



Manufacturer

TLV CO., LTD.

Kakogawa, Japan

is approved by LRQA Ltd to ISO 9001/14001



Instruction Manual

Pressure Reducing Valve for Steam **COS-3/COS-16/COS-21**

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Introduction

Thank you for purchasing the TLV COS pressure reducing valve for steam.

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

The TLV pressure reducing valve for steam, model COS, is a new reducing valve that eliminates these problems and makes possible the supply of very dry steam at a constant pressure.







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 DANGER, WARNING or CAUTION item.
	Indicates an urgent situation which poses a threat of death or serious injury
	Indicates that there is a potential threat of death or serious injury
	Indicates that there is a possibility of injury or equipment/product damage
	NEVER apply direct heat to the float. The float may explode due to increased internal pressure, causing accidents leading to serious injury or damage to property and equipment.
	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.
	DO NOT use the product in excess of the maximum operating pressure differential. Such use could make discharge through the product impossible (blocked).
	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.

Continued on the next page

 CAUTION	<p>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.</p>
	<p>Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way. Failure to observe these precautions may result in damage to the product and burns or other injury due to malfunction or the discharge of fluids.</p>
	<p>Do not use excessive force when connecting threaded pipes to the product. Over-tightening may cause breakage leading to fluid discharge, which may cause burns or other injury.</p>
	<p>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.</p>
	<p>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.</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.

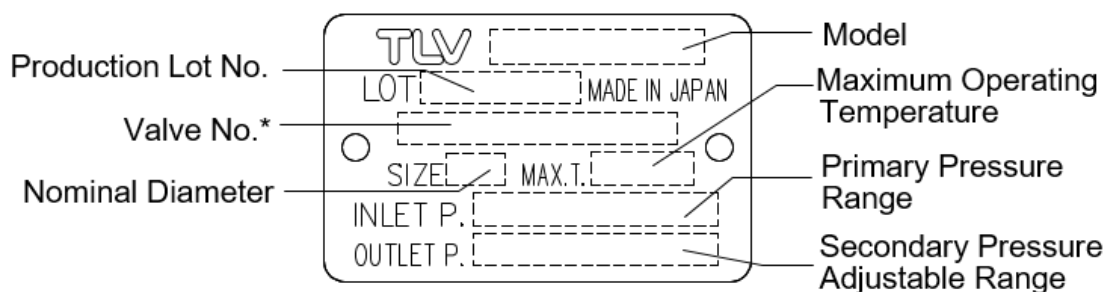


DO NOT use the trap in excess of the maximum operating pressure differential; such use could make discharge impossible (blocked).



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 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	COS-16	COS-21
Primary Pressure Range	0.1 to 0.3 MPaG (15 to 45 psig)	0.2 to 1.6 MPaG (30 to 250 psig)	1.35 to 2.1 MPaG (190 to 300 psig)
Adjustable Pressure Range (All conditions must be met)	0.01 to 0.05 MPaG (1.5 to 7 psig)	Within 10 – 84% of the primary pressure	
		Minimum adjustable pressure of 0.03 MPaG (5 psig)	Minimum adjustable pressure of 0.55 MPaG (80 psig)
		Pressure differential between 0.07 to 0.85 MPa (10 to 120 psi)	Maximum pressure differential of 0.85 MPa (120 psi)
Maximum Operating Temperature	220 °C (428 °F)		
Minimum Adjustable Flow Rate	5% of rated flow rate	5% of rated flow rate; 10% of rated flow rate for sizes 65 mm (2½ in) and larger	

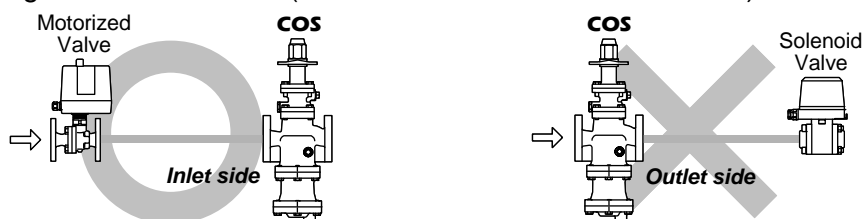
(1 MPa = 10.197 kg/cm²)

Correct Usage of the COS Pressure Reducing Valve



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.

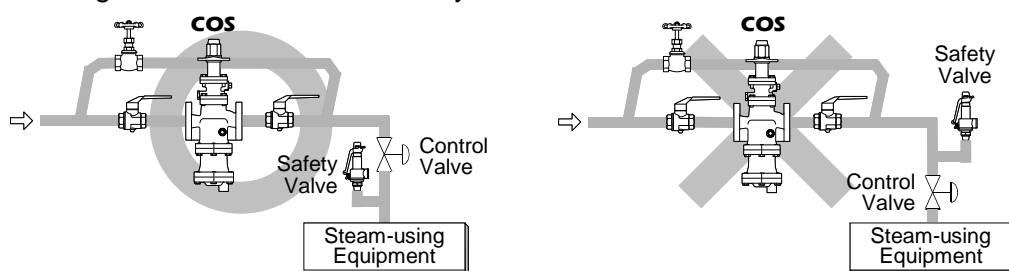
1. The COS should be operated only within its specifications.
2. Installing an ON/OFF Valve (Solenoid Valve or Motorized Valve)



If an on-off valve, such as a motorized valve, is required to stop supply of steam to the steam-using equipment, install it at the inlet side of the COS. If a solenoid valve is installed at the outlet of the COS, its opening and closing 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 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, it is recommended to install the on-off valve as near to the boiler as possible.

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

3. Installing a Control Valve and Safety Valve



A control valve installed between the COS and the steam-using equipment (downstream of the COS) for controlling equipment temperature may raise the pressure between the COS and the control valve when the control valve is closed, depending on the spatial relationship. A safety valve should be installed downstream of the control valve.

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

4. Precautions for the Installation of Additional Fittings Before or After the Reducing Valve

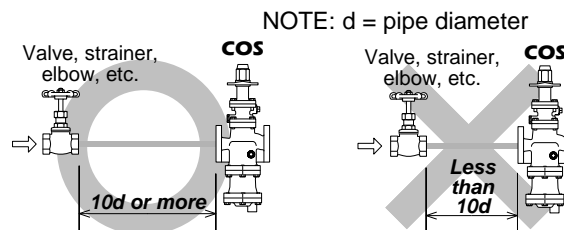
In order to ensure stable steam flow, the piping upstream and downstream of the COS must be straight runs. If a COS is installed either directly before or after an elbow or control valve, unevenness in steam flow may result in chattering and unstable pressure.

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

1) Inlet (primary side) of the COS

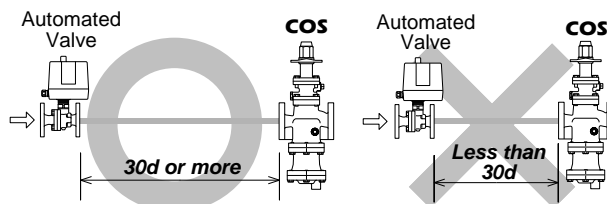
Maintain a straight piping run of **10 d or more** when a manual valve, a strainer or an elbow, etc. is installed.

(Example: if nominal size is 25 mm (1 in), have 250 mm (10 in) or more)



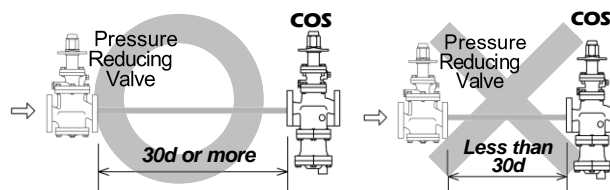
Maintain a straight piping run of **30 d or more** when an automated valve (on-off valve) is installed.

