

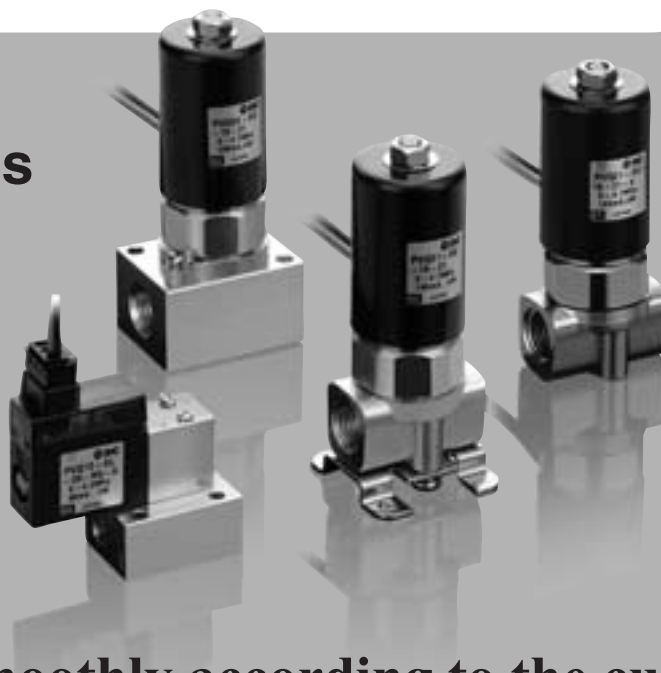
# Compact Proportional Solenoid Valve

## Series PVQ

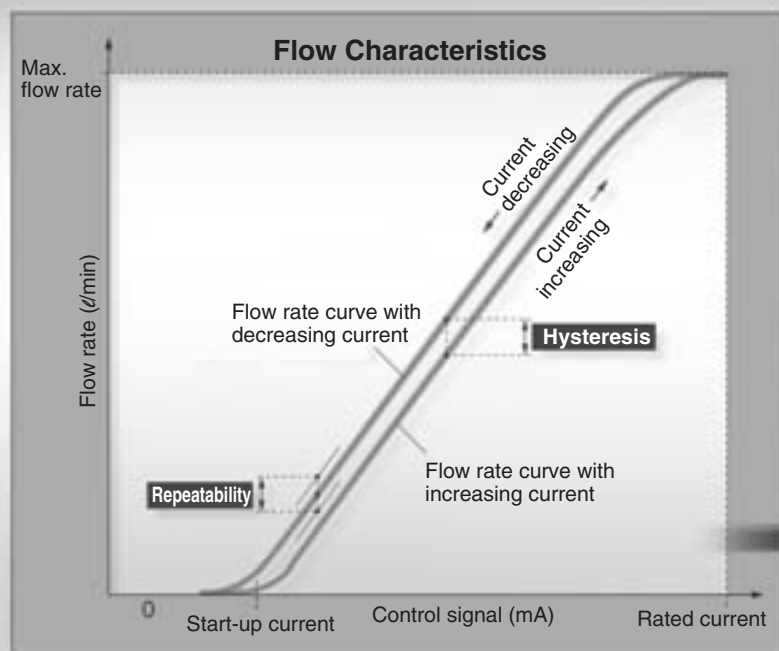
Repeatability: **3% or less**  
Hysteresis: **10% or less**

Fluid	Flow rate control range <sup>Note)</sup>	Series
Air, Inert gas	0 to 6 ℓ/min	<b>PVQ10</b>
	0 to 100 ℓ/min	<b>PVQ30</b>

Note) Varies depending on the model.



Control the flow rate smoothly according to the current



ARJ

AR425  
to 935

AMR

ARM

ARP

IR

IRV

VEX1□

SRH

SRP

SRF

ARX20

VCHR

ITV

IC

**PVQ**

VEF  
VEP

VER

VEA

VY2

VBA  
VBAT

AP100

- **Service life: Lasts 25 million cycles.** (PVQ30)

(SMC in-house life test conditions)

Specially coated sliding surface realized 25 million cycles within set operating range

- **Body material: Equivalent to C37 or Stainless Steel 304** (PVQ30)

**Seal material: FKM** (PVQ10, PVQ30)

- **Valve returns to closed position when power supply is turned off.**

- **Leakage amount: 5 cm<sup>3</sup>/min or less at OFF**

- **Can be used with vacuum.** (Minimum operating pressure 0.1 Pa-abs)

- **Operation noise during opening/closing of the valve reduced**

PVQ10	ON	30 dB or less	PVQ30	ON	43 dB or less
	OFF	32 dB or less		OFF	50 dB or less

\* Background noise: 20 to 25 dB

\* Background noise: 20 to 25 dB

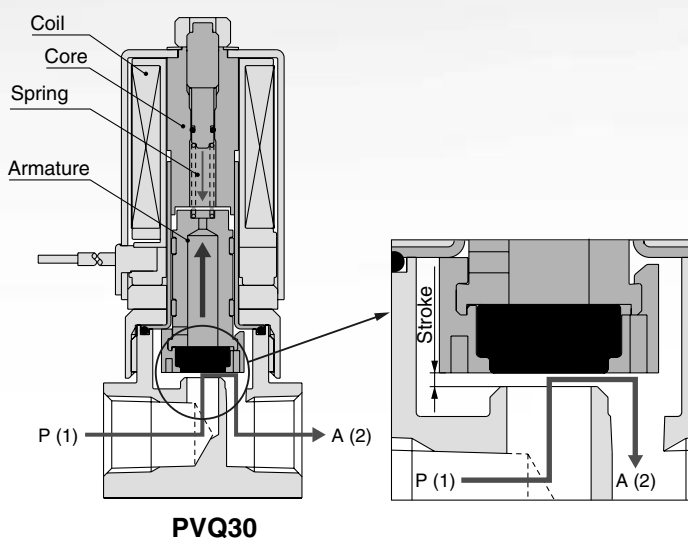
- **Can be mounted on manifolds**

When continuously energizing adjacent valves at the same time, ambient temperature rises since the coil generates heat. Implement measures to exhaust excess heat so that the temperature remains within the range of the table on the right.

