Soft Start-up Valve

Series AV2000/3000/4000/5000

Start-up valve for low speed air supply to gradually raise initial pressure in an air system and for quick exhaust by cutting off air supply.

**Large effective area (mm²)**
- AV2000/ 20 (Body size: 1/4)
- AV3000/ 37 (Body size: 3/8)
- AV4000/ 61 (Body size: 1/2)
- AV5000/ 113 (Body size: 3/4)
- AV5000/ 122 (Body size: 1)

**With supply/exhaust function by manual operation**

**Low power consumption**

**Connectable with modular type**

**F.R.L. combination unit**

Combination with F.R.L. unit

- AV2000
- AV3000
- AV4000
- AV5000
- AV5000 (Except AC40-06)
# Soft Start-up Valve

## AV2000/3000/4000/5000

### How to Order

<table>
<thead>
<tr>
<th>AV</th>
<th>20</th>
<th>00</th>
<th>02</th>
<th>1G</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft start-up valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Body size**

- 20: 1/4
- 30: 3/8
- 40: 1/2
- 50: 3/4

**Thread type**

- Nil
- N
- F
- Rc
- G
- NPT

**Port size**

- 02: 1/4 (AV2000 only)
- 03: 3/8 (AV3000 only)
- 04: 1/2 (AV4000 only)
- 06: 3/4 (AV5000 only)
- 10: 1 (AV5000 only)

**Flow direction**

- Nil: Left to right
- R: Right to left

**Manual override**

- Nil: Non-locking push type (Flush)
- B: Locking type (Tool required)
- C: Locking type (Lever)

**Light/Surge voltage suppressor**

- Nil: None
- S: With surge voltage suppressor (Grommet type only)
- Z: With light/surge voltage suppressor (Not possible with grommet type)

**Electrical entry**

- G: Grommet
- D: Type D DIN terminal (With connector)
- Y: Type Y DIN terminal (With connector)
- DO: Type D DIN terminal (Without connector)
- YO: Type Y DIN terminal (Without connector)

### How to Order Pilot Valve Assembly

<table>
<thead>
<tr>
<th>SF4</th>
<th>1G</th>
<th>-</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft start-up valve</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rated coil voltage**

- 1: 100 VAC (50/60 Hz)
- 2: 200 VAC (50/60 Hz)
- 3: 220 VAC (50/60 Hz)
- 4: 220 VAC (50/60 Hz)
- 5: 24 VDC
- 6: 12 VDC
- 7: 240 VAC (50/60 Hz)
- 9: Other

**Flow direction**

- Nil: Left to right
- R: Right to left

**Manual override**

- Nil: Non-locking push type (Flush)
- B: Locking type (Tool required)
- C: Locking type (Lever)

**Light/Surge voltage suppressor**

- Nil: None
- S: With surge voltage suppressor (Grommet type only)
- Z: With light/surge voltage suppressor (Not possible with grommet type)

**Note**

- The grommet type can have a surge voltage suppressor (direct coupling type lead wire), but without indicator light.

### TÜV approved product

Series AV has received approval from TÜV Rheinland, an EC Notified Body (EC authorization number 0197), for conformity to DIN VDE0580:1994 Standards.

Please consult with SMC for details when ordering TÜV approved products because of restrictions regarding product model, voltage specification, and electrical entry, etc.
**Soft Start-up Valve Series AV2000/3000/4000/5000**

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>AV2000</th>
<th>AV3000</th>
<th>AV4000</th>
<th>AV5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port size</td>
<td>1/4</td>
<td>3/8</td>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>Proof pressure</td>
<td>1.5 MPa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating pressure range</td>
<td>0.2 to 1 MPa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure gauge port size</td>
<td>1/8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td>0 to 60°C (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective area (mm²)</td>
<td>1(P) 2(A) 20</td>
<td>37</td>
<td>61</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>2(A) 3(R) 24</td>
<td>49</td>
<td>76</td>
<td>132</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>0.27</td>
<td>0.48</td>
<td>0.74</td>
<td>1.60</td>
</tr>
<tr>
<td>Rated coil voltage</td>
<td>100, 200, 110 to 120, 220 VAC (50/60 Hz), 240 VAC (50/60 Hz)</td>
<td>12, 24 VDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable voltage fluctuation</td>
<td>–15 to +10% of rated voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil insulation type</td>
<td>Equivalent to B type (130°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparent power (Current consumption)</td>
<td>5.6 VA (50 Hz), 5.0 VA (60 Hz)</td>
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<td></td>
<td></td>
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<tr>
<td>Inrush Energized</td>
<td>3.4 VA (2.1 W)/50 Hz, 2.3 VA (1.5 W)/60 Hz</td>
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<td></td>
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<tr>
<td>Current consumption DC</td>
<td>1.8 W</td>
<td></td>
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<tr>
<td>Electrical entry</td>
<td>Grommet, Type D DIN terminal, Type Y DIN terminal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option specifications</td>
<td>Indicator light/Surge voltage suppressor (2)</td>
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<td></td>
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</tr>
<tr>
<td>Pilot valve manual override</td>
<td>Non-locking push type (Flush); Locking type (Tool required), Locking type (Lever)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note 1** Use dry air when operating at a low temperature.

