Electro-Pneumatic Proportional Valve
Series VEF/VEP

Electro-pneumatic proportional valve: Flow type (VEF)
Controls the flow rate steplessly according to current. (It is a 2/3 port valve that has an electrical throttle valve function.) A model that is suitable for operating conditions, such as the number of ports or maximum effective area, can be selected.

Electro-pneumatic proportional valve: Pressure type (VEP)
Controls the pressure steplessly according to current. Also, because the effective fully opened area of the exhaust side is identical due to its construction, this valve provides a large exhaust capacity and can be used as a relief valve. (It is a 3 port valve that has an electrical pressure reducing valve function.)

Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>Flow type</th>
<th>Pressure type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VEF2121</td>
<td>VEF2131</td>
<td>VEF3121</td>
</tr>
<tr>
<td></td>
<td>VEF3121</td>
<td>VEF3131</td>
<td>VEF3141</td>
</tr>
<tr>
<td>Port size Rc</td>
<td>½&quot;, ¾&quot;</td>
<td>½&quot;, ¾&quot;</td>
<td>½&quot;, ¾&quot;</td>
</tr>
<tr>
<td>Fluid</td>
<td>Air</td>
<td>Air</td>
<td>Air</td>
</tr>
<tr>
<td>Maximum operating pressure</td>
<td>1.0 MPa</td>
<td>1.0 MPa</td>
<td>1.0 MPa</td>
</tr>
<tr>
<td>Ambient and fluid temperature</td>
<td>0 to 50°C (With no condensation)</td>
<td>0 to 50°C (With no condensation)</td>
<td>0 to 50°C (With no condensation)</td>
</tr>
<tr>
<td>Response time</td>
<td>0.03 s or less</td>
<td>0.05 s or less</td>
<td>0.03 s or less</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>3% F.S.</td>
<td>3% F.S.</td>
<td>3% F.S.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>3% F.S.</td>
<td>3% F.S.</td>
<td>3% F.S.</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.5% F.S.</td>
<td>0.5% F.S.</td>
<td>0.5% F.S.</td>
</tr>
<tr>
<td>Linearity</td>
<td>—</td>
<td>—</td>
<td>3% F.S. or less</td>
</tr>
<tr>
<td>Lubrication</td>
<td>Not required</td>
<td>Use turbine oil Class 1, ISO VG32, if lubricated.</td>
<td>Not required</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>0.9</td>
<td>1.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Note) The non-lubricated specification is not applicable to these models.

Proportional Solenoid Specifications

<table>
<thead>
<tr>
<th>Proportional solenoid recognition symbol</th>
<th>1 (Applicable power amplifier: VEA25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable power amplifier</td>
<td>VEA25</td>
</tr>
<tr>
<td>Max. current</td>
<td>1 A</td>
</tr>
<tr>
<td>Coil resistance</td>
<td>13 Ω (Ambient temperature 20°C)</td>
</tr>
<tr>
<td>Rated power consumption</td>
<td>13 W (Ambient temperature 20°C, with maximum current)</td>
</tr>
<tr>
<td>Coil insulation type</td>
<td>Class H or equivalent (180°C)</td>
</tr>
<tr>
<td>Max. temperature</td>
<td>140°C (Ambient temperature 50°C, with maximum current)</td>
</tr>
<tr>
<td>Electrical entry</td>
<td>DIN terminal</td>
</tr>
</tbody>
</table>

How to Order

<Flow type>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Port</th>
<th>Body size</th>
<th>Standard characteristics</th>
<th>Port size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>13</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>30</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>45</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3</td>
<td>4.5</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>2.5</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>25</td>
<td>06</td>
</tr>
</tbody>
</table>

<Pressure type>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Port</th>
<th>Body size</th>
<th>Standard characteristics</th>
<th>Port size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>0.05 to 0.65 MPa</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>0.1 to 0.9 MPa</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>0.005 to 0.15 MPa</td>
<td>03</td>
</tr>
</tbody>
</table>

Note) Does not conform to ISO1179-1.
**Application Example**

**Controlling pressure for die press cushion**

Electro-pneumatic proportional valve (Pressure control valve)

