

Electro-Pneumatic Proportional Valve

Series VEF/VEP

Electro-pneumatic proportional valve: Flow type (VEF)

Controls the flow rate steplessly according to current. (It is a 2/3 port valve that has an electrical throttle valve function.) A model that is suitable for operating conditions, such as the number of ports or maximum effective area, can be selected.

Electro-pneumatic proportional valve: Pressure type (VEP)

Controls the pressure steplessly according to current. Also, because the effective fully opened area of the exhaust side is identical due to its construction, this valve provides a large exhaust capacity and can be used as a relief valve. (It is a 3 port valve that has an electrical pressure reducing valve function.)



Specifications

Item	Model	Flow type			Pressure type	
		VEF2121 VEF3121	VEF2121	VEF2141 VEF3141	VEP3121	VEP3141
Port size Rc		1/4 ,3/8	1/4 ,3/8 ,1/2	3/8 ,1/2 ,3/4	1/4 ,3/8	3/8 ,1/2 ,3/4
Fluid		Air				
Maximum operating pressure		1.0 MPa				
Ambient and fluid temperature		0 to 50°C (With no condensation)				
Response time		0.03 s or less		0.05 s or less	0.03 s or less	0.05 s or less
Hysteresis		3% F.S.				
Repeatability		3% F.S.				
Sensitivity		0.5% F.S.				
Linearity		—			3% F.S. or less	
Lubrication		Not required (Use turbine oil Class 1, ISO VG32, if lubricated.)				
Mass (kg)		0.9	1.0	1.4	0.9	1.4

Note) The non-lubricated specification is not applicable to these models.

Proportional Solenoid Specifications

Proportional solenoid recognition symbol	1 (Applicable power amplifier: VEA25□)
Applicable power amplifier	VEA25□
Max. current	1 A
Coil resistance	13 Ω (Ambient temperature 20°C)
Rated power consumption	13 W (Ambient temperature 20°C, with maximum current)
Coil insulation type	Class H or equivalent (180°C)
Max. temperature	140°C (Ambient temperature 50°C, with maximum current)
Electrical entry	DIN terminal

How to Order

<Flow type>

VEF 3 1 4 1 - 1 - 03 □

Thread type

Nil	Rc
F	G
N	NPT
T	NPTF

Applicable power amplifier

Symbol	Power amplifier
1	VEA25□

Port Body size Standard characteristics Port size

Port Symbol	Body size Symbol	Standard characteristics Symbol	Max. effective area (mm ²)	Symbol	Port size
2	2	1	13	Nil	Without sub-plate
		2	9	02	1/4
		3	5	03	3/8
	3	1	30	02	1/4
		03		03	3/8
		04		04	1/2
3	4	1	45	03	3/8
		04		04	1/2
		06		06	3/4
	2	1	12	Nil	Without sub-plate
		2	8	02	1/4
		3	4.5	03	3/8
	4	4	2.5	03	3/8
		1	25	04	1/2
				06	3/4

<Pressure type>

VEP31 4 1 - 1 - 03 □

Thread type

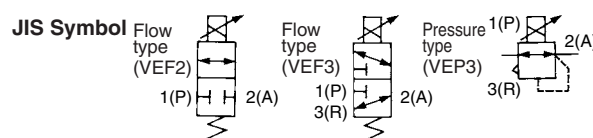
Nil	Rc
F	G
N	NPT
T	NPTF

Applicable power amplifier

Symbol	Power amplifier
1	VEA25□

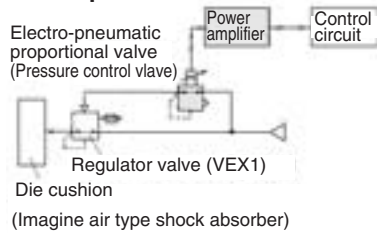
Body size Standard characteristics Port size

Body size Symbol	Standard characteristics Symbol	Set pressure range (MPa)	Symbol	Port size
2	1	0.05 to 0.65MPa	Nil	Without sub-plate
	2	0.1 to 0.9MPa	02	1/4
4	1	0.005 to 0.15MPa	03	3/8
			04	1/2
			06	3/4

