

Booster Regulator

VBA1110 to 4200

Specifications

Pressure increase ratio	VBA1110 VBA2□00 VBA4□00	MAX. 2
	VBA1111	MAX. 4
Fluid	Compressed air	
Proof pressure	VBA1110 VBA1111	3.0MPa
	VBA2□00 VBA4□00	1.5MPa
	Max. supply pressure	
Set pressure range	VBA1110 VBA1111	0.2 to 2.0MPa
	VBA2□00 VBA4□00	0.2 to 1.0MPa
	Ambient and fluid temperature	
Lubrication	Not required	
Installation	Horizontal	
Pressure adjustable mechanism	Relieving style	



VBA1110-02



VBA1111-02



VBA4100-04



VBA2100-03

Handle operated style

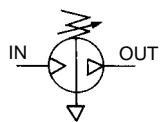


VBA4200-04

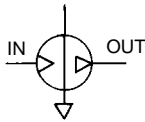


VBA2200-03

Air operated style



Handle operated



Air operated

Model

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

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

Accessory (Option)/Part Numbers

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

How to Order

Pressure	1 2.0MPa	Pressure increase ratio	0 Twice
Pressure setting	1 Handle operated	1 4 times	
Body size	1 1/4	Port size	Symbol Port size
		F02 G1/4	

VBA1000	EVBA	1	1	1	0	F02	GN
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VBA2000/4000	EVBA	2	1	0	0	F03	GN
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Body size	2 3/8	Option	G Gauge
4 1/2		N Silencer	

Pressure setting	1 Handle operated	Port size	Symbol Port size Applicable series
2 Air operated		F03 G3/8 VBA2100, 2200	
		F04 G1/2 VBA4100, 4200	

Pressure	0 1.0MPa
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Related Products

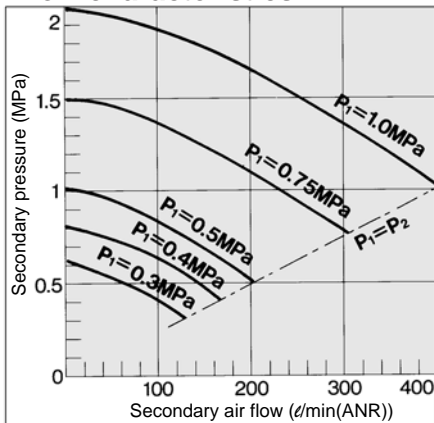
Description	Model	VBA1110/1111	VBA2100/2200	VBA4100/4200	Notes
Mist separator	AM250-02		AM450-04/06	AM550-06/10	P.4.6-1
Exhaust cleaner	AMC310-03		AMC510-06	AMC610-10	35dB or more of noise reduction
Air tank (Note)		(5ℓ, Directly connected to booster regulator)	(20ℓ, Directly connected to booster regulator) (38ℓ, Directly connected to booster regulator)		—
		(10ℓ, Directly connected to booster regulator)			

Note: Contact SMC for Air Tanks which comply to European Pressure Vessel Directive 97/23/EC

Booster Regulator VBA1110 to 4200

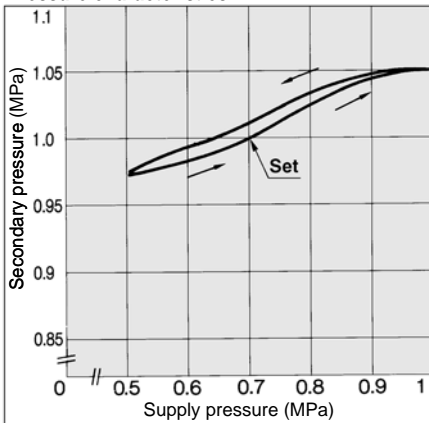
VBA1110

Flow characteristics

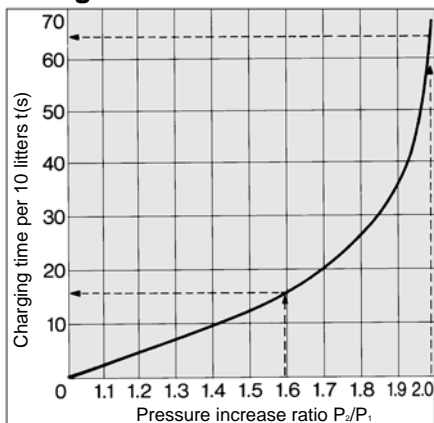


Conditions: Supply press. 0.7MPa
Secondary press. 1.0MPa
Flow: 20l/min(ANR)

