

# Booster Regulator VBA Series

RoHS

## How to Order



Made to Order

(For details, refer to page 1286.)

VBA 40A - 04 -

### Body size

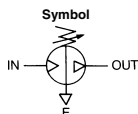
|                      |                                       |                                       |
|----------------------|---------------------------------------|---------------------------------------|
| 10A                  | 1/4", Knob-operated type              | Pressure increase ratio: Twice        |
| 20A                  | 3/8", Knob-operated type              |                                       |
| 40A                  | 1/2", Knob-operated type              |                                       |
| 22A                  | 3/8", Air-operated type               |                                       |
| 42A                  | 1/2", Air-operated type               | Pressure increase ratio: 2 to 4 times |
| 43A                  | 1/2", Max. operating pressure 1.6 MPa |                                       |
| 11A <sup>Note)</sup> | 1/4", Knob-operated type              |                                       |

Note) Set the pressure increase ratio to 2 or more.

### Thread type <sup>Note)</sup>

| Symbol | Thread type |
|--------|-------------|
| Nil    | Rc          |
| F      | G           |
| N      | NPT         |
| T      | NPTF        |

Note) Thread types apply to the IN, OUT, and EXH ports of the VBA1□A and to the IN, OUT, EXH, and gauge ports of the VBA2□A and VBA4□A. The gauge ports of the VBA1□A are Rc thread type regardless of the thread type indication.



VBA10A-02



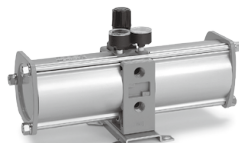
VBA11A-02



VBA20A-03



VBA22A-03



VBA40A-04



VBA42A-04



VBA43A-04

### Semi-standard

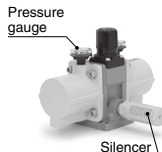
| Symbol             | Semi-standard                                                                                                                                            |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nil                | Standard product                                                                                                                                         |
| Z <sup>Note)</sup> | <ul style="list-style-type: none"> <li>Pressure unit on the product name label: psi</li> <li>Pressure unit on the pressure gauge: MPa and psi</li> </ul> |

Note) Thread type: NPT, NPTF  
Under the new measurement law, the pressure unit of "psi" on the pressure gauges cannot be used in Japan.

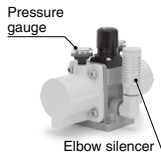
### Option

| Symbol | Option                                                               |
|--------|----------------------------------------------------------------------|
| Nil    | None                                                                 |
| G      | Pressure gauge                                                       |
| N      | Silencer                                                             |
| S      | High-noise reduction silencer <sup>Note)</sup>                       |
| GN     | Pressure gauge, Silencer                                             |
| GS     | Pressure gauge, High-noise reduction silencer <sup>Note)</sup>       |
| LN     | Elbow silencer <sup>Note)</sup>                                      |
| LS     | Elbow high-noise reduction silencer <sup>Note)</sup>                 |
| GLN    | Pressure gauge, Elbow silencer <sup>Note)</sup>                      |
| GLS    | Pressure gauge, Elbow high-noise reduction silencer <sup>Note)</sup> |

Note) Refer to "Combination of Thread Type and Options."



Silencer



Elbow silencer

### Port size

| Symbol | Port size | Applicable series |
|--------|-----------|-------------------|
| 02     | 1/4       | VBA1□A            |
| 03     | 3/8       | VBA2□A            |
| 04     | 1/2       | VBA4□A            |

### Combination of Thread Type and Options

| Body size         | Thread type | Option |   |   |   |    |    |    |    |     |     | Semi-standard |    |
|-------------------|-------------|--------|---|---|---|----|----|----|----|-----|-----|---------------|----|
|                   |             | Nil    | G | N | S | GN | GS | LN | LS | GLN | GLS | Nil           | -Z |
| 10A<br>11A        | Nil         | ●      | ● | ● | ● | ●  | ●  | ●  | ●  | ●   | ●   | ●             | —  |
|                   | F           | ●      | ● | ● | ● | ●  | ●  | ●  | ●  | ●   | ●   | ●             | —  |
|                   | N           | ●      | ● | ● | — | —  | —  | —  | —  | —   | —   | ●             | ●  |
|                   | T           | ●      | ● | ● | — | —  | —  | ●  | —  | —   | —   | ●             | ●  |
| 20A<br>22A        | Nil         | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | —  |
|                   | F           | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | —  |
|                   | N           | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | ●  |
|                   | T           | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | ●  |
| 40A<br>42A<br>43A | Nil         | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | —  |
|                   | F           | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | —  |
|                   | N           | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | ●  |
|                   | T           | ●      | ● | ● | ● | ●  | ●  |    |    |     |     | ●             | ●  |

### Air Tank Compatibility Chart

| Air tank \ Booster regulator | VBA10A/11A | VBA20A/22A | VBA40A/42A | VBA43A |
|------------------------------|------------|------------|------------|--------|
| VBAT05A(1)                   | ●          | —          | —          | —      |
| VBAT05S(1)                   | —          | —          | —          | —      |
| VBAT10A(1)                   | ●          | ●          | —          | —      |
| VBAT10S(1)                   | —          | —          | —          | —      |
| VBAT20A(1)                   | —          | ●          | ●          | —      |
| VBAT20S(1)                   | —          | —          | —          | ●      |
| VBAT38A(1)                   | —          | —          | —          | —      |
| VBAT38S(1)                   | —          | ●          | ●          | ●      |

