Power Valve: Economy Valve

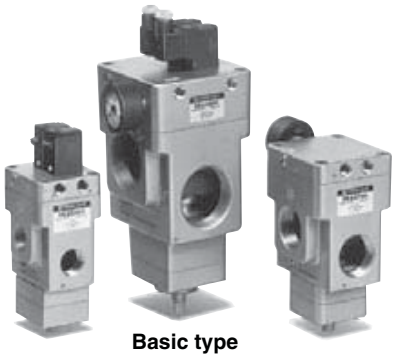
Series VEX5

Three functions (pressure regulator, switching valve, and speed controller) are provided by a single valve.

The conventional valve combination circuit has been condensed into a single valve.

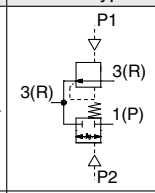
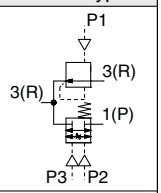
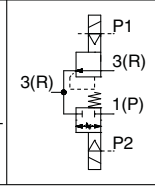
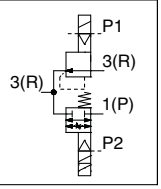
A large capacity and economical system.

This valve provides twice the system capacity of the conventional circuit. Therefore, it is possible to downsize 1 or 2 sizes (for example, a conventional 32A circuit can be changed to a 25A or a 20A). It is economical, as its performance cost (system price/effective area) is one half of the conventional type. (Comparison based on SMC data.)



Basic type

Select type

	Basic type	Select type
Air operated		
External pilot solenoid valve		

Note) With this valve, the port 3(R) is a supply port and port 1(P) is an exhaust port.

Standard Specifications

Model			VEX55□□-04/06/10			VEX57□□-10/12		VEX59□□-14/20	
Operation type			Air operated, External pilot solenoid						
Fluid			Air						
Pressure range			0 to 1.0 MPa						
Set pressure range			0.05 to 0.9 MPa						
Ambient and fluid temperature			Max. 50°C (Air operated 60°C)						
Pilot pressure			P1: 0.05 to 0.9 MPa P2: 0.2 to 0.9 MPa (Air operated: P2, P3: 0.2 to 0.9 MPa P2 ≤ P3)						
Repeatability			0.01 MPa						
Sensitivity			0.01 MPa						
Response time			60 ms or less						
Max. operating frequency			3 cycles/sec.						
Number of needle rotations			6 turns			8 turns			
Mounting			Free						
Lubrication			Not required (Use turbine oil Class 1 ISO VG32, if lubricated.)						
Port size		**Port**	04	06	10	10	12	14	20
		1 (P)	½	¾	1	1	1¼	1¼	2
		2 (A)							
		3 (R)				1¼		2	
Effective area		**mm²**	130	160	180	300	330	590	670
		Cv	7.2	8.9	10	17	18	33	37
Weight (kg)	**Air operated**	**Basic type**	2.0			3.2		4.7	
		Select type	2.3			3.5		5.0	
	Solenoid	**Basic type**	2.2			3.5		4.9	
		Select type	2.6			3.8		5.3	

Note) Non-lubricated specifications are not available for this product.

Pilot Solenoid Valve Specifications

Model			VEX5511/5711/5911/5501/5701/5901
Pilot valve			SF4-□□□-20
Electrical entry			Grommet (G), Grommet terminal (E), Conduit terminal (T), DIN terminal (D)
Coil rated voltage (V)	**AC (50/60Hz)**		100 V, 200 V, Other (Option)
	DC		24 V, Other (Option)
Allowable voltage			–15 to +10% of rated voltage
Apparent power	**AC**	**Inrush**	5.6 VA (50Hz), 5.0 VA (60Hz)
		Holding	3.4 VA (50Hz), 2.3 VA (60Hz)
Power consumption	**DC**		1.8 W (Without indicator light), 2 W (With indicator light)
Manual override			Non-locking push type

Accessory/Part No.

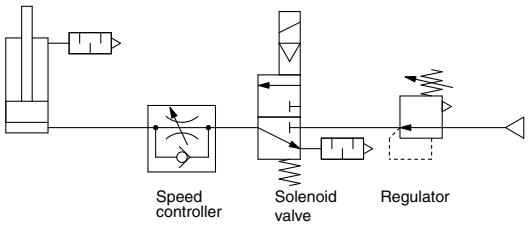
Description \ Model	Part no. VEX55□□-04/06/10	VEX57□□-10/12	VEX59□□-14/20
Bracket (With bolt and washer)	VEX5-32A	VEX7-32A	VEX9-32A
Pressure gauge	G46-10-01		

VEX

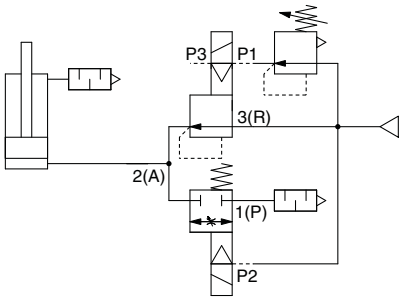
Applicable System/Example of Single Acting Circuit (The valves can be used also for double acting circuits, too. Please consult with SMC for details.)

1. Speed control

Conventional circuit



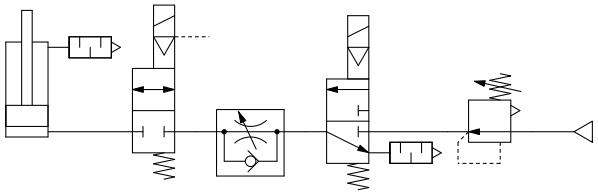
Economy system



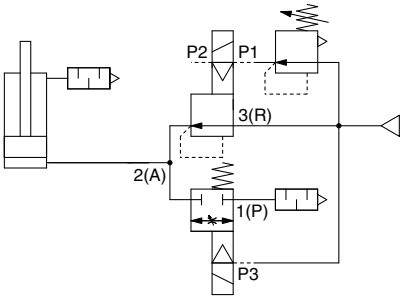
- Ascending speed is controlled by a pilot regulator.
- Descending speed is controlled by needle setting.

