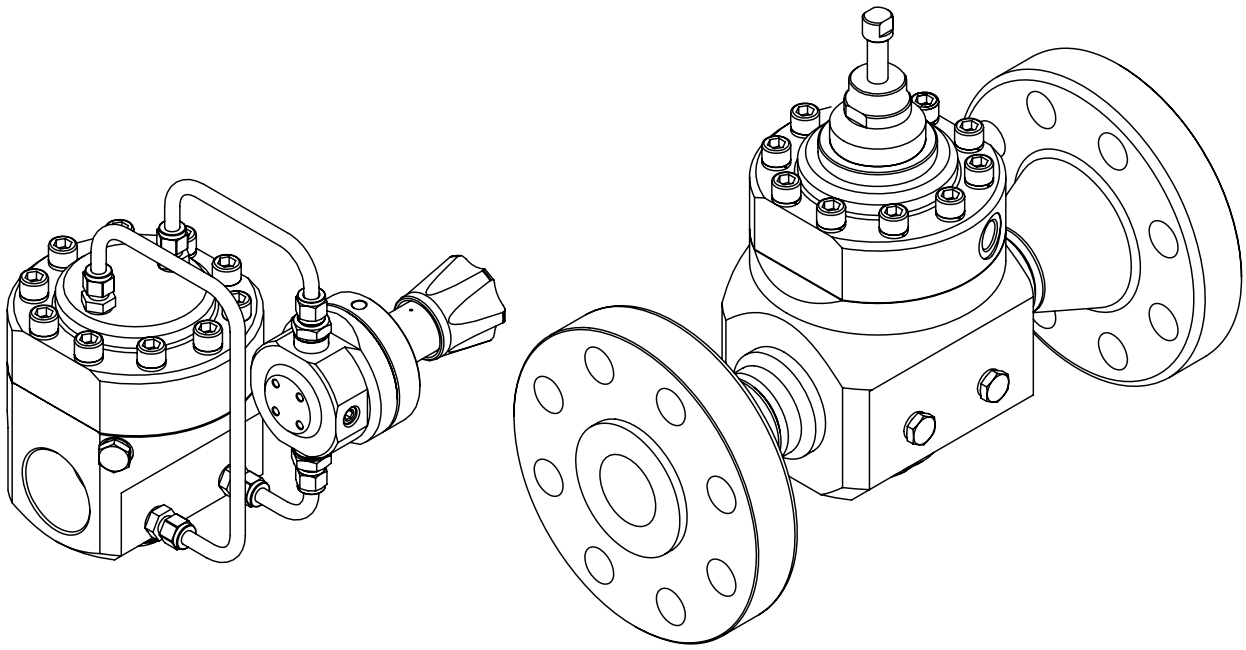
BD(H)20, 25(-DP)

USER MANUAL

Read the complete manual before installing and using the regulator.



RHPS Series

Swagelok

WARNING

INCORRECT OR IMPROPER USE OF THIS PRODUCT CAN CAUSE SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

Due to the variety of operating conditions and applications for this product, the user is solely responsible for making the final proper decisions concerning the correct assembly and functioning of the product and assuring that all the performance, safety and warning requirements are met.

- 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 of the product or its accessories.
- Operate within the temperature limits and other conditions specified for the product.
- Do not drop or damage the product in any other way. This may negatively effect 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.
- This product is not oxygen clean and therefore not suitable for oxygen service.

If there are questions or problems regarding the installation, operation and maintenance these should be directed to the proper authority on site before continuing.

CONTENTS

1 Introduction

1.1 Detailed description

The function of a backpressure regulator is to maintain a constant inlet pressure and to control the inlet pressure with a variable flow.

This regulator is a diaphragm sensing dome loaded backpressure regulator, designed for high pressure, high flow gases and liquids.
The regulator comprises a body and dome bolted together and has a removable seat and valve.
The product is designed to be used between -20 °C and +80 °C, whether ambient temperature or media temperature.

The regulator is soft seated for leak tight shut-off in zero flow conditions and is available in stainless steel or high tensile brass.

The regulator is a dome loaded type, which means it must be connected to a controlled pressure source to operate.

