Direct Operated 2 Port Solenoid Valve

**Large flow rate**
Flow rate

- **20% More flow** *(Size 1)*

**Compact**
Height

- **10% Smaller** *(Size 1)*

**Lightweight**
Weight

- **30% Lighter** *(Size 1, Aluminum body)*

*Comparison with SMC conventional model*

- **Body material**
  - Air
  - Aluminum, Resin
  - Water/Oil/Medium vacuum
  - C37 (Brass), Stainless steel

- **With one-touch fittings**
  - (resin body)

- **Conventional model**

**Enclosure**
- **IP65**
  - *Electrical entry “Faston” type terminal is IP40.*

**Power consumption**
- **4.5 W** *(Size 1)*
- **7 W** *(Size 2)*
- **10.5 W** *(Size 3)* *(DC)*

**Series VX21/22/23**

[Image of solenoid valve with dimensions and specifications]

*Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com*
Direct Operated 2 Port Solenoid Valve

- **Enclosure**: IP65
- **Power consumption**
  - 4.5 W (Size 1)
  - 7 W (Size 2)
  - 10.5 W (Size 3)
- **Flame resistance**: UL94V-0 conformed
- **Low-noise construction**: Metal noise reduced by the rubber damper
- **Body material**: Aluminum, Resin
  - C37 (Brass), Stainless steel
- **Piping variations**: Thread piping, one-touch fitting
- **Features 1**:
  - **Improved durability**: Service life is extended by the special construction.
    (compared with current shading coil)
  - **Improved OFF response**: Specially constructed to improve the OFF response when operated with a higher viscosity fluid such as oil.
  - **Reduced buzz noise**: Rectified to DC by the full-wave rectifier, resulting in a buzz noise reduction.
  - **Reduced apparent power**:
    - 10 VA → 7 VA (Size 1)
    - 20 VA → 9.5 VA (Size 2)
    - 32 VA → 12 VA (Size 3)
  - **Low-noise construction**: Specially constructed to reduce the metal noise during operation.

**Sizes and Orifice diameters**

<table>
<thead>
<tr>
<th>Size</th>
<th>Orifice diameter</th>
<th>Port size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 mmø</td>
<td>3 mmø</td>
</tr>
<tr>
<td>Size 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Select the fluid.

**Selection Steps**

**Step 1** Select the fluid.

- **Air** 
  - **Symbol**: 0
  - **Page**: P. 2

- **Water** 
  - **Symbol**: 2
  - **Page**: P. 6

- **Oil** 
  - **Symbol**: 3
  - **Page**: P. 8

- **Medium or Vacuum** 
  - **Symbol**: 4
  - **Page**: P. 4

**Step 2** Select “Body material”, “Port size” and “Orifice diameter” from “Flow rate — Pressure” of each fluid.

- **Size**: 3
- **Body material**: Aluminum
- **Port size**: 1/8
- **Orifice diameter**: 2

**Step 3** Select electrical specification.

- **Voltage**: 24 VDC
- **Electrical entry**: Grommet

**Step 4** For other special options, refer to page 10.

---

**Standard Specifications**

<table>
<thead>
<tr>
<th>Valve specifications</th>
<th>Valve construction</th>
<th>Direct operated poppet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Withstand pressure</td>
<td>MPa 2.0 (resin body type 1.5)</td>
</tr>
<tr>
<td></td>
<td>Body material</td>
<td>Aluminum, Resin, C37 (Brass), Stainless steel</td>
</tr>
<tr>
<td></td>
<td>Seal material</td>
<td>NBR, FKM</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
<td>Dusttight, Low jetproof (IP65)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coil specifications</th>
<th>Rated voltage</th>
<th>DC 100 VAC, 200 VAC, 110 VAC, 230 VAC (220 VAC, 240 VAC, 48 VAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allowable voltage fluctuation</td>
<td>±10% of rated voltage</td>
</tr>
<tr>
<td></td>
<td>Allowable leakage voltage</td>
<td>AC (Built-in full-wave rectifier type) 10% or less of rated voltage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DC 2% or less of rated voltage</td>
</tr>
<tr>
<td></td>
<td>Coil insulation type</td>
<td>Class B</td>
</tr>
</tbody>
</table>

**AC Specification (Built-in Full-wave Rectifier Type)**

<table>
<thead>
<tr>
<th>Size</th>
<th>Apparent power (VA) Note 1)</th>
<th>Temperature rise (°C) Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size 1</td>
<td>7</td>
<td>60</td>
</tr>
<tr>
<td>Size 2</td>
<td>9.5</td>
<td>70</td>
</tr>
<tr>
<td>Size 3</td>
<td>12</td>
<td>70</td>
</tr>
</tbody>
</table>

**Notes:**
- Note 1) Electrical entry “Faston” type terminal is IP40.
- Note 2) Voltage in ( ) indicates special voltage. (Refer to page 10.)
- Be sure to read “Specific Product Precautions” before handling.

**Solenoid Coil Specifications**

**DC Specification**

<table>
<thead>
<tr>
<th>Size</th>
<th>Power consumption (W) Note 1)</th>
<th>Temperature rise (°C) Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size 1</td>
<td>4.5</td>
<td>50</td>
</tr>
<tr>
<td>Size 2</td>
<td>7</td>
<td>55</td>
</tr>
<tr>
<td>Size 3</td>
<td>10.5</td>
<td>65</td>
</tr>
</tbody>
</table>

Note 1) Power consumption, Apparent power: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)
Note 2) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

---

For other special options, refer to page 10.
### Model/Valve Specifications

#### Normally Closed (N.C.)

**Aluminum Body Type**

<table>
<thead>
<tr>
<th>Size</th>
<th>Port size (mm)</th>
<th>Orifice diameter (mmø)</th>
<th>Model</th>
<th>Flow-rate characteristics</th>
<th>Maximum operating pressure differential (MPa)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/8, 1/4</td>
<td>2</td>
<td>VX210</td>
<td>C [dm³/(s·bar)] b Cv</td>
<td>0.63 0.63 0.23 1.0</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.05 0.68 0.41 0.6</td>
<td></td>
<td></td>
<td>1.05 0.68 0.41 0.67</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.20 0.39 0.62 0.2</td>
<td></td>
<td></td>
<td>2.20 0.39 0.62 0.2</td>
<td>220</td>
</tr>
<tr>
<td>2</td>
<td>1/4, 3/8</td>
<td>4</td>
<td>VX220</td>
<td>C [dm³/(s·bar)] b Cv</td>
<td>1.90 0.52 0.62 1.0</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3.99 0.44 1.08 0.15</td>
<td></td>
<td></td>
<td>3.99 0.44 1.08 0.15</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.96 0.55 0.75 1.0</td>
<td></td>
<td></td>
<td>1.96 0.55 0.75 1.0</td>
<td>450</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>5.67 0.33 1.58 0.3</td>
<td></td>
<td></td>
<td>5.67 0.33 1.58 0.3</td>
<td>450</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>7.4 0.64 2.21 0.1</td>
<td></td>
<td></td>
<td>7.4 0.64 2.21 0.1</td>
<td>470</td>
</tr>
<tr>
<td>3</td>
<td>1/4, 3/8</td>
<td>8</td>
<td>VX230</td>
<td>C [dm³/(s·bar)] b Cv</td>
<td>5.74 0.64 2.21 0.1</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
<td>5.74 0.64 2.21 0.1</td>
<td>450</td>
</tr>
</tbody>
</table>

#### Resin Body Type (Built-in One-touch Fittings)

<table>
<thead>
<tr>
<th>Size</th>
<th>Port size (mm)</th>
<th>Orifice diameter (mmø)</th>
<th>Model</th>
<th>Flow-rate characteristics</th>
<th>Maximum operating pressure differential (MPa)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C6</td>
<td>2</td>
<td>VX210</td>
<td>C [dm³/(s·bar)] b Cv</td>
<td>0.82 0.44 0.23 1.0</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.25 0.34 0.35 0.6</td>
<td></td>
<td></td>
<td>1.25 0.34 0.35 0.6</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.45 0.43 0.40 0.2</td>
<td></td>
<td></td>
<td>1.45 0.43 0.40 0.2</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>C8</td>
<td>2</td>
<td>VX220</td>
<td>C [dm³/(s·bar)] b Cv</td>
<td>2.11 0.32 0.56 0.2</td>
<td>220</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.69 0.40 0.47 1.0</td>
<td></td>
<td></td>
<td>1.69 0.40 0.47 1.0</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3.14 0.34 0.84 0.15</td>
<td></td>
<td></td>
<td>3.14 0.34 0.84 0.15</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>C10</td>
<td>4</td>
<td>VX230</td>
<td>C [dm³/(s·bar)] b Cv</td>
<td>3.54 0.36 0.90 0.15</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>5.69 0.64 1.76 0.1</td>
<td></td>
<td></td>
<td>5.69 0.64 1.76 0.1</td>
<td>460</td>
</tr>
</tbody>
</table>

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

Refer to “Glossary of Terms” on page 16 for details on the maximum operating pressure differential.