Table: Coil outer surface temperature range

Model	Coil outer surface temperature
PVQ10	90°C or less
PVQ30	100°C or less

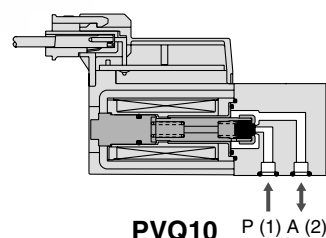
\* Ambient temperature: 50°C at the valve proximal section (approx. 1 mm) when the maximum current is applied



### Working Principle

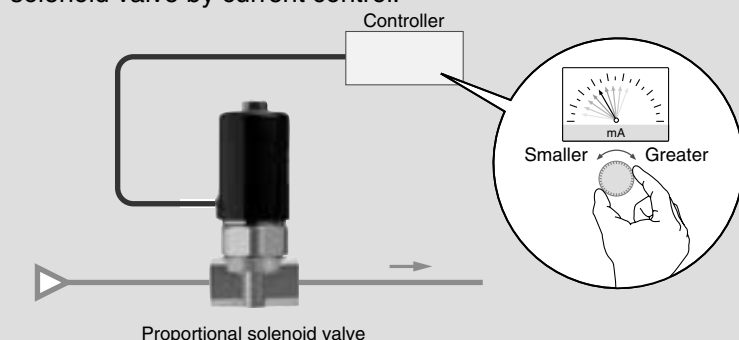
The armature is attracted to the core by electromagnetic force as the coil is energized. When the applied current varies, the attraction force also varies proportionally to it. The flow rate is controlled by the movement (stroke) of the armature, depending on the balance between this attraction force and the spring load.

Note) Sliding resistance at this point is the hysteresis of the flow.



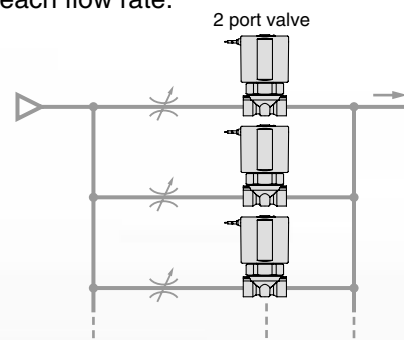
## Proportional Solenoid Valve

Flow rate can be controlled smoothly with one proportional solenoid valve by current control.



## Conventional (2 port valve)

One 2-port valve is required for each flow rate.



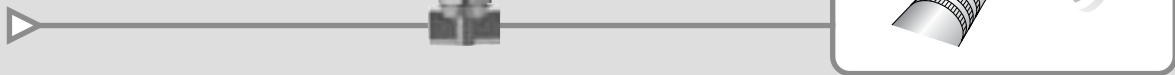
## Applications

### Air-blow

- Blow-off of debris or water.
- Work transportation



### Spin control of handpiece

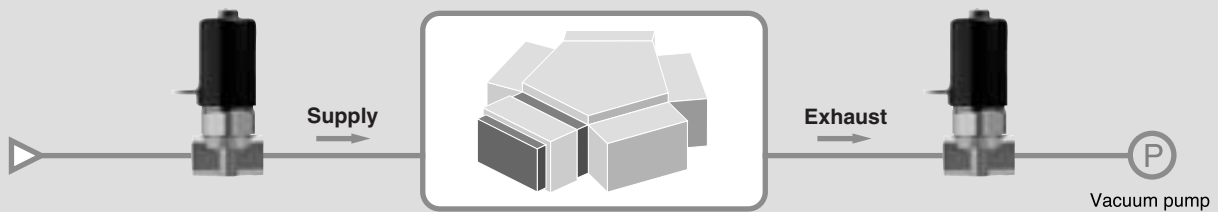



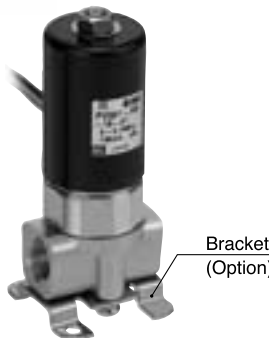

### Blood pressure gauge



### Vacuum chamber supply flow control

Smooth air supply/exhaust is possible by reducing the initial air supply.  
Prevents dust being stirred up inside the chamber.



Model	PVQ13				PVQ31		PVQ33	
Piping type	Base mounted				Body ported		Base mounted	
								
Valve construction	Direct operated poppet				Direct operated poppet			
Valve type	N.C.				N.C.			
Orifice size (mm)	0.3	0.4	0.6	0.8	1.6	2.3	4	
Max. operating pressure (MPa)	0.7	0.45	0.2	0.1	0.7	0.35	0.12	
Flow rate (ℓ/min)	0 to 5	0 to 6		0 to 5	0 to 100			0 to 75
Applied current (Power supply)	0 to 85 mA (24 VDC) 0 to 170 mA (12 VDC)				0 to 165 mA (24 VDC) 0 to 330 mA (12 VDC)			
Port size	M5				1/8			

# Series PVQ Model Selection

## <To use orifice $\phi 1.6$ (See PVQ30: Chart 1)>

Condition 1.  $P_1 = 0.7 \text{ MPa}$ ,  $P_2 = 0 \text{ MPa}$  (Atmospheric pressure)

Refer to curve A when  $\Delta P$  is 0.7 MPa.

Ex) At increasing current, the flow rate when 140 mA current is applied is 85  $\ell/\text{min}$ . (See ①.)

If current decreases at this point, the flow rate may not change by 135 mA due to hysteresis. (See ②.)

The flow rate at increasing current and decreasing current are not the same due to hysteresis. (① 85  $\ell/\text{min}$ ., ③ 93  $\ell/\text{min}$ .)

Condition 2.  $P_1 = 0.7 \text{ MPa}$ ,  $P_2 = 0.2 \text{ MPa}$

Refer to curve B when  $\Delta P$  is 0.5 MPa.

Ex) At increasing current, the flow rate when 150 mA current is applied is 65  $\ell/\text{min}$ . (See ④.)