Regulator valve (VEX1)

Die cushion

(Imagine air type shock absorber)

**Controlling welding pressure of welding machine electrode**

Electro-pneumatic proportional valve (Pressure control valve)

Regulator valve (VEX1)

Pressurizing cylinder

Electrode

Check valve

**Controlling pressure of low pressure die-casting**

Power amplifier with feedback circuit

Pressure sensor

Electro-pneumatic proportional valve (Flow type, 2 port)

Cooler

Lower pressure die-casting

Release valve

---

**How to Use DIN Terminal**

**Caution**

Wiring procedure:
1. Loosen the retaining screw and pull the connector from the pin plug.
2. Make sure to remove the retaining screw, insert the tip of a flat head screwdriver into the groove below the terminal block and pry it up to separate the terminal cover from the terminal block.
3. Securely connect the wires to the specified terminals in accordance with the wiring procedure.

Wiring:

- Pin plug shape
- Terminal block: Connection 3 is not used for terminal 1 and 2.
- Note: Coil has no polarity.

Applicable cable (Heavy-duty cable):
- 0.75 mm², 1.25 mm²/2 core, 3 core (O.D. ø6.8 to ø11.5) based on JIS C 3312 and C 3322

**Outlet changing procedure**

To change the wire outlet, first separate the terminal cover from the terminal block. Then, reinstall the terminal cover in the desired direction (in 90° increments).

**Pin plug shape**

**Caution**

1. Air supply
   - Poor quality air could increase the spool's sliding resistance, while preventing it from attaining its specified characteristics. Use compressor oil with a minimal generation of oxidants and install a mist separator (SMC's AM series). Refer to pages 2 and 3.
   - Avoid using ultra-dry air since it may reduce the amount of lubricant and shorten the service life.

2. Mounting
   - Vibrations are transmitted to the valve by the proportional solenoid's dither. If it is necessary to prevent the transmission of vibrations, insert vibration isolating rubber material.
   - Thoroughly flush the pipe to completely eliminate any dust or scales from the pipe inside.

3. Lubrication
   - This product can be used without lubrication. But if lubricated, use turbin oil Class 1, ISO VG32 (with no additive). It is impossible to use spindle oil, machine oil, or grease.

4. Manual operation
   - To check the operation of the valve without applying a current, remove the lock nut and use a screwdriver or the like to press the tip of the core. After checking the operation, reinstall the rubber cap in its original position.

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**Precautions**

Be sure to read before handling.

Refer to front matter 43 for Safety Instructions and pages 365 to 369 for Precautions on every series.

**Previous Type**

VEF, VEF0, VEA, VEBAT, AP100

**Caution**

VEF, VEF0 must be used in conjunction with the power amplifier VEA1.

The previous VEF, VEF0 cannot be used in combination with the current VEA25 and the current VEF cannot be used in combination with the previous VEA1.

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**Application Example**

Controlling pressure of low pressure die-casting

Controlling pressure of die press cushion

Controlling weld pressure of welding machine electrode

Controlling rotation of air motor

Controlling welding pressure of welding machine electrode

Controlling pressure of die press cushion

Controlling pressure for die press cushion

Controlling rotation of air motor

Controlling multispeed of cylinder

Surge absorber

Electro-pneumatic proportional valve

Flow type (3 port)

Power amplifier

Control circuit

Controlling pressure of low pressure die-casting

Controlling welding pressure of welding machine electrode

Controlling rotation of air motor

Controlling welding pressure of welding machine electrode

Controlling pressure of low pressure die-casting

Electro-pneumatic proportional valve

Network control valve

Regulator valve (VEX1)

Die cushion

(Imagine air type shock absorber)

**Controlling welding pressure of welding machine electrode**

Electro-pneumatic proportional valve (Pressure control valve)

Regulator valve (VEX1)

Pressurizing cylinder

Electrode

Check valve

**Controlling pressure of low pressure die-casting**

Power amplifier with feedback circuit

Pressure sensor

Electro-pneumatic proportional valve (Flow type, 2 port)

Cooler

Regulator valve VEX1

Low pressure die-casting

Release valve

---

**How to Use DIN Terminal**

**Caution**

Wiring procedure:
1. Loosen the retaining screw and pull the connector from the pin plug.
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2. Mounting
   - Vibrations are transmitted to the valve by the proportional solenoid's dither. If it is necessary to prevent the transmission of vibrations, insert vibration isolating rubber material.
   - Thoroughly flush the pipe to completely eliminate any dust or scales from the pipe inside.

