



Series VC

# Series VCB

*Direct Operated 2 Port Solenoid Valve for Heated Water*



IP65 Enclosure  
Cv Factors From 0.16 to 2.1  
Multiple Wiring Options  
Long Life

Multipurpose Valve for Heated Water  
 Direct Operated 2 Port Solenoid  
 Valve for Heated Water

# Series VCB

**Improved durability (Nearly twice the life of the previous series)**

Use of special magnetic material reduces the operating resistance of moving parts. Longevity, wear resistance and corrosion resistance improved.

**High flow rate: Cv factor 0.16 to 2.1**

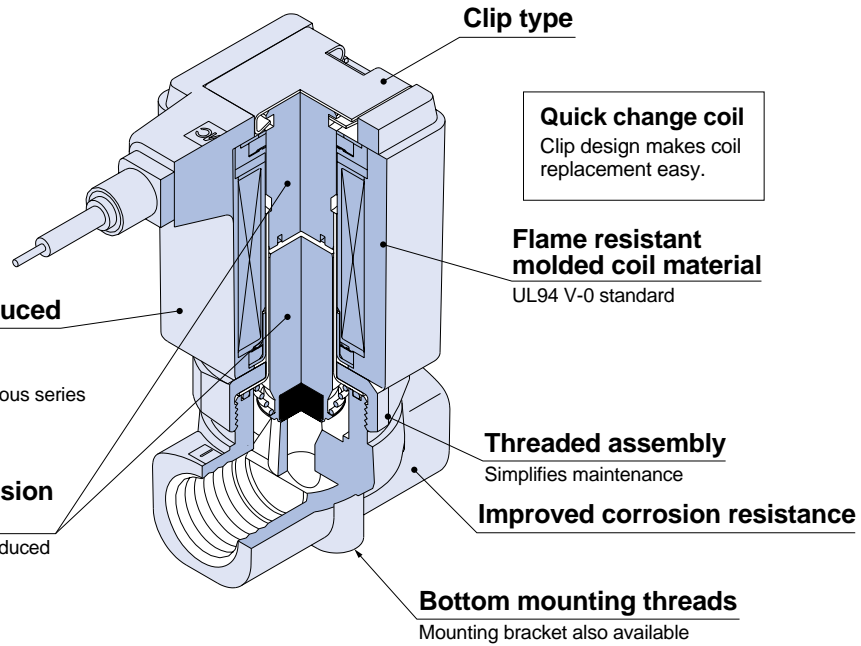
**Compact: Single valve volume reduced 15% (Class 3)**

**Coil size and weight reduced**

New compact coil reduces the size and weight of the valve  
 Volume: -15% } Compared to previous series  
 Weight: -20% } (Class 3)

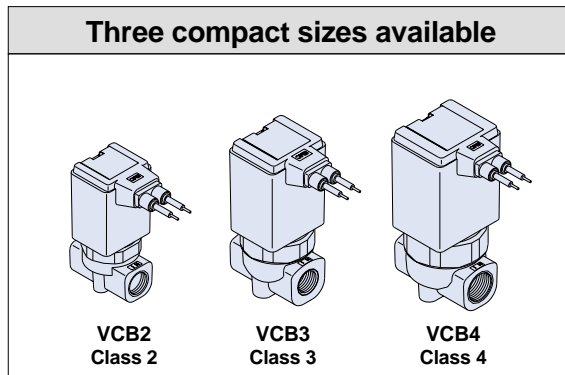
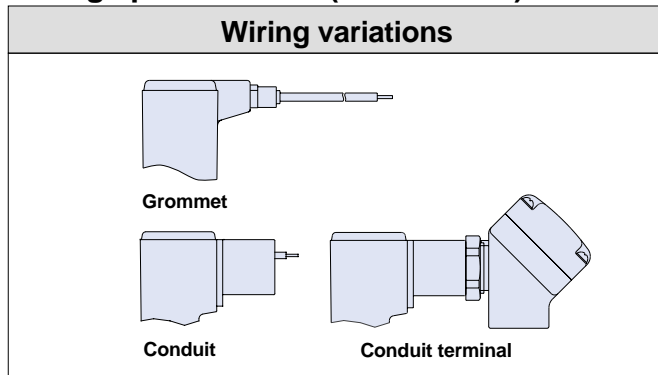
**Improved corrosion resistance**

Special materials introduced



**Enclosure: Dust-proof & splash-proof (IP65 equivalent)**

**Wiring specifications (Class H coil)**



## How to Order Valves

**VC B 2 1 1 G 2 02**

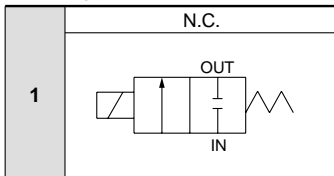
**For heated water**  
When no symbol is shown for material and insulation type

- Body material: CAC406
- Seal material: FKM
- Coil insulation: Class H

**Series**

2	Class 2
3	Class 3
4	Class 4

**Valve type**



**Voltage**

1	100VAC
2	200VAC
3	110VAC
4	220VAC
36	230VAC

\* Consult SMC regarding other voltages.