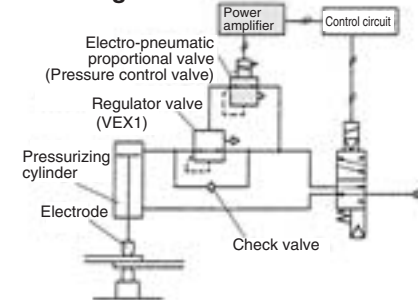


Application Example

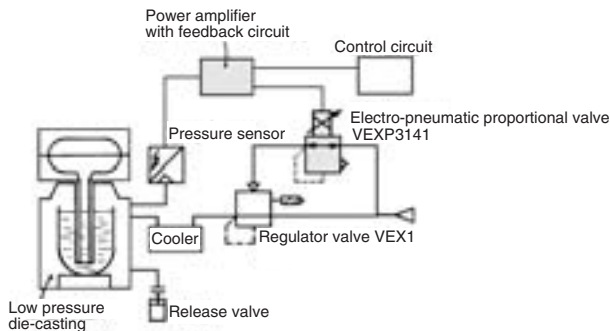
Controlling pressure for die press cushion



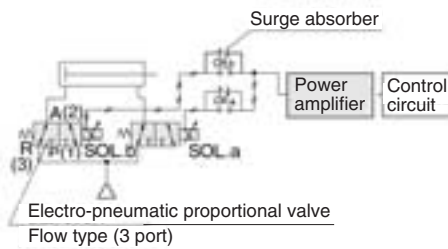
Controlling welding pressure of welding machine electrode



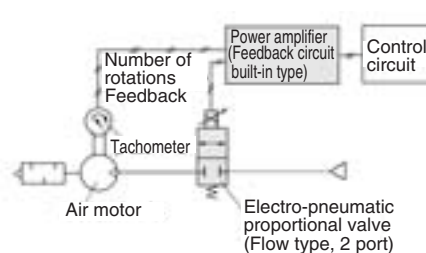
Controlling pressure of low pressure die-casting



Controlling multispeed of cylinder



Controlling rotation of air motor



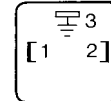
How to Use DIN Terminal

⚠ Caution

Wiring procedure

1. Loosen the retaining screw and pull the connector from the pin plug.
2. Make sure to remove the retaining screw, insert the tip of a flat head screwdriver into the groove below the terminal block and pry it up to separate the terminal cover from the terminal block.
3. Securely connect the wires to the specified terminals in accordance with the wiring procedure.

Wiring



Terminal block
Connection 3 is not used for terminal 1 and 2.
Note) Coil has no polarity.

Pin plug shape

Applicable cable (Heavy-duty cable)

0.75 mm², 1.25 mm²/2 core, 3 core (O.D. ø6.8 to ø11.5) based on JIS C 3312 and C 3322

Outlet changing procedure

To change the wire outlet, first separate the terminal cover from the terminal block. Then, reinstall the terminal cover in the desired direction (in 90° increments).

⚠ Precautions

Be sure to read before handling.

Refer to front matters 42 and 43 for Safety Precautions and pages 287 to 291 for Precautions on every series.

⚠ Caution

1. Air supply

- Poor quality air could increase the spool's sliding resistance, while preventing it from attaining its specified characteristics. Use compressor oil with a minimal generation of oxidants and install a mist separator (SMC's AM series). Refer to pages 2 and 3.
- Avoid using ultra-dry air since it may reduce the amount of lubricant and shorten the service life.

2. Mounting

- Vibrations are transmitted to the valve by the proportional solenoid's dither. If it is necessary to prevent the transmission of vibrations, insert vibration isolating rubber material.
- Thoroughly flush the pipe to completely eliminate any dust or scales from the pipe inside.

- Install a silencer (AN series) on the exhaust port.
- Be careful with the molded coil because it generates heat while current is applied to it.

3. Lubrication

This product can be used without lubrication. But if lubricated, use turbin oil Class 1, ISO VG32 (with no additive). It is impossible to use spindle oil, machine oil, or grease.

4. Manual operation

To check the operation of the valve without applying a current, remove the lock nut and use a screwdriver or the like to press the tip of the core. After checking the operation, reinstall the rubber cap in its original position.

Previous Type VEF□□□0, VEA1□□

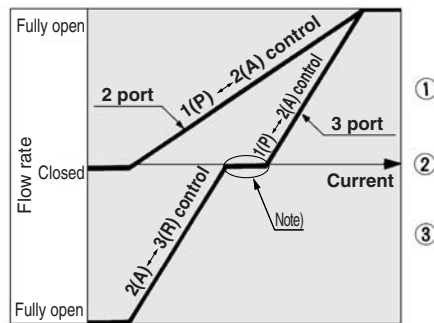
⚠ Caution

VEF□□□0 must be used in conjunction with the power amplifier VEA1□□. The previous VEF□□□0 cannot be used in combination with the current VEA25□, and the current VEF□□□1 cannot be used in combination with the previous VEA1□□.

