High precision, large capacity relief regulator
A 3 port large exhaust capacity pressure reducing valve which utilizes a nozzle flapper mechanism available as air operated or manual types.

Precise pressure setting
Having a relief Cv value that is similar to the supply Cv value, this regulator responds quickly in order to set a precise outlet pressure even when the outlet volume and the pressure fluctuations are large.

High precision
This regulator is well-suited for balancer applications because it minimizes pressure fluctuations with its large-volume supply/exhaust capability, in addition it features high precision F.S. (full span) sensitivity within 0.2% and F.S. repeatability of ±0.5%.

Rich line-up
Port sizes available from M5 to 2 inches, most flow rates and pipes can be accommodated.

Minimum size VEX1^33
- Non-grease only for VEX1^33
- Seal materials (NBR, FKM) only for VEX1^33

Manifold capable
- VVEXB 1/8—Up to 10 stations
- VVEX2 1/4—Up to 8 stations

Air operated type
Manual knob type

Minimum size
Application Example

**Relief Type Regulator**
Precise internal tank pressure setting

- Large effective areas of both supply and exhaust sides make it possible to precisely set large-flow internal tank pressure.

**Accurate Pressure Setting**
Sensitivity within 0.2% F.S. (Full span)
Tension control

**Contact Pressure Control**

**Balance and Drive**
Accurate balance pressure setting

- Pressure is kept steady, responding rapidly to the position change of the piston in the cylinder.
- Pressure changes during cylinder actuation are suppressed, balancing the cylinder in both static and dynamic conditions.
Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>VEX1A33</th>
<th>VEX1B33</th>
<th>VEX113</th>
<th>VEX123</th>
<th>VEX133</th>
<th>VEX153</th>
<th>VEX173</th>
<th>VEX193</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>M5 01</td>
<td>M5 01</td>
<td>M5 01</td>
<td>M5 01</td>
<td>M5 01</td>
<td>M5 01</td>
<td>M5 01</td>
<td>M5 01</td>
</tr>
<tr>
<td>1(P)</td>
<td>1/6</td>
<td>1/6</td>
<td>1/6</td>
<td>1/6</td>
<td>1/6</td>
<td>1/6</td>
<td>1/6</td>
<td>1/6</td>
</tr>
<tr>
<td>3(R)</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
<td>1 1/4</td>
</tr>
</tbody>
</table>

Operation
- Manual knob (Push locking slotted type)
- Internal pilot

Pilot
- External pilot can be switched.

Fluid
- Refer to Applicable Fluids.
- Air

Supply pressure
- (Set pressure + 0.1 MPa) to Max. 1 MPa

Setting pressure range
- 0.01 to 0.7 MPa
- 0.05 to 0.7 MPa

Ambient temperature
- 0 to 60°C (VEX1 33)
- 0 to 99°C (VEX1 33B)

Repeatability
- Within ±0.5% F.S. (Full span)

Sensitivity
- Within ±1% F.S. (Full span)

Linearity
- Within ±1% F.S. (Full span)

Air consumption
- 9.5 L/min (ANR) (at supply pressure 1.0 MPa)

Mounting
- Free

Weight (kg)
- 0.15
- 0.18
- 0.2
- 0.3
- 0.5
- 1.4
- 2
- 4

Note 1) No condensation.
Note 2) Large amount of air is exhausted all the time.
Note 3) Applicable only to air operated type.
Note 4) With sub-plate.
Note 5) Non-lubricated specifications are not available for valve sizes 1 to 9.

Applicable Fluids

<table>
<thead>
<tr>
<th>Model</th>
<th>VEX1A33</th>
<th>VEX1B33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid</td>
<td>Air (Normal, Dry)</td>
<td>High temp. air (Max. 99°C)</td>
</tr>
</tbody>
</table>

Symbol

- Air operated type
- Manual knob type
Power Valve/Precision Regulator  VEX1\[3\] Series

How to Order

VEX1 [3] Series

Regulator valve

Type
Precision regulator

Operation
Manual knob

Body size

Port size

Body ported
A
M5 M5
01
B
Nil Without sub-plate
01

Base mounted

VEX1[5][3][3][10][G]

Option

Seal material
Nil NBR seals
B FKM seals

Thread type
Nil Rc
F G Note 1
N NPT
T NPTF

Option (2)

Description
Bracket (With bolt and washer)
Foot (With bolt and washer)
Pressure gauge
Silencer for bleed port

Part no.