**Electrical entry**

<b>G – Grommet</b>	<b>C – Conduit</b>
<b>T – With conduit terminal</b> <b>TL – With conduit terminal and light</b>	

**Option**

Nil	None
F	Foot type bracket

**Material and insulation type**

Symbol	Body material	Seal material	Coil insulation
Nil	CAC406	FKM	Class H
M	CAC406 (BC6)	EPDM	
N	SUS	FKM	
P		EPDM	

**Thread type**

Nil	Rc
N	NPT
F	G

**Port size**

Symbol	Port size	Class 2	Class 3	Class 4
01	1/8 (6A)	○	—	—
02	1/4 (8A)	○	○	○
03	3/8 (10A)	—	○	○
04	1/2 (15A)	—	○	○
06	3/4 (20A)	—	—	○

**Orifice size**

Symbol	Orifice size (mmø)	Class 2	Class 3	Class 4
2	2	○	—	—
3	3	○	○	○
4	4	○	○	○
5	5	○	○	○
7	7	—	○	○
10	10	—	○	○

\* Refer to the table below for orifice and port size combinations.

**Orifice and port size combinations**

Class	Port size	Orifice size (mmø)					
		2	3	4	5	7	10
2	1/8 (6A)	●	●	●	●	—	—
	1/4 (8A)	●	●	●	●	—	—
3	1/4 (8A)	—	●	●	●	●	—
	3/8 (10A)	—	●	●	●	●	●
4	1/2 (15A)	—	—	—	—	—	●
	1/4 (8A)	—	●	●	●	●	—
	3/8 (10A)	—	●	●	●	●	●
	1/2 (15A)	—	—	—	—	—	●
	3/4 (20A)	—	—	—	—	—	●

## Standard Specifications



Valve specifications	Valve construction	Direct operated poppet	
	Fluid	Heated water (99°C or less [210°F or less])	
	Withstand pressure MPa	5.0 (725psi)	
	Body material	CAC406 (BC6), SUS	
	Seal material	FKM, EPDM	
	Ambient temperature	-20 to 100°C (-4 to 212°F)	
	Fluid temperature	99°C or less (210°F or less)	
	Enclosure	Dust proof, Splash proof (equivalent to IP65)	
	Environment	Location without corrosive or explosive gases	
	Valve leakage	0cm <sup>3</sup> /min (0in <sup>3</sup> /min) (with water pressure)	
	Mounting orientation	Unrestricted	
Vibration/Impact resistance m/s <sup>2</sup> <small>Note 1)</small>	30/150 or less		
Coil Specifications	Rated voltage	100VAC, 110VAC, 200VAC, 220VAC, 230VAC (50/60Hz)	
	Allowable voltage fluctuation	±10% of rated voltage	
	Coil insulation type	Class H	
	Power consumption W 50/60Hz	VCB2: 4.9/4.1, VCB3: 7.7/6.6, VCB4: 10.5/9.3	
	Apparent power VA 50/60Hz	Inrush	VCB2: 22/19, VCB3: 36/30, VCB4: 45/37
Holding		VCB2: 10/8, VCB3: 15/13, VCB4: 19/16	

Note 1) Vibration resistance ... Conditions when tested with one sweep of 10 to 300Hz in the axial direction and at a right angle to the armature, in both energized and deenergized states

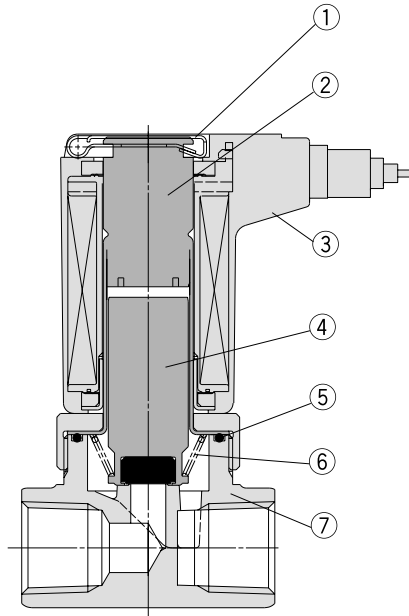
Impact resistance ..... Conditions when tested with a drop tester in the axial direction and at a right angle to the armature, one time each in energized and deenergized states