2. Intermediate (emergency) stop

Conventional circuit

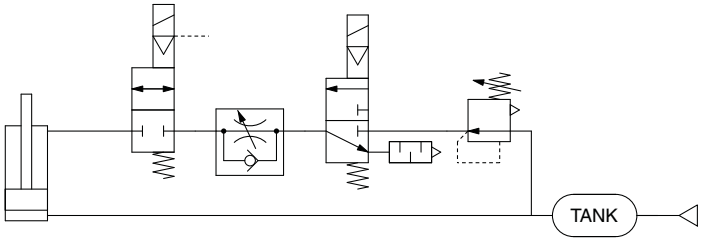


Economy system

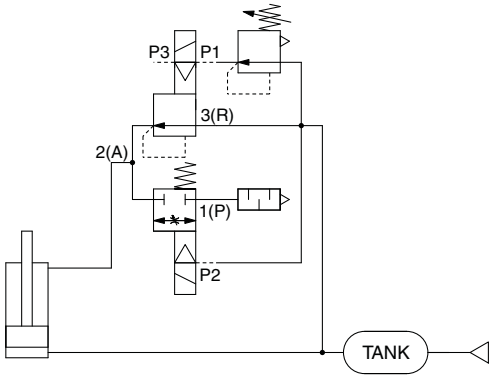


3. Double pressure driving···Energy-saving lifter (Air saving counter balance)

Conventional circuit

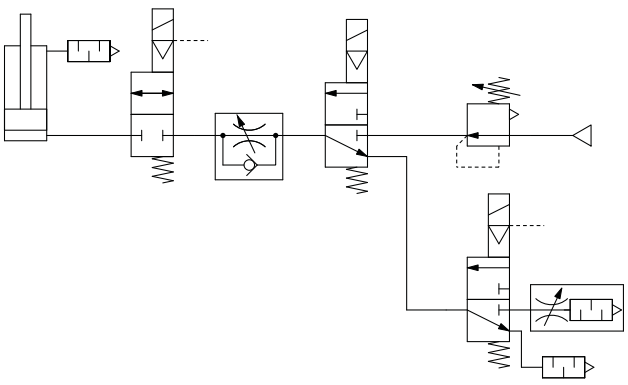


Economy system

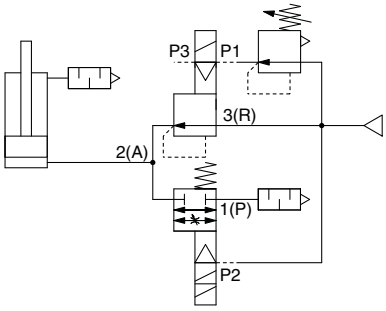


4. Two speed driving

Conventional circuit



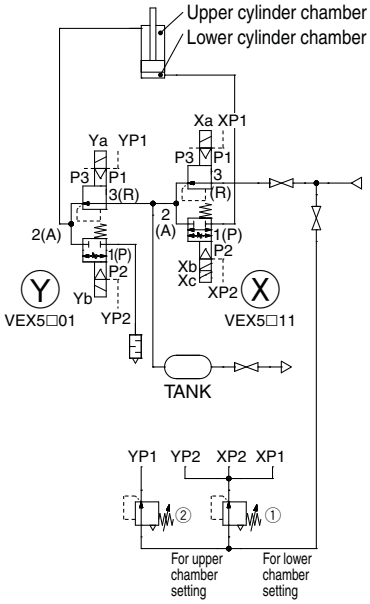
Economy system



Energy-saving Lifter

- **Simple**
  Two economy valves and a tank move the double-acting cylinder to raise and lower heavy objects.
- **Energy-saving**
  The balancing air reciprocates between the lower cylinder chamber and the tank, thus not being consumed. Low pressure air alone is exhausted from the upper chamber in every cycle, so the air consumption is reduced to 20 to 30% of the air consumption by the double acting cylinder with an ordinary change over valve.
- **Excellent operation control**
  The economy valve sets pressure and permits high speed and low speed operation as well as suspension of operation. While the piston moves up and down, the valve controls speed change in the middle of strokes, terminal deceleration, inching, and emergency stops.
- **Simple operation**
  The pilot system is composed of a small regulator and solenoid valve (which is unnecessary for solenoid style), remote controls the economy valve. Therefore, change in the pilot system sequence allows selection of a cylinder operation mode. Change in the large capacity main piping system is not necessary.

<System configuration and operation of circuit in which external pilot solenoid is used>



The two economy valves (hereinafter called VEX) Ⓧ and Ⓨ and a tank composes a main system that drives the double acting cylinder, and the small regulator (hereinafter called REG) and pilot valve (hereinafter called SOL) remote control the economy valve.

Action

Cylinder \ SOL		Xa	Xb	Xc	Yb	Ya	Mode
Upward	High speed	ON ●	●	OFF –	●	–	a
	Low speed	●	●	●	●	–	b
Downward	High speed	–	●	–	–	●	c
	Low speed	–	●	●	–	●	d
Stop		–	–	–	–	–	e

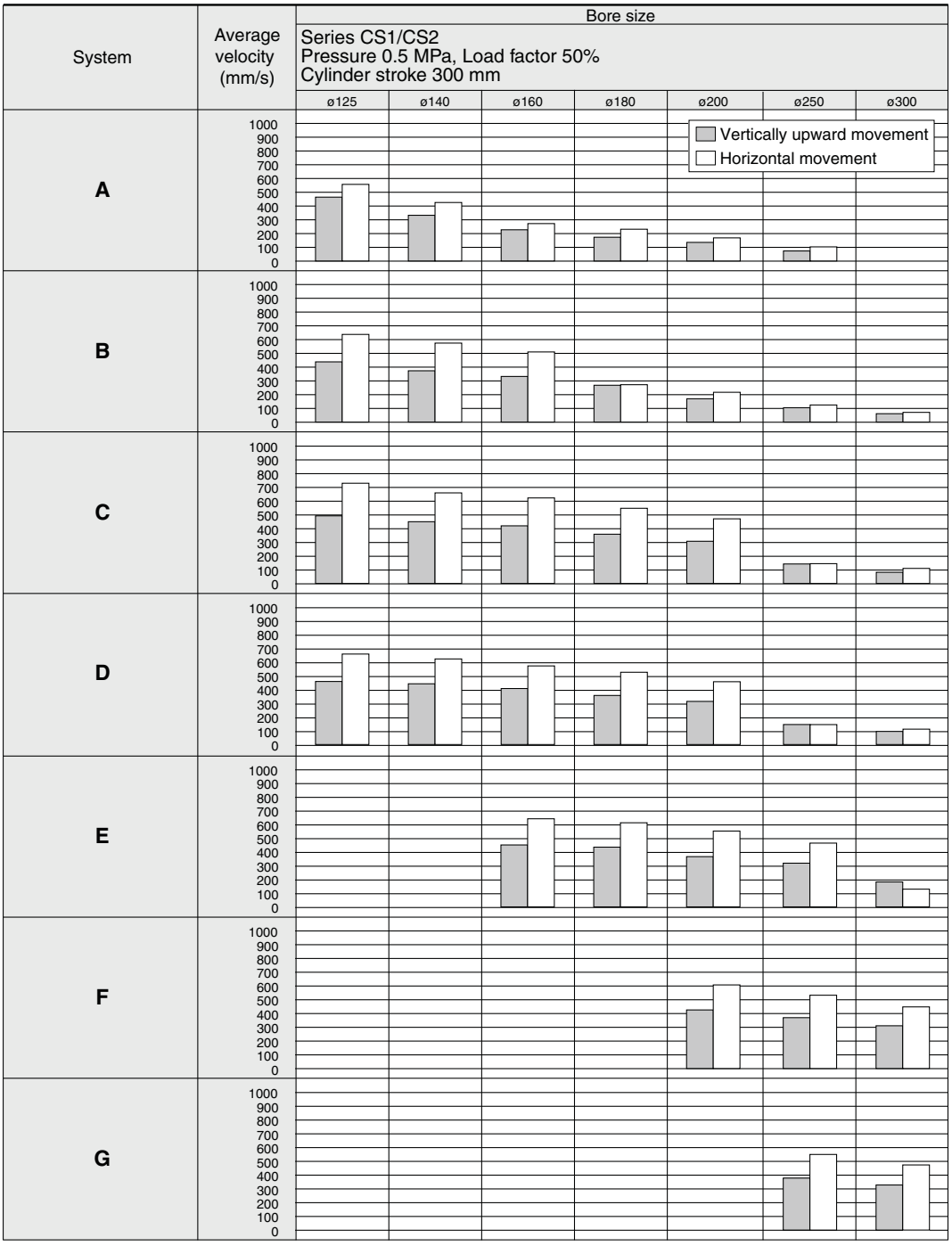
a: The air in the upper cylinder chamber is exhausted from the port 1 (P) of VEX Ⓨ, and the air in the tank flows in through the port 1 (P) of VEX Ⓧ.
b: Air flows into the lower cylinder chamber through a throttled opening, set by a needle, from the port 2 (A) to 1 (p) of VEX Ⓧ.
c: The air in the tank flows into the upper cylinder chamber at a preset low pressure from the port 2 (A) of VEX Ⓨ, while the air in the lower cylinder chamber returns to the tank through VEX Ⓧ.
d: Air returns to the tank through a throttled opening from the port 1 (P) to 2 (A) of VEX Ⓧ.
e: The air in the lower cylinder chamber is blocked at the port 1 (P) of VEX Ⓧ, while the air in the upper cylinder chamber is blocked at the port 2 (A) of VEX Ⓨ.