### Fluid and Ambient Temperature

<table>
<thead>
<tr>
<th>Fluid temperature (°C)</th>
<th>Ambient temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>−10 Note) to 60</td>
<td>−20 to 60</td>
</tr>
</tbody>
</table>

Note) Dew point temperature: −10°C or less

### Valve Leakage

#### Internal Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (Air) Note)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBR</td>
<td>1 cm³/min or less (Aluminum body type)</td>
</tr>
<tr>
<td></td>
<td>15 cm³/min or less (Resin body type)</td>
</tr>
</tbody>
</table>

#### External Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (Air) Note)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBR</td>
<td>1 cm³/min or less (Aluminum body type)</td>
</tr>
<tr>
<td></td>
<td>15 cm³/min or less (Resin body type)</td>
</tr>
</tbody>
</table>

Note) Leakage is the value at ambient temperature 20°C.

---

*Note: The data in the table represents the technical specifications for a series of solenoid valves, detailing their flow-rate characteristics, maximum operating pressure differential, and weights for different models and port sizes. The data is sourced from Steven Engineering, Inc.*
## How to Order (Single Unit)

### VX2 1 0 A A

#### Fluid
- For air

### Size/Valve type

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Size</th>
<th>Valve type</th>
<th>Body material/Port size/Orifice diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1/8</td>
<td>Aluminum</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>1/4</td>
<td>mathrm{}</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>3/8</td>
<td>mathrm{}</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>3/8</td>
<td>Resin</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>3/8</td>
<td>Resin</td>
<td>3</td>
</tr>
<tr>
<td>F</td>
<td>3/8</td>
<td>Resin</td>
<td>7</td>
</tr>
<tr>
<td>G</td>
<td>1/2</td>
<td>Resin</td>
<td>4</td>
</tr>
<tr>
<td>H</td>
<td>1/2</td>
<td>Resin</td>
<td>5</td>
</tr>
<tr>
<td>J</td>
<td>1/2</td>
<td>Resin</td>
<td>7</td>
</tr>
<tr>
<td>K</td>
<td>1/2</td>
<td>Resin</td>
<td>8</td>
</tr>
<tr>
<td>L</td>
<td>1/2</td>
<td>Resin</td>
<td>10</td>
</tr>
<tr>
<td>M</td>
<td>1/2</td>
<td>Resin</td>
<td>10</td>
</tr>
<tr>
<td>N</td>
<td>1/2</td>
<td>Resin</td>
<td>10</td>
</tr>
</tbody>
</table>

### Voltage/Electrical entry

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Voltage</th>
<th>Electrical entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>24 VDC</td>
<td>Grommet</td>
</tr>
<tr>
<td>B</td>
<td>100 VAC</td>
<td>Grommet</td>
</tr>
<tr>
<td>C</td>
<td>110 VAC</td>
<td>With surge voltage suppressor</td>
</tr>
<tr>
<td>D</td>
<td>200 VAC</td>
<td>230 VAC</td>
</tr>
<tr>
<td>E</td>
<td>230 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>F</td>
<td>24 VDC</td>
<td>DIN terminal</td>
</tr>
<tr>
<td>G</td>
<td>24 VDC</td>
<td>DIN terminal</td>
</tr>
<tr>
<td>H</td>
<td>100 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>J</td>
<td>110 VAC</td>
<td>100 VAC</td>
</tr>
<tr>
<td>K</td>
<td>200 VAC</td>
<td>Conduit terminal</td>
</tr>
<tr>
<td>L</td>
<td>230 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>M</td>
<td>24 VDC</td>
<td>100 VAC</td>
</tr>
<tr>
<td>N</td>
<td>24 VDC</td>
<td>230 VAC</td>
</tr>
<tr>
<td>P</td>
<td>110 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Q</td>
<td>200 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>R</td>
<td>230 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>S</td>
<td>24 VDC</td>
<td>Conduit</td>
</tr>
<tr>
<td>T</td>
<td>100 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>U</td>
<td>110 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>V</td>
<td>200 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>W</td>
<td>230 VAC</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Y</td>
<td>24 VDC</td>
<td>Faston terminal</td>
</tr>
<tr>
<td>Z</td>
<td>Other voltages and electrical options</td>
<td></td>
</tr>
</tbody>
</table>

### Common Specifications

- Valve type: N.C.
- Seal material: NBR
- Coil insulation type: Class B
- Thread type: Rc

### Specifications

- Direct Operated 2 Port Solenoid Valve Series VX21/22/23
- For Air Single Unit
- For Medium Vacuum
- For Water
- For Oil

### Construction Dimensions

- For other special options, refer to page 10.

### Special voltage

- 48 VAC
- 220 VAC
- 240 VAC
- 12 VDC

### Option

- DIN terminal with light
- Conduit terminal with light
- Low concentration ozone resistant (Seal material: FKM)
- Oil-free
- G thread
- NPT thread

---

Dimensions → Page 11 (Single unit)
# Model/Valve Specifications

## Normally Closed (N.C.)

<table>
<thead>
<tr>
<th>Size</th>
<th>Port size</th>
<th>Orifice diameter (mm)</th>
<th>Model</th>
<th>Flow-rate characteristics</th>
<th>Operating pressure range</th>
<th>Note</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/8, 1/4</td>
<td>2</td>
<td>VX214</td>
<td>C [dm³/(s·b-ar)]</td>
<td>0.63</td>
<td>0.63</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.05</td>
<td></td>
<td>0.68</td>
<td>0.41</td>
<td>0.62</td>
<td>0 to 0.6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.20</td>
<td></td>
<td>0.39</td>
<td>0.62</td>
<td>0.62</td>
<td>0 to 0.2</td>
</tr>
<tr>
<td>2</td>
<td>1/4, 3/8</td>
<td>4</td>
<td>VX224</td>
<td>1.90</td>
<td>0.52</td>
<td>0.62</td>
<td>0 to 1.0</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>3.99</td>
<td></td>
<td>0.44</td>
<td>1.08</td>
<td>0.75</td>
<td>0 to 0.15</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>5.67</td>
<td></td>
<td>0.33</td>
<td>1.58</td>
<td>0.75</td>
<td>0 to 0.15</td>
</tr>
<tr>
<td>3</td>
<td>1/4, 3/8</td>
<td>5</td>
<td>VX234</td>
<td>1.96</td>
<td>0.55</td>
<td>2.21</td>
<td>0 to 1.0</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>8.42</td>
<td></td>
<td>0.39</td>
<td>2.21</td>
<td>0.75</td>
<td>0 to 0.3</td>
</tr>
<tr>
<td>1/2</td>
<td>10</td>
<td>8.42</td>
<td></td>
<td>0.39</td>
<td>2.21</td>
<td>0.75</td>
<td>0 to 0.1</td>
</tr>
</tbody>
</table>

**Note:** Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

## Fluid and Ambient Temperature

<table>
<thead>
<tr>
<th>Fluid temperature (°C)</th>
<th>Ambient temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 60</td>
<td>−20 to 60</td>
</tr>
</tbody>
</table>

**Note:** With no freezing

## Valve Leakage

### Internal Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (^{(\text{Note})})</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKM</td>
<td>(10^{-6}) Pa·m³/sec or less</td>
</tr>
</tbody>
</table>

