

Series VC

Direct Operated 2 Port Solenoid Valve for Oil

Series *VCL*



VX
VN□
VQ
VDW
VC
LV
PA

Multipurpose Valve for Oil

Direct Operated 2 Port Solenoid Valve for Oil

Series VCL

Kerosene, Fuel oil class 1 (fuel oil A), Silicone oil, Machine oil,
Compressor oil, Gas oil, Hydraulic fluid, Turbine oil

Improved durability (nearly twice the life of the previous series)

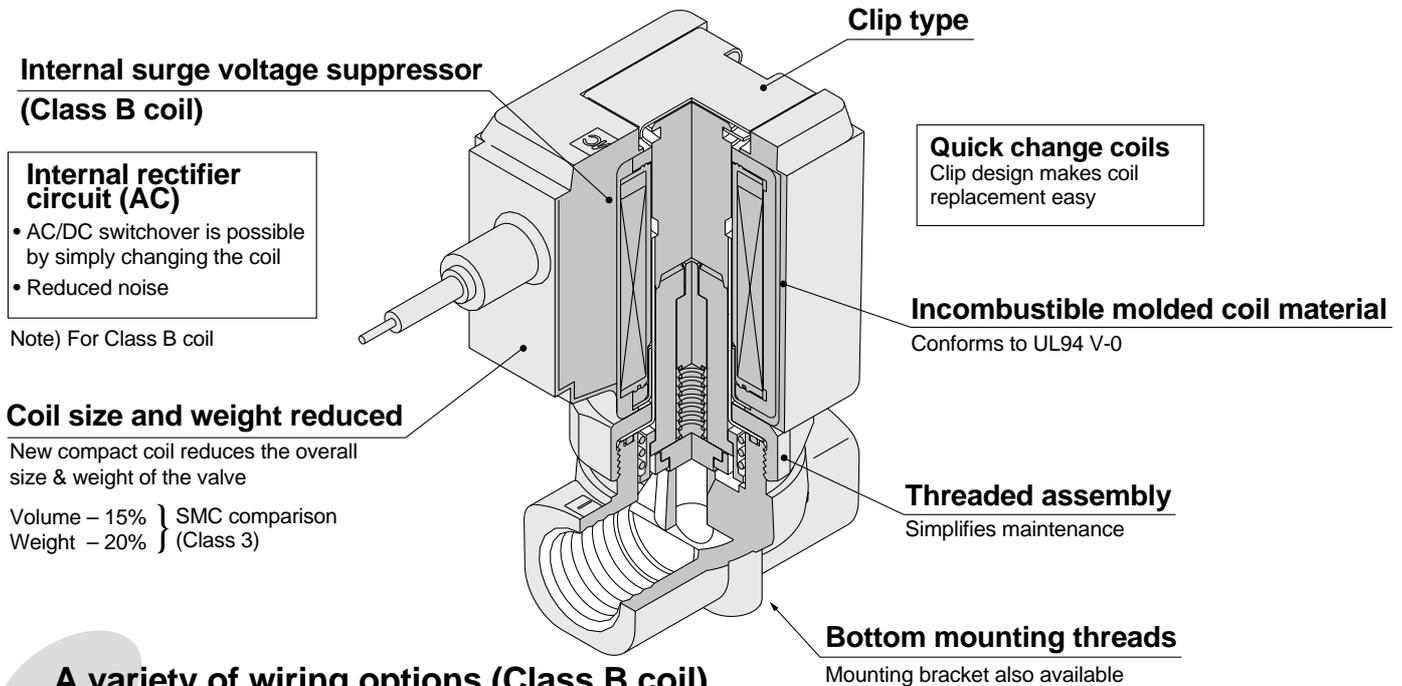
The internal wear of moving parts has been reduced through the use of a unique magnetic material. Service life, durability and corrosion resistance have been increased.

