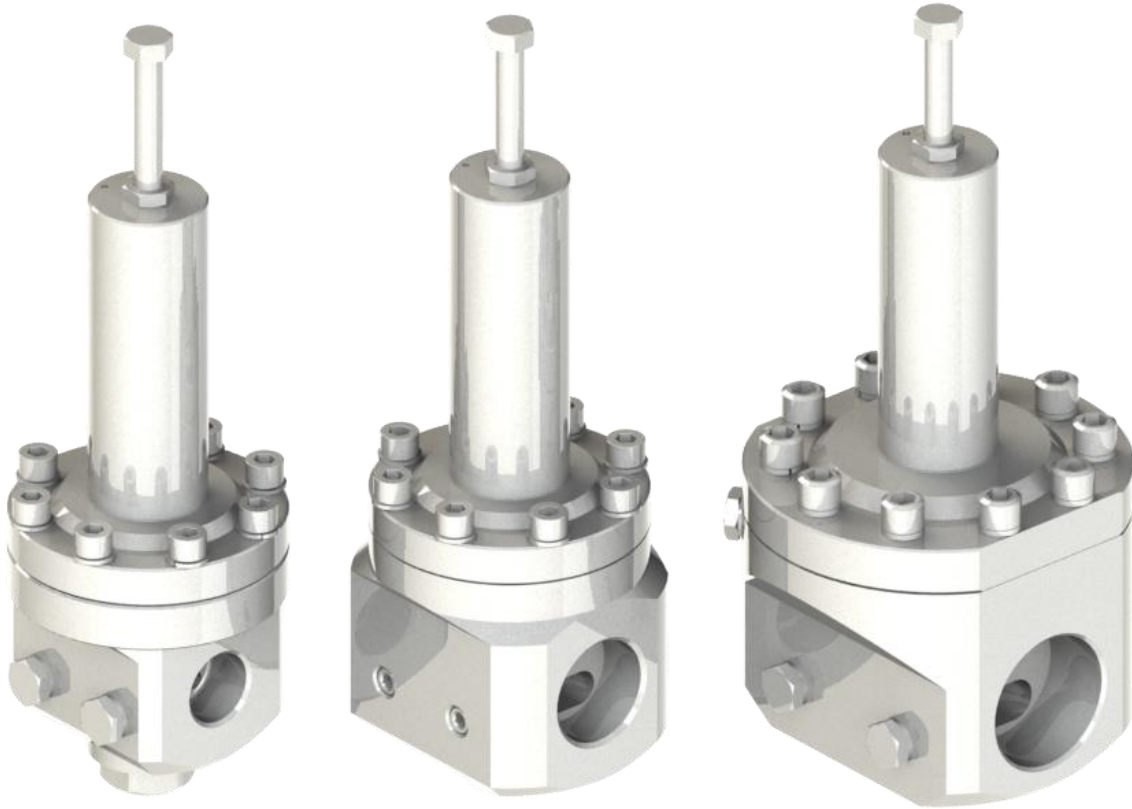


RS(H)10/15/20 Pressure-Reducing Regulator User Manual



Read the complete manual before installing and using the regulator.

Safe Product Selection

When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.



WARNING

- Users must be trained and equipped for the handling, use, and servicing of pressure products and systems.
- Users must contact their gas or liquid supplier for specific safety precautions and instructions.
- Gaseous media should be free of excessive moisture to prevent icing at high flow.
- Always wear the appropriate protective clothing, including safety glasses, gloves, etc., if required.
- Follow the applicable safety and maintenance procedures.
- Obey specific local regulations.
- Do not exceed the maximum inlet and outlet pressure rating of the product or its accessories.
- Operate within the temperature limits and any other conditions specified for the product.
- Do not drop or damage the product in any other way. This may negatively affect the performance of the product which can cause the product to malfunction.
- Venting fluids and gases can be dangerous. Vent to a safe environment away from people. Ensure adequate ventilation.

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Introduction

Overview

- The RS(H)10, RS(H)15 and RS(H)20 series are spring-loaded pressure-reducing regulators designed for the regulation of high pressure, high flow gases, and liquids.
- For pressure and temperature rating information refer to the *Pressure Regulators, RHPS Series* catalog, MS-02-430. Note that seat seal material selection can limit the regulator operational pressure at elevated temperatures.



WARNING

Check that system pressures and temperatures do not exceed those stated on the regulator as this could result in product failure.

Standard Features

- Bolted construction
- Stainless steel as standard
- Fully serviceable
- Diaphragm or piston sensing
- Balanced poppet

Additional Options

The regulator is available with the following options:

Anti-tamper

Oxygen Service

- For more information about hazards and risks of oxygen enriched systems see the *Swagelok Oxygen System Safety* technical report (MS-06-13).
- Cleaning and packaging to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C is available. Refer to the *Pressure Regulators, RHPS Series* catalog, MS-02-430, for additional information.

Installation



CAUTION

Do not use the regulator as a shutoff device. A level of leakage across the regulator seat can occur during normal operation.

Points of Attention Before Installation

This regulator can be equipped with a variety of different options. Before installing the regulator you should fully understand the functions of the supplied options and the suitability of your particular regulator for the intended application.

