

Booster Regulator

Series VBA1110 to 4200

Specifications

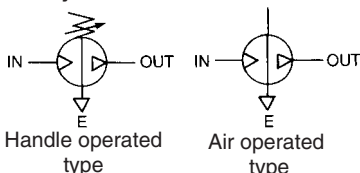
Pressure increase ratio	VBA1110 VBA2□00 VBA4□00	Max. 2
	VBA1111	2 to 4
Fluid		Compressed air
Proof pressure	VBA1110 VBA1111	3.0 MPa
	VBA2□00 VBA4□00	1.5 MPa
Max. supply pressure		0.1 to 1.0 MPa
Set pressure range	VBA1110 VBA1111	0.2 to 2.0 MPa
	VBA2□00 VBA4□00	0.2 to 1.0 MPa
Ambient and fluid temperature		2 to 50°C (No freezing)
Lubrication		Not required
Installation		Horizontal
Pressure adjustable mechanism		Relieving type



Handle operated type

Air operated type

JIS Symbol



Model

Model	Handle operated type				Air operated type	
	VBA1110-02	VBA1111-02	VBA2100-03	VBA4100-04	VBA2200-03	VBA4200-04
Max. flow (ℓ/min(ANR)) ^{Note)}	400	60	1000	1900	1000	1900
Connection port size Rc	1/4 (IN/OUT)		3/8 (IN/OUT)	1/2 (IN/OUT)	3/8 (IN/OUT)	1/2 (IN/OUT)
Exhaust port size Rc	1/4		3/8	1/2	3/8	1/2
Pilot port size Rc	—				1/8	
Pilot pressure range	—				0.1 to 0.5 MPa	
Weight (kg)	0.85	0.98	3.8	7.5	3.8	7.5

Note) Flow conditions VBA1110: IN = OUT = 1.0 MPa, VBA1111, VBA2□00, 4□00: IN=OUT=0.5 MPa
Refer to the flow characteristics table for selection.

Accessory (Option) / Part No.

Description	Model	Part no.				
		VBA1110-1111	VBA2100	VBA4100	VBA2200	VBA4200
Pressure gauge		G27-20-R1 ...2 pcs.	G27-10-R1-X209 ...2 pcs.	G46-10-01 ...2 pcs.	G27-10-R1-X209 ...2 pcs.	G46-10-01 ...2 pcs.
Silencer		AN200-02	AN300-03	AN400-04	AN300-03	AN400-04

How to Order

Pressure: 1 2.0 MPa

Pressure increase ratio: 0 Twice, 1 4 times

Pressure setting: 1 Handle operated type

Body size: 1 1/4

Port size: Symbol 02, Port size Rc 1/4

Series VBA1000: VBA 1 1 1 0 - 02 GN

Series VBA2000/4000: VBA 2 1 0 0 - 03 GN

Body size: 2 3/8, 4 1/2

Pressure setting: 1 Handle operated type, 2 Air operated type

Pressure: 0 1.0 MPa

Option: G Pressure gauge, N Silencer

Port size: Symbol 03, Port size Rc 3/8, Applicable series VBA2100, 2200; Symbol 04, Port size Rc 1/2, Applicable series VBA4100, 4200

Related Products

Description	Model	VBA1110/1111	VBA2100/2200	VBA4100/4200	Note
Mist separator		AM250-02	AM450-04, 06	AM550-06, 10	P. 14-20-16
Exhaust cleaner		AMC310-03	AMC510-06	AMC610-10	35 dB or more of noise reduction
Air tank		VBAT05 (5 ℓ, Directly connected to booster regulator)	VBAT20 (20 ℓ, Directly connected to booster regulator)	VBAT38 (38 ℓ, Directly connected to booster regulator)	—
		VBAT10 (10 ℓ, Directly connected to booster regulator)			

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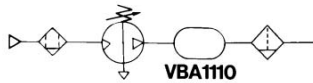
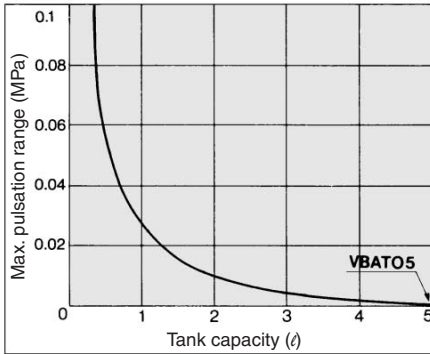
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Series VBA1110 to 4200

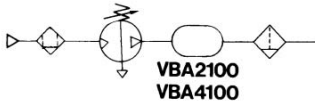
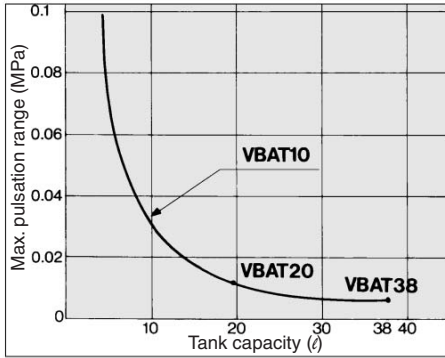
Pulsation is decreased by using tank.