Pressure characteristics



Charge characteristics



VBA1110

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

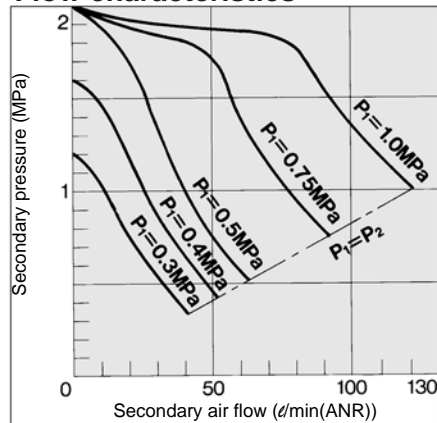
$$\frac{P_2}{P_1} = \frac{0.8}{0.5} = 1.6 \quad \frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0$$

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,

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

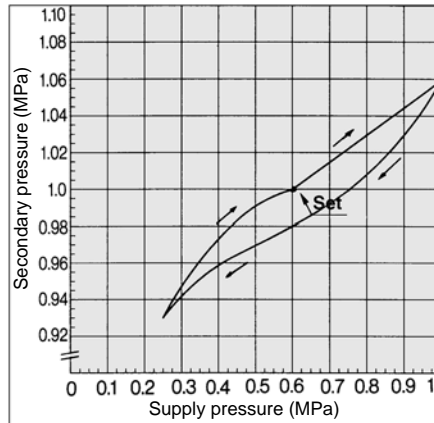
VBA1111

Flow characteristics

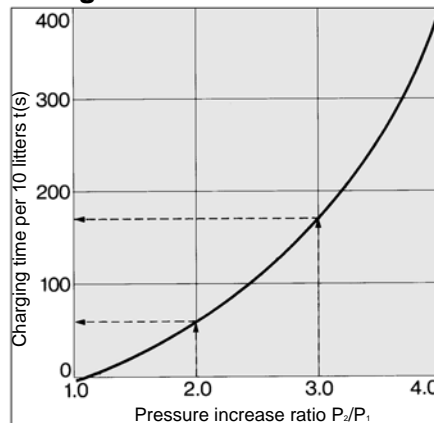


Conditions: Supply press. 0.6MPa
Secondary press. 1.0MPa
Flow: 10l/min(ANR)

Pressure characteristics



Charge characteristics



VBA1111

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

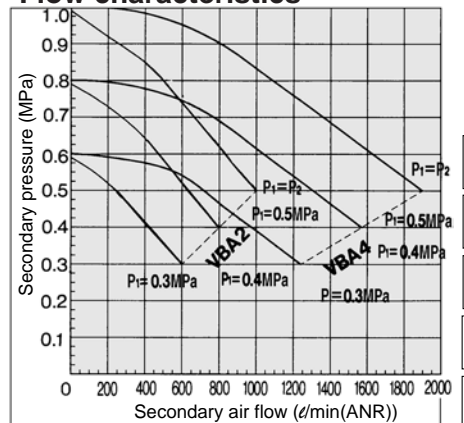
$$\frac{P_2}{P_1} = \frac{1.0}{0.5} = 2.0 \quad \frac{P_2}{P_1} = \frac{1.5}{0.5} = 3.0$$

With the pressure increase ratio from 2 to 3, 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,

