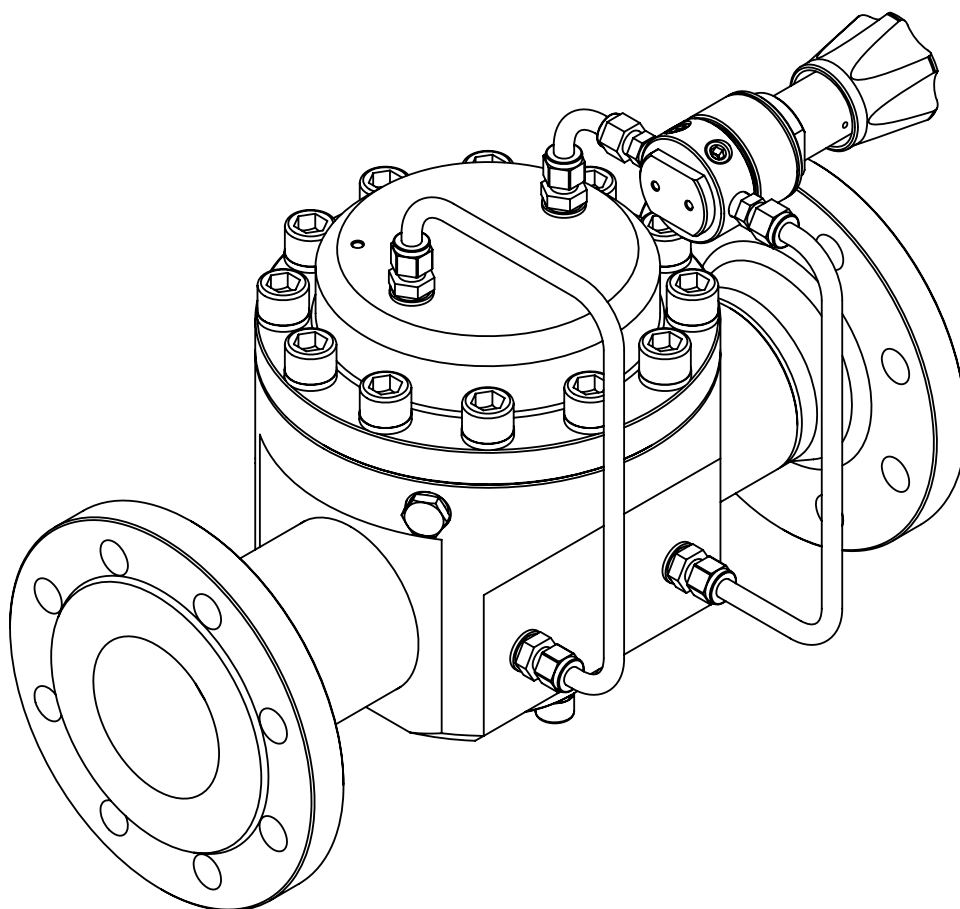


RD(H)F30

USER MANUAL

Read the complete manual before installing and using the regulator.





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.

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1 Introduction

1.1 Detailed description

This regulator is a diaphragm sensing dome loaded pressure 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.

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, **flange limits not included**:

- | | | | |
|---|-----------------------|-----------------|-----------------|
| - | Flanged models RDF30 | : Inlet 70 bar | Outlet 70 bar |
| - | Flanged models RDHF30 | : Inlet 280 bar | Outlet 200 bar* |



