Self-operated Pressure Regulators

Type 2405 Pressure Reducing Valve

ANSI version

Application
Pressure reducing valve for set points from 0.075 psi to 150 psi (5 mbar to 10 bar). Valves in NPS ½ to 2 ¹) (DN 15 to 50). Pressure rating Class 125 to 300 (PN 16 to 40). Suitable for gases at temperatures from –5 to +140 °F/32 to +300 °F ²) (–20 to +60 °C/0 to +150 °C) ²)

This regulator is used to control the pressure of flammable gases used as a source of energy, e.g. in boilers, driers, vaporizers, heat exchangers or industrial ovens. Alternatively, it can control the compressed air supply in process engineering applications. An additional application of the regulator is the pressure control of inert gas used for inerting or blanketing reaction or storage tanks to protect the product in the tank from oxidation, explosion or escaping.

To achieve an economical consumption of the inert gas, its pressure must be controlled to always remain slightly higher than atmospheric pressure while the tank is being filled or emptied.

Special features
• Low-maintenance proportional regulator
• Compact regulator design providing excellent control accuracy
• Internal set point springs with set point adjustment using a nut on the actuator
• Spring-loaded, single-seated valve balanced by a balancing diaphragm
• External connection of a control line
• Fulfills stricter fugitive emission requirements (TA-Luft)
• Minimum leakage class IV
• Suitable as vacuum breaker

Version
Valve NPS ½ to 2 (DN 15 to 50). Flanged connections Soft-seated plug. Body made of cast iron A126B, cast steel A216 WCC or stainless cast steel A351 CF8M

Special versions
• Version with FDA-compliant materials for food processing and pharmaceutical industries
• Version to comply with NACE (sour gas)
• Actuator with leakage line connection (also as vacuum breaker)
• Version with force limiter (for higher pressures at the operating diaphragm)

¹) NPS ½ and NPS ¾ not in Class 125
²) For unbalanced versions with FPM diaphragm or FPM soft seal
Principle of operation

The medium flows through the valve as indicated by the arrow. The position of the valve plug and the area released between the plug (3) and seat (2) determine the flow rate.

In the pressureless state (control line not connected and no pressure applied) the valve is opened by the force of the set point spring (7).

The downstream pressure \( p_2 \) to be controlled is tapped downstream of the valve and transmitted over the control line to the actuator where it is converted into a positioning force. This force is used to move the valve plug according to the force of the set point spring (7).

The spring force can be adjusted at the set point adjuster (8). When the force resulting from the downstream pressure \( p_2 \) rises above the adjusted set point, the valve closes proportionally to the change in pressure.

In the version with pressure balancing, the forces produced by the upstream and downstream pressures acting on the plug are balanced by the balancing diaphragm (10). The plug is fully balanced.

Fig. 2 · Functional diagram of Type 2405 Pressure Reducing Valve
Table 1 · Technical data

