

# 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	VEF2131	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.)						
Weight (kg)	0.9	1.0	1.4	0.9	1.4		

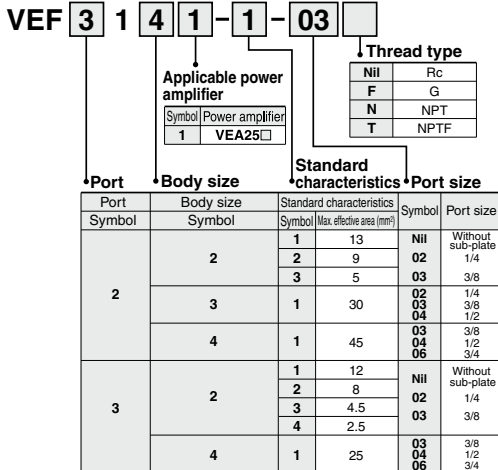
Note) The non-lubricated specification is not applicable to these models.

### Proportional Solenoid Specifications

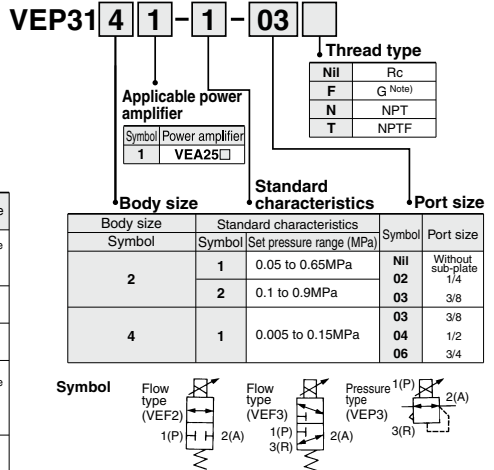
Proportional solenoid recognition symbol	1 (Applicable power amplifier: VEA25□)
Applicable power amplifier	VEA25□
Max. current	1 A
Coil resistance	13 Ω (Ambient temperature 20°C)
Rated power consumption	13 W (Ambient temperature 20°C, with maximum current)
Coil insulation type	Class H or equivalent (180°C)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

### How to Order

<Flow type>



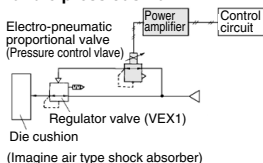
<Pressure type>



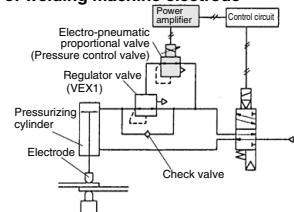
Note) Does not conform to ISO1179-1.

## Application Example

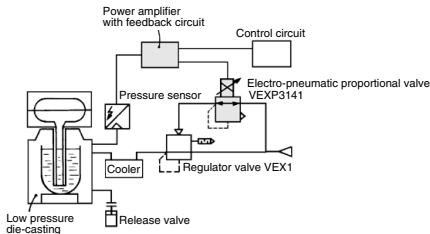
### Controlling pressure for die press cushion



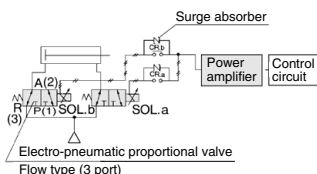
### Controlling welding pressure of welding machine electrode



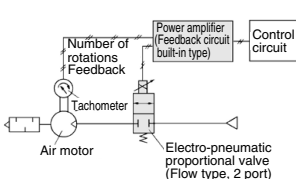
### Controlling pressure of low pressure die-casting



### 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 mm<sup>2</sup>, 1.25 mm<sup>2</sup>/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 matter 43 for Safety Instructions and pages 365 to 369 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 turbine 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□□□

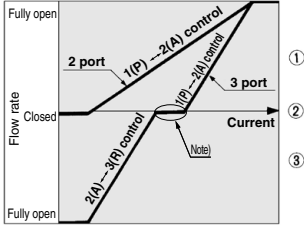
### ⚠ Caution

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□□□□.