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

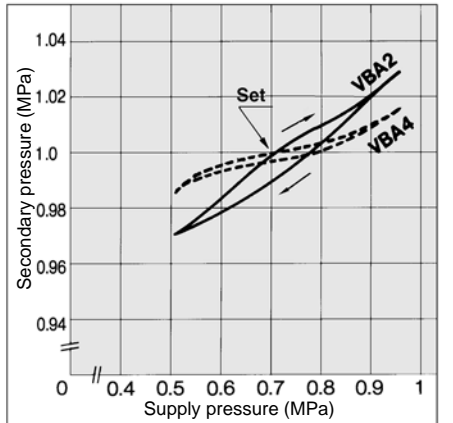
VBA2□00/4□00

Flow characteristics

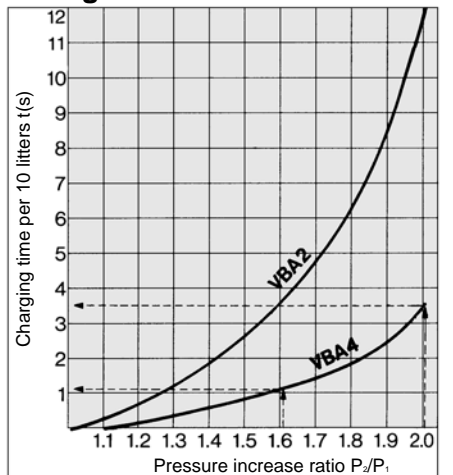


Conditions: Supply press. 0.7MPa
Secondary press. 1.0MPa
Flow: 20l/min(ANR)

Pressure characteristics



Charge characteristics



VBA4

● The required time to increase tank pressure from 0.8MPa to 1.0MPa at 0.5MPa 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,

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

AC

AV

AU

AF

AR

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VEX

SRP

AW

AMR

AWM

AWD

ITV

VBA

G

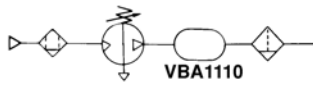
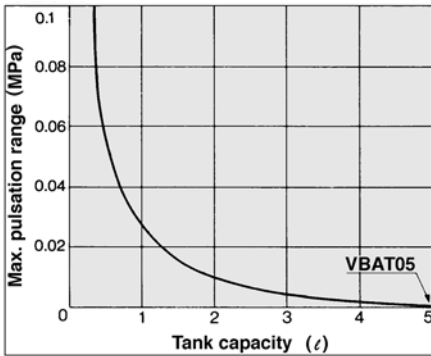
AL

VBA1110 to 4200

Pulsation is decreased by using tank.

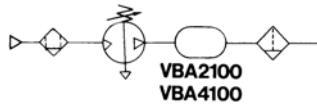
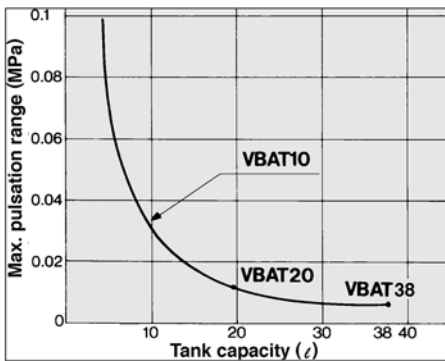
If secondary capacity is undersized, pulsation may occur.

5 Litre tank



VBA1110

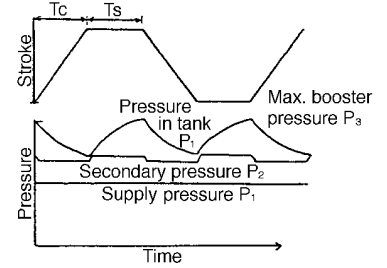
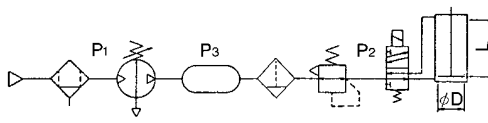
10, 20 & 38 Litre tank



VBA2100
VBA4100

Condition:
Supply pressure: 0.5MPa
Secondary side set pressure: 1MPa
Flow rate: Between 0 and max. flow rate

Size Selection



START

Example

Provide necessary conditions on selection.

Necessary conditions:
D[mm]: Cylinder bore size
L[mm]: Cylinder stroke
W[mm/s]: Cylinder operating speed
C[pc.]: Number of cylinders

Other conditions:
Qb[l/min(ANR)]: Flow rate at secondary 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.
(Primary press. X intensified press.ratio)
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
(Necessary cylinder pressure)

Calculate momentary flow Q.

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

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

Refer to p.1.13-2 for flow rate characteristics table.

VBA2□00: Qb = 500 [l/min(ANR)]
VBA4□00: Qb = 1100 [l/min(ANR)]

Select booster regulator size from flow characteristic table.

Judgement of flow rate
Qb < Q

NO VBA4□00

YES

VBA2□00

Can not get necessary pressure.

Calculate tank capacity

$$Tc[s] = \frac{L}{W}$$

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

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

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

Select tank with the capacity over V.