## Characteristic Specifications

Model	Class	Note 1) Port size	Note 1) Orifice size mmø	Maximum operating pressure differential MPa (psi)	Effective area mm <sup>2</sup> (Cv factor)	Maximum operating pressure MPa (psi)	Weight kg (lb)
VCB2	2	1/8 (6A) 1/4 (8A)	2	2.0 (290)	2.8 (0.16)	3.0 (435)	1/8: 0.21 (0.46) 1/4: 0.24 (0.53)
			3	0.8 (116)	5.9 (0.33)		
			4	0.5 (72)	9.2 (0.51)		
			5	0.3 (43)	11.7 (0.65)		
VCB3	3	1/4 (8A) 3/8 (10A) 1/2 (15A)	3	2.0 (290)	6.3 (0.35)	3.0 (435)	1/4: 0.42 (0.93) 3/8: 0.40 (0.88) 1/2: 0.49 (1.08)
			4	0.8 (116)	9.7 (0.54)		
			5	0.5 (72)	14.4 (0.80)		
			7	0.2 (29)	24.8 (1.38)		
			10	0.1 (14)	37.8 (2.10)		
VCB4	4	1/4 (8A) 3/8 (10A) 1/2 (15A) 3/4 (20A)	3	3.0 (435)	6.3 (0.35)	3.0 (435)	1/4: 0.58 (1.28) 3/8: 0.55 (1.21) 1/2: 0.62 (1.37) 3/4: 0.78 (1.72)
			4	1.3 (188)	10.8 (0.60)		
			5	0.7 (101)	15.3 (0.85)		
			7	0.3 (43)	24.8 (1.38)		
			10	0.12 (17)	37.8 (2.10)		

Note 1) Refer to model selection on page 5 regarding port size and orifice size combinations.

**Construction**

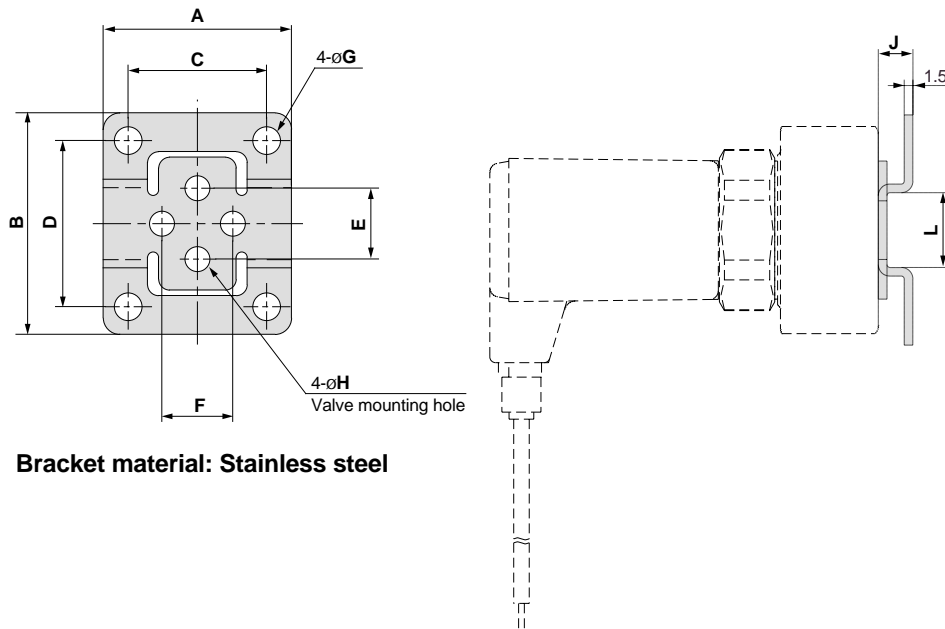


**Parts list**

No.	Description	Material
		Standard
1	Clip	Stainless steel
2	Core assembly	Stainless steel/Cu
3	Coil assembly	Class H
4	Armature assembly	Stainless steel/FKM (EPDM)
5	Seal	FKM (EPDM)
6	Return spring	Stainless steel
7	Body	CAC406 (stainless steel)

**Bracket Dimensions (mm)**

1in = 25.4mm



**Bracket material: Stainless steel**

**Bracket mounting dimensions**

(mm)