VEX1A33 VEX1B33 VEX113\$ VEX123\$ VEX133\$ VEX153\$ VEX173\$ VEX193\$

Bracket (With bolt and washer) B VEX1-18-1A VEX1-18-1A VEX3-2A VEX5-2A VEX7-2A VEX9-2A

Foot (With bolt and washer) F VEX1-18-2A VEX1-18-2A VEX3-2A VEX5-2A VEX7-2A VEX9-2A

Pressure gauge G G27-10-R1-X207 G27-10-01 G36-10-01 G46-10-01

Silencer for bleed port (PE) N AN120-M5

Note 1) Not conforming to ISO1179-1.
Note 2) The optional parts are shipped in the same package.
Note 3) If a pressure gauge other than that which is indicated in the option table is to be used, also enter the part number of the pressure gauge.

• For VEX1[3][3] (NBR seals) Fixed orifice assembly (with O-ring) part no.: VEX1-A30-3
• For VEX1[3][3]B (FKM seals) Fixed orifice assembly (with O-ring) part no.: VEX1-A30-3B

Note) O-rings cannot be shipped as a single unit.

Caution

Using the External Pilot

1. If a pressure difference over 0.1 MPa between the supply and the set pressure cannot be maintained, change to an external pilot to obtain the necessary pressure difference.

2. If a mist separator cannot be installed on the supply side, change to an external pilot, and make sure to install a mist separator on the pilot side.

How to Switch to External Pilot

1. Using a flat head screwdriver, remove the fixed orifice from port P1.

2. Install the fixed orifice facing in the opposite direction (external pilot). Install it carefully to prevent damage to the O-ring.

3. Tighten the fixed orifice again and connect the pilot piping to port P1 using an M5 fitting.

Dimensions of port P1

For VEX1[3][3] (NBR seals)

Fixed orifice assembly (with O-ring) part no.: VEX1-A30-3

For VEX1[3][3]B (FKM seals)

Fixed orifice assembly (with O-ring) part no.: VEX1-A30-3B

Note) O-rings cannot be shipped as a single unit.

Option (2)

Note 1) Not conforming to ISO1179-1.
Note 2) The optional parts are shipped in the same package.
Note 3) If a pressure gauge other than that which is indicated in the option table is to be used, also enter the part number of the pressure gauge.

• For VEX1[3][3] (NBR seals) Fixed orifice assembly (with O-ring) part no.: VEX1-A30-3
• For VEX1[3][3]B (FKM seals) Fixed orifice assembly (with O-ring) part no.: VEX1-A30-3B

Note) O-rings cannot be shipped as a single unit.

Note 4) Face seal type One-touch fittings cannot be used.
## VEX1 □ 3 Series

### Sub-plate/Base Gasket Part No.

<table>
<thead>
<tr>
<th>Valve body size</th>
<th>B</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sub-plate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Base gasket</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### VEXB-2-

- **Port size**
  - Symbol: A
  - Port size: M5
  - Symbol: B
  - Port size: 1/8

- **Thread type**
  - Symbol: Nil
  - Thread type: Rc
  - Symbol: F
  - Thread type: NPT
  - Symbol: T
  - Thread type: NPTF

#### VEX1-9-1

- **Port size**
  - Symbol: A
  - Port size: 1/8
  - Symbol: B
  - Port size: 1/4

- **Thread type**
  - Symbol: Nil
  - Thread type: Rc
  - Symbol: F
  - Thread type: NPT
  - Symbol: T
  - Thread type: NPTF

#### VEXB-4

- **Seal material**
  - Symbol: Nil
  - Seal material: NBR seals
  - Symbol: B
  - Seal material: FKM seals

#### VEX1-11-2

- **Note:** Not conforming to ISO1179-1.
**VEX1\textsuperscript{3} Series**

**Manifold Specifications**

### Specifications

<table>
<thead>
<tr>
<th>Applicable valve</th>
<th>VEX1B33</th>
<th>VEX123 &lt;sup&gt;0&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve stations</td>
<td>2 to 10 stations &lt;sup&gt;Note1&lt;/sup&gt;</td>
<td>2 to 8 stations &lt;sup&gt;Note1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Air passage</td>
<td>Common supply/exhaust</td>
<td></td>
</tr>
<tr>
<td>Pilot</td>
<td>Internal pilot</td>
<td>Common external pilot</td>
</tr>
<tr>
<td>Pilot port size</td>
<td>1/4 M5 x 0.8</td>
<td>1/4 M5 x 0.8</td>
</tr>
</tbody>
</table>