⚠Caution

A lifter circuit can be composed of air operated valves. Please contact SMC for details.

Cylinder Speed Chart

Please assume the chart is offered as the guideline. For details about various each condition, please make use of SMC Model Selection Software and then decide it.



∗ When the cylinder is extended, the speed controller is metered-out, is connected with the cylinder directly, and its needle is fully open.
∗ Values on the average velocity of a cylinder are obtained from the stroke length divided by full stroke time.
∗ Load proportion is ((load weight x 9.8)/theoretical force) x 100%

Conditions of Speed Chart

System	Solenoid valve	Speed controller	Silencer	Tubing diameter x Length
A	VEX55□□-04/06/10	AS420-04	AN40-04	SGP15A x 1 m
B		AS500-06	AN500-06	SGP20A x 1 m
C		AS600-10	AN600-10	SGP25A x 1 m
D	VEX57□□-10/12	AS600-10	AN600-10	SGP25A x 1 m
E		AS800-12	AN700-12	SGP32A x 1 m
F	VEX59□□-14/20	AS900-14	AN800-14	SGP40A x 1 m
G		AS900-20	AN900-20	SGP50A x 1 m

How to Order

VEX5 5 1 1 – 06 2 E Z – B

Economy valve

Type

0	Basic
1	Select

Operation type

0	Air operated
1	External pilot solenoid

Body size **Port size**

Body size	Port size		
		port 1(P), 2(A)	port 3(R)
5	04	1/2	1/2
	06	3/4	3/4
	10	1	1
7	10	1	1 1/4
	12	1 1/4	
9	14	1 1/2	2
	20	2	

Thread type

Nil	Rc
F	G(1)
N	NPT
T	NPTF

Note 1) Not conforming to ISO1179-1.

Rated voltage (Only with solenoid)

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3*	110 VAC 50/60 Hz
4*	220 VAC 50/60 Hz
5	24 VDC
6*	12 VDC
7*	240 VAC 50/60 Hz
9*	Other

* Option

Electrical entry (Only with solenoid)

G	Grommet, Lead wire length 300 mm
H	Grommet, Lead wire length 600 mm
E	Grommet terminal
T	Conduit terminal
D	DIN terminal

Light/Surge voltage suppressor (Only with solenoid)

Nil	None
S	With surge voltage suppressor (Grommet only)
Z	With light/surge voltage suppressor (Except grommet)

Option

Nil	None
B	Bracket
G	Pressure gauge

• How to order pilot valves

SF4 – □ □ □ – 20

- **Light/Surge voltage suppressor**
- **Electrical entry**
- **Rated voltage**

(Ex.) **SF4-1G-20**

- 100 VAC, Grommet

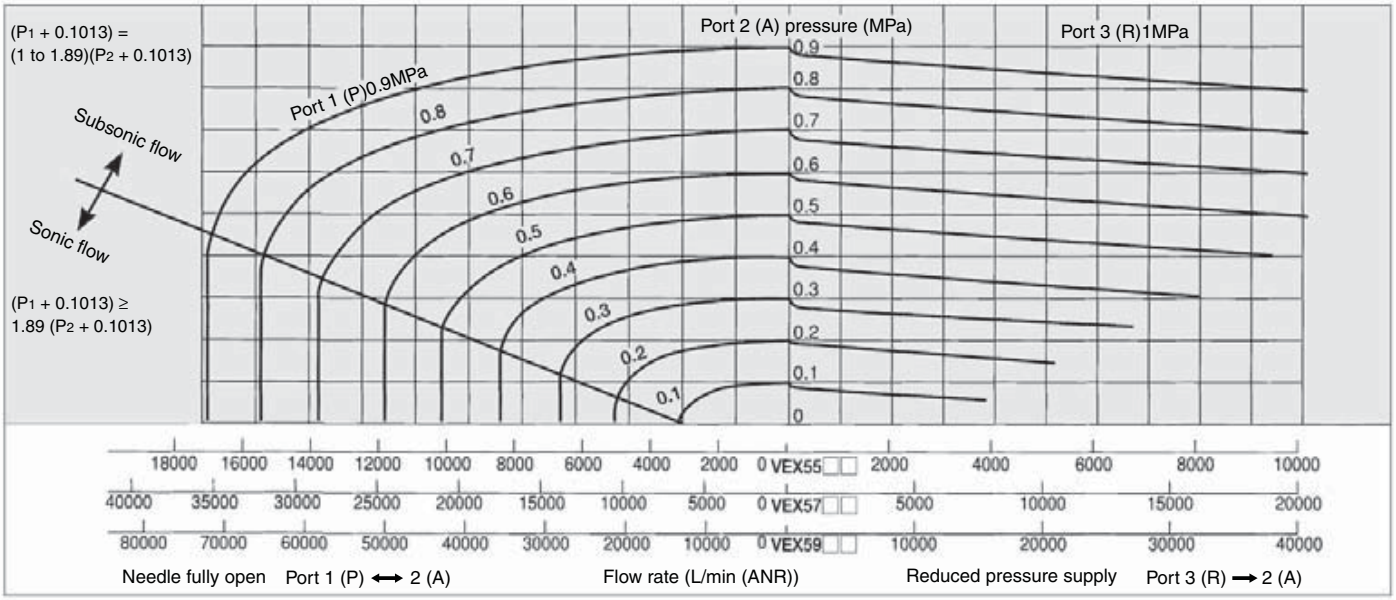
(Ex.)
VEX5511-062EZ-BG
Body size 5, Select, External pilot solenoid
Port size 3/4
200 VAC, Grommet terminal, with light/surge voltage suppressor
Option···Bracket, with pressure gauge