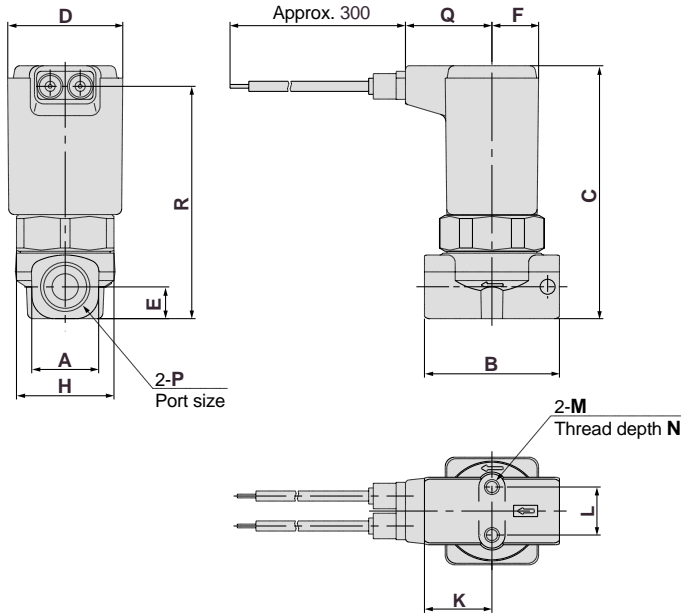
Valve model	Port size	Bracket part no.	A	B	C	D	E	F	G	H	J	L
VCB2□	1/8, 1/4	VCW20-12-01A	34	40	25	30	12.8	12.8	5	4.5	6	13
VCB3□	1/4, 3/8	VCW30-12-02A	42	52	30	40	19	19	6	5.5	7	19
	1/2	VCW30-12-04A	48	56	36	44	23	23	6	5.5	7	23
VCB4□	1/4, 3/8	VCW40-12-02A	42	52	30	40	23	23	6	5.5	7	19
	1/2	VCW30-12-04A	48	56	36	44	23	23	6	5.5	7	23
	3/4	VCW40-12-06A	56	65	44	53	28.2	28.2	6	5.5	7	26

\* Two mounting screws (for mounting bracket) are included with the above parts.

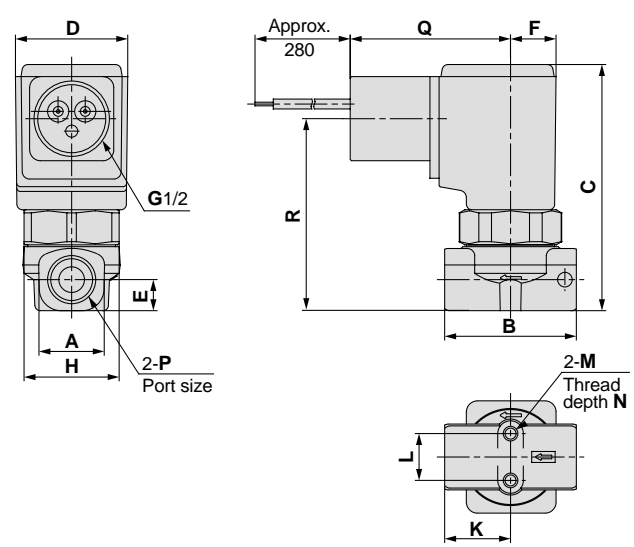
## Dimensions (mm)

