

# INSTRUCTION MANUAL

Keep this manual in a safe place for future reference

## TLV® PRESSURE REDUCING VALVES FOR STEAM COS/COSR Series



**COS-3/COS-16  
COS-21**



**COSR-3/COSR-16  
COSR-21**

Manufacturer

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**EAC**



# Introduction

Steam-using equipment can perform its intended operation only when dry saturated steam is available. Steam containing entrained condensate, scale, air, etc. not only reduces steam equipment productivity, but also shortens the life of pressure reducing valves.

TLV REDUCING VALVES models COS/COSR are innovative reducing valves, which help eliminate these problems by supplying dry saturated steam at a constant pressure at all times. This manual should be read prior to installing or operating TLV COS/COSR SERIES REDUCING VALVES.



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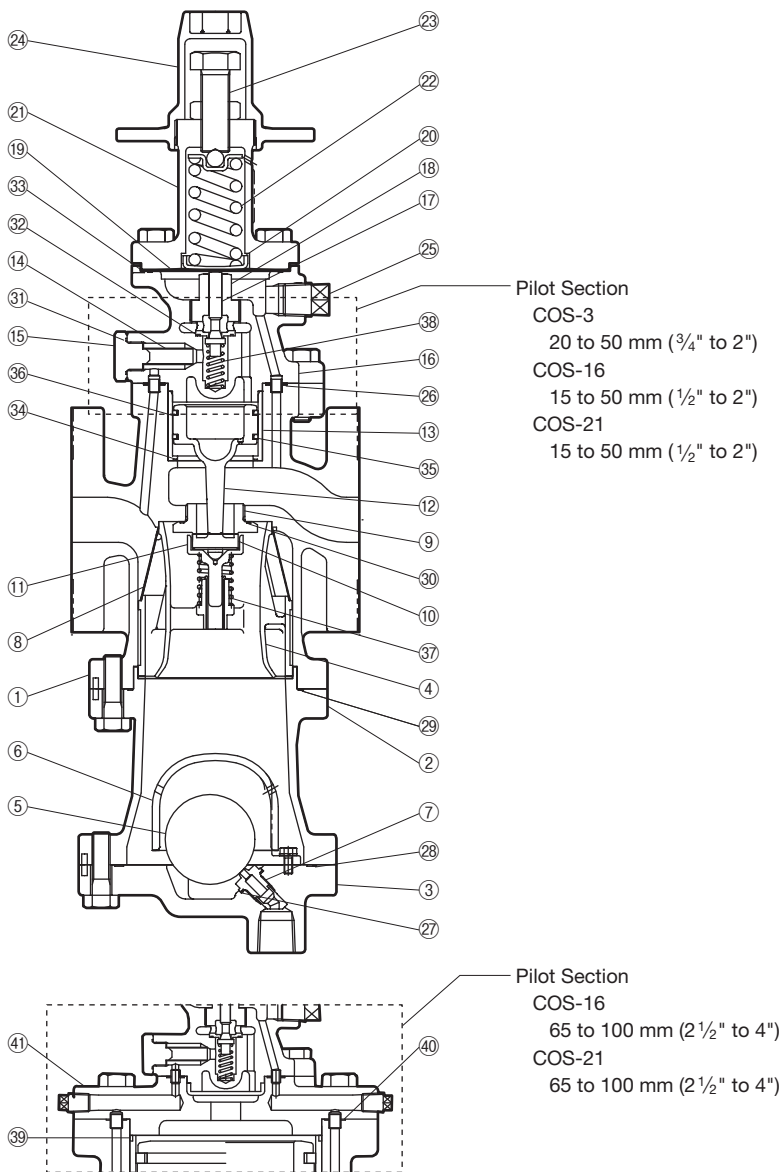
# 1. Safety Considerations

- 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.

 <b>DANGER</b>	 <b>WARNING</b>	 <b>CAUTION</b>
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>WARNING</b>	<b>NEVER apply direct heat to the float.</b> The float may explode due to increased internal pressure, causing accidents leading to serious injury or damage to property and equipment.
	<b>Install properly and 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, which may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.
	<b>DO NOT use this product in excess of the maximum operating pressure differential.</b> Such use could make discharge impossible.
	<b>Use hoisting equipment for heavy objects (weighing approximately 20 kg (44 lb) 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>CAUTION</b>	<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.
	<b>Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way.</b> 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.
	<b>Do not use excessive force when connecting threaded pipes to the product.</b> Overtightening may cause breakage leading to fluid discharge, which may cause burns or other injury.
	<b>Use only under conditions in which no freeze-up will occur.</b> Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury.
	<b>Use under conditions in which no water hammer will occur.</b> The impact of water hammer may damage the product, leading to fluid discharge, which may cause burns or other injury.

## 2. Configuration COS-3/COS-16/COS-21



No.	Description	A1	A2	B	C1	C2	D1	D2	E	F	G
1	Main Body										
2	Trap Body										
3	Trap Cover										
4	Separator										
5	Float										✓
6	Float Cover										
7	Trap Valve Seat									✓	
8	Separator Screen			✓							
9	Main Valve Seat			✓							
10	Main Valve			✓							
11	Main Valve Holder			✓							
12	Piston				✓	✓					
13	Cylinder				✓	✓					
14	Pilot Screen								✓		
15	Pilot Screen Holder										
16	Pilot Body										
17	Pilot Valve								✓		
18	Pilot Valve Seat								✓		
19	Diaphragm										
20	Diaphragm Support										
21	Spring Housing										
22	Coil Spring										
23	Adjustment Screw										
24	Spanner Cap										
25	Plug or Sensing Line Port*										
26	Lower Pilot Body Gasket	✓	✓		✓		✓				
27	Trap Valve Seat Gasket	✓	✓							✓	
28	Trap Cover Gasket	✓	✓							✓	
29	Trap Body Gasket	✓	✓	✓							
30	Main Valve Seat Gasket	✓	✓	✓							
31	Pilot Screen Holder Gasket	✓	✓						✓		
32	Pilot Valve Seat Gasket	✓	✓						✓		
33	Upper Pilot Body Gasket	✓	✓						✓		
34	Cylinder Gasket	✓			✓						
35	Piston Ring				✓	✓	✓	✓			
36	Tension Ring				✓	✓	✓	✓			
37	Main Valve Spring			✓							
38	Pilot Valve Spring								✓		
39	Seal Ring		✓			✓					
40	Pilot Cover Gasket		✓			✓		✓			
41	Pilot Cover										

\* Plug for internal sensing models, or sensing line port for external sensing models.

See 4.16 and 4.17 for details.

