

# Booster Regulator VBA Series



## How to Order

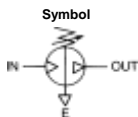
VBA **40A** - **04** - **04** - **04**

Body size	Pressure increase ratio
10A	1/4", Knob-operated type
20A	3/8", Knob-operated type
40A	1/2", Knob-operated type
22A	3/8", Air-operated type
42A	1/2", Air-operated type
43A	1/2", Max. operating pressure 1.6 MPa
11A (Note)	1/4", Knob-operated type

Pressure increase ratio: Twice

Pressure increase ratio: 2 to 4 times

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



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□□ and to the IN, OUT, EXH, and gauge ports of the VBA2□□ and VBA4□□. The gauge ports of the VBA1□□ are Rc thread type regardless of the thread type indication.

Symbol	Semi-standard
Nil	Standard product
Z (Note)	Pressure unit on the product name label: psi Pressure unit on the pressure gauge: MPa and psi

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

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

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

VBA10A-02

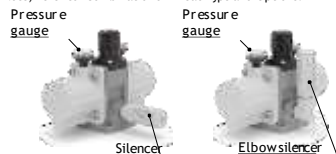
VBA11A-02

VBA20A-03

VBA22A-03

VBA40A-04

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



### 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 11A	Nil	●	●	●	●	●	●	●	●	●	●	●	●	—
	F	●	●	●	●	●	●	●	●	●	●	●	●	—
	N	●	●	●	—	—	—	—	—	—	—	—	—	●
	T	●	●	●	—	—	—	●	—	—	—	—	—	●
20A 22A	Nil	●	●	●	●	●	●	—	—	—	—	—	●	—
	F	●	●	●	●	●	●	—	—	—	—	—	●	—
	N	●	●	●	●	●	●	—	—	—	—	—	●	—
	T	●	●	●	●	●	●	—	—	—	—	—	●	—
40A 42A 43A	Nil	●	●	●	●	●	●	—	—	—	—	—	●	—
	F	●	●	●	●	●	●	—	—	—	—	—	●	—
	N	●	●	●	●	●	●	—	—	—	—	—	●	—
	T	●	●	●	●	●	●	—	—	—	—	—	●	—

### Air Tank Compatibility Chart

Booster regulator or Air tank	VBA10A/1A	VBA20A/2A	VBA40A/4A	VBA43A
VBA105A(1)	●	—	—	—
VBA105S(1)	—	—	—	—
VBA110A(1)	●	●	—	—
VBA110S(1)	—	—	—	—
VBA120A(1)	—	●	—	—
VBA120S(1)	—	—	●	—
VBA138A(1)	—	●	●	—
VBA138S(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 Note 4
Pressure adjustment mechanism	Knob-operated with relief mechanism			Air-operated		Knob-operated with relief mechanism Note 2)	
Max. flow rate (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) (IN/OUT/EXH: 3 locations)	1/4	3/8	1/2	3/8	1/2		1/4
Pressure gauge port size (Rc) (IN/OUT: 2 locations)	1/8						
Tank connection port (with plug) <sup>N</sup>	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 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.

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.)

Description	Model	VBA10A-02 VBA10A-F02	VBA20A-03 VBA20A-F03	VBA40A-04 VBA40A-F04	VBA22A-03 VBA22A-F03	VBA42A-04 VBA42A-F04	VBA43A-04 VBA43A-F04	VBA11A-02 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.)

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

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

Description	Model	VBA10A-N02* VBA10A-T02* *: when "-Z"	VBA20A-N03* VBA20A-T03* *: when "-Z"	VBA40A-N04* VBA40A-T04* *: when "-Z"	VBA22A-N03* VBA22A-T03* *: when "-Z"	VBA42A-N04* VBA42A-T04* *: when "-Z"	VBA43A-N04* VBA43A-T04* *: when "-Z"	VBA11A-N02* VBA11A-T02* *: when "-Z"
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"		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
								—
							—	KT-VBA10A-18N

## Related Products/Part No.

### Mist Separator, Exhaust Cleaner

Description	Model	For VBA10A-02 For VBA11A-02	For VBA20A-03 For VBA22A-03	For VBA40A-04 For VBA42A-04 For VBA43A-04
1288			AMC510-06	AMC610-10

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.

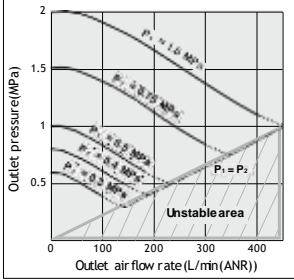
Ex.) For the VBA10A: When the inlet pressure is 0.5 MPa and the set pressure is 1.0 MPa, operate at an outlet air flow rate of 180 L/min (ANR) or less.