If the outlet side capacity is undersized, pulsation may occur.

VBAT05



VBAT10, VBAT20, VBAT38



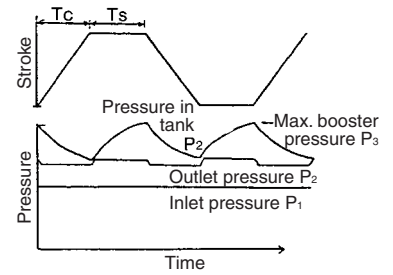
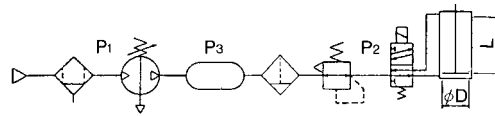
Conditions:
 Inlet pressure: 0.5 MPa
 Outlet side set pressure: 1 MPa
 Flow rate: Between 0 and max. flow rate

Performance of Air Tank

- Alleviates the pulsation generated on the outlet pressure side.
- Manages supply air to be consumed for a short period of time by storing air through raising the tank pressure.

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

Size Selection



START

□ : Example

Provide requisite conditions for selection.

Necessary conditions:
 D [mm]: Bore size
 L [mm]: Cylinder stroke
 W [mm/s]: Cylinder operating speed
 C [pc.]: Number of cylinders
 Ts [s]: Cylinder stop time
 P1 [MPa]: Inlet pressure
 P2 [MPa]: Outlet pressure (Necessary cylinder pressure)

Other conditions:
 Qb [l/min (ANR)]: Flow rate at the outlet side at P1 and P2
 Tc [s]: Cylinder stroke time
 K: Cylinder one side press. is 1, both sides intensified press. is 2.
 P3 [MPa]: Max. booster press. (Smaller one between inlet press. x Intensified press. ratio and Max. operating pressure.)
 T1 [s]: Charge time by P2 and P1 in charge characteristics table
 T2 [s]: Charge time by P3 and P1 in charge characteristics table
 Z [pc.]: Number of booster regulators

Calculate momentary flow Q.

$$Q \text{ [l/min(ANR)]} = \frac{\pi \times D^2 \times W}{4 \times 10^6} \times \frac{(P_2 + 0.101)}{0.101} \times 60 \times C$$

$$Q \text{ [l/min(ANR)]} = \frac{\pi \times 100^2 \times 200}{4 \times 10^6} \times \frac{(0.8 + 0.101)}{0.101} \times 60 \times 1 = 841$$

Select booster regulator size from flow characteristics table.

Refer to page 14-9-3 for flow characteristics.

VBA2□00: Qb = 500 [l/min (ANR)]
 VBA4□00: Qb = 1050 [l/min (ANR)]

Judgement of flow rate
 Qb < Q

NO : VBA4□00

YES : VBA2□00

Can not get necessary pressure.

Obtain the tank capacity V.

$$T_c \text{ [s]} = \frac{L}{W}$$

$$V \text{ [l]} = \frac{(Q - Q_b/2) \times (T_c \times K/60)}{(P_3 - P_2) \times 9.9}$$

$$T_c \text{ [s]} = \frac{100}{200} = 0.5$$

$$V \text{ [l]} = \frac{(841 - 500/2) \times (0.5 \times 2/60)}{(1 - 0.8) \times 9.9} = 5$$

Select tank with the capacity over V.

Select VBAT10 (10l), which can be directly connected to VBA2□00.

Calculate charge time T from charge characteristics table.

Refer to page 14-9-3 for charge characteristics table.

$$T \text{ [s]} = (V/10) \times (T_2 - T_1) / (Z)$$

$$T \text{ [s]} = (5/10) \times (12 - 3.7) = 4.2$$

Judgement of charge time
 T ≤ Ts

NO

Extend stop time
 Ts up to charge time T or more.

NO

Increase number of booster regulators (Z) to decrease T.