Note: Replacement parts available for COS-3/COS-16 in kits specified; contact TLV for COS-21 parts

(A1) Maintenance kit for COS-3 (20 to 50 mm, 3/4" to 2") and COS-16 (15 to 50 mm, 1/2" to 2")

(A2) Maintenance kit for COS-16 (65 to 100 mm, 2 1/2" to 4")

(B) Repair kit for Main Valve

(C1) Repair kit for Piston for COS-3 (20 to 50 mm, 3/4" to 2") and COS-16 (15 to 50 mm, 1/2" to 2")

(C2) Repair kit for Piston for COS-16 (65 to 100 mm, 2 1/2" to 4")

(D1) Repair kit for Piston Ring for COS-3 (20 to 50 mm, 3/4" to 2") and COS-16 (15 to 50 mm, 1/2" to 2")

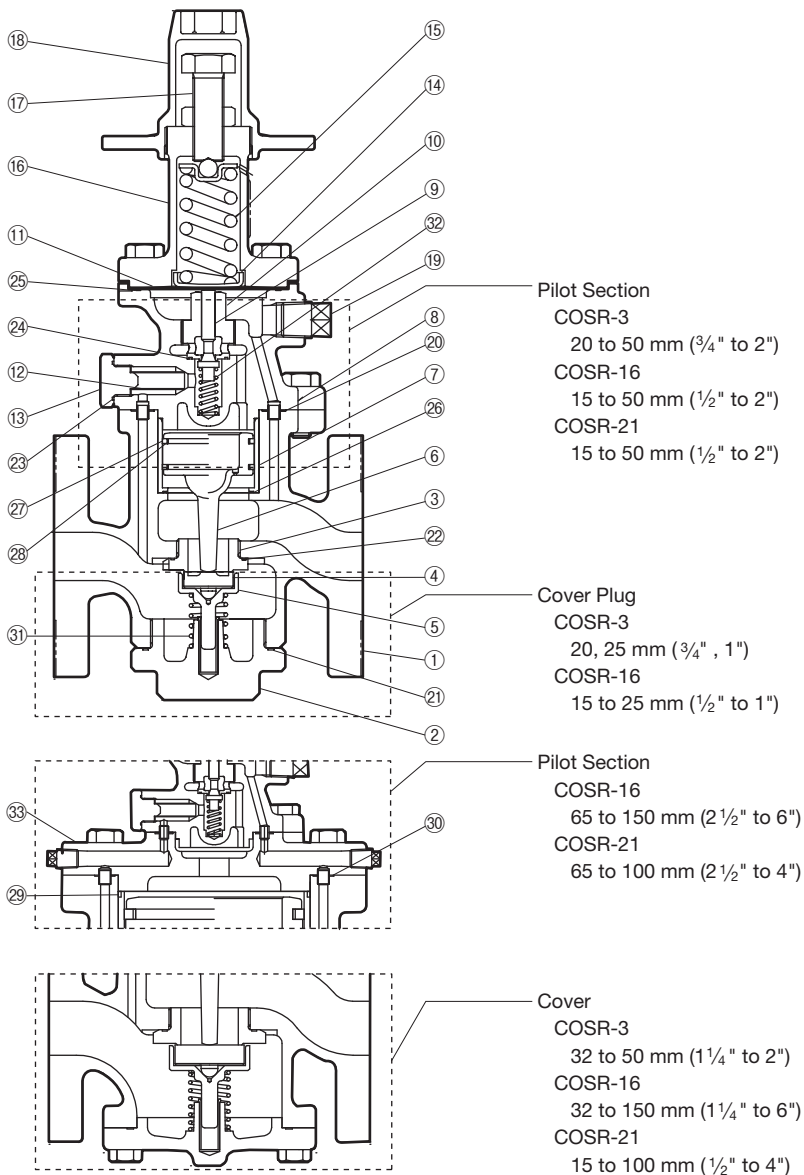
(D2) Repair kit for Piston Ring for COS-16 (65 to 100 mm, 2 1/2" to 4")

(E) Repair kit for Pilot Valve

(F) Repair kit for Trap Valve Seat

(G) Float

COSR-3/COSR-16/COSR-21



No.	Description	A1	A2	B	C1	C2	D1	D2	E
1	Main Body								
2	Cover Plug								
	Cover								
3	Main Valve Seat			✓					
4	Main Valve			✓					
5	Main Valve Holder			✓					
6	Piston				✓	✓			
7	Cylinder				✓	✓			
8	Pilot Body								
9	Pilot Valve								✓
10	Pilot Valve Seat								✓
11	Diaphragm								
12	Pilot Screen								✓
13	Pilot Screen Holder								
14	Diaphragm Support								
15	Coil Spring								
16	Spring Housing								
17	Adjustment Screw								
18	Spanner Cap								
19	Plug or Sensing Line Port*								
20	Lower Pilot Body Gasket	✓	✓		✓		✓		
21	Cover Plug Gasket	✓		✓					
	Cover Gasket	✓	✓	✓					
22	Main Valve Seat Gasket	✓	✓	✓					
23	Pilot Screen Holder Gasket	✓	✓						✓
24	Pilot Valve Seat Gasket	✓	✓						✓
25	Upper Pilot Body Gasket	✓	✓						✓
26	Cylinder Gasket	✓			✓				
27	Piston Ring				✓	✓	✓	✓	
28	Tension Ring				✓	✓	✓	✓	
29	Seal Ring		✓			✓			
30	Pilot Cover Gasket		✓			✓		✓	
31	Main Valve Spring			✓					
32	Pilot Valve Spring								✓
33	Pilot Cover								

\* Plug for internal sensing models, or sensing line port for external sensing models.  
See 4.16 and 4.17 for details.

Note: Replacement parts available for COSR-3/COSR-16 in kits specified; contact TLV for COSR-21 parts

(A1) Maintenance kit for COSR-3 (20 to 50 mm, 3/4" to 2") and COSR-16 (15 to 50 mm, 1/2" to 2")

(A2) Maintenance kit for COSR-16 (65 to 150 mm, 2 1/2" to 6")

(B) Repair kit for Main Valve

(C1) Repair kit for Piston for COSR-3 (20 to 50 mm, 3/4" to 2") and COSR-16 (15 to 50 mm, 1/2" to 2")

(C2) Repair kit for Piston for COSR-16 (65 to 150 mm, 2 1/2" to 6")

(D1) Repair kit for Piston Ring for COSR-3 (20 to 50 mm, 3/4" to 2") and COSR-16 (15 to 50 mm, 1/2" to 2")

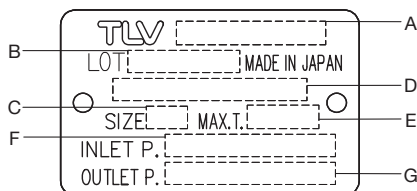
(D2) Repair kit for Piston Ring for COSR-16 (65 to 150 mm, 2 1/2" to 6")

(E) Repair kit for Pilot Valve

### 3. Specifications

Refer to the product nameplate for detailed specifications.

- A. Model
- B. Production Lot No.
- C. Nominal Diameter
- D. Valve No.\*
- E. Maximum Operating Temperature
- F. Primary Pressure Range
- G. Secondary Pressure Adjustable Range



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

#### Acceptable Operating Range

Model	COS-3 COSR-3	COS-16 COSR-16	COS-21 COSR-21
Primary Pressure Range	0.1 to 0.3 MPaG 1 to 3 barg 15 to 45 psig	0.2 to 1.6 MPaG 2 to 16 barg 30 to 250 psig	1.35 to 2.1 MPaG 13.5 to 21 barg 190 to 300 psig
Secondary Pressure Adjustable Range (All conditions must be met)	0.01 to 0.05 MPaG 0.1 to 0.5 barg 1.5 to 7 psig	Within 10 to 84% of primary pressure	
		Minimum adjustable pressure of 0.03 MPaG, 0.3 barg, 5 psig	Minimum adjustable pressure of 0.55 MPaG, 5.5 barg, 80 psig
		Pressure differential between 0.07 to 0.85 MPaG 0.7 to 8.5 barg 10 to 120 psig	Maximum pressure differential of 0.85 MPa 8.5 bar 120 psig
Minimum Adjustable Flow Rate	5% of rated flow rate	5% of rated flow rate; 10% of rated flow rate for sizes 65 mm and larger	

1 MPa = 10 bar = 10.197 kg/cm<sup>2</sup>



To avoid malfunctions, product damage, accidents or serious injury, install properly and DO NOT use this product outside the specification range. Local regulations may restrict the use of this product to below the conditions quoted.



## 4. Piping and Installation



- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- Take measures to prevent people from coming into direct contact with product outlets.
- Install for use under conditions in which no freeze-up will occur.
- Install for use under conditions in which no water hammer will occur.