The maximum in- and outlet pressure for the models are, **limits for other connection types not included:**

- Threaded models BD20-01(-DP) : Inlet 70 bar Outlet 70 bar
- Threaded models BDH20-01(-DP) : Inlet 200 bar Outlet 200 bar*
- Threaded models BD20-02(-DP) : Inlet 70 bar Outlet 70 bar
- Threaded models BDH20-02(-DP) : Inlet 200 bar Outlet 200 bar*
- Flanged models BDF25-02(-DP) : Inlet max. 70 bar, depending upon pressure rating of flange : Outlet 70 bar
- Flanged models BDHF25-02(-DP) : Inlet max. 200 bar, depending upon pressure rating of flange : Outlet 200 Bar*

⚠ **Check the assembly drawing or regulator for the specific pressure limits of the supplied regulator.**

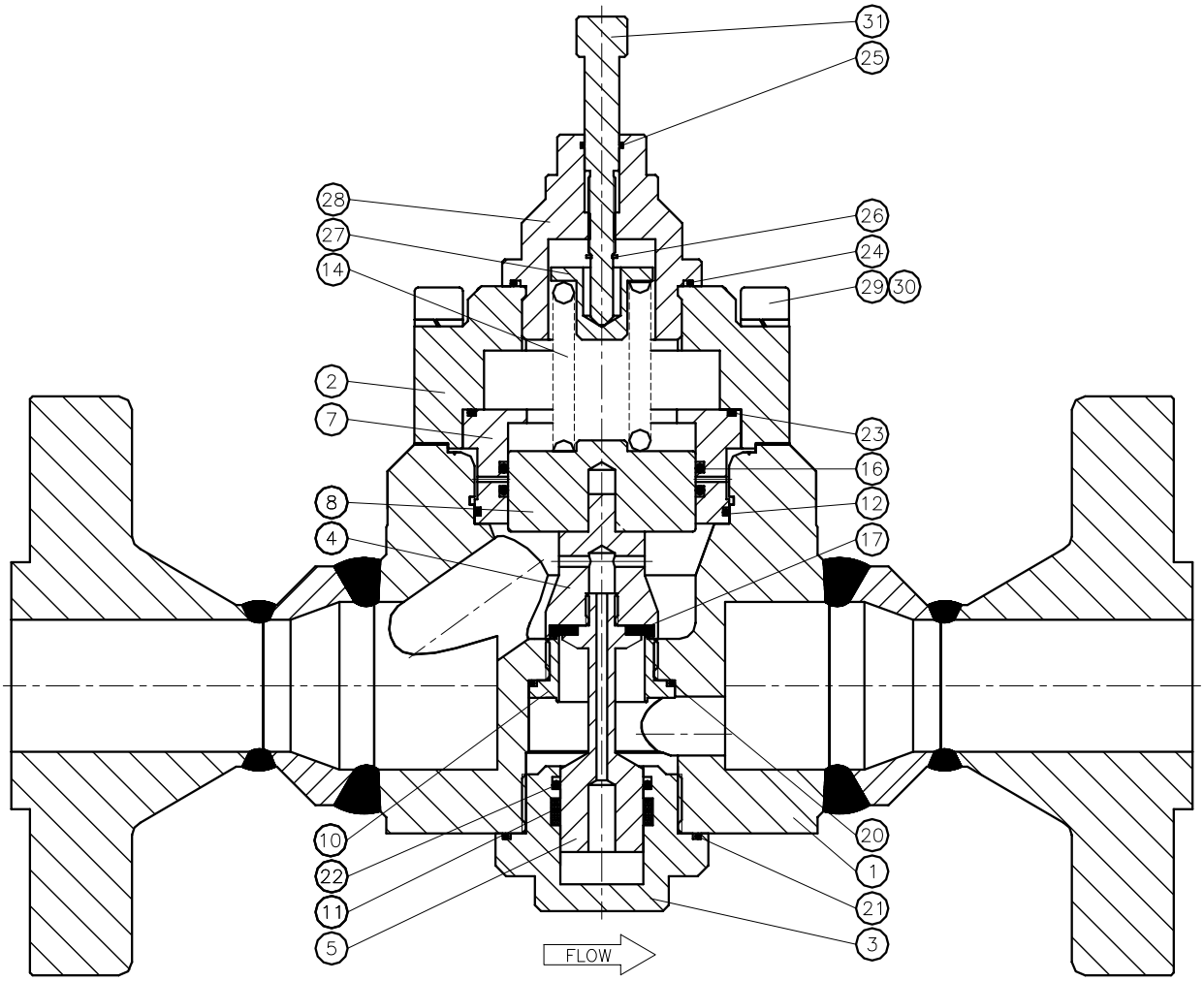
⚠ *** When using the BDH20 or BDHF25 with an inlet pressure higher than 200 bar, a safety valve must be installed in the outlet line, because the outlet pressure may not exceed 200 bar.**