1 in = 25.4mm

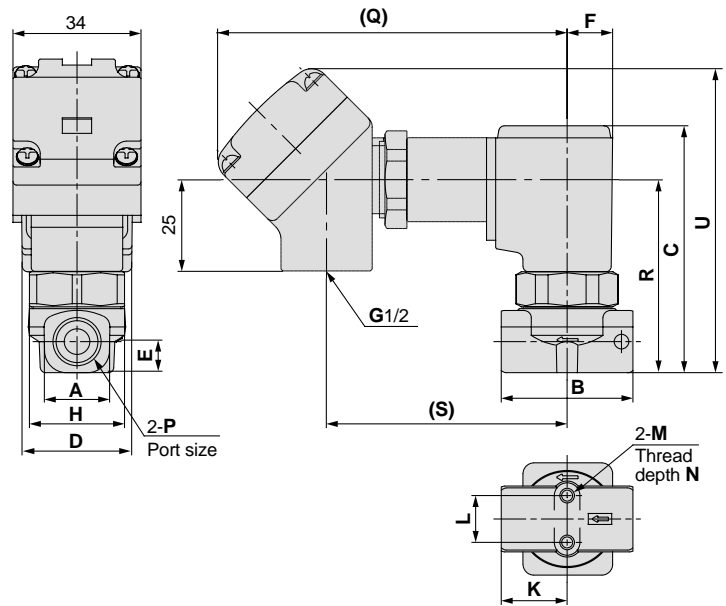
### Grommet: G



### Conduit: C



### Conduit terminal: T



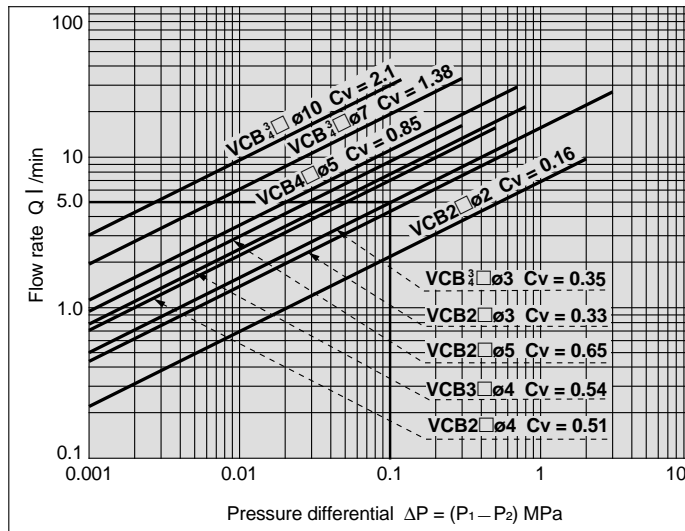
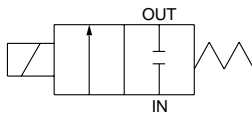
(mm)

Model	P Port size	A	B	C	D	E	F	H	K	L	M	N	Electrical entry							
													Grommet: G		Conduit: C		Conduit terminal: T			
													Q	R	Q	R	Q	R	S	U
VCB21	1/8	13.5	28	64	31	6.5	12.5	28	14	12.8	M4	4.5	22	59	44	50	99	50	66	83
	1/4	18	36	67.5	31	8.5	12.5	28	18	12.8	M4	6	22	62	44	53	99	53	66	86
VCB31	1/4, 3/8	22	40	81.5	36.5	11	15	32	20	19	M5	8	24	76	46	66.5	101	66.5	68	99
	1/2	30	50	86	36.5	13.5	15	32	25	23	M5	8	24	80	46	71	101	71	68	104
VCB41	1/4, 3/8	22	45	90	41	11	17	36	22.5	23	M5	8	26	84	48	74.5	103	74.5	70	107
	1/2	30	50	94	41	13.5	17	36	25	23	M5	8	26	88	48	78.5	103	78.5	70	111.5
	3/4	35	60	102	41	17.5	17	36	30	28.2	M5	8	26	96	48	86.5	103	86.5	70	119

## Model Selection

### VCB (for heated water) 2 port solenoid valve

Model	Material		Class	Port size	Orifice size mmØ					
	Body	Seal			2	3	4	5	7	10
VCB (for heated water) 2 port solenoid valve	CAC406 (SUS)	FKM (EPDM)	2	1/8 (6A)	●	●	●	●	—	—
				1/4 (8A)	●	●	●	●	—	—
			3	1/4 (8A)	—	●	●	●	●	—
				3/8 (10A)	—	●	●	●	●	●
				1/2 (15A)	—	—	—	—	—	●
			4	1/4 (8A)	—	●	●	●	●	—
				3/8 (10A)	—	●	●	●	●	●
				1/2 (15A)	—	—	—	—	—	●
				3/4 (20A)	—	—	—	—	—	●



### Viewing the graph

To generate a water flow of 5 l/min at a differential pressure of 0.1MPa, an effective area with Cv factor 0.35 (VCB<sub>3</sub>ø3, ø3) or more is required.

### How to find the flow rate for water

- Formula based on Cv factor  
 $Q = 14.2 \cdot Cv \cdot \sqrt{10.2 \cdot \Delta P} \dots \text{l/min}$
- Formula based on effective area (Smm<sup>2</sup>)  
 $Q = 0.8 \cdot S \cdot \sqrt{10.2 \cdot \Delta P} \dots \text{l/min}$

Q: Flow rate (l/min)

ΔP: Pressure differential (P<sub>1</sub> - P<sub>2</sub>)

P<sub>1</sub>: Upstream pressure (MPa)

P<sub>2</sub>: Downstream pressure (MPa)

S: Effective area (mm<sup>2</sup>)

Cv: Cv factor

Note: 1 l/min = 0.353SCFM  
 1MPa = 145psi  
 1in = 25.4mm

## Explanation of Terminology

### Pressure Terminology

#### 1. Maximum operating pressure differential

This indicates the maximum pressure differential (the difference between the upstream and downstream pressure) which can be allowed for operation with the valve closed or open. When the downstream pressure is 0MPa, this becomes the maximum operating pressure.

#### 2. Maximum operating pressure

This indicates the upper limit of pressure that can be applied inside the pipelines (line pressure).

(The pressure differential of the solenoid valve unit must be no more than the maximum operating pressure differential.)

#### 3. Proof pressure

The pressure which must be withstood without deterioration in performance when the valve returns to the operating pressure range (the value under the specified conditions).

### Electrical Terminology

#### 1. Surge voltage

A high voltage which is momentarily generated in the shut-off unit by shutting off the power.

