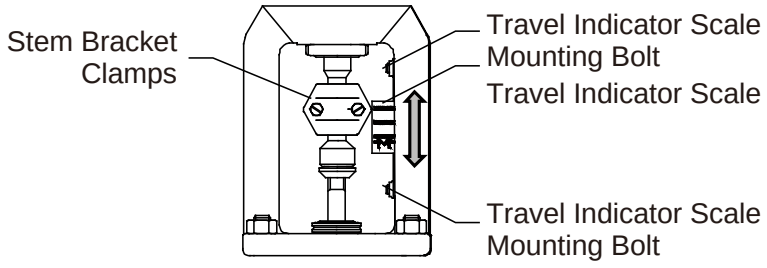


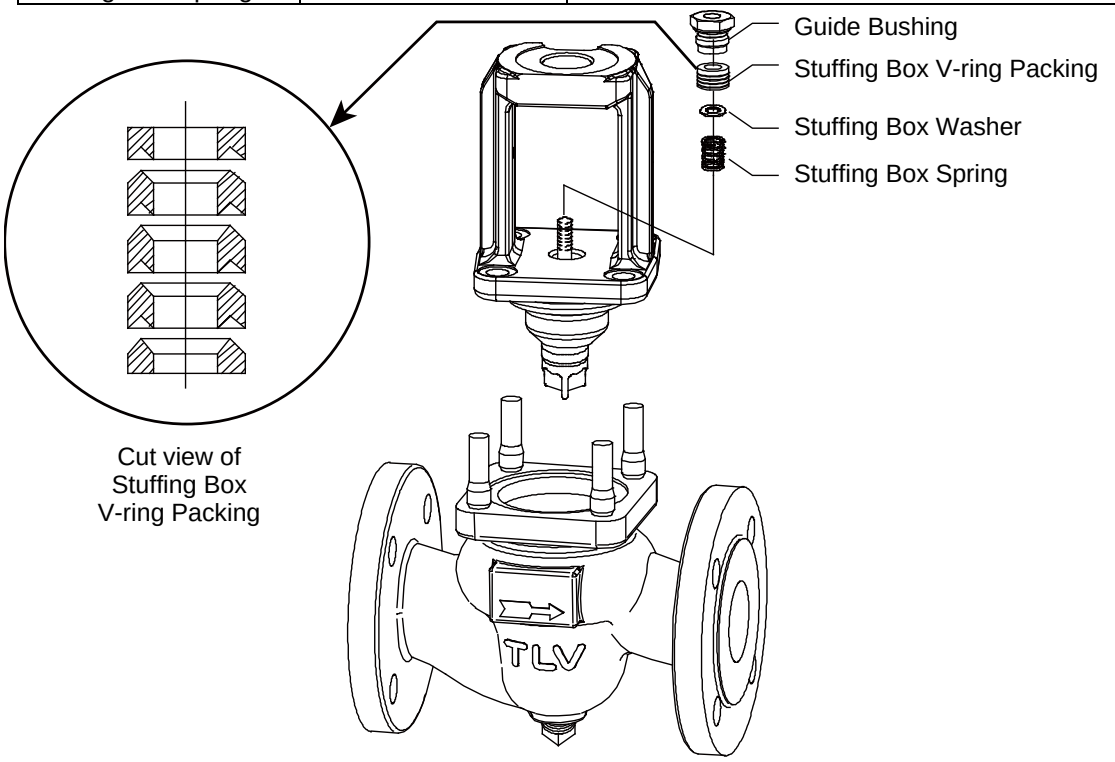
Fig. 5



Disassembling/Reassembling the Gland and its Components

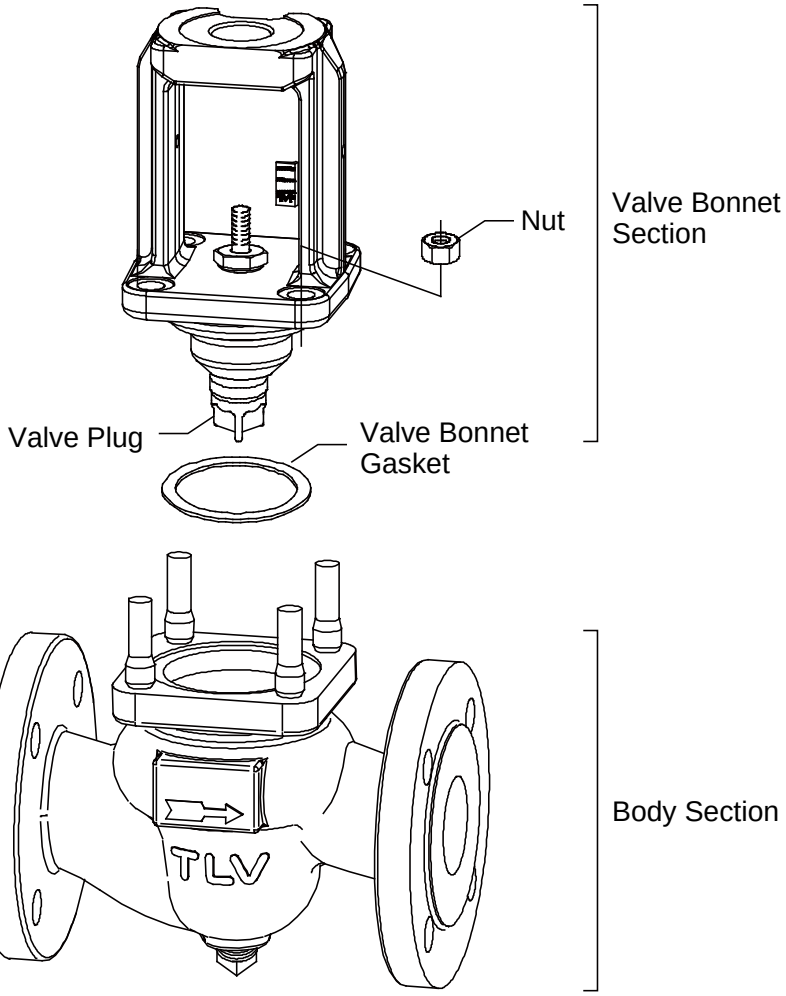
In the procedure below, first partially loosen the guide bushing and then remove the valve plug & stem before removing the other parts. (The procedure is most easily performed if the bushing is loosened while it is attached to the valve body.)

Part	During Disassembly	During Reassembly
Guide Bushing	Remove with a socket wrench	Consult the table of tightening torques and tighten to the proper torque
Stuffing Box V-ring Packing	Pull up and out	Make sure to reassemble the V-ring packing in the proper orientation; coat the groove with heat-resistant silicon grease; reattach the V-ring packing with the grooves facing downward
Stuffing Box Washer/ Stuffing Box Spring	Pull up and out	Reinsert



Disassembling/Reassembling of the Valve Bonnet Section

Part	During Disassembly	During Reassembly
Nut	Remove with a socket wrench	Consult the table of tightening torques and tighten to the proper torque, making sure to tighten evenly