**Note 2** The grommet type is equipped with a surge voltage suppressor (direct coupling type lead wire), but not an indicator light.

### Piston B Switching Pressure (Close → Open)

![Piston B Switching Pressure Graph](image)

### Needle Valve Flow Characteristics

![Needle Valve Flow Characteristics Graph](image)

### Accessory/Pressure Gauge

<table>
<thead>
<tr>
<th>Description</th>
<th>Pressure gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part no.</td>
<td>G36-10-01</td>
</tr>
<tr>
<td>Pressure range</td>
<td>1 MPa</td>
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</table>
Working Principle

<table>
<thead>
<tr>
<th>Working condition</th>
<th>Pilot valve</th>
<th>Pressure conditions</th>
<th>Working description</th>
<th>Pressure time chart (Meter-out control) example</th>
<th>Cylinder drive circuit (Meter-out control) example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low speed supply</td>
<td>ON</td>
<td>1/2 ( P_P &lt; P_A )</td>
<td>When pilot valve ① is turned ON by energization or manual override, the pilot air pushes piston A ③ and main valve ⑤ downward and opens main valve ⑪ while R port closes simultaneously. The air from P port moves to needle valve ⑨, where its flow is adjusted, and flows to A port. The meter-in control of needle valve ⑨ slowly moves the cylinder from ⑥ to ⑦.</td>
<td><img src="image" alt="Pressure time chart" /></td>
<td><img src="image" alt="Cylinder drive circuit" /></td>
</tr>
<tr>
<td>High speed supply</td>
<td>⑨</td>
<td>1/2 ( P_P \leq P_A )</td>
<td>When 1/2 ( P_P \leq P_A ) after the cylinder reaches ⑩, piston B ⑬ fully opens and ( P_A ) increases rapidly as shown from ⑨ to ⑪ and becomes the same pressure as ( P_P ).</td>
<td><img src="image" alt="Pressure time chart" /></td>
<td><img src="image" alt="Cylinder drive circuit" /></td>
</tr>
<tr>
<td>Normal operation</td>
<td>⑨</td>
<td>1/2 ( P_P \leq P_A )</td>
<td>Since piston B ⑬ holds the fully open condition, during normal operation the cylinder's speed will be controlled by the usual meter-out control.</td>
<td><img src="image" alt="Pressure time chart" /></td>
<td><img src="image" alt="Cylinder drive circuit" /></td>
</tr>
<tr>
<td>Quick exhaust</td>
<td>OFF</td>
<td>—</td>
<td>When pilot valve ① is turned OFF, spring ⑨ pushes piston A ③ and main valve ⑤ upward and opens R port while shutting off the air supply from P port. The pressure difference generated at this time lets the check valve ⑩ open and the residual pressure on the A port side is quickly exhausted from R port.</td>
<td><img src="image" alt="Pressure time chart" /></td>
<td><img src="image" alt="Cylinder drive circuit" /></td>
</tr>
</tbody>
</table>
Soft Start-up Valve  
**Series AV2000/3000/4000/5000**

**Construction**

![Diagram of the Soft Start-up Valve Series AV2000/3000/4000/5000]

**Component Parts**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>Aluminum die-casted</td>
</tr>
<tr>
<td>2</td>
<td>Cap</td>
<td>Aluminum die-casted</td>
</tr>
<tr>
<td>3</td>
<td>Cover</td>
<td>Aluminum die-casted</td>
</tr>
</tbody>
</table>