### Other

#### 1. Materials

FKM: Fluoro rubber – Trade names: Viton®, Dai-el®, etc.

EPDM: Ethylene propylene rubber

CAC406: Bronze (BC6)

C37: Brass

SUS: Stainless steel



These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1) and other safety practices.

**⚠ Caution :** Operator error could result in injury or equipment damage.

**⚠ Warning :** Operator error could result in serious injury or loss of life.

**⚠ Danger :** In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414 : Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems

## **⚠ Warning**

### **1. The compatibility of equipment is the responsibility of the person who designs the system or decides its specifications.**

Since the products specified here are used in various operating conditions, their compatibility for the specific system must be based on specifications or after analysis and/or tests to meet your specific requirements. Be particularly careful in determining the compatibility of the fluid to be used.

### **2. Only trained personnel should operate machinery and equipment.**

The fluid can be dangerous if handled incorrectly. Assembly, handling or repair of systems should be performed by trained and experienced operators.

### **3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions and measures to prevent danger from the fluid.
2. When equipment is to be removed, confirm the safety process as mentioned above, release fluid pressure and be certain there is no danger from fluid leakage or fluid remaining in the system.
3. Restart machinery carefully, confirming that safety measures are being implemented.

### **4. Contact SMC if the product is to be used in any of the following conditions:**

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. With fluids whose application causes concern due to the type of fluid or additives, etc.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

## Design

**⚠ Warning****1. Cannot be used as an emergency shutoff valve, etc.**

The valves presented in this catalog are not designed for safety applications such as an emergency shutoff valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

**2. Extended periods of continuous energization**

Consult SMC if valves will be continuously energized for extended periods of time.

**3. Liquid seals**

In cases with a flowing liquid, provide a by-pass valve in the system to prevent the liquid from entering the liquid seal circuit.

**4. This solenoid valve cannot be used for explosion proof applications.****5. Maintenance space**

The installation should allow sufficient space for maintenance activities.

## Selection

**⚠ Warning****1. Confirm the specifications.**

Give careful consideration to operating conditions such as the application, fluid and environment, and use within the operating ranges specified in this catalog.

**2. Fluid temperature**

Operate within the prescribed fluid temperature range. The temperature range changes depending on the seal material, coil insulation and the type of power supply, etc.

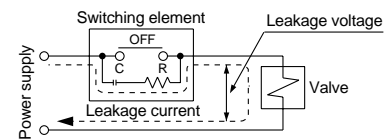
**3. Fluid quality**

The use of fluid which contains foreign matter can cause problems such as malfunction and seal failure by promoting wear of the valve seat and armature, and by sticking to the sliding parts of the armature, etc. Install a suitable filter (strainer) immediately upstream from the valve. As a general rule, use 80 to 100 mesh.

When used to supply water to boilers, substances such as calcium and magnesium which generate hard scale and sludge are included. Since this scale and sludge can cause valve malfunction, install water softening equipment, and a filter (strainer) directly upstream from the valve to remove these substances.

**⚠ Caution****1. Leakage voltage**

Particularly when using a resistor in parallel with a switching element and using a C-R element (surge voltage suppressor) to protect the switching element, take note that leakage current will flow through the resistor and C-R element, etc., creating a danger that the valve may not shut OFF.



AC coil

10% or less of rated voltage

**2. Low temperature operation**

1. The valve can be used at ambient temperatures as low as  $-20^{\circ}\text{C}$ , but take measures to prevent freezing or solidification of impurities, etc.
2. When used in cold areas, adopt freeze prevention measures such as draining the water from pipelines. If warmed with a heater, etc., avoid the coil unit. Also, implement warming or other freeze prevention measures for the body.

### Mounting

#### ⚠ Warning

##### 1. If air leakage increases or equipment does not operate properly, stop operation.

After mounting is completed, confirm that it has been done correctly by performing a suitable function test.

##### 2. Do not apply external force to the coil section.

When tightening is performed, apply a wrench or other tool to the outside of the piping connection parts.

##### 3. Do not warm the coil assembly with a heat insulator, etc.

Use tape and heaters, etc., for freeze prevention on the piping and body only. They can cause burn out of the coil.

##### 4. Secure with brackets, except in the case of steel piping and copper fittings.

##### 5. Avoid sources of vibration, or adjust the arm from the body to the minimum length so that resonance will not occur.

##### 6. Instruction manual

Mount the product after reading the manual carefully and understanding its contents. Also keep the manual where it can be referred to as necessary.

##### 7. Painting and coating

Warnings or specifications printed or pasted on the product should not be erased, removed or covered up.