Dotted line: Outside of the set pressure range

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

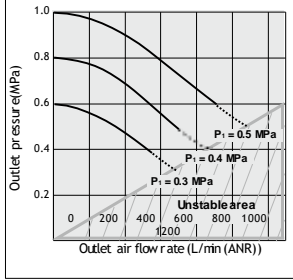
## VBA10A

### Flow Rate Characteristics



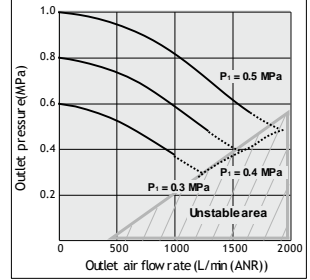
## VBA20A, 22A

### Flow Rate Characteristics



## VBA40A, 42A

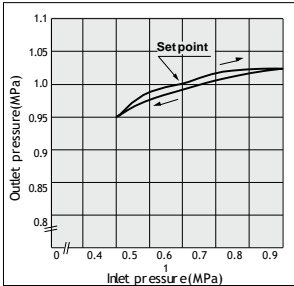
### Flow Rate Characteristics



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.

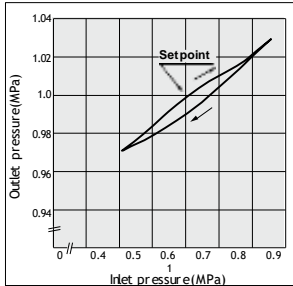
### Pressure Characteristics

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



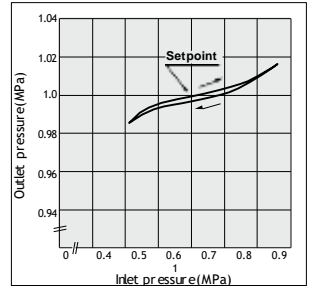
### Pressure Characteristics

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



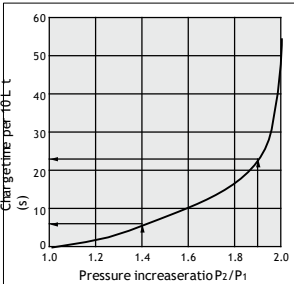
### Pressure Characteristics

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



### 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:

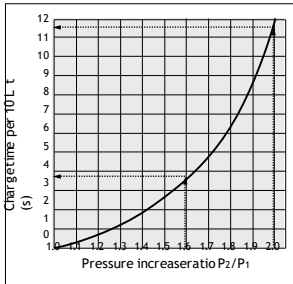
$$\frac{P_2}{P_1} = \frac{0.7}{0.5} = 1.4 \quad \frac{P_2}{P_1} = \frac{0.95}{0.5} = 1.9$$

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:

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

### 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:

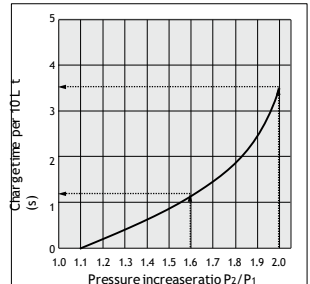
$$\frac{P_2}{P_1} = \frac{0.8}{0.5} = 1.6 \quad \frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0$$

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:

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

## Gentle Automatic Solution Sdn Bhd

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[waze.to/r/hw28325k63](https://wa.me/60380237743)

Solid line: Operating range

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

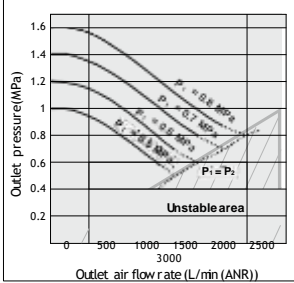
Ex.) For the VBA10A: When the inlet pressure is 0.5 MPa and the set pressure is 1.0 MPa, operate at an outlet air flow rate of 180 L/min (ANR) or less.

Dotted line: Outside of the set pressure range

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

## VBA43A

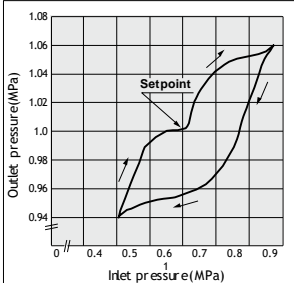
### Flow Rate Characteristics



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.

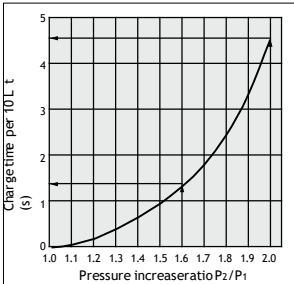
### Pressure Characteristics

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



### 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

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

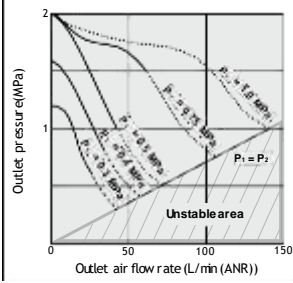
With the pressure increase ratio from 1.6 to 2.0, the charge time of 4.5 - 1.3 = 3.2 sec. (t) is given by the graph. Then, the charge time (T) for a 100 L tank:

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

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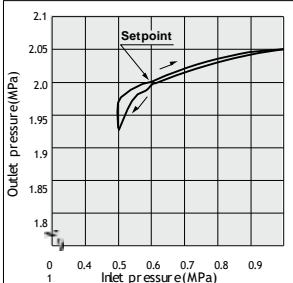
## VBA11A