**Replacement Parts**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Pilot valve assembly</td>
<td></td>
<td>SF4-C-80^1</td>
</tr>
<tr>
<td>5</td>
<td>Piston A assembly</td>
<td>POM, NBR</td>
<td>P424204A</td>
</tr>
<tr>
<td>6</td>
<td>Piston B assembly</td>
<td>Brass, NBR (HNBR)</td>
<td>P424205A</td>
</tr>
<tr>
<td>7</td>
<td>Main valve assembly</td>
<td>Brass, NBR (HNBR)</td>
<td>P424206A</td>
</tr>
<tr>
<td>8</td>
<td>Check valve</td>
<td>Brass, NBR (HNBR)</td>
<td>P424207</td>
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<tr>
<td>9</td>
<td>Piston guide assembly</td>
<td>POM, NBR</td>
<td>P424208A</td>
</tr>
<tr>
<td>10</td>
<td>Needle assembly</td>
<td>Brass, NBR</td>
<td>P424209A</td>
</tr>
<tr>
<td>11</td>
<td>Valve spring</td>
<td>Steel wire</td>
<td>P424211</td>
</tr>
<tr>
<td>12</td>
<td>Piston spring</td>
<td>Stainless steel</td>
<td>P424212</td>
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<tr>
<td>13</td>
<td>Check spring</td>
<td>Stainless steel</td>
<td>P424213</td>
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<tr>
<td>14</td>
<td>Needle spring</td>
<td>Steel wire</td>
<td>P424214</td>
</tr>
<tr>
<td>15</td>
<td>Type C retaining ring for shaft</td>
<td>Tool steel</td>
<td>SF4-C-L50132-80</td>
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<tr>
<td>16</td>
<td>Type C retaining ring for hole</td>
<td>Tool steel</td>
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<td>17</td>
<td>Seal</td>
<td>NBR</td>
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<tr>
<td>18</td>
<td>O-ring</td>
<td>NBR</td>
<td>10 x 8 x 1</td>
</tr>
</tbody>
</table>

AV2000  | AV3000  | AV4000  | AV5000  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P424204A</td>
<td>P424304A</td>
<td>P424404A</td>
<td>P424504A</td>
</tr>
<tr>
<td>P424205A</td>
<td>P424305A</td>
<td>P424405A</td>
<td>P424505A</td>
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<td>P424408A</td>
<td>P424508A</td>
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<td>P424409A</td>
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<td>P424411</td>
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<td>P424312</td>
<td>P424412</td>
<td>P424512</td>
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<td>P424313</td>
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<tr>
<td>G-5</td>
<td>STW-5</td>
<td>STW-8</td>
<td>STW-10</td>
</tr>
<tr>
<td>0-9</td>
<td>0-10</td>
<td>RTW-12</td>
<td>RTW-15</td>
</tr>
</tbody>
</table>

^1 For "How to Order" pilot valve assembly, refer to page 436.
## Series AV2000/3000/4000/5000

### Dimensions

**Grommet:** AV□□-□□□G, GS

**DIN terminal:** AV□□-□□□D, DZ

**DIN terminal for European use:** AV□□-□□□Y, YZ

![Diagram of model AV2000 series]

300 mm (Lead wire length)

Manual override (Locking lever type)

Pressure gauge mounting bore 1/8

Port size

![Diagram of model AV3000 series]