Select VBAT10 (10L) can connect directly to VBA2□00.

Calculate charge time T from charge characteristics table.

Refer to p.1.13-2 for charge characteristics table.

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

$$T[s] = (4.8/10) \times (12 - 3.7) = 4$$

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 ≤ 29

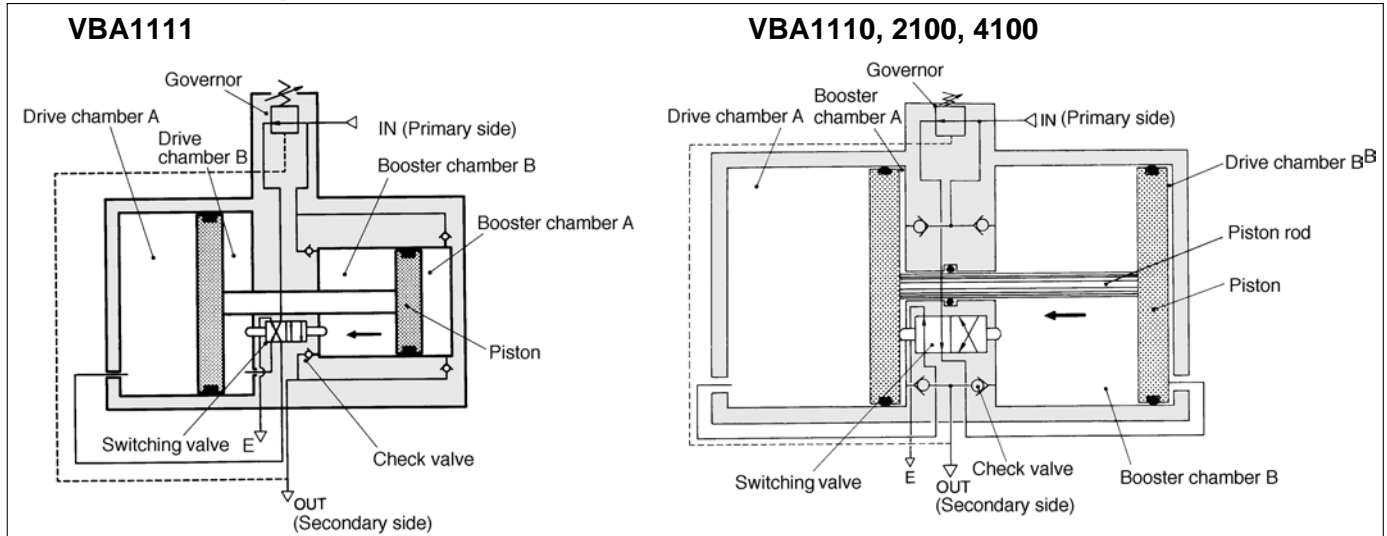
YES

END

Booster	VBA111□	VBA2□00	VBA4□00
Tank	5 Litre	10 Litre	20 Litre

Booster Regulator VBA1110 to 4200

Construction/Principle



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 boost the air in pressure boosting chamber A and send 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.

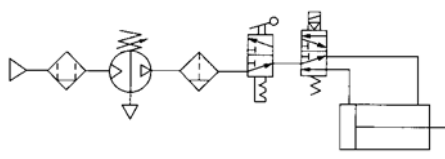
AC
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VEX
SRP
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AMR
AWM
AWD
ITV
VBA
G
AL

⚠️ Precaution

Be sure to read before handling. Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalogue, and refer to p.1.0-2 and 1.0-3 for precautions on every series.

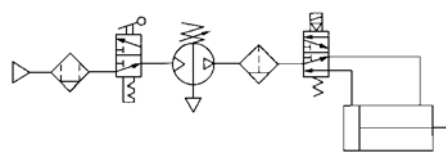
Precautions on design

- #### ⚠️ Warning
- Warning concerning abnormal secondary pressure**
 - If there is a likelihood of causing a secondary 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 secondary pressure could exceed its set range if there is a large fluctuation in the primary pressure, and 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 secondary pressure side, such as when servicing the equipment (refer to the diagram below). The residual secondary pressure 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 (AM series) on the primary side of the booster valve.
 - Also install a cleaning device such as an air filter or a mist separator on the secondary 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 secondary side because the accumulation of oil in the booster valve could lead to equipment malfunction.
- After completing the work, release the supply pressure from the primary side by operating the residual pressure release valve, thus stopping any unnecessary movement and preventing equipment malfunction.