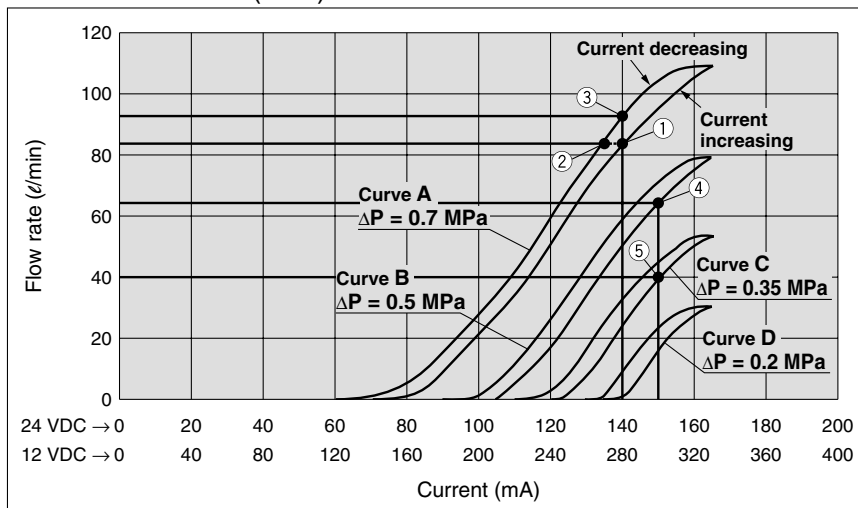
If the outlet pressure  $P_2$  increases by 0.15 MPa,  $\Delta P$  decreases by 0.15 MPa and becomes 0.35 MPa (See curve C), and the flow rate when the same current is applied is 40  $\ell/\text{min}$ . (See ⑤.)

- The flow rate decreases due to change (increase) in outlet pressure, even if the inlet pressure and current value are the same.

Condition 3. In a vacuum

- For vacuum specifications, the operating pressure range is from 0.1 Pa-abs to max. operating pressure differential.
- A(2) port is applicable with vacuum pressure.

## <Chart 1> PVQ30 ( $\phi 1.6$ )



$\Delta P = (P_1 - P_2) \text{ MPa}$   
 $\Delta P$ : Pressure differential  
 $P_1$ : Inlet pressure  
 $P_2$ : Outlet pressure

## ● Q. Required flow rate = 0 to 75 ℓ/min.

$P_1$  = No conditions,  $P_2$  = 0 MPa (Atmospheric pressure)

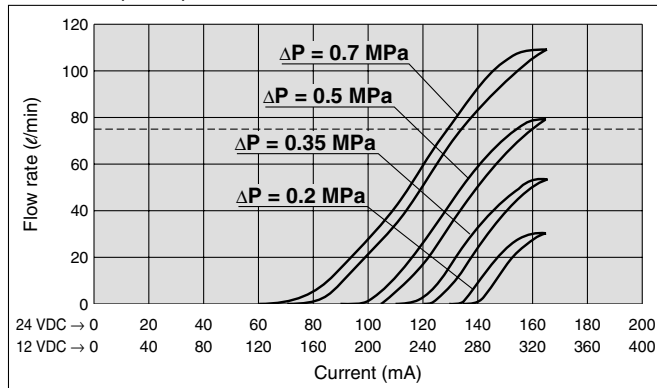
In this case, all orifice sizes of PVQ30 series satisfy the required flow rate. (Flow rate when rated current is applied)  
The table below shows the pressure differentials to satisfy the required flow rate. In the flow rate characteristic charts, a pressure differential over the flow rate indicated by the dashed line (75 ℓ/min.) up to the max. operating pressure differential will satisfy the required flow rate.

**Table. Pressure differential to satisfy required flow rate = 0 to 75 ℓ/min.**

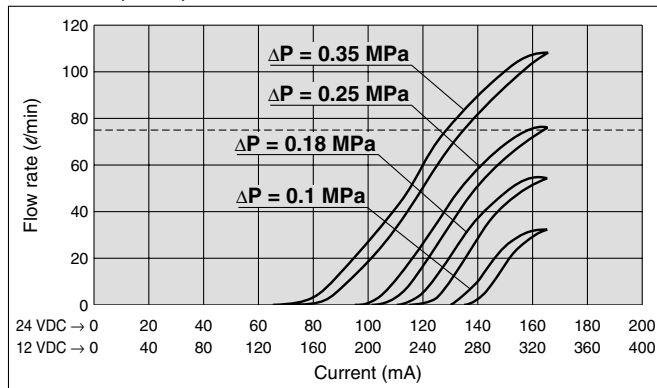
	ø1.6	ø2.3	ø4.0
Pressure differential ( $\Delta P$ )	0.5 to 0.7 MPa	0.25 to 0.35 MPa	0.12 MPa

$\Delta P = (P_1 - P_2)$  MPa  
 $\Delta P$ : Pressure differential  
 $P_1$ : Inlet pressure  
 $P_2$ : Outlet pressure

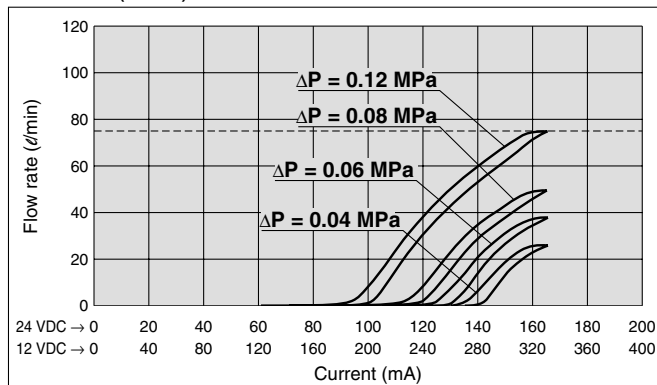
### PVQ30 (ø1.6)



### PVQ30 (ø2.3)



### PVQ30 (ø4.0)



## ● Note

- 1) Follow the same procedure for selecting PVQ10 series.
- 2) Flow rate depends on individual differences between valves and piping conditions. Refer to flow characteristic chart to select the model with adequate margin for required flow rate.

# Compact Proportional Solenoid Valve

## Series *PVQ10*

### How to Order

#### Base mounted



**PVQ 13 - 5 L - 03 - M5 - A**

Valve type  
**13** N.C.