### Piping

#### ⚠ Caution

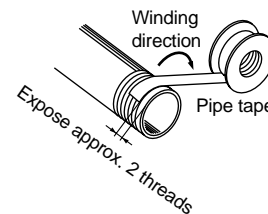
##### 1. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

##### 2. Wrapping of pipe tape

When connecting pipes and fittings, etc., be sure that chips from the pipe threads and sealing material do not get inside the valve.

Furthermore, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



##### 3. Avoid connection of ground lines to piping, as this may cause electric corrosion of the system.

##### 4. Always tighten threads with the proper tightening torque.

When screwing fittings into valves, tighten with the proper tightening torque shown below.

#### Tightening torque for piping

Connection threads	Proper tightening torque N·m
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30

##### 5. Connection of piping to products

When connecting piping to a product, refer to its instruction manual to avoid mistakes regarding the supply port, etc.

Furthermore, be sure to hold the product with a tool such as a wrench when tightening.

## Wiring

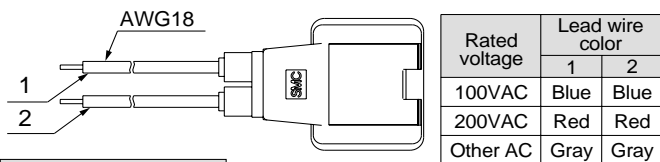
### ⚠ Caution

- As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25mm<sup>2</sup> for wiring. Furthermore, do not allow excessive force to be applied to the lines.
- Use electrical circuits which do not generate chattering in their contacts.
- Use voltage which is within  $\pm 10\%$  of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within  $\pm 5\%$  of the rated value. The voltage drop is the value in the lead wire section connecting the coil.
- When surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid.

## Electrical Connections

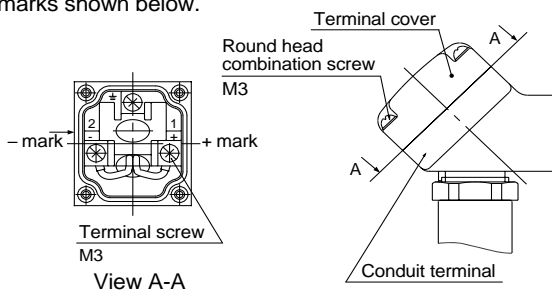
### ⚠ Caution

#### Grommet/Conduit



#### Conduit terminal

In the case of the conduit terminal, make connections according to the marks shown below.



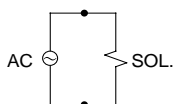
(Internal connection diagram)

\* Tighten the terminal cover screws and terminal screws with a torque of 0.5N·m.

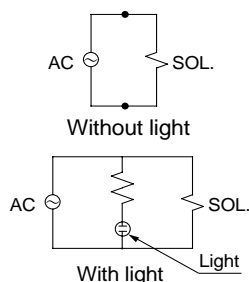
## Electrical Circuits

### ⚠ Caution

#### Grommet/Conduit



#### Conduit terminal



## Operating Environment

### ⚠ Warning

- Do not use valves in atmospheres of corrosive gases, chemicals, salt water, water, or where there is direct contact with any of these.
- Do not use in explosive atmospheres.
- Do not use in locations subject to vibration or impact.
- Do not use in locations where radiated heat will be received from nearby heat sources.
- Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

## Maintenance

### ⚠ Warning

- Perform maintenance in accordance with the procedures in the instruction manual.

Improper handling can cause damage or malfunction of machinery and equipment, etc. In addition, perform maintenance inspections once every six months to ensure optimum performance.

#### 2. Removing the product

The valve will reach a high temperature when used with high temperature fluids. Confirm that the valve temperature has dropped sufficiently before performing work. If touched inadvertently, there is a danger of being burned.

#### Removal

- Shut off the fluid supply and release the fluid pressure in the system.
- Shut off the power supply.
- Demount the product.

#### 3. Low frequency operation

Switch valves at least once every 30 days to prevent malfunction.

### ⚠ Caution

#### 1. Filters and strainers

- Be careful regarding clogging of filters and strainers.
- Replace filter elements after one year of use, or earlier if the pressure drop reaches 0.1MPa.
- Clean strainers when the pressure drop reaches 0.1MPa.

#### 2. Storage

In case of long term storage after use with heated water, first thoroughly remove all moisture to prevent rust and deterioration of rubber materials, etc.

## Operating Precautions

### ⚠ Warning

- Valves will reach high temperatures from high temperature fluids. Use caution, as there is a danger of being burned if a valve is touched directly.
- Valves may reach high temperatures when continuously energized. Use caution, as there is a danger of being burned if a valve is touched directly.