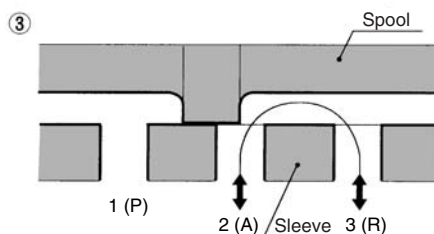
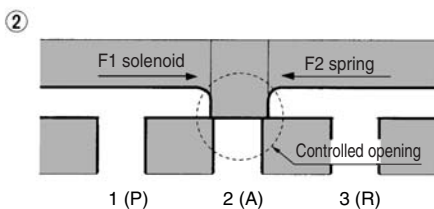
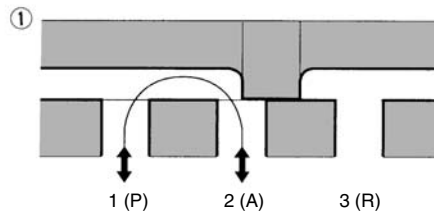
Flow type: VEF

Diagram of Working Principle

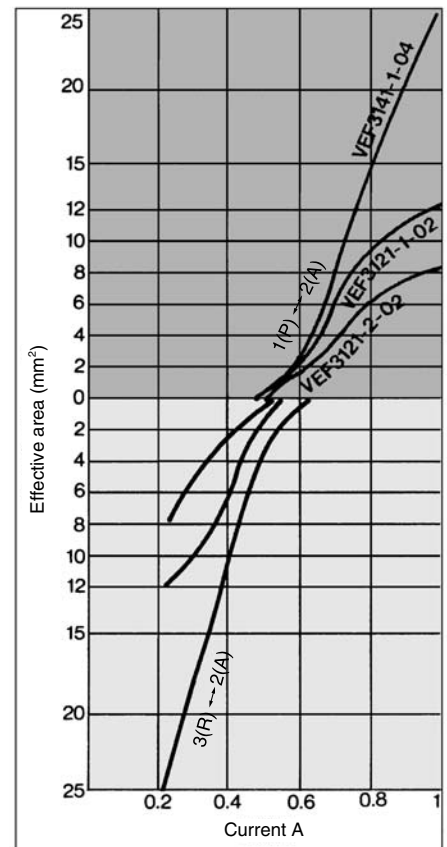
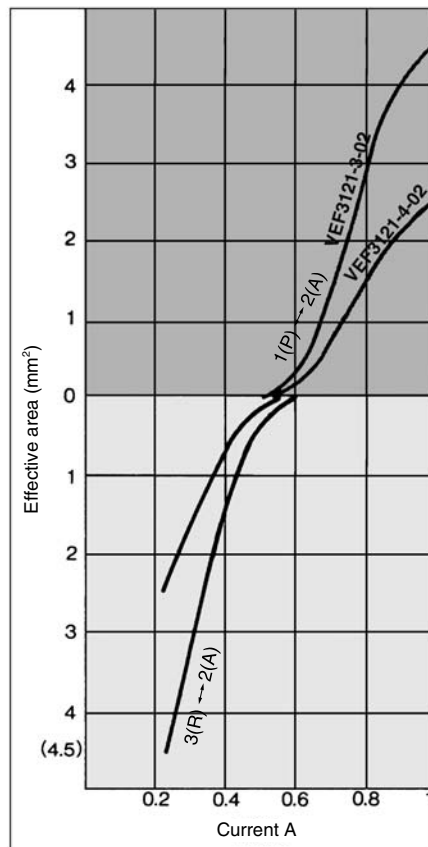
The spool controls the sleeve's opening through the balance between the proportional solenoid's pulling force (F1) and the spring's reaction force (F2). The spool moves in accordance with the amperage that is applied to the proportional solenoid, thus controlling the flow rate.



Note) The areas between port 1 (P) and 2 (A) and between port 2 (A) and 3 (R) will not equal the effective area of 0 mm² (valve closed) at the same time. (Refer to the flow characteristics.)