High speed response (nearly twice the previous series) (Class 3)

High flow rate: NI/min 187 to 2061

Smaller size: Single valve – 15% reduction in volume (Class 3)

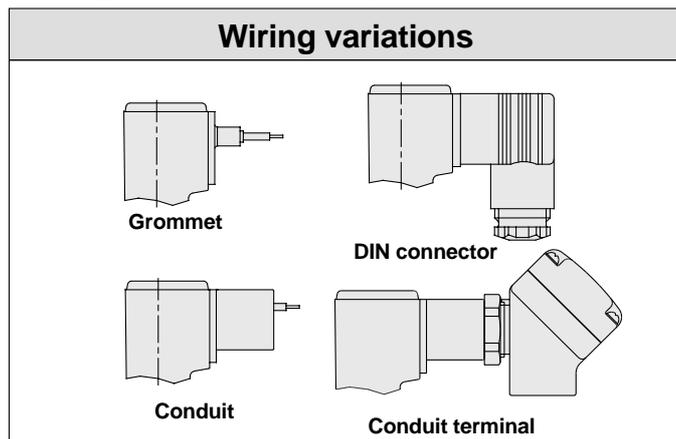
Manifold length – Reduced by 18% (Class 3: 5 stations) (SMC comparison)



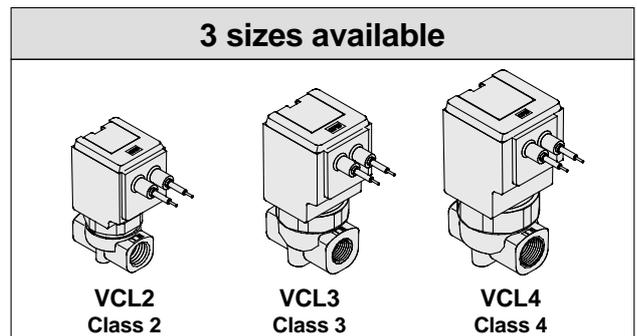
A variety of wiring options (Class B coil)

Grommet, DIN connector, Conduit, Conduit terminal

Wiring specifications (Class B coil)



Enclosure: Dust tight and splash proof (equivalent to IP65)



Direct Operated 2 Port Solenoid Valve for Oil Series VCL

How to Order Valves (Single Type)

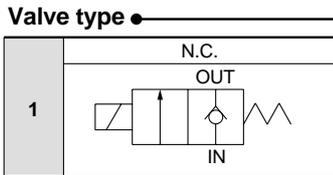
VC L 2 1 1 G 2 02 [] [] [] Q

For oil
When no symbol is shown for material and insulation type

- Body material: C37
- Seal material: FKM
- Coil insulation: Class B

Series

2	Class 2
3	Class 3
4	Class 4



Voltage

1	100VAC
2	200VAC
3	110VAC
4	220VAC
5	24VDC
6	12VDC
36	230VAC

* Class B with AC has a built-in rectifying circuit.
** Class H is AC only. Without rectifying circuit.
*** Contact SMC regarding other voltages.

Note: AC specifications are only for the DIN terminal and conduit terminal type.

Contact SMC for other voltages (9)

Protective class class III (Mark:)..... Grommet, L and M plug connector

Option

Nil	None
F	Foot type bracket

Material and insulation type

Symbol	Body material	Seal material	Coil insulation
Nil	C37	FKM	Class B
D			Class H
H	Stainless steel	FKM	Class B
N			Class H

Thread type

Nil	Rc
N	NPT
T	NPTF
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)	—	—	○

Electrical entry

G-Grommet	C-Conduit
T -With conduit terminal TL-With conduit terminal/light	D -DIN connector DL-DIN connector with light DO-For DIN connector (without connector)

* All class B coils are equipped with surge voltage suppressor.
** Class H coils are available only with "G-Grommet" electrical entry. (Not equipped with surge voltage suppressor.)

