LPRD20- 40
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.
1 Introduction

1.1 Detailed description

This regulator is a diaphragm sensing dome loaded pressure regulator, designed for low pressure, high flow gases.

The regulator comprises a body and dome welded 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, limits for other connection types not included:

- Flanged models LPRDF20-02 : Inlet 16 bar Outlet 2 bar
- Flanged models LPRDF25-02 : Inlet 16 bar Outlet 2 bar
- Flanged models LPRDF30-02 : Inlet 16 bar Outlet 2 bar
- Flanged models LPRDF40-02 : Inlet 16 bar Outlet 2 bar

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

* When using the LPRD20, 25, 30 or LPRD40 with an inlet pressure higher than 2 bar, a safety valve must be installed in the outlet line, because the outlet pressure may not exceed 2 bar.

Standard features:

- large diaphragm sensing
- bubble tight shut-off
- LPRD20: 25mm seat
- LPRD25: 32mm seat
- LPRD30: 42mm seat
- LPRD40: 60mm seat
- balanced valve
- pilot regulator
- dynamic regulation
- external feedback
- pressure gauges (in-/outlet)

1.2 Special features and options

The regulator is available with the following options:

- orifice plates (diffuser)
1.3 Typical picture of a standard LPRD25 and its components

<table>
<thead>
<tr>
<th>Number</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>body assembly</td>
</tr>
<tr>
<td>2</td>
<td>dome cover</td>
</tr>
<tr>
<td>3</td>
<td>bodyplug</td>
</tr>
<tr>
<td>4</td>
<td>valve case</td>
</tr>
<tr>
<td>5</td>
<td>valve screw</td>
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<tr>
<td>6</td>
<td>push rod</td>
</tr>
<tr>
<td>7</td>
<td>bodyplate</td>
</tr>
<tr>
<td>8</td>
<td>diaphragmplate</td>
</tr>
<tr>
<td>9</td>
<td>diaphragm screw</td>
</tr>
<tr>
<td>10</td>
<td>seat</td>
</tr>
<tr>
<td>11</td>
<td>guide ring</td>
</tr>
<tr>
<td>12</td>
<td>retaining ring</td>
</tr>
<tr>
<td>13</td>
<td>valve spring</td>
</tr>
<tr>
<td>14</td>
<td>o-ring</td>
</tr>
<tr>
<td>15</td>
<td>diaphragm</td>
</tr>
<tr>
<td>16</td>
<td>valve insert</td>
</tr>
<tr>
<td>17</td>
<td>valve insert</td>
</tr>
<tr>
<td>18</td>
<td>guide bush</td>
</tr>
<tr>
<td>19</td>
<td>o-ring</td>
</tr>
<tr>
<td>20</td>
<td>o-ring</td>
</tr>
<tr>
<td>21</td>
<td>o-ring</td>
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<tr>
<td>22</td>
<td>o-ring</td>
</tr>
<tr>
<td>23</td>
<td>o-ring</td>
</tr>
<tr>
<td>24</td>
<td>ring</td>
</tr>
<tr>
<td>25</td>
<td>nut</td>
</tr>
<tr>
<td>26</td>
<td>socket head cap screw</td>
</tr>
<tr>
<td>27</td>
<td>ring</td>
</tr>
<tr>
<td>28</td>
<td>nut</td>
</tr>
</tbody>
</table>
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. 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-vent ing 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.

2.1 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 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 using manual or electronic/pneumatic 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. This method can be used for low and medium pressure systems.
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. This method can be used for high pressure systems.

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.
2.4 External feedback

⚠️ When using the regulator with external feedback, 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.

⚠️ 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. In case of a pilot regulator with adjustment screw, a 13mm spanner is 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-vent ing 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.

<table>
<thead>
<tr>
<th>Dependency Ratio's LPRD20, 25, 30 &amp; 40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>LPRD20 + LPRSN4</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>LPRD25 + LPRSN4</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>LPRD30 + LPRSN4</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>LPRD40 + LPRSN4</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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:
3.3 Changing the set pressure

- Check the supply of medium at the inlet side.

⚠️ *When using the LPRD20, 25, 30 or LPRD40 with an inlet pressure higher than 2 bar, a safety valve must be installed in the outlet line, because the outlet pressure may not exceed 2 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 95mm (LPRD20&25 only)
- a pair of tongs for a retaining ring 140mm (LPRD30&40 only)
- a torque wrench
- a torque wrench hexagon head key 10mm for the bodyplug (LPRD30&40 only)
- a torque wrench hexagon head key 5mm for the dome cover bolts
- a torque wrench “open-end insert tool”, 46mm for the body plug (LPRD20&25 only)
- open-end spanners 11/16”, 3/4” & 7/8” (for compression fittings)
- open-end spanners 10 & 17mm (for dome cover nuts and dome screw)
- 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 cover.
- Lift out the diaphragm, along with the diaphragm plates/-screw
- Loosen the body plug and remove the valve assembly, 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 (bodyplug) 50 Nm (LPRD30&40 only)
- Bodyplug 50 Nm (LPRD20&25 only)
- Dome cover screws M6 15 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 connectors and plugs, with low- and high inlet pressure.
Check the regulator for leakage across the diaphragm, with low- and high outlet pressure.

A well performing LPRD20- 40 is 100% bubble tight.
If there is a leakage across the seat or the diaphragm, the damaged parts must be replaced.
## 5 Trouble shooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The outlet pressure creeps up, without increasing the dome pressure.</td>
<td>A damaged valve and/or seat.</td>
<td>Replace the valve and/or the seat.</td>
</tr>
<tr>
<td>Leakage around the bodyplug.</td>
<td>A damaged o-ring or insufficient torque on the bodyplug.</td>
<td>Replace the o-ring or tighten the bodyplug according to the torque specifications.</td>
</tr>
<tr>
<td>Leakage between dome and the dome cover.</td>
<td>A damaged diaphragm or insufficient torque on the bolts.</td>
<td>Replace the diaphragm or tighten the bolts according to the torque specifications.</td>
</tr>
<tr>
<td>Controlled pressure drops off sharply even when the flow is within regulator capabilities.</td>
<td>The systems filter element is clogged.</td>
<td>Replace the system filter element.</td>
</tr>
<tr>
<td>The required outlet pressure can not be reached.</td>
<td>The inlet pressure to the dome regulator or to the pilot regulator is not high enough.</td>
<td>Make sure that the inlet pressure to the dome regulator and to the pilot regulator is sufficient.</td>
</tr>
<tr>
<td>The outlet pressure rises too much when going from a dynamic to a static situation.</td>
<td>There is too much flow in the dynamic situation.</td>
<td>A larger regulator is required. Check the specific application data with the flow curves in our documentation, if available.</td>
</tr>
<tr>
<td>The outlet pressure does not drop if the pressure in the dome is lowered.</td>
<td>The regulator is non-venting.</td>
<td>A shut-off valve in the outlet line must be opened to reduce the outlet pressure.</td>
</tr>
<tr>
<td>The outlet pressure has changed without adjusting the dome pressure.</td>
<td>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.</td>
<td>Maintain a constant inlet pressure to the regulator. See section “operation” about dependency.</td>
</tr>
</tbody>
</table>

### Warranty Information

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