- The preferred mounting position of the regulator is horizontal with the spring housing facing upwards per Fig 2. Alternative mounting positions may increase the risk of component wear.
- It may be necessary to remove the regulator from the system during maintenance or service. Ensure that this is possible.
- The regulator is suitable for gases or liquids. Ensure compatibility between the regulator's materials of construction and the system media.

Installation

- Verify that the regulator, its connections, and any accessories are undamaged.
- Verify that the regulator and any accessories are suitable for the system operating pressure and temperature and have suitable connections.
- At the time of delivery any gauge ports may be plugged with blind fittings. Remove these and connect gauges if desired.
- If inlet/outlet fittings are being used, assemble them to the regulator, per the manufacturer's instructions, prior to installing the regulator in the system.



CAUTION

Ensure all upstream tubing/pipework is clean and free from debris. Any swarf, lint, wire, etc. may damage the regulator, resulting in a seat leak.

- Verify the flow direction of the system and mount the regulator accordingly.
- Securely make the appropriate connections to the regulator in accordance with the procedures recommended by the connection manufacturer.
- Ensure that the tubing/pipework and the regulator are adequately supported and that there is no stress on the connections.
- Upstream and downstream shutoff valves should be installed in the system to facilitate servicing, maintenance, and troubleshooting of the regulator.



WARNING

When using an RSH10 or RSH15 with an inlet pressure higher than 3625 psig (250 bar) a safety valve must be installed in the outlet line to ensure the outlet pressure does not exceed 3625 psig (250 bar), which could result in product failure.



WARNING

When using an RSH20 with an inlet pressure higher than 2900 psig (200 bar) a safety valve must be installed in the outlet line to ensure the outlet pressure does not exceed 2900 psig (200 bar), which could result in product failure.

Operation

Required Tools for Operation

- A 19 mm open-ended wrench is required for changing the set pressure on a standard regulator.
- A 19 mm and a 32 mm open-ended wrench are required for anti-tamper regulators.

Points of Attention Before Operation



CAUTION

The product can be hot or cold, depending on the environmental temperature and the process media temperature. Take the necessary precautions before operating or touching the product.

- Stopping flow through the regulator by closing a downstream shutoff valve may result in a rise in outlet pressure above the set pressure. This is usually referred to as “**lock-up**”. This phenomenon does not indicate a problem with the regulator.
- A decrease of the flow rate may result in a rise of the outlet pressure. An increase of the flow rate may result in a fall of the outlet pressure. This is usually referred to as “**droop**”. This phenomenon does not indicate a problem with the regulator.
- A decrease of the inlet pressure may result in a rise of the outlet pressure. An increase of the inlet pressure may result in a fall of the outlet pressure. This is usually referred to as “**inlet dependency**” or “**Supply Pressure Effect (SPE)**”. This phenomenon does not indicate a problem with the regulator.

Adjusting the Set Pressure

- The set pressure is the desired outlet pressure of the regulator.
 - To set the regulator, ensure that the supply pressure is greater than the required set pressure but does not exceed the maximum rating of the regulator.
 - The regulator must be able to flow in order for it to reduce the outlet pressure.
1. Partially open any downstream valve. This will allow minimal flow through the regulator when adjusting the set pressure, reducing media consumption during this process.
 2. Fully unwind the adjusting screw counterclockwise.
 3. Steadily open the supply valve to allow inlet pressure to the regulator.
 4. To operate the regulator, turn the adjusting screw clockwise to increase the set pressure. Turn the adjusting screw counterclockwise to reduce the set pressure.
 5. To obtain the most accurate set pressure, final adjustment must be made while **increasing** the set pressure. If the desired outlet pressure is exceeded, reduce the pressure below this value then increase up to it.
 6. Fully open the downstream valve to allow full flow during operation.
 7. Once under flow conditions make any final set pressure adjustments per steps 3 and 4 if required.

Maintenance

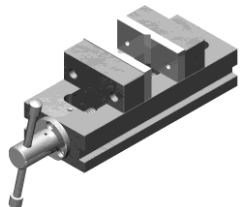

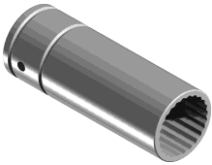
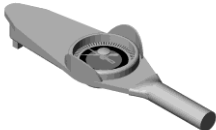






WARNING

Incorrect or improper repair or servicing of this product can cause serious personal injury and property damage.

- All repairs, servicing, and testing of this product must be performed by competent personnel.
- Following any maintenance of the regulator, it is recommended that the product be tested for operation and leakage.
- The product should be checked periodically for proper and safe operation. It is the user's sole responsibility to determine the frequency of maintenance based on the application.
- To reduce maintenance related system downtime to a minimum, either during commissioning or normal operation, Swagelok recommends having maintenance kits readily available on site. The need for maintenance kits is particularly important during the commissioning phase of a system installation due to residual assembly debris remaining in the system. Such debris can cause a seat leak in the regulator, resulting in components needing to be replaced.

Required Tools for Maintenance

Smooth-jawed vise		Seat insertion tool RHPS-10-SEAT-TOOL RHPS-15-SEAT-TOOL RHPS-20-SEAT-TOOL	
36mm socket ^①		Calibrated torque wrench up to 52 lbf·ft (70 N·m)	
46mm socket ^②			
8mm hex drive ^①		Lubricant (included in kit): WL-8 ^③ Krytox® 240 AC ^④	
10mm hex drive ^②			
C-ring pliers		Liquid leak detector	

① RS(H)10 and RS(H)15 series only

② RS(H)20 series only

③ Standard cleaned assemblies

④ ASTM G93 or SC11 cleaned assemblies

Table 1

Points of Attention Before Removal from the System

- Swagelok recommends removing the regulator from the system for servicing and maintenance.
- Follow all local system safety and maintenance procedures when removing the regulator.