## Standard Specifications

| Model                                                   | VBA10A-02                                                  | VBA20A-03  | VBA40A-04 | VBA22A-03    | VBA42A-04 | VBA43A-04                                                  | VBA11A-02                           |
|---------------------------------------------------------|------------------------------------------------------------|------------|-----------|--------------|-----------|------------------------------------------------------------|-------------------------------------|
| Fluid                                                   | Compressed air                                             |            |           |              |           |                                                            |                                     |
| Pressure increase ratio                                 | Twice                                                      |            |           |              |           |                                                            | 2 to 4 times <small>Note 4)</small> |
| Pressure adjustment mechanism                           | Knob-operated with relief mechanism <small>Note 2)</small> |            |           | Air-operated |           | Knob-operated with relief mechanism <small>Note 2)</small> |                                     |
| Max. flow rate <small>Note 3)</small> (L/min (ANR))     | 230                                                        | 1000       | 1900      | 1000         | 1900      | 1600                                                       | 70                                  |
| Set pressure range (MPa)                                | 0.2 to 2.0                                                 | 0.2 to 1.0 |           | 0.2 to 1.0   |           | 0.2 to 1.6                                                 | 0.4 to 2.0                          |
| Supply pressure range (MPa)                             | 0.1 to 1.0                                                 | 0.1 to 0.9 |           |              |           | 0.1 to 1.0                                                 |                                     |
| Proof pressure (MPa)                                    | 3                                                          | 1.5        |           |              |           | 2.4                                                        | 3                                   |
| Port size (Rc)<br>(IN/OUT/EXH: 3 locations)             | 1/4                                                        | 3/8        | 1/2       | 3/8          | 1/2       | 1/4                                                        |                                     |
| Pressure gauge port size (Rc)<br>(IN/OUT: 2 locations)  | 1/8                                                        |            |           |              |           |                                                            |                                     |
| Tank connection port (with plug) <small>Note 5)</small> | 1/4                                                        | 3/8        | 1/2       | 3/8          | 1/2       | 1/4                                                        |                                     |
| Ambient and fluid temperature (°C)                      | 2 to 50 (No freezing)                                      |            |           |              |           |                                                            |                                     |
| Installation                                            | Horizontal                                                 |            |           |              |           |                                                            |                                     |
| Lubrication                                             | Grease (Non-lube)                                          |            |           |              |           |                                                            |                                     |
| Weight (kg)                                             | 0.84                                                       | 3.9        | 8.6       | 3.9          | 8.6       | 8.6                                                        | 0.89                                |

Note 1) Be sure to secure an air supply capacity of the minimum operating pressure (0.1 MPa) or more.

Note 2) If the OUT pressure is higher than the set pressure by the knob, excess pressure is exhausted from the back of the knob.

Note 3) Flow rate at IN= OUT= 0.5 MPa. The pressure varies depending on the operating conditions. Refer to "Flow Rate Characteristics" on pages 1276 and 1277.

Note 4) Set the pressure increase ratio to 2 or more, and ensure the pressure difference between the inlet pressure and outlet pressure is 0.3 MPa or more.

Note 5) The tank connection port cannot be used for applications other than the connection with VBAT.

## Options/Part No.

### Pressure Gauge, Silencer (When thread type is Rc or G.)

| Model                         | VBA10A-02      | VBA20A-03  | VBA40A-04  | VBA22A-03   | VBA42A-04  | VBA43A-04  | VBA11A-02    |
|-------------------------------|----------------|------------|------------|-------------|------------|------------|--------------|
| Description                   | VBA10A-F02     | VBA20A-F03 | VBA40A-F04 | VBA22A-F03  | VBA42A-F04 | VBA43A-F04 | VBA11A-F02   |
| Pressure gauge                | G G27-20-01    | G36-10-01  |            | KT-VBA22A-7 | G36-10-01  | G27-20-01  | G27-20-01    |
| Silencer                      | N AN20-02      | AN30-03    | AN40-04    | AN30-03     | AN40-04    | AN40-04    | AN20-02      |
| High-noise reduction silencer | S ANA1-02      | ANA1-03    | ANA1-04    | ANA1-03     | ANA1-04    | ANA1-04    | ANA1-02      |
| Elbow for silencer            | L KT-VBA10A-18 | —          | —          | —           | —          | —          | KT-VBA10A-18 |

Note 1) In the case of options GN, two pressure gauges and one silencer are included in the same container as accessories.

Note 2) KT-VBA22A-7 is a pressure gauge with fitting. (Please order two units when using with IN and OUT.)

### Pressure Gauge, Silencer (When thread type is NPT or NPTF.)

| Model                                          | VBA10A-N02*      | VBA20A-N03*     | VBA40A-N04* | VBA22A-N03*  | VBA42A-N04*     | VBA43A-N04*     | VBA11A-N02*    |
|------------------------------------------------|------------------|-----------------|-------------|--------------|-----------------|-----------------|----------------|
| Description                                    | VBA10A-T02*      | VBA20A-T03*     | VBA40A-T04* | VBA22A-T03*  | VBA42A-T04*     | VBA43A-T04*     | VBA11A-T02*    |
| Pressure gauge *: when Nil                     | G G27-20-01      | G36-10-N01      |             | KT-VBA22A-7N | G36-10-N01      | G27-20-N01      | G27-20-01      |
| Pressure gauge *: when "-Z" <sup>Note 4)</sup> | G G27-P20-01-X30 | G36-P10-N01-X30 |             | KT-VBA22A-8N | G36-P10-N01-X30 | G27-P20-N01-X30 | G27-P20-01-X30 |
| Silencer                                       | N AN20-N02       | AN30-N03        | AN40-N04    | AN30-N03     | AN40-N04        | AN40-N04        | AN20-N02       |
| High-noise reduction silencer                  | S —              | ANA1-N03        | ANA1-N04    | ANA1-N03     | ANA1-N04        | ANA1-N04        | —              |
| Elbow for silencer                             | L KT-VBA10A-18N  | —               | —           | —            | —               | —               | KT-VBA10A-18N  |

Note 1) In the case of options GN, two pressure gauges and one silencer are included in the same container as accessories.

Note 2) KT-VBA22A-7N, KT-VBA22A-8N are pressure gauges with fittings. (Please order two units when using with IN and OUT.)

Note 3) Under the new measurement law, the pressure unit of "psi" on the pressure gauges cannot be used in Japan.

Note 4) Pressure unit on the pressure gauge: MPa and psi

## Related Products/Part No.

### Mist Separator, Exhaust Cleaner

| Model           | For VBA10A-02<br>For VBA11A-02 | For VBA20A-03<br>For VBA22A-03 | For VBA40A-04<br>For VBA42A-04<br>For VBA43A-04 |
|-----------------|--------------------------------|--------------------------------|-------------------------------------------------|
| Description     | AM250C-02                      | AM450C-04, 06                  | AM550C-06, 10                                   |
| Mist separator  | AM30-02-D                      | AM50-06-D<br>AM50-10-D         | AM60-10-D                                       |
| Exhaust cleaner | AMC310-03                      | AMC510-06                      | AMC610-10                                       |

Note) Refer to page 1288 for air tanks, page 329 for mist separators and the

Web Catalog for exhaust cleaners.