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



*** When using the RDHF30 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:

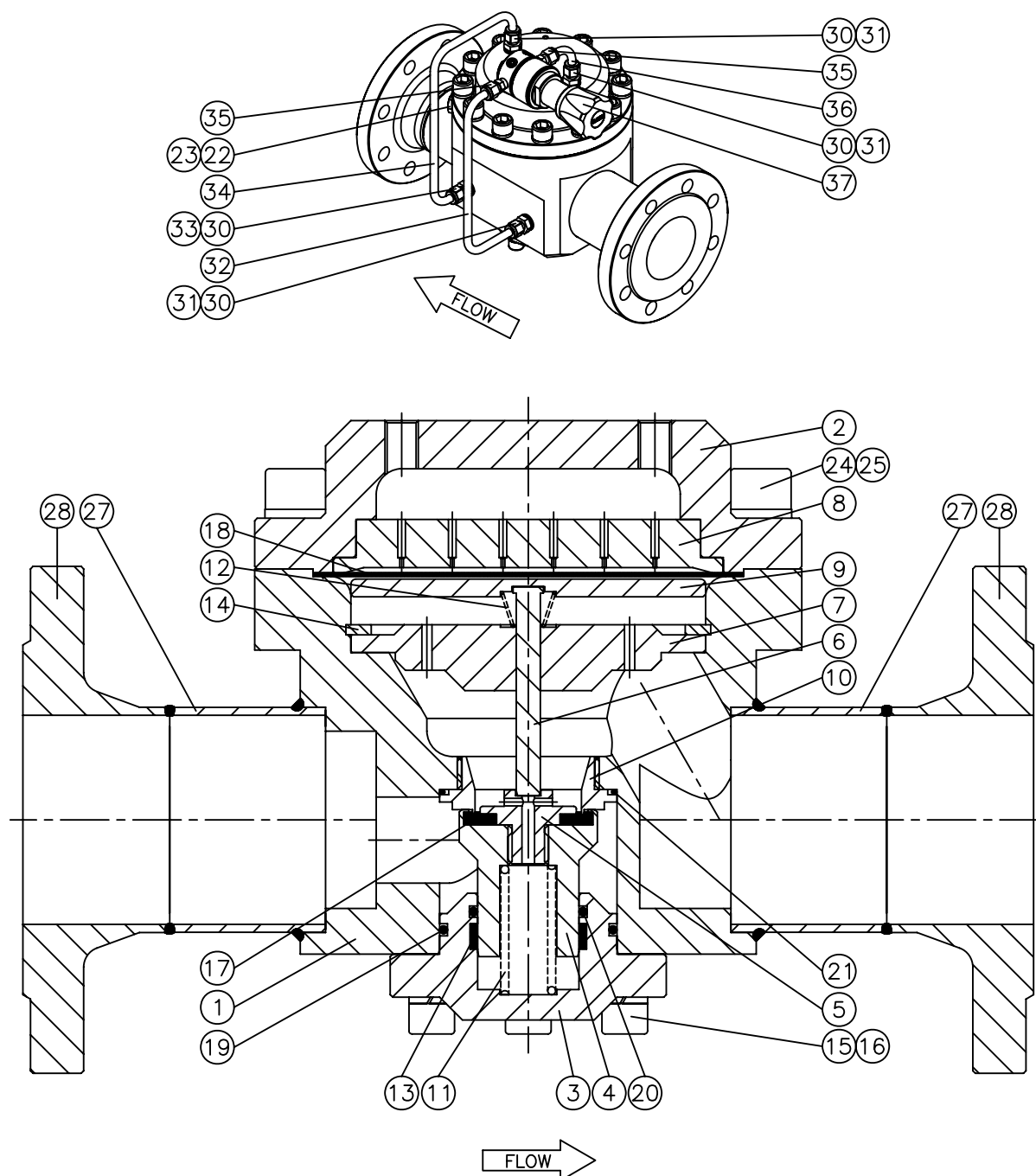
- diaphragm sensing
- bubble tight shut-off
- 42mm valve
- balanced valve
- pilot regulator
- dynamic regulation

1.2 Special features and options

The regulator is available with the following options:

- external feedback

1.3 Typical picture of the standard RD(H)F30 and its components



1	body	11	valve spring	21	o-ring	33	bleedplug 1/4" bsp
2	dome	12	conical spring	22	o-ring	34	dynamic regulation tube
3	bottomplate	13	guide ring	23	blindplug 1/4" bsp	35	male connector
4	valve case	14	retaining ring	24	ring	36	tube 3/8"
5	valve screw	15	ring	25	socket head cap screw	37	pilot regulator
6	valve stem	16	socket head cap screw	27	tube		
7	bodyplate	17	valve insert	28	flange		
8	domeplate	18	diaphragm	30	bonded seal		
9	diaphragmplate	19	o-ring	31	male connector		
10	seat	20	o-ring	32	tube 3/8"		

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.
- 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.