3. Lubrication
   - This product can be used without lubrication. But if lubricated, use turbin oil Class 1, ISO VG32 (with no additive). It is impossible to use spindle oil, machine oil, or grease.

4. Manual operation
   - To check the operation of the valve without applying a current, remove the lock nut and use a screwdriver or the like to press the tip of the core. After checking the operation, reinstall the rubber cap in its original position.

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**Precautions**

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Refer to front matter 43 for Safety Instructions and pages 365 to 369 for Precautions on every series.

**Previous Type**

VEF, VEF0, VEA, VEBAT, AP100

**Caution**

VEF, VEF0 must be used in conjunction with the power amplifier VEA1.

The previous VEF, VEF0 cannot be used in combination with the current VEA25 and the current VEF cannot be used in combination with the previous VEA1.

---

**Application Example**

Controlling pressure of low pressure die-casting

Controlling pressure for die press cushion

Controlling welding pressure of welding machine electrode

Controlling rotation of air motor

Controlling welding pressure of welding machine electrode

Controlling pressure of low pressure die-casting

Electro-pneumatic proportional valve

Network control valve

Regulator valve (VEX1)

Die cushion

(Imagine air type shock absorber)

**Controlling welding pressure of welding machine electrode**

Electro-pneumatic proportional valve (Pressure control valve)

Regulator valve (VEX1)

Pressurizing cylinder

Electrode

Check valve

**Controlling pressure of low pressure die-casting**

Power amplifier with feedback circuit

Pressure sensor

Electro-pneumatic proportional valve (Flow type, 2 port)

Cooler

Regulator valve VEX1

Low pressure die-casting

Release valve

---

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4. Manual operation
   - To check the operation of the valve without applying a current, remove the lock nut and use a screwdriver or the like to press the tip of the core. After checking the operation, reinstall the rubber cap in its original position.

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**Precautions**

Be sure to read before handling.

Refer to front matter 43 for Safety Instructions and pages 365 to 369 for Precautions on every series.

**Previous Type**

VEF, VEF0, VEA, VEBAT, AP100
Series VEF/VEP

Flow type: VEF

Diagram of Working Principle

The spool controls the sleeve’s opening through the balance between the proportional solenoid’s pulling force (F1) and the spring’s reaction force (F2). The spool moves in accordance with the amperage that is applied to the proportional solenoid, thus controlling the flow rate.

Flow Characteristics: 3 Port

\[
Q = 120 \times S \left( P + 0.1 \right) \sqrt{\frac{293}{273 + T}}
\]

- **Q**: Air flow rate [L/min (ANR)]
- **S**: Effective area [mm²]
- **P**: Valve-inlet pressure [MPa]
- **T**: Temperature [°C]

Flow Characteristics: 2 Port

\[
Q = 120 \times S \left( P + 0.1 \right) \sqrt{\frac{293}{273 + T}}
\]

- **Q**: Air flow rate [L/min (ANR)]
- **S**: Effective area [mm²]
- **P**: Valve-inlet pressure [MPa]
- **T**: Temperature [°C]
Diagram of Working Principle

The control opening becomes closed when the solenoid’s pulling force (F1) balances with the force (F2), which is created by the outlet pressure that passes through the feedback passage and acts on the spool surface. As a result, the outlet pressure is established.

Current-Pressure Characteristics

The horizontal axis of the characteristics represents the output amperage of the power amplifier VEA25 (if NULL and GAIN are in the shipping condition, 0 to 1 A can be viewed by substituting them with command signals 0 to 5 V.)