Applicable cab tire cord D.O.: 06, 08

With light/surge voltage suppressor

Indicator light

Pressure gauge mounting bore 1/8

### Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Port size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
<th>Q</th>
<th>R</th>
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</thead>
<tbody>
<tr>
<td>AV2000-□□□□G</td>
<td>1/4</td>
<td>66</td>
<td>105</td>
<td>31</td>
<td>22</td>
<td>40</td>
<td>38</td>
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<td>47.5</td>
<td>—</td>
<td>—</td>
<td>93</td>
<td>20</td>
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<tr>
<td>AV2000-□□□□G</td>
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<td>125</td>
<td>31</td>
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<td>65.5</td>
<td>—</td>
<td>6</td>
<td>29</td>
<td>23.5</td>
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<tr>
<td>AV2000-□□□□D</td>
<td>1/4</td>
<td>66</td>
<td>125</td>
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<td>23.5</td>
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<tr>
<td>AV2000-□□□□D</td>
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<td>66</td>
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<td>23.5</td>
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<tr>
<td>AV2000-□□□□Y</td>
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<td>66</td>
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<tr>
<td>AV3000-□□□□G</td>
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<td>76</td>
<td>112</td>
<td>36</td>
<td>24</td>
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<td>43</td>
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<td>—</td>
<td>100</td>
<td>28</td>
<td>27.5</td>
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<td>76</td>
<td>112</td>
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<td>24</td>
<td>48</td>
<td>43</td>
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<td>50.5</td>
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<td>100</td>
<td>28</td>
<td>27.5</td>
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<tr>
<td>AV3000-□□□□D</td>
<td>3/8</td>
<td>76</td>
<td>132</td>
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<td>70.5</td>
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<td>3.5</td>
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<td>28</td>
<td>27.5</td>
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</tr>
<tr>
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<td>3/8</td>
<td>76</td>
<td>132</td>
<td>36</td>
<td>24</td>
<td>48</td>
<td>43</td>
<td>2</td>
<td>70.5</td>
<td>—</td>
<td>3.5</td>
<td>—</td>
<td>28</td>
<td>27.5</td>
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</tr>
<tr>
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<td>3/8</td>
<td>76</td>
<td>132</td>
<td>36</td>
<td>24</td>
<td>48</td>
<td>43</td>
<td>2</td>
<td>70.5</td>
<td>—</td>
<td>3.5</td>
<td>—</td>
<td>28</td>
<td>27.5</td>
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</tr>
<tr>
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<td>132</td>
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<td>3.5</td>
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<td>28</td>
<td>27.5</td>
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<td>47</td>
<td>32</td>
<td>52</td>
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<td>—</td>
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<td>37</td>
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<td>1</td>
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<tr>
<td>AV4000-□□□□G</td>
<td>1/2</td>
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<td>127</td>
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<td>32</td>
<td>52</td>
<td>57</td>
<td>3</td>
<td>62.5</td>
<td>—</td>
<td>—</td>
<td>115</td>
<td>42</td>
<td>37</td>
<td>M6</td>
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</tr>
<tr>
<td>AV4000-□□□□D</td>
<td>1/2</td>
<td>98</td>
<td>147</td>
<td>47</td>
<td>32</td>
<td>52</td>
<td>57</td>
<td>3</td>
<td>78.5</td>
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<td>95.5</td>
<td>6</td>
<td>42</td>
<td>37</td>
<td>M6</td>
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<tr>
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<td>42</td>
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<td>M6</td>
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<tr>
<td>AV4000-□□□□Y</td>
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<td>98</td>
<td>147</td>
<td>47</td>
<td>32</td>
<td>52</td>
<td>57</td>
<td>3</td>
<td>82.5</td>
<td>—</td>
<td>—</td>
<td>99.5</td>
<td>10.5</td>
<td>42</td>
<td>37</td>
<td>M6</td>
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<tr>
<td>AV4000-□□□□Y</td>
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<td>147</td>
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<td>99.5</td>
<td>10.5</td>
<td>42</td>
<td>37</td>
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</tr>
<tr>
<td>AV5000-□□□□G</td>
<td>3/4.1</td>
<td>128</td>
<td>155</td>
<td>59</td>
<td>39</td>
<td>74</td>
<td>77</td>
<td>7</td>
<td>0</td>
<td>74</td>
<td>—</td>
<td>—</td>
<td>143</td>
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<td>46</td>
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<tr>
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<td>128</td>
<td>155</td>
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<td>39</td>
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<tr>
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<td>M6</td>
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<tr>
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<td>111</td>
<td>50</td>
<td>46</td>
<td>M6</td>
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</tbody>
</table>
Soft Start-up Valve Series AV2000/3000/4000/5000

Connecting Spacer for Modular Style F.R.L. Unit

Select one of the spacers below when connecting to an F.R.L. combination unit (AC20 to AC60).
(Spacers must be ordered separately.)

![Spacer Diagram]

<table>
<thead>
<tr>
<th>Model</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y200</td>
<td>AV2000</td>
</tr>
<tr>
<td>Y300</td>
<td>AV3000</td>
</tr>
<tr>
<td>Y400</td>
<td>AV4000</td>
</tr>
<tr>
<td>Y600</td>
<td>AV5000</td>
</tr>
</tbody>
</table>

![Spacer with Bracket Diagram]

<table>
<thead>
<tr>
<th>Model</th>
<th>Applicable model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y200T</td>
<td>AV2000</td>
</tr>
<tr>
<td>Y300T</td>
<td>AV3000</td>
</tr>
<tr>
<td>Y400T</td>
<td>AV4000</td>
</tr>
<tr>
<td>Y600T</td>
<td>AV5000</td>
</tr>
</tbody>
</table>
Series AV2000/3000/4000/5000
Specific Product Precautions 1

Be sure to read before handling. Refer to front matters 42 and 43 for Safety Instructions and pages 287 to 291 for F.R.L. Precautions.

---

**Caution on Design**

**Warning**

1. Actuator drive
   When using solenoid valve or actuator in the outlet side of this product, implement appropriate measures to prevent potential danger caused by actuator operation.

2. Holding pressure
   Since the valve might have slight interal leakage, it is not suitable for holding pressure in a tank or another vessel for a long period of time.