2.2 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.

2.3 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.
- 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.

2.4 Filling the dome

The dome can be filled using manual or electronic loading.

Manual loading:

1. This can be done by taking the gas pressure from the system and feeding this through a spring loaded pilot regulator into the dome. This is shown in sketch A.
2. In liquid systems the gas pressure for manual dome loading can be taken from a cylinder or mains. This is shown in sketch B.

Substituting the spring loaded pilot regulator for a proportional control valve and a pressure sensor, allows you to control the pressure electronically.

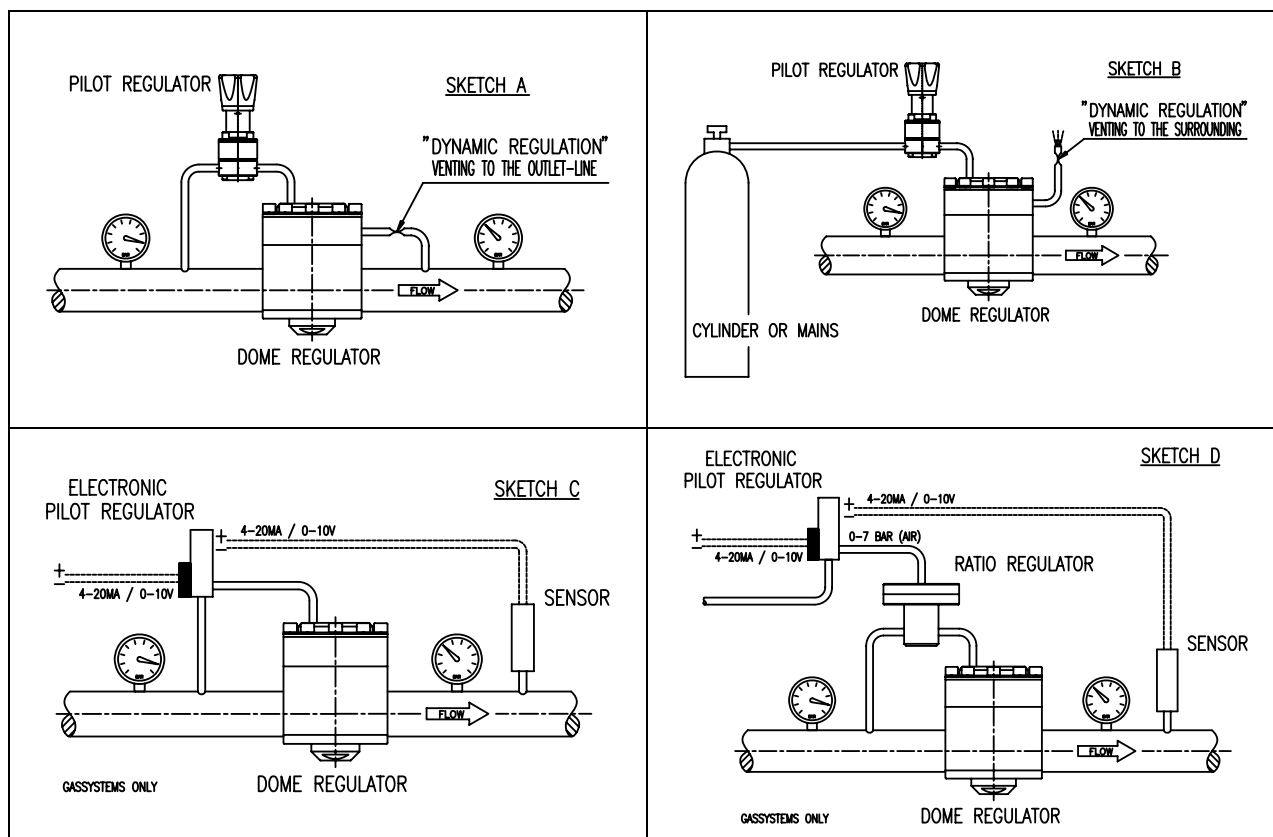
Electronic loading:

1. This can be done by taking the gas pressure from the system and feeding this through a proportional control valve into the dome. This is shown in sketch C.
2. This can be done by taking the gas pressure from the system and feeding this through a proportional controlled ratio regulator into the dome. This is shown in sketch D.