- Considering the transmission of piston cycle vibration, use retaining bolts (VBA1: M5; VBA2, 4: M10) and tighten them to the specified torque (VBA1: 3Nm; VBA2, 4: 24Nm).
- If it is necessary to prevent the transmission of vibration, place an isolating rubber material in between the 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 inside the piping, 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.

Source air

- #### ⚠️ Caution
- Quality of source air**
 - Connect a mist separator to the primary 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 it in an area that is exposed to vibrations. If it must be used in such an area due to unavoidable circumstances, contact SMC beforehand.

Handling

- #### ⚠️ Warning
- Pressure setting**
 - Do not exceed the set pressure when turning the governor handle (VBA *1**) or supplying pilot pressure (VBA₄: 200). If the primary pressure rises, the secondary pressure will also rise, possibly exceeding the maximum operating pressure.

Selection

- #### ⚠️ Caution
- Verify the specifications.** Consider the operating conditions and operate this product within the specification range that is described in this manual.
 - Based on the requirements (pressure, flow rate, tact time, etc.) of the secondary side of the booster valve, select the size of the booster valve in accordance with the selection procedure described in this manual.

Installation

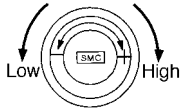
- #### ⚠️ Caution
- Transporting**
 - When transporting this product, hold it lengthwise with both hands. Never hold it by the black handle that protrudes from the centre because the handle could become detached from the body, causing the body to fall and leading to injury.
 - Installation**
 - Install this product so that the tie rod painted silver is horizontal.

VBA1110 to 4200

⚠ Caution

① Setting the pressure on the handle operated style (VBA *1**, VBA1311)

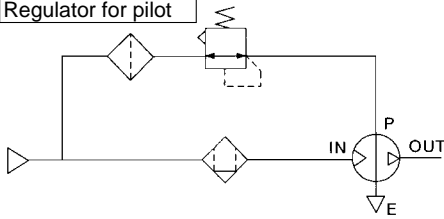
- If air is supplied to the product in the shipped state, the air will be released. Set the pressure by quickly pulling up on the governor handle, and rotating it in the direction of the arrow (+).
- After completing the pressure setting, push the handle in.
- After the pressure has been set, the secondary 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.



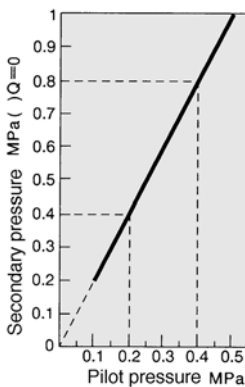
② Setting the pressure on the air operated style (VBA2200, VBA4200)

- Connect the secondary 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 secondary pressure.
- The recommended pilot regulators are AR2000 and AW2000.

Regulator for pilot



- 2 times of pilot pressure is secondary pressure.
- At 0.4MPa at primary pressure
Pilot pressure 0.2MPa to 0.4MPa
Secondary pressure 0.4MPa to 0.8MPa



③ Draining

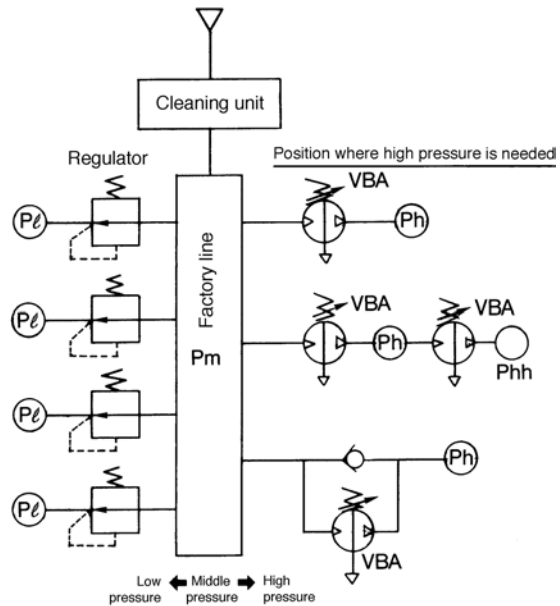
- If this product is used with a large amount of drainage accumulated in the filter, mist separator, or the tank, the drainage could flow out, leading to equipment malfunction. Therefore, drain the system once a day. If it is equipped with an auto drain, check its operation once a day.