Refer to the separate operation manual for the connection method.

# VBA Series

Solid line: Operating range

Operate so that the flow rate follows the solid line even when the outlet side air has been consumed.

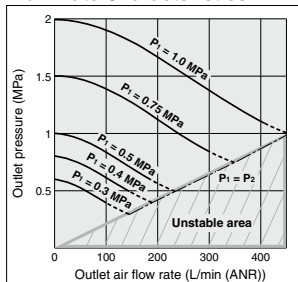
Ex.) For the VBA10A: When the inlet pressure is 0.5 MPa and the set pressure is 1.0 MPa, operate at an outlet air flow rate of 180 L/min (ANR) or less.

Dotted line: Outside of the set pressure range

P<sub>1</sub>: Inlet pressure P<sub>2</sub>: Outlet pressure

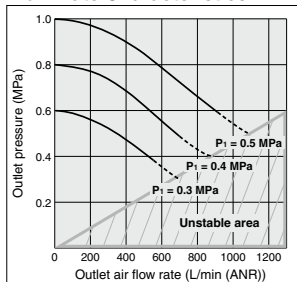
## VBA10A

### Flow Rate Characteristics



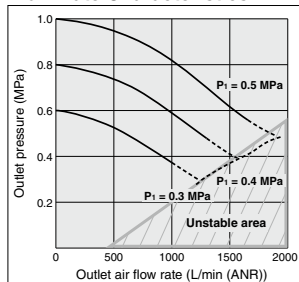
## VBA20A, 22A

### Flow Rate Characteristics



## VBA40A, 42A

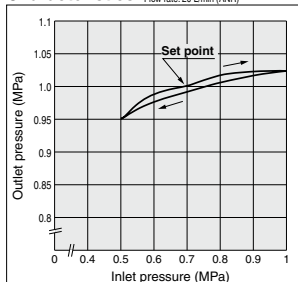
### Flow Rate Characteristics



When operated at a flow rate that falls within the unstable area ( $P_2 < P_1$  conditions) as shown in the graphs above, the booster regulator may not operate normally and may therefore fail to increase the pressure.

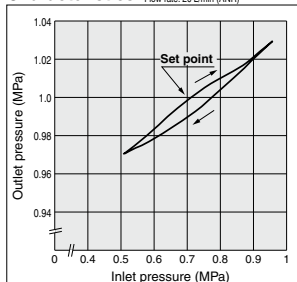
### Pressure Characteristics

Inlet pressure: 0.7 MPa  
Outlet pressure: 1.0 MPa  
Flow rate: 20 L/min (ANR)  
(Representative value)



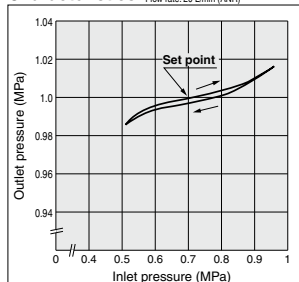
### Pressure Characteristics

Inlet pressure: 0.7 MPa  
Outlet pressure: 1.0 MPa  
Flow rate: 20 L/min (ANR)  
(Representative value)



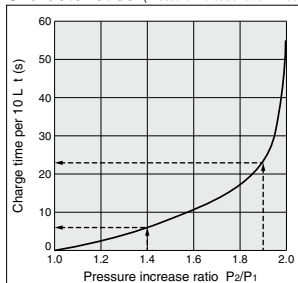
### Pressure Characteristics

Inlet pressure: 0.7 MPa  
Outlet pressure: 1.0 MPa  
Flow rate: 20 L/min (ANR)  
(Representative value)



### Charge Characteristics

(Pressure increase ratio: Twice)



### VBA10A

• The time required to charge pressure in the tank from 0.7 MPa to 0.95 MPa at 0.5 MPa supply pressure:

$$\frac{P_2}{P_1} = \frac{0.7}{0.5} = 1.4 \quad \frac{P_2}{P_1} = \frac{0.95}{0.5} = 1.9$$

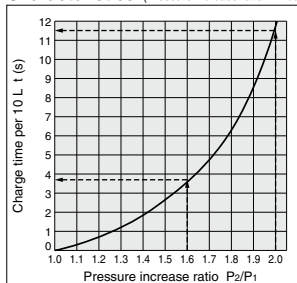
With the pressure increase ratio from 1.4 to 1.9, the charge time of 23 – 6 = 17 sec. (t) is given by the graph. Then, the charge time (T) for a 10 L tank:

$$T = t \times \frac{V}{10} = 17 \times \frac{10}{10} = 17 \text{ (s).}$$

1276

### Charge Characteristics

(Pressure increase ratio: Twice)



### VBA20A, 22A

• The time required to charge pressure in the tank from 0.8 MPa to 1.0 MPa at 0.5 MPa supply pressure:

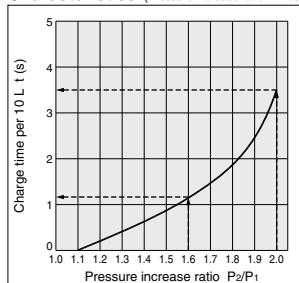
$$\frac{P_2}{P_1} = \frac{0.8}{0.5} = 1.6 \quad \frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0$$

With the pressure increase ratio from 1.6 to 2.0, the charge time of 11.5 – 3.8 = 7.7 sec. (t) is given by the graph. Then, the charge time (T) for a 100 L tank:

$$T = t \times \frac{V}{10} = 7.7 \times \frac{100}{10} = 77 \text{ (s).}$$

### Charge Characteristics

(Pressure increase ratio: Twice)



### VBA40A, 42A

• The time required to charge pressure in the tank from 0.8 MPa to 1.0 MPa at 0.5 MPa supply pressure:

$$\frac{P_2}{P_1} = \frac{0.8}{0.5} = 1.6 \quad \frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0$$

With the pressure increase ratio from 1.6 to 2.0, the charge time of 3.5 – 1.1 = 2.4 sec. (t) is given by the graph. Then, the charge time (T) for a 100 L tank:

$$T = t \times \frac{V}{10} = 2.4 \times \frac{100}{10} = 24 \text{ (s).}$$

Solid line: Operating range

Operate so that the flow rate follows the solid line even when the outlet side air has been consumed.