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



Maintain a straight piping run of **30 d or more** when another pressure reducing valve is installed. (Two-stage pressure reduction)

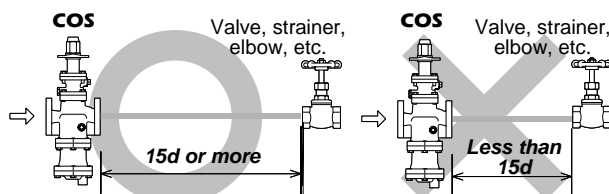
(Example: if nominal size is 25 mm (1 in), have 750 mm (30 in) or more)



2) Outlet (secondary side) of the COS

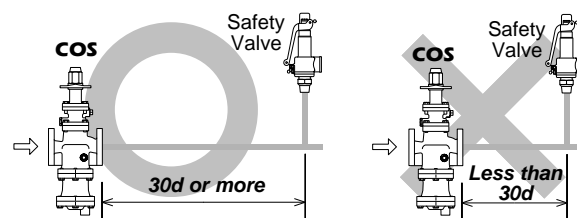
Maintain a straight piping run of **15 d or more** when a manual valve, a strainer or an elbow, etc. is installed.

(Example: if nominal size is 25 mm (1 in), have 375 mm (15 in) or more)



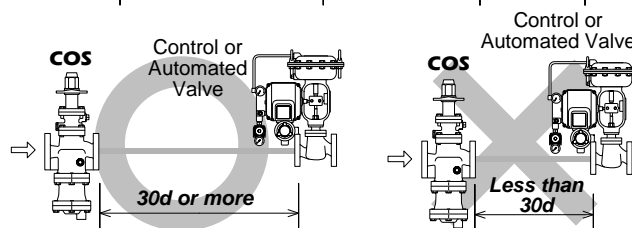
Maintain a straight piping run of **30 d or more** when a safety valve is installed.

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

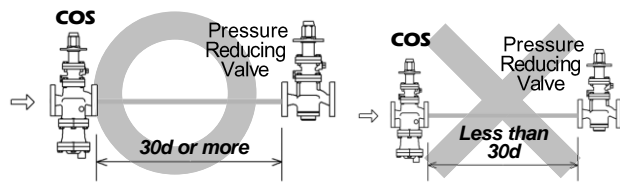


Maintain a straight piping run of **30 d or more** when a control valve or an automated valve (on-off valve) is installed.

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



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

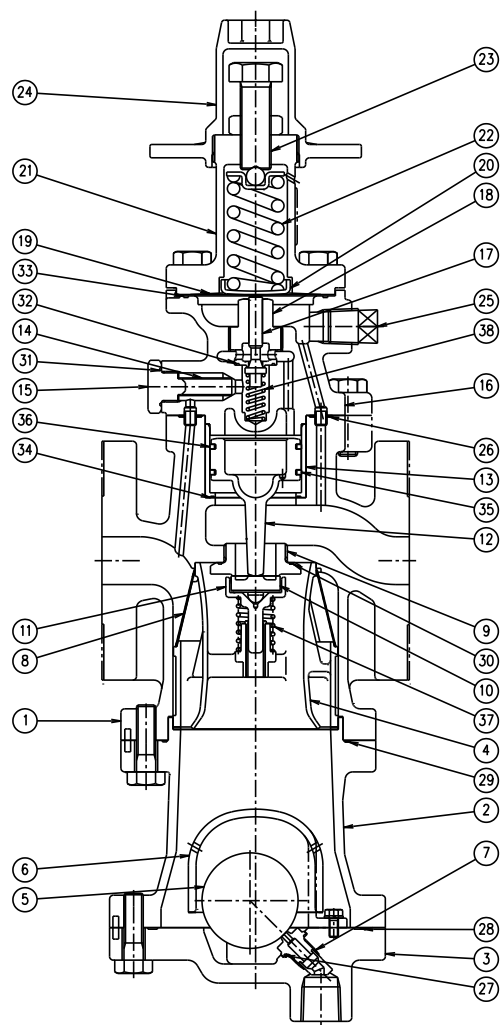


Configuration

COS-3

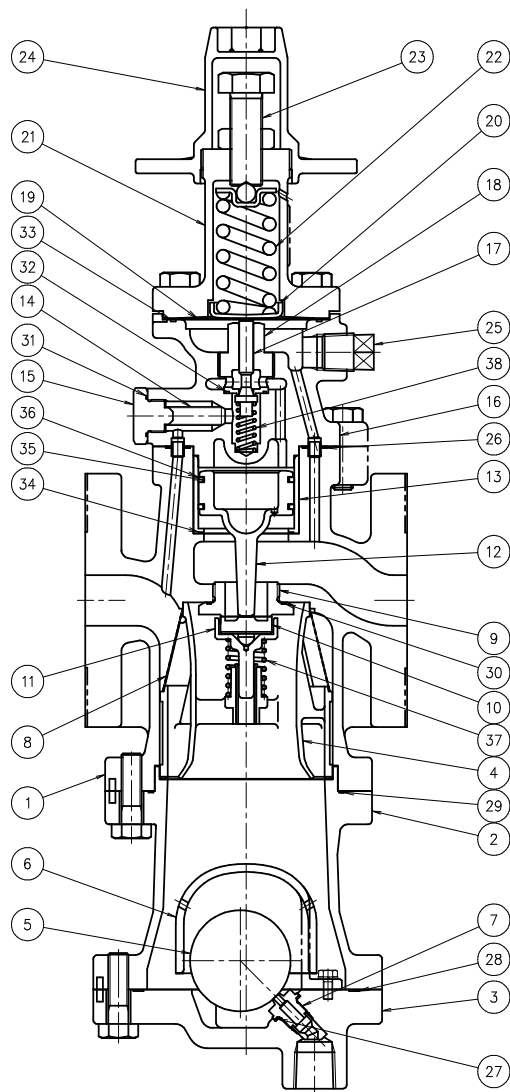
20 to 50 mm ($\frac{3}{4}$ to 2 in)

(Cast Iron, Cast Stainless Steel)



No.	Name	A	B	C	D	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 – Sensing Line Port							
26	Gasket (Pilot Body/Main Body)	✓		✓	✓			
27	Trap Valve Seat Gasket	✓					✓	
28	Gasket (Trap Body/Trap Cover)	✓					✓	
29	Gasket (Main Body/Trap Body)	✓	✓					
30	Main Valve Seat Gasket	✓	✓					
31	Pilot Screen Holder Gasket	✓				✓		
32	Pilot Valve Seat Gasket	✓				✓		
33	Diaphragm Gasket	✓				✓		
34	Cylinder Gasket	✓		✓				
35	Piston Ring			✓	✓			
36	Tension Ring			✓	✓			
37	Main Valve Spring		✓					
38	Pilot Valve Spring					✓		

- A: Maintenance Kit
 B: Repair Kit for Main Valve
 C: Repair Kit for Piston
 D: Repair Kit for Piston Ring
 E: Repair Kit for Pilot Valve
 F: Repair Kit for Trap Valve Seat
 G: Float