Standard features:
- diaphragm sensing
- bubble tight shut-off
- BD(H)20: 25mm seat
- BD(H)F25: 32mm seat
- balanced valve
- pilot regulator

1.2 Special features and options

The regulator is available with the following options:
- dynamic regulation
- pilot regulator

1.3 Typical picture of the standard BD20, 25-DP and its components

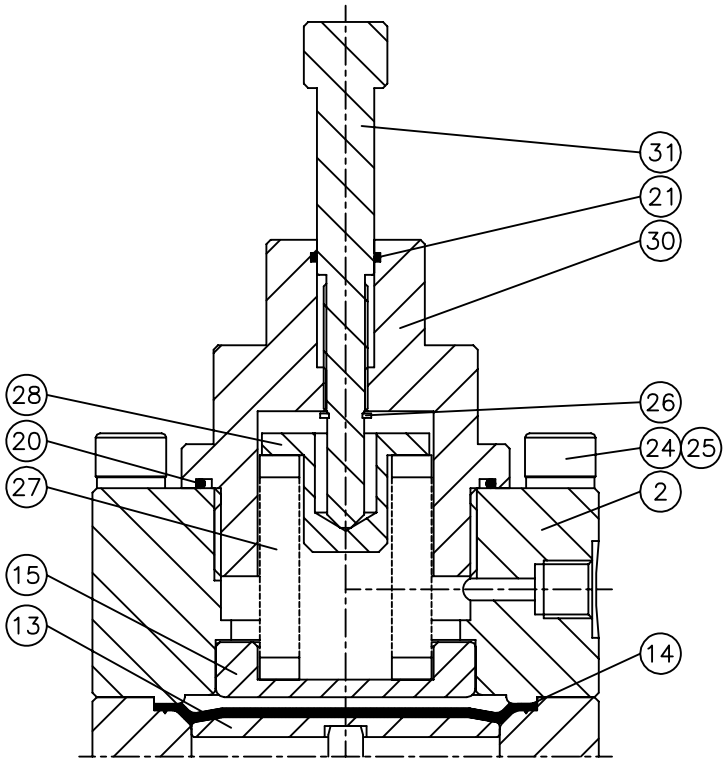


1	body assembly	11	guide ring	27	springguide
2	dome	12	o-ring	28	domescrew
3	bodyplug	13		29	ring
4	valve case	14	setspring	30	socket head cap screw
5	valve screw	16	o-ring	31	setscrew
6		17	valve insert		
7	pistonplate	21	o-ring		
8	piston	22	o-ring		
9		25	o-ring		
10	seat	26	retaining ring		

1.4 Dome loading with differential pressure

A differential pressure dome loaded regulator is a dome regulator with a set spring inside the dome.
The set spring is used to maintain a desired pressure difference between the dome pressure and the outlet pressure.
Usually the used dome pressure is a reference pressure taken elsewhere out of the system.

You set the desired differential pressure using the set spring, and the remaining pressure is set using the dome pressure.



2	dome
13	diaphragm plate
14	diaphragm
15	bottom springguide
20	o-ring
21	o-ring
24	socket head cap screw
25	ring
26	retaining ring
27	set spring
28	springguide
30	dome screw
31	setscrew

2 Installation

WARNING

A PRESSURE REGULATOR IS NOT A SHUT-OFF VALVE AND SHOULD NOT BE USED AS SUCH.