Flow Characteristics: 3 Port



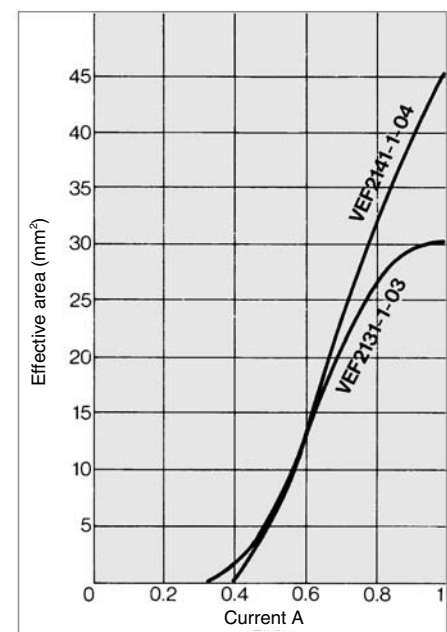
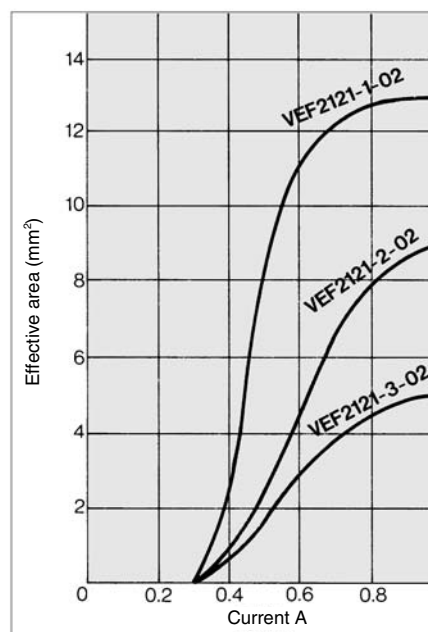
Choked flow

$$Q = 120 \times S (P + 0.1) \sqrt{\frac{293}{273 + t}}$$

Q: Air flow rate [L/min(ANR)]
S: Effective area [mm²]

P: Inlet pressure [MPa]
t: Temperature [°C]

Flow Characteristics: 2 Port



Choked flow

$$Q = 120 \times S (P + 0.1) \sqrt{\frac{293}{273 + t}}$$

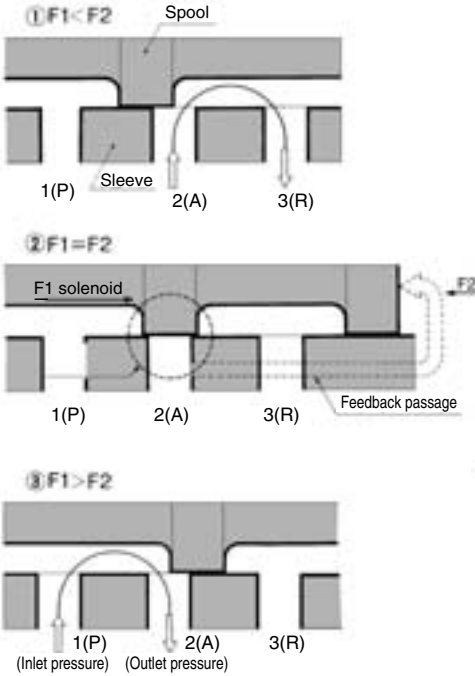
Q: Air flow rate [L/min(ANR)]
S: Effective area [mm²]

P: Inlet pressure [MPa]
t: Temperature [°C]

Pressure Type: **VEP**

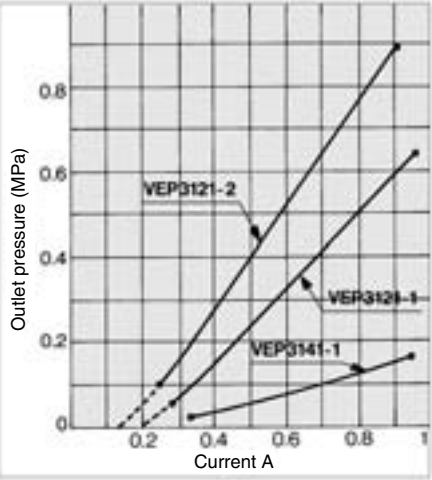
Diagram of Working Principle

The control opening becomes closed when the solenoid's pulling force (F1) balances with the force (F2), which is created by the outlet pressure that passes through the feedback passage and acts on the spool surface. As a result, the outlet pressure is established.