### Flow Rate Characteristics



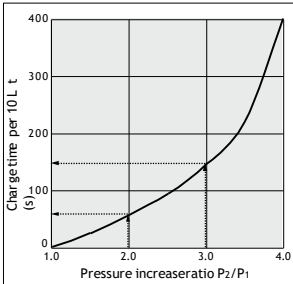
### Pressure Characteristics

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



### 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:

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

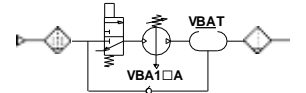
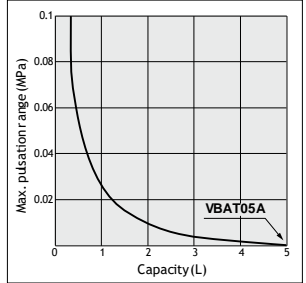
With the pressure increase ratio from 2.0 to 3.0, the charge time of 147 - 58 = 89 sec. (t) is given by the graph. Then, the charge time (T) for a 10 L tank:

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

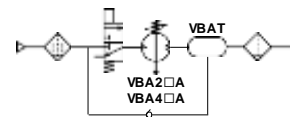
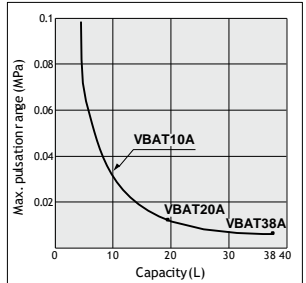
**Pulsation/Pulsation is decreased with a tank.**

If the outlet capacity is undersized, pulsation may occur.

## VBAT05A



## VBAT10A, 20A, 38A



Conditions:

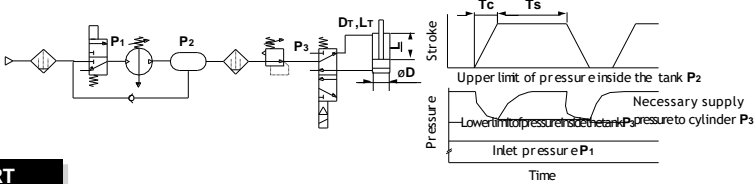
Inlet pressure: 0.5 MPa

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 boresize  
 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

Note1) P3 is the necessary supply pressure to cylinder, and set the pressure below the lower limit pressure inside the tank with a regulator. Adjust the pressure taking the maximum operating pressure of equipment into consideration.  
 Note2) P3 is the output pressure of the booster regulator, which is also the upper limit of the pressure in the tank.

**Other conditions:**  
 QAE [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

$$V_{CYL} [L] = \frac{\pi \times Dc^2 \times Lc}{4 \times 10^6} \times \frac{P_3 + 0.101}{0.101} \times N$$

Piping capacity

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

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

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

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

Calculate air flow rate (Q).

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

Average air flow rate

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

(Reciprocation)

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

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

Maximum instantaneous air flow rate

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

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

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

Select the booster regulator from the average air flow rate QAE 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 (cylinder supply pressure, P2) in the catalog flow characteristic table (p. 1276, 1277) is equal to the average air flow rate QAE 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

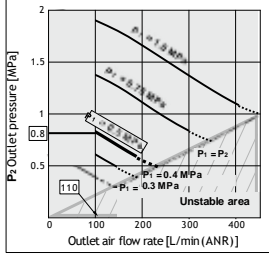
- Set the pressure increase ratio of the VBA11A (pressure increase ratio 4) to 2 or more. As a malfunction may occur when operated at a pressure increase ratio of 2 times or less, operate at a pressure increase ratio of 2 (VBA10, VBA20A, etc.).
- Since the booster regulator is a compressor powered by 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.

**Selection example**

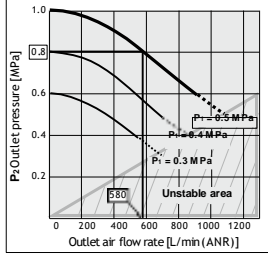
P<sub>1</sub>: 0.5 (MPa), P<sub>2</sub>: 0.8 (MPa)  
 Average air flow rate Q<sub>AE</sub>: 146 (L/min)  
 Maximum instantaneous air flow rate Q<sub>MAK</sub>: 877 (L/min)

Outlet air flow rate  
**VBA10A**: 110 (L/min)  
**VBA20A**: 580 (L/min)  
**VBA40A**: 1,050 (L/min)

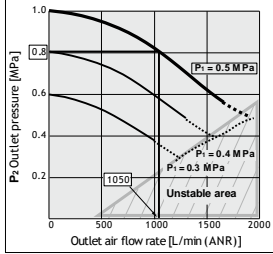
**VBA10A**  
**Flow Rate Characteristics**