Voltage  
**5** 24 VDC  
**6** 12 VDC

Electrical entry

<b>L</b>	L plug connector	
<b>M</b>	M plug connector	

With / Without lead wire

<b>Nil</b>	With lead wire
<b>O</b>	Without lead wire

Body / Seal material

Symbol	Body	Seal
<b>A</b>	C36	FKM

Port size

<b>Nil</b>	Without sub-plate (with mounting screw M1.7 x 17L, 2 pcs.)	
<b>M5</b>	With sub-plate M5 x 0.8	

Orifice size

Symbol	Orifice dia.	Max. operating pressure
<b>03</b>	0.3 mmø	0.7 MPa
<b>04</b>	0.4 mmø	0.45 MPa
<b>06</b>	0.6 mmø	0.2 MPa
<b>08</b>	0.8 mmø	0.1 MPa

### Specifications

Standard specifications	Valve construction	Direct operated poppet	
	Fluid	Air, Inert gas	
	Seal material	FKM	
	Body material	C36	
	Fluid temperature	0 to +50°C	
	Ambient temperature <sup>Note 1)</sup>	0 to +50°C	
	Action	N.C. (Normally closed)	
	Mounting orientation	Unrestricted	
	Port size	M5	
	Power supply	24 VDC	12 VDC
Coil specifications	Coil current	0 to 85 mA	0 to 170 mA
	Power consumption	0 to 2 W	
	Coil insulation	Class B	

Characteristic specifications	Orifice diameter (mmø)	0.3	0.4	0.6	0.8
	Max. operating pressure differential (MPa) <sup>Note 2)</sup>	0.7	0.45	0.2	0.1
	Max. operating pressure (MPa)	1 MPa			
	Min. operating pressure (MPa) (Vacuum) <sup>Note 3)</sup>	0 (0.1 Pa.abs)			
	Flow rate (l/min) (at max. operating pressure differential)	0 to 5	0 to 6		0 to 5
	Hysteresis (at max. operating pressure differential)	10% or less			
	Repeatability (at max. operating pressure differential)	3% or less			
	Start-up current (at max. operating pressure differential)	50% or less			

Note 1) Ambient temperature is for the valve proximal section (approx. 1 mm).

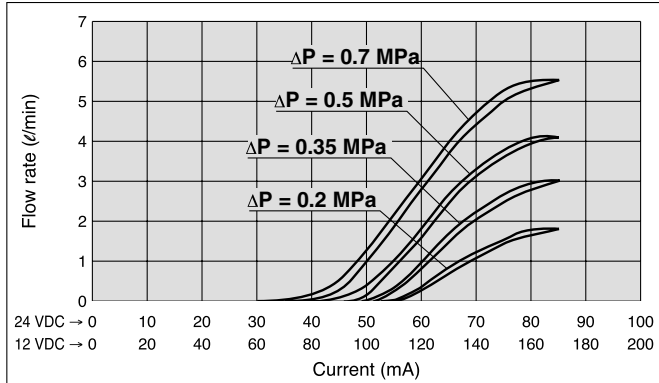
When the valve is continuously energized at an ambient temperature of 50°C (when applying maximum current), the coil outer surface reaches 90°C. The temperature changes depending on the operating conditions, and the coil outer surface temperature must be kept at 90°C or lower.

Note 2) Maximum operating pressure differential indicates pressure differential (difference between inlet and outlet pressure) which can be allowed for operation with the valve closed or open. If the pressure differential exceeds the max. operating pressure differential of orifice, the valve may leak.

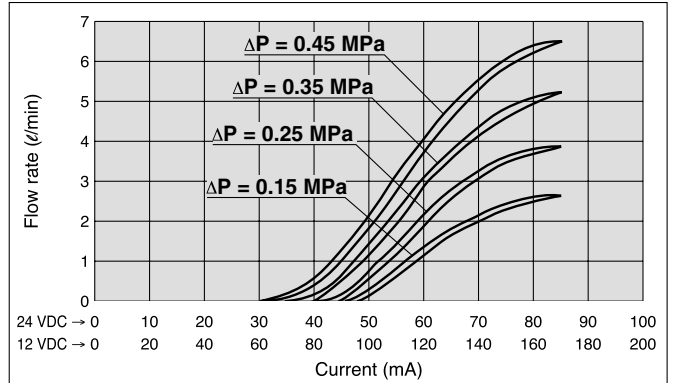
Note 3) For vacuum application, max. operating pressure range is 0.1 Pa-abs to max. operating pressure differential. A(2) port is applicable for vacuum pressure.