<table>
<thead>
<tr>
<th>Valve size</th>
<th>NPS ½ DN 15</th>
<th>NPS ¾ DN 20</th>
<th>NPS 1 DN 25</th>
<th>NPS 1½ and 2 DN 40 and 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure rating (valve)</td>
<td>Class 125 · Class 150 · Class 300</td>
<td>PN 16 · PN 25 · PN 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_v ) coefficients</td>
<td>0.02 - 0.05</td>
<td>0.02 - 0.05</td>
<td>0.02 - 0.05</td>
<td>2.3 - 5.7</td>
</tr>
<tr>
<td></td>
<td>0.12 - 0.3 - 0.5</td>
<td>0.12 - 0.3 - 0.5</td>
<td>0.12 - 0.3 - 0.5</td>
<td>9.4 - 20.23.37</td>
</tr>
<tr>
<td></td>
<td>1.2 - 2.3 - 3.5</td>
<td>1.2 - 2.3 - 3.5 - 7.5</td>
<td>1.2 - 2.3 - 3.5 - 7.5 - 9.4</td>
<td></td>
</tr>
<tr>
<td>( K_{VS} ) coefficients</td>
<td>0.016 - 0.04 - 0.1</td>
<td>0.016 - 0.04 - 0.1</td>
<td>0.016 - 0.04 - 0.1</td>
<td>1.6 - 2.5 - 4.63</td>
</tr>
<tr>
<td></td>
<td>0.25 - 0.4 - 1</td>
<td>0.25 - 0.4 - 1</td>
<td>0.25 - 0.4 - 1</td>
<td>8 - 16 - 20 - 32</td>
</tr>
<tr>
<td></td>
<td>1.6 - 2.5 - 4.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. perm. upstream pressure</td>
<td>145 psi · 175 psi (^1) (10 bar · 12 bar (^1))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. perm. temperature range (medium temperature)</td>
<td>(-5) to (+140^\circ\text{F}/(+300^\circ\text{F}) (^1) ((-20) to (+60^\circ\text{C}/0) to (+150^\circ\text{C}) (^2))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leakage class acc. to ANSI/FCI 70-2</td>
<td>Soft sealing, min. class IV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set point ranges</td>
<td>0.075 to 0.25 psi · 0.15 to 0.42 psi · 0.35 to 0.87 psi · 0.75 to 3 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.5 to 8 psi · 3 to 15 psi · 10 to 35 psi · 30 to 75 psi · 65 to 150 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.1 to 0.6 bar · 0.2 to 1 bar · 0.8 to 2.5 bar · 2 to 5 bar · 4.5 to 10 bar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. perm. pressure across operating diaphragm</td>
<td>186 in(^2) · 0.075 to 0.25 psi 0.15 to 0.42 psi 15 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200 cm(^2) · 5 to 15 mbar 1 bar</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>100 in(^2) · 0.15 to 0.42 psi 0.35 to 0.87 psi 60 psi ((C_v = 0.12) to 1.2) · 30 psi ((C_v = 2) to 37)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>640 cm(^2) · 10 to 30 mbar 25 to 60 mbar 4 bar ((K_{VS} = 0.1) to 1) · 2 bar ((K_{VS} = 1.6) to 32)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 in(^2) · 0.35 to 0.87 psi 0.75 to 3 psi 120 psi ((C_v = 0.12) to 1.2) · 60 psi ((C_v = 2) to 37)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>320 cm(^2) · 25 to 60 mbar 8 bar ((K_{VS} = 0.1) to 1) · 4 bar ((K_{VS} = 1.6) to 32)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure balancing</td>
<td>( C_v = 0.02 ) to 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( K_{VS} = 0.016 ) to 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( C_v = 7.5 ) to 37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( K_{VS} = 6.3 ) to 32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control line connection</td>
<td>External (^4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Version with set points from 0.5 to 150 psi (0.1 to 10 bar) · 2) For unbalanced versions with FPM diaphragm or FPM soft seal 3) Version with force limiter · 4) Special version for set point ranges 10 to 37.5 psi (0.8 to 2.5 bar), 30 to 75 psi (2 to 5 bar) and 65 to 150 psi (4.5 to 10 bar): pressure tapping directly at the valve body (see small photo on page 1)

Table 2 · Materials

<table>
<thead>
<tr>
<th>Body</th>
<th>A126B, A216 WCC</th>
<th>A351 CF8M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat</td>
<td>1.4112 (^1)</td>
<td>316L</td>
</tr>
<tr>
<td>Plug</td>
<td>1.4305 (^1)</td>
<td>316L</td>
</tr>
<tr>
<td>Plug spring</td>
<td>1.4310 (^2)</td>
<td></td>
</tr>
<tr>
<td>Plug stem</td>
<td>316L</td>
<td></td>
</tr>
<tr>
<td>Seal</td>
<td>EPDM · FPM · NBR</td>
<td></td>
</tr>
<tr>
<td>Balancing diaphragm</td>
<td>EPDM · FPM · NBR</td>
<td></td>
</tr>
<tr>
<td>Actuator housing</td>
<td>1.0332</td>
<td></td>
</tr>
<tr>
<td>Operating diaphragm</td>
<td>EPDM · FPM · NBR</td>
<td></td>
</tr>
</tbody>
</table>