Valve Bonnet	Pull up and off, being careful not to damage the valve plug or valve seat	Reattach, being careful not to damage the valve plug or valve seat; insert the bonnet securely into the gasket housing without tilting; check to make sure that there is no catching or biting when the valve plug is seated in the valve seat, and that the valve plug is securely seated in the valve seat
Valve Bonnet Gasket	Remove the gasket and clean sealing surfaces	Replace with a new gasket; make sure that the gasket does not protrude from the housing in the body; DO NOT coat with anti-seize

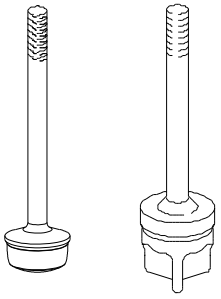


Disassembling/Reassembling the Valve Plug & Stem

After pulling out the valve plug, remove the loosened guide bushing, stuffing box V-ring packing, washer and coil spring.

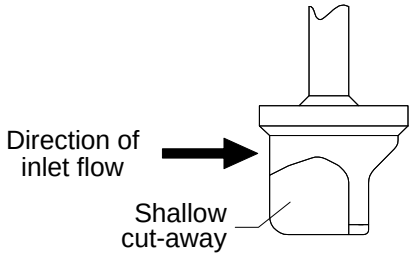
Part	During Disassembly	During Reassembly
Valve Plug & Stem	—	When the Cv value is 30 or greater, be careful of the orientation of the valve wing-blades during reassembly; improper orientation can result in noise or erosion of the valve plug and/or valve seat

NOTE: Valve reassembly orientation for Cv values of 30 or greater. (When the Cv value is 20 or less, there is no designated reassembly orientation.)