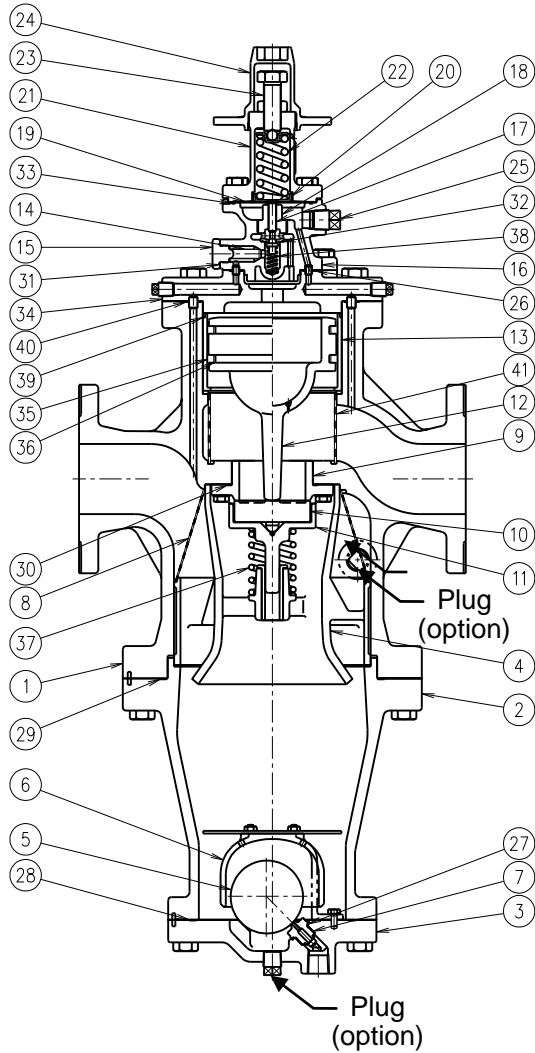
COS-16/COS-21**15 to 50 mm (1/2 to 2 in)****(Cast Iron, Cast Stainless Steel)**

- A: Maintenance Kit
 B: Repair Kit for Main Valve
 C: Repair Kit for Piston
 D: Repair Kit for Piston Ring
 E: Repair Kit for Pilot Valve
 F: Repair Kit for Trap Valve Seat
 G: Float

No.	Name	A	B	C	D	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 – Sensing Line Port							
26	Gasket (Pilot Body/Main Body)	✓		✓	✓			
27	Trap Valve Seat Gasket	✓					✓	
28	Gasket (Trap Body/Trap Cover)	✓					✓	
29	Gasket (Main Body/Trap Body)	✓	✓					
30	Main Valve Seat Gasket	✓	✓					
31	Pilot Screen Holder Gasket	✓				✓		
32	Pilot Valve Seat Gasket	✓				✓		
33	Diaphragm Gasket	✓				✓		
34	Cylinder Gasket	✓		✓				
35	Piston Ring			✓	✓			
36	Tension Ring			✓	✓			
37	Main Valve Spring		✓					
38	Pilot Valve Spring					✓		

NOTE: No kits available for COS-21 parts. Please order per parts if needed.

COS-16/COS-21
65 to 100 mm (2½ to 4 in)
(Cast Iron)



No.	Name	A	B	C	D	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 – Sensing Line Port							
26	Gasket (Pilot Body/ Pilot Cover)	✓			✓			
27	Trap Valve Seat Gasket	✓					✓	
28	Gasket (Trap Body/Trap Cover)	✓					✓	
29	Gasket (Main Body/Trap Body)	✓	✓					
30	Main Valve Seat Gasket	✓	✓					
31	Pilot Screen Holder Gasket	✓				✓		
32	Pilot Valve Seat Gasket	✓				✓		
33	Diaphragm Gasket	✓				✓		
34	Pilot Cover							
35	Piston Ring			✓	✓			
36	Tension Ring			✓	✓			
37	Main Valve Spring		✓					
38	Pilot Valve Spring					✓		
39	Seal Ring	✓		✓				
40	Gasket (Pilot Cover/Main Body)	✓		✓	✓			
41	Silencer							

- A: Maintenance Kit
- B: Repair Kit for Main Valve
- C: Repair Kit for Piston
- D: Repair Kit for Piston Ring
- E: Repair Kit for Pilot Valve
- F: Repair Kit for Trap Valve Seat
- G: Float

NOTE: No kits available for COS-21 parts. Please order per parts if needed.

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.



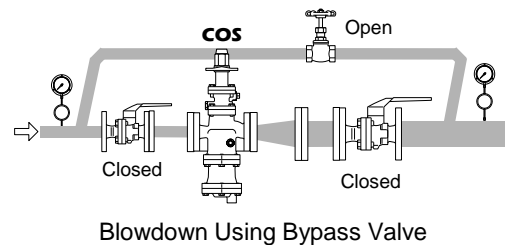
Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.

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

1. Blowdown

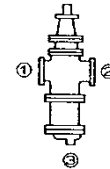
Before installing the COS unit, be sure to blow down all piping thoroughly. If this is not possible, perform a blowdown using the bypass valve.

Blowdown is especially important for newly installed piping or after the system has been shut down for a long period of time.



2. Removing Seal and Cap

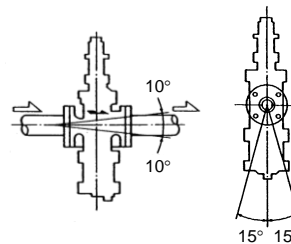
Before installation, be sure to remove all protective seals and caps. (Found in 3 locations, on the product inlet and outlets.)



3. Installation Angle

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

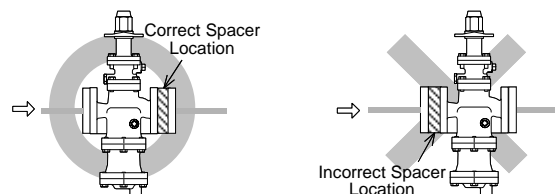
Allowable inclination is 10 degrees in the fore-aft direction and 15 degrees in the plane perpendicular to the steam flow line.



4. Spacer Installation

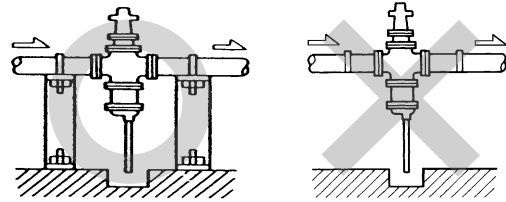
If spacing adjustment is necessary to accommodate installation, install a spacer on the outlet flange.

The spacer should consist of a spacer, gaskets, bolts and nuts. Fit gaskets to both sides of the spacer between the COS outlet and the pipe flange. Fasten with bolts and nuts.



5. Piping Support

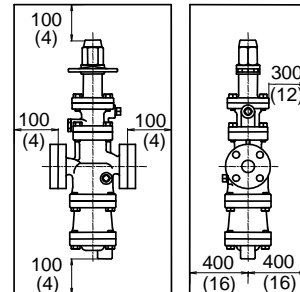
Install the COS, paying attention to avoid excessive load, bending and vibration. Support the inlet and outlet pipes securely.



6. Maintenance Space

Leave sufficient space for maintenance, inspection and repair.

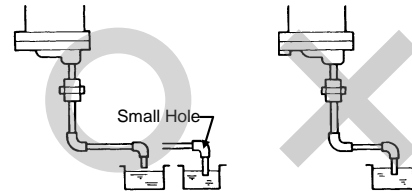
(Unit: mm (in))



7. Trap Outlet Pipe

For ease of maintenance, installation of a union connection is recommended for the trap outlet pipe.

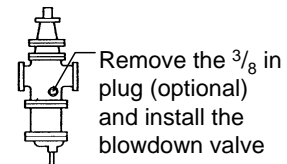
Connect the outlet pipe to a condensate return line, or extend it to a trench. In the case of the latter, make sure the end of the pipe is above the waterline. (Dirt and water may be sucked up by the vacuum formed during trap closure and system shutdown.)