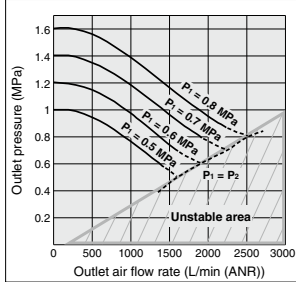
Ex.) For the VBA10A: When the inlet pressure is 0.5 MPa and the set pressure is 1.0 MPa, operate at an outlet air flow rate of 180 L/min (ANR) or less.

Dotted line: Outside of the set pressure range

$P_1$ : Inlet pressure  $P_2$ : Outlet pressure

## VBA43A

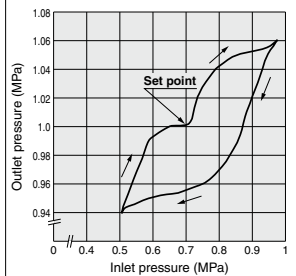
### Flow Rate Characteristics



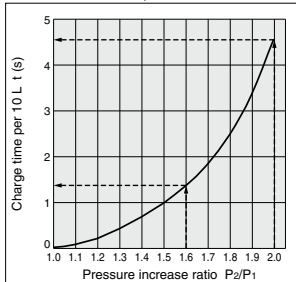
When operated at a flow rate that falls within the unstable area ( $P_2 < P_1$  conditions) as shown in the graphs above, the booster regulator may not operate normally and may therefore fail to increase the pressure.

### Pressure Characteristics

Inlet pressure: 0.7 MPa  
Outlet pressure: 1.0 MPa  
Flow rate: 20 L/min (ANR)  
(Representative value)



### Charge Characteristics (Pressure increase ratio: Twice)



#### VBA43A

• The time required to charge pressure in the tank from 0.8 MPa to 1.0 MPa at 0.5 MPa supply pressure:

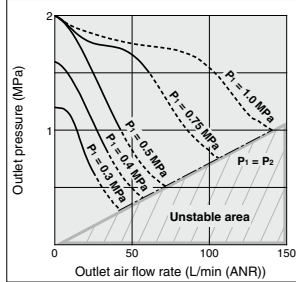
$$\frac{P_2}{P_1} = \frac{0.8}{0.5} = 1.6 \quad \frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0$$

With the pressure increase ratio from 1.6 to 2.0, the charge time of 4.5 – 1.3 = 3.2 sec. (t) is given by the graph. Then, the charge time (T) for a 100 L tank:

$$T = t \times \frac{V}{10} = 3.2 \times \frac{100}{10} = 32 \text{ (s)}$$

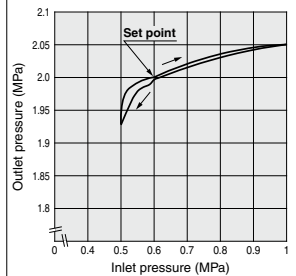
## VBA11A

### Flow Rate Characteristics

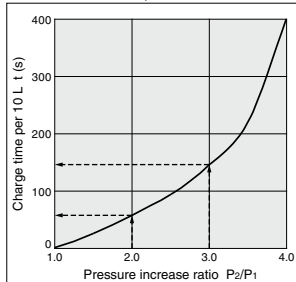


### Pressure Characteristics

Inlet pressure: 0.6 MPa  
Outlet pressure: 2.0 MPa  
Flow rate: 10 L/min (ANR)  
(Representative value)



### Charge Characteristics (Pressure increase ratio: Twice)



#### VBA11A

• The time required to charge pressure in the tank from 1.0 MPa to 1.5 MPa at 0.5 MPa supply pressure:

$$\frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0 \quad \frac{P_2}{P_1} = \frac{1.5}{0.5} = 3.0$$

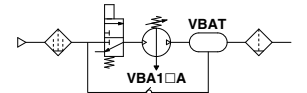
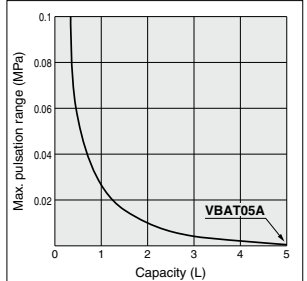
With the pressure increase ratio from 2.0 to 3.0, the charge time of 147 – 58 = 89 sec. (t) is given by the graph. Then, the charge time (T) for a 10 L tank:

$$T = t \times \frac{V}{10} = 89 \times \frac{10}{10} = 89 \text{ (s)}$$

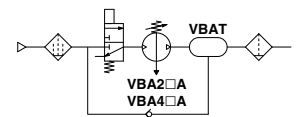
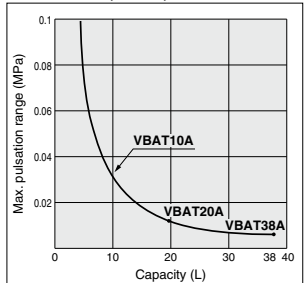
## Pulsation/Pulsation is decreased with a tank.

If the outlet capacity is undersized, pulsation may occur.

## VBAT05A



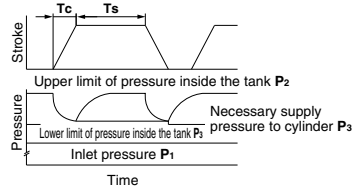
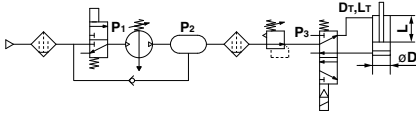
## VBAT10A, 20A, 38A



Conditions:  
Inlet pressure: 0.5 MPa  
Outlet set pressure: 1 MPa  
Flow rate: Between 0 and max. flow rate

- Performance of air tank
  - Alleviates the pulsation generated on the outlet side.
  - When air consumption exceeds air supply during intermittent operation, required air will be accumulated in the tank for use. This does not apply for continuous operation.
  - Operation at a flow rate that falls within the unstable area under temporary  $P_1 \geq P_2$  conditions can be prevented when the outlet side air has been consumed.