### 4.1 Recommended Straight Pipe Runs

If the COS/COSR is installed either directly before or after an elbow or control valve, unevenness in flow may result in chattering and unstable pressure.

To ensure stable steam flow, it is recommended that the COS/COSR be installed on straight runs of piping, as illustrated below.

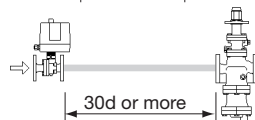
#### ① Inlet (primary side) of the COS/COSR

- Maintain a straight piping run of  $10d$  or more when a manual valve, a strainer or an elbow, etc. is installed.  
(Example: if nominal size is 25 mm (1"), have 250 mm (10") or more)

$d$  = pipe diameter

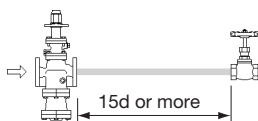


- Maintain a straight piping run of  $30d$  or more when an automated valve (on-off valve) is installed.  
(Example: If nominal size is 25 mm (1"), have 750 mm (30") or more)

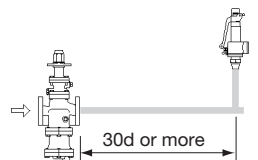


#### ② Outlet (secondary side) of the COS/COSR

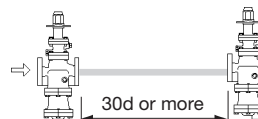
- Maintain a straight piping run of  $15d$  or more when a manual valve, a strainer or an elbow, etc. is installed.  
(Example: If nominal size is 25 mm (1"), have 375 mm (15") or more)



- Maintain a straight piping run of  $30d$  or more when a safety valve is installed.  
(Example: If nominal size is 25 mm (1"), have 750 mm (30") or more)

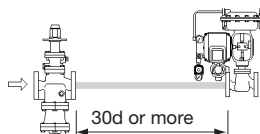


- Maintain a straight piping run of  $30d$  or more when another pressure reducing valve is installed. (Two-stage pressure reduction)  
(Example: If nominal size is 25 mm (1"), have 750 mm (30") or more)



- Maintain a straight piping run of  $30d$  or more when a control valve or an automated valve (on-off valve) is installed.

(Example: If nominal size is 25 mm (1"), have 750 mm (30") or more)



## 4.2 Installing an ON-OFF Valve (solenoid valve or motorized valve)

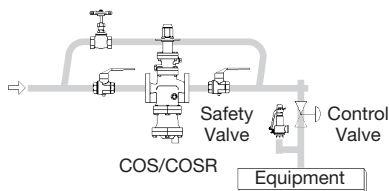
If an on-off valve is required to stop supply of steam to the steam-using equipment, install it at the inlet side of the COS/COSR (see section 4.1). If a solenoid valve is installed at the outlet of the COS/COSR, it will cause heavy chattering and may lead to damage of the piston and main valve. (When the on-off valve opens, the secondary pressure of the COS/COSR changes from zero to the set pressure. Passing through an area of the reducing ratio of less than 10:1 where adjustment is impossible, chattering occurs momentarily.)

To save energy, install the on-off valve as near to the boiler as possible.

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

## 4.3 Installing a Control Valve

A control valve (i.e. for temperature control) installed between the COS/COSR and the steam equipment (downstream of the COS/COSR) may raise pressure between the COS/COSR and the control valve when the control valve is closed, depending on their spatial relationship. Therefore, the control valve should be installed close 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 the equipment or directly before the inlet of the steam-using equipment. If the safety valve is installed between the COS/COSR and a control valve, an eventual pressure rise could activate the safety valve

## 4.4 Blowdown

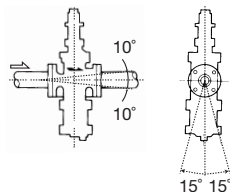
Before installing the COS/COSR unit, be sure to blow down all piping thoroughly. If this is not possible, perform a blowdown using the bypass valve. Blowdown is especially important for newly installed piping or after the system has been shut down for a long period of time.

## 4.5 Remove Protective Seals

Before installation, be sure to remove all protective seals and caps covering the product inlet and outlets. (Found at 3 locations for the COS, 2 locations for the COSR.)

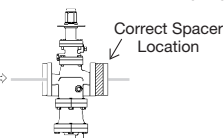
## 4.6 Installation Angle

Install the COS/COSR vertically, so that the arrow mark on the body points horizontally in the direction of steam flow. Allowable inclination is 10 degrees in the fore-aft direction and 15 degrees in the plane perpendicular to the steam flow line.



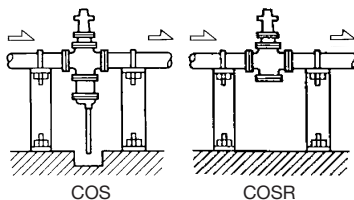
## 4.7 Spacer Installation

If spacing adjustment is necessary to accommodate installation, install a spacer on the outlet flange. The spacer should consist of a spacer, gaskets, bolts and nuts. Fit gaskets to both sides of the spacer between the COS/COSR outlet and the pipe flange. Fasten with bolts and nuts.



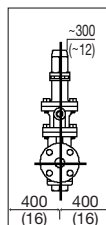
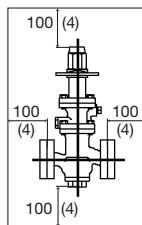
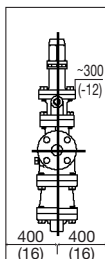
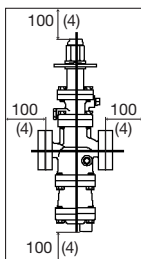
## 4.8 Piping Support

Install the COS/COSR, paying attention to avoid excessive load, bending or vibration. Support the inlet and outlet pipes securely.



## 4.9 Maintenance Space

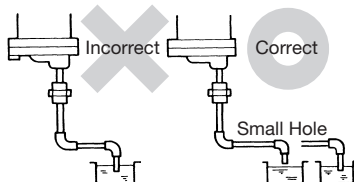
Leave sufficient space for maintenance, inspection and repair.



Units: mm (inch)

## 4.10 Trap Outlet Pipe (COS)

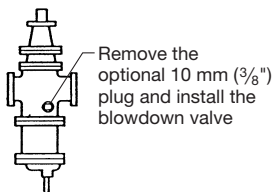
For ease of maintenance, installation of a union connection is recommended for the trap outlet pipe. Connect the outlet pipe to a condensate return line, or extend it to a trench. In the case of the latter, make sure the end of the pipe is above the waterline. (Dirt and water may be sucked up by the vacuum formed during trap closure and system shutdown.)



## 4.11 Blowdown Valve (COS) (requires optional plug)

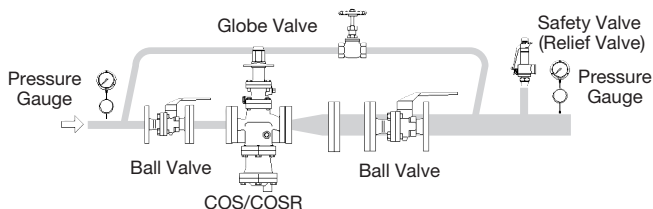
In an environment of heavy dirt or scale, or when the steam equipment is used only periodically, such as for room heating equipment, be sure to use a blowdown valve.

1. Remove the plug from the main body.
2. Install the blowdown valve.
3. Open the blowdown valve and blow any residual dirt and scale off of the separator screen.
4. Periodically activate the blowdown valve to keep the system free of dirt and scale.