④ Exhaust air

- After operating this product for an extended time in the set state, if the booster valve is switched, it could take a longer period of time to discharge the air from the E port. This symptom is normal.

Diagram example

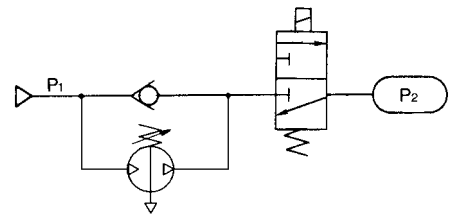
Energy and cost saving booster regulator for factory.



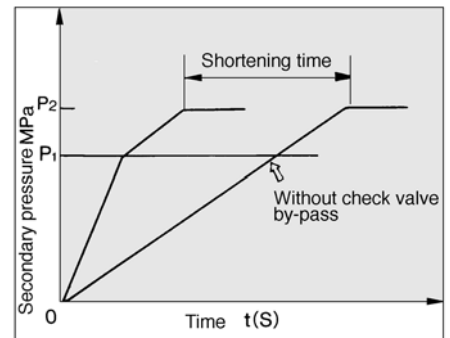
Applications

- ① When certain equipment requires a higher pressure than the plant's line pressure.
- ② When the lower limit pressure for equipment must be ensured due to the fluctuation and reduction of the plant's line pressure.
- ③ When the actuator lacks power output for some reason but it is not feasible to replace it with a large bore cylinder due to space constraints.
- ④ In spite of diverse pressure conditions of the end user, equipment that achieves the specified high power output must be provided.
- ⑤ When a small cylinder size is desired while ensuring sufficient power, in order to achieve a compact drive unit.

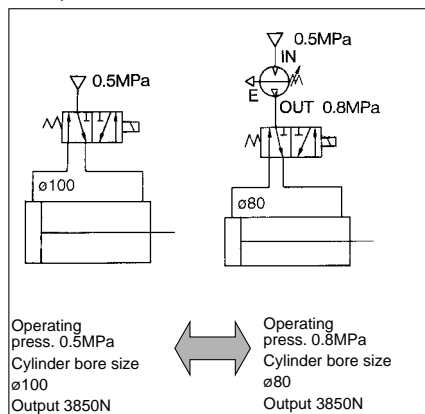
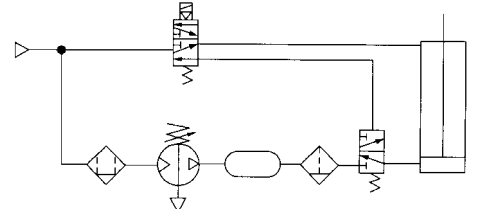
- ⑨ When the tank must be filled from the atmosphere in a short time.