**Sizing** (Please use the Booster Regulator Model Selection Software on the SMC website,  
<https://mssc.smcworld.com/brmss/>)



## START

Provide requisite conditions for selection.

### Necessary conditions:

**Dc** [mm]: Cylinder bore size  
**Lc** [mm]: Cylinder stroke  
**N** [pc.]: Number of cylinders  
**Tc** [s]: Cylinder operating time  
**Dr** [mm]: Piping bore (Valve-Cylinder)  
**Lt** [mm]: Piping length (Valve-Cylinder)  
**C** [cpm]: Operating frequency  
**P1** [MPa]: Booster regulator inlet pressure  
**P2** [MPa]: Booster regulator outlet pressure (Set pressure)  
**P3** [MPa]: Supply pressure for cylinder

Note 1) **P3** is the necessary supply pressure to a cylinder, and set the pressure below the lower limit of pressure inside the tank with a regulator. Adjust the pressure taking the maximum operating pressure of equipment in use into consideration.  
 Note 2) **P2** is the output pressure of the booster regulator, which is also the upper limit of charge pressure to the tank.

### Other conditions:

**QAVE** [L/min]: Average air flow rate  
**QMAX** [L/min]: Maximum instantaneous air flow rate  
**K**: Cylinder double-acting: 2, single-acting: 1  
**T1** [s]: Time to charge (Time to charge to **P3**)  
**T2** [s]: Time to charge (Time to charge to **P2**)  
**T** [s]: Time to charge (Time to charge from **P2** to **P3**)

## Obtain the capacity (V).

Obtain the piping volume from the valve to the cylinder and the volume of the cylinder to obtain the air flow rate from the outlet side of the booster regulator.

Cylinder volume

$$V_{CVL} [L] = \frac{\pi \times D_c^2 \times L_c}{4 \times 10^6} \times \frac{P_3 + 0.101}{0.101} \times N$$

Piping capacity

$$V_{TUBE} [L] = \frac{\pi \times D_r^2 \times L_t}{4 \times 10^6} \times \frac{P_3}{0.101} \times N$$

Obtain the average air flow rate **QAVE** to select the size of the booster regulator.

Average air flow rate

$$Q_{AVE} [L/min (ANR)] = (V_{CVL} + V_{TUBE}) \times \frac{K}{T} \times C$$

(Reciprocation)

Obtain the maximum instantaneous air flow rate **QMAX** to check the necessity of an air tank.

Maximum instantaneous air flow rate

$$Q_{MAX} [L/min (ANR)] = \frac{(V_{CVL} + V_{TUBE})}{T_c} \times 60$$

## Calculate air flow rate (Q).

| Selection example   |                      |  |  |
|---------------------|----------------------|--|--|
| <b>Dc</b> [mm]: 100 | <b>Lt</b> [mm]: 500  |  |  |
| <b>Lc</b> [mm]: 100 | <b>C</b> [cpm]: 10   |  |  |
| <b>N</b> [pc.]: 1   | <b>P1</b> [MPa]: 0.5 |  |  |
| <b>Tc</b> [s]: 0.5  | <b>P2</b> [MPa]: 1.0 |  |  |
| <b>Dr</b> [mm]: 10  | <b>P3</b> [MPa]: 0.8 |  |  |

$$V_{CVL} [L] = \frac{\pi \times 100^2 \times 100}{4 \times 10^6} \times \frac{0.8 + 0.101}{0.101} \times 1 = 7.0 [L]$$

$$V_{TUBE} [L] = \frac{\pi \times 10^2 \times 500}{4 \times 10^6} \times \frac{0.8}{0.101} \times 1 = 0.3 [L]$$

$$Q_{AVE} [L/min (ANR)] = (7.0 + 0.3) \times 2 \times 10 = 146 [L/min (ANR)]$$

$$Q_{MAX} [L/min (ANR)] = \frac{(7.0 + 0.3)}{0.5} \times 60 = 877 [L/min (ANR)]$$

Select the booster regulator and check the necessity of an air tank.

Select the booster regulator from the average air flow rate **QAVE** and check the necessity of an air tank from the maximum instantaneous air flow rate **QMAX**.

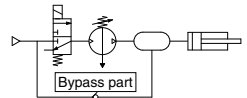
It can be used when the outlet air flow rate of the intersecting point between the booster regulator inlet pressure (**P1**) and outlet pressure (**P2**) on the catalog flow characteristic table (p. 1276, 1277) is equal to the average air flow rate **QAVE** or higher.

An air tank is required when the outlet air flow rate is less than the maximum instantaneous air flow rate **QMAX**.

An air tank is not required when the outlet air flow rate is at the maximum instantaneous air flow rate **QMAX** or higher.

## ⚠ Caution

- Set the pressure increase ratio of the VBA11A (pressure increase ratio 4) to 2 or more. As a malfunction may occur when operated at a pressure increase ratio of 2 times or less, operate at a pressure increase ratio of 2 (VBA10, VBA20A, etc.).
- Since the booster regulator is a compressor powered by the air, it consumes the air. The air consumption is approximately 1.2 times (pressure increase ratio 2) or 3.7 times (pressure increase ratio 4) larger than the outlet side volume. Therefore, the booster regulator requires a supply capacity of the inlet side volume that is approximately 2.2 times (pressure increase ratio 2) or 4.7 times (pressure increase ratio 4) larger than the outlet side volume.



### Bypass circuit example

By bypassing the booster regulator inlet pressure (**P1**) to the booster regulator outlet pressure (**P2**) and starting up the booster regulator after the air tank has finished charging, the equipment can be started up without air flowing above the max. flow rate. In addition, it prevents unnecessary booster regulator operation during startup, allowing for an improved service life.