YES : 4.2 ≤ 29

YES

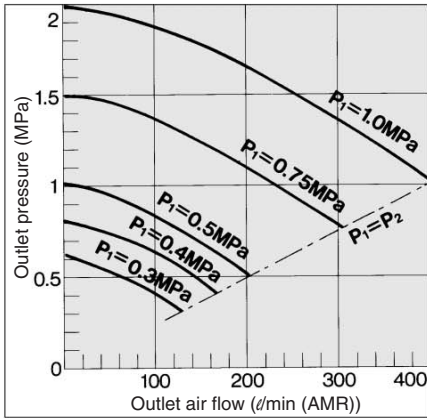
END

Booster regulator	VBA111□	VBA2□00	VBA4□00
Tank	VBAT05	VBAT10	VBAT20

Booster Regulator Series VBA1110 to 4200

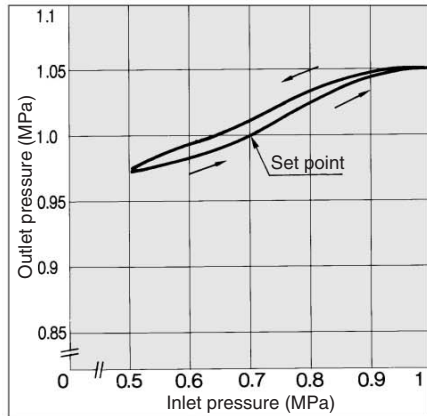
VBA1110

Flow Characteristics

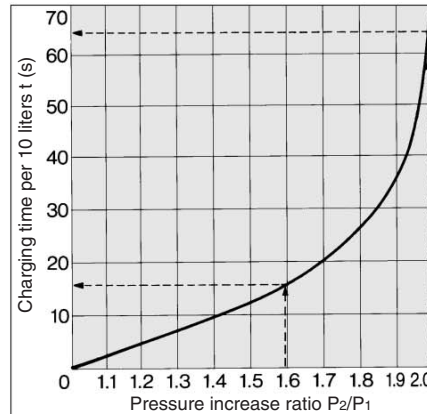


Pressure Characteristics

Inlet press.: 0.7 MPa
Outlet press.: 1.0 MPa
Flow rate : 20 l/min (ANR)



Charge Characteristics



VBA1110

● The required time to increase tank pressure from 0.8 MPa to 1.0 MPa at 0.5 MPa supply pressure is calculated as follows.

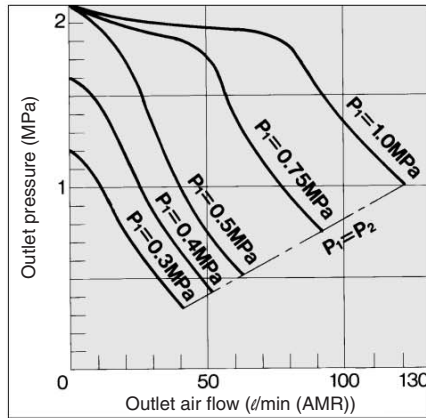
$$\frac{P_2}{P_1} = \frac{0.8}{0.5} = 1.6 \quad \frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0$$

With the pressure increase ratio from 1.6 to 2.0, the time of 65 - 16 = 49 sec. (t) is given for 10ℓ tank by the graph. Then, the charging time (T) for a 10ℓ tank,

$$T = t \times \frac{V}{10} = 49 \times \frac{10}{10} = 49 \text{ (s)}$$

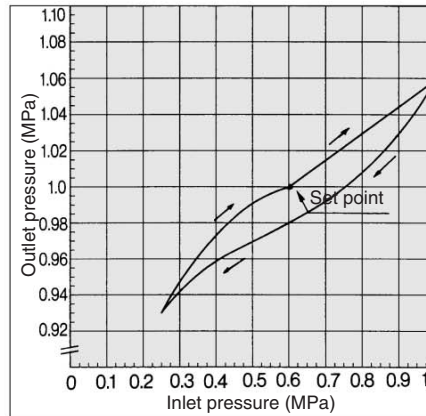
VBA1111

Flow Characteristics

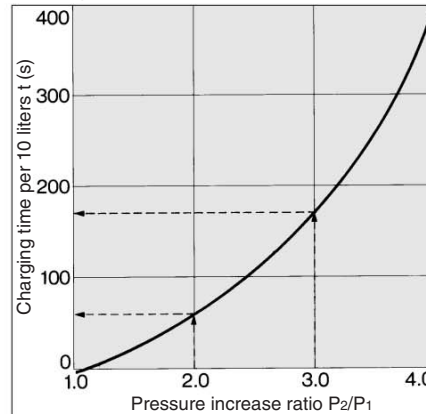


Pressure Characteristics

Inlet press.: 0.6 MPa
Outlet press.: 1.0 MPa
Flow rate : 10 l/min (ANR)



Charge Characteristics



VBA1111

● The required time to increase tank pressure from 1.0 MPa to 1.5 MPa at 0.5 MPa supply pressure is calculated as follows.

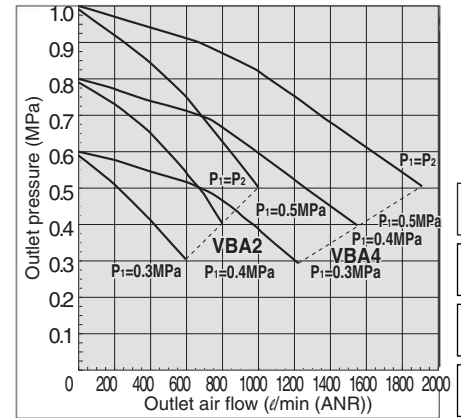
$$\frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0 \quad \frac{P_2}{P_1} = \frac{1.5}{0.5} = 3.0$$