Orifice size

Symbol	Orifice diameter	Class 2	Class 3	Class 4
2	ø2mm	○	—	—
3	ø3mm	○	○	○
4	ø4mm	○	○	○
5	ø5mm	○	○	○
7	ø7mm	—	○	○
10	ø10mm	—	○	○

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

Orifice and port size combinations

Class	Port size	Orifice diameter					
		ø2	ø3	ø4	ø5	ø7	ø10
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)	—	—	—	—	—	●

VX

VN□

VQ

VDW

VC

LV

PA



Specifications

		Standard specifications	High temperature specifications	
Valve specifications	Valve construction	Direct operated poppet		
	Fluid	Oil [50mm ² /s (50cSt)] or less		
	Withstand pressure MPa	5.0		
	Body material	C37, Stainless steel		
	Seal material	FKM		
	Ambient temperature °C	-20 to 60	-20 to 100	
	Fluid temperature °C	-10 to 60 (with no freezing)	-10 to 100	
	Enclosure	Splash-proof (equivalent to IP65)		
	Environment	Location without corrosive or explosive gases		
	Valve leakage cm ³ /min	0 (with oil pressure)		
Mounting position	Unrestricted			
Coil specifications	Rated voltage	24VDC, 12VDC, 100VAC, 110VAC, 200VAC, 220VAC, 230VAC (50/60Hz)	100VAC, 200VAC, 220VAC, 230VAC (50/60Hz)	
	Allowable voltage fluctuation	±10% of rated voltage		
	Coil insulation type	Class B		
	Power consumption	DC	VCL20: 6W, VCL30: 8W, VCL40: 11.5W	
	Apparent power	AC 50/60Hz	VCL20: 8.5VA, VCL30: 10VA, VCL40: 13VA	Inrush
Holding				VCL20: 10/8VA, VCL30: 15/13VA, VCL40: 19/16VA

Note 1) When the ambient temperature or fluid temperature is 60°C or more, use high temperature specifications (class H coil).

Note 2) Since a rectifier circuit is used for class B coils with AC, there is no difference in apparent power for starting or holding.

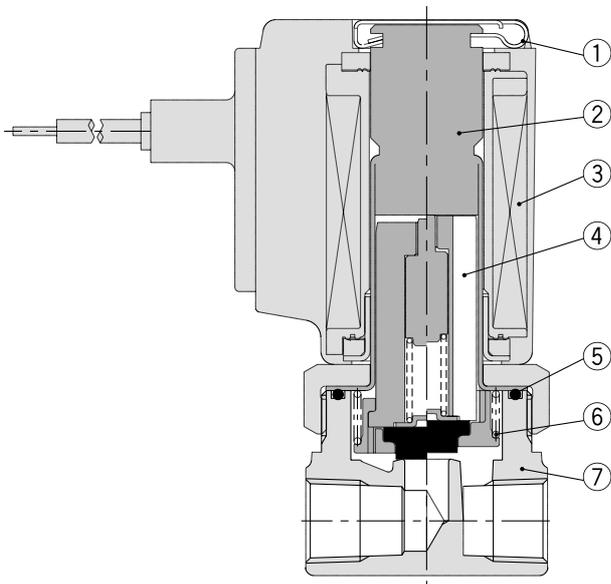
Characteristic Specifications

Model	Class	Port size <small>Note 1)</small>	Orifice diameter <small>Note 1)</small>	N.C. Max. operating pressure difference MPa	Effective area mm ² (N _l /min)	Max. system pressure MPa	Weight kg <small>Note 2)</small>
VCL2	2	1/8 (6A) 1/4 (8A)	ø2	1.5	2.8 (157)	2.0	1/8: 0.21 1/4: 0.24
			ø3	0.8	5.9 (324)		
			ø4	0.4	9.2 (500)		
			ø5	0.25	11.7 (638)		
VCL3	3	1/4 (8A) 3/8 (10A) 1/2 (15A)	ø3	1.5	6.3 (344)	2.0	1/4: 0.42 3/8: 0.40 1/2: 0.49
			ø4	0.8	9.7 (530)		
			ø5	0.5	14.4 (785)		
			ø7	0.2	24.8 (1354)		
			ø10	0.1	37.8 (2061)		
VCL4	4	1/4 (8A) 3/8 (10A) 1/2 (15A) 3/4 (20A)	ø3	2.0	6.3 (343)	2.0	1/4: 0.58 3/8: 0.55 1/2: 0.62 3/4: 0.78
			ø4	1.1	10.8 (589)		
			ø5	0.7	15.3 (834)		
			ø7	0.3	24.8 (1354)		
			ø10	0.12	37.8 (2061)		