### External Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (^{(\text{Note})})</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKM</td>
<td>(10^{-6}) Pa·m³/sec or less</td>
</tr>
</tbody>
</table>

**Note:** Leakage \(10^{-6}\) Pa·m³/sec is the value at differential pressure 0.1 MPa and ambient temperature 20°C.
### How to Order (Single Unit)

#### VX2 Series

**Size/Valve type**
- Size 1: Single unit N.C.
- Size 2: Single unit N.C.
- Size 3: Single unit N.C.

**Body material/Port size/Orifice diameter**
- Port size: 1/4, 3/8, 1/2
- Orifice diameter: 2, 3, 5
- Body material: C37, Stainless steel

**Voltage/Electrical entry**
- Voltage: 24 VDC, 100 VAC, 110 VAC, 200 VAC, 230 VAC
- Electrical entry: Grommet, DIN terminal, Conduit terminal

**Common Specifications**
- Valve type: N.C.
- Seal material: FKM
- Coil insulation type: Class B
- Thread type: Rc
- Special voltage: 48 VAC, 220 VAC, 240 VAC, 12 VDC
- DIN terminal with light
- Conduit terminal with light
- G thread
- NPT thread
- Bracket interchangeable with old type

---

For other special options, refer to page 10.
Series VX21/22/23

For Water Single Unit

Model/Valve Specifications

| Passage symbol |

| Normally Closed (N.C.) |

<table>
<thead>
<tr>
<th>Size</th>
<th>Port size</th>
<th>Orifice diameter (mmø)</th>
<th>Model</th>
<th>Flow-rate characteristics</th>
<th>Maximum operating pressure differential (MPa)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/8, 1/4</td>
<td>2</td>
<td>VX212</td>
<td>5.5</td>
<td>0.23</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.0</td>
<td>0.42</td>
<td>0.6</td>
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<td></td>
<td></td>
<td></td>
<td>15.0</td>
<td>0.63</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>1/4, 3/8</td>
<td>4</td>
<td>VX222</td>
<td>15.0</td>
<td>0.63</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26.0</td>
<td>1.08</td>
<td>0.15</td>
</tr>
<tr>
<td>3</td>
<td>1/4, 3/8</td>
<td>5</td>
<td>VX232</td>
<td>18.0</td>
<td>0.75</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>38.0</td>
<td>1.58</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>1/2</td>
<td>8</td>
<td></td>
<td>53.0</td>
<td>2.21</td>
<td>0.1</td>
</tr>
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<td></td>
<td></td>
<td>10</td>
<td></td>
<td>53.0</td>
<td>2.21</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

Refer to "Glossary of Terms" on page 16 for details on the maximum operating pressure differential.

Fluid and Ambient Temperature

<table>
<thead>
<tr>
<th>Fluid temperature (°C)</th>
<th>Ambient temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 60</td>
<td>-20 to 60</td>
</tr>
</tbody>
</table>

Note) With no freezing

Valve Leakage

Internal Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakeg rate (Water) (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBR</td>
<td>0.1 cm³/min or less</td>
</tr>
</tbody>
</table>

External Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (Water) (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBR</td>
<td>0.1 cm³/min or less</td>
</tr>
</tbody>
</table>

Note) Leakage is the value at ambient temperature 20°C.
How to Order (Single Unit)

<table>
<thead>
<tr>
<th>Size/Valve type</th>
<th>Body material/Port size/Orifice diameter</th>
<th>Voltage/Electrical entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>Size</td>
<td>Valve type</td>
</tr>
<tr>
<td>1</td>
<td>Single unit N.C.</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>J</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>Single unit N.C.</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F</td>
</tr>
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<td></td>
<td></td>
<td>G</td>
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<td></td>
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<td>H</td>
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<td>J</td>
</tr>
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<td></td>
<td>K</td>
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<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>3</td>
<td>Single unit N.C.</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
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<td>E</td>
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<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>J</td>
</tr>
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<td>K</td>
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<tr>
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<td></td>
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<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P</td>
</tr>
</tbody>
</table>

For other special options, refer to page 10.

Dimensions → Page 11 (Single unit)
### Fluid and Ambient Temperature

<table>
<thead>
<tr>
<th>Fluid temperature (°C)</th>
<th>Ambient temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>−5 Note) to 60</td>
<td>−20 to 60</td>
</tr>
</tbody>
</table>

Note) Kinematic viscosity: 50 mm²/s or less

### Valve Leakage

#### Internal Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (Oil) Note)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKM</td>
<td>0.1 cm³/min or less</td>
</tr>
</tbody>
</table>

#### External Leakage

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Leakage rate (Oil) Note)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKM</td>
<td>0.1 cm³/min or less</td>
</tr>
</tbody>
</table>

Note) Leakage is the value at ambient temperature 20°C.

### Model/Valve Specifications

#### Normally Closed (N.C.)

<table>
<thead>
<tr>
<th>Size</th>
<th>Port size</th>
<th>Orifice diameter (mmø)</th>
<th>Model</th>
<th>Flow-rate characteristics</th>
<th>Maximum operating pressure differential (MPa)</th>
<th>Weight Note) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/8, 1/4</td>
<td>2</td>
<td>VX213</td>
<td>5.5</td>
<td>0.23</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>10.0</td>
<td>0.42</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>15.0</td>
<td>0.63</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>1/4, 3/8</td>
<td>4</td>
<td>VX223</td>
<td>15.0</td>
<td>0.63</td>
<td>460</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td></td>
<td>26.0</td>
<td>1.08</td>
<td>460</td>
</tr>
<tr>
<td>3</td>
<td>1/4, 3/8</td>
<td>5</td>
<td>VX233</td>
<td>18.0</td>
<td>0.75</td>
<td>580</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td>38.0</td>
<td>1.58</td>
<td>580</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td>53.0</td>
<td>2.21</td>
<td>580</td>
</tr>
<tr>
<td></td>
<td>1/2</td>
<td>10</td>
<td></td>
<td>53.0</td>
<td>2.21</td>
<td>630</td>
</tr>
</tbody>
</table>

Note) Weight of grommet type. Add 10 g for conduit type, 30 g for DIN terminal type, 60 g for conduit terminal type respectively.

*Refer to "Glossary of Terms" on page 16 for details on the maximum operating pressure differential.*

### For Oil Single Unit

When the fluid is oil. The kinematic viscosity must not exceed 50 mm²/s. The special construction of the armature adopted in the built-in full-wave rectifier type gives an improvement in OFF response by providing clearance on the absorbed surface when it is switched ON.

### Passage symbol

![Passage symbol diagram]

Model/Valve Specifications

For Oil Single Unit

Series VX21/22/23

By Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Direct Operated 2 Port Solenoid Valve Series VX21/22/23

For Oil Single Unit

How to Order (Single Unit)

Size/Valve type

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Size</th>
<th>Valve type</th>
<th>Body material/Port size/Orifice diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Size 1</td>
<td>Single unit N.C.</td>
<td>A: C37 1/8, 2; B: C37 3/8, 4; C: Stainless steel 3/4, 5</td>
</tr>
<tr>
<td>2</td>
<td>Size 2</td>
<td>Single unit N.C.</td>
<td>A: C37 3/8, 4; B: C37 1/4, 7; C: Stainless steel 1/2, 10</td>
</tr>
<tr>
<td>3</td>
<td>Size 3</td>
<td>Single unit N.C.</td>
<td>A: C37 1/4, 5; B: C37 3/8, 8; C: Stainless steel 1/2, 10</td>
</tr>
</tbody>
</table>

Voltage/Electrical entry

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Voltage</th>
<th>Electrical entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>24 VDC</td>
<td>Grommet</td>
</tr>
<tr>
<td>B</td>
<td>100 VAC</td>
<td>Grommet</td>
</tr>
<tr>
<td>C</td>
<td>110 VAC</td>
<td>(With surge voltage suppressor)</td>
</tr>
<tr>
<td>D</td>
<td>200 VAC</td>
<td>230 VAC</td>
</tr>
<tr>
<td>E</td>
<td>24 VDC</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>24 VDC</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>24 VDC</td>
<td>DIN terminal</td>
</tr>
<tr>
<td>H</td>
<td>100 VAC</td>
<td>(With surge voltage suppressor)</td>
</tr>
<tr>
<td>J</td>
<td>110 VAC</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>200 VAC</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>230 VAC</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>24 VDC</td>
<td>Conduit terminal</td>
</tr>
<tr>
<td>N</td>
<td>100 VAC</td>
<td>(With surge voltage suppressor)</td>
</tr>
<tr>
<td>P</td>
<td>110 VAC</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>200 VAC</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>230 VAC</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>24 VDC</td>
<td>Conduit</td>
</tr>
<tr>
<td>T</td>
<td>100 VAC</td>
<td>(With surge voltage suppressor)</td>
</tr>
<tr>
<td>U</td>
<td>110 VAC</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>200 VAC</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>230 VAC</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>24 VDC</td>
<td>Faston terminal</td>
</tr>
<tr>
<td>Z</td>
<td>Other voltages and electrical options</td>
<td></td>
</tr>
</tbody>
</table>

For other special options, refer to page 10.