3. Maintenance space
   Allow the sufficient space for maintenance and inspection.

**Selection**

**Warning**

1. Confirm the specifications.
   The products presented in this catalog are designed only for use in compressed air systems. Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to specifications.) Please contact SMC if using for other fluids than compressed air.

2. Extended periods of continuous energization
   Please contact SMC if valves will be continuously energized for extended periods of time.

3. Operation of closed center solenoid valves
   Even if this product is used for closed center solenoid valves or actuator with a load factor of more than 50%, jumping (stick-slip phenomenon) cannot be prevented.

4. Using a regulator in the outlet side
   When mounting a regulator in the outlet side (A port side), use a residual pressure relief regulator (AR25K to 40K) or a check type regulator. With a standard regulator (AR10 to 60), the outlet side pressure may not be released when this valve is exhausted.

5. Operation of solenoid valves in the outlet side
   To operate solenoid valves mounted on this product’s outlet side (A port side), first confirm that the outlet side’s pressure (PA) has increased to become equal to the inlet side’s pressure (PI).

6. Operation
   The residual pressure release function of this product is for emergency use only; therefore, avoid the operation in the same manner as ordinary 3 port valves.

7. Using a lubricator
   If mounting a lubricator, mount it on the inlet side (P port side), of this product. If mounted on the outlet side (A port side), back flow of oil will occur and may spurt out of the valve’s R port.

8. Operation for air blowing
   This product cannot be operated for air blowing due to the mechanism that switches the main valve to be fully open after the outlet side’s pressure increases to approximately 1/2 of the inlet side.

---

**Caution**

1. Voltage leakage
   Particularly when using a C-R element (surge voltage suppressor) for protection of the switching element, use caution that leakage voltage will increase due to leakage current flowing through the C-R element, etc.

AC coil is 20% or less of rated voltage.
DC coil is 3% or less of rated voltage.

2. Low temperature operation
   Although the valve can be operated at temperature as low as 0°C, measures should be taken to avoid solidifying or freezing drainage and moisture, etc.

**Warning**

1. If air leakage increases or equipment does not operate properly, stop operation.
   After mounting or maintenance, etc., connect the compressed air and power supplies, and perform appropriate function and leakage tests to confirm that the unit is mounted properly.

2. Instruction manual
   Mount and operate the product after reading the manual carefully and understanding its contents. Also keep the manual in a place where it can be referred to as necessary.

3. Painting and coating
   Warnings or specifications printed or labeled on a product should not be erased, removed or covered up. Furthermore, please contact SMC before painting the resin parts, as this may cause adverse effects depending on the solvent.

---

**Adjustment**

**Caution**

1. To perform the initial speed adjustment of a outlet side actuator, supply air from this valve’s inlet side and turn ON the pilot valve. Then, rotate the needle counterclockwise from the fully closed position.
**Series AV2000/3000/4000/5000**

**Specific Product Precautions 2**

Be sure to read before handling. Refer to front matters 42 and 43 for Safety Instructions and pages 287 to 291 for F.R.L. Precautions.

---

### Piping

**Caution**

1. **Preparation before piping**
   Before piping is connected, it should be thoroughly blown out by air (flushed) or washed to eliminate cutting chips, cutting oil, and other debris from the pipe inside.

2. **How to wrap a pipe tape**
   When connecting pipes and fittings, etc., ensure that cutting chips and sealing materials from the pipe threads should not get inside the valve. When a pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.

3. **Tighten threads with the proper tightening torque.**
   When screwing fittings into valves, tighten with the torques given below.

**Tightening Torque when Piping**

<table>
<thead>
<tr>
<th>Connection threads</th>
<th>Proper tightening torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rc 1/4</td>
<td>12 to 14</td>
</tr>
<tr>
<td>Rc 3/8</td>
<td>22 to 24</td>
</tr>
<tr>
<td>Rc 1/2</td>
<td>28 to 30</td>
</tr>
<tr>
<td>Rc 3/4</td>
<td>28 to 30</td>
</tr>
<tr>
<td>Rc 1</td>
<td>36 to 38</td>
</tr>
</tbody>
</table>

4. **Piping to products**
   When piping to products, avoid making an error of supply port, etc., by referring to the instruction manuals.

5. **F.R.L. module combination**
   When connecting to a modular F.R.L. combinations (AC20 to 60), select one of the spacers, which are included. (Refer to page 441 for details.) However, modular combinations with AC40-06 are not possible. Furthermore, connect soft start-up valves to the outlet side of the F.R.L. combination.