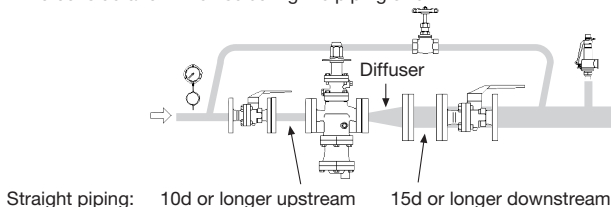
## 4.12 Accessories

Always install a shutoff valve and pressure gauge at both the inlet and outlet, and a shutoff valve in the bypass line. Ball valves, which will not retain condensate, are recommended for inlet and outlet shutoff valves. The bypass pipe should be at least one half the size of the inlet pipe.



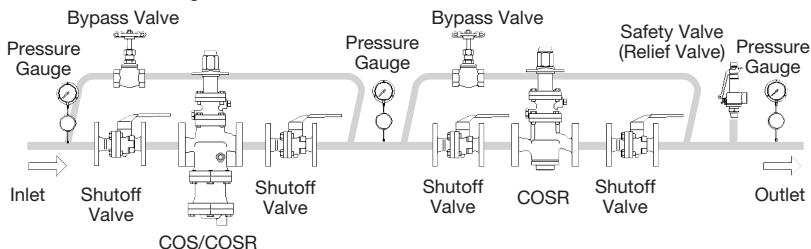
## 4.13 Piping Size/Diffuser

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 reducing valve and the steam-using equipment is great, a possible drop in pressure should be taken into consideration when selecting the piping size.



## 4.14 Two-stage Pressure Reduction

Two-stage pressure reduction should be performed whenever the pressure cannot be reduced to the desired level with a single COS/COSR due to operating range limitations, such as when the reduction ratio is greater than 10:1.



## 4.15 Strainer Installation (COSR)

A strainer should be installed ahead of the COSR. The strainer should be 60 mesh or finer, but not so fine that it causes constriction of the flow area and a subsequent pressure drop. The strainer should be installed horizontally and at 90° to its normal orientation to the pipeline, in order to prevent condensate accumulation in the screen body (see picture).



## 4.16 External Sensing Line

### NORTH AMERICAN MODELS

North American models are factory prepared for external sensing.

An external sensing line **MUST** be installed.

**DO NOT SUPPLY STEAM** until all piping and a 10 mm ( $\frac{3}{8}$ " ) secondary pressure sensing line with a slightly falling pitch have been properly installed. Install a shutoff valve in the pressure sensing line for maintenance purposes.



Keep the shutoff valve in the pressure sensing line open at all times during operation. If the shutoff valve is closed, **COS/COSR will fully open and PRIMARY PRESSURE WILL BE SUPPLIED TO THE EQUIPMENT** (see 4.16 number 5).

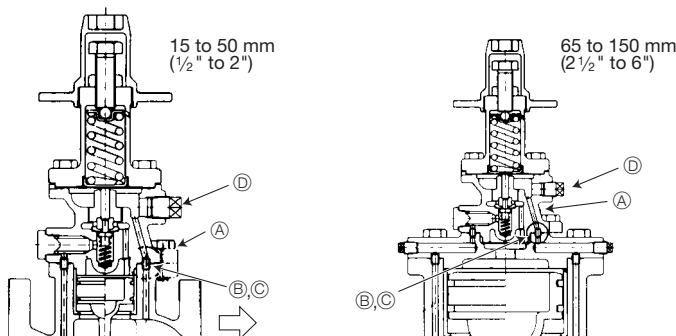
### OTHER MODELS

Other models are factory prepared for internal sensing.

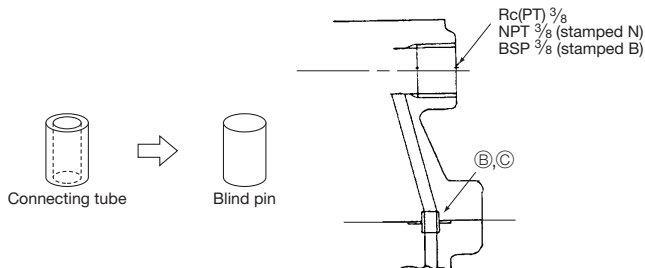
A secondary pressure detection port has been added to all COS/COSR pilot bodies to allow for installation of a 10 mm ( $\frac{3}{8}$ " ) secondary pressure sensing line, which improves performance and increases valve capacity (flow rate). All except North American models are delivered with a secondary pressure sensing line plug installed in this port.

When the external detection method is used, follow the installation procedure shown below: (for North American models, the blind pin has been factory installed and no secondary pressure sensing line plug is provided).

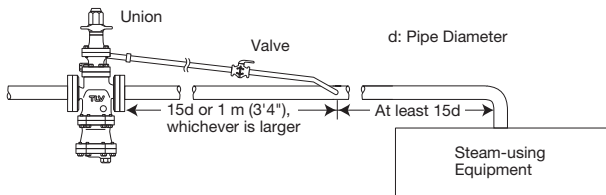
1. Loosen and remove the four (4) bolts (A) that attach the pilot body to the main body (15 to 50 mm,  $\frac{1}{2}$ " to 2" ) or the pilot cover (65 to 150 mm, 2  $\frac{1}{2}$ " to 6" ), and remove the pilot body.



2. Install the blind pin (B) provided by first removing the connecting tube (C) from the main body or pilot cover and then substituting the pin.



3. Re-install the pilot body and fasten the four (4) bolts (A) evenly to the fastening torque shown on page 21.
4. Next, loosen and remove the threaded secondary pressure sensing line plug (D) to install the external pressure sensing line.
5. Install the secondary pressure sensing line with a slightly falling pitch.  
The 10 mm ( $\frac{3}{8}$ " ) pipe should be connected to a point where the pressure is to be sensed. The connection must be at a point on the main piping where there is a straight section of upstream main piping of a length of 15d (d = pipe diameter), or 1 m (3'4"), whichever is greater, and a straight section of downstream main piping of a length of at least 15d.

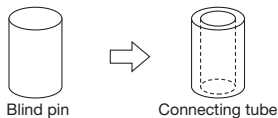


A shutoff valve and pipe union should be installed in the secondary pressure sensing line, to be used when the valve is taken out of service (see beginning of section 4.16).

## 4.17 Internal Sensing for North American Models

All models except North American models are factory prepared for internal sensing. When internal pressure sensing is required for North American models, please contact the nearest TLV representative to request both a connecting tube, which must be installed in place of the blind pin, and a threaded secondary pressure sensing plug.\* Follow the connecting tube installation procedure shown below:

1. Loosen and remove the four (4) bolts that attach the pilot body to the main body (15 to 50 mm,  $\frac{1}{2}$ " to 2") or the pilot cover (65 to 150 mm,  $2\frac{1}{2}$ " to 6"), and remove the pilot valve body.
2. Install the connecting tube by first removing the blind pin from the secondary side of the main body or pilot cover and then substituting the connecting tube.



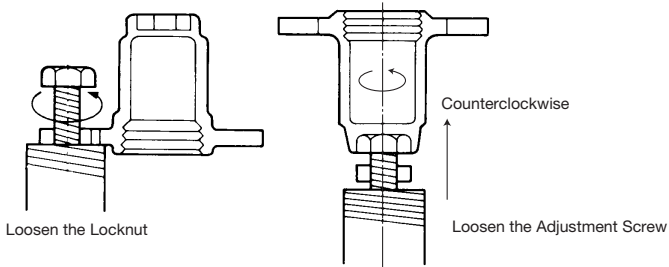
3. Re-install the pilot body and fasten the four (4) bolts evenly.  
Consult page 21 in this manual for torque requirements of these bolts.
4. If a secondary pressure sensing pipe has previously been installed, remove it and be certain to install the threaded secondary pressure sensing line plug in its place.