Model

Model	Basic type		Select type		Port size	
	Air operated	External pilot solenoid	Air operated	External pilot solenoid	Port 1 (P), 2 (A)	Port 3 (R)
Economy valve	VEX5500	VEX5501	VEX5510	VEX5511	1/2, 3/4, 1	1/2, 3/4, 1
	VEX5700	VEX5701	VEX5710	VEX5711	1, 1 1/4	1 1/4
	VEX5900	VEX5901	VEX5910	VEX5911	1 1/2, 2	2

VEX

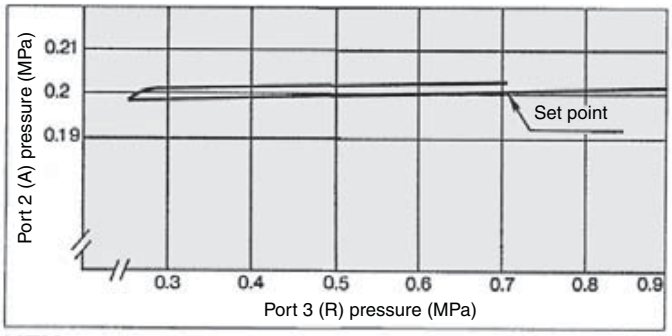
Flow Characteristics



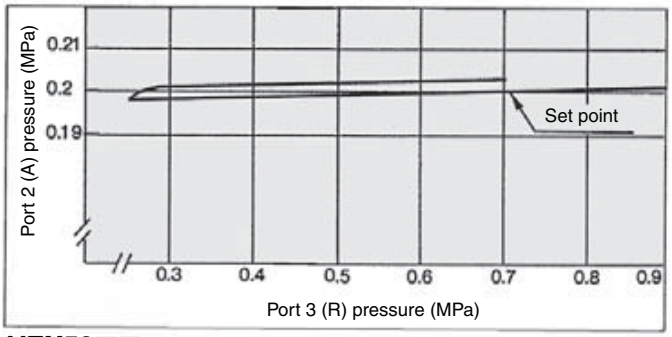
Pressure Characteristics

Shows the outlet pressure (port 3 (R)) change against the inlet pressure (port 2 (A)) change. They conform to JIS B 8372 (Air pressure regulator).

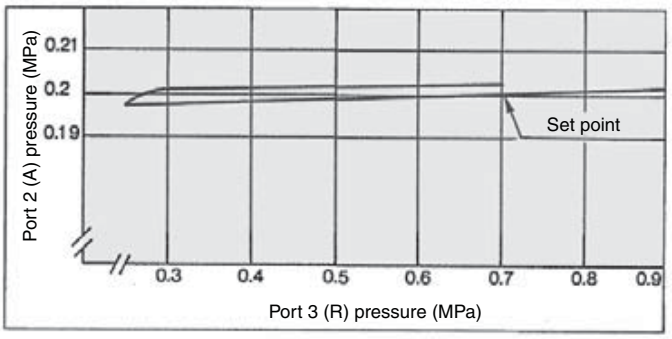
VEX55□□



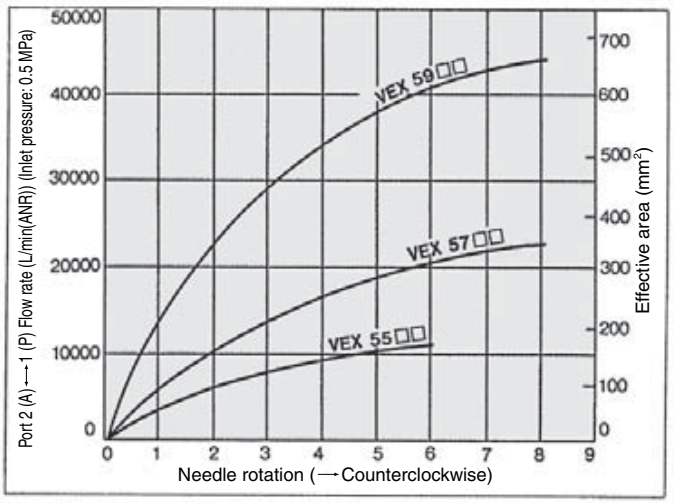
VEX57□□



VEX59□□

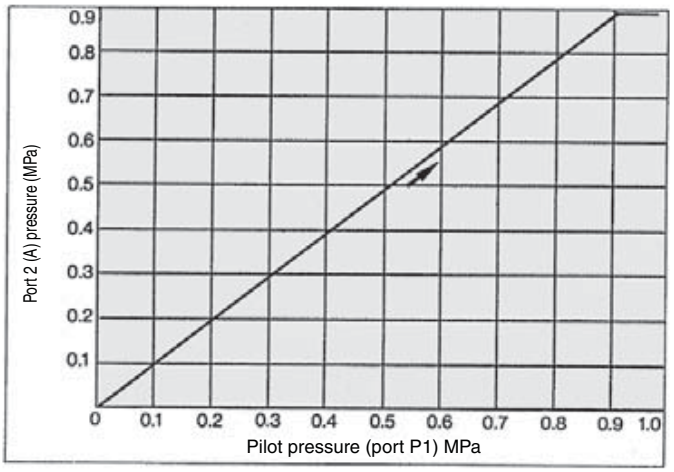


Needle Characteristics Port 2 (A)⟷1 (P)



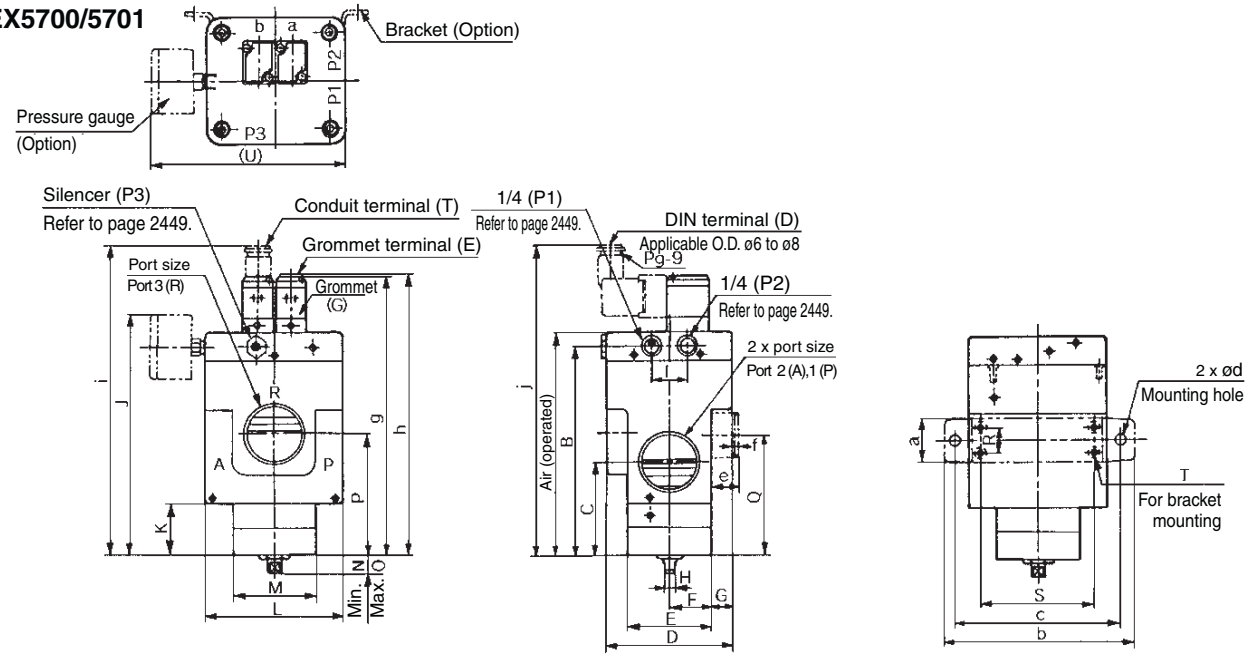
Setting Pressure Characteristics

Port 2 (A) pressure is set according to pilot pressure.
(port 3 (R) ⟶2 (A): Non-relief regulator)