8. Blowdown Valve (requires optional plug)

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

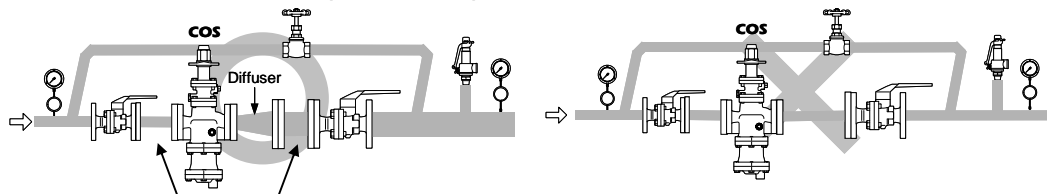
- 1) Remove the plug from the main body.
- 2) Install the blowdown valve.
- 3) Open the blowdown valve and blow any residual dirt and scale off of the screen.
- 4) Periodically activate the blowdown valve to keep the system free of dirt and scale.



9. Piping Size

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

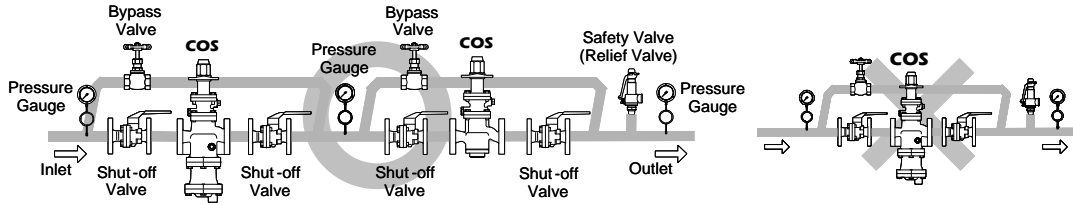
In addition, when installing the strainer, the strainer screen should be either at the 3 o'clock or 9 o'clock position to prevent condensate accumulation.



Straight-run Piping Lengths (d = pipe diameter) :
Upstream = 10 d or more; Downstream = 15 d or more

10. Two-stage Pressure Reduction

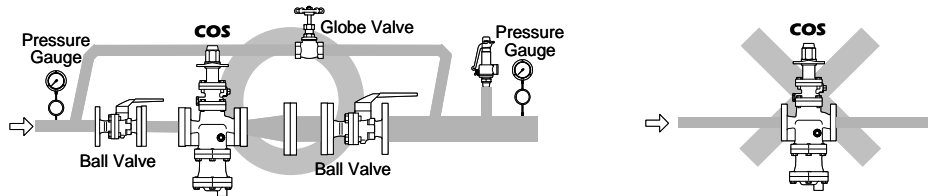
Two-stage pressure reduction should be performed whenever the pressure cannot be reduced to the desired level with a COS due to operating range limitations, such as when the reduction ratio is greater than 10:1.



11. Accessories

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

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



External Secondary Pressure Sensing Line

Standard model is factory prepared for internal sensing.

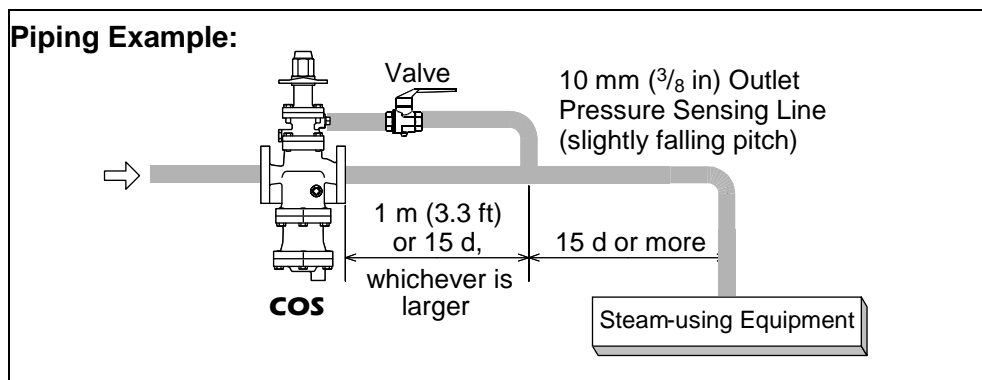
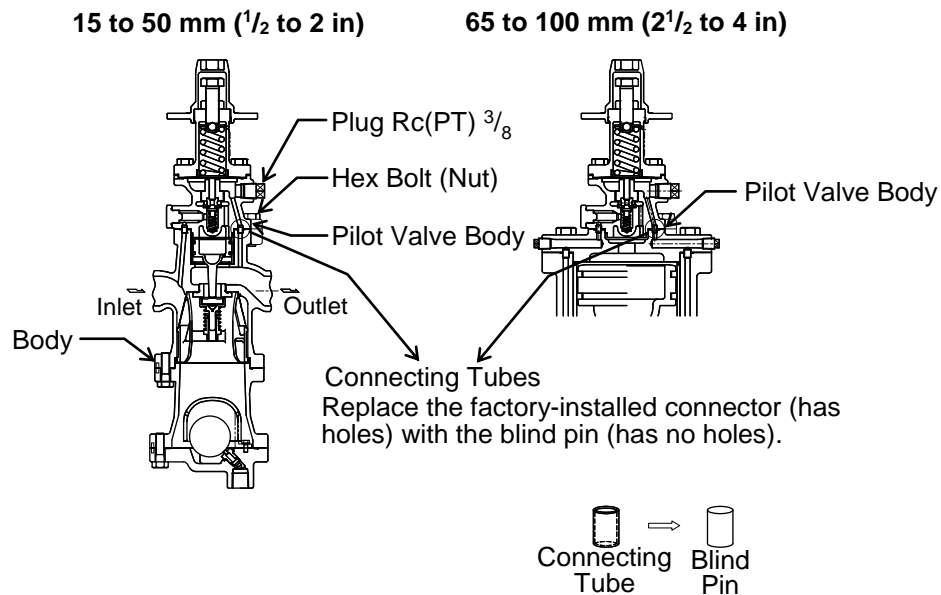
A secondary pressure detection port has been added to all COS pilot bodies to allow for installation of a 10 mm ($\frac{3}{8}$ in) secondary pressure sensing line, which improves performance and increases valve capacity (flow rate). This model is delivered with a secondary pressure sensing line plug installed in this port. When the external sensing method is used, follow the installation procedure shown below.

For proper use of COS with the external secondary pressure sensing line, follow the installation procedure below.

- 1) Loosen and remove the hex bolts (nuts) that attach the pilot body to the main body or the pilot cover (65 to 150 mm ($2\frac{1}{2}$ to 4 in)) and remove the pilot body.
- 2) Install the provided blind pin by first removing the connecting tube from the main body and then substituting the blind pin.
- 3) Re-install the pilot body and fasten the hex bolts (nuts) evenly.
- 4) Remove the plug Rc(PT) $\frac{3}{8}$ (or NPT $\frac{3}{8}$) and connect the secondary pressure sensing line with a slightly falling pitch.

The end of the external secondary pressure sensing line should be connected to the place on the steam-using equipment where the pressure is to be sensed.

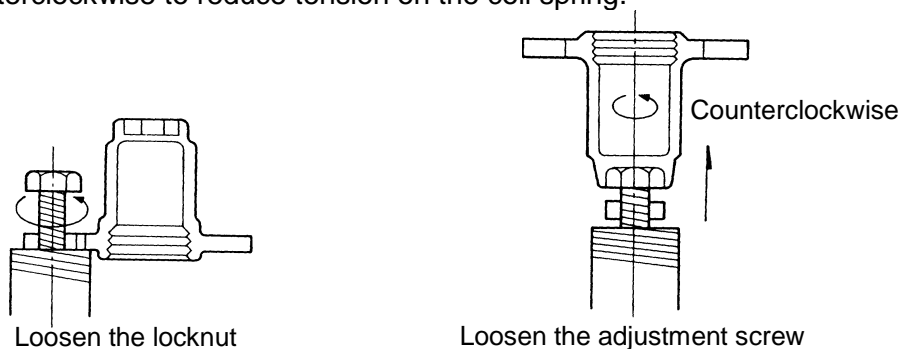
A shut-off valve should be installed in the external secondary pressure sensing line.