\* Internal sensing should not be used when 15 mm ( $\frac{1}{2}$ " ) and 20 mm ( $\frac{3}{4}$ " ) COS-16/COSR-16 will be used below 0.3 MPaG (3 barg, 45 psig) and 0.1 MPaG (1 barg, 15 psig) respectively, and below 50% of primary pressure.

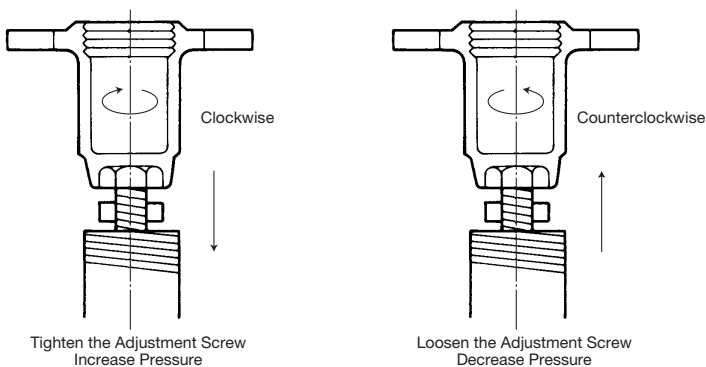
## 5. Adjustment

The COS/COSR reducing valve should be properly adjusted for protection of the steam equipment against water hammer.

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 steam 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 COS/COSR are completely closed.
3. Remove the spanner cap, loosen the locknut and turn the adjustment screw counterclockwise to reduce tension on the coil spring.



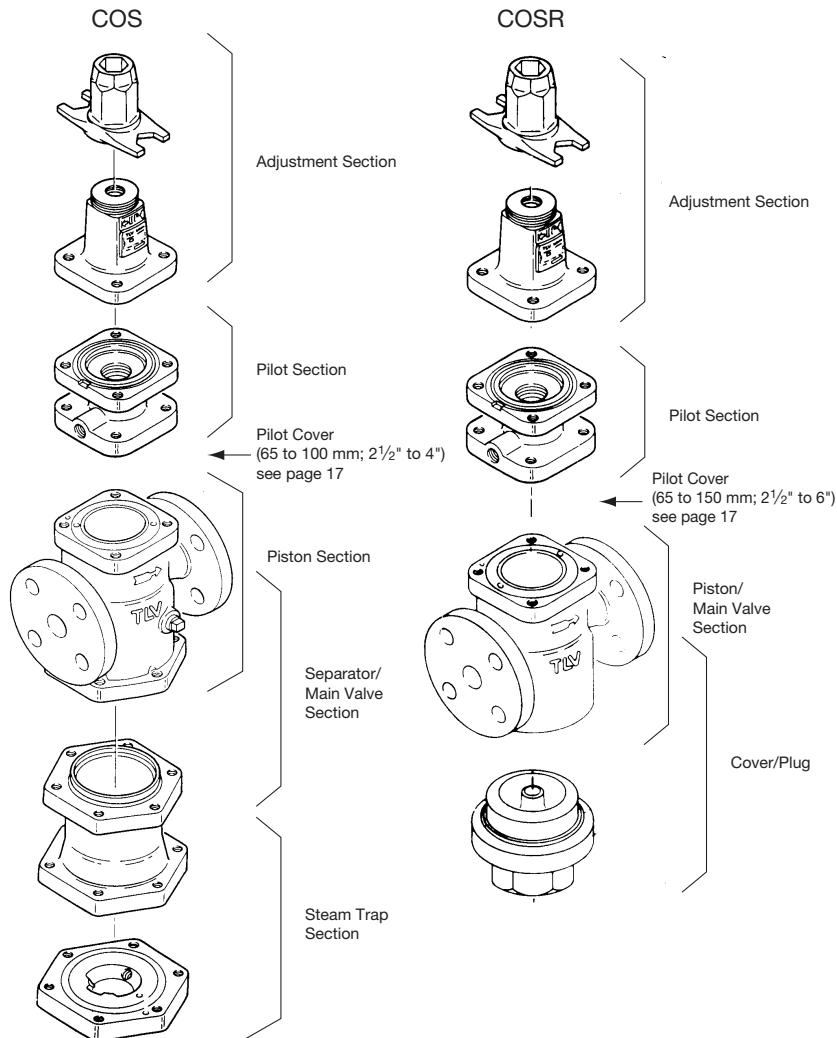
4. Slowly, fully open the shutoff valve at the inlet of the COS/COSR. Allow sufficient time for condensate remaining at the inlet of the COS/COSR to be discharged.
5. Slightly open the shutoff valve at the outlet of the COS/COSR.
6. Turn the adjustment screw until the desired outlet pressure is obtained. Wait several minutes.



7. Slowly, fully open the shutoff valve on the outlet side.
8. After setup, tighten the locknut and replace the cap.
9. When shutting down the system, always close the outlet shutoff valve first and then the inlet valve.

## 6. Disassembly and Inspection

It is a recommended practice to dismantle and inspect the COS/COSR once a year for preventive maintenance purposes. It is especially important to do so immediately after the initial run of a new line or before or after the equipment is out of service for a long period of time.



The size and shape of some COS and COSR parts for large valve sizes will be different from those shown.





- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- Be sure to use the proper components and NEVER attempt to modify the product.

## 6.1 Before Disassembly

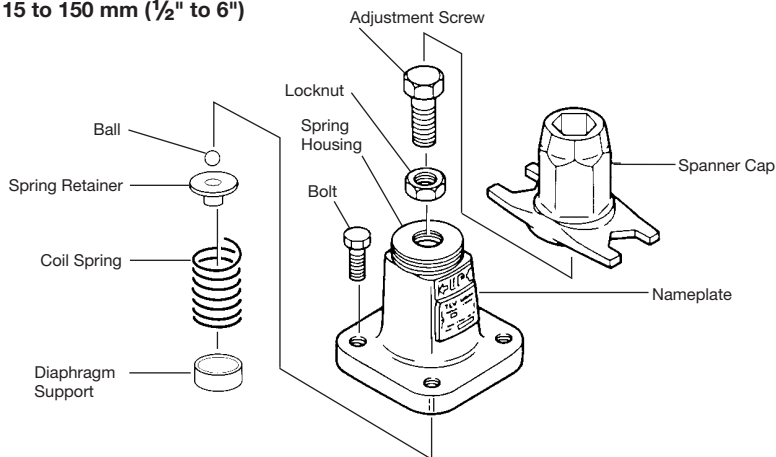
Remove all steam from the piping (both upstream and downstream). If the steam supply to the system cannot be shut off, change over to bypass operation. Close shutoff valves at the inlet and outlet of the COS/COSR completely. Relieve residual steam pressure by loosening slightly the spring housing bolt and pilot screen holder or sensing line plug. Wait for the body to cool before attempting to remove the COS/COSR from the line. Then remove inlet and outlet flange retaining bolts and trap discharge pipe union connection (COS) to permit removal of the COS/COSR for disassembly and inspection. Secure the COS/COSR in a vise to perform the inspection.

## 6.2 Disassembling the Adjustment Section

Loosen the adjustment screw completely and remove the bolts. Having removed the spring housing, you will see the diaphragm support, coil spring, spring retainer and ball.

Check for seizure or any damaged screw threads.