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



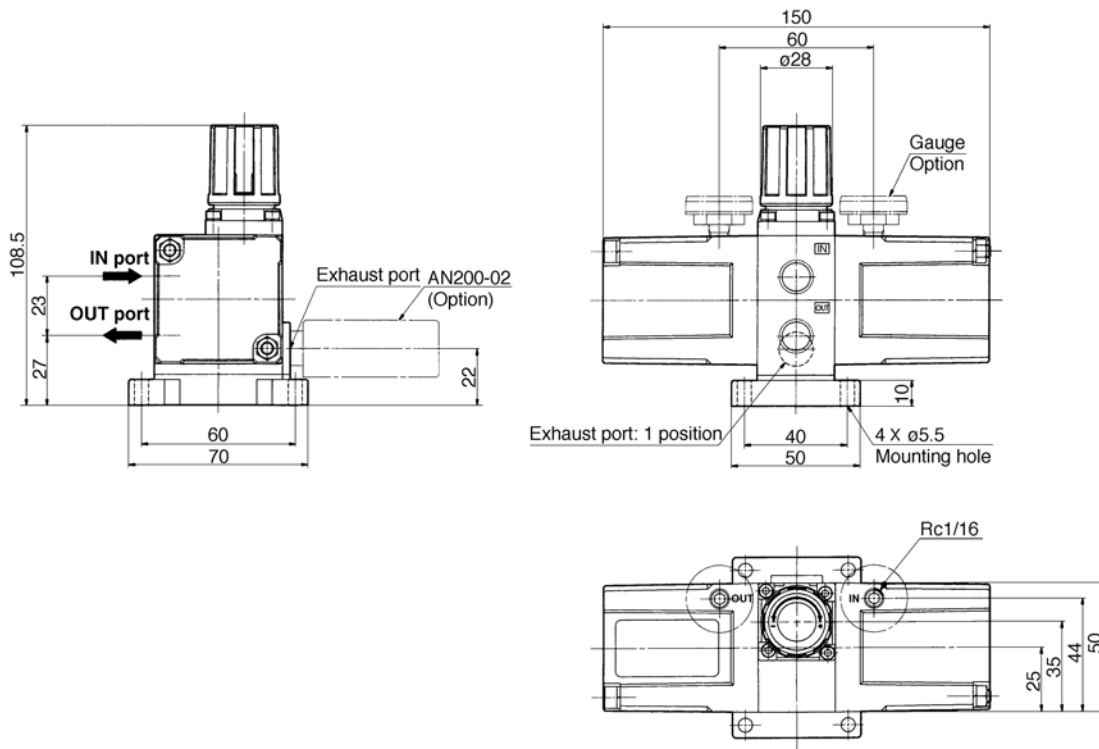
- ⑩ When the pressure in one chamber of the cylinder must be boosted.



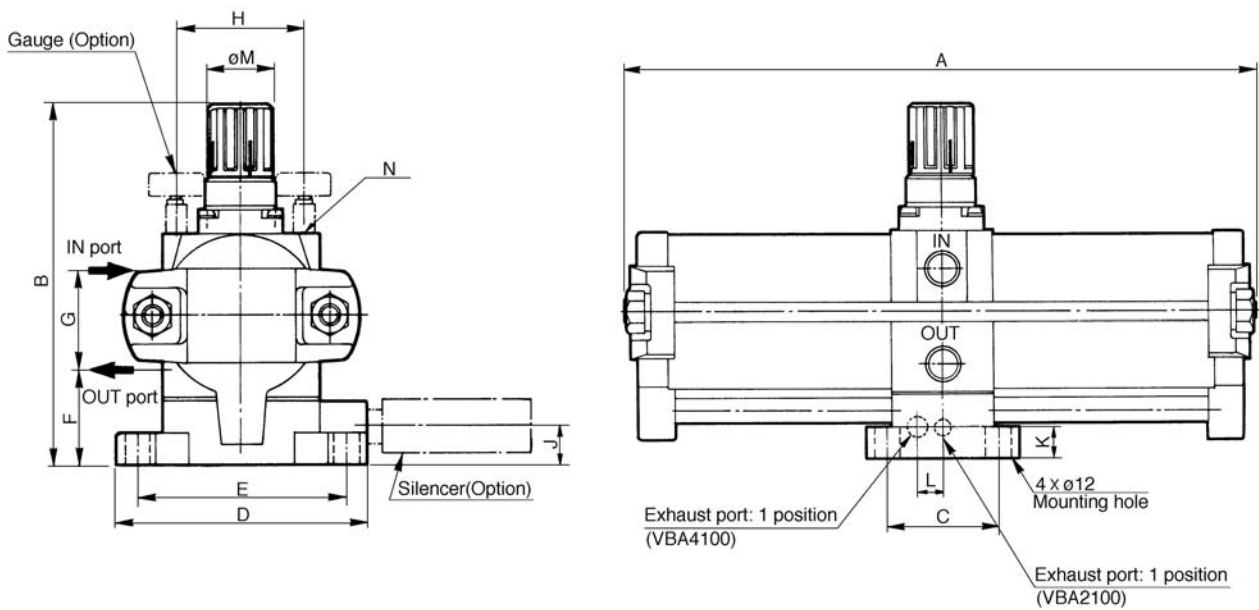
- ⑥ When the hydraulic pressure of an air-hydro unit must be raised.
- ⑦ When the pressure must be raised in an explosion-proof environment.
- ⑧ To boost the pressure by remote operation, using an air operated type.