2.1 Points of attention before installation

This regulator can be equipped with different options and connections.
Before installing the regulator you should fully understand the options and the suitability of your particular regulator and its suitability for the application.

- The preferred mounting position of the regulator is horizontal with the dome facing upwards. It may be necessary to remove the regulator from the system during maintenance or service. Make sure that this is possible, especially if mounted in a different position.
- The regulator is suitable for gases and liquids. Check if the materials on the assembly drawing, which came with the regulator, are compatible with the used media.
- SWAGELOK B.V. recommends not to use a self-venting version pilot regulator with hazardous or toxic media.
  If required take the necessary safety precautions to ensure a safe workspace and your personal safety. Vent to a safe environment away from people and ensure adequate ventilation.
- Avoid sealing compounds which harden, be careful with anaerobic (loctite type) compounds. Particles of these compounds can run into the regulator and lock moving parts.
- Frequent assembly and disassembly of the in- and outlet fittings can damage the in- and outlet thread of the regulator. Damaged threads can cause serious injury.
- The product is designed to be used between -20 °C and +80 °C, whether ambient temperature or media temperature. In all other cases consult SWAGELOK B.V..
- The regulator is standard not oxygen clean. Although all regulators are ultrasonically cleaned, this does not make them suitable for oxygen use.

2.1 Oxygen service

- Specification of materials in regulators for oxygen service is the user's responsibility. SWAGELOK B.V. can perform cleaning for Oxygen service based on ASTM-G93LevelC/CGA4.1 at additional cost.

2.2 Installation instructions

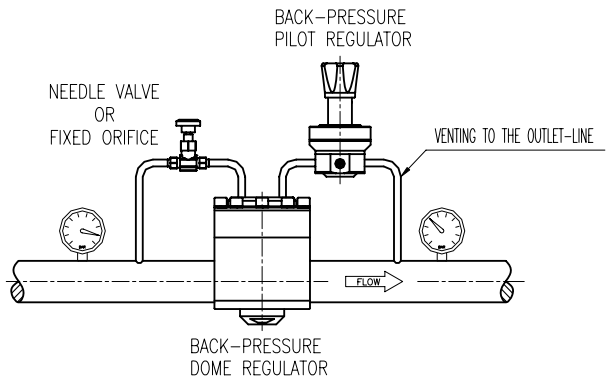
- Verify that the regulator, the connections and its accessories are undamaged.
- Verify that the regulator and its accessories are suitable for the system operating pressure and have the proper connections.
- Carefully clean all pipes and connections. **Any swarf, lint, wire etc. may cause seat leakage.**
- 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 manufacturer of the connections.
- Check if the in- and outlet fittings are fitted far enough into the regulator and check for leakage across the fitting.
- Check if the in- and outlet flange is bolted in-line with the systems counter flange at a correct preload, and check for leakage across the flange facings.
- Shut-off valves should be mounted in the system for service or maintenance.
- At the time of delivery, every unused gauge connection is plugged with blind fittings. Remove these and connect gauges if desired.
- If earthing is required, connect an earth wire under a dome bolt.

2.3 Filling the dome

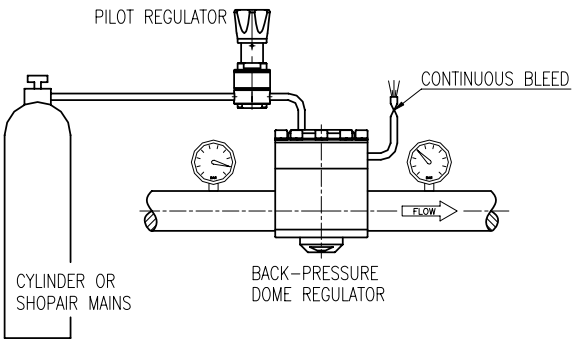
The dome can be filled in different ways.

1. This can be done by taking the gas or liquid pressure from the system and feeding this through a needle valve or fixed orifice into the dome.
   A spring loaded back pressure regulator controls the dome pressure. The outlet pressure from the pilot regulator could be vented to the atmosphere or into the outlet line.
   This is shown in sketch A.
2. The pressure in the dome can also be controlled with an external pressure source. The gas pressure can be taken from a cylinder or shopair mains.
   A spring loaded pressure regulator controls the dome pressure. The regulator works best with a continuous bleed on the dome.
   This is shown in sketch B.