15 to 150 mm (1/2" to 6")

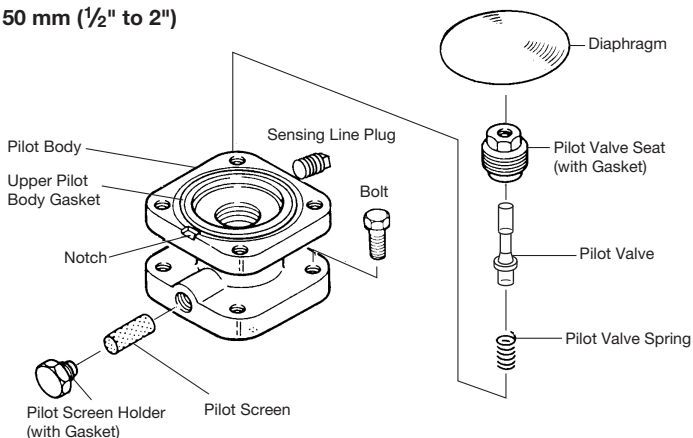


## 6.3 Disassembling the Pilot Section

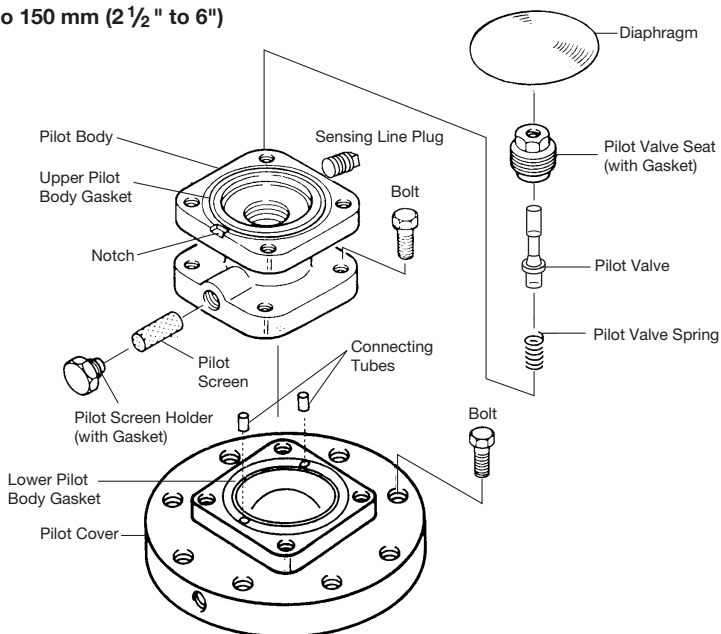
The diaphragm is removed by utilizing the notch in the pilot body. Loosen and remove the pilot valve seat with a box wrench. Pick up the pilot valve and the pilot valve spring with a pair of tweezers. Loosen the pilot screen holder to remove the pilot screen.

Check for any fault on the seat of the pilot valve, flaws on the gaskets, and clogging of the pilot screen. Check for deformation, corrosion or faults on the diaphragm. The diaphragm should be convex (open downward), with the printed UP mark on the top.

### 15 to 50 mm (1/2" to 2")



### 65 to 150 mm (2 1/2" to 6")

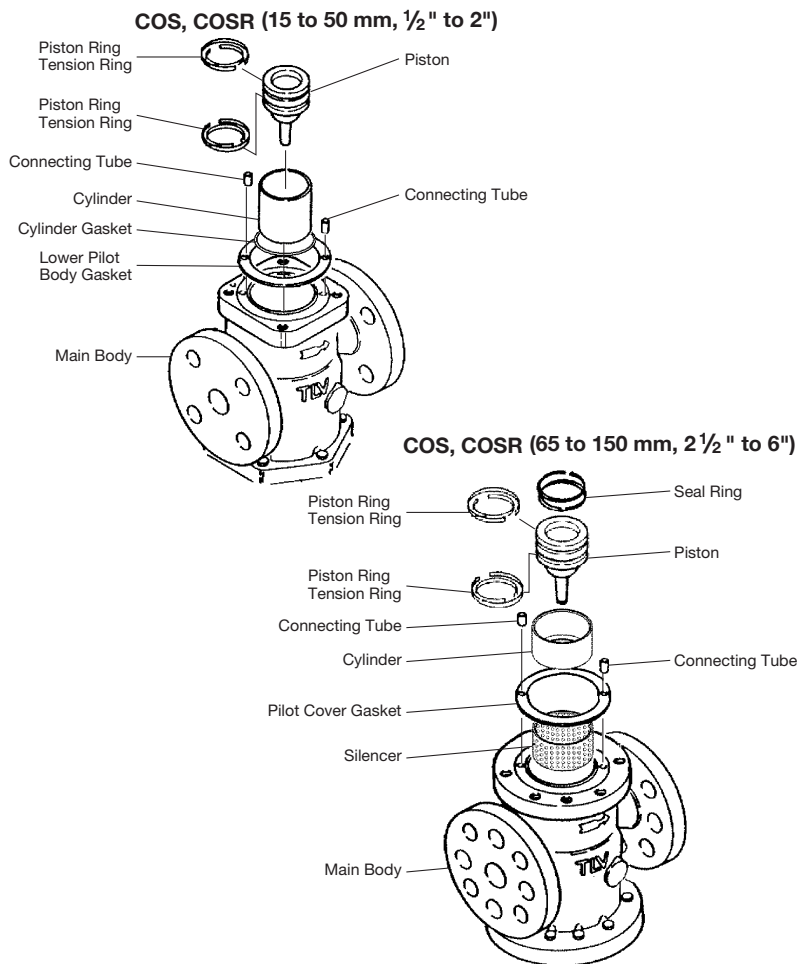


## 6.4 Disassembling the Piston Section

Remove the pilot body after loosening and removing the bolts. During this process, pay attention not to lose the connecting tubes. Remove the piston, the cylinder and the silencer (only sizes 65 to 150 mm, 2 1/2" to 6") from the main body. Then remove the piston rings and the tension rings from the piston.

NOTE: Do not apply too much force when removing the piston rings and tension rings.

Inspect the interior of the cylinder, the exterior of the piston rings, the small hole on the piston and the gaskets for any fault or abnormality.



The size and shape of some COS and COSR parts will be different from those shown.

## 6.5 Disassembling the Separator (COS) and Main Valve (COS/COSR)

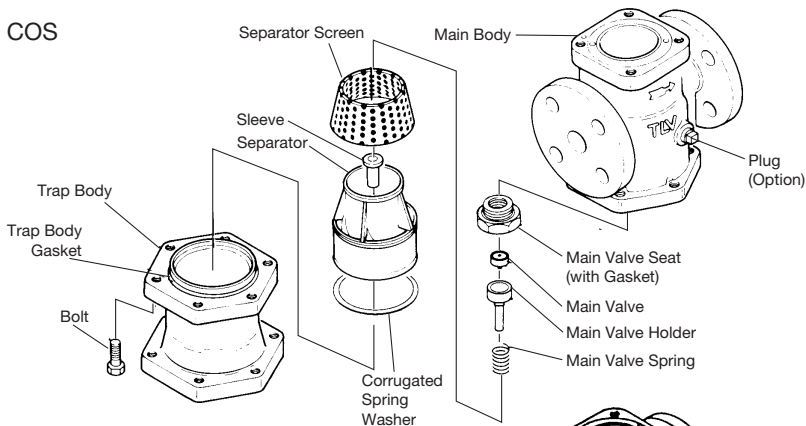
Turn the COS upside down for easy dismantling of the separator and main valve. Loosen the bolts and remove the trap body. Be careful, as the separator may drop off when the COS is returned to the normal attitude.

Removal of the separator and pressed-in sleeve for COS, or the cover plug for COSR, permits removal of the main valve spring, the main valve, the main valve holder and the separator screen. Remove the main valve seat from main the body with a box wrench.