The best results will be achieved by allowing a small flow to continuously pass through the pilot regulator. This flow can either be vented or, in gas systems, fed back through an orifice into the downstream piping. This is usually referred to as “dynamic regulation”.



It is not recommended to place a gauge on the dome to set or check the outlet pressure. Because of forces in the regulator, the dome pressure will always be higher than the outlet pressure. Place a gauge in the outlet line to set or check the outlet pressure.



2.5 External feedback



When using the regulator with external feedback, option –EF, make sure that the outlet pressure can be fed back to the external feedback connection before applying pressure to the regulator. Failing to do so may lead to damage and non-functioning of the regulator as the inlet pressure will be put straight through to the outlet.

The purpose of the external feedback on a pressure regulator is to get a more accurate regulation of the outlet pressure. This can be achieved by sensing the outlet pressure downstream of the regulator and feeding it back to the regulator. For this purpose SWAGELOK B.V. has provided a special connection, marked on the regulator itself as "P2 feedback".

2.6 Connecting the external feedback

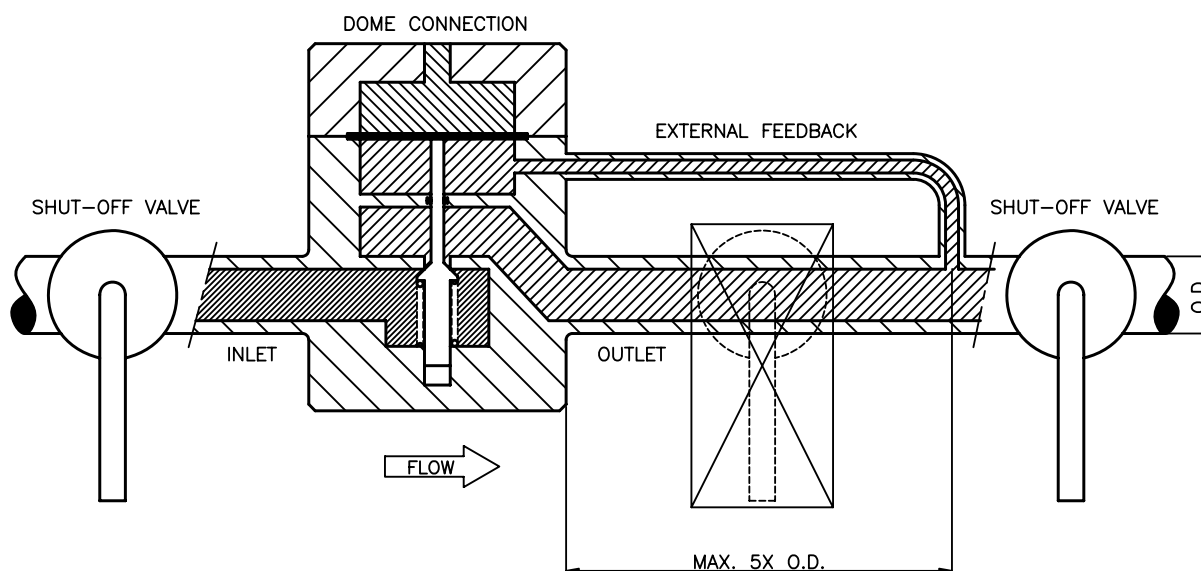
The external feedback must be installed as follows:

- The external feedback is to be connected in a turbulence-free zone in the downstream piping, at a maximum distance of 5x the outside diameter of the downstream piping.
- The external feedback must be connected on top of the downstream piping.
- The tube-size of the external feedback should be $\frac{3}{8}$ " or $\frac{1}{2}$ ".