**VBA20A, 22A**  
**Flow Rate Characteristics**



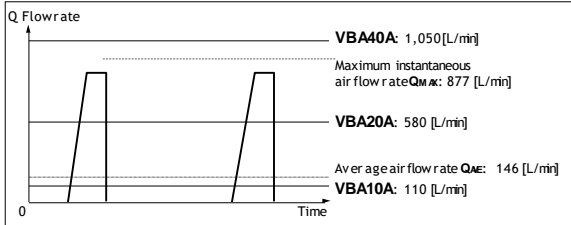
**VBA40A, 42A**  
**Flow Rate Characteristics**



**Fig.1 FlowRate Characteristics**

**Results**

- VBA10A: Cannot be used**  
 (The outlet air flow rates is less than the average air flow rate Q<sub>AE</sub>.)
- VBA20A: Can be used (air tank required)**  
 (The outlet air flow rates is at the average air flow rate Q<sub>AE</sub> or higher and less than the max. instantaneous air flow rate Q<sub>MAK</sub>.)
- VBA40A: Can be used**  
 (The outlet air flow rates is at the average air flow rate Q<sub>AE</sub> or higher and at the max. instantaneous air flow rate Q<sub>MAK</sub> or higher.)



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

**Obtain the air tank capacity.**

Obtain the air tank capacity.

$$V [L] = \frac{Q_{MAK}}{(P_2 - P_3) \times 9.9} \times \frac{T_C}{60} \times K$$

**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.

$$T = \left(\frac{V}{10}\right) \times (T_2 - T_1) \leq \frac{60}{C}$$

**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.

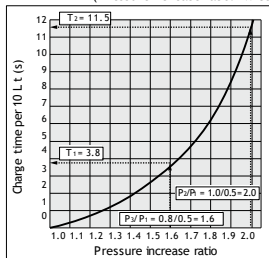
**Application example**

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)



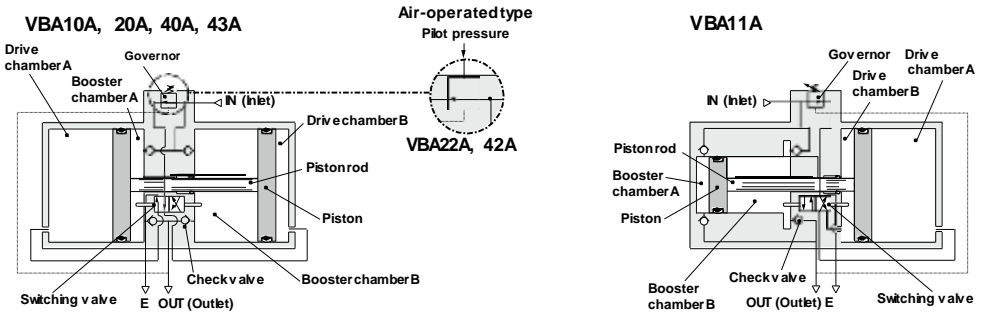
**END**

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.

# VBA Series

## Working Principle

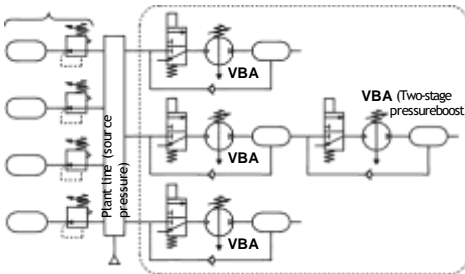
The **IN** air passes through the check valve to **booster chambers A and B**. Meanwhile, air is supplied to **drive chamber B** via the governor and the switching valve. Then, the air pressure from **drive chamber B** and **booster chamber A** are applied to the piston, boosting the air in **booster 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

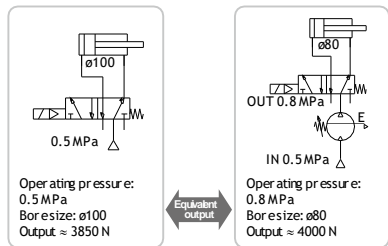
- When only some of the machines in the plant require high-pressure air, booster regulators can be installed for only the equipment that requires it. This allows the overall system to use low-pressure air while accommodating machines requiring high-pressure air.

General line (low pressure)      Locations requiring high pressure

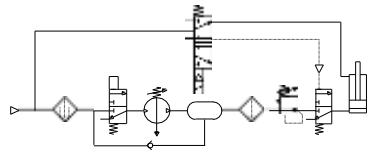


- When using two booster regulators for 2-stage pressure boost, be sure to supply sufficient flow to each booster regulator in order to stabilize the booster regulator inlet pressure. Refer to Selection 2. on page 1281 for the inlet side supply amount.

- 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.



**Design**

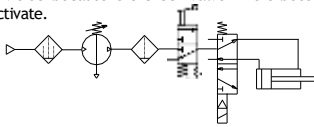
**Warning**

**1. Warning concerning abnormal outlet pressure**

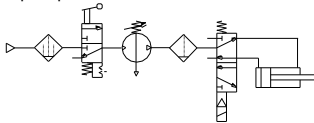
- If there is a likelihood of causing an outlet pressure drop due to unforeseen circumstances such as equipment malfunction, thus leading to a major problem, take safety measures on the system side.
- Because the outlet pressure could exceed its set range if there is a large fluctuation in the inlet pressure, leading to unexpected accidents, take safety measures against abnormal pressures. If operation at a flow rate that falls within the unstable area ( $P_1 \geq P_2$ ) occurs due to outlet pressure consumption, install an air tank, etc. (Refer to page 1277.)
- Operate the equipment within its maximum operating pressure and set pressure range.