1) Version with set points from 0.5 to 150 psi (0.1 to 10 bar) · 2) For unbalanced versions with FPM diaphragm or FPM soft seal 3) Version with force limiter · 4) Special version for set point ranges 10 to 37.5 psi (0.8 to 2.5 bar), 30 to 75 psi (2 to 5 bar) and 65 to 150 psi (4.5 to 10 bar): pressure tapping directly at the valve body (see small photo on page 1)
Installation

Preferably the regulator is to be installed in horizontal pipelines:
- Actuator housing on top, facing upwards.
- The direction of medium flow must correspond with the arrow on the valve body.
- In applications in which the blanketing gas can liquefy, condensate may form in the control line, causing damage to the regulator. To allow condensate to run back into the tank, install the control line with an approximate 10% slope to the pressure tapping point at the tank.
- Distance between the pressure tapping point and regulator min. 6 x NPS.

In exceptional cases, the regulator can also be installed in vertical pipelines with the direction of flow from the top. See EB 2520 EN for more details.

Application

If the pressure p of the inert gas in the tank falls below the set point adjusted at the Type 2405 Pressure Reducing Valve (1), this valve opens to allow more gas to enter the tank. The valve (1) closes again when the pressure p of the blanketing gas has been re-established.

If the pressure is too high, the inert gas is vented off over the Type 2406 Excess Pressure Valve (2).

Dimensions

Fig. 4 · Dimensions of Type 2405

The control line connection is turned by 90° in the drawing. The connection is normally located opposite the side with the arrow indicating the direction of flow.

A G ¼ (¼ NPT) adapter (order no. 0230-3417) must be ordered separately.
### Table 3 - Dimensions and weights

<table>
<thead>
<tr>
<th>Valve size</th>
<th>NPS ½ (DN 15)</th>
<th>NPS ¾ (DN 20)</th>
<th>NPS 1 (DN 25)</th>
<th>NPS 1½ (DN 40)</th>
<th>NPS 2 (DN 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height H3  inch</td>
<td>2.2</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPS ½ (DN 15)</td>
<td>7.3</td>
<td>7.3</td>
<td>7.3</td>
<td>8.8</td>
<td>10</td>
</tr>
<tr>
<td>NPS ¾ (DN 20)</td>
<td>184</td>
<td>184</td>
<td>184</td>
<td>222</td>
<td>254</td>
</tr>
<tr>
<td>NPS 1 (DN 25)</td>
<td>191</td>
<td>194</td>
<td>197</td>
<td>235</td>
<td>267</td>
</tr>
<tr>
<td>NPS 1½ (DN 40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPS 2 (DN 50)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Valve**
  - **Class 125**
    - Height H: 13” (330 mm)
    - Actuator: \( \varnothing D = 19.3” (490 \text{ mm}), A = 186 \text{ in}^2 (1200 \text{ cm}^2) \)
  - **Class 150**
    - Height H: 12.8” (325 mm)
    - Actuator: \( \varnothing D = 15” (380 \text{ mm}), A = 100 \text{ in}^2 (640 \text{ cm}^2) \)
  - **Class 300**
    - Height H: 12.8” (325 mm)
    - Actuator: \( \varnothing D = 11.2” (285 \text{ mm}), A = 50 \text{ in}^2 (320 \text{ cm}^2) \)

- **Actuator**
  - \( \varnothing D = 11.2” (285 \text{ mm}), A = 50 \text{ in}^2 (320 \text{ cm}^2) \)