Basic Type/Dimensions

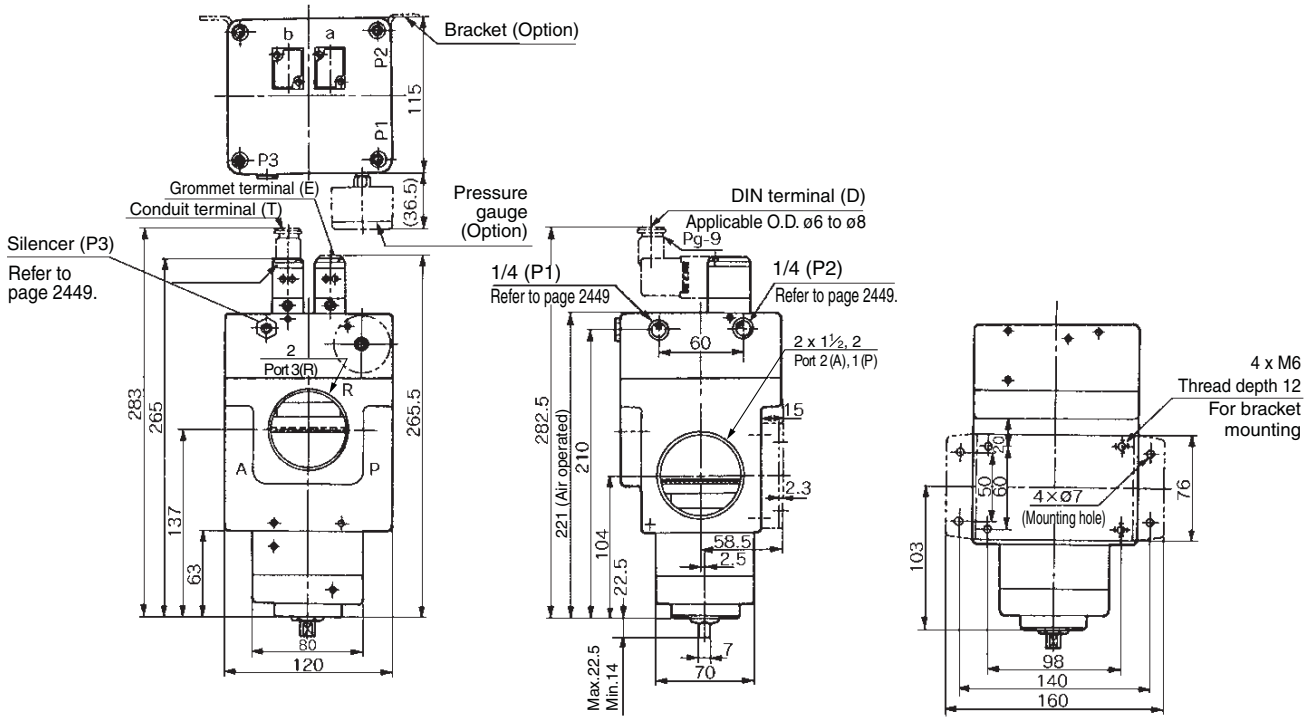
VEX5500/5501
VEX5700/5701



Model	Port size		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	Port 2 (A),1 (P)	Port 3 (R)																					
VEX5500 VEX5501	1/2, 3/4, 1	1/2, 3/4, 1	143.5	133.5	62.5	70	50	25	10	7	25	156.5	36.5	80	60	16.5	20	81.5	83.5	Center	60	2 x M6 Thread depth 9	116.5
VEX5700 VEX5701	1, 1 1/4	1 1/4	160.5	150.5	62.5	90	60	30	15	7	25	173.5	37.5	100	60	13	17	88.5	86.5	18	82	2 x M6 Thread depth 6	136.5

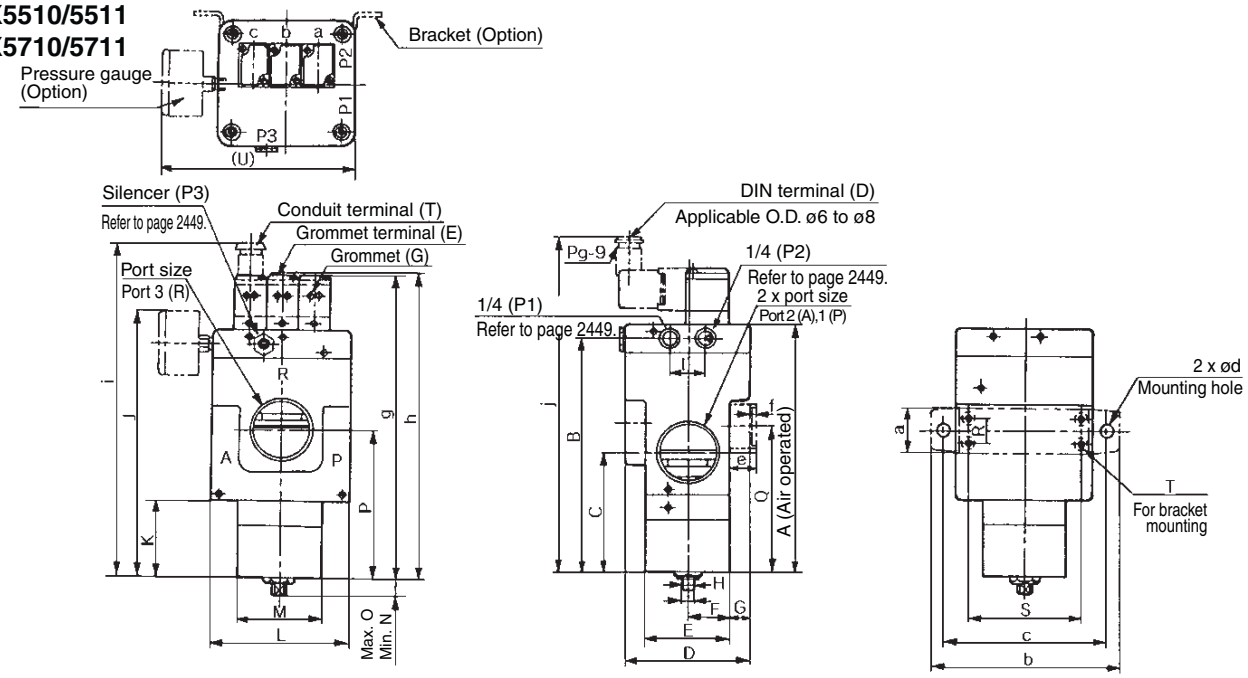
Model	Bracket mounting dimensions						Grommet	Grommet terminal	Conduit terminal	DIN terminal
	a	b	c	d	e	f	g	h	i	j
VEX5500 VEX5501	19	130	110	9	12	2.3	187	187.5	205.5	205
VEX5700 VEX5701	32	136	120	9	20	2.3	204	204.5	222.5	222