## Flow Characteristics

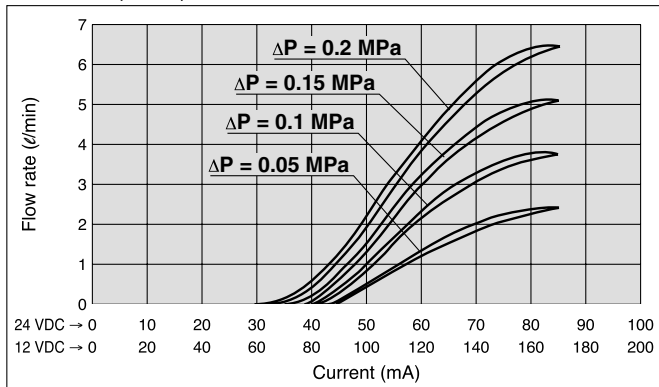
**PVQ10 (ø0.3)**



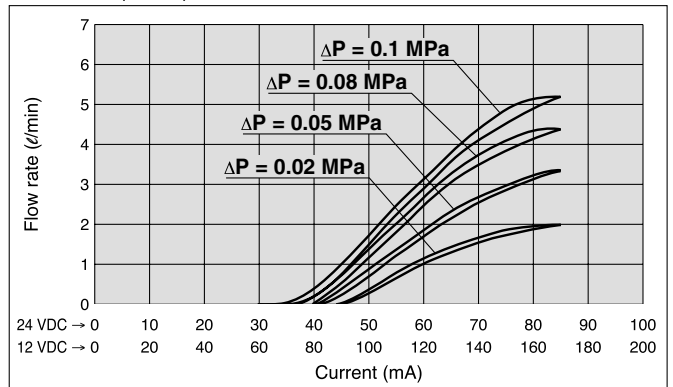
**PVQ10 (ø0.4)**



**PVQ10 (ø0.6)**

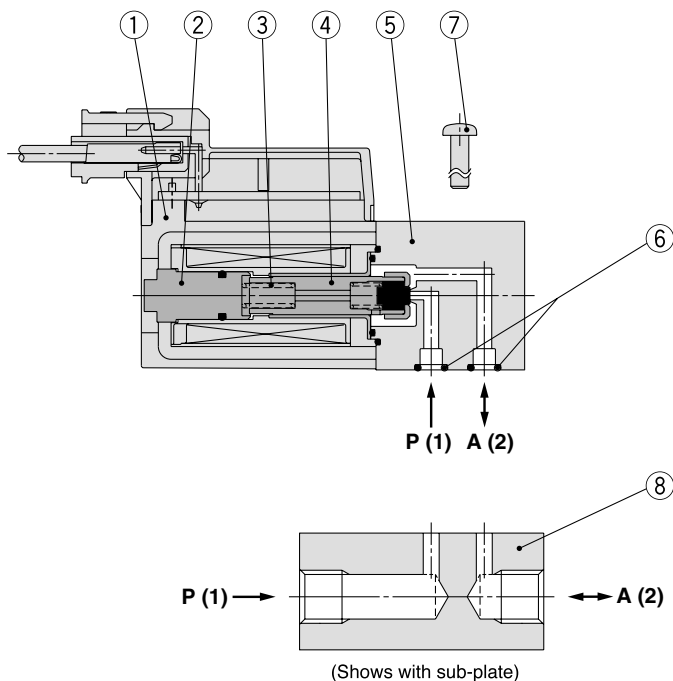


**PVQ10 (ø0.8)**



Note) Flow rate varies depending on model differences and piping conditions.  
Select the model that fully satisfies the necessary flow rate based on the flow characteristics graphs.

## Construction



### Component Parts

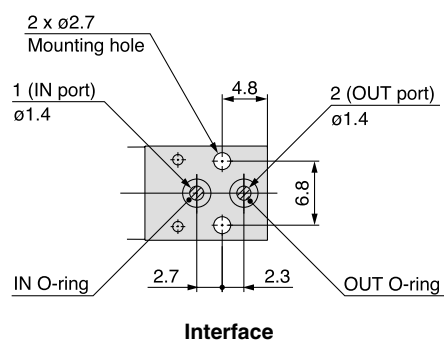
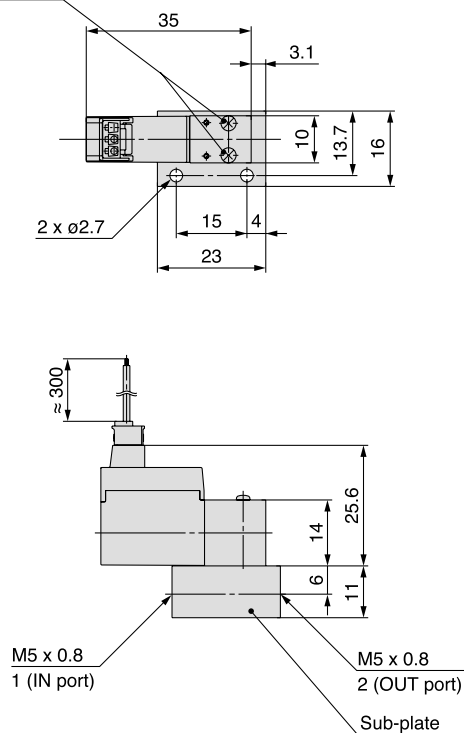
No.	Description	Material	Note
1	Solenoid coil assembly	—	
2	Core	Stainless steel	
3	Return spring	Stainless steel	
4	Armature assembly	Stainless steel, Aluminum, FKM	
5	Body	C36	
6	O-ring	FKM	
7	Round head combination screw	Steel	M1.7 x 0.35 x 17L, 2 pcs.
8	Sub-plate	C36	Part no: PVQ10-15-M5

# Series PVQ10

## Dimensions

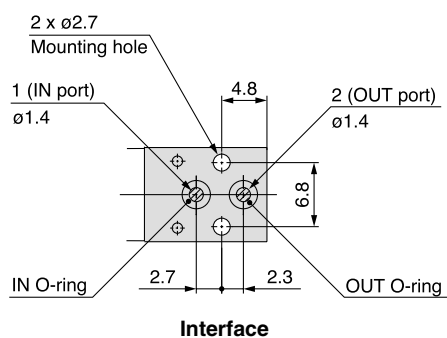
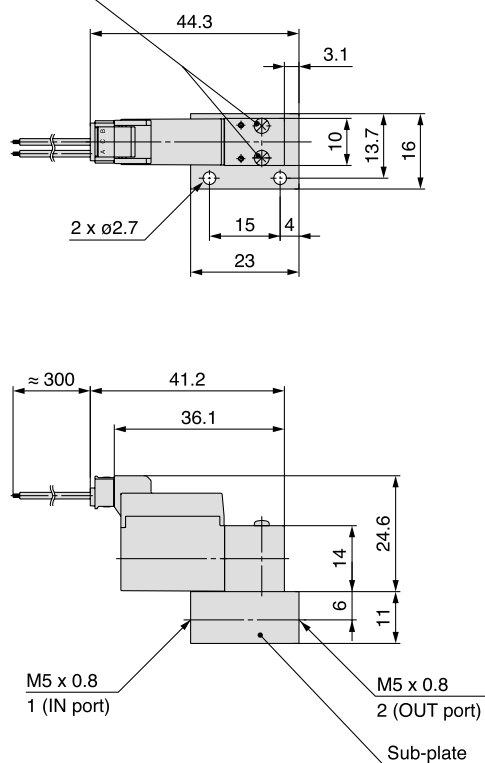
### L plug connector PVQ13-□L-□-M5

Round head combination screw



### M plug connector PVQ13-□M-□-M5

Round head combination screw





# Compact Proportional Solenoid Valve

## Series PVQ30



Body ported



Base mounted

### How to Order

Valve type  
31 N.C.