WARNING

Before removing a regulator from the system, to avoid personal injury, you must:

- Depressurize the system.
- Purge the system to remove any residual system media left in the regulator.
- Always vent to a safe environment away from people and ensure there is adequate ventilation.



CAUTION

Check if the process media is hazardous or toxic. If required, take the necessary safety precautions to ensure a safe workspace and your personal safety.



CAUTION

The product can be hot or cold, depending on the environmental temperature and the process media temperature. Take the necessary precautions before operating or touching the product.

Removal from the System

1. Isolate the regulator from all pressure sources by closing all appropriate upstream valves in the system.
2. With the regulator set, open all appropriate downstream valves to allow pressure to vent from the regulator.



WARNING

Ensure all pressure on the inlet and outlet has been fully vented. The accidental release of residual trapped pressure can cause serious personal injury.

3. Disconnect and remove the regulator from the system.

Assembly Reference Data

Item	Component Name	Kit Type(s)	Torque lbf-ft (N-m)	Recommended Lubrication (included in kit per Table 1)
1	Body plug	C1, C2	RS(H)10: 37 (50)	Lubricate threads
			RS(H)15: 37 (50)	
			RS(H)20: 52 (70)	
2	Body plug O-ring	B1, B2, C1, C2		
3	Poppet spring	C1, C5		
4	Poppet backup ring	A1, A2, B1, B2, C1		
5	Poppet O-ring	A1, A2, B1, B2, C1		Lubricate
6	Poppet	A1, A2, B1, C1		
7	Seat	A1, B1, C1	RS(H)10: 7 (10)	Lubricate threads
			RS(H)15: 11 (15)	
			RS(H)20: 15 (20)	
8	Seat O-ring	A1, B1, B2, C1		
9	Body	N/A		
10	Body plate	C1		
11	Retaining ring	C1		
12	Conical spring	C1		
13	Diaphragm plate	C1		
14	Diaphragm	C1, C3		
15	Bottom spring guide	C1		
16	Piston	C1, C3		
17	Piston O-ring	B1, B2, C1, C3		Lubricate
18	Piston backup ring	B1, B2, C1, C3		
19	Piston plate	C1, C3		
20	Piston plate O-ring	B1, B2, C1, C3		
21	Set spring	C1, C4		
22	Upper spring guide	C1		Lubricate central recess
23	Ball	C1		Lubricate
24	Spring housing	N/A		
25	Washer	E1		
26	Cap screw	E1	RS(H)10: 22 (30)	Lubricate threads
			RS(H)15: 22 (30)	
			RS(H)20: 52 (70)	
27	Lock nut	D1		
28	Adjusting screw	D1		Lubricate threads
29	Anti-tamper cover O-ring	B1, B2, D1		
30	Anti-tamper cover	D1		Lubricate threads
31	Blind plug	N/A	NPT: 15 (20)	Wrap threads in 2 layers of PTFE tape. Lubricate tape.
			BSP: 26 (35)	Lubricate threads
32	BSP blind plug O-ring	B1, B2, C1		

Table 2

For more information on RHPS series maintenance kits, refer to the *Pressure Regulators, RHPS Series* catalog, MS-02-430.