6. **Inlet side piping conditions**
   The nominal size of the piping material’s or equipment’s bore should be equal to or larger than the soft start-up valve’s port size. The composite effective area of the inlet side’s (P port side’s) piping or equipment should be equal to or larger than the values below.

<table>
<thead>
<tr>
<th>Model</th>
<th>Composite effective area (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV2000</td>
<td>5</td>
</tr>
<tr>
<td>AV3000</td>
<td>22</td>
</tr>
<tr>
<td>AV4000</td>
<td>35</td>
</tr>
<tr>
<td>AV5000</td>
<td>50</td>
</tr>
</tbody>
</table>

When the piping is restricted or the supply pressure is insufficient, the main valve will not switch and air leakage may occur from the R port.

---

### Light/Surge Voltage Suppressor

**Caution**

**Voltage**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>AC and 100 VDC</th>
<th>24 VDC or less</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal no. 1 (+)</td>
<td>ZNR</td>
<td>+</td>
</tr>
<tr>
<td>Terminal no. 2 (+)</td>
<td>ZNR</td>
<td>–</td>
</tr>
</tbody>
</table>

**Erection of the DIN terminal**

- **Terminal**
  - 1
  - 2
- **DIN terminal**
  - +
  - –

**Electrical Connection**

**Caution**

The internal connection of the DIN terminal is as shown below, connect to the power supply side as shown.

**Lubrication**

1. The valve has been lubricated for life at the factory, and does not require any further lubrication.

2. Use turbine oil Class 1, ISO VG32 (with no additives), if lubricated. Besides, if the lubrication is suspended halfway, the original lubricant will be lost and may result in a malfunction. Be sure to keep lubricating continuously.

Refer to the brand name table given below for lubricants by each company, conforming to turbine oil Class 1 (with no additives), ISO VG32.

**Turbine Oil Class 1 (With no additives), ISO VG32**

<table>
<thead>
<tr>
<th>Viscosity classification (cSt at 40°C)</th>
<th>ISO viscosity grade</th>
<th>ISO viscosity grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Idemitsu Kisan Co., Ltd.</td>
<td>Turbine oil P-32</td>
<td>Kyowa Oil Co.</td>
</tr>
<tr>
<td>Nippon Mitsubishi Oil Corp.</td>
<td>Turbine oil 32</td>
<td>Shima Oil Co.</td>
</tr>
<tr>
<td>Cosmo Oil Co., Ltd.</td>
<td>Cosmo turbine 32</td>
<td>Showa Shell Sekiyu K.K.</td>
</tr>
<tr>
<td>Japan Energy Corp.</td>
<td>Kyodo turbine 32</td>
<td>Tohokuseki K.K.</td>
</tr>
<tr>
<td>Fujikin Co., Ltd.</td>
<td></td>
<td>Fuji Kosan Co., Ltd.</td>
</tr>
</tbody>
</table>

Please contact SMC regarding turbine oil Class 2 (with additives), ISO VG32.
Warning
1. Use clean air.
   Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.

Caution
1. Install air filters.
   Install air filters close to valves at their upstream side. A filtration degree of 5 μm or less should be selected.
2. Implement countermeasures by installing after-cooler or air dryer, or water separator, etc.
   The air including excess drain may result in a malfunction of valves and other pneumatic equipment. Implement countermeasures by installing after-cooler or air dryer, or water separator, etc.

Operating Environment
Warning
1. Do not use valves in such environments where corrosive gases, chemicals, or brine or water or steam is airborne, or where valves can be directly exposed to any of those.
2. Do not use in an explosive environment.
3. Do not use in locations influenced by vibrations or impacts.
4. A protective cover, etc., should be used to shield valves from direct sunlight.
5. Shield valves from radiated heat generated by nearby heat sources.
6. Take suitable protective measures in locations where there are contacts with water droplets, oil, or welding spatter, etc.
7. In a dusty environment or when valve switching noise is intrusive, install a silencer in the R port to prevent dust from entering, and to reduce noise.

Maintenance
Warning
1. Perform maintenance and inspection as shown in the instruction manual.
   If handled improperly, damage may occur in machine or equipment or an operational error may result in.
2. Equipment removal and supply/exhaust of compressed air
   When equipment is removed, first confirm that measures are implemented to prevent dropping of workpiece and runaway of equipment, etc. Then cut the supply pressure and power, and exhaust all compressed air from the system using its residual pressure release function.
3. Low frequency operation
   Valves should be switched at least once every 30 days to prevent malfunction. (Use caution regarding the air supply.)
4. Manual override operation
   When the manual override is operated, connected equipment will be actuated.
   Confirm the safety before operating.

