Series 250
Control Valves with Ceramic Valve Trims

Application
Control valves for use in process engineering where valve trim and valve body are subjected to erosive and abrasive wear
Nominal size DN 25 to DN 150
Nominal pressure PN 16 to PN 400
Temperatures Up to 500 °C

In industrial plants, pneumatic and electric control valves control different media, often under unfavorable flow conditions. In flashing service and with aggressive fluids containing solid matter, the valve trim, i.e. seat and plug, as well as the valve body are subject to erosive and abrasive wear.

In some applications, valve trims made of cast iron or PTFE are worn out within only a few days and valve trims of stellite or forged titanium within a few weeks. Valve trims made of low-wear ceramic, however, show almost no signs of wear after one year in service.

Depending on the valve design and the particular properties of the ceramic material used, the following advantages can be attained:
• Seat and plug made of hot-pressed silicon nitride (HPSN)
• Constant high flexural strength and resistance to abrasive wear
• Corrosion resistance
• Service life 200 times longer compared to valve trims made of austenitic steel used under highly erosive and abrasive conditions
• Longer service life of angle valve bodies thanks to the flow-to-close direction of flow and an additional anti-wear sleeve of silicon carbide (SiC)

The control valves have a modular design and can be equipped with various accessories, such as positioners, solenoid valves and other accessories according to IEC 60534-6 and NAMUR recommendation. See Information Sheet T 8350 EN for details.

Versions
The pneumatic control valves illustrated in Figs. 1 and 2 can be equipped with ceramic valve trims. They are equipped with the Type 3271 Pneumatic Actuator.
- Type 3251-1 · Type 3251 Globe Valve
- Type 3256-1 · Type 3256 Angle Valve

Additional versions with
- Electric actuator · On request
Fail-safe position
Depending on the arrangement of the compression springs in the actuator (for details, see Data Sheets T 8310-1 EN and T 8310-2 EN), the control valve has two different fail-safe positions which become effective when the supply air fails:

"Actuator stem extends",
The valve is closed when the air supply fails.

"Actuator stem retracts",
The valve is opened when the air supply fails.

Materials
The data sheets listed in Table 1 contain exact details on the materials used.
The valve bodies are available in standard or stainless cast steel as well as in cold-resisting or high-temperature cast steel.
The ceramic valve trim, i.e. plug and seat or seat ring, consists of silicon nitride (Si₃N₄), which is hot-pressed at 1700 to 1800 °C. The anti-wear sleeve is made of hot-pressed silicon carbide (SiC).
The data in Table 2 indicate the favorable properties of these materials.

Permissible differential pressures Δp
The permissible differential pressures for versions with $K_v$ values of 1.6 to 160 are specified in the data sheets listed in Table 1. Here, only the combination of nominal sizes and seat diameters shown in Tables 3 can be applied. Permissible differential pressures for versions with $K_v \leq 1$ and $K_v > 160$ are available on request.
Table 1 · Technical data

<table>
<thead>
<tr>
<th>Valve</th>
<th>Type</th>
<th>3251</th>
<th>3256</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator 1)</td>
<td>Type</td>
<td>Type 3271 or Type 3277 (up to 700 cm²)</td>
<td></td>
</tr>
<tr>
<td>Body style</td>
<td>Globe valve</td>
<td>·</td>
<td>–</td>
</tr>
<tr>
<td>Angle valve</td>
<td>–</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Nominal sizes</td>
<td>DN</td>
<td>25 – 50 – 80 – 100 – 150</td>
<td></td>
</tr>
<tr>
<td>Nominal pressure</td>
<td>PN</td>
<td>16 … 400</td>
<td></td>
</tr>
</tbody>
</table>

Reinforcement

- Ceramic valve trim: HPSN (Si₃N₄)
- Ceramic anti-wear sleeve: – SIC

Temperature ranges (see associated data sheet) · Permissible operating pressures acc. to pressure-temperature diagrams (see T 8000-2 EN)