With the pressure increase ratio from 2.0 to 3.0, the time of 170 - 60 = 110 sec. (t) is given for 10ℓ tank by the graph. Then, the charging time (T) for a 10ℓ tank,

$$T = t \times \frac{V}{10} = 110 \times \frac{10}{10} = 110 \text{ (s)}$$

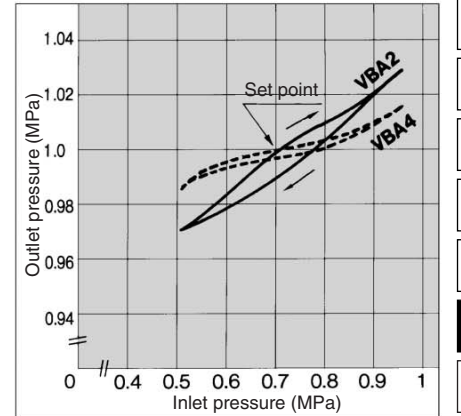
VBA2□00, 4□00

Flow Characteristics

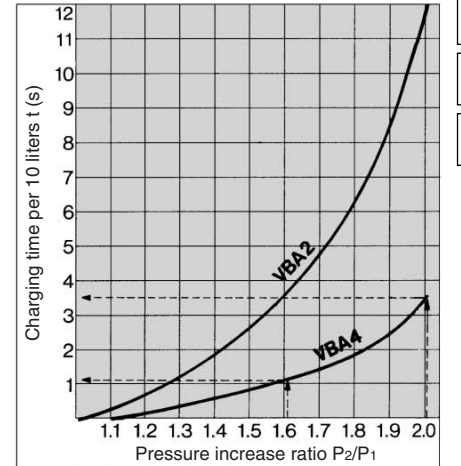


Pressure Characteristics

Inlet press.: 0.7 MPa
Outlet press.: 1.0 MPa
Flow rate : 20 l/min (ANR)



Charge Characteristics



VBA4

● The required time to increase tank pressure from 0.8 MPa to 1.0 MPa at 0.5 MPa supply pressure is calculated as follows.

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

With the pressure increase ratio from 1.6 to 2.0, the time of 3.5 - 1.1 = 2.4 sec. (t) is given for 10ℓ tank by the graph. Then, the charging time (T) for a 100ℓ tank,

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

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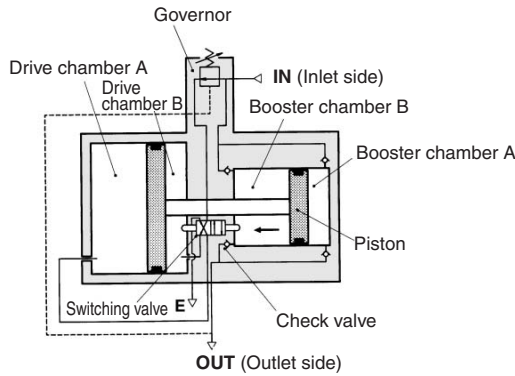
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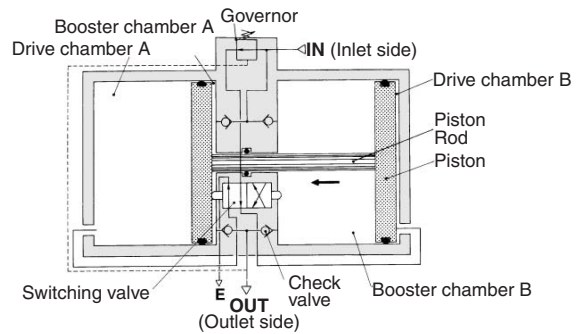
Series VBA1110 to 4200

Construction/Principle

VBA1111



VBA1110/2100/4100



The IN air passes the check valve to pressure boosting chambers A and B. Meanwhile, air is supplied to actuating chamber B via the governor and the switching valve. Then, the air from chamber B and boosting chamber A are applied to the piston, boosting the air in chamber B. As the piston travels, the boosted air is pushed via the check valve to the OUT side. When the piston reaches the end, the piston causes the switching valve to switch so that chamber B is in the exhaust state and chamber A is in the supply. Then, the piston reverses its movement, this time, the pressures from chamber B and chamber A boosts the air in pressure boosting 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 secondary pressure.

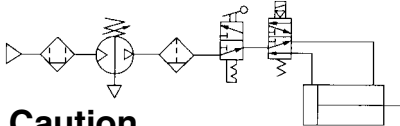
⚠ Precautions

Be sure to read before handling.
Refer to pages 14-21-3 to 14-21-4 for Safety Instructions and Common Precautions.

Caution on Design

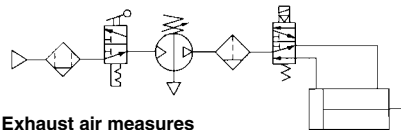
⚠ Warning

- 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, safety measures must be provided on the system side.
 - Because the outlet pressure could exceed its set range if there is a large fluctuation in the inlet pressure, and it could lead to unexpected accidents, provide safety measures against abnormal pressures.
 - Operate the equipment by maintaining its maximum operating pressure and set pressure range.
- Residual pressure measures**
 - Connect a 3 port valve to the OUT side of the booster valve if the residual pressure must be released quickly from the outlet pressure side, such as when servicing the equipment (refer to the diagram below.). The residual outlet pressure side cannot be released if the 3 port valve is connected to the IN side because the check valve in the booster valve will activate.