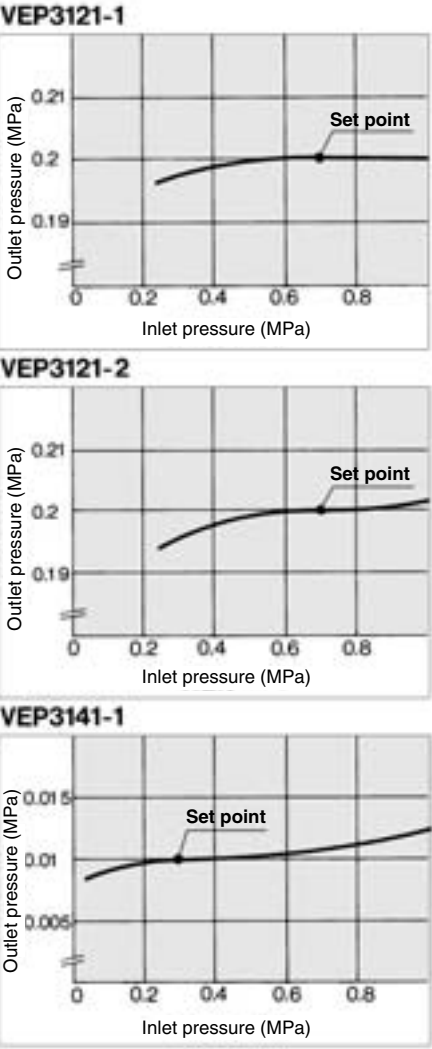


Current-Pressure Characteristics

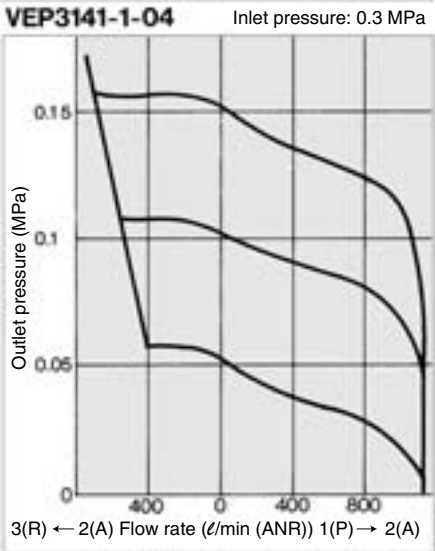
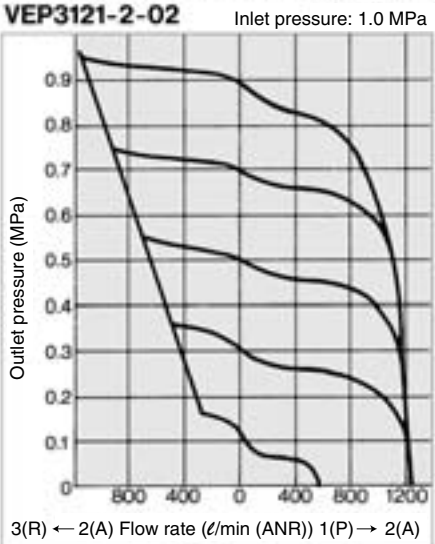
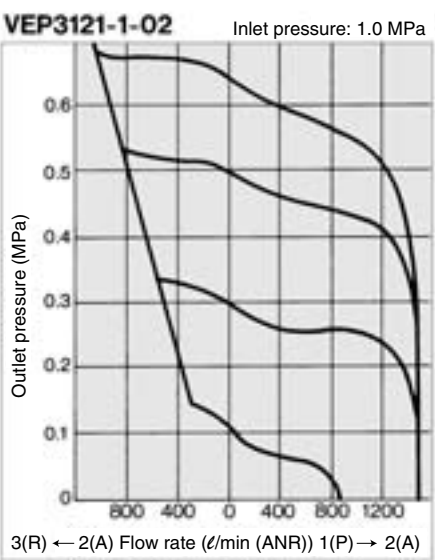
The horizontal axis of the characteristics represents the output amperage of the power amplifier VEA25□. (If NULL and GAIN are in the shipping condition, 0 to 1 A can be viewed by substituting them with command signals 0 to 5 V.)