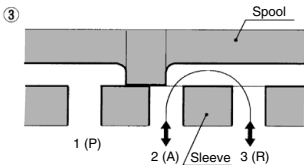
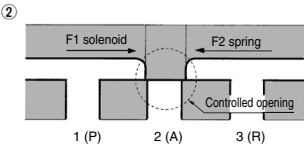
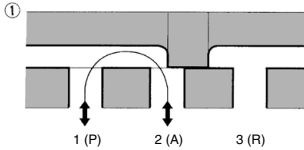
## Flow type: VEF

### Diagram of Working Principle

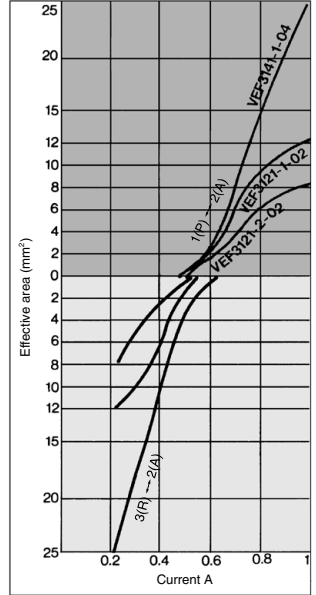
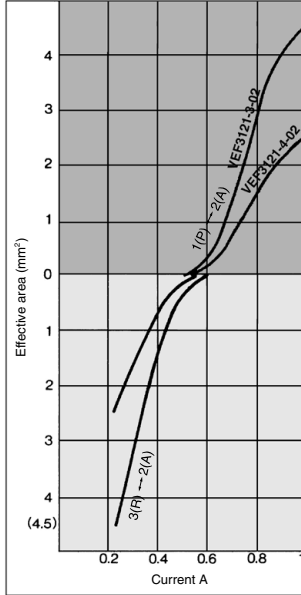
The spool controls the sleeve's opening through the balance between the proportional solenoid's pulling force (F1) and the spring's reaction force (F2). The spool moves in accordance with the amperage that is applied to the proportional solenoid, thus controlling the flow rate.



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 mm<sup>2</sup> (valve closed) at the same time. (Refer to the flow characteristics.)



### Flow Characteristics: 3 Port



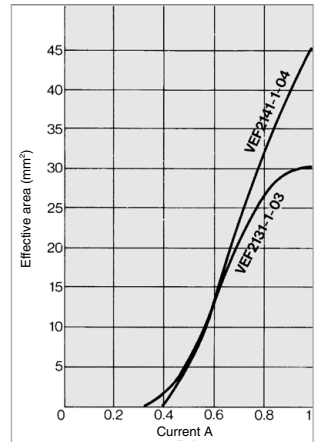
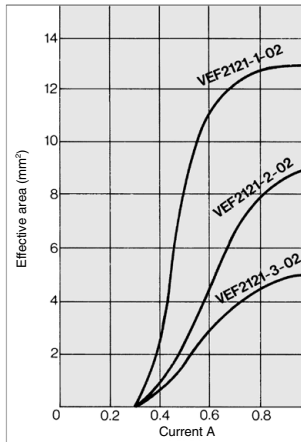
#### Choked flow

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

Q: Air flow rate [L/mi (ANR)]  
S: Effective area [mm<sup>2</sup>]

P: Valve-inlet pressure [MPa]  
t: Temperature [°C]

### Flow Characteristics: 2 Port



#### Choked flow

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

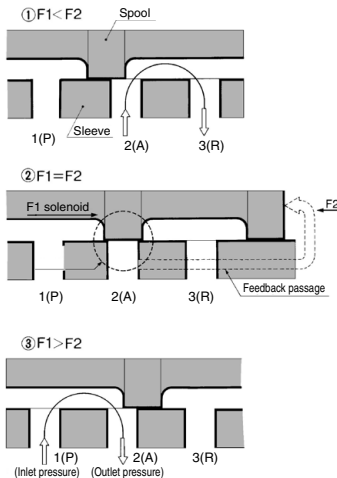
Q: Air flow rate [L/mi (ANR)]  
S: Effective area [mm<sup>2</sup>]

P: Valve-inlet pressure [MPa]  
t: Temperature [°C]

## Pressure Type: VEP

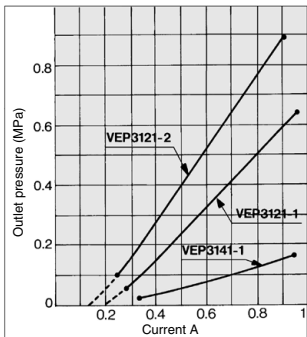
### Diagram of Working Principle

The control opening becomes closed when the solenoid's pulling force ( $F_1$ ) balances with the force ( $F_2$ ), 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.