Port size  
01 1/8 (6A)

#### Option

Nil	None
F	Foot bracket

\* Bracket is not mounted but is provided at the time of shipment.

PVQ 31 - 5 G - 16 - 01

PVQ 33 - 5 G - 16 - 01

Valve type  
33 N.C.

Voltage	
5	24 VDC
6	12 VDC

Electrical entry: Grommet

#### Body / (Sub-plate) Seal material

Symbol	Body	Seal
Nil	C37	FKM
H	Stainless steel	FKM

#### Thread type (with sub-plate)

Nil	Rc
F	G
N	NPT
T	NPTF

#### Orifice size

Symbol	Orifice dia.	Max. operating pressure
16	1.6 mmø	0.7 MPa
23	2.3 mmø	0.35 MPa
40	4 mmø	0.12 MPa

#### Port size

Nil	Without sub-plate (with mounting screw M3 x 8L, 2 pcs.)	
01	With sub-plate 1/8 (6A)	

### Specifications

Standard specifications	Valve construction		Direct operated poppet
	Fluid		Air, Inert gas
	Seal material		FKM
	Body material		C37 (Standard), Stainless steel
	Fluid temperature		0 to +50°C
	Ambient temperature <sup>Note 1)</sup>		0 to +50°C
	Action		N.C. (Normally closed)
	Mounting orientation		Unrestricted
	Enclosure		IP40
	Port size		Rc 1/8
Coil specifications	Power supply		24 VDC      12 VDC
	Coil current		0 to 165 mA      0 to 330 mA
	Power consumption		0 to 4 W
	Coil insulation		Class B

Note 1) Ambient temperature is for the valve proximal section (approx. 1 mm).

When the valve is continuously energized at an ambient temperature of 50°C (when applying maximum current), the coil outer surface reaches 100°C. The temperature changes depending on the operating conditions, and the coil outer surface temperature must be kept at 100°C or lower.

Note 2) Maximum operating pressure differential indicates pressure differential (difference between inlet and outlet pressure) which can be allowed for operation with the valve closed or open. If the pressure differential exceeds the max. operating pressure differential of orifice, the valve may leak.

Note 3) For vacuum application, max. operating pressure range is 0.1 Pa-abs to max. operating pressure differential. A(2) port is applicable for vacuum pressure.

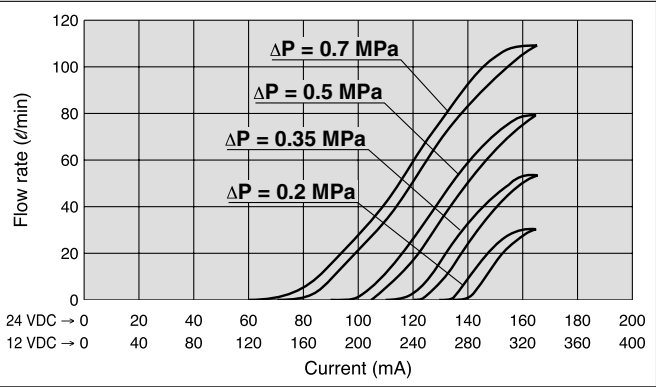
Characteristic specifications	Orifice diameter (mmø)	1.6	2.3	4.0
	Max. operating pressure differential (MPa) <sup>Note 2)</sup>	0.7	0.35	0.12
	Max. operating pressure (MPa)	1 MPa		
	Min. operating pressure (MPa) (Vacuum) <sup>Note 3)</sup>	0 (0.1 Pa.abs)		
	Flow rate (d/min) (at max. operating pressure differential)	0 to 100		0 to 75
	Hysteresis (at max. operating pressure differential)	10% or less		13% or less
	Repeatability (at max. operating pressure differential)	3% or less		
	Start-up current (at max. operating pressure differential)	50% or less		65% or less

# Series PVQ30

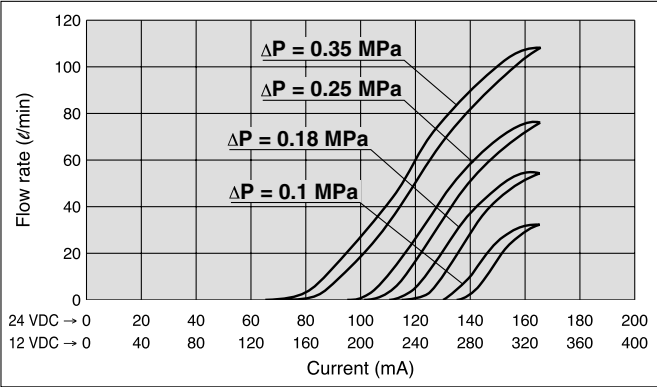
## Flow Characteristics

Air

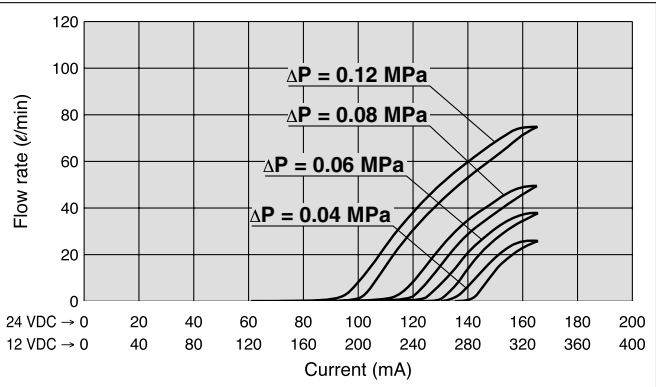
PVQ30 (ø1.6)



PVQ30 (ø2.3)