RS(H)10/15/20 Series, Exploded view

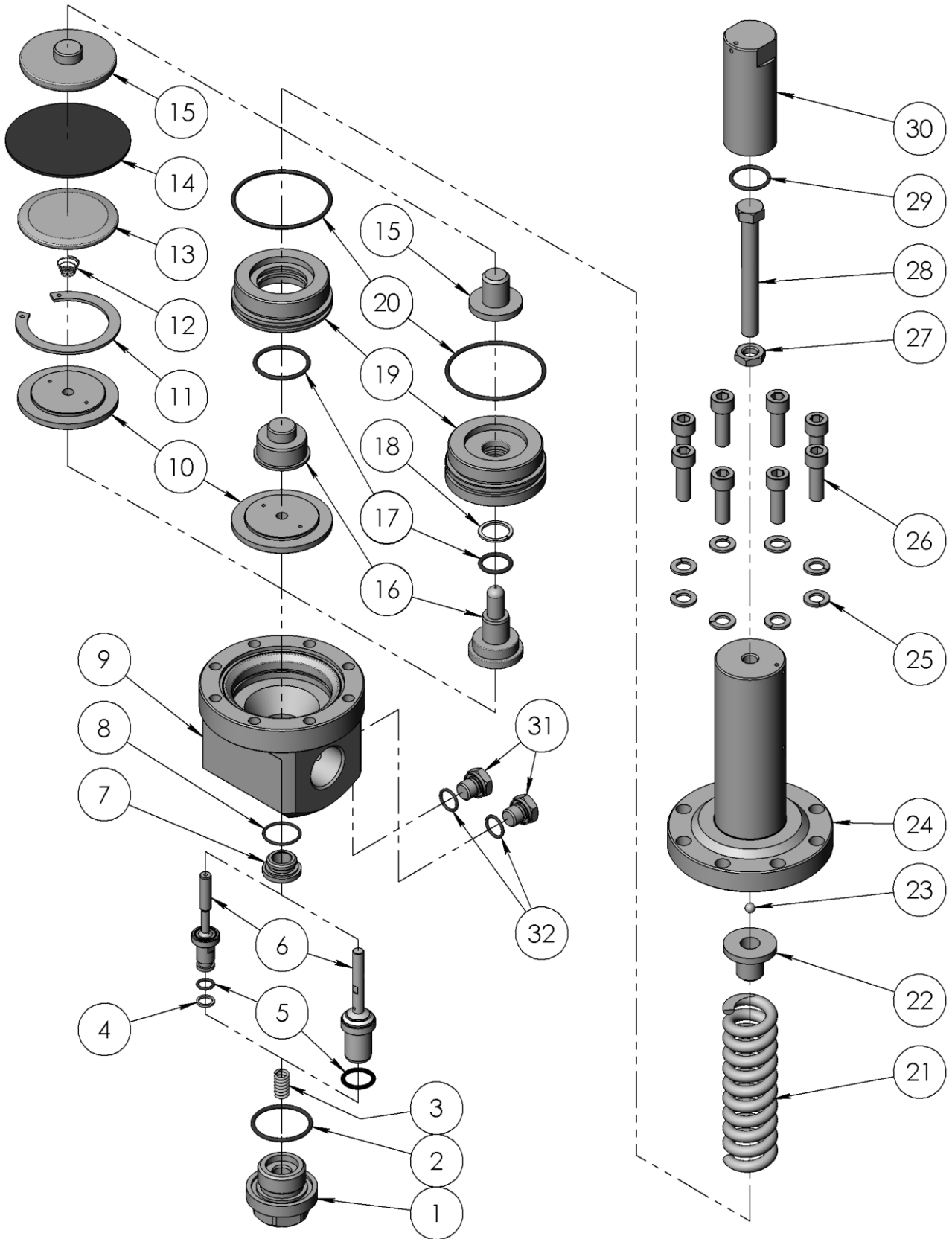


Fig 1

RS(H)10/15 Series, Diaphragm Sensing, Section View

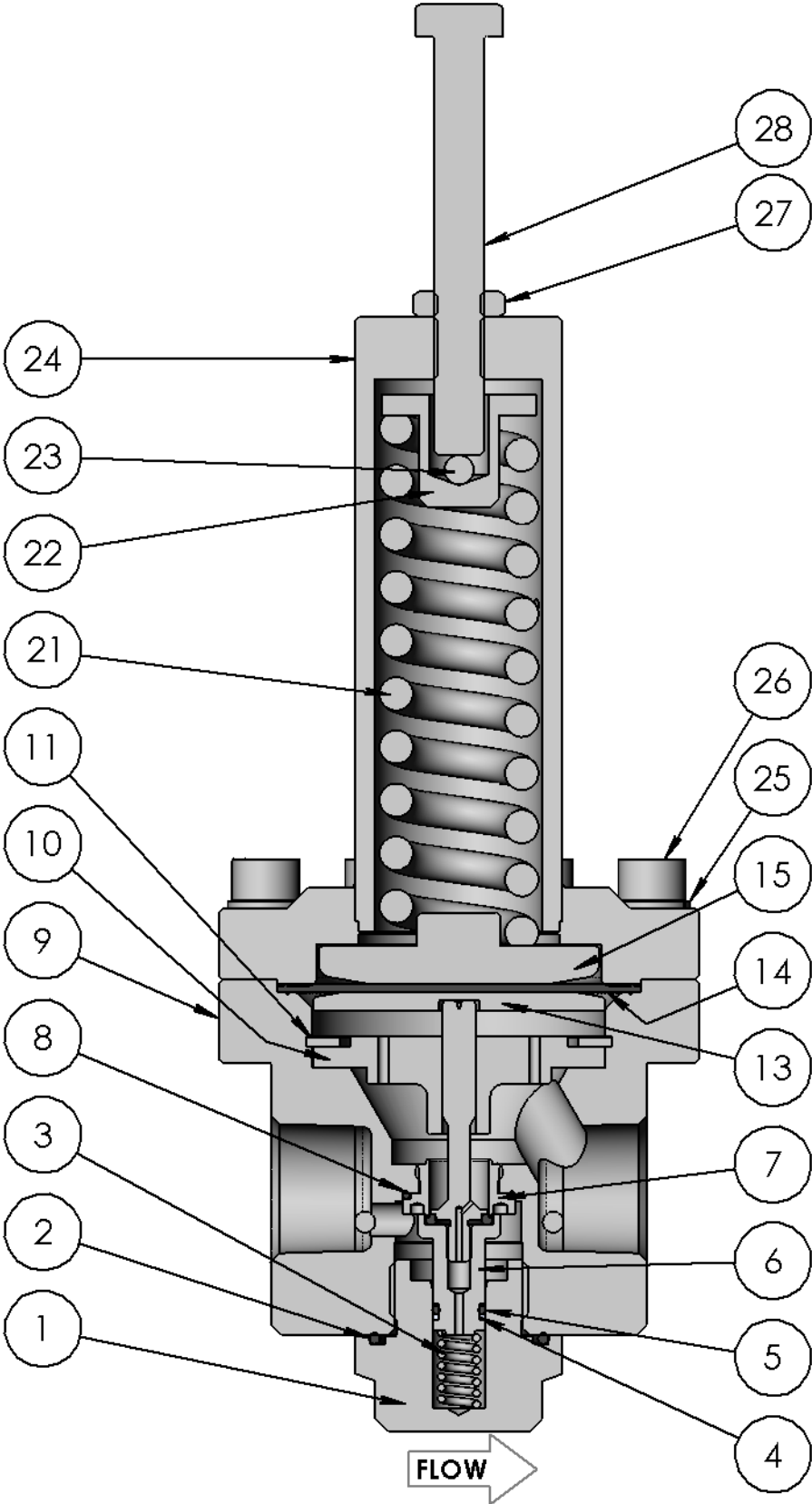


Fig 2

RS(H)10/15 Series, Piston Sensing, Section View; Control Range 5

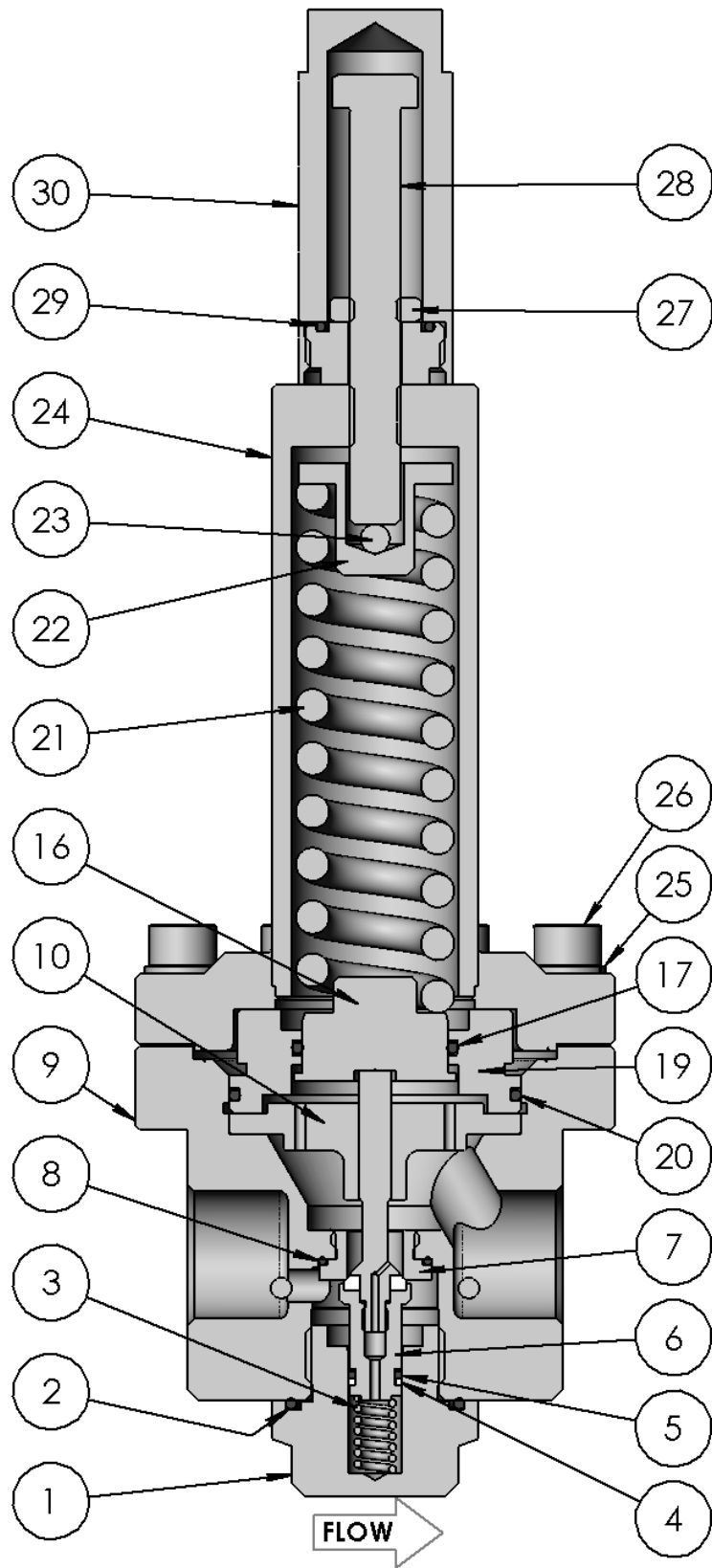


Fig 3

RSH10/15 Series, Piston Sensing, Section View; Control Ranges 6,7 and 8

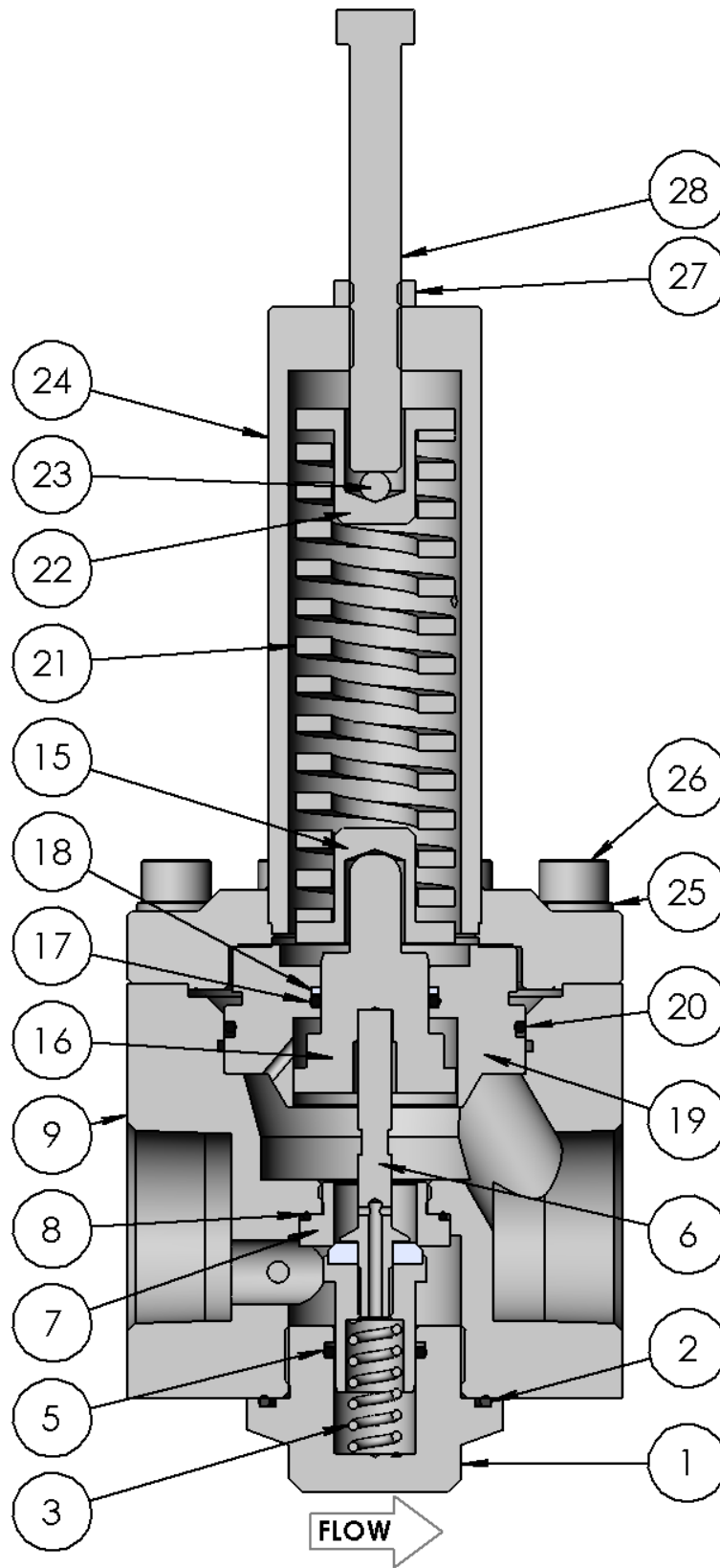


Fig 4

RS(H)20 Series, Section View

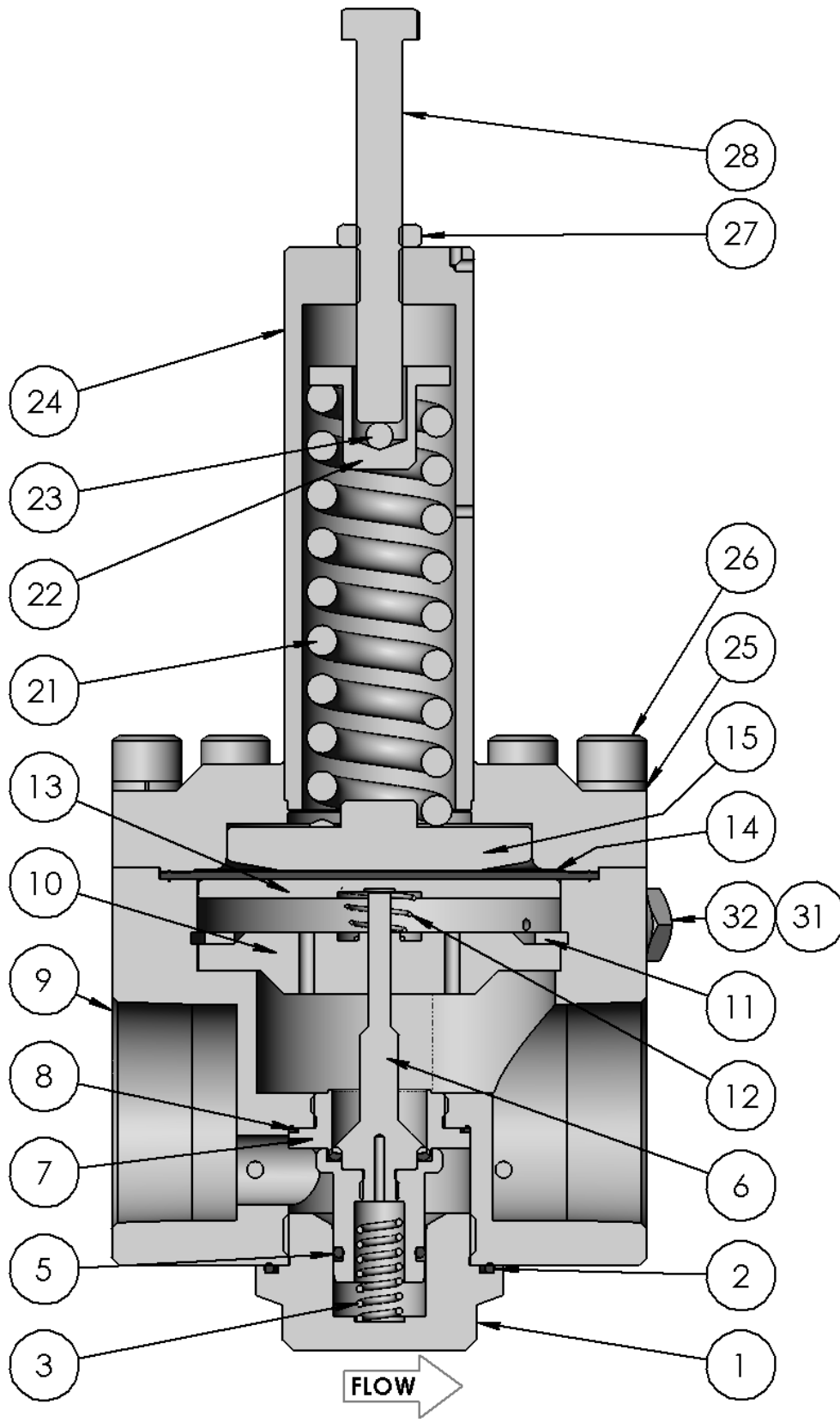


Fig 5

Disassembly

- The following instructions describe how to fully disassemble the regulator for the purposes of maintenance and repair.
 - Note that not all components listed appear in all regulator configurations.
 - Only disassemble the regulator as far as is required to replace the components supplied in the maintenance kit.
 - Discard all components being replaced.
1. Remove the body plug (1), poppet spring (3) and poppet (6) from the body (9).
 2. Remove the body plug O-ring (2), poppet O-ring (5) and, if present, poppet backup ring (4) from the body plug (1) and poppet (6).