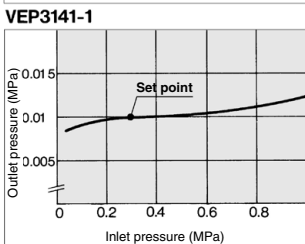
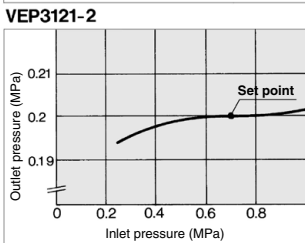
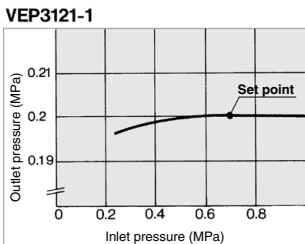


### Current-Pressure Characteristics

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.)

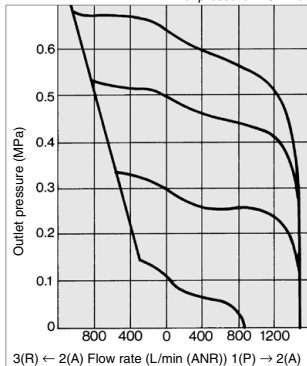


### Pressure Characteristics JIS B 8372 (In accordance with air regulator)

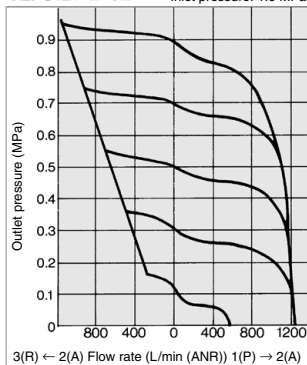


### Flow Characteristics

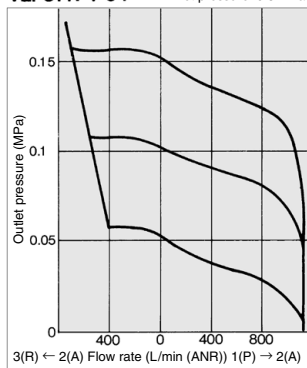
#### VEP3121-1-02 Inlet pressure: 1.0 MPa



#### VEP3121-2-02 Inlet pressure: 1.0 MPa



#### VEP3141-1-04 Inlet pressure: 0.3 MPa



ARJ

AR425 to 935

ARX

AMR

ARM

ARP

IR

IRV

VEX

SRH

SRP

SRF

VCHR

ITV

IC

ITVX

PVQ

VEF

VEP

VER

VEA

VY1

VBA

VBAT

AP100

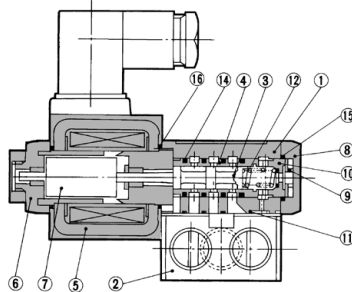
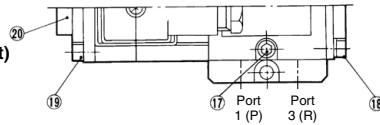
# Series VEF/VEP

## Construction

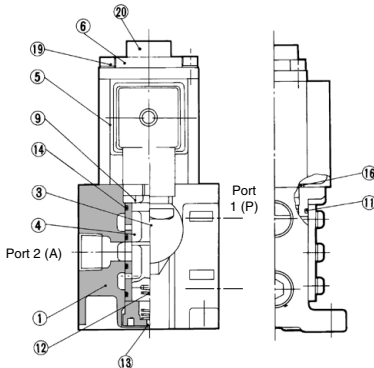
Flow type: VEF2121 (2 Port)

VEF3121 (3 Port)

Pressure type: VEP3121 (3 Port)



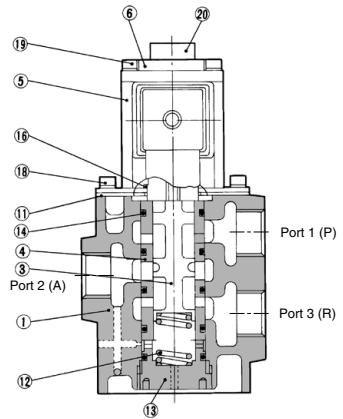
Flow type: VEF2131 (2 Port)



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 VE<sub>23</sub>121 Part No.