Booster Regulator *VBA1110 to 4200*

Handle operated style **VBA1110-02, VBA1111-02**



Handle operated style **VBA2100-03, VBA4100-04**

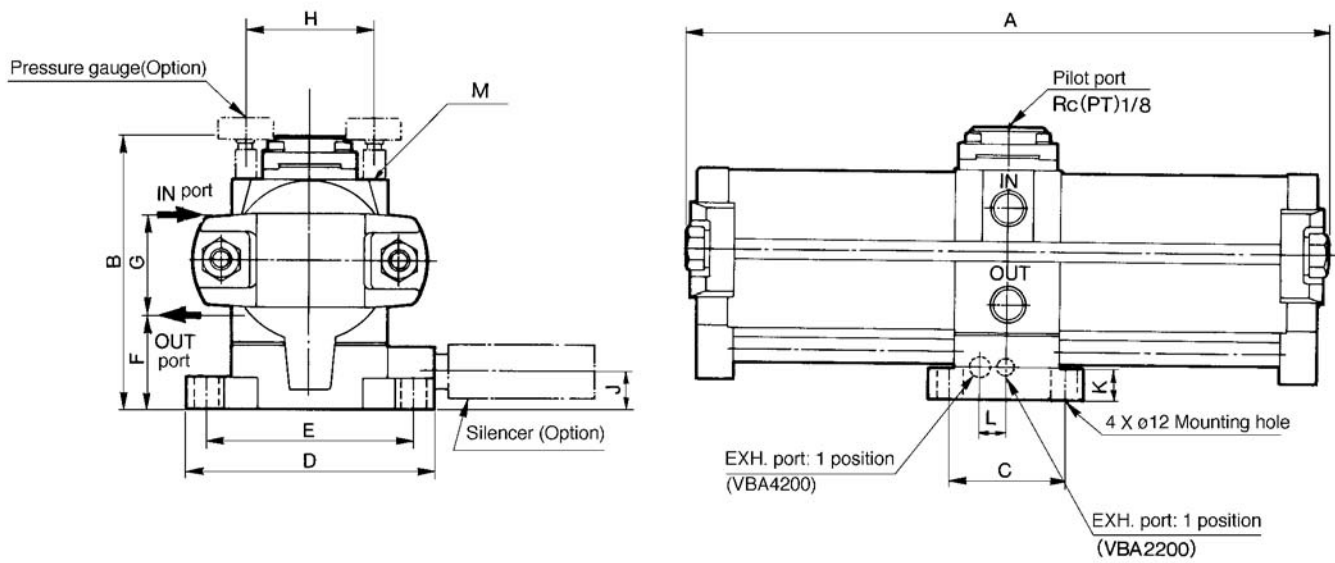


Model	Port size	A	B	C	D	E	F	G	H	J	K	L	øM	N
VBA2100-03	Rc (PT) 3/8	300	170	53	118	98	46	43	60.5	18	15	—	31	Rc1/16
VBA4100-04	Rc (PT) 1/2	404	207.5	96	150	130	62.8	62	90	17	15	20	40	Rc(PT)1/8

AC
AV
AU
AF
AR
IR
VEX
SRP
AW
AMR
AWM
AWD
ITV
VBA
G
AL

VBA1110 to 4200

Air operated style VBA2200-03, VBA4200-04



Model	Port size	A	B	C	D	E	F	G	H	J	K	L	M
VBA2200-03	Rc(PT) 3/8	300	126.5	53	118	98	46	43	60.5	18	15	—	Rc1/16
VBA4200-04	Rc(PT)1/2	404	167	96	150	130	62.8	62	90	17	15	20	Rc(PT)1/8

⚠ Air Tank Precautions

Be sure to read before handling.

Refer to p.0-26 and 0-27 for Safety Instructions and common precautions on the products mentioned in this catalogue, and refer to p.1.0-2 and 1.0-3 for precautions on every series.

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 must be designed in compliance with the regulations in Europe. 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 secondary side.

Selection

⚠ Caution

- Consider the operating conditions and operate this product within its specification range.
- Follow the size selection procedure indicated on p.1.14-3 to select the size of the air tank if it will be used with a booster valve connected to it.

Installation

⚠ 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

- To connect a booster valve to the tank, refer to the operation manual that is provided with the air tank before assembly.
- To mount the air tank on a floor surface, use the four holes to secure the tank with bolts or anchor bolts.

Maintenance and Inspection

⚠ 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.