Note 1) Refer to model selection on page 4.5-47 regarding port size and orifice size combinations.

Note 2) The weight is the value for the grommet type.

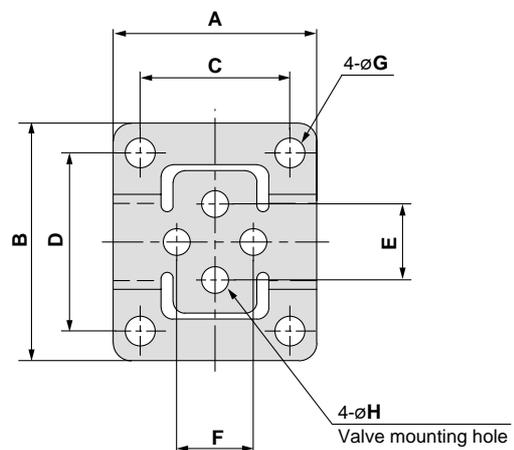
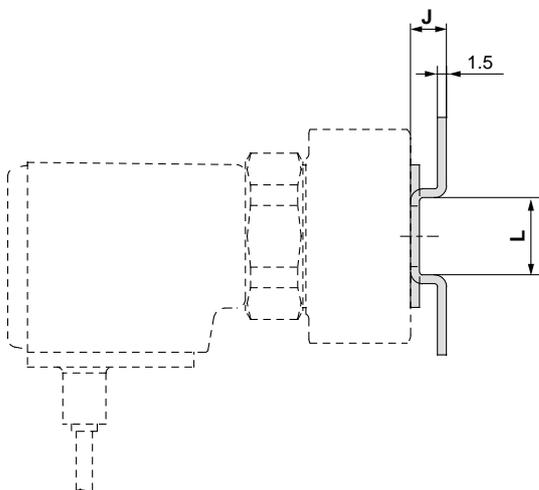
Construction



Parts list

No.	Description	Material	
		Standard	Optional
1	Clip	Stainless steel	—
2	Tube assembly	Stainless steel	Stainless steel, Cu (for class H coil)
3	Coil assembly	Class B	Class H
4	Armature assembly	Stainless steel, FKM	—
5	O-ring	FKM	—
6	Return spring	Stainless steel	—
7	Body	C37	Stainless steel

Dimensions/Bracket



Bracket mounting dimensions

Valve model	Port size	Bracket part no.	A	B	C	D	E	F	G	H	J	L
VCL2□	1/8, 1/4	VCW20-12-01A	34	40	25	30	12.8	12.8	5	4.5	6	13
VCL3□	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
VCL4□	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