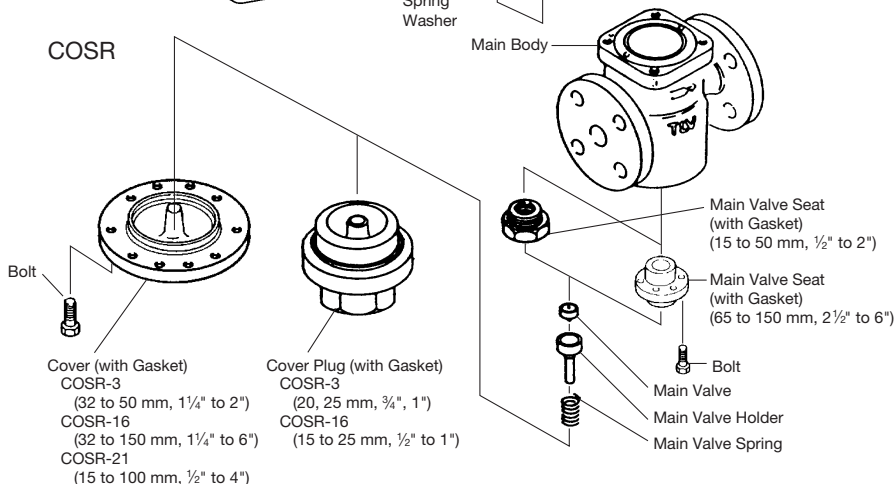
Check for damage on the seating and sliding surfaces of the main valve and main valve holder, the seating surface of the main valve seat and the gaskets, and for clogging of the separator screen.

[At start-up following shutdown for a long period, always blow down the piston section of the main body through the plug (if optional plug is supplied).]

### COS



### COSR



The size and shape of some COS and COSR parts for large valve sizes will be different from those shown.

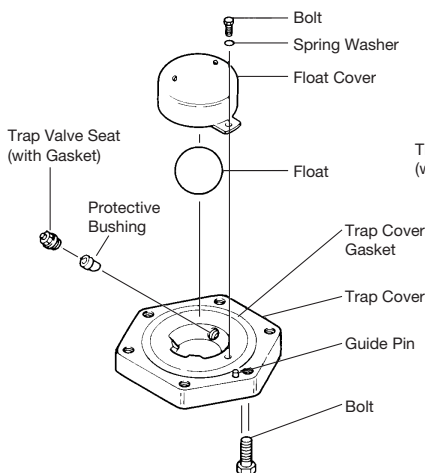
## 6.6 Disassembling the Steam Trap (COS)

Loosen the bolts and remove the trap cover. Be careful, as hot condensate may splash out.

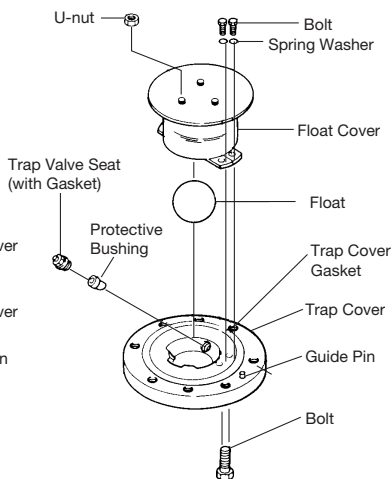
Remove the bolts from the trap cover and the float cover to reveal the float. Remove the float, then loosen and remove the trap valve seat with a box wrench.

Check to verify that there is no deformation of the float, abnormality in the trap valve seat, or dirt accumulation in the trap cover.

15 to 50 mm (1/2" to 2")



65 to 100 mm (2 1/2" to 4")



## 6.7 Cleaning

After inspection and removal of any abnormality, clean and reassemble the parts. The following parts will require cleaning before reassembly. A mild detergent should be used for effective cleaning.

COS, COSR		COS	COSR
Main Valve Seat	Pilot Screen	Trap Cover	Cover Plug/Cover
Main Valve	Pilot Valve	Float	
Main Valve Holder	Pilot Valve Seat	Trap Valve Seat	
Piston	Adjustment Screw	Separator Screen	
Piston Ring	Spring Retainer		
Cylinder			

## 6.8 Reassembly

Assemble the unit using the same procedure as used for dismantling it, but in reverse order.

1. Standard torque for fastening the respective bolts are as follows:

Tightening Torques and Distance Across Flats				
Part	Connection Size mm (inch)	Distance Across Flats mm (inch)	Tightening Torque N·m (lb·ft)	
Bolt for Spring Housing/Pilot Body	All	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )*	40	(29)
Pilot Valve Seat	All	19 ( $\frac{3}{4}$ )	70	(51)
Pilot Screen Holder	All	24 ( $\frac{15}{16}$ )	40	(29)
Bolt for Pilot Body/Main Body	15 to 40 ( $\frac{1}{2}$ to $1\frac{1}{2}$ ) 50 (2)	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )* 19 ( $\frac{3}{4}$ )	60 70	(44) (51)
Bolt for Pilot Body/Pilot Cover	65 to 150 ( $2\frac{1}{2}$ to 4)	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )*	60	(44)
Bolt for Pilot Cover/Main Body	65, 80 ( $2\frac{1}{2}$ , 3) 100, 125 (4, 5) 150 (6)	19 ( $\frac{3}{4}$ ) 24 ( $\frac{15}{16}$ ) 36 ( $\frac{13}{32}$ )	70 150 300	(51) (110) (220)
Bolt for Main Body/Trap Body (COS only)	15 to 40 ( $\frac{1}{2}$ to $1\frac{1}{2}$ ) 50 to 80 (2 to 3) 100 (4)	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )* 19 ( $\frac{3}{4}$ ) 24 ( $\frac{15}{16}$ )	60 70 150	(44) (51) (110)
Bolt for Trap Body/Trap Cover (COS only)	15 to 40 ( $\frac{1}{2}$ to $1\frac{1}{2}$ ) 50 to 80 (2 to 3) 100 (4)	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )* 19 ( $\frac{3}{4}$ ) 24 ( $\frac{15}{16}$ )	60 70 150	(44) (51) (110)
Main Valve Seat	15, 20 ( $\frac{1}{2}$ , $\frac{3}{4}$ )	36 ( $\frac{13}{32}$ )	100	(73)
	25 (1)	41 ( $\frac{15}{16}$ )	125	(92)
	32, 40 ( $1\frac{1}{4}$ , $1\frac{1}{2}$ )	60 ( $2\frac{3}{4}$ )	250	(185)
	50 (2)	70 ( $2\frac{3}{4}$ )	300	(220)
	65, 80 ( $2\frac{1}{2}$ , 3)	13 ( $\frac{1}{2}$ )	30	(22)
Bolt for Main Valve Seat	100, 125 (4, 5) 150 (6)	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )* 22 ( $\frac{7}{8}$ )	40 70	(29) (51)
	15, 20 ( $\frac{1}{2}$ , $\frac{3}{4}$ )	8 ( $\frac{5}{16}$ )	7	(5)
	25 to 40 (1 to $1\frac{1}{2}$ ) 50 to 100 (2 to 4)	10 ( $\frac{3}{8}$ ) 13 ( $\frac{1}{2}$ )	10 20	(7) (15)
Trap Valve Seat (COS only)	15, 20 ( $\frac{1}{2}$ , $\frac{3}{4}$ )	11 ( $\frac{7}{16}$ )	10	(7)
	25 to 40 (1 to $1\frac{1}{2}$ ) 50 to 80 (2 to 3) 100 (4)	13 ( $\frac{1}{2}$ ) 16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )* 19 ( $\frac{3}{4}$ )	15 40 55	(11) (29) (40)
	15, 20 ( $\frac{1}{2}$ , $\frac{3}{4}$ )	41 ( $\frac{15}{16}$ )	250	(185)
	25 (1)	46 ( $\frac{13}{16}$ )	350	(260)
Bolt for Cover/Main Body (COSR only)	32, 40 ( $1\frac{1}{4}$ , $1\frac{1}{2}$ ) 50 to 80 (2 to 3) 100, 125 (4, 5) 150 (6)	16, 17* ( $\frac{5}{8}$ , $\frac{21}{32}$ )* 19 ( $\frac{3}{4}$ ) 24 ( $\frac{15}{16}$ ) 36 ( $\frac{13}{32}$ )	60 70 150 300	(44) (51) (110) (220)

Sizes 125 and 150 mm (5" and 6") available for COSR only

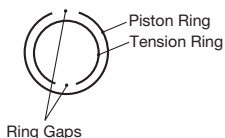
1 N·m  $\approx$  10 kg·cm

\* Size depends on bolt standard

Note: If a torque greater than that recommended is applied, the COS/COSR or components may be damaged.