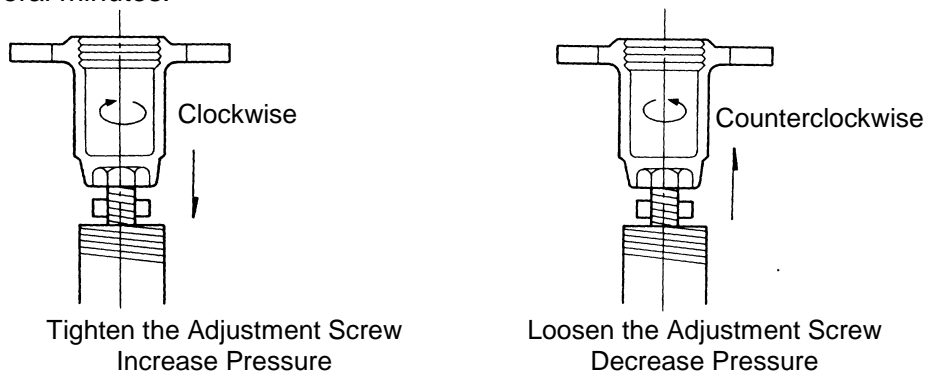
Adjustment

The COS reducing valve should be properly adjusted for protection of the steam-using 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-using equipment. (Stay clear of any pressurized blow-out from the safety valve.)
2. Make sure that the shut-off valve and the bypass valve located upstream and downstream of the COS 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 shut-off valve at the inlet of the COS. Allow sufficient time for condensate remaining at the inlet of the COS to be discharged.
5. Slightly open the shut-off valve at the outlet of the COS.
6. Turn the adjustment screw until the desired outlet pressure is obtained. Wait several minutes.



7. Slowly, fully open the shut-off valve at the outlet of the COS.
8. After setup, retighten the locknut and replace the spanner cap.
9. When shutting down the system, always close the outlet shut-off valve first and then the inlet valve.

Maintenance



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



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

Operational Check

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

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

Disassembly



WARNING

NEVER apply direct heat to the float. The float may explode due to increased internal pressure, causing accidents leading to serious injury or damage to property and equipment.



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

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

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

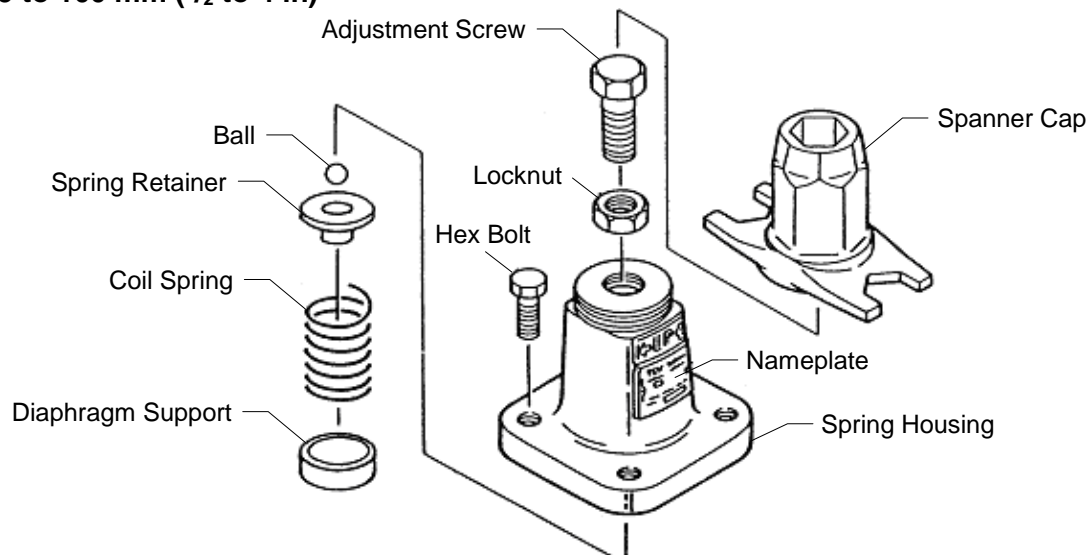
Remove all steam from the piping (both upstream and downstream). If the steam supply to the system cannot be shut off, change over to bypass operation. Close shut-off valves at the inlet and outlet of the COS completely. Relieve residual steam pressure by loosening slightly the spring housing hex bolt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

Disassembling the Adjustment Section

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

⇒ Check for seizure or any damaged screw threads.

15 to 100 mm (1/2 to 4 in)