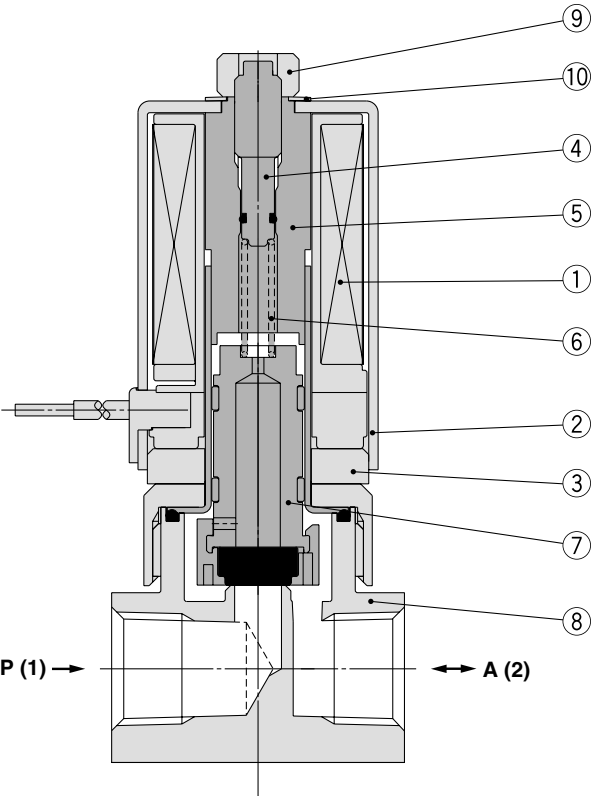


PVQ30 (ø4.0)



Note) Flow rate varies depending on model differences and piping conditions.  
Select the model that fully satisfies the necessary flow rate based on the flow characteristics graphs.

## Construction



### Component Parts

No.	Description	Material	Note
1	Solenoid coil assembly	—	
2	Coil cover	SPCE	
3	Magnetic plate	SUY	
4	Adjusting screw	Stainless steel	
5	Tube assembly	Stainless steel	
6	Return spring	Stainless steel	
7	Armature assembly	Stainless steel, PPS, PTFE, FKM	
8	Body	C37 or Stainless steel	
9	Nut	Steel	
10	Wave washer	Stainless steel	
11	Round head combination screw	Copper	Base mounted only M3 x 0.5 x 8L, 2 pcs. Part no.: PVQ30-15□-01□
12	Sub-plate	C36 or Stainless steel	
13	O-ring	FKM	
14	O-ring	FKM	

Option (Body ported only)

• Bracket assembly: VDW20-15A-1

Sub-plate Part No.