2. The PTFE gasket may be re-used if free from fault, crush or deformation.
3. Apply anti-seize to the threaded portion of screws and bolts, the spring retainer, ball and adjustment screw. Apply a small amount of anti-seize to the threads of the main valve seat, pilot valve seat and pilot screen holder. Apply anti-seize carefully to ensure it does not come into contact with other parts.
4. Fasten the bolts one at a time in an alternating diagonal pattern to provide uniform seating.
5. After assembly, make sure that the piston and the pilot valve operate smoothly without binding.

Assembling the Piston Ring



- 1) Fit the piston ring to the outside of the tension ring.
- 2) The ring gaps should be opposite each other.

## 6.9 Regular Inspection and Maintenance

To ensure long service life, the following inspection and maintenance should be done regularly.

Part	Inspection and Maintenance Frequency
Separator Screen (COS only), Pilot Screen	Disassemble and clean annually. If there is substantial blockage, install a strainer (approx. 60 mesh) ahead of the COS/COSR.
Main Valve, Main Valve Seat, Pilot Valve and Pilot Valve Seat	Replace after 15,000 hours. If there is chattering or dirt, premature wear may result.
Piston Ring	Replace after 8,000 hours. If there is chattering or if scale build-up is severe, premature wear may result.
Piston	Replace after 30,000 hours. If hunting or chattering takes place, premature wear may result.
Trap Valve Seat	Replace after 40,000 hours. If scale build-up is severe, blockage may occur in a short period of time.
Diaphragm	Replace after 30,000 hours. If hunting or chattering takes place, cracks or fatigue may develop in a short period of time.

## 7. Troubleshooting

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 COS/COSR, consult the troubleshooting guide below.

Problems are classified as follows:

1. Secondary pressure does not increase
2. Secondary pressure cannot be adjusted or increases abnormally
3. Hunting occurs (fluctuation in secondary pressure)
4. Chattering occurs (heavy mechanical noise)
5. Steam leaks from the steam trap or condensate is not discharged
6. Abnormal noises

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

To ensure performance for a long period of time, it is recommended that the Safety Considerations and Adjustment sections be reviewed.

### Troubleshooting Chart

Problem	Symptom	Cause	Remedy
Secondary pressure does not rise	The body is not warm	No steam is being supplied or the inlet valve is closed	Check the valves
	The body is warm, but pressure does not increase	The screens are clogged	Clean or blow down
Secondary pressure cannot be adjusted or increases abnormally	Adjustment is difficult, and set pressure varies	The pilot screen is clogged	Clean
		There is insufficient steam flow	Check the flow, replace the COS/COSR if necessary
		Piston is clogged with dirt	Clean; check the piston ring
		The small hole on the piston is clogged	Clean
		The piston ring is worn	Replace with a new piston ring
		There is dirt build-up on the sliding surfaces of the pilot valve, piston or main valve	Clean
		Flow rate exceeds rated flow rate	Check the flow rate, replace with a larger size
		The adjustment screw has seized	Replace with a new adjustment screw
		The diaphragm is distorted or damaged	Replace with a new diaphragm
		There is a fluctuation in steam consumption	Check the flow rate, replace the COS/COSR if necessary
The selected model is inappropriate for the service conditions (specifications)	Check the model selection, replace the COS/COSR if necessary		



## Troubleshooting Chart (continued)

<b>Problem</b>	<b>Symptom</b>	<b>Cause</b>	<b>Remedy</b>
Secondary pressure cannot be adjusted or increases abnormally (continued)	Upon closing secondary side valves, secondary pressure abruptly rises as high as primary pressure	The bypass valve is leaking	Check, clean, and replace with a new valve if necessary
		The pilot valve seat or main valve seat is damaged or there is a build-up of dirt	Clean; align; replace if necessary
Hunting or chattering occurs	Occurs at low steam demand	COS/COSR is operated below the lower flow rate limit	Check steam supply volume, replace with smaller valve
	Hunting never stops	Reduction ratio is too high (operated at below 10% of the primary pressure)	Use a two-stage reduction arrangement
		The selected model is inappropriate for the service conditions (specifications)	Check the model selection, replace the COS/COSR if necessary
	Chattering never stops	Condensate is contained, or the trap is blocked	Check the trap; check the piping
The selected model is inappropriate for the service conditions (specifications)		Check the model selection, replace the COS/COSR if necessary	
Abnormal noises	Makes a high-pitched noise	Reduction ratio is too high	Use two-stage reduction
		The flow is too great	Check the flow rate, use a larger size valve
		There is a high-speed open/close valve nearby	Install the valve as far away as possible
Faulty steam trap (COS only)	Steam is blowing	There is dirt build-up on the trap valve seat or at the float base	Clean
		The body is installed tilted	Check the piping
		The float is deformed	Check for water hammer; replace with a new float
	No condensate is discharged	Piping vibration	Secure the piping
		The primary pressure exceeds the trap valve seat maximum working pressure (exceeds operating pressure range of COS)	Ensure COS is used within the operating pressure range
		Water is inside the float	Replace with a new float
		The outlet piping is clogged	Check the piping; clean
The trap valve seat is clogged	Clean or replace with a new trap valve seat		

## 8. TLV EXPRESS LIMITED WARRANTY

Subject to the limitations set forth below, TLV Corporation, a North Carolina corporation (“**TLV**”) warrants that products which are sold by it, TLV CO., LTD., a Japanese corporation (“**TLVJ**”) or TLV International, Inc., a Japanese corporation (“**TII**”), (hereinafter the “**Products**”) are designed and manufactured by TLVJ, conform to the specifications published by TLV for the corresponding part numbers (the “**Specifications**”) and are free from defective workmanship and materials. 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 other than TLV 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 other than TLV 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; 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 the earlier of: (i) three (3) years after delivery of Products to the first end user in the case of sealed SST-Series Products for use in steam pressure service up to 650 psig; (ii) two (2) years after delivery of Products to the first end user in the case of PowerTrap® units; or (iii) one (1) year after delivery of Products to the first end user in the case of all other Products. Notwithstanding the foregoing, asserting a claim under this warranty must be brought by the earlier of one of the foregoing periods, as applicable, or within five (5) 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 TLV.

### 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 TLV IN WRITING WITHIN THE APPLICABLE 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 TLV, FREIGHT AND TRANSPORTATION COSTS PREPAID, UNDER A RETURN MATERIAL AUTHORIZATION AND TRACKING NUMBER ISSUED BY TLV. 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. TLV 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 TLV'S REASONABLE DISCRETION, THAT THE

CLAIMED DEFECT IS NOT COVERED BY THIS WARRANTY, THE PARTY ASSERTING THIS WARRANTY SHALL PAY TLV 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 TLVJ 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.

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