- Special voltage: 48 VAC, 220 VAC, 240 VAC, 12 VDC
- DIN terminal with light
- Conduit terminal with light
- Oil-free
- G thread
- NPT thread
- Bracket interchangeable with old type

Dimensions → Page 11 (Single unit)
Series VX21/22/23
Other Special Options

Electrical options (Special voltage, with light)

**VX2** 10AZ1A

Enter standard product number.

**VX2** 10AAZ

Enter standard product number.

Other options (Low concentration ozone resistant, oil-free, special thread)

**VX2** 10A AZ

Enter standard product number.

Bracket interchangeable with old type

The brackets are interchangeable with brackets of old VX21/22/23 series. For details of exterior dimensions, please contact SMC.

- Only for C37 and stainless steel
- (Select C37 when interchangeable product is necessary for air.)

Construction

Normally closed (N.C.)

Body material: Aluminum, C37, Stainless steel

Body material: Resin

Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solenoid coil</td>
<td>Cu + Fe + Resin</td>
</tr>
<tr>
<td>2</td>
<td>Fixed armature</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>3</td>
<td>Tube</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>5</td>
<td>Armature assembly</td>
<td>NBR, FKM, Stainless steel</td>
</tr>
<tr>
<td>6</td>
<td>Seal</td>
<td>NBR, FKM</td>
</tr>
<tr>
<td>7</td>
<td>Body</td>
<td>Aluminum, C37, Stainless steel</td>
</tr>
</tbody>
</table>

Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solenoid coil</td>
<td>Cu + Fe + Resin</td>
</tr>
<tr>
<td>2</td>
<td>Fixed armature</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>3</td>
<td>Tube</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>5</td>
<td>Armature assembly</td>
<td>NBR, Stainless steel</td>
</tr>
<tr>
<td>6</td>
<td>Seal</td>
<td>NBR, FKM</td>
</tr>
<tr>
<td>7</td>
<td>Body</td>
<td>Resin (PBT)</td>
</tr>
</tbody>
</table>

Note) Applicable to air

Enter symbols in the order below when ordering a combination of electrical option, other options, and bracket interchangeable with old type.

**Example)** VX2 10AZ 1A XB

Enter standard product number.

Bracket interchangeable with old type
### Direct Operated 2 Port Solenoid Valve Series VX21/22/23

#### Dimensions: Body Material: Aluminum

<table>
<thead>
<tr>
<th>Size</th>
<th>Port size</th>
<th>A</th>
<th>B</th>
<th>B₁</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Electrical entry (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Q</td>
<td>R</td>
<td>S</td>
<td>T</td>
<td>Q</td>
<td>R</td>
<td>Q</td>
<td>R</td>
</tr>
<tr>
<td>1/8, 1/4</td>
<td>19</td>
<td>43</td>
<td>21</td>
<td>61</td>
<td>30</td>
<td>9.5</td>
<td>20</td>
<td>30</td>
<td>28.5</td>
</tr>
<tr>
<td>1/4, 3/8</td>
<td>24</td>
<td>45</td>
<td>22.5</td>
<td>76</td>
<td>35</td>
<td>12</td>
<td>22</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>1/2</td>
<td>30</td>
<td>50</td>
<td>25</td>
<td>86.5</td>
<td>40</td>
<td>15</td>
<td>24.5</td>
<td>47.5</td>
<td></td>
</tr>
</tbody>
</table>

#### DIN terminal

- Cable ø6 to ø12

#### Conduit terminal

- Conduit Ø2

#### Conduit

- G1/2

#### Faston type

- Terminal part

#### Terminal part Faston connector 250 Series

- For Air
- For Medium
- For Vacuum
- For Water
- For Oil

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Series VX21/22/23

For Air, Medium Vacuum, Water, Oil

Dimensions: Body Material: Resin

For information on handling one-touch fittings and appropriate tubing, refer to page 25 and KQ2 series one-touch fittings in Best Pneumatics No. 6. The KQ2 series information can be downloaded from the following SMC website, http://www.smcworld.com

<table>
<thead>
<tr>
<th>Size</th>
<th>One-touch fitting P</th>
<th>B</th>
<th>B₁</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Mounting hole size</th>
<th>Mounting bracket dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C₆, C₈</td>
<td>53.5</td>
<td>29</td>
<td>65.5</td>
<td>30</td>
<td>13.5</td>
<td>20</td>
<td>45</td>
<td>U₁: 22.5, W: 22, X: 26, Y: 30</td>
</tr>
<tr>
<td>3</td>
<td>C₁₀, C₁₂</td>
<td>68</td>
<td>37</td>
<td>84</td>
<td>40</td>
<td>16.5</td>
<td>24.5</td>
<td>58</td>
<td>U₁: 29, W: 31, X: 67, Y: 40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>One-touch fitting P</th>
<th>Grommet (with surge voltage suppressor)</th>
<th>DIN terminal</th>
<th>Conduit terminal</th>
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<tbody>
<tr>
<td>1</td>
<td>C₆, C₈</td>
<td>Q: 27, R: 42.5, S: 30, T: 29</td>
<td>Q: 64.5, R: 34.5, S: 52.5, T: 99.5, S: 68.5, T: 81.5</td>
<td>Q: 36.5, R: 50.5, S: 73.5, T: 98.5</td>
</tr>
</tbody>
</table>

Grommet

DIN terminal

Conduit terminal

Cable ø6 to ø12

Grommet (with surge voltage suppressor)

2 x ø3.4 Mounting hole

Mounting hole

For information on handling one-touch fittings and appropriate tubing, refer to page 25 and KQ2 series one-touch fittings in Best Pneumatics No. 6. The KQ2 series information can be downloaded from the following SMC website, http://www.smcworld.com

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Direct Operated 2 Port Solenoid Valve  **Series VX21/22/23**

**Dimensions: Body Material: Resin**

### Conduit

![Conduit Diagram](image)

### Faston type

![Faston Diagram](image)

#### Terminal part

**Faston connector**

**250 Series**

<table>
<thead>
<tr>
<th>Size</th>
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<th>B</th>
<th>B₁</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Mounting bracket dimensions</th>
<th>Electrical entry</th>
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<tr>
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**Specifications**

- **For Air**
- **For Medium Vacuum**
- **For Water**
- **For Oil**

**Construction**

**Dimensions**

- **Body Material: Resin**

---

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Series VX21/22/23
For Air, Medium Vacuum, Water, Oil

Dimensions: Body Material: C37, Stainless Steel

Grommet

Grommet (with surge voltage suppressor)

DIN terminal

Conduit terminal

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<tr>
<th>Size</th>
<th>Port size (P)</th>
<th>A</th>
<th>B</th>
<th>B₁</th>
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Electrical entry

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<th>Conduit terminal</th>
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<td>S₁</td>
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Dimensions: Body Material: C37, Stainless Steel

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Direct Operated 2 Port Solenoid Valve *Series VX21/22/23*

Dimensions: Body Material: C37, Stainless Steel

### Conduit

---

![Conduit Diagram]

**Faston type**

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![Faston Type Diagram]

### Dimensions (mm)

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<th>Size</th>
<th>Port size</th>
<th>P</th>
<th>A</th>
<th>B</th>
<th>B₁</th>
<th>C</th>
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<td>55</td>
<td>28</td>
<td>61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Replacement Parts

- **DIN Connector Part No.**
  - Without electrical option: C18312G6GCU
  - With electrical option (light): GDM2A-L

- **Gasket for DIN Connector**
  - VCW20-1-29-1

- **Lead Wire Assembly for Faston Terminal (Set of 2 pcs.)**
  - VX021S-1-16FB

---

**Electrical option**

- With light

**Rated voltage**

- 1: 100 VAC, 110 VAC
- 2: 200 VAC, 220 VAC
- 3: 230 VAC, 240 VAC
- 4: 24 VDC
- 5: 12 VDC
- 6: 48 VAC

---

**Specifications**

- **For Air**
- **For Medium**
- **Vacuum**
- **For Water**
- **For Oil**

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**Construction**

- Dimensions

---

**For"nud*"(Att*tr)"("*s*"r*ii)"

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---

15
Pressure Terminology

1. **Maximum operating pressure differential**
The maximum pressure differential (the difference between the inlet and outlet pressure) which is allowed for operation. When the outlet pressure is 0 MPa, this becomes the maximum operating pressure.