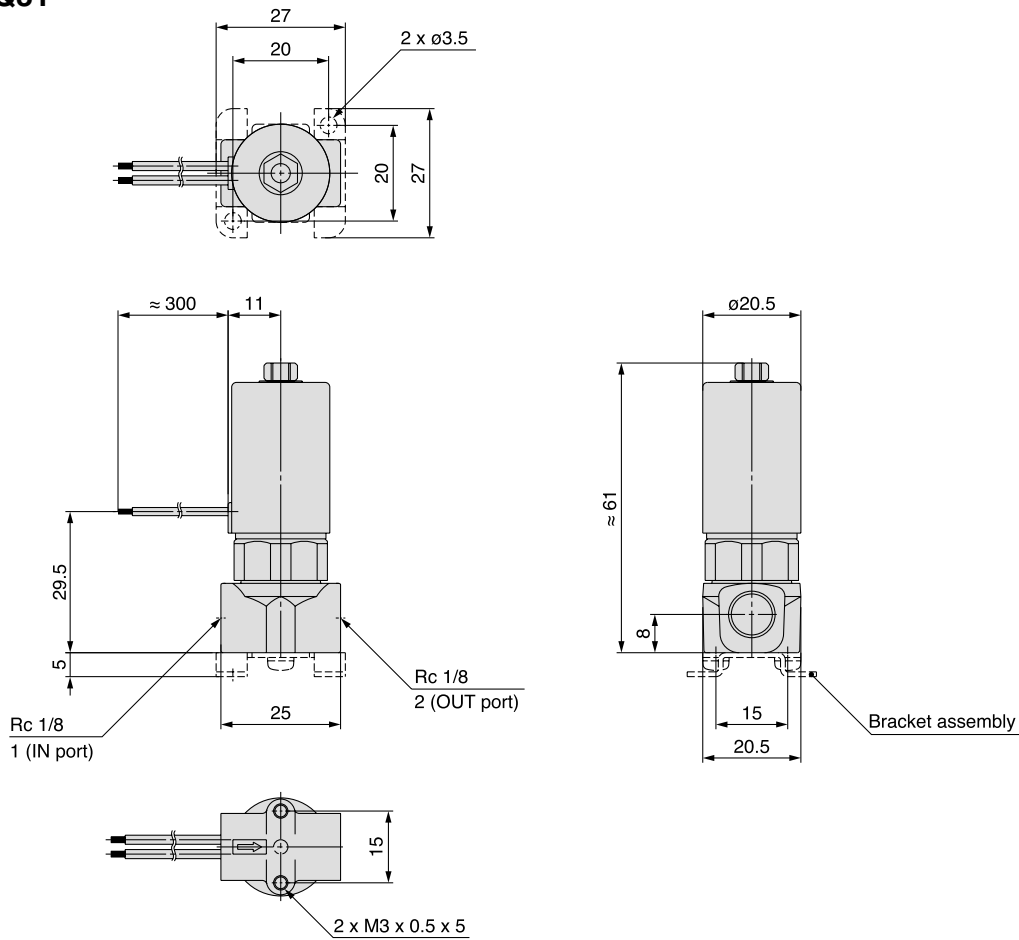
PVQ30-15 □ -01 □

• Thread type  
• Material

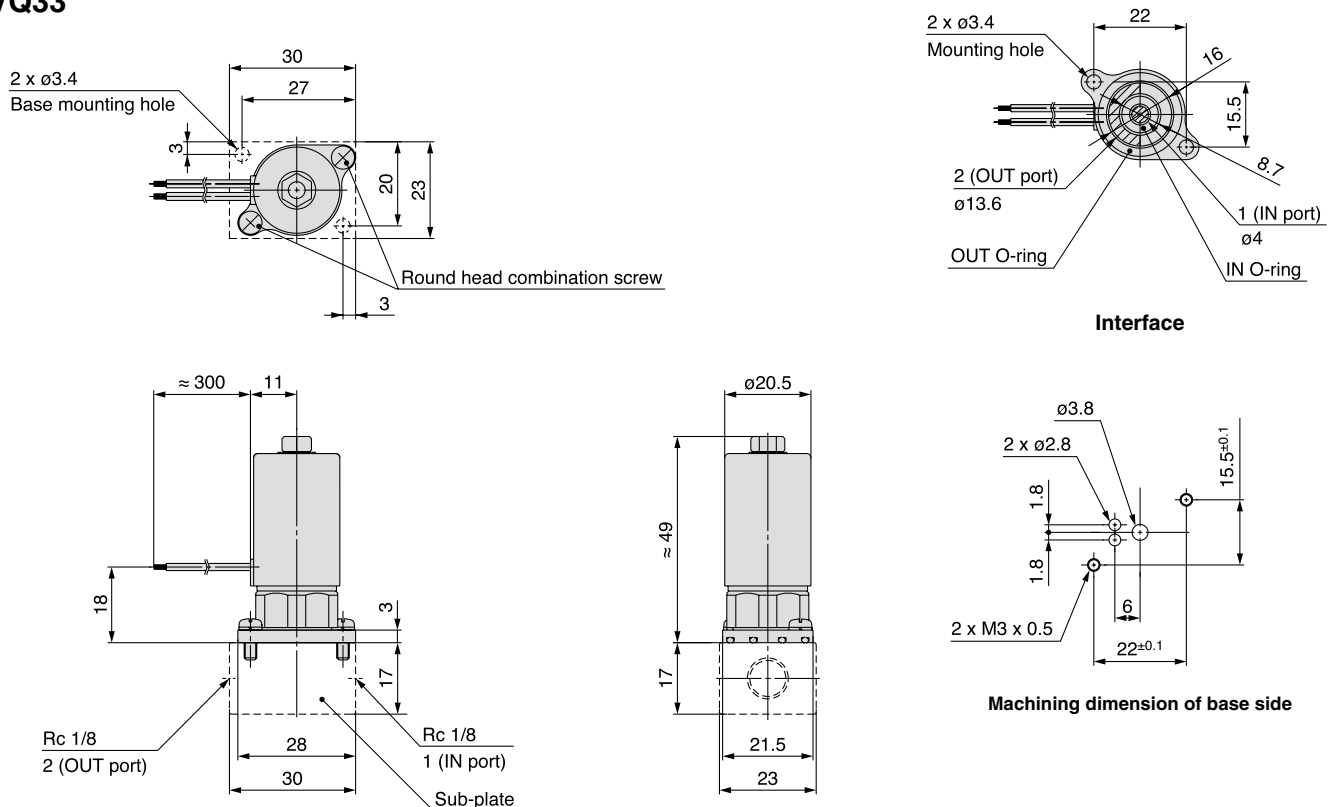
C	C36
S	Stainless steel

## Dimensions

### PVQ31



### PVQ33



ARJ

AR425  
to 935

AMR

ARM

ARP

IR

IRV

VEX1□

SRH

SRP

SRF

ARX20

VCHR

ITV

IC

PVQ

VEF  
VEP

VER

VEA

VY2

VBA  
VBAT

AP100

# Glossary

## ■ Proportional control

Control the fluid proportionally according to input signal (current).

## ■ Max. operating pressure differential

Indicates max. pressure differential (difference between inlet and outlet pressure) which is allowed for operation with the valve closed or open.

## ■ Max. operating pressure

This indicates the limit of pressure that can be applied to the inlet. (The pressure differential of the proportional valve must be no more than the maximum operating pressure differential.)

## ■ Orifice diameter

Diameter of the hole for sealing the valve body of the proportional valve. This does not indicate the effective cross section.

## ■ Hysteresis

Greatest flow rate difference between current increase and current decrease (with the same current).  
(Percentage divided by max. flow rate)

## ■ Repeatability

Deviation of output flow rate when the same current is applied.  
(Percentage divided by max. flow rate)

## ■ Start-up current

Current at which the flow rate is actually output while increasing current from zero.  
(Percentage divided by rated current)



# Series PVQ

## Specific Product Precautions

Be sure to read before handling.  
Refer to front matters 42 and 43 for Safety Precautions.

### Power Source Selection

#### ⚠ Caution

**This product makes proportional control possible with constant current.**

If controlled with voltage, the output flow rate cannot be kept constant due to current fluctuation. Use stable DC power source of sufficient capacity without much ripple.

### Handling

#### ⚠ Caution

**1. This product is adjusted to the respective specifications at SMC factory before delivery.**

Do not disassemble the product or remove parts as it could cause breakdown of the product.

**2. Flow rate is controlled by balancing the valve body.**

Do not expose the product to external vibration and impact as it changes the flow rate.

Vibration may occur depending on the piping conditions or control methods.

### Pressure Difference

#### ⚠ Caution

**Leakage from the valve may be caused if the pressure difference is larger than the maximum operating pressure differential of the respective models.**

### Flow Rate

#### ⚠ Caution

**Flow rate varies depending on model differences and piping conditions.**

**Select the model that fully satisfies the necessary flow rate based on the flow characteristics graphs.**

### Operation in Vacuum

#### ⚠ Caution

**When the product is used in vacuum, apply vacuum pressure to A (2) port.**

The pressure at P(1) port should be larger than the pressure at A(2) port.

### Valve Mounting

#### ⚠ Caution

**When mounting a valve to the sub-plate, tighten the screw securely with the tightening torque shown in the table below after checking the installation condition of the O-ring on the interface side.**

#### Proper Tightening Torque (N·m)

PVQ10 (Base mounted)	PVQ30 (Base mounted)
0.15 to 0.22	0.8 to 1.0

### Continuous Energization

#### ⚠ Warning

**Do not touch the valve directly with hands. The coil can be hot depending on the ambient temperature or energizing time.**

Install a protective cover over the valve if it can be touched directly with hands.

ARJ

AR425  
to 935

AMR

ARM

ARP

IR

IRV

VEX1□

SRH

SRP

SRF

ARX20

VCHR

ITV

IC

PVQ

VEF  
VEP

VER

VEA

VY2

VBA  
VBAT

AP100