⚠ **It is not recommended to place a gauge on the dome to check the set pressure. Because of forces in the regulator, the dome pressure will always be lower than the inlet pressure. Place a gauge in the inlet line to check the set pressure.**



sketch A



sketch B

3 Operation

3.1 Required tools for operation

For changing the set pressure on a standard regulator, no tools are required.

3.2 Points of attention before operation

- The product can be hot or cold, depending on the environment temperature and the used media temperature. Take the necessary precautions before operating or touching the product.
- SWAGELOK B.V. recommends not to use a self-venting version pilot regulator with hazardous or toxic media.
  If required take the necessary safety precautions to ensure a safe workspace and your personal safety. Vent to a safe environment away from people and ensure adequate ventilation.
- If the shut-off valve at the outlet side is closed after changing the set pressure, the outlet pressure will rise a little because of the closing force required for bubble-tight closing of the regulator.
  This phenomenon is usually referred to as the "**lock-up**" and does not indicate a problem with the regulator.
- An increase in the flow will result in a rise of the set pressure.
  A decrease in the flow will result in a fall of the set pressure.
  This is because of the force required for opening the valve of the regulator.
  This phenomenon is usually referred to as the "**accumulation pressure**" and does not indicate a problem with the regulator.
- A decrease of the inlet pressure will result in a rise of the outlet pressure.
  An increase of the inlet pressure will result in a fall of the outlet pressure.
  This phenomenon is usually referred to as the "**dependency**" and does not indicate a problem with the regulator.

Each regulator type has its own dependency, which is related to the ratio between the effective seat area and the sensing area.

Dependency Ratio BDH25: 1/80

The approximate change can be calculated as shown below:

ΔP1 = ratio x ΔP2
A ratio of 1/X means that for every pressure change to P1 of X bar, the P2 pressure will change 1 bar.

3.3 Changing the set pressure

- Check the supply of medium at the inlet side.
- Make sure the inlet pressure is higher than the required set pressure and that the inlet pressure does not exceed the maximum allowed inlet pressure. Open the shut-off valve at the outlet side.
- Open the shut-off valve at the inlet side slightly to allow a minimal flow.
- Controlled inlet pressure settings are obtained by adjusting the pressure in the dome. Increasing the pressure in the dome raises the inlet pressure while decreasing the pressure in the dome lowers the inlet pressure.
- Final adjustment must be made in flow condition, to obtain the most accurate set point.

4 Maintenance

WARNING

INCORRECT OR IMPROPER REPAIR OR SERVICING OF THIS PRODUCT CAN CAUSE SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.

SWAGELOK B.V. recommends the product to be removed from the system and to be shipped to SWAGELOK B.V. for service or maintenance as all products must pass rigid acceptance tests before leaving the factory.
All repairs and servicing of this product must be performed by factory certified personnel and tested for operation and leakage.
If this procedure is not followed for any reason, or if any customer changes are made to the product, SWAGELOK B.V. cannot assume responsibility for the performance or safety of a customer repaired product or for any damage resulting from failure of the product.

The product should be checked periodically for proper and safe operation.
It is the users sole responsibility to determine the frequency of maintenance based on the application.

RECOMMENDATION

SWAGELOK B.V. RECOMMENDS TO HAVE SPARE-PART KITS READILY AVAILABLE ON SITE.

All regulators require maintenance at scheduled intervals. Annual maintenance is recommended under normal use.
From experience SWAGELOK B.V. can tell that especially during the start-up of a system, the demand for spare-part kits is high.
This is despite all the effort taken to assure a clean system, there is usually some debris left in the system, which damages the regulator.
Having spare-part kits on site will save time and money, as the downtime of the system will be reduced to a minimum, whether during start-up or normal operation.