2. **Minimum operating pressure differential**
The minimum pressure differential (the difference between the inlet pressure and outlet pressure) required to keep the main valve fully opened.

3. **Maximum system pressure**
The maximum pressure that can be applied inside the pipelines (line pressure).

   *The pressure differential in the solenoid valve portion must be less than the maximum operating pressure differential.*

4. **Withstand pressure**
The pressure in which the valve must be withstood without a drop in performance after holding for one minute under prescribed (static) pressure and returning to the operating pressure range. [value under the prescribed conditions]

Others

1. **Material**
   - NBR: Nitrile rubber
   - FKM: Fluoro rubber – Trade names: Viton®, Dai-el®, etc.

2. **Oil-free treatment**
The degreasing and washing of wetted parts

3. **Passage symbol**
   In the JIS symbol (            ) IN and OUT are in a blocked condition ( ), but actually in the case of reverse pressure (OUT> IN), there is a limit to the blocking. ( ) is used to indicate that blocking of reverse pressure is not possible.

Faston Terminal

1. **Faston™** is a trademark of Tyco Electronics Corp.

2. For electrical connection of the Faston terminal and molded coil, please use Tyco’s “Amp/Faston connector/250 Series” or the equivalent.

Electrical Terminology

1. **Surge voltage**
   A high voltage which is momentarily generated by shutting off the power in the shut-off area.

2. **Enclosure**
   A degree of protection defined in the “JIS C 0920: Waterproof test of electric machinery/appliance and the degree of protection against the intrusion of solid foreign objects”.

   Verify the degree of protection for each product.

   ![IP symbol]

   - **First Characteristics:**
     Degrees of protection against solid foreign objects

     |   | First characteristic numeral | Second characteristic numeral |
     |---|-------------------------------|-------------------------------|
     | 0 | Non-protected                 |                               |
     | 1 | Protected against solid foreign objects of 50 mme and greater |
     | 2 | Protected against solid foreign objects of 12 mmø and greater |
     | 3 | Protected against solid foreign objects of 2.5 mmø and greater |
     | 4 | Protected against solid foreign objects of 1.0 mmø and greater |
     | 5 | Dust-protected                |
     | 6 | Dusttight                     |

   - **Second Characteristics:**
     Degrees of protection against water

     |   | First characteristic numeral | Second characteristic numeral |
     |---|-------------------------------|-------------------------------|
     | 0 | Non-protected                 |                               |
     | 1 | Protected against vertically falling water drops | Dripproof type 1 |
     | 2 | Protected against vertically falling water drops when enclosure tilted up to 15° | Dripproof type 2 |
     | 3 | Protected against rainfall when enclosure tilted up to 60° | Rainproof type |
     | 4 | Protected against splashing water | Splashproof type |
     | 5 | Protected against water jets | Low jetproof type |
     | 6 | Protected against powerful water jets | Strong jetproof type |
     | 7 | Protected against the effects of temporary immersion in water | Immersible type |
     | 8 | Protected against the effects of continuous immersion in water | Submersible type |

Example) IP65: Dusttight, Low jetproof type

“Low jetproof type” means that no water intrudes inside an equipment that could hinder from operating normally by means of applying water for 3 minutes in the prescribed manner. Take appropriate protection measures, since a device is not usable in an environment where a droplet of water is splashed constantly.
1. Indication of flow-rate characteristics

The flow-rate characteristics in equipment such as a solenoid valve, etc. are indicated in their specifications as shown in Table (1).

### Table (1) Indication of Flow-rate Characteristics

<table>
<thead>
<tr>
<th>Corresponding equipment</th>
<th>Indication by international standard</th>
<th>Other indications</th>
<th>Conformed standard</th>
</tr>
</thead>
</table>
| Pneumatic equipment              | \(C, b\)                             |                         | ISO 6358: 1989  
|                                  |                                       |                         | JIS B 8390: 2000                   |
| Process fluid control equipment  | \(A_v\)                              |                         | IEC60534-2-3: 1997  
|                                  |                                       |                         | JIS B 2005: 1995                   |
|                                  | \(C_v\)                              |                         | ANSI/(NFPA)T3.21.3: 1990           |

2. Pneumatic equipment

2.1 Indication according to the international standards

(1) Conformed standard

- **ISO 6358: 1989**: Pneumatic fluid power—Components using compressible fluids—Determination of flow-rate characteristics
- **JIS B 8390: 2000**: Pneumatic fluid power—Components using compressible fluids—How to test flow-rate characteristics

(2) Definition of flow-rate characteristics

- **Sonic conductance \(C\)**: Value which divides the passing mass flow rate of an equipment in a choked flow condition by the product of the upstream absolute pressure and the density in a standard condition.
- **Critical pressure ratio \(b\)**: Pressure ratio (downstream pressure/upstream pressure) which will turn to a choked flow when the value is smaller than this ratio.
- **Choked flow**: The flow in which the upstream pressure is higher than the downstream pressure and where sonic speed in a certain part of an equipment is reached.
- **Gaseous mass flow rate is in proportion to the upstream pressure and not dependent on the downstream pressure.**
- **Subsonic flow**: Flow greater than the critical pressure ratio
- **Standard condition**: Air in a temperature state of 20°C, absolute pressure 0.1 MPa (= 100 kPa = 1 bar), relative humidity 65%.
- It is stipulated by adding the “(ANR)” after the unit depicting air volume. (standard reference atmosphere)

(3) Formula for flow rate

Described by the practical units as following.

When \( \frac{P_2 + 0.1}{P_1 + 0.1} \leq b \), choked flow

\[
Q = 600 \times C \left( \frac{P_1 + 0.1}{P_1 + 0.1} \right) \left( \frac{293}{273 + t} \right) \quad (1)
\]

When \( \frac{P_2 + 0.1}{P_1 + 0.1} > b \), subsonic flow

\[
Q = 600 \times C \left( \frac{P_1 + 0.1}{P_1 + 0.1} \right) \left( 1 - \frac{\frac{P_2 + 0.1}{P_1 + 0.1} - b}{1 - b} \right)^2 \left( \frac{293}{273 + t} \right) \quad (2)
\]

\(Q\): Air flow rate [dm³/min (ANR)], dm³ (Cubic decimeter) of SI unit are allowed to be described by L (liter).

1 dm³ = 1 L
**Series VX21/22/23**  
**Solenoid Valve Flow-rate Characteristics 2**  
*(How to indicate flow-rate characteristics)*

\[ C : \text{Sonic conductance [dm}^3/(s\cdot\text{bar})] \]
\[ b : \text{Critical pressure ratio [-]} \]
\[ P_1 : \text{Upstream pressure [MPa]} \]
\[ P_2 : \text{Downstream pressure [MPa]} \]
\[ t : \text{Temperature [}^\circ\text{C]} \]

**Note**  
Formula of subsonic flow is the elliptic analogous curve.

Flow-rate characteristics are shown in Graph (1). For details, please make use of SMC’s “Energy Saving Program”.