Never connect the external feedback line downstream of a shut-off valve.

Principle sketch of external feedback:



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.
- A decrease in the flow will result in a rise of the outlet pressure.
An increase in the flow will result in a fall of the outlet pressure and is usually referred to as the **"droop"**.
This phenomenon 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. The approximate change can be calculated as shown below:

$\Delta P_2 = \text{ratio} \times \Delta P_1$

A ratio of 1/X means that for every pressure change to P1 of X bar, the P2 pressure will change 1 bar:

RD(H)F30: ratio = 1/118

Example:

Regulator with ratio 1/118

Start position:	End position
P1 = 200 bar	P1 = 20 bar
P2 = 10 bar	P2 = ?? bar

$\Delta P_2 = \text{ratio} \times \Delta P_1$
 $\Delta P_2 = 1/118 \times (200-20)$
 $\Delta P_2 = 1,5 \text{ bar}$

So, as a result of a pressure drop in the inlet pressure from 200 to 20 bar, the outlet pressure will rise from 10 bar to approximately 11,5 bar without adjusting the regulator.



If the pilot regulator also has changing inlet pressures, this will make the pressure difference in the outlet line of the dome regulator even bigger. This is because the pilot regulator will also increase its outlet pressure, which is the dome pressure. Any rise to the dome pressure will result in a rise of the outlet pressure.

3.3 Changing the set pressure

- Check the supply of medium at the inlet side.



*** When using the RD(H)F30 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.**

- Make sure the inlet pressure is higher than the required outlet pressure and that the inlet pressure does not exceed the maximum allowed inlet pressure. Open the shut-off valve at the inlet side.
- Open the shut-off valve at the outlet side slightly to allow a minimal flow.
- Controlled outlet pressure settings are obtained by adjusting the pressure in the dome. Increasing the pressure in the dome raises the outlet pressure while decreasing the pressure in the dome lowers the outlet pressure.



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

Final adjustment must be made while increasing the pressure in the dome to obtain the most accurate set point(s).

- Open the shut-off valve at the outlet side fully to allow full flow during operation.

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 pair of tongs for a retaining ring 140mm
- a torque wrench
- a torque wrench hexagon head key 10 and 14
- 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, diaphragm and diaphragm plate.
- Loosen the hexagon socket head screws and remove the bottom plate, valve, valve spring and 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 |
| - | Hexagon socket head screws M16 | 90 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.



*** When using the RDHF30 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.**

4.9.1 Leakage across the seat

- Make sure there is no more pressure in the dome.
- Maintain a test pressure of approximately 5 bar on the inlet and check for leakage (bubbles) at the outlet by using a little soapy water.
- Repeat the procedure with the highest inlet pressure suitable for the regulator.

4.9.2 Leakage across the diaphragm

- The outlet side and gauge connections must be plugged off bubble tight.
- Maintain a test pressure of approximately 5 bar on the inlet and turn the adjustment knob of the pilot regulator clockwise until you've reached 1 bar outlet pressure for the regulator.
- Check the connection between body and dome for bubbles by using a little soapy water.
- Repeat the procedure with the highest inlet- and outlet pressure suitable for the regulator.

A well performing RD(H)F30 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 bottom plate.
Cause:	A damaged o-ring.
Solution:	Replace the o-ring.
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:	Controlled pressure drops off sharply even when the flow is within regulator capabilities.
Cause:	The systems filter element is clogged.
Solution:	Replace the system filter element.
Problem:	The required outlet pressure can not be reached.
Cause:	The inlet pressure to the dome regulator or to the pilot regulator is not high enough.
Solution:	Make sure that the inlet pressure to the dome regulator and to the pilot regulator is sufficient.
Problem:	The outlet 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 regulator is non-venting.
Solution:	A shut-off valve in the outlet line must be opened to reduce the outlet pressure.
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.

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty.

For a copy, visit swagelok.com or contact your authorized Swagelok representative.