**2. Residual pressure measures**

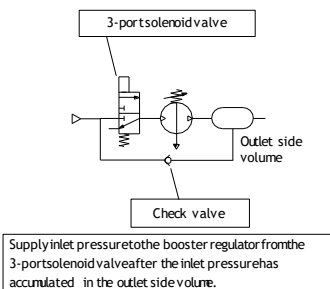
- Connect a 3-port valve to the OUT side of the booster regulator if the residual pressure must be released quickly from the outlet pressure side for maintenance, etc. (Refer to the diagram below.) The residual outlet pressure side cannot be released even if the 3-port valve is connected to the IN side because the check valve in the booster regulator will activate.



- After operation is finished, release the supply pressure at the inlet. This stops the booster regulator from moving needlessly and prevents operating malfunctions.
- When stopping the booster regulator, after the pressure has risen, exhaust the pressure starting from the inlet side, and then stop the product.



- If operated so that the inlet pressure and outlet pressure are exhausted every operational cycle, the flow rate will occasionally fall within the unstable area shown in the Flow Rate Characteristics graphs on pages 1276 and 1277, resulting in the switching valve stopping halfway and failing to increase the pressure. (The restart method is shown on page 1283.)
- When exhausting inlet pressure or outlet pressure (residual pressure), supply inlet pressure to the booster regulator after supplying the inlet pressure to the outlet side volume.



**Design**

**Caution**

**1. System configuration**

- Be sure to secure an air supply capacity of the minimum operating pressure (0.1 MPa) or more. If the internal operating pressure becomes the minimum operating pressure or less, the switching valve may remain in the intermediate position, which may cause a restart failure.
- The IN port of the booster regulator has metallic mesh to prevent dust from entering the booster regulator. However, it cannot remove dust continuously or separate drainage. Make sure to install a mist separator (AM series) on the inlet side of the booster regulator.
- The booster regulator has a sliding part inside, and it generates dust. Also, install an air purification device such as an air filter or a mist separator on the outlet side as necessary.
- Connect a lubricator to the outlet side. If a lubricator is connected to the inlet side, oil will accumulate on the sliding parts of the switching valve in the booster regulator, which may result in increased sliding resistance and thermal function of the product.

**2. Exhaust air measures**

- Provide a dedicated pipe to release the exhaust air from each booster regulator. If centralized piping is used for the exhaust air, the switching valve may stop halfway and fail to increase the pressure due to the influence of other exhaust. In the same manner, if a silencer or exhaust cleaner other than those designated by SMC is used, back pressure will be generated due to the clogging of the silencer, which may result in the switching valve stopping halfway and failing to increase the pressure.
- Depending on the necessity, install a silencer or an exhaust cleaner on the exhaust port of the booster regulator to reduce the exhaust noise.

**2. Maintenance space**

- Allow the sufficient space for maintenance and inspection.

**Selection**

**Caution**

**1. Check the specifications.**

- Consider the operating conditions and operate this product within the specification range that is described in this catalog.

**2. Selection**

- Based on the conditions (such as pressure, flow rate and cycle time) required for the outlet side of the booster regulator, check the selection procedures described in this catalog or model selection software for size selection of the booster regulator. Model selection can be done using the selection software on the SMC website. Go to Documents/Downloads → Model Selection Software → Booster Regulators
- 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.
- Set the pressure of the VBA10A, VBA20A, VBA22A, VBA40A, VBA42A or VBA43A (pressure increase ratio 2) to a level that is at least 0.1 MPa higher than the inlet pressure. If the pressure differential is 0.1 MPa or less, the internal operating pressure becomes the minimum operating pressure or less, and the switching valve may remain at the intermediate position, causing a restart failure.
- Set the pressure increase ratio of the VBA11A (pressure increase ratio 4) to 2 or more. When the VBA11A is used at a pressure increase ratio of 2 or less, the internal operating pressure becomes the minimum operating pressure or less, and the switching valve may remain at the intermediate position, causing a restart failure.
- When operating the booster regulator continuously for longer periods of time, particularly confirms service life.
- The service life of the booster regulator depends on not the operation hours but the operating cycles (piston sliding distance). The operating cycles (piston sliding distance) depend on the outlet flow of the booster regulator. Thus, when more outlet flow of the booster regulator is used, its service life becomes shorter. Selecting a booster regulator of a larger size will result in reduced operation frequency, thus increasing the service life of the product.
- When using two booster regulators for 2-stage pressure boost, be sure to provide a stable supply of pressure to the downstream booster regulator, and install a pressure vessel such as an air tank, etc., between the booster regulators. (Refer to the circuit diagram shown on page 1280.)