VEX5900/5901



Select Type/Dimensions

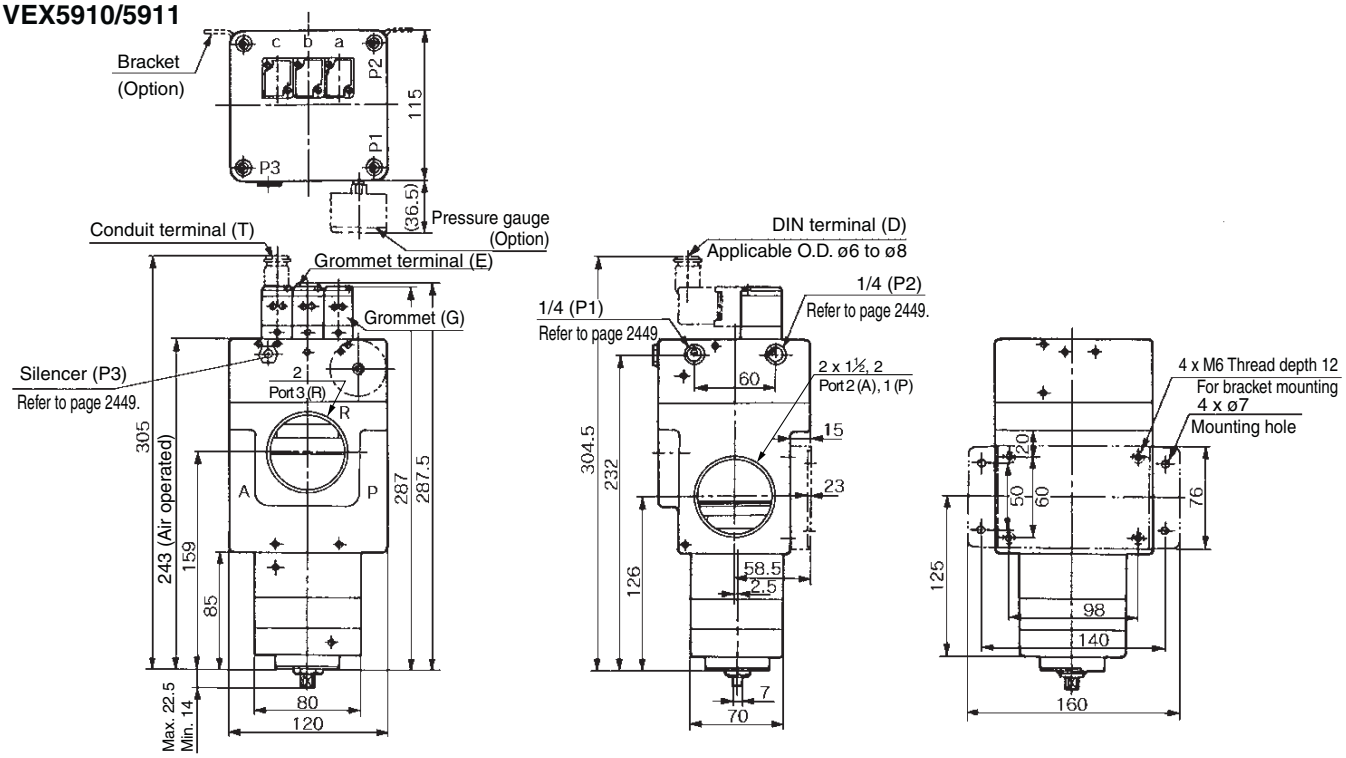
VEX5510/5511
VEX5710/5711



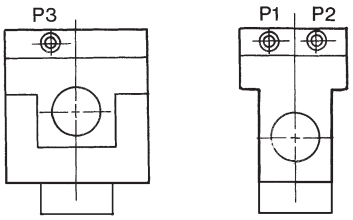
Model	Port size		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
	Port 2 (A),1 (P)	Port 3 (R)																					
VEX5510 VEX5511	1/2, 3/4, 1	1/2, 3/4, 1	160	150	79	70	50	25	10	7	25	173	53	80	60	13	18	98	100	Center	60	2 x M6 Thread depth 9	116.5
VEX5710 VEX5711	1, 1 1/4	1 1/4	177.5	167.5	84.5	90	60	30	15	7	25	190.5	54.5	100	60	13	17	105.5	103.5	18	82	4 x M6 Thread depth 6	136.5

Model	Bracket mounting dimensions						Grommet	Grommet terminal	Conduit terminal	DIN terminal
	a	b	c	d	e	f	g	h	i	j
VEX5510 VEX5511	19	130	110	9	12	2.3	204	204.5	222	221.5
VEX5710 VEX5711	32	136	120	9	20	2.3	221	221.5	239.5	239

VEX5910/5911



External Pilot Piping



Port 3 (R) side **Port 1 (P) side**

Model	P1	P2	P3
VEX5□00	External pilot	External pilot	Plug
VEX5□01	External pilot	External pilot	Pilot exhaust Note)
VEX5□10	External pilot	External pilot	External pilot
VEX5□11	External pilot	External pilot	Pilot exhaust Note)

Note) For pilot exhaust port, silencer AN210-02 is mounted.

⚠Caution

Refer to front matter 53 for Safety Instructions and pages 3 to 8 for 3/4/5 Port Solenoid Valve Precautions.

How to Use DIN Terminal

1. Disassembly

1) After loosening the screw ①, then if the housing ② is pulled in the direction of the screw ①, the connector will be removed from the body of equipment (solenoid, etc.).
2) Pull the screw ① out of the housing ②.
3) On the bottom part of the terminal block ③, there's a cut-off part ⑨. If a small flat head screwdriver is inserted between the opening in the bottom, terminal block ③ will be removed from the housing ②. (Refer to the figure-1.)
4) Remove the cable gland ④, plain washer ⑤ and rubber seal ⑥.

2. Wiring

1) Pass the cable ⑦ through the cable gland ④, plain washer ⑤ and rubber seal ⑥ in this order, and then insert them into the housing ②.
2) Loosen the screw ⑪ attached to the terminal block ③. Then, pass the lead wire ⑩ through the terminal block ③ and tighten the screw ⑪ again.
   Note 1) Tighten within the tightening torque of 0.5 N·m ±15%.
   Note 2) Cable ⑦ outside diameter: ø6 to ø8 mm

3. Assembly

1) Pass the cable ⑦ through the cable gland ④, plain washer ⑤ and rubber seal ⑥ in this order and connect to the terminal block ③. Then, mount the terminal block ③ on the housing ②. (Push it down until you hear the click sound.)
2) Put the rubber seal ⑥ and plain washer ⑤ in this order into the cable entry of the housing ②, and then tighten the cable gland ④ securely.
3) Insert the gasket ⑧ between the bottom part of terminal block ③ and the plug attached to the equipment. Then, screw in ① from the top of the housing ② to tighten it.
   Note) Tighten within the tightening torque of 0.5 N·m ±20%.