**Example**  
Obtain the air flow rate for \( P_1 = 0.4 \) [MPa], \( P_2 = 0.3 \) [MPa], \( t = 20 \) [\(^{\circ}\text{C}\)] when a solenoid valve is performed in \( C = 2 \) [dm\(^3\)/(s\cdot\text{bar})] and \( b = 0.3 \).

According to formula (1), the maximum flow rate = \( 600 \times 2 \times (0.4 + 0.1) \times \sqrt{\frac{293}{273 + 20}} = 600 \) [dm\(^3\)/min (ANR)]

\[ \text{Pressure ratio} = \frac{0.3 + 0.1}{0.4 + 0.1} = 0.8 \]

Based on Graph (1), the flow rate ratio will be 0.7 when the pressure ratio is 0.8 and \( b = 0.3 \). Therefore, flow rate = Maximum flow rate \times flow rate ratio = 600 \times 0.7 = 420 \) [dm\(^3\)/min (ANR)]

(4) Test method  
Attach a test equipment with the test circuit shown in Fig. (1) while maintaining the upstream pressure to a certain level which does not go below 0.3 MPa. Next, measure the maximum flow to be saturated in the first place, then measure this flow rate at 80%, 60%, 40%, 20% and the upstream and downstream pressure. And then, obtain the sonic conductance \( C \) from this maximum flow rate. Besides that, substitute each data of others for the subsonic flow formula to find \( b \), then obtain the critical pressure ratio \( b \) from that average.

---

**Graph (1) Flow-rate characteristics**

**Fig. (1) Test circuit based on ISO 6358, JIS B 8390**

---

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2.2 Effective area $S$

(1) Conformed standard

- JIS B 8390: 2000: Pneumatic fluid power—Components using compressible fluids—How to test flow-rate characteristics
- Equipment standards: JIS B 8373: 2 port solenoid valve for pneumatics
- JIS B 8374: 3 port solenoid valve for pneumatics
- JIS B 8375: 4 port, 5 port solenoid valve for pneumatics
- JIS B 8379: Silencer for pneumatics
- JIS B 8381: Fittings of flexible joint for pneumatics

(2) Definition of flow-rate characteristics

Effective area $S$: The cross-sectional area having an ideal throttle without friction or without reduced flow. It is deduced from the calculation of the pressure changes inside an air tank when discharging the compressed air in a choked flow, from an equipment attached to the air tank. This is the same concept representing the “easy to run through” as sonic conductance $C$.

(3) Formula for flow rate

When $\frac{P_2 + 0.1}{P_1 + 0.1} \leq 0.5$, choked flow

$$Q = 120 \times S \left( \frac{P_1 + 0.1}{293} \right)^{\frac{293}{273 + t}}$$

When $\frac{P_2 + 0.1}{P_1 + 0.1} > 0.5$, subsonic flow

$$Q = 240 \times S \sqrt{\left( \frac{P_2 + 0.1}{P_1 + 0.1} \right) \left( P_1 - P_2 \right)} \left( \frac{293}{273 + t} \right)$$

Conversion with sonic conductance $C$:

$$S = 5.0 \times C$$

$Q$: Air flow rate [dm$^3$/min(ANR)], dm$^3$ (cubic decimeter) of SI unit are allowed to be described by L (liter).

1 dm$^3$ = 1 L

$S$: Effective area [mm$^2$]

$P_1$: Upstream pressure [MPa]

$P_2$: Downstream pressure [MPa]

$t$: Temperature [°C]

Note) Formula for subsonic flow (4) is only applicable when the critical pressure ratio $b$ is unknown for equipment. In the formula (2) by the sonic conductance $C$, it is the same formula as when $b = 0.5$.

(4) Test method

Attach a test equipment with the test circuit shown in Fig. (2) in order to discharge air into the atmosphere until the pressure inside the air tank goes down to 0.25 MPa (0.2 MPa) from an air tank filled with the compressed air at a certain pressure level (0.5 MPa) which does not go below 0.6 MPa. At this time, measure the discharging time and the residual pressure inside the air tank which had been left until it turned to be the normal values to determine the effective area $S$, using the following formula. The volume of an air tank should be selected within the specified range by corresponding to the effective area of an equipment for test. In the case of JIS B 8373, 8374, 8375, 8379, 8381, the pressure values are in parentheses and the coefficient of the formula is 12.9.

$$S = 12.1 \frac{V}{t} \log_{10} \left( \frac{P_s + 0.1}{P + 0.1} \right) \left( \frac{293}{T} \right)$$

$S$: Effective area [mm$^2$]

$V$: Air tank capacity [dm$^3$]

$t$: Discharging time [s]

$P_s$: Pressure inside air tank before discharging [MPa]

$P$: Residual pressure inside air tank after discharging [MPa]

$T$: Temperature inside air tank before discharging [K]

Fig. (2) Test circuit based on JIS B 8390
2.3 Flow coefficient \( C_v \) factor

The United States Standard ANSI/(NFPA)T3.21.3: 1990: Pneumatic fluid power—Flow rating test procedure and reporting method for fixed orifice components defines the flow coefficient, \( C_v \) factor by the following formula which is based on the test conducted by the test circuit analogous to ISO 6358.

\[
C_v = \frac{Q}{114.5 \sqrt{\frac{\Delta P (P_2 + P_a)}{T_1}}} \tag{7}
\]

\( \Delta P \): Pressure drop between the static pressure tapping ports [bar]
\( P_1 \): Pressure of the upstream tapping port [bar gauge]
\( P_2 \): Pressure of the downstream tapping port [bar gauge]: \( P_2 = P_1 - \Delta P \)
\( Q \): Flow rate [dm\(^3\)/s standard condition]
\( P_a \): Atmospheric pressure [bar absolute]
\( T_1 \): Upstream absolute temperature [K]

Test conditions are \( P_1 + P_a = 6.5 \pm 0.2 \) bar absolute, \( T_1 = 297 \pm 5 \) K, 0.07 bar \( \leq \Delta P \leq 0.14 \) bar.

This is the same concept as effective area \( A \) which ISO 6358 stipulates as being applicable only when the pressure drop is smaller than the upstream pressure and the compression of air does not become a problem.

3. Process fluid control equipment

(1) Conformed standard


JIS B 2005: 1995: How to test flow coefficient of a valve

Equipment standards:
- JIS B 8471: Solenoid valve for water
- JIS B 8472: Solenoid valve for steam
- JIS B 8473: Solenoid valve for fuel oil

(2) Definition of flow-rate characteristics

\( A_v \) factor: Value of the clean water flow rate represented by m\(^3\)/s which runs through a valve (equipment for test) when the pressure differential is 1 Pa. It is calculated using the following formula.

\[
A_v = Q \sqrt{\frac{\rho}{\Delta P}} \tag{8}
\]

\( A_v \): Flow coefficient [m\(^2\)]
\( Q \): Flow rate [m\(^3\)/s]
\( \Delta P \): Pressure differential [Pa]
\( \rho \): Fluid density [kg/m\(^3\)]

(3) Formula for flow rate

Described by the practical units. Also, the flow-rate characteristics are shown in Graph (2).

In the case of liquid:

\[
Q = 1.9 \times 10^6 A_v \sqrt{\frac{\Delta P}{G}} \tag{9}
\]

\( Q \): Flow rate [L/min]
\( A_v \): Flow coefficient [m\(^2\)]
\( \Delta P \): Pressure differential [MPa]
\( G \): Specific gravity [water = 1]

In the case of saturated steam:

\[
Q = 8.3 \times 10^5 A_v \sqrt{\frac{\Delta P (P_2 + 0.1)}{P_1}} \tag{10}
\]

\( Q \): Flow rate [kg/h]
\( A_v \): Flow coefficient [m\(^2\)]
\( \Delta P \): Pressure differential [MPa]
\( P_1 \): Upstream pressure [MPa]: \( \Delta P = P_1 - P_2 \)
\( P_2 \): Downstream pressure [MPa]
Conversion of flow coefficient:
\[ \text{Av} = 28 \times 10^{-6} \quad \text{Kv} = 24 \times 10^{-6} \quad \text{Cv} \]  

Here,  
\( \text{Kv} \) factor : Value of the clean water flow rate represented by m³/h which runs through a valve at 5 to 40°C, when the pressure differential is 1 bar.