## Mounting

### ⚠ Caution

#### 1. Transporting

- When transporting this product, hold it lengthwise with both hands. Never hold it by the black knob that protrudes from the center because the knob could become detached from the body, causing the body to fall and leading to injury.

#### 2. Installation

- Install this product so that the silver-colored tie-rods and cover are placed horizontally. If mounted vertically, it may result in a malfunction.
- Because the piston cycle vibration is transferred, use the following mounting bolts (VBA1: M5; VBA2, 4: M10) and tighten them with the specified torque (VBA1: 3 N·m; VBA2, 4: 24 N·m).
- If the transmission of vibration is not preferred, insert an isolating rubber material before installation.
- Mount the pressure gauge with a torque of 7 to 9 N·m.

## Piping

### ⚠ Caution

#### 1. Flushing

- Use an air blower to flush the piping to thoroughly remove any cutting chips, cutting oil, or debris from the piping inside, before connecting them. If they enter the inside of the booster regulator, they could cause the booster regulator to malfunction or its durability could be affected.

#### 2. Piping size

- To bring the booster regulator's ability into full play, make sure to match the piping size to the port size.

## Air Supply

### ⚠ Caution

#### 1. Quality of air source

- Connect a mist separator to the inlet side near the booster regulator. If the quality of the compressed air is not thoroughly controlled, the booster regulator could malfunction (without being able to boost) or its durability could be affected.
- If dry air (atmospheric pressure dew point: -23°C or less) is used, the life expectancy may be shortened because dry air will accelerate evaporation of grease inside.

#### 2. Pressure fluctuation

- Provide a stable supply of pressure for the inlet pressure. If the inlet pressure supply is unstable, operation also becomes unstable, which may result in the switching valve stopping halfway and failing to increase the pressure.
- When starting up the compressor, be sure to wait for the pressure to stabilize at the min. operating pressure (0.1 MPa) or higher before supplying air so that pressure less than the min. operating pressure isn't being supplied to the booster regulator.

## Operating Environment

### ⚠ Caution

#### 1. Installation location

- Do not install this product in an area that is exposed to rainwater or direct sunlight.
- Do not install in locations influenced by vibrations. If it must be used in such an area due to unavoidable circumstances, please contact SMC beforehand.

## Handling

### ⚠ Caution

#### 1. Setting the pressure on the knob-operated type

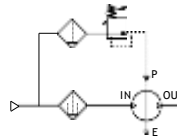
- If air is supplied to the product in the shipped state, the air will be released. Set the pressure by quickly pulling up on the governor knob, releasing the lock, and rotating the knob in the direction of the arrow (+).
- There is an upper and lower limit for the knob rotation. If over-rotating the knob even after reaching to the limit, the internal parts may be damaged. If the knob suddenly feels heavy while being turned, stop turning the knob.
- Once the setting is completed, push the knob down and lock it.
- To decrease the outlet pressure, after the pressure has been set, rotate the knob in the direction of the arrow (-). The residual air will be released from the area of the knob, due to the relief construction of the governor.
- To reset the pressure, first reduce the pressure so that it is lower than the desired pressure; then, set it to the desired pressure.



#### 2. Setting the pressure on the air-operated type (VBA22A, 42A)

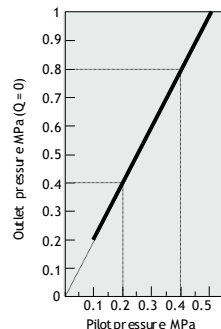
- Connect the outlet pipe of the pilot regulator for the remote control to the pilot port (P). (Refer to the diagram below.)
- Refer to the graph below for the relationship between the pilot pressure and outlet pressure.
- The AR20 and AW20 are recommended for the pilot regulator.

Pilot regulator



- The outlet pressure is twice the pilot pressure.
- When the inlet pressure is 0.4 MPa:

Pilot pressure  
0.2 MPa to 0.4 MPa  
Outlet pressure  
0.4 MPa to 0.8 MPa



**Handling**

**⚠ Caution**

**3. Draining**

- If this product is used with a large amount of drainage accumulated in the filter, mist separator or tank, the drainage could flow out, leading to equipment malfunction. Therefore, drain the system once a day. If it is equipped with an auto drain, check its operation once a day.

**4. Exhaust**

- If the air on the OUT side is not consumed for a long period of time when the pressure increase ratio is set to 2 or less, there may be delays in the left and right switching operation of the piston, which may result in air leakage from the exhaust port. This phenomenon is not considered abnormal. The leak will stop once the air on the OUT side is consumed.

**5. Maintenance**

**Booster regulator**

- Life expectancy varies depending on the quality of air and the operating conditions. Signs that the unit is reaching the end of its service life include the following:
  - Constant bleed from under the knob.
  - Air exhaust noise can be heard from the booster regulator at 10 to 20 second intervals even when there is no air consumption on the outlet side.
 Conduct maintenance earlier than scheduled in such cases.
- When maintenance is required, confirm the model and lot number of the booster regulator, and please contact S M C for maintenance kit.
- Conduct maintenance according to the specified maintenance procedure by individuals possessing enough knowledge and experiences in maintaining pneumatic equipment.
- The list of replacement parts and kit number are shown on page 1284, and the figure shows the position of the parts.