## Selection example

P<sub>1</sub>: 0.5 (MPa), P<sub>2</sub>: 0.8 (MPa)

Average air flow rate Q<sub>AVE</sub>: 146 (L/min)

Maximum instantaneous air flow rate Q<sub>MAX</sub>: 877 (L/min)

Outlet air flow rate

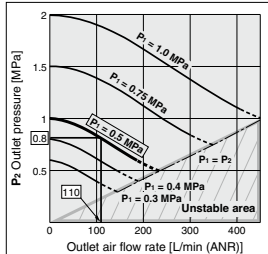
**VBA10A**: 110 (L/min)

**VBA20A**: 580 (L/min)

**VBA40A**: 1,050 (L/min)

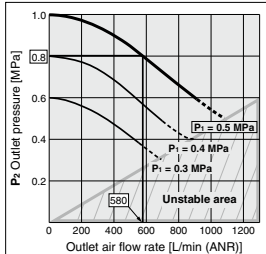
## VBA10A

### Flow Rate Characteristics



## VBA20A, 22A

### Flow Rate Characteristics



## VBA40A, 42A

### Flow Rate Characteristics

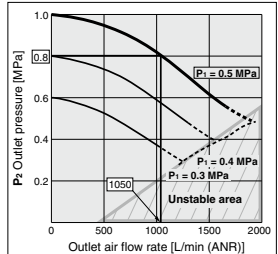


Fig. 1 Flow Rate Characteristics

## Results

### •VBA10A: Cannot be used

(The outlet air flow rate is less than the average air flow rate Q<sub>AVE</sub>.)

### •VBA20A: Can be used (air tank required)

(The outlet air flow rate is at the average air flow rate Q<sub>AVE</sub> or higher and less than the max. instantaneous air flow rate Q<sub>MAX</sub>.)

### •VBA40A: Can be used

(The outlet air flow rate is at the average air flow rate Q<sub>AVE</sub> or higher and at the max. instantaneous air flow rate Q<sub>MAX</sub> or higher.)

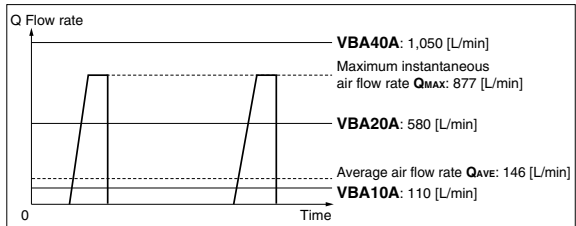


Fig. 2 Booster regulator selection and air tank necessity confirmation results

## Obtain the air tank capacity.

Obtain the air tank capacity.

$$V [L] = \frac{Q_{MAX}}{(P_2 - P_1) \times 9.9} \times \frac{T_c}{60} \times K$$

## Check the air tank charge characteristics.

Obtain the time T from the catalog charge characteristics table (p. 1276, 1277) and check that it satisfies the operating frequency.

$$T = \left( \frac{V}{C} \right) \times (T_2 - T_1) \leq \frac{60}{C}$$

## Application example

$$T = \left( \frac{7.4}{10} \right) \times (11.5 - 3.8) = 5.7 \leq \frac{60}{10}$$

A tank smaller than the calculation results may satisfy the requirement since this size selection calculation provides calculation which is on the safe side. This does not consider air flowing from the booster regulator.

Please use the booster regulator model selection software on the SMC website.

## Application example

Required air tank volume for **VBA20A**

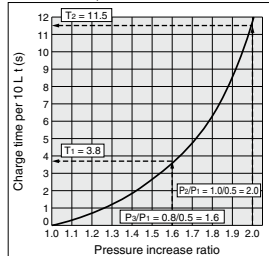
$$V [L] = \frac{877}{(1.0 - 0.8) \times 9.9} \times \frac{0.5}{60} \times 2 = 7.4 [L]$$

\* Air tank of 7.4 L or more is required.

## VBA20A, 22A

### Charge Characteristics

(Pressure increase ratio: Twice)

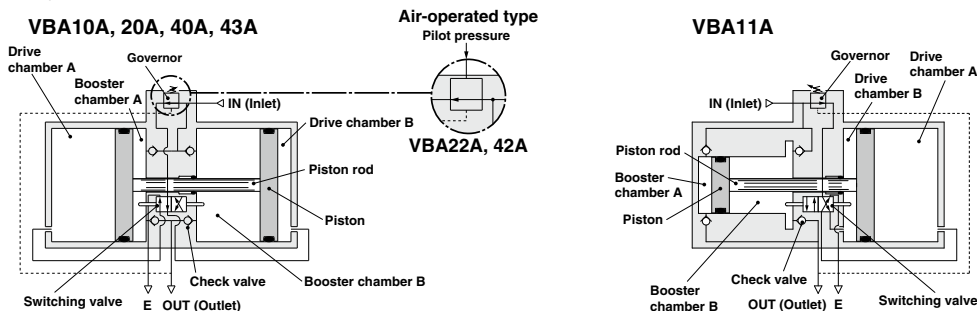


END

When running continuously for longer periods of time, confirm the life expectancy.  
When the life expectancy is shorter than required, select a larger sized booster regulator.

## Working Principle

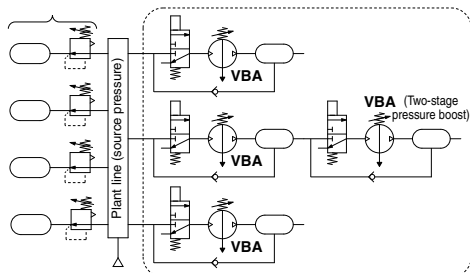
The **IN** air passes through the check valve to **booster chambers A and B**. Meanwhile, air is supplied to **drive chamber B** via the governor and the switching valve. Then, the air pressure from **drive chamber B** and **booster chamber A** are applied to the piston, boosting the air in **booster chamber B**. As the piston travels, the boosted air is pushed via the check valve to the **OUT** side. When the piston reaches to the end, the piston causes the switching valve to switch, so that **drive chamber B** is in the exhaust state and **drive chamber A** is in the supply state respectively. Then, the piston reverses its movement, this time, the pressures from **booster chamber B** and **drive chamber A** boosts the air in **booster chamber A** and sends it to the **OUT** side. The process described above is repeated to continuously supply highly pressurized air from the **IN** to the **OUT** side. The governor establishes the outlet pressure by knob operation and pressure adjustment in the drive chamber by feeding back the outlet pressure.



## Circuit Example

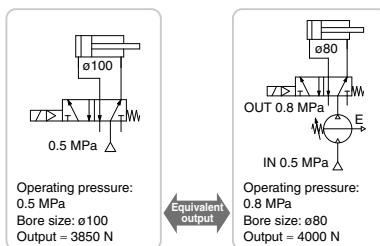
- When only some of the machines in the plant require high-pressure air, booster regulators can be installed for only the equipment that requires it. This allows the overall system to use low-pressure air while accommodating machines requiring high-pressure air.