Pressure Characteristics JIS B 8372 (In accordance with air regulator)



Flow Characteristics

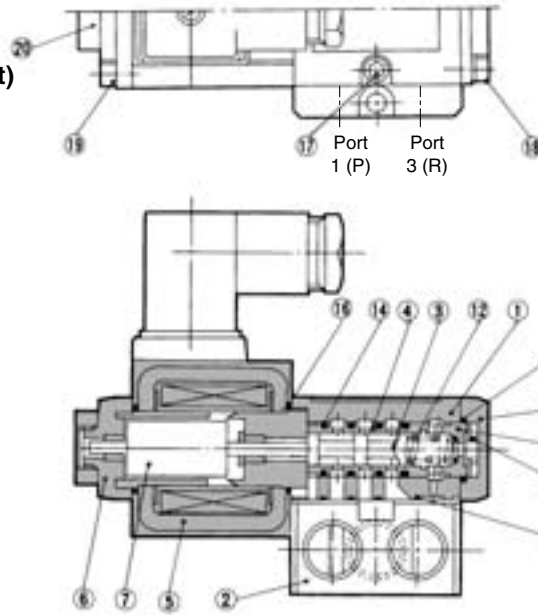


Construction

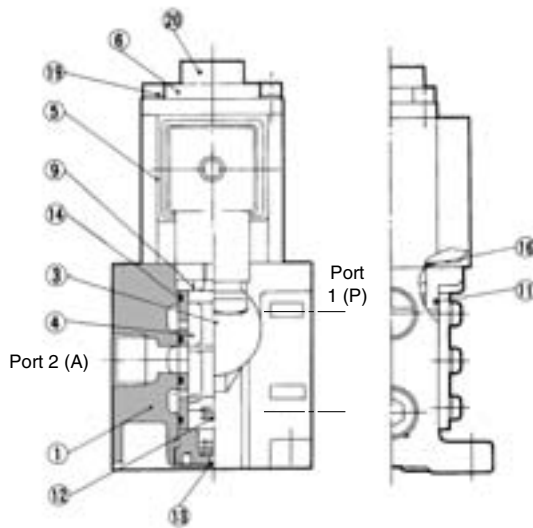
Flow type: VEF2121 (2 Port)

VEF3121 (3 Port)

Pressure type: VEP3121 (3 Port)



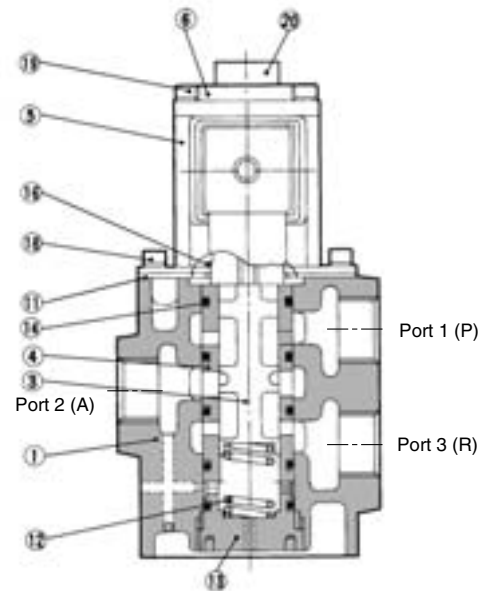
Flow type: VEF2131 (2 Port)



Flow type: VEF2141 (2 Port)

VEF3141 (3 Port)

Pressure type: VEP3141 (3 Port)



Component Parts

No.	Description	Material	Note
1	Body	Aluminum alloy	Metallic painted
2	Sub-plate	Aluminum alloy	Metallic painted
3	Spool	Special stainless steel	—
4	Sleeve	Special stainless steel	—
5	Mold coil	—	—
6	Solenoid cap assembly	Aluminum alloy	Metallic painted
7	Movable core assembly	—	—
8	End cover	Aluminum alloy	—
9	Bush	Resin	—
10	Set bushing	Brass	—
11	Gasket	NBR	—
12	Spring	Stainless steel/Piano wire	—
13	Spring seat	Brass	—
14	O-ring	NBR	—
15	O-ring	NBR	—
16	O-ring	NBR	—
17	Hex. socket head cap screw	Chromium-molybdenum	—
18	Hex. socket head cap screw	Chromium-molybdenum	—
19	Hex. socket head cap screw	Chromium-molybdenum	—
20	Lock nut	NBR	—

Sub-plate and Gasket for VEF_{P3}121 Part No.