**Silencer**

It is normal for the silencer to change in color due to the turbine oil, grease, and drain contained in the exhaust, the surrounding atmosphere, etc. Back pressure will be generated if the silencer is clogged, which may result in the switching valve stopping halfway and failing to increase the pressure; therefore, be sure to perform regular maintenance on the product.

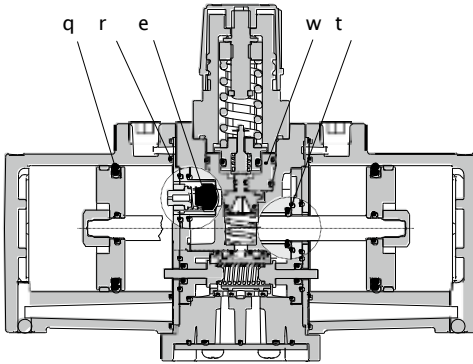
**6. Restart method when the pressure will not increase**

- With the inlet side in a pressurized state, use your finger, a finger valve, etc., to block the exhaust port, let the exhaust pressure rise, and then quickly release it.
- Release inlet and outlet pressure air and, after confirming the safety of the downstream devices, resupply the air.

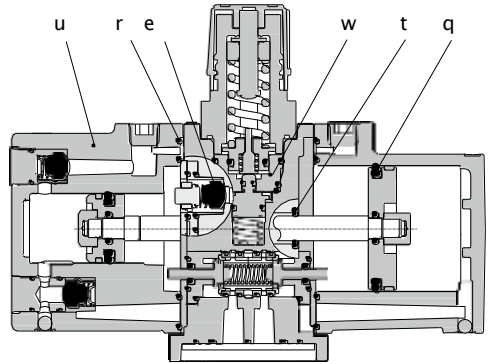
# VBA Series

## Construction/Replacement Parts

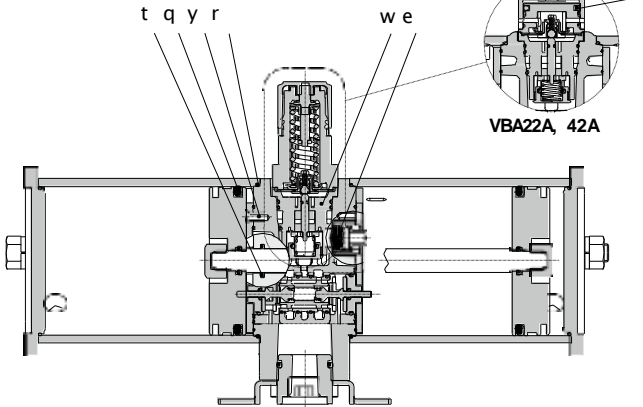
VBA10A



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 q to u and a grease pack.

No.	Description	Model	VBA10A	VBA20A	VBA40A	VBA22A	VBA42A	VBA43A	VBA11A
1	Piston seal			2		2 large 1 small		2	1 each large 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 Assembly								1
			1		2	1	2		1

- \* 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.

### Gentle Automatic Solution Sdn Bhd

No.36, Jalan Industri USJ 1/13, Taman Perindustrian USJ 1, 47600 Subang Jaya, Selangor.

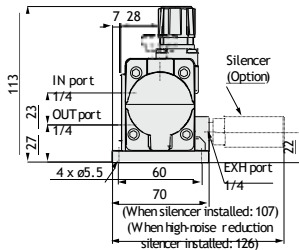
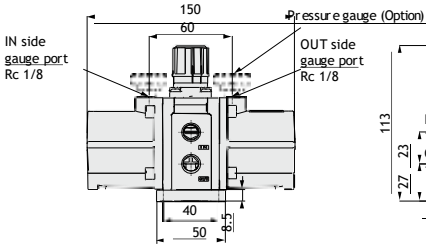
TEL: 603-8023 7743 / 8743 FAX: 603-8023 9743

 [sales@gentle.com.my](mailto:sales@gentle.com.my)  
 [www.gentle.com.my](http://www.gentle.com.my)

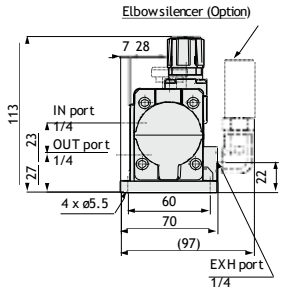
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 [waze.to/r/hw28325k63](https://wa.me/60380237743)

**Dimensions**

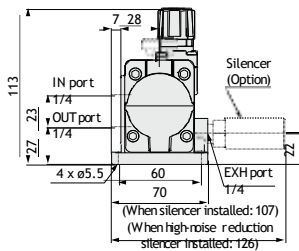
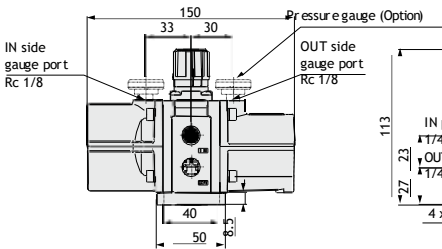
**VBA10A-02**