\( \text{Cv} \) factor (Reference values): Value of the clean water flow rate represented by US gal/min which runs through a valve at 60°F, when the pressure differential is 1 lbf/in² (psi).

Value is different from \( \text{Kv} \) and \( \text{Cv} \) factors for pneumatic purpose due to different test method.

Example 1)
Obtain the pressure differential when water 15 [L/min] runs through a solenoid valve with an \( \text{Av} = 45 \times 10^{-6} \) [m²]. Since \( Q_0 = 15/45 = 0.33 \) [L/min], according to Graph (2), if reading \( \Delta P \) when \( Q_0 \) is 0.33, it will be 0.031 [MPa].

Example 2)
Obtain the saturated steam flow rate when \( P_1 = 0.8 \) [MPa], \( \Delta P = 0.008 \) [MPa] with a solenoid valve with an \( \text{Av} = 1.5 \times 10^{-6} \) [m²].

According to Graph (2), if reading \( Q_0 \) when \( P_1 \) is 0.8 and \( \Delta P \) is 0.008, it is 0.7 [kg/h]. Therefore, the flow rate \( Q = 0.7 \times 1.5 = 1.05 \) [kg/h].

(4) Test method
Attach a test equipment with the test circuit shown in Fig. (3). Next, pour water at 5 to 40°C, then measure the flow rate with a pressure differential of 0.075 MPa. However, the pressure differential needs to be set with a large enough difference so that the Reynolds number does not go below a range of 4 x 10⁴.

By substituting the measurement results for formula (8) to figure out \( \text{Av} \).
### For Air

**Series VX21/22/23**

**Flow-rate Characteristics**

Note: Use this graph as a guide. In the case of obtaining an accurate flow rate, refer to pages 17 through to 21.

**How to read the graph**

The sonic range pressure to generate a flow rate of 400 L/min (ANR) is

$P_1 = 0.2$ MPa for a ø4 orifice and $P_1 = 0.58$ MPa for a ø3 orifice.

### For Water

**How to read the graph**

When a water flow of 2 L/min is generated, $\Delta P = 0.013$ MPa for a valve with ø3 orifice.
### Design

**Warning**

1. **Cannot be used as an emergency shutoff valve, etc.**
   The valves presented in this catalog are not designed for safety applications such as an emergency shutoff valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

2. **Extended periods of continuous energization**
   The solenoid coil will generate heat when continuously energized. Avoid using in a tightly shut container. Install it in a well-ventilated area. Furthermore, do not touch it while it is being energized or right after it is energized.

3. **Liquid rings**
   In cases with a flowing liquid, provide a bypass valve in the system to prevent the liquid from entering the liquid seal circuit.

4. **Actuator drive**
   When an actuator, such as a cylinder, is to be driven using a valve, take appropriate measures to prevent potential danger caused by actuator operation.

5. **Pressure (including vacuum) holding**
   It is not usable for an application such as holding the pressure (including vacuum) inside of a pressure vessel because air leakage is entailed in a valve.

6. **When the conduit type is used as equivalent to an IP65 enclosure, install a wiring conduit, etc.**

7. **When an impact, such as water hammer, etc., caused by the rapid pressure fluctuation is applied, the solenoid valve may be damaged. Give an attention to it.**

### Selection

**Warning**

1. **Fluid**
   - **Type of fluid**
     Before using a fluid, check whether it is compatible with the materials of each model by referring to the fluids listed in this catalog. Use a fluid with a kinematic viscosity of 50 mm²/s or less. If there is something you do not know, please contact SMC.
   - **Flammable oil, Gas**
     Confirm the specification for leakage in the interior and/or exterior area.
   - **Corrosive gas**
     Cannot be used since it will lead to cracks by stress corrosion or result in other incidents.
   - **Depending on water quality, a brass body can cause corrosion and internal leakage may occur. If such abnormalities occur, exchange the product for a stainless steel body.**
   - **Use an oil-free specification when any oily particle must not enter the passage.**
   - **Applicable fluid on the list may not be used depending on the operating condition. Give adequate confirmation, and then determine a model, just because the compatibility list shows the general case.**

2. **Fluid quality**
   - **The use of a fluid that contains foreign objects can cause problems such as malfunction and seal failure by promoting wear of the valve seat and armature, and by sticking to the sliding parts of the armature, etc. Install a suitable filter (strainer) immediately upstream from the valve. As a general rule, use 80 to 100 mesh.**
   - **When using tap water, since substances such as calcium and magnesium which generate hard scale and sludge are included and can cause the valve to malfunction, install water softening equipment and a filter (strainer) right before the valve to remove these substances.**

3. **Air quality**
   - **1) Use clean air.**
     Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction.
   - **2) Install an air filter.**
     Install an air filter close to the valve on the upstream side. A filtration degree of 5 µm or less should be selected.
   - **3) Install an aftercooler or air dryer, etc.**
     Compressed air that contains excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an aftercooler or air dryer, etc.
   - **4) If excessive carbon powder is generated, eliminate it by installing a mist separator on the upstream side of valves.**
     If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.
     Refer to Best Pneumatics No.5 for further details on compressed air quality.

4. **Ambient environment**
   Use within the operable ambient temperature range. Check the compatibility between the product’s composition materials and the ambient atmosphere. Be certain that the fluid used does not touch the external surface of the product.

5. **Countermeasures against static electricity**
   Take measures to prevent static electricity since some fluids can cause static electricity.

6. **Low temperature operation**
   - **1) The valve can be used in an ambient temperature of between –10 to –20°C. However, take measures to prevent freezing or solidification of impurities, etc.**
   - **2) When using valves for water application in cold climates, take appropriate countermeasures to prevent the water from freezing in tubing after cutting the water supply from the pump, by draining the water, etc. When warming by a heater, etc., be careful not to expose the coil portion to a heater.**
     Installation of a dryer, heat retaining of the body is recommended to prevent a freezing condition in which the dew point temperature is high and the ambient temperature is low, and the high flow runs.  

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### Selection

#### ! Warning

**7. Fluid quality**

- **Water**
  
  The use of a fluid that contains foreign objects can cause problems such as malfunction and seal failure by promoting wear of the valve seat and armature, and by sticking to the sliding parts of the armature, etc. Install a suitable filter (strainer) immediately upstream from the valve. As a general rule, use 50 to 100 mesh.

  When using tap water, since substances such as calcium and magnesium which generate hard scale and sludge are included and can cause the valve to malfunction, install water softening equipment and a filter (strainer) right before the valve to remove these substances.

- **Air**
  
  Use ordinary compressed air where a filter of 5 µm or less is provided on the inlet side piping. (Except dry air)

- **Oil**
  
  Generally, FKM is used as seal material, as it is resistant to oil. The resistance of the sealing material may deteriorate depending on the type of oil, manufacturer, or additives. Check the resistance before using.

#### ! Caution

**1. Leakage voltage**

  Particularly when using a resistor in parallel with a switching element and using a C-R element (surge voltage suppressor) to protect the switching element, take note that leakage current will flow through the resistor, C-R element, etc., creating a possible danger that the valve may not turn off.

**2. Selecting model**

  Material depends on fluid. Select optimal models for the fluid.

**3. When the fluid is oil.**

  The kinematic viscosity must not exceed 50 mm²/s.

### Mounting

#### ! Warning

**3. Mount a valve with its coil position upwards, not downwards.**

When mounting a valve with its coil positioned downwards, foreign objects in the fluid will adhere to the iron core leading to a malfunction. Especially for strict leakage control, such as with vacuum applications and non-leak specifications, the coil must be positioned upwards.

**4. Do not warm the coil assembly with a heat insulator, etc.**

Use tape, heaters, etc., for freeze prevention on the piping and body only. They can cause the coil to burn out.

**5. Secure with brackets, except in the case of steel piping and copper fittings.**

**6. Avoid sources of vibration, or adjust the arm from the body to the minimum length so that resonance will not occur.**

**7. Painting and coating**

  Warnings or specifications printed or labeled on the product should not be erased, removed or covered up.