General line (low pressure)      Locations requiring high pressure

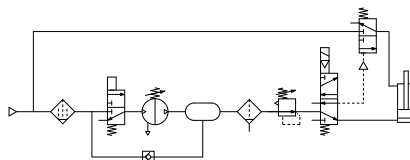


- When using two booster regulators for 2-stage pressure boost, be sure to supply sufficient flow to each booster regulator in order to stabilize the booster regulator inlet pressure. Refer to Selection 2. on page 1281 for the inlet side supply amount.

- When the actuator output is insufficient but space limitations prohibit switching to a larger cylinder diameter, a booster regulator can be used to increase the pressure. This makes it possible to boost the output without replacing the actuator.
- When a certain level of output is required but the cylinder size must be kept small so that the driver remains compact.

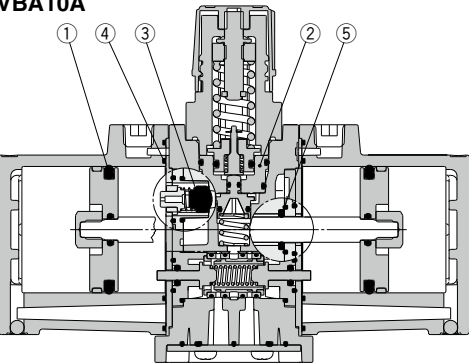


- When only one side of the cylinder is used for work, booster regulators can be installed only on the lines that require them to reduce the overall air consumption volume.

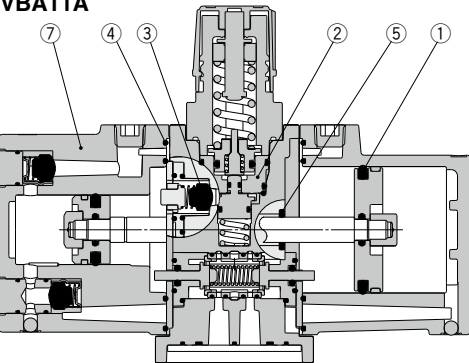


Construction/Replacement Parts

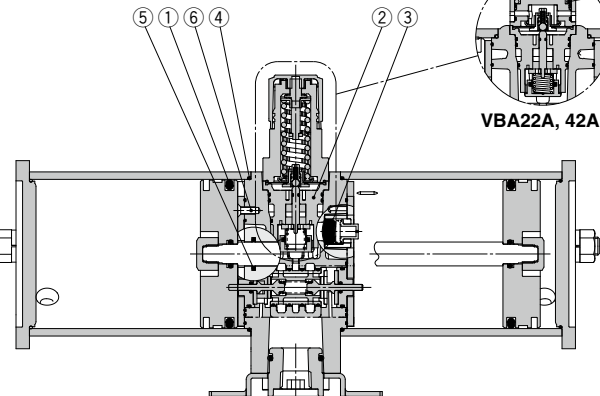
VBA10A



VBA11A



VBA20A, 22A,  
VBA40A, 42A, 43A



Replacement Parts/Kit No.

Place an order with the following applicable kit number.

| Model   | VBA10A      | VBA20A      | VBA40A      | VBA22A      | VBA42A      | VBA43A      | VBA11A       |
|---------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Kit no. | KT-VBA10A-1 | KT-VBA20A-1 | KT-VBA40A-1 | KT-VBA22A-1 | KT-VBA42A-1 | KT-VBA43A-1 | KT-VBA11A-20 |

The kit includes the parts from ① to ⑦ and a grease pack.

| No.         | Model             | VBA10A   | VBA20A | VBA40A | VBA22A  | VBA42A  | VBA43A | VBA11A                 |
|-------------|-------------------|----------|--------|--------|---------|---------|--------|------------------------|
| Description |                   | Quantity |        |        |         |         |        |                        |
| 1           | Piston seal       | 2        |        |        | 2 large | 1 small | 2      | 1 each large and small |
| 2           | Governor assembly | 1        |        |        |         |         |        |                        |
| 3           | Check valve       | 4        |        |        |         |         |        | 2                      |
| 4           | Gasket            | 2        |        |        |         |         |        |                        |
| 5           | Rod seal          | 1        |        |        |         |         |        |                        |
| 6           | Mounting screw    | —        | 8      | 12     | 8       | 12      | —      | —                      |
| 7           | Cover C assembly  | —        |        |        |         |         |        |                        |
| —           | Grease pack       | 1        | —      | 2      | 1       | 2       | —      | 1                      |

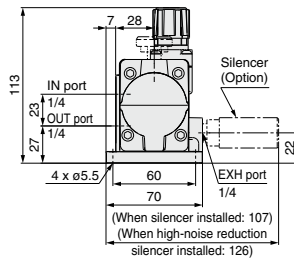
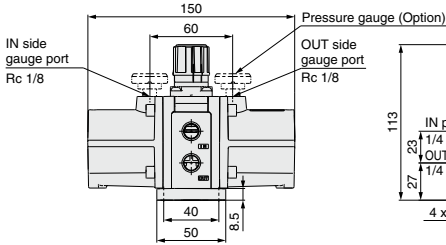
- \* The grease pack has 10 g of grease.
- \* Make sure to refer to the procedure for maintenance.
- \* For details on the replacement parts kit, refer to the procedure for maintenance.
- \* Refer to page 1275 for pressure gauges.