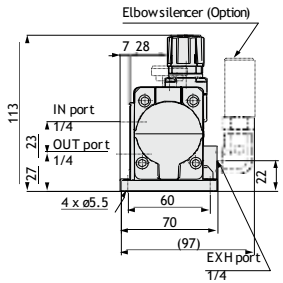
**With elbow silencer (Option)**



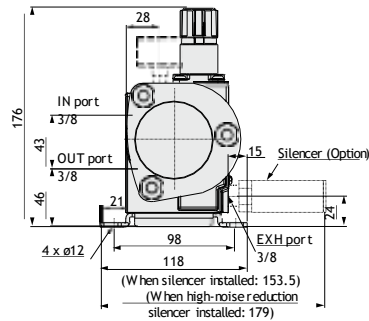
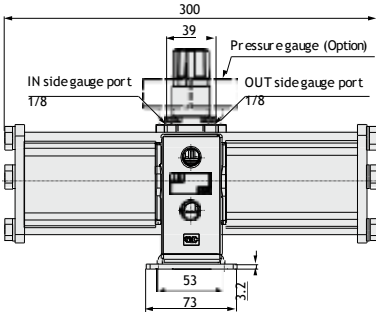
**VBA11A-02**



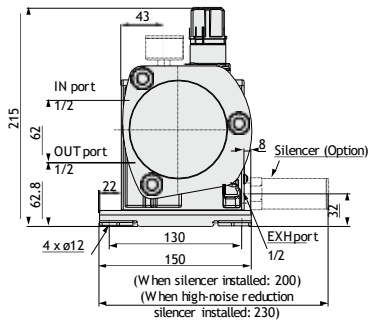
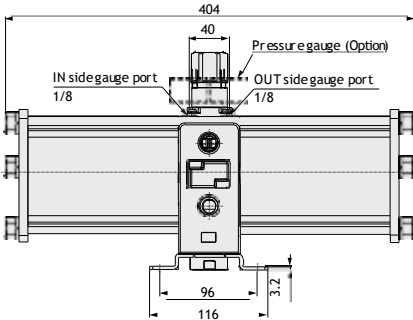
**With elbow silencer (Option)**



**VBA20A-03**



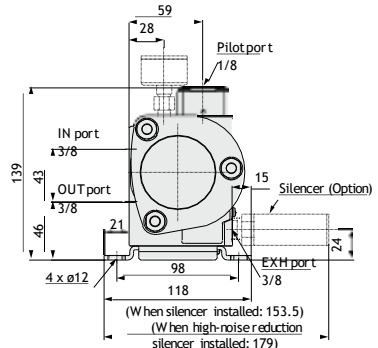
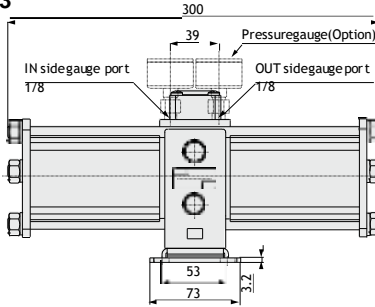
**VBA40A-04**



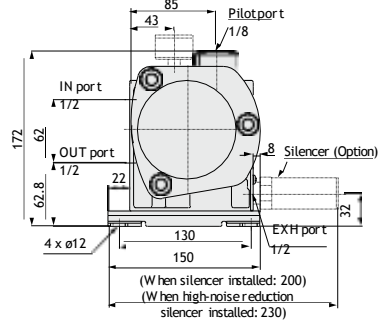
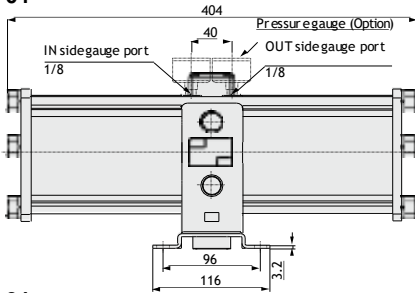
# VBA Series

## Dimensions

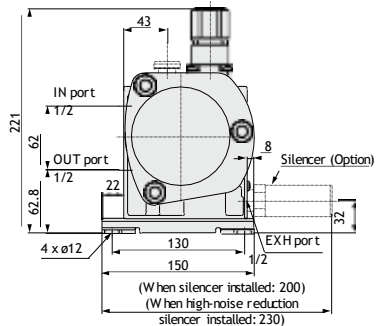
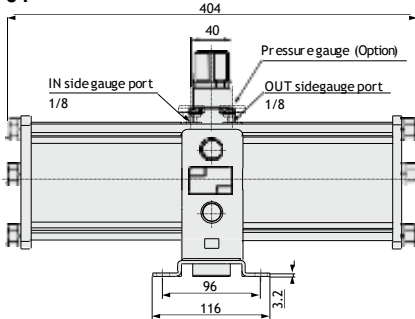
### VBA22A-03



### 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.

### 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 NB R (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.

## Gentle Automatic Solution Sdn Bhd

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