Changing the entry direction

The orientation of a connector can be changed 180°, depending on the combination of a housing ② and a terminal block ③.

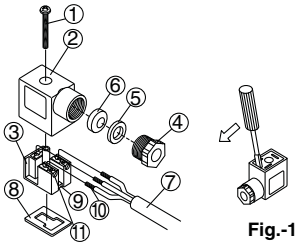


Fig.-1

Related Products:

Silencer (Series AN)

- Over 30 dB noise reduction
- Sufficient effective area

- Refer to Best Pneumatics No. 6 for details.

Exhaust Cleaner (Series AMC)

- Provides a silencing capability and an oil mist recovery function.
- Can also be used in a centralized piping system.

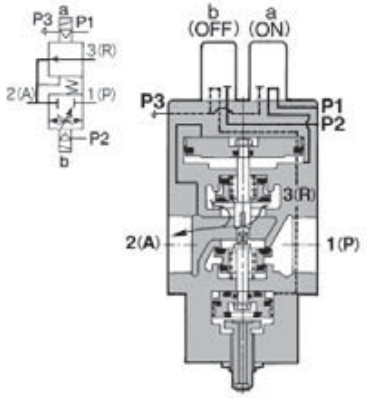
- Refer to Best Pneumatics No. 6 for details.

VEX

Basic Type/Construction/Working Principle/Component Parts

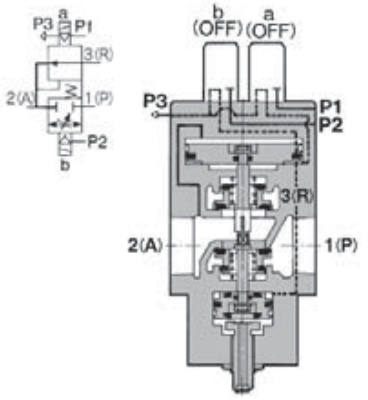
Note) With this valve, the port 3 (R) is a supply port and port 1 (P) is an exhaust port.

1. 3 (R)➞2 (A) Reduced pressure supply



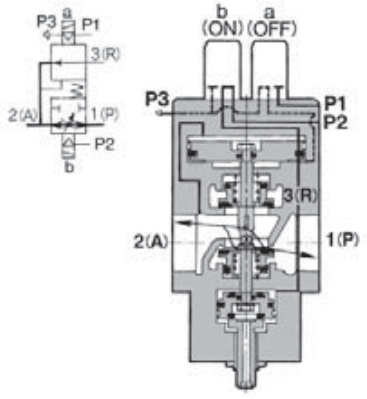
When the pilot solenoid valve "a" is energized (or when pilot pressure is applied to the port P1 of the air operated type) while the port P1 is under the pilot pressure, reduced pressure is supplied from the port 3 (R) to the port 2 (A).
The acting force of the pilot pressure (port P1) reaches the space under the pressure control piston ③ pushes the piston upward and opens the poppet valve ⑥. Thus air is supplied from the port 3 (R) to the port 2 (A).
The air entering through the port 2 (A) flows through the feedback passage to the space above the piston, and when its pressure balances with the pilot pressure under the pressure control piston, the poppet valve closes, thus setting the port 2 (A) pressure corresponding to the pilot pressure (port P1).
(port P1 pressure: port 2 (A) pressure = 1:1)
When the reduced pressure is supplied from 3 (R) to 2 (A), air will not be exhausted from 2 (A) to 1 (P) even when the pilot pressure (port P1) is larger than the port 2 (A) pressure.

2. Closed center



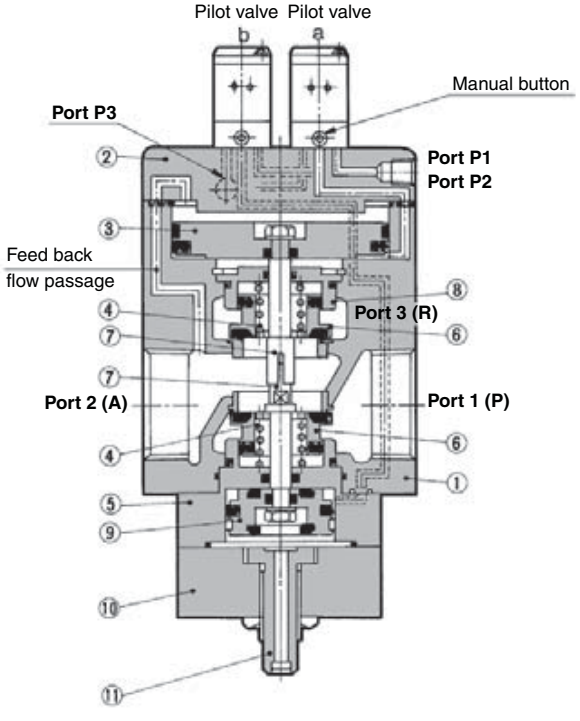
When neither the pilot solenoid valves "a" or "b" is energized (or when no pilot pressure is applied to the ports P1 and P2 of the air operated type), no acting force is applied to the pressure control piston ③ and operation piston ⑨, and the spring ④ closes both poppet valves ⑥, thus the valves assume the closed center position.
While the port 2 (A) is being pressurized, air will not be released even if electrical power to the pilot solenoid valve "a" is turned off (or pilot pressure is released from the port P1 of the air operated type).

3. 2 (A)⟷1 (P) Throttled exhaust



When the pilot solenoid valve "b" is energized while pilot pressure is in the port P2 (or when the pilot pressure is applied to the port P2 of the air operated type), an acting force generated above the operation piston ⑨ pushes the operation piston down, and thus the port 1 (P) and port 2 (A) are connected.
At that time, the lower poppet valve ⑥ opens by the degree preset by the needle ⑪.
(Counterclockwise rotation of the needle opens the poppet valve.)
The upper and lower poppet valves operate independently. When the pilot solenoid valves "a" and "b" are energized alternately (or when pilot pressure is applied to the ports P1 and P2 of the air operated style alternately), the supplied reduced pressure (3 (R)➞2 (A)) can be throttled and exhausted (2 (A)➞1 (P)).