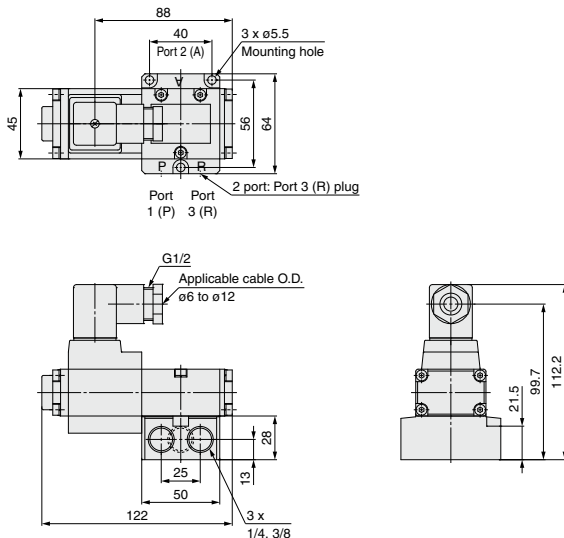
② Sub-plate	DXT172-2-□□P	Thread type
	Port size	Symbol Thread type
	Symbol Port size	Nil Rc
	1 1/4	F G (Note)
	2 3/8	N NPT
		T NPTF
⑪ Gasket	DXT172-7	
⑰ Hex. socket head cap screw (With SW)	XT012-25D-1 (M4 x 32)	

Note) Does not conform to ISO1179-1.

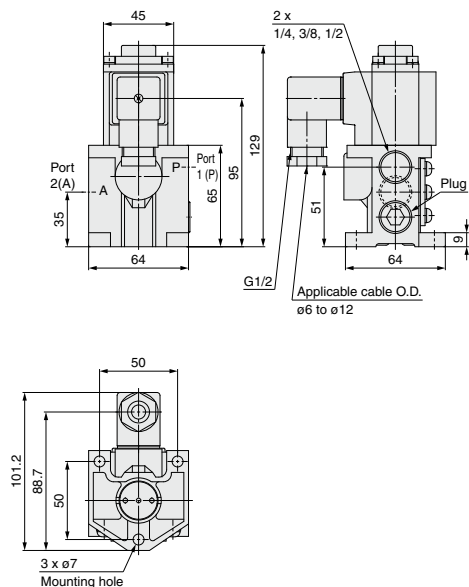
**Dimensions**

Flow type: VEF2121, VEF3121

Pressure type: VEP3121

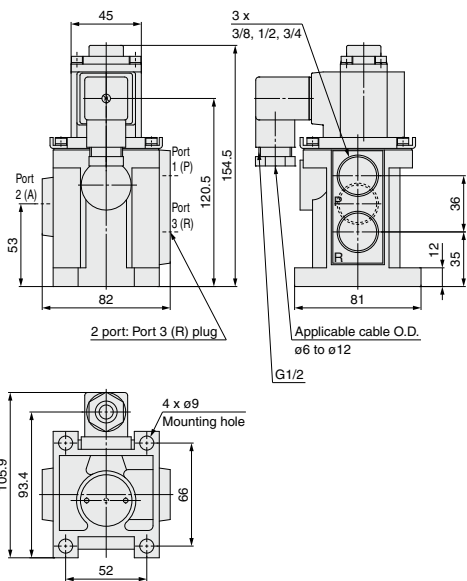


Flow type: VEF2131



Flow type: VEF2141, VEF3141

Pressure type: VEP3141



ARJ
AR425 to 935
ARX
AMR
ARM
ARP
IR
IRV
VEX
SRH
SRP
SRF
VCHR
ITV
IC
ITVX
PVQ
VEF
VEP
VER
VEA
VY1
VBA
VBAT
AP100