**Blanking plate**

- VEXB-5 (With gasket and mounting bolt)
- VEX1-17 (With gasket and mounting bolt)

**Seal material**

- Nil
- NBR seals
- FKM seals

**How to Order**

**VVEXB - 1 - 5 - 01**

- Body size
- Pilot type
- Port size 1/4
- Valve stations 2 stations

**VVEX2 - 1 - 5 - 02**

- Body size
- Pilot type
- Port size 1/4
- Valve stations 8 stations

**Set Pressure Characteristics**

- **(Air Operated Type)**
- **(Manual Knob Type)**

**List symbols in the order of precision regulators and blanking plates for manifolds from the left-hand side (Port 2(A) faces this side) of the manifold base.**

Ex.) VVEX2-2-5-02
- VEX1233-G - 4 pieces
- VEX1-17 - 1 piece

**Note:** Not conforming to ISO1179-1.

**Set Pressure Characteristics**

- **(Air Operated Type)**
- **(Manual Knob Type)**
Flow Rate Characteristics

Port 1(P) pressure: 1 MPa

Pressure Characteristics

Port 1(P) pressure: 0.7 MPa, Port 2(A) pressure: 0.2 MPa, Flow: 0 L/min (ANR)
Construction/Working Principle

VEX1A33, VEX1B33

When set-knob ⑨ is turned clockwise, the force generated by set spring ⑩ causes flapper ⑩ to close nozzle ⑩, allowing the nozzle back pressure to be applied to the right surface of top diaphragm ⑩. Then, valve ⑩ moves to the left, allowing the supply air to flow from port 1(P) to port 2(A). The air pressure that has flowed in is applied to the left surface of top diaphragm ⑩ and counteracts the force generated by the nozzle back pressure; at the same time, it is applied to the left surface of diaphragm ⑩, and balances with the set pressure that counteracts the compression force of set spring ⑩.

When the outlet pressure increases higher than the set pressure, it pushes diaphragm ⑩ towards the right, and the pressure at the right side of top diaphragm ⑩ decreases, causing top diaphragm ⑩ to move to the right. Then, valve ⑩ moves away from the left surface of top diaphragm ⑩, the outlet pressure flows from port 2(A) via the valve hollow and is discharged through port 3(R) (atmosphere). If set knob ⑩ is turned counterclockwise, the movement will be the opposite, the outlet pressure will decrease and will balance with a newly set pressure.

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>Zinc alloy die-cast</td>
</tr>
<tr>
<td>2</td>
<td>Bonnet</td>
<td>Aluminum alloy die-cast</td>
</tr>
<tr>
<td>3</td>
<td>Upper diaphragm</td>
<td>NBR/FKM</td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>5</td>
<td>Valve guide</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>6</td>
<td>Valve</td>
<td>NBR/FKM</td>
</tr>
<tr>
<td>7</td>
<td>Retainer</td>
<td>Resin</td>
</tr>
<tr>
<td>8</td>
<td>Lower diaphragm</td>
<td>NBR/FKM</td>
</tr>
</tbody>
</table>

Replacement Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Knob</td>
<td>VBA1-10fl1</td>
</tr>
</tbody>
</table>

VEX113⑩, VEX123⑩, VEX133⑩, VEX153⑩, VEX173⑩, VEX193⑩

Manual knob type

When set-knob ⑩ is turned clockwise, the force generated by set spring ⑩ causes flapper ⑩ to close nozzle ⑩, allowing the nozzle back pressure to be applied to the top of piston ⑩. Then, via shaft ⑩, poppet valve (supply air) ⑩ opens, allowing the supply air to flow from port 1(P) to port 2(A). The air pressure that has flowed in is applied to the bottom surface of piston ⑩ and counteracts the force generated by the nozzle back pressure; at the same time, it is applied to the bottom surface of diaphragm ⑩, and balances with the set pressure that counteracts the compression force of set spring ⑩.