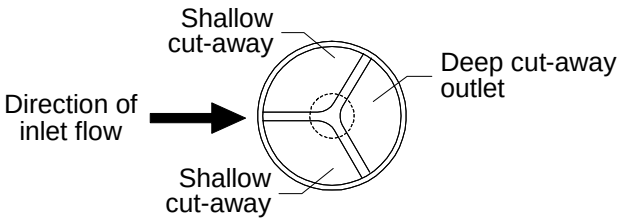


Cv Value: 20 or less | Cv Value: 30 or more

Valve Plug: Viewed from side

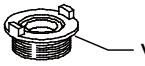


Valve Plug: Viewed from bottom



Removing/Reinserting the Valve Seat (Special tool required)

Part	During Disassembly	During Reassembly
Valve Seat	This procedure requires a special tool; contact TLV for details	Over-tightening could result in damage to the valve seat and body; consult the table of tightening torques and tighten to the proper torque



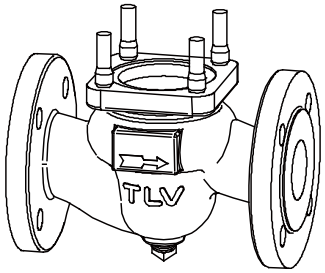


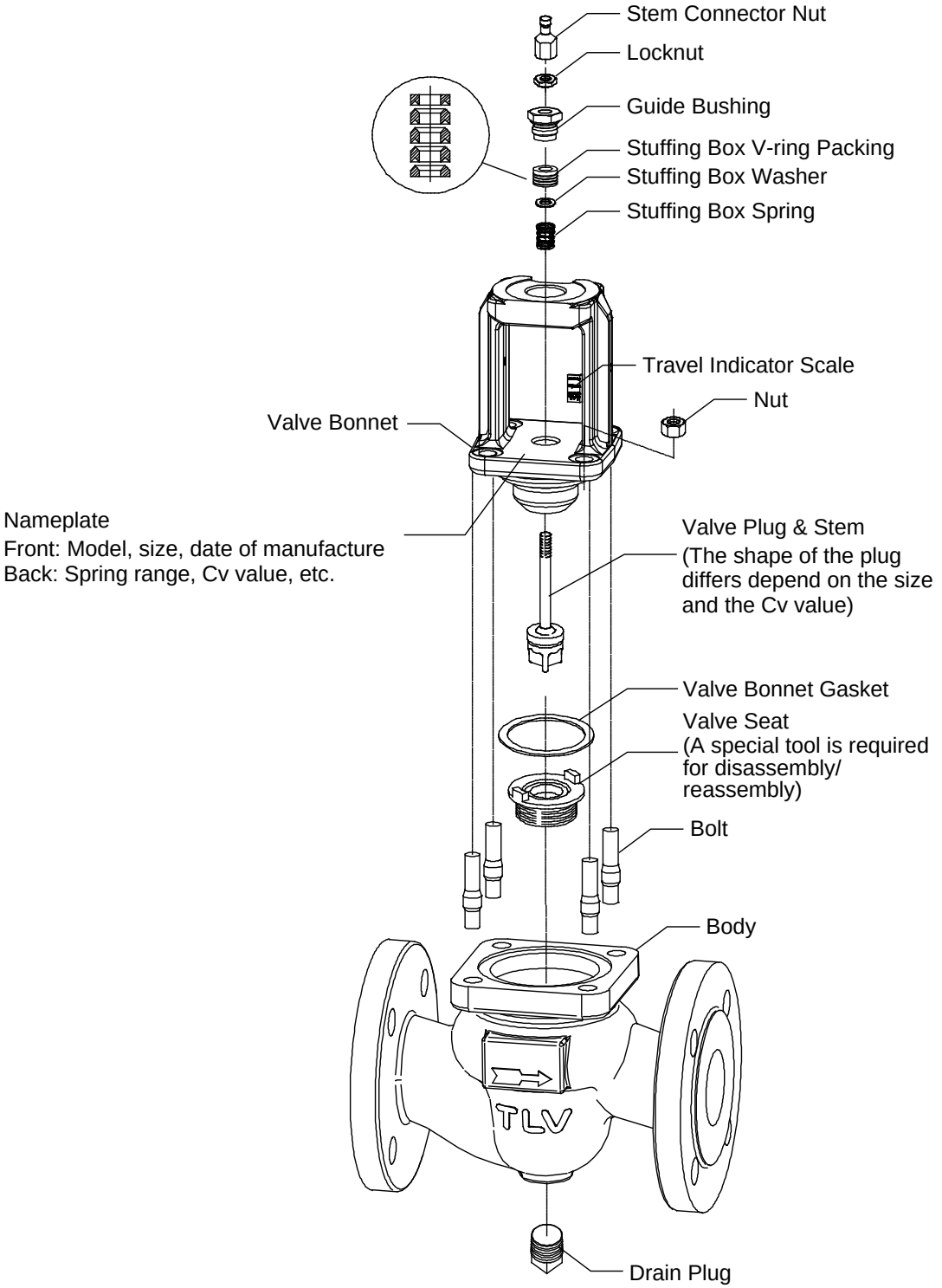
Table of Tightening Torques

Part	Size mm	Size (in)	Torque N·m	Torque (lbf·ft)	Distance Across Flats mm	Distance Across Flats (in)
Guide Bushing	15 to 80	(1/2 to 3)	50	(37)	24	(15/16)
	100, 150	(4, 6)	80	(59)	27	(1 1/16)
Valve Bonnet Nut	15 to 25	(1/2 to 1)	30	(22)	16/17 [1]	(5/8 / 21/32) [1]
	40, 50	(1 1/2, 2)	50	(37)	18/19 [1]	(11/16 / 3/4) [1]
	65, 80	(2 1/2, 3)	100	(73)	24	(15/16)
	100, 150	(4, 6)	150	(110)	30	(1 3/16)
Valve Seat	15 to 25	(1/2 to 1)	170	(124)	Special tool required [2]	
	40, 50	(1 1/2, 2)	500	(368)		
	65, 80	(2 1/2, 3)	1050	(774)		
	100	(4)	1550	(1143)		
	150	(6)	2600	(1918)		
Fixing Nut	15 to 150	(1/2 to 6)	150	(110)	Special tool required [2]	
Stem Connector Nut, Locknut	15 to 80	(1/2 to 3)	50	(37)	16/17 [1]	(5/8 / 21/32) [1]
	100, 150	(4, 6)	120	(88)	24	(15/16)
Stem Bracket Bolt	240 cm^2 [3]	(0.37 in^2) [3]	5	(4)	8	(5/16)
	350 cm^2 [3]	(0.54 in^2) [3]	9	(6.5)	9	(11/32)
	700 cm^2 [3]	(1.08 in^2) [3]	9	(6.5)	9	(11/32)
Drain Plug [4]	15 to 150	(1/2 to 6)	50	(37)	—	

[1] Size depends on bolt specifications. (1 N·m ≈ 10 kg·cm)
[2] Contact TLV for details.
[3] Actuator area
[4] Rc(PT)1/2, other standards available. Torque values with sealing tape wrapped 3 to 3.5 turns around the threads

NOTE: -Coat all threaded portions with anti-seize.