 3. Using the seat insertion tool, remove the seat (7) and seat O-ring (8).
 4. Ensure the adjusting screw (28) is backed out and not acting on the set spring (21). It can be fully removed, if required, by unwinding counterclockwise until it detaches from the spring housing (24).
 5. Loosen the cap screws (26) and remove the spring housing (24).
 6. Remove the upper spring guide (22), including the ball (23), set spring (21), and bottom spring guide (15).
 7. Remove the diaphragm (14) and diaphragm plate (13) or piston plate (19) and piston (16).
 8. Remove any O-ring (17, 20) and backup ring (18) from the piston plate (19).
 9. If required remove the body plate (10) by removing the retaining ring (11).

Points of Attention Before Reassembly

- Visually inspect all components for abnormal wear or damage. Replace components in case of doubt.
- All parts must remain clean and undamaged before starting assembly.
- Maintenance kit components will be supplied preassembled where practicable to aid reassembly.
- Swagelok recommends replacing all O-rings removed during disassembly.
- Swagelok recommends that dynamic O-rings should be lightly lubricated per Table 2.



NOTICE

All threaded components must be lightly lubricated per Table 2 before reassembly to avoid galling of threads.

Reassembly

RS(H)10 Series: Standard Diaphragm Sensing

1. Fit the body plate (10) into the body (9) and retain with the retaining ring (11).
2. Fit the Seat O-ring (8) into the body (9) and ensure that it is seated all the way round.
3. Lightly lubricate the seat threads (7) then insert the seat (7) into the body (9) using the seat insertion tool.
4. Torque the seat (7) to 7 lbf·ft (10 N·m). Take care not to pinch the seat O-ring (8) or damage the seat (7) with the tool.
5. Fit the poppet O-ring (5) and, if present, backup ring (4) onto the poppet (6). Ensure they are oriented correctly per Fig 2.
6. Lightly lubricate the poppet O-ring (5) then insert the poppet (6) through the seat (7) and body plate (10). Take care not to damage either the seat (7) or poppet (6).
7. Place the poppet spring (3) onto the poppet (6).
8. Fit the body plug O-ring (2) onto the body plug (1) and lightly lubricate the body plug threads.
9. Screw the body plug (1) into the body (9) over the poppet spring (3). Torque to 37 lbf·ft (50 N·m).
10. Place the diaphragm plate (13) onto the poppet (6).
11. Place the diaphragm (14) onto the diaphragm plate (13) and locate it in the body (9).
12. Place the bottom spring guide (15) centrally onto the diaphragm (14).
13. Fit the ball (23) into the upper spring guide (22) and retain in place.
14. Place the set spring (21) and spring guide (22) onto the bottom spring guide (15).
15. Lightly lubricate the cap screws (26). Fit the spring housing (24) over the spring (21) and secure with the cap screws (26) and washers (25).
16. Torque the cap screws (26) to 22 lbf·ft (30 N·m).
17. Lightly lubricate the adjusting screw (28) then insert it and the lock nut (27) into the spring housing (24).