⚠ Caution

- System configuration**
 - Make sure to install a mist separator (Series AM) on the inlet side of the booster valve.
 - Also install a cleaning device such as an air filter or a mist separator on the outlet side as necessary. Because the booster valve contains a sliding mechanism and the inner wall of the tank for the booster valve is untreated, dust flows out to the secondary side.
 - Connect a lubricator to the outlet side, because the accumulated oil in the booster valve may result in a malfunction.
 - After completing the work, release the supply pressure from the inlet side by operating the residual pressure release valve, thus stopping any unnecessary movement and preventing equipment malfunction.



- Exhaust air measures**
 - Provide a dedicated pipe to release the exhaust air from each booster valve. If exhaust air is converged into a pipe, the back pressure that is created could cause improper operation.
 - Depending on the necessity, install a silencer or an exhaust cleaner on the exhaust port of the booster valve to reduce the exhausting sound.
- Maintenance space**
 - Allow the sufficient space for maintenance and inspection.

Selection

⚠ Caution

- Verify the specifications.**
 - Consider the operating conditions and operate this product within the specification range that is described in this manual.
- Selection**
 - Based on the conditions (pressure, flow rate, tact time, etc.) required for the outlet side of the booster valve, select the size of the booster valve in accordance with the selection procedures described in this manual.
 - Use VBA1111 (boost pressure ratio 4) between boost pressure ratio of 2 to 4. Usage of boost pressure ratio below 2 (boost pressure ratio 2) is preferred. A stable operation and increased life expectancy will result.
 - Inlet supply pressure volume is approximately twice the volume of the outlet side. (Approx. 2 times (boost pressure ratio 2), Approx. 4 times (boost pressure ratio 4)). Boost regulator requires that the inlet side volume should be the sum of the flow volume running into the outlet side and the volume exhausted from E port (for driving), because air is the power source.
 - When running continuously for a longer period of time, confirm the life expectancy. The life expectancy of a booster regulator is dependant upon the operational cycle. Thus, when used for driving cylinders, etc. from the outlet side, life expectancy will be reduced.
 - Make sure the outlet pressure is set more than 0.1 MPa higher than the inlet pressure. A pressure difference less than 0.1 MPa makes the operation unstable and may result in a malfunction.

Mounting

⚠ Caution

- Transporting**
 - When transporting this product, hold it lengthwise with both hands. Never hold it by the black handle that protrudes from the center because the handle could become detached from the body, causing the body to fall and lead to injury.
- 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 retaining 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 between a product and the mounting surface.

Piping

⚠ Caution

- Flushing**
 - Use an air blower to thoroughly flush the piping, or wash 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 valve, they could cause the booster valve to malfunction or its durability could be affected.
- Piping size**
 - To bring the booster valve's ability into full play, make sure to match the piping size to the port size.

Air Supply

⚠ Caution

- Quality of source air**
 - Connect a mist separator to the inlet side near the booster valve. If the quality of the compressed air is not thoroughly controlled, the booster valve could malfunction (without being able to boost) or its durability could be affected.

Operating Environment

⚠ Caution

- Installation location**
 - Do not install this product in an area that is exposed to water 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

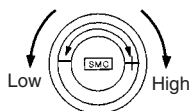
⚠ Caution

1. Pressure setting

- Do not exceed the set pressure when turning the governor handle (VBA□1□□) or supplying pilot pressure (VBA□200). If the inlet pressure rises, the outlet pressure will also rise, and there may be exceeding the maximum operating pressure. If the inlet pressure rises, the outlet pressure will also rise, possibly exceeding the maximum operating pressure.
- The outlet pressure cannot be set below the inlet pressure. The outlet pressure has to be more than the inlet pressure.

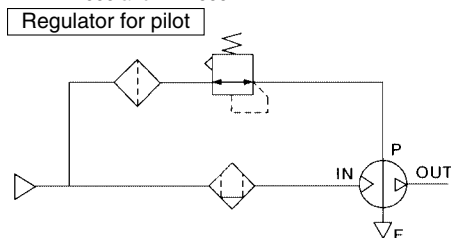
2. Setting the pressure on the handle operated type (VBA*1**, VBA1311)

- 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 handle, and rotating it in the direction of the arrow (+).
- If the handle suddenly feels heavy while being turned, stop turning the handle. Once the setting is completed, push the handle down.
- After completing the pressure setting, push the handle in.
- After the pressure has been set, the outlet pressure will be released from the area of the handle, due to the relief construction of the handle.
- To reset the pressure, first reduce the pressure so that it is lower than the desired pressure; then, set it to the desired pressure.

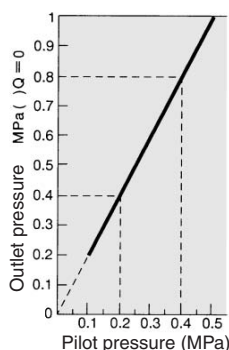


3. Setting the pressure on the air operated type (VBA2200, VBA4200)

- Connect the outlet pipe of the pilot regulator for remote operation to the pilot port (P). (Refer to the diagram below.)
- Refer to the diagram below for the pilot pressure and the outlet pressure.
- The recommended pilot regulators are AR2000 and AW2000.