Flow Characteristics

<table>
<thead>
<tr>
<th>Inlet pressure: 1.0 MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet pressure (MPa)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inlet pressure: 0.3 MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet pressure (MPa)</td>
</tr>
</tbody>
</table>

Pressure Characteristics

JIS B 8372 (In accordance with air regulation)
Series VEF/VEP

Construction

Flow type: VEF2121 (2 Port)
VEF3121 (3 Port)
Pressure type: VEP3121 (3 Port)

Flow type: VEF2131 (2 Port)

Flow type: VEF2141 (2 Port)
VEF3141 (3 Port)
Pressure type: VEP3141 (3 Port)

Component Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>Aluminum alloy</td>
<td>Metallic painted</td>
</tr>
<tr>
<td>2</td>
<td>Sub-plate</td>
<td>Aluminum alloy</td>
<td>Metallic painted</td>
</tr>
<tr>
<td>3</td>
<td>Spool</td>
<td>Special stainless steel</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sleeve</td>
<td>Special stainless steel</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Mold coil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Solenoid cap assembly</td>
<td>Aluminum alloy</td>
<td>Metallic painted</td>
</tr>
<tr>
<td>7</td>
<td>Movable core assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>End cover</td>
<td>Aluminum alloy</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Bush</td>
<td>Resin</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Set bushing</td>
<td>Brass</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Gasket</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Spring</td>
<td>Stainless steel/Piano wire</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Spring seat</td>
<td>Brass</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>O-ring</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>O-ring</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>O-ring</td>
<td>NBR</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Hex. socket head cap screw</td>
<td>Chromium-molybdenum</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Hex. socket head cap screw</td>
<td>Chromium-molybdenum</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Hex. socket head cap screw</td>
<td>Chromium-molybdenum</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Lock nut</td>
<td>NBR</td>
<td></td>
</tr>
</tbody>
</table>

Sub-plate and Gasket for VEF121 Part No.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Gasket</td>
<td>DXT172-7</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Sub-plate</td>
<td>DXT172-2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Port size</th>
<th>Symbol</th>
<th>Thread type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/4</td>
<td>F</td>
</tr>
<tr>
<td>2</td>
<td>3/8</td>
<td>G note</td>
</tr>
<tr>
<td>3</td>
<td>NPT</td>
<td>N</td>
</tr>
<tr>
<td>4</td>
<td>NPTF</td>
<td>T</td>
</tr>
</tbody>
</table>

Note) Does not conform to ISO1179-1.
**Electro-Pneumatic Proportional Valve Series VEF/VEP**

**Dimensions**

**Flow type: VEF2121, VEF3121**
**Pressure type: VEP3121**

![Diagram of VEF/VEP Series Dimensions]

**Flow type: VEF2131**

**Flow type: VEF2141, VEF3141**
**Pressure type: VEP3141**

![Diagram of VEF/VEP Series Dimensions]

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**Symbols:**
- **ARJ**
- **AR425 to 935**
- **ARX**
- **AMR**
- **ARM**
- **ARP**
- **IR**
- **IRV**
- **VEX**
- **SRH**
- **SRP**
- **SRF**
- **VCHR**
- **ITV**
- **IC**
- **ITVX**
- **PVQ**
- **VEF**
- **VEP**
- **VER**
- **VEA**
- **VY1**
- **VBA**
- **VBAT**
- **AP100**

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**Additional Information:**
- **Applicable cable O.D.:** ø6 to ø12
- **3 x ø7**
- **Mounting hole**
- **2 port: Port 3 (R) plug**
- **2 x 1/4, 3/8, 1/2**

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**Technical Details:**
- **Model:** VEF/VEP Series
- **Flow type:** VEF2121, VEF3121
- **Pressure type:** VEP3121
- **Applicable cable O.D.:** ø6 to ø12
- **Dimensions:**
  - Port 1 (P)
  - Port 2 (A)
  - Port 3 (R)
  - G1/2
  - 2 port: Port 3 (R) plug
  - 3 x ø7
  - Mounting hole
  - 2 x 1/4, 3/8, 1/2
  - 3 x ø5.5
  - Mounting hole

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**Diagram Details:**
- **Series:** VEF/VEP
- **Electro-Pneumatic Proportional Valve**