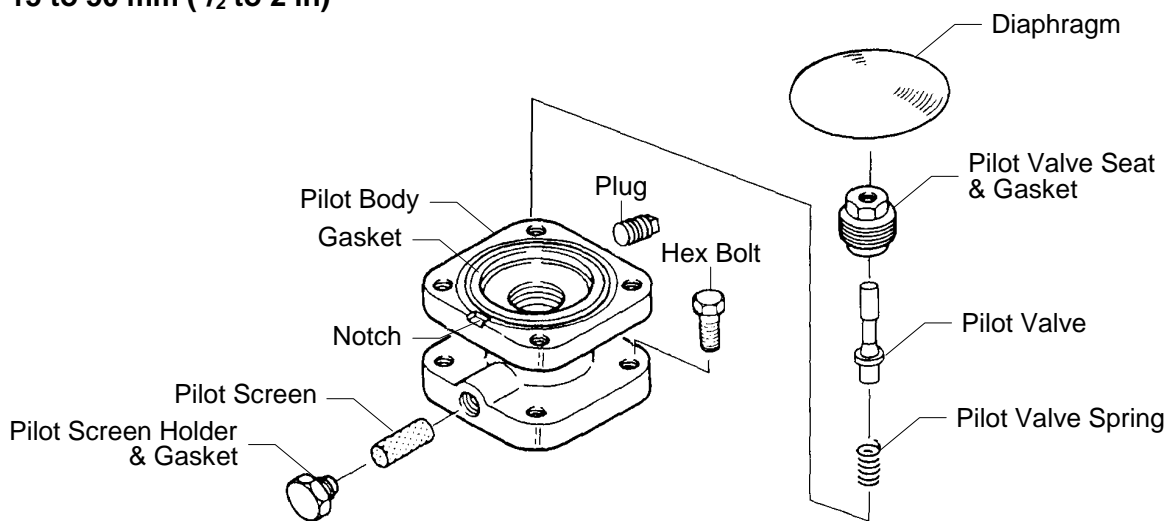


Disassembling the Pilot Section

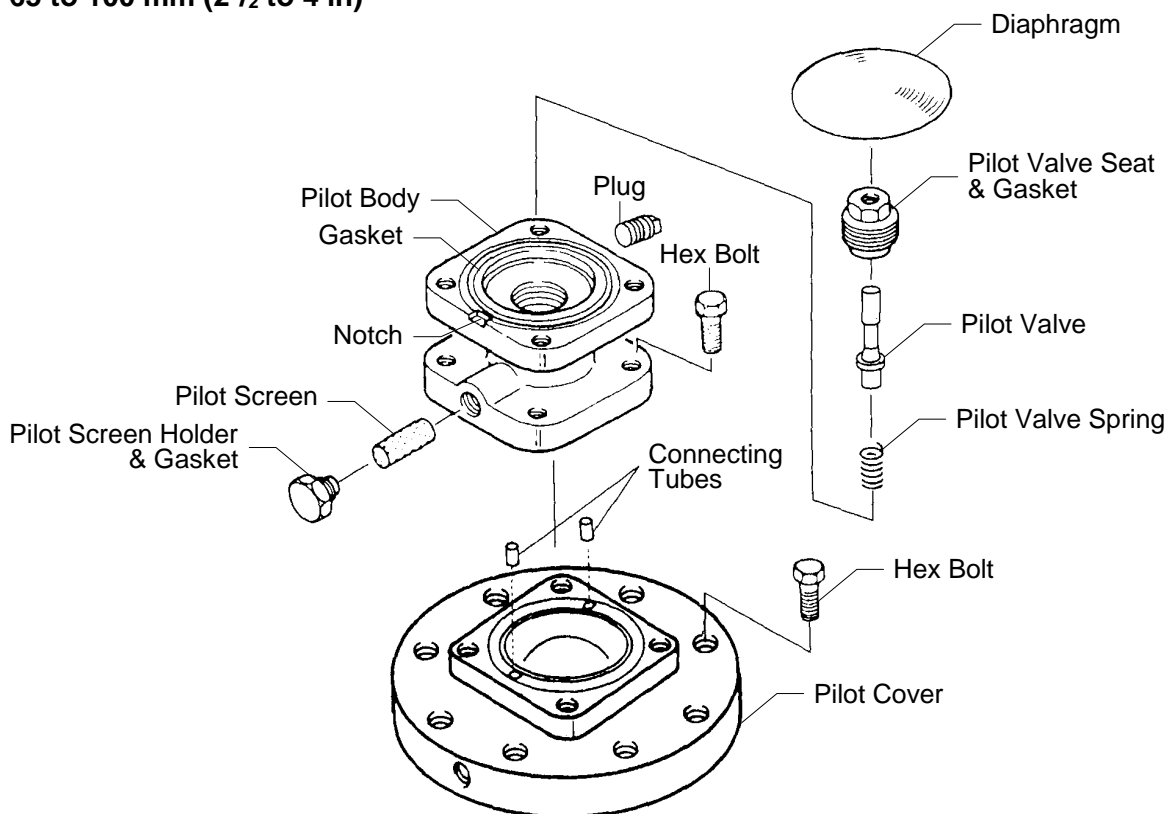
The diaphragm is removed by utilizing the notch in the pilot body. Loosen the pilot valve seat with a box wrench and remove it. Lift the pilot valve spring up and out with a pair of tweezers. Then loosen and remove the screen holder to remove the screen.

⇒ Check for any fault on the seat of the pilot valve, flaws on the gaskets, and clogging of the 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 ($\frac{1}{2}$ to 2 in)



65 to 100 mm ($2\frac{1}{2}$ to 4 in)



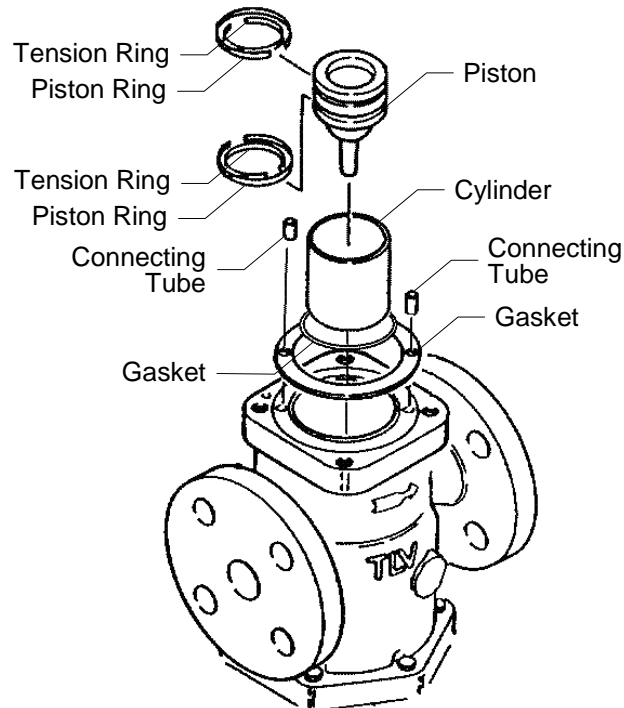
Disassembling the Piston Section

Remove the pilot body after loosening and removing the bolts (stud bolts). During this process, pay attention not to lose the connecting tubes (2).

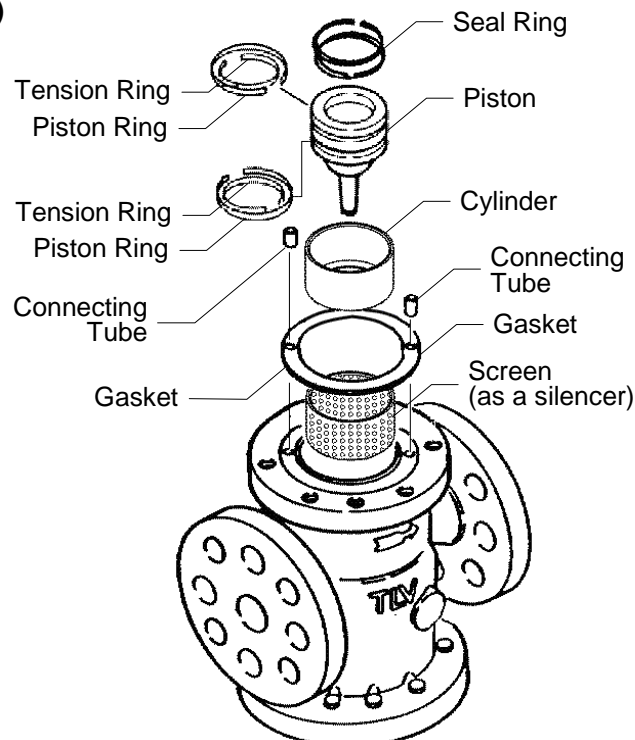
Remove the piston, cylinder and the silencer (for 65 to 100 mm (2½ to 4 in) only) from the body. Then remove the piston rings and the tension rings from the piston. Do not apply too much force when removing the piston rings and tension rings.

⇒ Check for 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.

15 to 50 mm (½ to 2 in)



65 to 100 mm (2½ to 4 in)



Disassembling the Separator and Main Valve Section

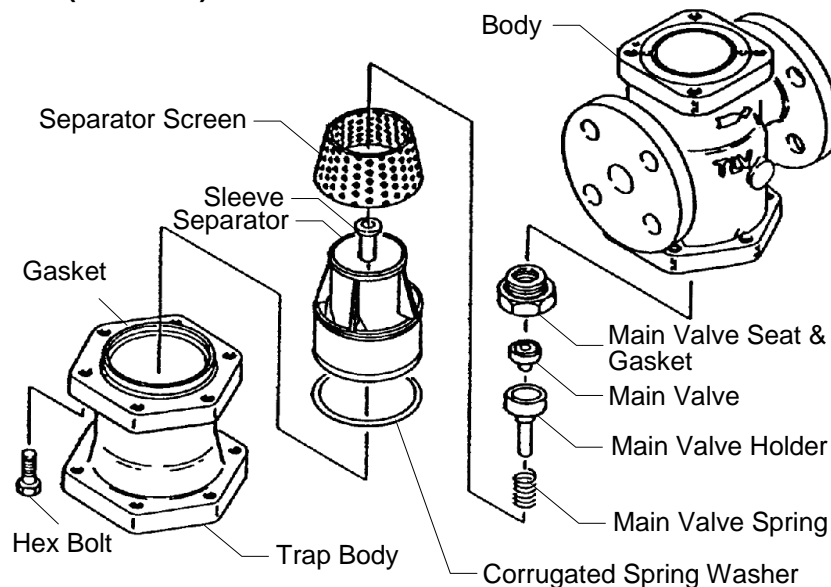
Turn the COS upside down for easy dismantling of the separator and main valve. Loosen the hex bolts and remove the trap body. Be careful, as the separator may drop off when the COS is returned to the normal attitude.