4.1 Required tools for maintenance

- a vice to fasten the regulator
- pincers to take out the o-rings
- a torque wrench
- a torque wrench hexagon head key 10mm
- a torque wrench “open-end insert tool”, 38mm (-DP only) & 46mm
- an open-end wrench, 15mm (-DP only)
- media and temperature compatible lubricant for reassembling threaded parts
- media and temperature compatible lubricant for o-rings
- soapy water for leak-testing

4.2 Points of attention before removal from the system

- SWAGELOK B.V. recommends removing the regulator from the installation.
- Make sure that a spare-part kit is present.
- Check if the used media is hazardous or toxic.
  If required take the necessary safety precautions to ensure a safe workspace and your personal safety. Vent to a safe environment away from people and ensure adequate ventilation.
- Follow your system safety, maintenance or special local procedures when removing the regulator.
- The product can be hot or cold, depending on the environment temperature and the used media temperature. Take the necessary precautions before operating or touching the product.

4.3 Removal from the system

- Isolate the regulator from all pressure sources by closing the appropriate valves in the system.
- Make sure there is no more pressure left in the dome.
  If the pilot regulator is a self-venting version, the excess pressure in the dome will leave the regulator through the relief connection.
- Make sure that the inlet and outlet pressure are both reduced to zero.

A shut-off valve on the outlet side must be opened to relief the pressure on the outlet side.

4.4 Disassembly instructions

- Loosen the hexagon socket head screws and remove the dome, dome plate, piston(plate) and valve assembly.
- Loosen the body plug and remove the seat.

4.5 Inspection of disassembled parts

- Check all parts for abnormal wear. Replace parts in case of doubt.

4.6 Points of attention before assembly

- All parts must be clean and undamaged before starting assembly.
- SWAGELOK B.V. recommends replacing all o-rings and the diaphragm before assembly.
- All threaded parts must be lubricated a little before assembly, this to avoid galling of threads.
- All o-rings need to be lubricated a little to improve the lifetime of the o-ring and the performance of the regulator.

4.7 Assembly instructions

Follow the points for disassembly in reverse order to assemble the regulator.

4.8 Recommended torques

Only tighten the bolts or parts if the regulator is completely pressure less.

-	Hexagon socket head screws M12	50 Nm
-	Bodyplug	50 Nm
-	Dome screw (-DP only)	30 Nm

4.9 Testing

Check the regulator for leakage across the seat, with low- and high inlet pressure.
Check the regulator for leakage across the diaphragm, with low- and high outlet pressure.

A well performing BD(H)20/BD(H)F25 is 100% bubble tight.
If there is a leakage across the seat or the diaphragm, the damaged parts must be replaced.

5 Trouble shooting

Problem:	The outlet pressure creeps up, without increasing the dome pressure.
Cause:	A damaged valve and/or seat.
Solution:	Replace the valve and/or the seat.

Problem:	Leakage around the bodyplug.
Cause:	A damaged o-ring or insufficient torque on the body plug.
Solution:	Replace the o-ring or tighten the bodyplug according to the torque specifications.

Problem:	Leakage between the body and the dome.
Cause:	A damaged diaphragm or insufficient torque on the bolts.
Solution:	Replace the diaphragm or tighten the bolts according to the torque specifications.

Problem:	The required set pressure can not be reached.
Cause:	The inlet pressure is not high enough.
Solution:	Make sure that the inlet pressure is sufficient.

Problem:	The inlet pressure rises too much when going from a dynamic to a static situation.
Cause:	There is too much flow in the dynamic situation.
Solution:	A larger regulator is required. Check the specific application data with the flow curves in our documentation, if available.

Problem:	The outlet pressure does not drop if the pressure in the dome is lowered.
Cause:	The valve is sticking.
Solution:	Replace the valve assembly.

Problem:	The outlet pressure has changed without adjusting the dome pressure.
Cause:	Changes to the inlet pressure will result in changes to the outlet pressure. A decrease of the inlet pressure will result in a rise of the outlet pressure. An increase of the inlet pressure will result in a fall of the outlet pressure.
Solution:	Maintain a constant inlet pressure to the regulator. See section “operation” about dependency.

Problem:	The regulator will not relief at the set point.
Cause:	The valve assembly is sticking or the dome pressure is accidentally adjusted.
Solution:	Replace the valve assembly or re-adjust the dome pressure.

Warranty Information

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