② Sub-plate	DXT172-2-□□P
① Gasket	DXT172-7
①⑦ Hex. socket head cap screw (With SW)	XT012-25D-1 (M4 x 32)

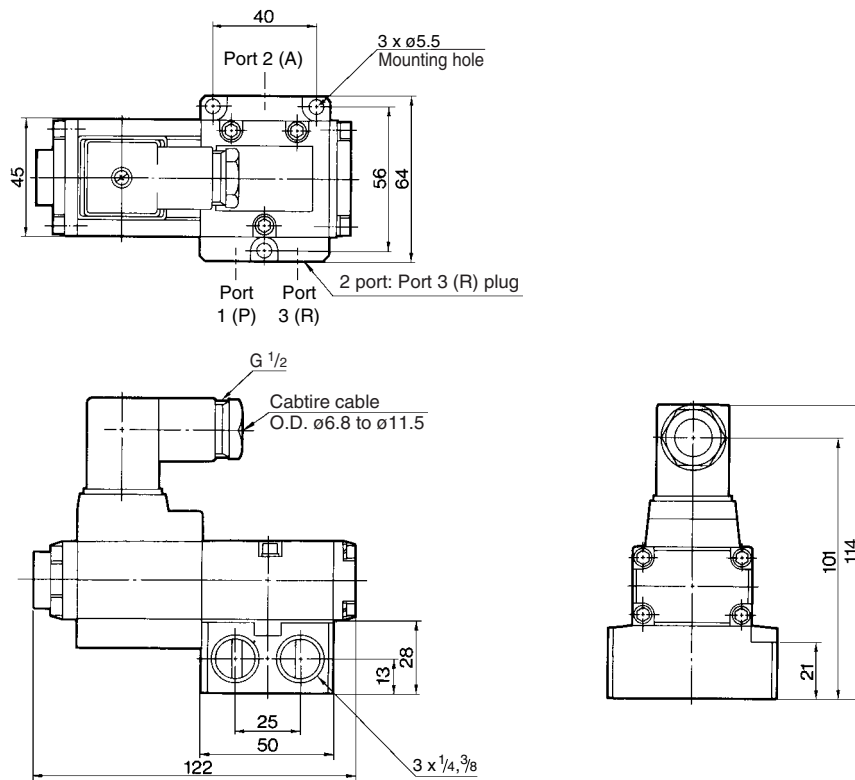
Port size		Thread type	
Symbol	Port size	Symbol	Thread type
1	1/4	Nil	Rc
2	3/8	F	G
		N	NPT
		T	NPTF

Series VEF/VEP

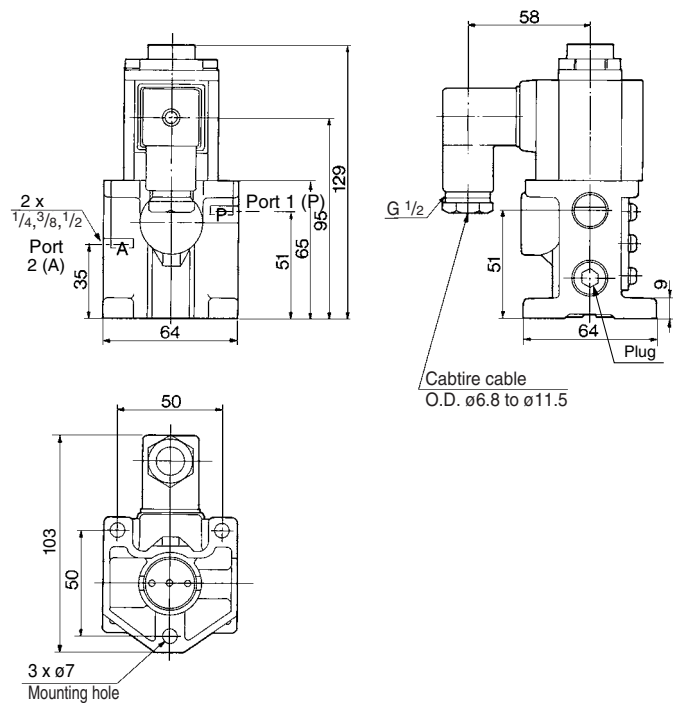
Dimensions

Flow type: VEF2121, VEF3121

Pressure type: VEP3121



Flow type: VEF2131



Flow type: VEF2141, VEF3141

Pressure type: VEP3141