Construction



(Basic type: External pilot solenoid)

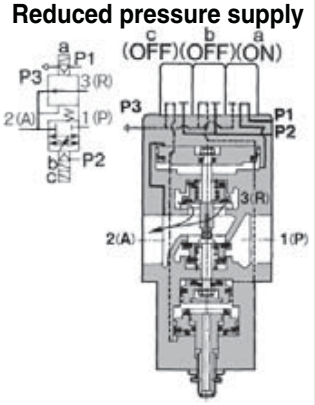
Component Parts

No.	Description	Material
1	**Body**	Aluminum alloy casted
2	**Cover**	Aluminum alloy casted
3	**Pressure control piston**	Aluminum alloy
4	**Spring**	Stainless steel
5	**Chamber**	Aluminum alloy
6	**Poppet valve**	NBR
7	**Rod**	Stainless steel
8	**Valve guide**	Aluminum alloy
9	**Operation piston**	Aluminum alloy
10	**Bottom cover**	Aluminum alloy
11	**Needle**	Brass

Select Type/Construction/Working Principle/Component Parts

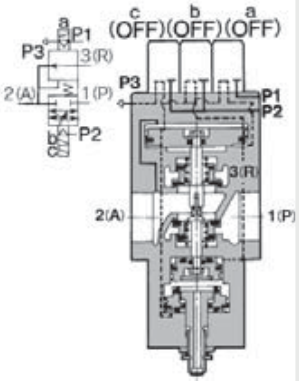
Note) With this valve, the port 3 (R) is a supply port and port 1 (P) is an exhaust port.

1. 3 (R) ➡ 2 (A) Reduced pressure supply



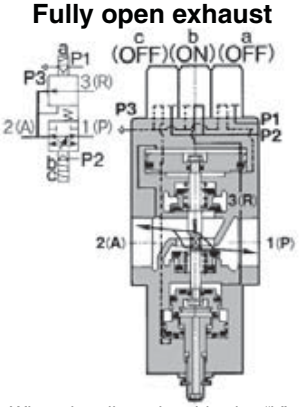
When the pilot solenoid valve "a" is energized (or when pilot pressure is applied to the port P1 of the air operated type) while the port P1 is under the pilot pressure, reduced pressure is supplied from the port 3 (R) to the port 2 (A).
The acting force of the pilot pressure (port P1) reaches the space under the pressure control piston ③ pushes the piston upward and opens the poppet valve ⑥. Thus air is supplied from the port 3 (R) to the port 2 (A).
The air entering through the port 2(A) flows through the feedback passage to the space above the piston and when its pressure balances with the pilot pressure under the pressure control piston, the poppet valve closes, thus setting the port 2 (A) pressure corresponding to the pilot pressure (port P1).
(port P1 pressure: port 2(A) pressure = 1:1)
When the reduced pressure is supplied from 3 (R) to 2 (A), air will not be exhausted from 2 (A) to 1 (P) even when the pilot pressure (port P1) is larger than the port 2 (A) pressure.

2. Closed center



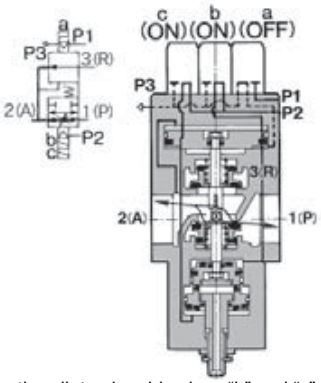
When neither the pilot solenoid valve "a" nor "b" is energized (or when no pilot pressure is applied to the ports P1 and P2 of the air operated type), no acting force is applied to the pressure control piston ③ and operation piston ⑨, and the spring ④ closes both poppet valves ⑥, thus the valve assumes the closed center position.
While the port 2(A) is being pressurized, air will not be released even if electrical power to the pilot solenoid valve "a" is turned off (or pilot pressure is released from the port P1 of the air operated type).

3. 2 (A)⟷1 (P) Fully open exhaust



When the pilot solenoid valve "b" is energized while pilot pressure is in the port P2 (or when the pilot pressure is applied to the port P2 of the air operated type), an acting force generated above the operation piston ⑨, and pushes down the operation piston, and thus the ports 1(P) and 2 (A) are connected.
At that time, the lower poppet valve ⑥ fully opens.

4. 2 (A)⟷1 (P) Throttled exhaust

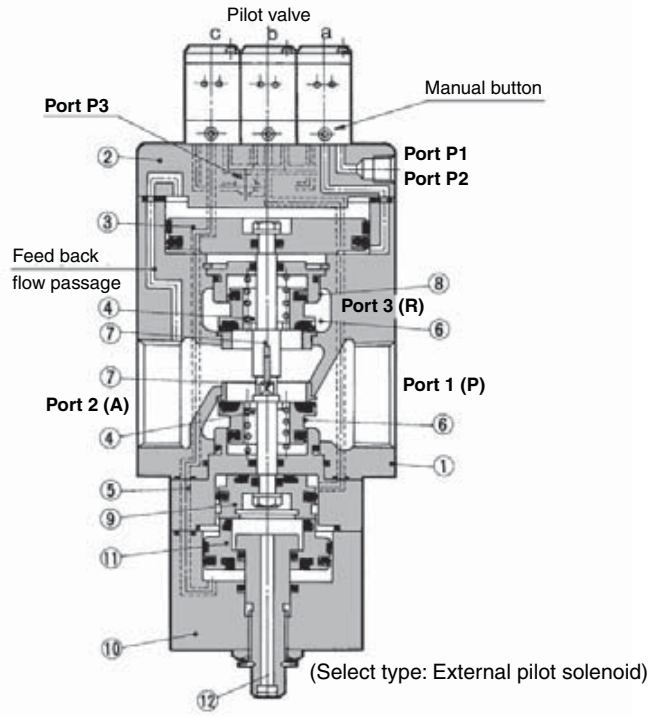


When the pilot solenoid valves "b" and "c" are energized simultaneously while pilot pressure is in the port P2 (or when the pilot pressure is applied simultaneously to the ports P2 and P3 of the air operated type), an acting force generated above the operation piston ⑨ pushes the piston down and another acting force generated under the stopper ⑪ pushes up the stopper, and thus the ports 1 (P) and 2 (A) are connected.
At that time, the lower poppet valve ⑥ opens by the degree preset by the needle ⑫. (Counterclockwise rotation of the needle opens the poppet valve.)
The upper and lower poppet valves operate independently. When the pilot solenoid valves "a" and "b" are energized alternately (or when pilot pressure is applied alternately to the ports P1 and P2 of the air operated type), the supplied reduced pressure (3 (R) ➡ 2 (A)) can be throttled and exhausted (2 (A) ➡ 1 (P)).

∗ The pilot solenoid valve "c" remains energized (or pilot pressure remains applied to the port P3 of the air operated type).

By turning on/off the pilot solenoid valve "c" (or by supplying/exhausting pilot pressure to/from the port P3 of the air operated type) while electric power is being supplied to the pilot solenoid valve "b" (or pilot pressure is being applied to the port P2 of the air operated type), either throttling or fully open exhaust can be selected (decelaration/ accelaration) for the port 2 (A)⟷1 (P).

Construction



Component Parts

No.	Description	Material
1	**Body**	Aluminum alloy casted
2	**Cover**	Aluminum alloy casted
3	**Pressure control piston**	Aluminum alloy
4	**Spring**	Stainless steel
5	**Chamber**	Aluminum alloy
6	**Poppet valve**	NBR
7	**Rod**	Stainless steel
8	**Valve guide**	Aluminum alloy
9	**Operation piston**	Aluminum alloy
10	**Bottom cover**	Aluminum alloy
11	**Stopper**	Aluminum alloy
12	**Needle**	Brass

VEX