Caution
1. Drain removal
   Remove drain from air filters periodically.

How to Find the Flow Rate
(At air temperature of 20°C)

Choke flow: \( (P_2 + 0.1)/(P_1 + 0.1) \leq 0.5 \)
\[
Q = 120 \times S \times (P_1 + 0.1) \times \sqrt{\frac{293}{273 + t}}
\]

Subsonic flow: when \( (P_2 + 0.1)/(P_1 + 0.1) > 0.5 \)
\[
Q = 240 \times S \times \sqrt{(P_1 - P_0)(P_2 + 0.1)} \times \sqrt{\frac{293}{273 + t}}
\]

Q: Air flow rate \([\text{min (ANR)}]\)
S: Effective area \([\text{mm}^2]\)
P1: Inlet pressure \([\text{MPa}]\)
P2: Outlet pressure \([\text{MPa}]\)
t: Air temperature \([\text{°C}]\)

Note 1) Formulas above are applied to pneumatics only.
Related Products

Conforming to OSHA Standard
Pressure Relief 3-Port Valve with Locking Hole
VHS 20/30/40/50

Manually operated valve can be used to prevent accidents caused by residual pressure in pneumatic lines.

Can prevent accidents due to inadvertent air supply.

The supply/exhaust status of the air flow can be verified at a glance in the indicating window.

OSHA standard (Occupational Safety and Health Administration Department of Labor)

For safety control, OSHA rule requires energy sources for certain equipment be turned off or disconnected and that the device either be locked or labelled with a warning tag.

Combination with a modular style FRL is possible.

Combination with a modular style FRL

<table>
<thead>
<tr>
<th>Pressure relief 3-port valve</th>
<th>Interface P/N</th>
<th>Spacer with bracket P/N</th>
<th>Applicable air preparation equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHS20</td>
<td>Y200</td>
<td>Y200T</td>
<td>AC20, AC25</td>
</tr>
<tr>
<td>VHS30</td>
<td>Y300</td>
<td>Y300T</td>
<td>AC30, AC35</td>
</tr>
<tr>
<td>VHS40</td>
<td>Y400</td>
<td>Y400T</td>
<td>AC40, AC45</td>
</tr>
<tr>
<td>VHS40-06</td>
<td>Y400</td>
<td>Y400T</td>
<td>AC40, AC45</td>
</tr>
<tr>
<td>VHS50</td>
<td>Y500</td>
<td>Y500T</td>
<td>AC50, AC55</td>
</tr>
</tbody>
</table>

An interface part is required if a spacer or spacer with bracket shown in the table below is attached to a modular FRL.

Supplied with a 3/8"-16 UNF-2B Female NPT female thread.

Note: Although connection to AC60 is possible, the flow rate may decrease due to the mounting position.

Locations Worldwide!

The Americas
- Argentina
- Brazil
- Canada
- Mexico
- U.S.A.
- Venezuela

Europe
- Austria
- Bulgaria
- Croatia
- Czech
- Denmark
- Estonia
- France
- Finland
- Germany
- Hungary
- Ireland
- Italy
- Latvia
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- Lux
### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>AV2000</th>
<th>AV3000</th>
<th>AV4000</th>
<th>AV5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port size</td>
<td>1/4</td>
<td>3/8</td>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>Proof pressure</td>
<td>225psi (1.5MPa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td>32 to 140°F (0 to 60°C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective area (mm²)</td>
<td>20 (1P) to 22 (2A)</td>
<td>37 to 55</td>
<td>61 to 88</td>
<td>113 to 139</td>
</tr>
<tr>
<td>Weight manual/solenoid (Kg/lb)</td>
<td>0.64 (1.14) to 1.84 (4.06)</td>
<td>0.74 (1.63) to 1.90 (4.21)</td>
<td>1.00 (2.21) to 1.94 (4.35)</td>
<td>1.84 (4.06)</td>
</tr>
<tr>
<td>Weight manual (Kg/lb)</td>
<td>0.52 (1.15) to 1.87 (4.39)</td>
<td>0.62 (1.37) to 1.93 (4.37)</td>
<td>0.88 (1.94) to 2.36 (5.27)</td>
<td>1.72 (3.79)</td>
</tr>
<tr>
<td>Rated coil voltage</td>
<td>100, 200, 110 to 120, 220VAC (50/60Hz), 12, 24VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inrush (AC)</td>
<td>5.6V (50Hz), 5.0VA (60Hz)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energized (AC)</td>
<td>3.4VA (2.1W), 50Hz, 2.3VA (1.5W), 60Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption DC</td>
<td>1.8W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric entry</td>
<td>Type D DIN Terminal, M12 connector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optional specification</td>
<td>Indicator light/Surge voltage suppressor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### How to Order