- 2 times of pilot pressure is outlet pressure.
- At 0.4 MPa at inlet pressure
Pilot pressure: 0.2 MPa to 0.4 MPa
Outlet pressure: 0.4 MPa to 0.8 MPa



4. Draining

- If this product is used with a large amount of drainage accumulated in the filter, mist separator, or the 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.

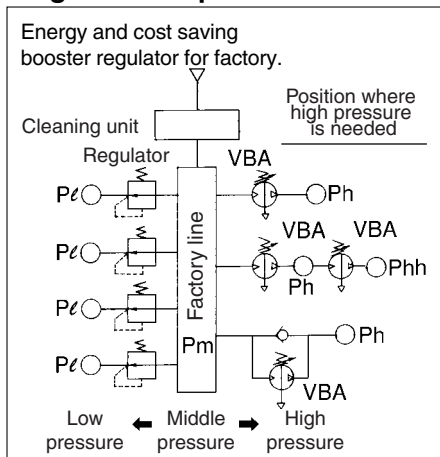
5. Exhaust

- Exhausting time from E port may be longer for a booster regulator which is set to switch in longer hour intervals. This is not an abnormal phenomenon.

6. Maintenance

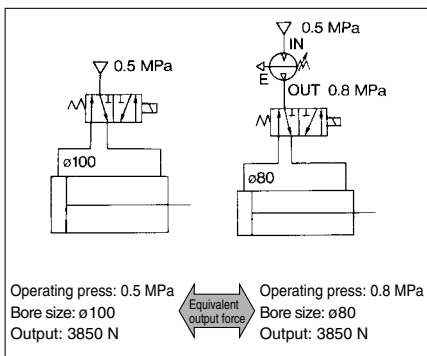
- Life expectancy varies depending on the quality of air and the operating conditions. As a symptom of the end of life expectancy, it can be found by breathing all the time beneath the handle, or hearing the exhausting sound from booster regulator in 10 to 20 second intervals despite no air consumption in the outlet side. Conduct maintenance earlier than scheduled in such cases.
- When maintenance is required, confirm the model and serial number of the booster regulator, and please contact SMC for maintenance kit.
- Maintenance should be carried out according to the specified maintenance procedure by individuals possessing enough knowledge and experiences in maintaining pneumatic equipment.

Diagram Example



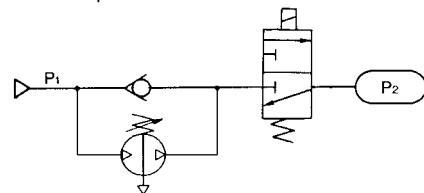
Application

- When certain equipment requires a higher pressure than the plant's line pressure.
- When the lower limit pressure for equipment must be ensured due to the fluctuation and reduction of the plant's line pressure.
- When the actuator lacks power output for some reason but it is not feasible to replace it with a larger bore cylinder due to space constraints.
- In spite of diverse pressure conditions of the end user, equipment that achieves the specified high power output must be provided.
- When a small cylinder size is desired while ensuring sufficient power, in order to achieve a compact drive unit.

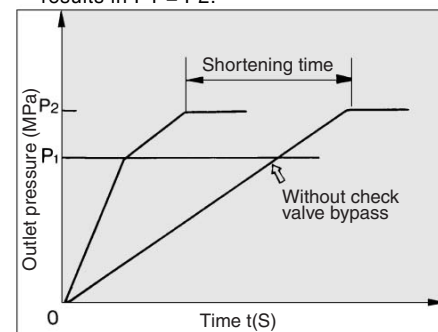


- When the hydraulic pressure of an air-hydro unit must be raised.
- When the pressure must be raised in an explosion-proof environment.
- To boost the pressure by remote operation, using an air operated type.

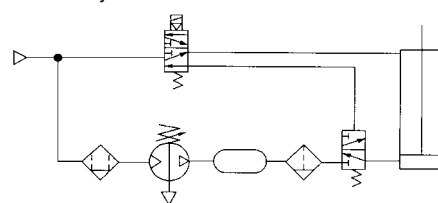
- When the tank must be filled from the atmosphere in a short time.



Initially, inlet pressure (P1) passes through the check valve, fills P2, and results in P1 = P2.



- When the pressure in one chamber of the cylinder must be boosted.