RS(H)15 Series: Standard Diaphragm Sensing

1. Follow steps 1 through 3 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
2. Torque the seat (7) to 11 lbf·ft (15 N·m). Take care not to pinch the seat O-ring (8) or damage the seat (7) with the tool.
3. Fit the poppet O-ring (5) into the body plug (1).
4. Follow steps 6 through 17 of the RS(H)10 series standard diaphragm sensing reassembly procedure.

RS(H)20 Series: Standard Diaphragm Sensing

1. Follow steps 1 through 3 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
2. Torque the seat (7) to 11 lbf·ft (20 N·m). Take care not to pinch the seat O-ring (8) or damage the seat (7) with the tool.
3. Follow steps 5 through 8 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
4. Insert the body plug (1) into the body (9) over the poppet spring (3). Torque to 52 lbf·ft (70 N·m).
5. Place the conical spring (12) onto the body plate (10).
6. Follow steps 10 through 15 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
7. Torque the cap screws (26) to 52 lbf·ft (70 N·m).
8. Follow step 17 of the RS(H)10 series standard diaphragm sensing reassembly procedure.

RS(H)10 Series: Standard Piston Sensing

1. Follow steps 2 through 9 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
2. If present fit the body plate (10) into the body (9) oriented per Fig 3.
3. Fit the piston plate O-ring (20), piston O-ring (17) and, if present, piston backup ring (18) onto and into the piston plate (19).
4. Lightly lubricate the piston O-ring (17) then insert the piston (16) into the piston plate (19).
5. Fit the piston plate (19) into the body (9).
6. If present, place the bottom spring guide (15) onto the piston (16).
7. Follow steps 13 through 17 of the RS(H)10 series standard diaphragm sensing reassembly procedure.

RS(H)15 Series: Standard Piston Sensing

1. Follow steps 2 and 3 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
2. Torque the seat (7) to 11 lbf-ft (15 N·m). Take care not to pinch the seat O-ring (8) or damage the seat (7) with the tool.
3. Fit the poppet O-ring (5) into the body plug (1).
4. Follow steps 6 through 9 of the RS(H)10 series standard diaphragm sensing reassembly procedure.
5. If present fit the body plate (10) into the body (9) oriented per Fig 3.
6. Fit the piston plate O-ring (20), piston O-ring (17) and, if present, piston backup ring (18) onto and into the piston plate (19).
7. Lightly lubricate the piston O-ring (17) then insert the piston (16) into the piston plate (19).
8. Fit the piston plate (19) into the body (9).
9. If present, place the bottom spring guide (15) onto the piston (16).
10. Follow steps 13 through 17 of the RS(H)10 series standard diaphragm sensing reassembly procedure.

Testing

Swagelok recommends that the regulator be tested for seat and shell leakage to atmosphere. A well performing regulator will not show any indication of leaking. If any evidence of a leak is identified this must be rectified. Any damaged components must be replaced.

Seat Leak Test

1. Ensure there is sufficient supply pressure to the regulator to be able to perform the tests.
2. Ensure the adjusting screw is screwed fully counterclockwise.
3. Maintain an inlet pressure of approximately 14.5 psig (1 bar) on the regulator and close the downstream shutoff valve.
4. Monitor the outlet pressure. An increase in pressure over time indicates a seat leak.
5. Repeat the procedure with the highest inlet pressure applicable for the regulator and system.

Shell Leak Test

1. Maintain an inlet pressure of approximately 29 psig (2 bar) on the regulator and close the downstream shutoff valve.
2. Increase the outlet pressure to approximately 14.5 psig (1 bar).
3. Using liquid leak detector, check for bubbles at the spring housing to body interface, body plug to body interface and the spring housing weep hole.
4. Repeat the procedure with the highest inlet and outlet pressure applicable for the regulator and system.

Troubleshooting

Symptom	Cause	Remedy
The outlet pressure creeps up, without adjusting the spring.	A damaged poppet and/or seat.	Replace the poppet and/or seat.
Leakage around the body plug.	A damaged O-ring.	Replace the O-ring.
Leakage between the body and the spring housing or through the spring housing weep hole.	A damaged diaphragm or O-ring.	Replace the diaphragm or O-ring.
	Insufficient torque on the cap screws.	Tighten the cap screws per Table 2.
Controlled pressure drops off sharply even when the flow is within regulator capabilities.	The system filter element is clogged.	Replace the system filter.
The required outlet pressure cannot be reached.	The inlet pressure to the regulator is not high enough.	Ensure that the inlet pressure to the regulator is equal to or greater than the desired set pressure.
The outlet pressure rises too much when going from a dynamic to a static situation.	There is too much flow in the dynamic situation.	A larger regulator or parallel regulator is required. Review application flow capacity and contact your local authorized sales and service center.
The outlet pressure does not drop when the actuating stem is adjusted counterclockwise.	The regulator is non-venting.	A shutoff valve in the outlet line must be opened to reduce the outlet pressure.
The outlet pressure has changed without adjusting the actuating stem.	Changes to the inlet pressure may result in changes to the outlet pressure.	Maintain a constant inlet pressure to the regulator. See “ Points of Attention Before Operation ” about dependency .
	Changes to the flow may result in changes to the outlet pressure.	Maintain a constant flow through the regulator. See “ Points of Attention Before Operation ” about droop .

Table 3

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty.
For a copy, visit swagelok.com or contact your authorized Swagelok representative.

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