Temperature limits °C

-250 … 500

Leakage class according to DIN EN 1349: 2000

Valve plug: IV-S2

For details, see Data Sheet T 8051 EN T 8065 EN

1) Type 3251-2 and Type 3256-2 Electric Control Valves on request

Table 2 · Properties of ceramic materials

<table>
<thead>
<tr>
<th>Material</th>
<th>HPSN</th>
<th>SIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural strength (4-point)</td>
<td>N/mm²</td>
<td>600 … 800</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>N/mm²</td>
<td>300 … 500</td>
</tr>
<tr>
<td>Compressive strength</td>
<td>N/mm²</td>
<td>2500</td>
</tr>
<tr>
<td>Young’s Modulus</td>
<td>kN/mm²</td>
<td>310 … 320</td>
</tr>
<tr>
<td>Hardness HV 10</td>
<td>N/mm²</td>
<td>&gt;16 000</td>
</tr>
<tr>
<td>Thermal expansion (α)</td>
<td>10⁻⁶/°C</td>
<td>3.2</td>
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<tr>
<td>Corrosion resistance</td>
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</table>

Selection and sizing

Control valves with ceramic valve trim require especially careful sizing. Therefore, final sizing is carried out by SAMSON.

1. Calculate the appropriate Kᵥ coefficient according to IEC 60534.
2. Select the nominal size and Kᵥ coefficient according to Table 3.
3. Determine the permissible differential pressure Δp and select the appropriate actuator according to the data sheets listed in Table 1.
4. Select materials and accessories according to the pressure-temperature diagram and the corresponding data sheets.

The following details are required on ordering

- Valve type: DN … PN …
- Body material: Acc. to associated data sheet
- End connection: Flanges/welding ends
- Plug: Ceramic/balanced
- Characteristic: Equal percentage or linear
- Anti-wear sleeve: For Type 3256
- Actuator: Versions according to T 8310-1 EN and T 8310-2 EN
- Fail-safe action: Valve OPEN/CLOSED
- Process medium: Density in kg/m³ and temperature in °C or K
- Max. flow rate: kg/h or m³/h under standard or operating conditions
- Pressure: p₁ in bar (absolute pressure pabs₁) p₂ in bar (absolute pressure pabs₂)
- Accessories: Positioner and/or limit switch
### Table 3a  Type 3251 Globe Valve with ceramic valve trim
Flow-to-open · Versions in fields highlighted in gray also available with balanced plug

<table>
<thead>
<tr>
<th>$K_{vs}$</th>
<th>0.1 · 0.16 · 0.25</th>
<th>0.4 · 0.63</th>
<th>1.0</th>
<th>1.6</th>
<th>2.5</th>
<th>4.0</th>
<th>6.3</th>
<th>10</th>
<th>16</th>
<th>25</th>
<th>40</th>
<th>63</th>
<th>100</th>
<th>160</th>
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<tbody>
<tr>
<td>Seat Ø mm</td>
<td></td>
<td></td>
<td>8</td>
<td>12</td>
<td>24</td>
<td>31</td>
<td>38</td>
<td>50</td>
<td>63</td>
<td>80</td>
<td>100</td>
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<tr>
<td>Rated travel mm</td>
<td></td>
<td></td>
<td>15</td>
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Terms for control valve sizing according to DIN EN 60534, Parts 2-1 and 2-2: $f_t = 0.95$, $x_t = 0.75$

### Table 3b  Type 3256 Angle Valve with ceramic valve trim and ceramic anti-wear sleeve
Flow-to-close · Versions in fields highlighted in gray also available with balanced plug

<table>
<thead>
<tr>
<th>$K_{vs}$</th>
<th>0.1 · 0.16 · 0.25</th>
<th>0.4 · 0.63</th>
<th>1.0</th>
<th>1.6</th>
<th>2.5</th>
<th>4.0</th>
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<td>DN</td>
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<td>25</td>
<td>0.15</td>
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<td>50</td>
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<td>80</td>
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<td>150</td>
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Terms for control valve sizing according to DIN EN 60534, Parts 2-1 and 2-2: $f_t = 0.85$, $x_t = 0.6$

Specifications subject to change without notice.