When the outlet pressure increases higher than the set pressure, it pushes the diaphragm ⑩ upward, the pressure at the top surface of piston ⑩ decreases, causes piston ⑩ to move upward, opens poppet valve (exhaust) ⑩ via shaft ⑩, and is discharged through port 3(R) to the atmosphere. If set-knob ⑩ is turned counterclockwise (if the set pressure of the pressure-reducing valve connected to the signal port is decreased), the movement will be the opposite; the outlet pressure will decrease and balance with a newly set pressure.

Note) Those indicated in parentheses are for the air operated type.

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 alloy die-cast</td>
</tr>
<tr>
<td>2</td>
<td>Bonnet</td>
<td>Aluminum alloy die-cast</td>
</tr>
<tr>
<td>3</td>
<td>Regulating piston</td>
<td>Aluminum alloy</td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>5</td>
<td>Valve guide</td>
<td>Aluminum alloy</td>
</tr>
<tr>
<td>6</td>
<td>Poppet valve</td>
<td>NBR</td>
</tr>
<tr>
<td>7</td>
<td>Shaft</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>8</td>
<td>Valve guide</td>
<td>Aluminum alloy</td>
</tr>
</tbody>
</table>

Replacement Parts

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Knob</td>
<td>VBA1-10fl1</td>
</tr>
</tbody>
</table>
**VEX1A33-M5, 01**

A section view

Pressure gauge (Option)

VEX1-18-2A

2 x M3 thread depth 6.5
(For bracket and foot mounting)

4 x ø4.5 (Mounting hole)

M5

Foot (Option)

VEX1-18-1A

M5

Bracket (Option)

VEX1-18-1A

2 x ø4.5 (Mounting hole)

Note) ( ) are the dimensions of “M5”.

---

**VEX113-01, 02**

A section view

Foot (Option)

VEX1-18-2A

2 x M3 thread depth 6.5
(For bracket and foot mounting)

4 x ø4.5 (Mounting hole)

Pressure gauge (Option)

G27-10-01

Air operated type

Bracket E

VEX1-18-1A

(OPTION)
VEX133\( \frac{3}{3} \)-02, 03, 04

Pressure gauge (Option)

G36-10-01

Air operated type

Bracket VEX3-32A
(Option)

VEX153\( \frac{3}{3} \)-04, 06, 10

Pressure gauge (Option)

G46-10-01

Air operated type

Bracket VEX5-32A
(Option)

2 x M5 thread depth 8
(For bracket mounting)

2 x M6 thread depth 9
(For bracket mounting)
VEX1□3 Series

Body Ported

VEX173□-10, 12

VEX193□-14, 20

Bracket (Option)
VEX7-32A

Air operated type

Pressure gauge (Option)
G46-10-01

Bracket (Option)
VEX9-32A

Air operated type

Pressure gauge (Option)
G46-10-01

850
Base Mounted

VEX1B33-M5, 01

Pressure gauge (Option)

G27-10-R1-X207

VEX123\textsuperscript{3/4}-01, 02

Air operated type

Pressure gauge (Option)

G27-10-01
**Manifold: VVEXB-□-□-01**

**Applicable valve: VEX1B33**

**Valve mounting side**

- Pilot port
- Pressure gauge (Option)
- For 6 manifold stations or more, exhaust from both sides.

**Port 3(R): \( \frac{1}{4} \)**
- Without thread: Internal pilot VVEXB-1
- With M5 thread: Common external pilot VVEXB-2

**External pilot port**
- For 6 manifold stations or more, exhaust from both sides.

**L Dimension**

<table>
<thead>
<tr>
<th>L Dimension</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L1</strong></td>
<td>87</td>
<td>118</td>
<td>149</td>
<td>180</td>
<td>211</td>
<td>242</td>
<td>273</td>
<td>304</td>
<td>335</td>
</tr>
<tr>
<td><strong>L2</strong></td>
<td>74</td>
<td>105</td>
<td>136</td>
<td>167</td>
<td>198</td>
<td>229</td>
<td>260</td>
<td>291</td>
<td>322</td>
</tr>
</tbody>
</table>

\( L_1 = 31n + 25, L_2 = 31n + 12 \) n: Station
Manifold: VVEX2-□-□-02

Applicable valve: VEX123 3

Valve mounting side

Port 2(A)

Pilot port

Internal pilot

VVEX2-1

Common external pilot

VVEX2-2

L Dimension

<table>
<thead>
<tr>
<th>L1 = 31n + 29, L2 = 31n + 14</th>
<th>n: Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>L1</td>
<td>91</td>
</tr>
<tr>
<td>L2</td>
<td>76</td>
</tr>
</tbody>
</table>
### Precautions

Be sure to read this before handling the products. Refer to back page 50 for Safety Instructions and pages 387 to 391 for Precautions on every series.