Removal of the separator and pressed-in sleeve permits removal of the main valve coil spring, the main valve, main valve holder and screen. Loosen the valve seat with a box wrench and remove it from the body.

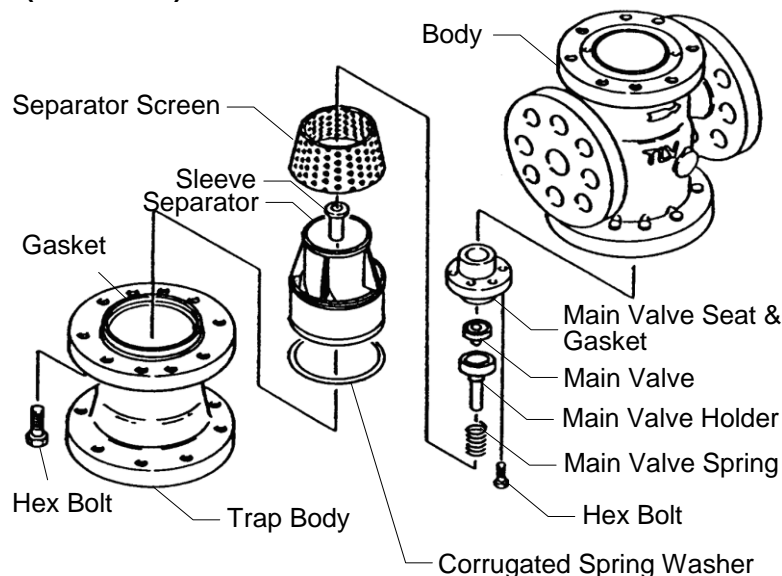
⇒ Check for damage on the seating and sliding surfaces of the main valve and main valve holder, the seating surface of the valve seat, the gaskets, and for clogging of the screen.

At start-up following shut-down for a long period, always blow down the piston section of the body through the plug (option).

15 to 50 mm ($\frac{1}{2}$ to 2 in)



65 to 100 mm ($2\frac{1}{2}$ to 4 in)



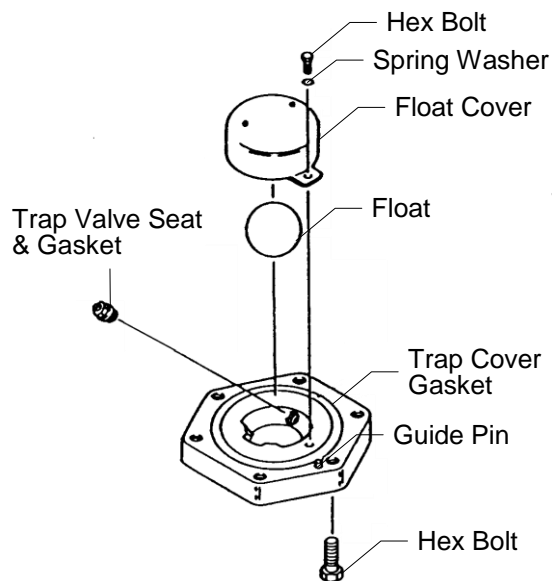
Disassembling the Steam Trap Section

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

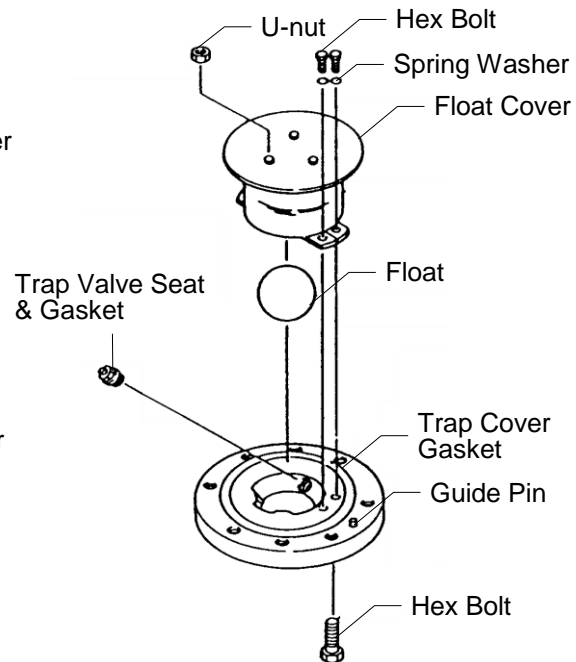
Remove the hex bolts from the trap cover and the float cover to reveal the float. Remove the float, then loosen the trap valve seat with a box wrench and remove it.

⇒ Check to determine 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 in)



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



Cleaning

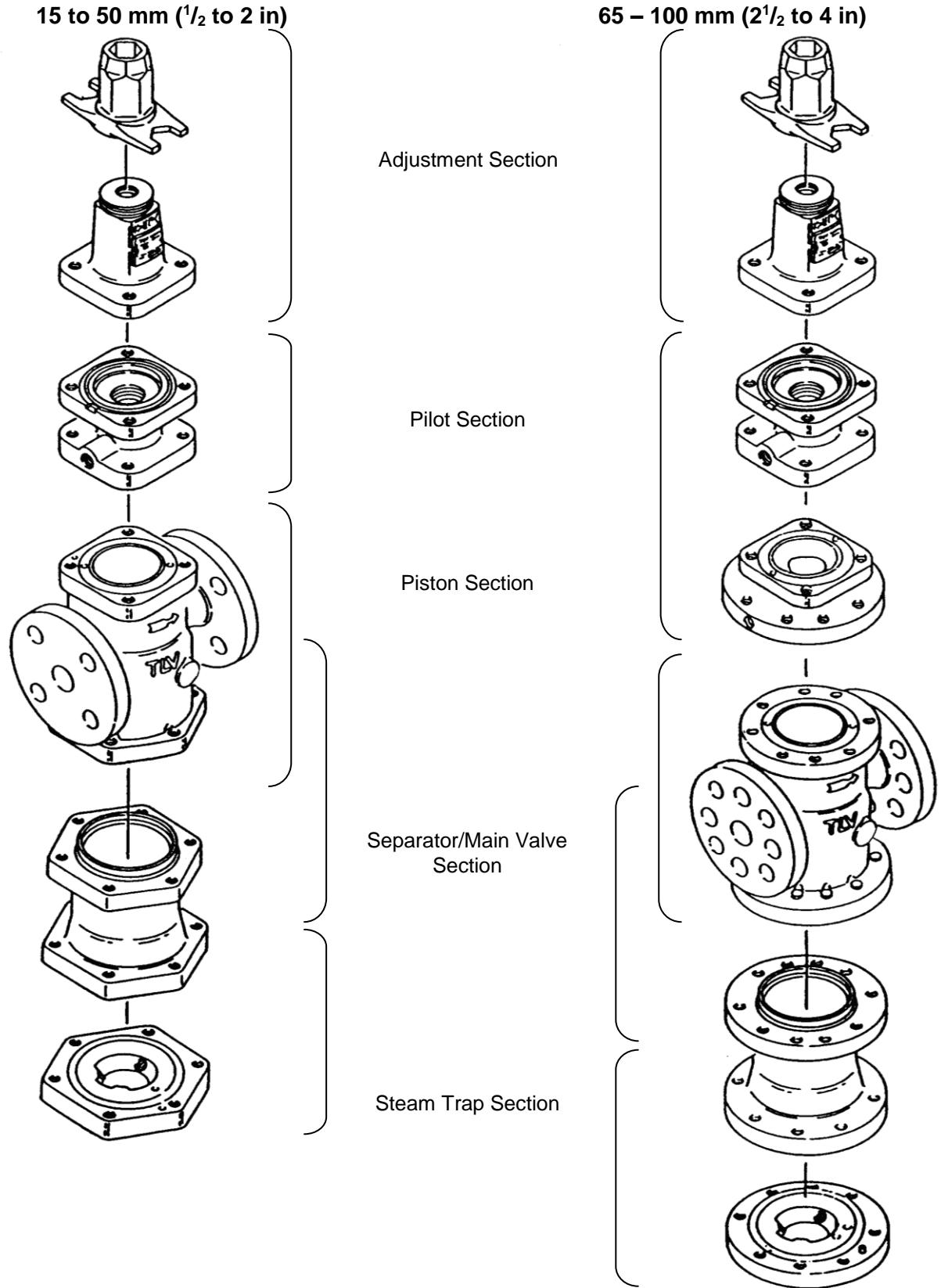
After inspection and removal of any abnormality, clean and reassemble the parts.