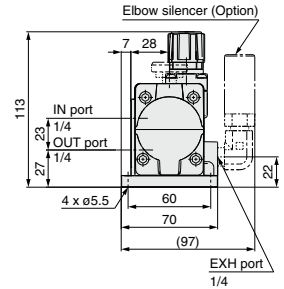
Procedure for maintenance

## Dimensions

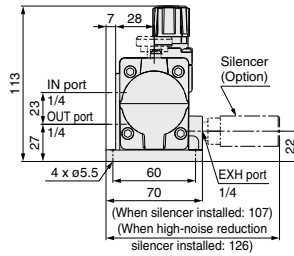
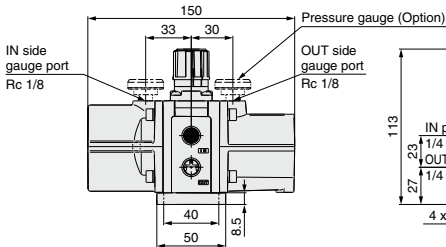
### VBA10A-02



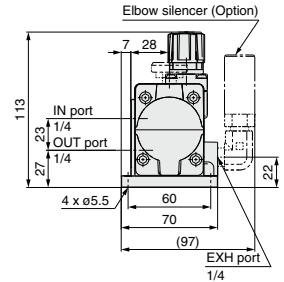
### With elbow silencer (Option)



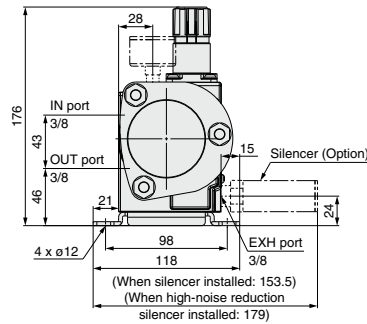
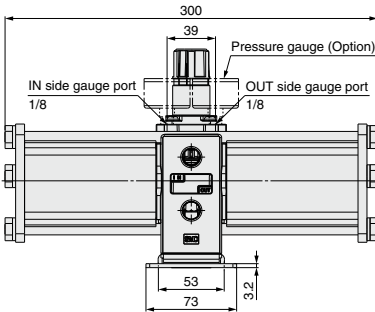
### VBA11A-02



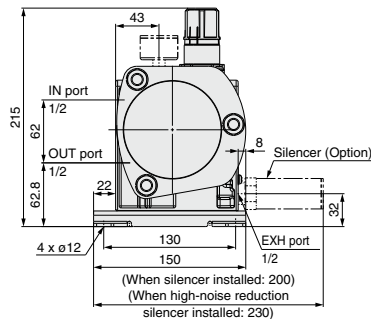
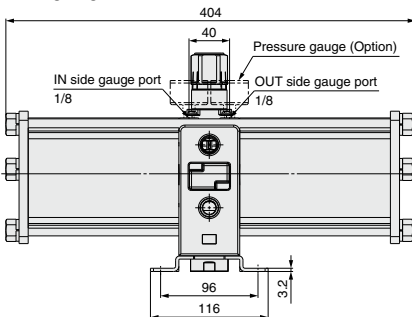
### With elbow silencer (Option)



### VBA20A-03



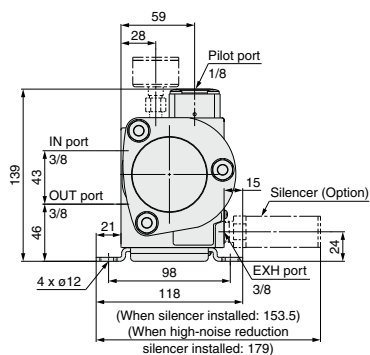
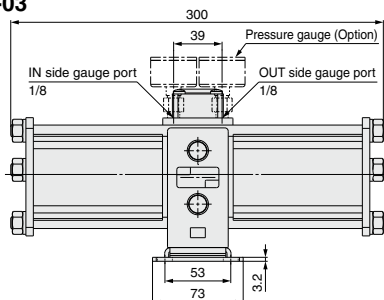
### VBA40A-04



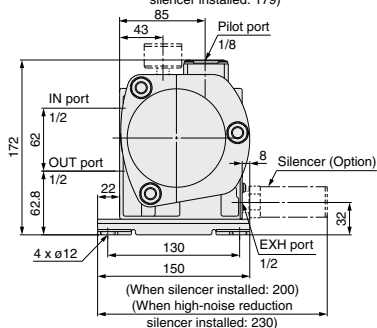
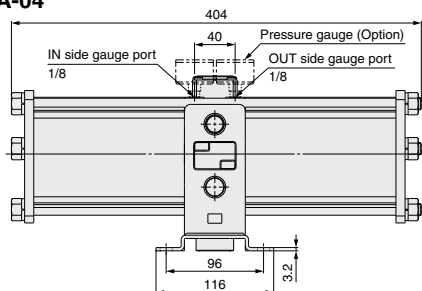
# VBA Series

## Dimensions

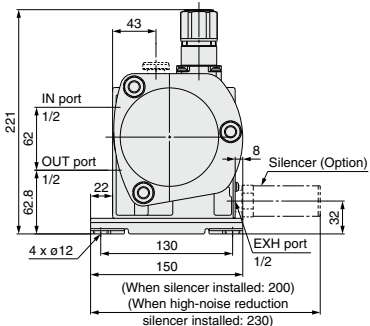
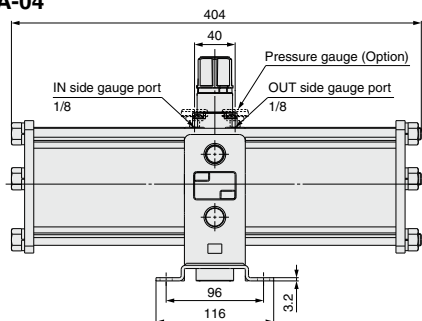
### VBA22A-03



### VBA42A-04



### VBA43A-04



## Made to Order

### 1 Copper-free/Fluorine-free

The inner or outer copper parts material has been changed to stainless steel or aluminum. The fluorine resin parts has been changed to general resin.

#### 20 — Standard model no.

- Made to Order  
Copper-free/Fluorine-free  
(Excludes models with a pressure gauge (Option))

\* This option cannot be selected for air tank with safety valve.

1286

### 2 CE/UKCA explosion-proof directive (ATEX) compliant

#### 56 — Standard model no.

- Made to Order  
CE/UKCA explosion-proof directive  
(ATEX): Category 3GD

### 3 Ozone resistant

Ozone resistance is strengthened through the use of fluororubber (diaphragm) and hydrogenated NBR (valve, rod seal) for the rubber parts of the seal material.

#### 80 — Standard model no.

- Made to Order  
Ozone resistant

\* Weather resistant NBR (diaphragm) and hydrogenated NBR (valve) are used for the rubber parts of the standard model.



For detailed dimensions, specifications and lead times, please contact SMC.