**AVL** 20 00 - **F** 02 **G** - 5 **DZM** - **R**

- **Body size**
  - 20: 1/4
  - 30: 3/8
  - 40: 1/2
  - 50: 3/4, 1

- **Port size**
  - 02: 1/4
  - 03: 3/8
  - 04: 1/2
  - 06: 3/4
  - 10: 1

- **Port thread**
  - Nil
  - Rc
  - N
  - NPT

- **Port size**
  - 02: 1/4 (AVL2000)
  - 03: 3/8 (AVL3000)
  - 04: 1/2 (AVL4000)
  - 06: 3/4 (AVL5000)
  - 10: 1 (AVL5000)

- **Model**
  - AVL2000
  - AVL3000
  - AVL4000
  - AVL5000

- **Option**
  - Nil
  - G: Pressure gauge (Unit: MPa)
  - P: Pressure gauge (Unit: MPa, psi)

### Piston B Switching Pressure (Close to Open)

- Inlet pressure psi (MPa)
- Outlet pressure psi (MPa)

**Combination with a modular style FRL is possible.**

---

**Soft start up valve with lock out**

- Large effective area
- Low power consumption
- Manual/Manual solenoid lock out
- Modular design

**AVL2000/3000/4000/5000**

O.S.H.A compliant-lockable soft start valve. Gradual increase of supply pressure and rapid exhaust of system air when the supply is shut off.

---

**Dimension AVL2000 to AVL5000**

<table>
<thead>
<tr>
<th>Model</th>
<th>Port size</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVL2000-02</td>
<td>1/4</td>
<td>67</td>
<td>-</td>
<td>111</td>
<td>31</td>
<td>55</td>
<td>-</td>
<td>40</td>
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</tr>
<tr>
<td>AVL2000-02/DZM</td>
<td>1/4</td>
<td>67</td>
<td>20.5</td>
<td>111</td>
<td>31</td>
<td>55</td>
<td>34</td>
<td>40</td>
<td>-</td>
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<tr>
<td>AVL3000-03</td>
<td>3/8</td>
<td>76</td>
<td>-</td>
<td>118</td>
<td>36</td>
<td>57</td>
<td>-</td>
<td>48</td>
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</tr>
<tr>
<td>AVL3000-03/DZM</td>
<td>3/8</td>
<td>76</td>
<td>12.5</td>
<td>118</td>
<td>36</td>
<td>57</td>
<td>34</td>
<td>48</td>
<td>-</td>
</tr>
<tr>
<td>AVL4000-04</td>
<td>1/2</td>
<td>98</td>
<td>-</td>
<td>133</td>
<td>47</td>
<td>61</td>
<td>-</td>
<td>52</td>
<td>-</td>
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<tr>
<td>AVL4000-04/DZM</td>
<td>1/2</td>
<td>98</td>
<td>47</td>
<td>133</td>
<td>47</td>
<td>61</td>
<td>34</td>
<td>52</td>
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<tr>
<td>AVL5000-06 to 10</td>
<td>3/4/1.1</td>
<td>128</td>
<td>-</td>
<td>161</td>
<td>59</td>
<td>77</td>
<td>34</td>
<td>74</td>
<td>-</td>
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<tr>
<td>AVL5000-06 to 10/DZM</td>
<td>3/4/1.1</td>
<td>128</td>
<td>77</td>
<td>161</td>
<td>59</td>
<td>77</td>
<td>34</td>
<td>74</td>
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</tr>
</tbody>
</table>

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**Dimension AC20* to AC60**

<table>
<thead>
<tr>
<th>Model</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC20</td>
<td>41.5</td>
<td>43</td>
<td>67.5</td>
</tr>
<tr>
<td>AC25*</td>
<td>55</td>
<td>57</td>
<td>78</td>
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<tr>
<td>AC30*</td>
<td>55</td>
<td>57</td>
<td>78</td>
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<tr>
<td>AC40*</td>
<td>72.5</td>
<td>75</td>
<td>100.5</td>
</tr>
<tr>
<td>AC50*</td>
<td>93</td>
<td>96</td>
<td>131</td>
</tr>
<tr>
<td>AC55</td>
<td>98</td>
<td>96</td>
<td>131</td>
</tr>
<tr>
<td>AC60*</td>
<td>98</td>
<td>101</td>
<td>131</td>
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