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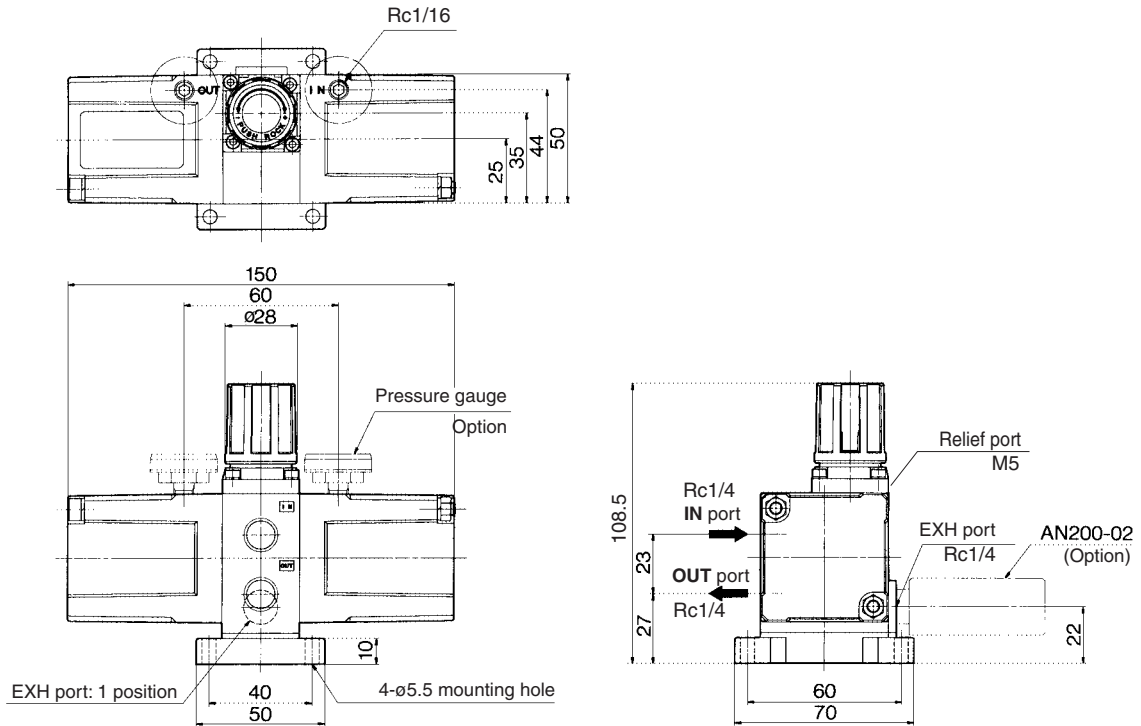
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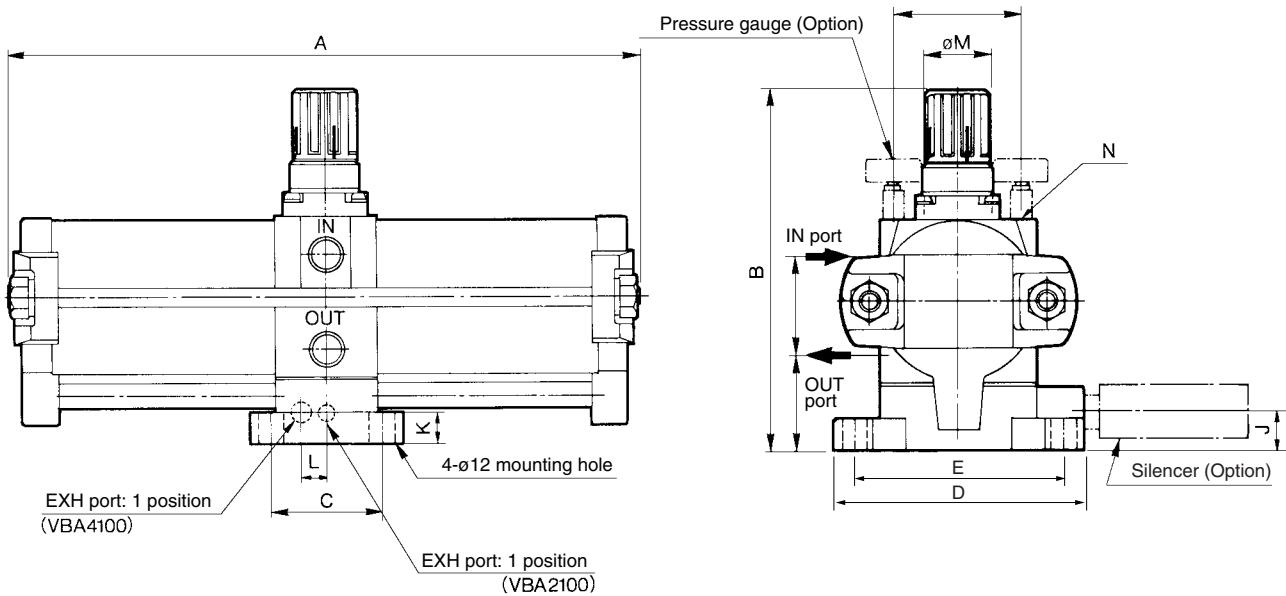
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Series VBA1110 to 4200