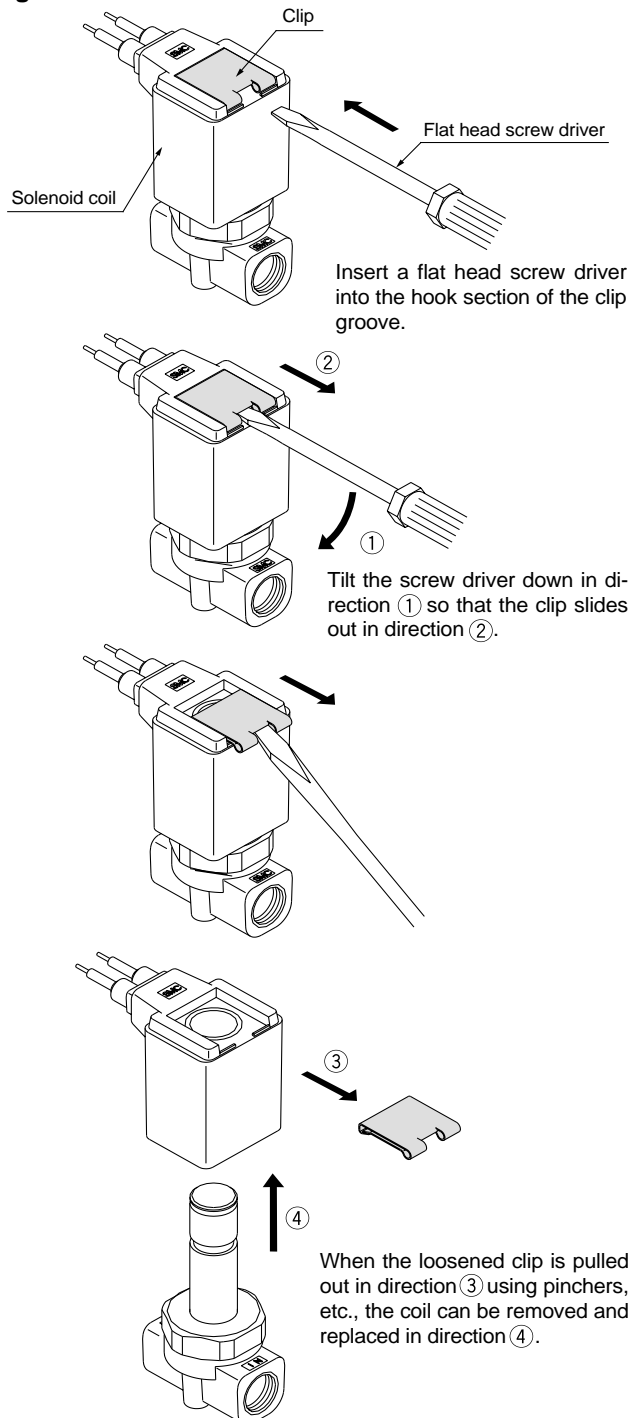
Specific Product Precautions  
Be sure to read before handling

Refer to pages 7 through 10 for safety instructions and precautions of 2 port solenoid valve for fluid control

## Replacing the Solenoid Coil

### ⚠ Caution

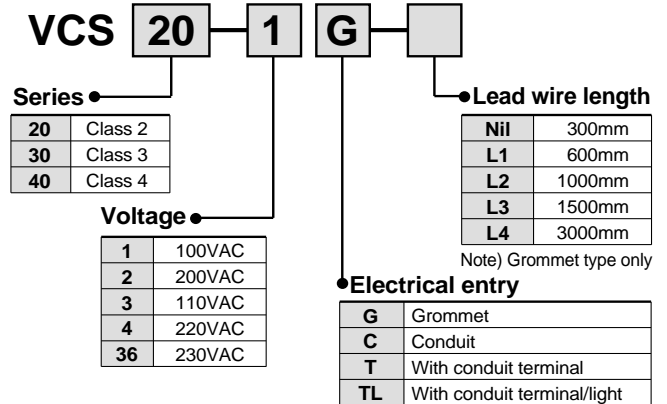
The valve will reach high temperatures from high temperature fluids such as heated water. Confirm that the valve has cooled sufficiently before performing work. If touched inadvertently, there is a danger of being burned.



After replacing the coil, the clip is reinstalled by pushing it back in the direction opposite to its removal.

## Replacement Parts

### Solenoid coil part numbers



### Clip part numbers

**AZ-T-VCB**

How to Order Valves → Page 1 Valve model  
Page 5 Valve model

Note) Indicate the valve model, as a label will be attached to the clip.

### Seal part numbers

Valve

For VCB20

**OR-1860-120-F**

F: FKM  
E: EPDM

For VCB30

**OR-2380-130-F**

F: FKM  
E: EPDM

For VCB40

**OR-2600-180-F**

F: FKM  
E: EPDM

If external leakage occurs after replacing the coil, replace the above seals.

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