#### Operating Fluid

**Caution**
1. If drainage or debris is present in the supply pressure line, the fixed orifice becomes clogged, resulting in a malfunction. Therefore, in addition to the air filter (SMC’s AF series), make sure to use a mist separator (SMC’s AM, AFM series). Concerning the quality of the operating air, refer to SMC’s the air preparation equipment selection guide (pages 2 and 3).
2. Make sure to perform a maintenance periodically on air filter and mist separator (by discharging the drain and cleaning a filter element or replacing with new one).
3. Never use a lubricator on the supply side with the internal pilot remaining in place, doing so will cause the fixed orifice to become clogged, invariably leading to a malfunction.
4. When lubrication to terminal device is required: Connect a lubricator on the supply [port 1(P)] side using the external pilot type. Use mist separator passage on the pilot air [port P1] side.
5. Use a supply pressure in the recommended range (the range indicated in the diagram below).

#### Piping

**Warning**
1. Use the flow rate characteristics on page 846 as reference to select a regulator size so that the required flow rates on the reduced pressure supply and relief exhaust sides have sufficient allowances. If the reduced pressure supply and relief exhaust that may cause extreme changes in flow rate are repeated (main valve is fully opened and closed repeatedly), the nozzle flapper is deformed. This may cause the pressure set value to deviate or the diaphragm to break early. So, do not use under such conditions.

**Caution**
1. Tightening the fittings and their torque
   - When screwing fittings into the valve, make sure to tighten them to the proper torque values given below.
   - Connection thread: M5
     - First, tighten by hand, then use a wrench appropriate for the hexagon flats of the body to tighten an additional 1/6 to 1/4 turn.
     - A reference value for the tightening torque is 1 to 1.5 N·m.
   - Use the fitting with sealant as the Uni-Thread fitting cannot be used.
   - For the fitting with R or NPT, first, tighten it by hand, then use a wrench appropriate for the hexagon flats of the body to tighten it a further two or three turns. For a tightening torque guide, refer to the table below.

<table>
<thead>
<tr>
<th>Connection thread size [R, NPT]</th>
<th>Proper tightening torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>3 to 5</td>
</tr>
<tr>
<td>1/4</td>
<td>8 to 12</td>
</tr>
<tr>
<td>3/8</td>
<td>15 to 20</td>
</tr>
<tr>
<td>1/2</td>
<td>20 to 25</td>
</tr>
<tr>
<td>3/4</td>
<td>28 to 30</td>
</tr>
<tr>
<td>1</td>
<td>36 to 38</td>
</tr>
<tr>
<td>1 1/8</td>
<td>40 to 42</td>
</tr>
<tr>
<td>1 1/4</td>
<td>48 to 50</td>
</tr>
<tr>
<td>1 1/2</td>
<td>48 to 50</td>
</tr>
</tbody>
</table>

2. Ordinarily, air is discharged from the bleed port (PE). The consumption of air through this discharge is normal, owing to the construction of the precision pressure regulator.

#### Regulator for Signals (Air operated type only)

**Caution**
1. Applicable model
   - Regulator IR2000 series
   - VEX1203 series
   - VEX133 series
   - In the case of multiple pressure control, consider using ITV series or the E-HYREG® VY series, which can simplify your system.

#### Zero Adjustment Screw

**Caution**
- The zero adjustment screw has been adjusted at the time of shipment to set the signal pressure and the output pressure as close to 1:1 as possible. Thus, it is not necessary to adjust it for operational purposes.

### Related Products:

#### Silencer (AN series)
- Noise reduction capability of over 30 dB.
- Provides a sufficient effective area.

For details, refer to Best Pneumatics No. 7.

#### Exhaust cleaner (AMC series)
- Provides noise reduction and oil mist recovery functions.
- Can also be used in an intensive piping system.
- Oil mist removal of 99.9%
- Noise reduction of over 35 dB.

For details, refer to Best Pneumatics No. 7.