The following parts will require cleaning before reassembly:

Trap Cover	Piston
Float	Piston Ring
Trap Valve Seat	Cylinder
Pilot Screen	Separator Screen
Main Valve Seat	Pilot Valve
Main Valve	Pilot Valve Seat
Main Valve Holder	Adjustment Screw

It is permissible to clean using water, however cleaning with a mild detergent is recommended for more effective cleaning.

Exploded View

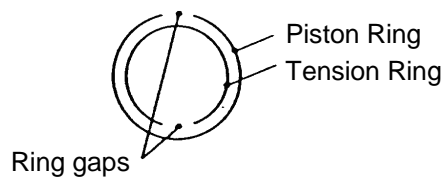


Reassembly

Assemble the unit using the same procedure as used for disassembling it; but in reverse order. Observe the following precautions:

1. The PTFE gaskets may be re-used if free from fault, crushing or deformation.
2. 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 valve seat, pilot valve seat and screen holder. Apply anti-seize carefully to ensure it does not come into contact with other parts.
3. Fasten the bolts one at a time in an alternating diagonal pattern to provide uniform seating.
4. 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.

5. Standard fastening torque and the distance across flats for the tools to be used are as follows:

Part	COS Connection Size		Distance Across Flats		Tightening Torque	
	(mm)	(in)	(mm)	(in)	(N·m)	(lbf·ft)
Bolts (Spring Housing)	All		16/17*	(⁵ / ₈ , ²¹ / ₃₂)*	40	(29)
Pilot Valve Seat	All		19	(³ / ₄)	70	(51)
Screen Holder	All		24	(¹⁵ / ₁₆)	40	(29)
Bolts (Pilot Body)	15 – 40	(¹ / ₂ – 1 ¹ / ₂)	16/17*	(⁵ / ₈ , ²¹ / ₃₂)*	60	(44)
	50	(2)	19	(³ / ₄)	70	(51)
	65 – 100	(2 ¹ / ₂ – 4)	16/17*	(⁵ / ₈ , ²¹ / ₃₂)*	60	(44)
Bolts (Body/Pilot Cover)	65, 80	(2 ¹ / ₂ , 3)	19	(³ / ₄)	70	(51)
	100	(4)	24	(¹⁵ / ₁₆)	150	(110)
Bolts (Trap Cover/Trap Body)	15 – 40	(¹ / ₂ – 1 ¹ / ₂)	16/17*	(⁵ / ₈ , ²¹ / ₃₂)*	60	(44)
	50 – 80	(2 – 3)	19	(³ / ₄)	70	(51)
	100	(4)	24	(¹⁵ / ₁₆)	150	(110)
Main Valve Seat (65 – 100 mm Hex Bolt)	15, 20	(¹ / ₂ , ³ / ₄)	36	(¹⁷ / ₁₆)	100	(73)
	25	(1)	41	(¹⁵ / ₈)	125	(92)
	32, 40	(1 ¹ / ₄ , 1 ¹ / ₂)	60	(2 ³ / ₈)	250	(185)
	50	(2)	70	(2 ³ / ₄)	300	(220)
	65, 80	(2 ¹ / ₂ , 3)	13	(¹ / ₂)	30	(22)
	100	(4)	16/17*	(⁵ / ₈ , ²¹ / ₃₂)*	40	(29)
Bolts (Float Cover)	15, 20	(¹ / ₂ , ³ / ₄)	8	(⁵ / ₁₆)	7	(5)
	25 – 40	(1 – 1 ¹ / ₂)	10	(³ / ₈)	10	(7)
	50 – 100	(2 – 4)	13	(¹ / ₂)	20	(15)
Trap Valve Seat	15, 20	(¹ / ₂ , ³ / ₄)	11	(⁷ / ₁₆)	10	(7)
	25 – 40	(1 – 1 ¹ / ₂)	13	(¹ / ₂)	15	(11)
	50 – 80	(2 – 3)	16/17*	(⁵ / ₈ , ²¹ / ₃₂)*	40	(29)
	100	(4)	19	(³ / ₄)	55	(40)

* Size depends on bolt standard

(1 N·m ≈ 10 kg·cm)

NOTE: -If a torque greater than that recommended is applied, the body or components may be damaged.

-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.

Troubleshooting



WARNING

NEVER apply direct heat to the float. The float may explode due to increased internal pressure, causing accidents leading to serious injury or damage to property and equipment.



CAUTION

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

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

Problems are classified as follows:

1. The secondary pressure does not increase.
2. The secondary pressure cannot be adjusted or increases abnormally.
3. Hunting (fluctuation of the secondary pressure) occurs.
4. Chattering (a heavy mechanical noise) occurs.
5. 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 specifications), insufficient pressure or flow rate, and clogs by dirt and scale.

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

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

Problem	Symptom	Cause	Remedy
The secondary pressure does not rise	The COS body is not warm	No steam is being supplied or the inlet valve is closed	Check the valves and piping
	The body is warm, but the pressure does not increase	The entrance to the screens or strainer is clogged	Clean or blow down
The 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 if necessary
		The piston is clogged with dirt	Clean Check the piston ring
		The piston ring is worn	Replace with a new piston ring
		There is a build-up of dirt on the sliding surfaces of the pilot, piston or main valve	Clean

Continued on the next page

Problem	Symptom	Cause	Remedy
The secondary pressure cannot be adjusted or increases abnormally (continued)	Adjustment is difficult, and set pressure varies	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 small hole on the piston is clogged	Clean
		Wear on piston ring	Replace piston rings
		The diaphragm is distorted or damaged	Replace with a new diaphragm
		There is fluctuation in steam consumption	Check the flow rate, replace the COS if necessary
		The selected model is inappropriate for the service conditions (specifications)	Check the model selection, replace the COS if necessary
	Upon closing the valves on the secondary side, the secondary pressure abruptly rises as high as the primary pressure	The bypass valve is leaking	Check, clean, and replace with a new valve if necessary
		There is a build-up of dirt on or damage to the pilot valve seat or main valve seat	Clean Align Replace if necessary
	Hunting or chattering occurs	Occurs at low steam demand	It is being operated below the lower flow rate limit
Hunting never stops		There is too high a reduction ratio (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 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 if necessary
Abnormal noises	Makes a high-pitched noise	There is too high a reduction ratio	Use two-stage reduction
		The flow is too great	Check the flow rate and use a larger size valve
		There is a high-speed open/close valve nearby	Install the valve as far away as possible

Continued on the next page

Problem	Symptom	Cause	Remedy
Faulty steam trap	Steam is blowing	There is a build-up of dirt 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
		There is vibration in the piping	Secure the piping
	No condensate is discharged	The primary pressure exceeds the trap valve seat maximum working pressure	Adjust primary pressure
		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 Replace with a new trap valve seat

NOTE: When replacing parts for the COS-3, COS-16 and COS-21, use the parts list for reference, and replace with new parts from the kits shown there. Please note that replacement parts for the COS-3, COS-16 and COS-21 are only available as part of a replacement parts kit.

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This warranty does not cover defects or failures caused by:

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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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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.

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