### Piping

#### ! Warning

**1. During use, deterioration of the tube or damage to the fittings could cause tubes to come loose from their fittings and thrash about.**

To prevent uncontrolled tube movement, install protective covers or fasten tubes securely in place.

**2. For piping the tube, fix the product securely using the mounting holes so that the product is not in the air.**

#### ! Caution

**1. Preparation before piping**

  Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

  Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.

**2. Avoid connecting ground lines to piping, as this may cause electric corrosion of the system.**

**3. Tighten threads with the proper tightening torque.**

  When attaching fittings to valves, tighten with the proper tightening torque shown below.

** Tightening Torque for Piping **

<table>
<thead>
<tr>
<th>Connection thread</th>
<th>Proper tightening torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rc1/8</td>
<td>7 to 9</td>
</tr>
<tr>
<td>Rc1/4</td>
<td>12 to 14</td>
</tr>
<tr>
<td>Rc3/8</td>
<td>22 to 24</td>
</tr>
<tr>
<td>Rc1/2</td>
<td>28 to 30</td>
</tr>
</tbody>
</table>

**4. Connection of piping to products**

  When connecting piping to a product, refer to its operation manual to avoid mistakes regarding the supply port, etc.

**5. In applications such as vacuum and non-leak specifications, use caution specifically against the contamination of foreign objects or airtightness of the fittings.**
**Series VX21/22/23**

**Specific Product Precautions 3**

Be sure to read before handling.

Refer to back cover for Safety Instructions, “Handling Precautions for SMC Products” (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website. http://www.smcworld.com

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### Operating Environment

**Warning**

1. Do not use in an atmosphere having corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.
2. Do not use in explosive atmospheres.
3. Do not use in locations subject to vibration or impact.
4. Do not use in locations where radiated heat will be received from nearby heat sources.
5. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

### Maintenance

**Warning**

1. Removing the product
   - The valve will reach a high temperature when used with high temperature fluids. Confirm that the valve temperature has dropped sufficiently before performing work. If touched inadvertently, there is a danger of being burned.
     1) Shut off the fluid supply and release the fluid pressure in the system.
     2) Shut off the power supply.
     3) Remove the product.

2. Low frequency operation
   - Switch valves at least once every 30 days to prevent malfunction. Also, in order to use it under the optimum state, conduct a regular inspection once a half year.

**Caution**

1. Filters and strainers
   - 1) Be careful regarding clogging of filters and strainers.
   - 2) Replace filter elements after one year of use, or earlier if the pressure drop reaches 0.1 MPa.
   - 3) Clean strainers when the pressure drop reaches 0.1 MPa.

2. Lubrication
   - When using after lubricating, never forget to lubricate continuously.

3. Storage
   - In case of long term storage after use with heated water, thoroughly remove all moisture to prevent rust and deterioration of rubber materials, etc.

4. Exhaust the drainage from an air filter periodically.

---

### Operating Precautions

**Warning**

1. If there is a possibility of reverse pressure being applied to the valve, take countermeasures such as mounting a check valve on the downstream side of the valve.
2. When problems are caused by a water hammer, install water hammer relief equipment (accumulator, etc.), or use an SMC water hammer relief valve (Series VXR). For details, please consult with SMC.

---

### Recommended Piping Conditions

1. When connecting tubes using one-touch fittings, provide some spare tube length shown in Fig. 1, recommended piping configuration.
   - Also, do not apply external force to the fittings when binding tubes with bands, etc. (see Fig. 2.)

**Fig. 1 Recommended piping configuration**

<table>
<thead>
<tr>
<th>Tube size</th>
<th>Mounting pitch A</th>
<th>Straight portion length</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø1/8&quot;</td>
<td>44 or more</td>
<td>16 or more</td>
</tr>
<tr>
<td>ø6</td>
<td>29 or more</td>
<td>30 or more</td>
</tr>
<tr>
<td>ø1/4&quot;</td>
<td>56 or more</td>
<td>32 or more</td>
</tr>
<tr>
<td>ø8</td>
<td>58 or more</td>
<td>40 or more</td>
</tr>
<tr>
<td>ø10</td>
<td>70 or more</td>
<td>50 or more</td>
</tr>
<tr>
<td>ø12</td>
<td>82 or more</td>
<td>60 or more</td>
</tr>
</tbody>
</table>

**Fig. 2 Binding tubes with bands**

---

### Wiring

**Caution**

1. As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25 mm² for wiring.
   - Furthermore, do not allow excessive force to be applied to the lines.
2. Use electrical circuits which do not generate chattering in their contacts.
3. Use voltage which is within ±10% of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within ±5% of the rated value. The voltage drop is the value in the lead wire section connecting the coil.
4. When a surge from the solenoid affects the electrical circuitry, install a surge voltage suppressor, etc., in parallel with the solenoid. Or, adopt an option that comes with the surge voltage protection circuit. (However, a surge voltage occurs even if the surge voltage protection circuit is used. For details, please consult with SMC.)

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## Electrical Connections

### Caution

#### Grommet

Class B coil: AWG20  Outside insulator diameter of 2.5 mm

#### DIN terminal

Since internal connections are shown below for the DIN terminal, make connections to the power supply accordingly.

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN terminal</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

* There is no polarity.
  - Use a heavy-duty cord with an outside cable diameter of ø6 to 12 mm.
  - Use the tightening torques below for each section.

#### Conduit terminal

In the case of the conduit terminal, make connections according to the marks shown below.

- Use the tightening torques below for each section.
- Properly seal the terminal connection (G1/2) with the special wiring conduit, etc.

![Conduit terminal diagram](image)

### Conduit

When used as an IP65 equivalent, use seal to install the wiring conduit. Also, use the tightening torque below for the conduit.

Class B coil: AWG20  Outside insulator diameter of 2.5 mm

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Lead wire color</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Black</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>100 VAC</td>
<td>Blue</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>200 VAC</td>
<td>Red</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Other AC</td>
<td>Gray</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

* There is no polarity.
  - (There is polarity for power-saving type.)

Note) Please order separately.

### Note

- For an outside cable diameter of ø9 to 12 mm, remove the internal parts of the rubber seal before using.
Specific Product Precautions 5

Be sure to read before handling.
Refer to back cover for Safety Instructions, “Handling Precautions for SMC Products” (M-E03-3) and the Operation Manual for 2 Port Solenoid Valves for Fluid Control Precautions. Please download it via our website. http://www.smcworld.com

Electrical Circuits

⚠️ Caution

[DC circuit]

Grommet, Faston terminal

Without electrical option

Grommet, DIN terminal, Conduit terminal

With surge voltage suppressor

DIN terminal, Conduit terminal

With light/surge voltage suppressor

[AC circuit]

* For AC (Class B), the standard product is equipped with surge voltage suppressor.

Grommet, DIN terminal, Conduit terminal

Without electrical option

DIN terminal, Conduit terminal

With light

One-touch Fitting

⚠️ Caution

For information on handling one-touch fittings and appropriate tubing, refer to page 25 and the KQ2 series one-touch fittings in Best Pneumatics No. 6. The KQ2 series information can be downloaded from the following SMC website, http://www.smcworld.com
## Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of **“Caution,” “Warning”** or **“Danger.”** They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

<table>
<thead>
<tr>
<th>Caution:</th>
<th>Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning</td>
<td>Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>Danger</td>
<td>Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.</td>
</tr>
</tbody>
</table>

### Warning

1. **The product is provided for use in manufacturing industries.**
   - The product herein described is basically provided for peaceful use in manufacturing industries. If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
   - If anything is unclear, contact your nearest sales branch.

#### Limited warranty and Disclaimer

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements.”

#### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

---

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*1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines.
(Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots - Safety.

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Caution:

- **Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
- **Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
- **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

### Warning

1. **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
   - Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. **Only personnel with appropriate training should operate machinery and equipment.**
   - The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. **Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
   1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
   2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
   3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
   1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
   2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
   3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
   4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

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**Safety Instructions**: Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

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The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements.”

#### Compliance Requirements

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.\(^\text{2}\) Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   - This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.
   -\(^\text{2}\) Vacuum pads are excluded from this 1 year warranty.
   - A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

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Caution:

1. **Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

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