- **Set point ranges**
  - **0.75 to 3 psi - 5 to 15 mbar**
    - Height H: 12.8” (325 mm)
    - Actuator: \( \varnothing D = 11.2” (285 \text{ mm}), A = 50 \text{ in}^2 (320 \text{ cm}^2) \)
  - **0.15 to 0.42 psi - 10 to 30 mbar**
    - Height H: 12.8” (325 mm)
    - Actuator: \( \varnothing D = 11.2” (285 \text{ mm}), A = 50 \text{ in}^2 (320 \text{ cm}^2) \)
  - **0.35 to 0.87 psi - 25 to 60 mbar**
    - Height H: 12.6” (320 mm)
    - Actuator: \( \varnothing D = 6.7” (170 \text{ mm}), A = 12 \text{ in}^2 (80 \text{ cm}^2) \)
  - **0.75 to 3 psi - 50 to 200 mbar**
    - Height H: 12.6” (320 mm)
    - Actuator: \( \varnothing D = 6.7” (170 \text{ mm}), A = 12 \text{ in}^2 (80 \text{ cm}^2) \)

- **Length L**
  - **Actuator**
    - \( \varnothing D = 6.7” (170 \text{ mm}), A = 6 \text{ in}^2 (40 \text{ cm}^2) \)

- **Weight**
  - \( \text{in lb and kg, approx.} \)
    - \( 0.075 \text{ to } 0.25 \text{ psi - 5 to } 15 \text{ mbar} \)
      - \( 61.7 \text{ lb } - 28 \text{ kg} \)
      - \( 88.2 \text{ lb } - 40 \text{ kg} \)
    - \( 0.15 \text{ to } 0.42 \text{ psi - 10 to } 30 \text{ mbar} \)
      - \( 39.7 \text{ lb } - 18 \text{ kg} \)
      - \( 66.1 \text{ lb } - 30 \text{ kg} \)
    - \( 0.35 \text{ to } 0.87 \text{ psi - 25 to } 60 \text{ mbar} \)
      - \( 30.9 \text{ lb } - 14 \text{ kg} \)
      - \( 57.3 \text{ lb } - 26 \text{ kg} \)
    - \( 0.75 \text{ to } 3 \text{ psi - 50 to } 200 \text{ mbar} \)
      - \( 22 \text{ lb } - 10 \text{ kg} \)
      - \( 48.5 \text{ lb } - 22 \text{ kg} \)
    - **1.5 to 8 psi - 0.1 to 0.6 bar**
      - \( 17.6 \text{ lb } - 8 \text{ kg} \)
      - \( 44.1 \text{ lb } - 20 \text{ kg} \)
    - \( 3 \text{ to } 15 \text{ psi - 0.2 to } 1 \text{ bar} \)
      - \( 17.6 \text{ lb } - 8 \text{ kg} \)
      - \( 44.1 \text{ lb } - 20 \text{ kg} \)
    - \( 10 \text{ to } 35 \text{ psi - 0.8 to } 2.5 \text{ bar} \)
      - \( 19.8 \text{ lb } - 9 \text{ kg} \)
      - \( 46.3 \text{ lb } - 21 \text{ kg} \)
    - \( 30 \text{ to } 75 \text{ psi - 2 to } 5 \text{ bar} \)
      - \( 19.8 \text{ lb } - 9 \text{ kg} \)
      - \( 46.3 \text{ lb } - 21 \text{ kg} \)

1) Body made of cast steel A216 WCC +10 %

### Ordering text

**Type 2405 Pressure Reducing Valve**

- **Valve size NPS (DN) ..., set point range ... psi (mbar, bar),**
  - \( C_V \) coefficient \( (K_{VS} \) coefficient) ...  
- **Body material ...**
- **Materials:**
  - Plug sealing ..., balancing diaphragm ..., operating diaphragm ...
Specifications subject to change without notice