-If drawings or other special documentation were supplied for the product, any torque given there takes precedence over values shown here.

Exploded View



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.**

When the valve unit fails to operate properly, use the following table to locate the cause and remedy. When the actuator and positioner fail to operate properly, refer to the applicable manual.

Problem	Cause	Diagnosis	Remedy (Countermeasure)
Valve Leakage	The pressure of the air supply to the positioner is too high	Check the pressure of the air supply to the positioner (confirm product specifications on the nameplate)	Adjust the pressure of the air supply for the positioner to match the pressure in the product specifications Refer to the instruction manual for the positioner for zero point adjustment
	The positioner's zero point is miscalibrated	Check the actuator air supply pressure (on the positioner's pressure gauge) when the operation signal is at zero point	If the pressure on the pressure gauge is elevated, adjust the positioner's zero point (refer to the instruction manual for positioner)
	The inlet pressure for the control valve is too high	Check the inlet pressure for the control valve	Decrease the inlet pressure (Cv value and the spring range must be changed)
	The valve plug and valve seat are off-center	Move the valve plug & stem up and down and check to see if it catches	Reassemble the valve bonnet section correctly
	Wear of the sealing surfaces of the valve plug and valve seat	Check the valve plug and valve seat	Replace the valve plug and valve seat. Consider replacing with a valve plug and valve seat of a more durable material.

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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.

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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.

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