Handle Operated Type VBA1110-02, VBA1111-02



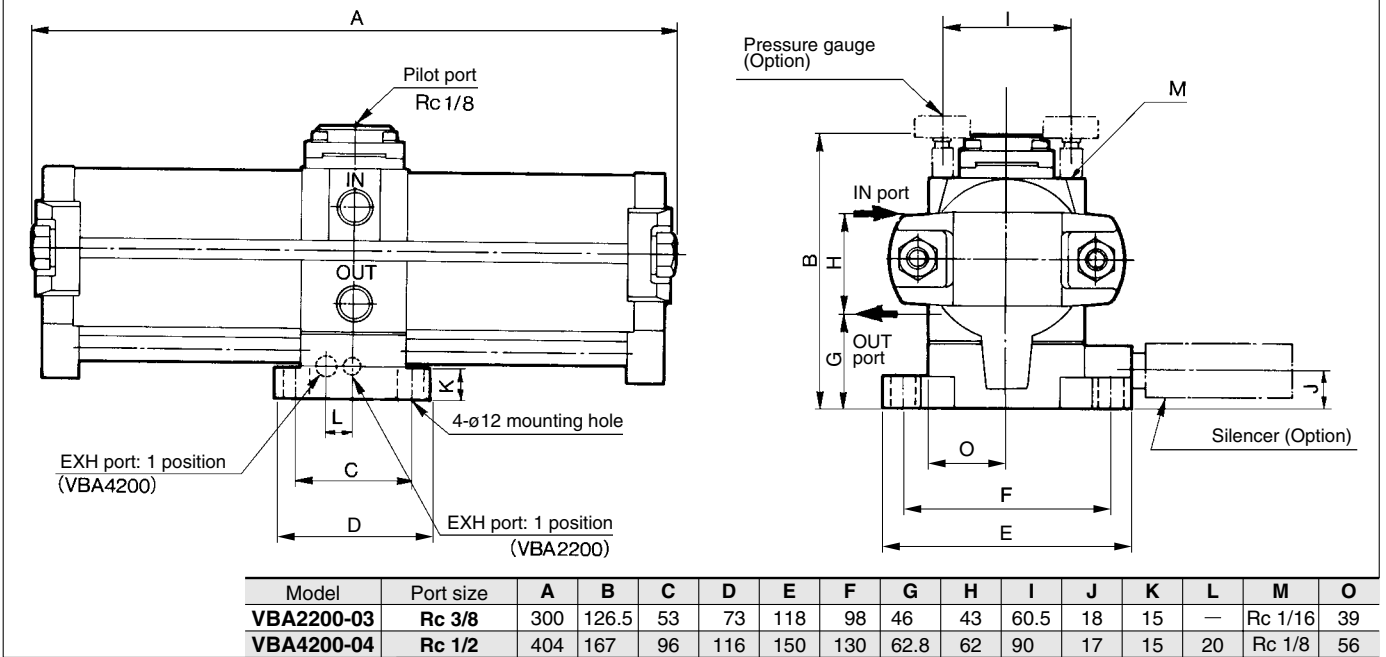
Handle Operated Type VBA2100-03, VBA4100-04



Model	Port size	A	B	C	D	E	F	G	H	I	J	K	L	ϕM	N	O
VBA2100-03	Rc 3/8	300	170	53	73	118	98	46	43	60.5	18	15	—	31	Rc 1/16	39
VBA4100-04	Rc 1/2	404	207.5	96	116	150	130	62.8	62	90	17	15	20	40	Rc 1/8	56

Booster Regulator Series VBA1110 to 4200

Air Operated Type VBA2200-03, VBA4200-04



⚠ Precautions (Air Tank)

Be sure to read before handling.
Refer to pages 14-21-3 to 14-21-4 for Safety Instructions and Common Precautions.

Caution on Design

⚠ Warning

1. Operating pressure

- Operate this product at or below the maximum operating pressure. If it is necessary, take appropriate safety measures to ensure that the maximum operating pressure is not exceeded.
- Even when the tank alone is used, use a pressure switch or a safety valve to make sure that the maximum operating pressure is not exceeded.

2. Applicability

- The air tank has been designed in compliance with the regulations in Japan. Compliance with the regulations in Japan might not be applicable when the product is used overseas. Therefore, verify the regulations of the country in question before operating this product.

3. Connection

- Connect a filter or a mist separator to the OUT side of the tank. Because the inner wall of the tank is untreated, there is a possibility of dust flowing out to the outlet side.
- Using tank accessories, a VBA booster valve can be connected in the combinations indicated below.

		Booster regulator		
		VBA1*1*	VBA2*00	VBA4*00
Air tank	VBAT05(S)	●		
	VBAT10(S)	●	●	
	VBAT20(S)		●	●
	VBAT38(S)		●	●

Selection

⚠ Caution

- Consider the operating conditions and operate this product within its specification range.
- Follow the size selection procedure indicated on page 14-8-30 to select the size of the air tank if it will be used with a booster valve connected to it.

Mounting

⚠ Caution

1. Accessories

- The accessories are secured by bands to the feet of the tank. Once removed, make sure not to lose them.

2. Installation

- Tank should be installed away from people. It is dangerous if the accumulated air inside the tank were to seep out.
- When connecting a booster valve with the tank, refer to the operation manual first, which is provided with the air tank before assembling.
- To mount the air tank on a floor surface, use the four holes to secure the tank with bolts or anchor bolts.

Maintenance

⚠ Warning

1. Inspection

- The use of pressure vessels could lead to an unexpected accident due to external damage or internal corrosion caused by drainage. Therefore, make sure to check periodically for external damage, or the extent of internal corrosion through the port hole. An ultrasonic thickness indicator may also be used to check for any reduction in material thickness.

2. Draining

- If this product is used with a large amount of drainage accumulated in the filter, mist separator, or the 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.

F.R.L.

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