* Bracket material: Stainless steel

VX

VN□

VQ

VDW

VC

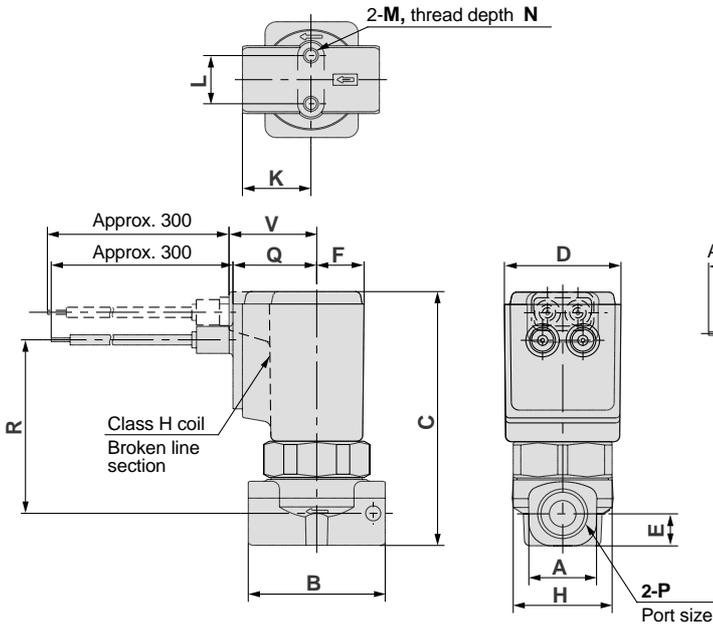
LV

PA

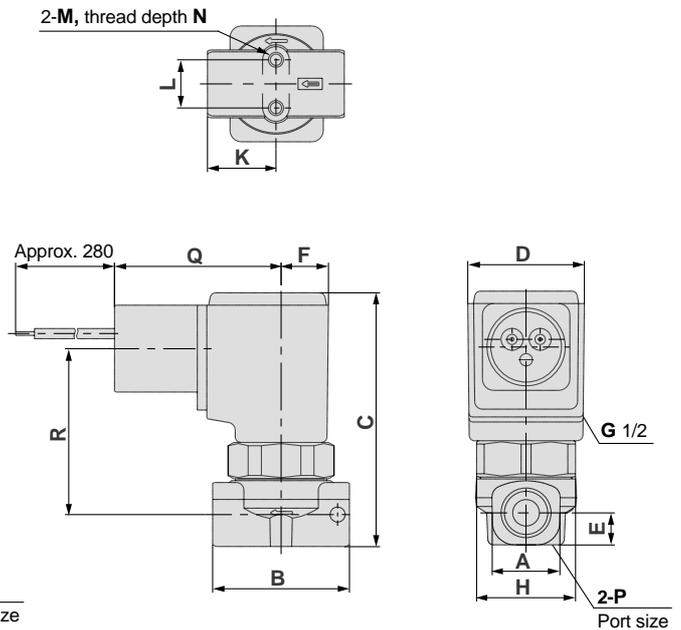
Series VCL

Dimensions (N.C.)

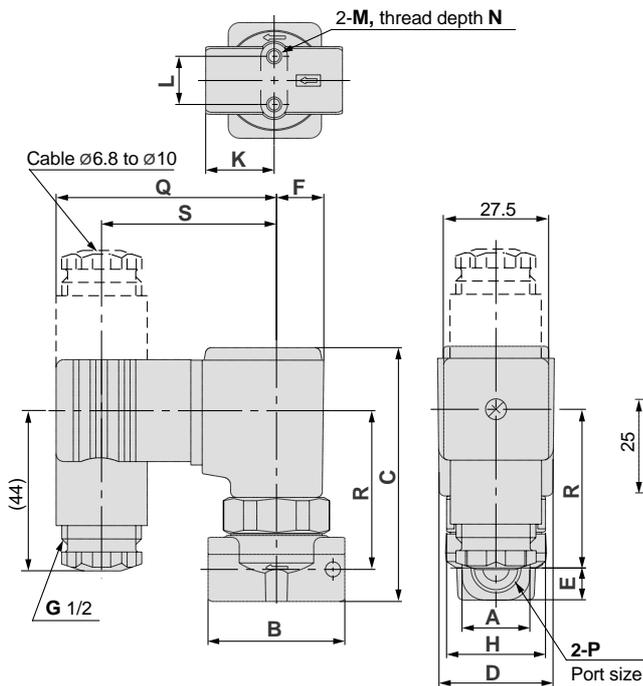
Grommet: G



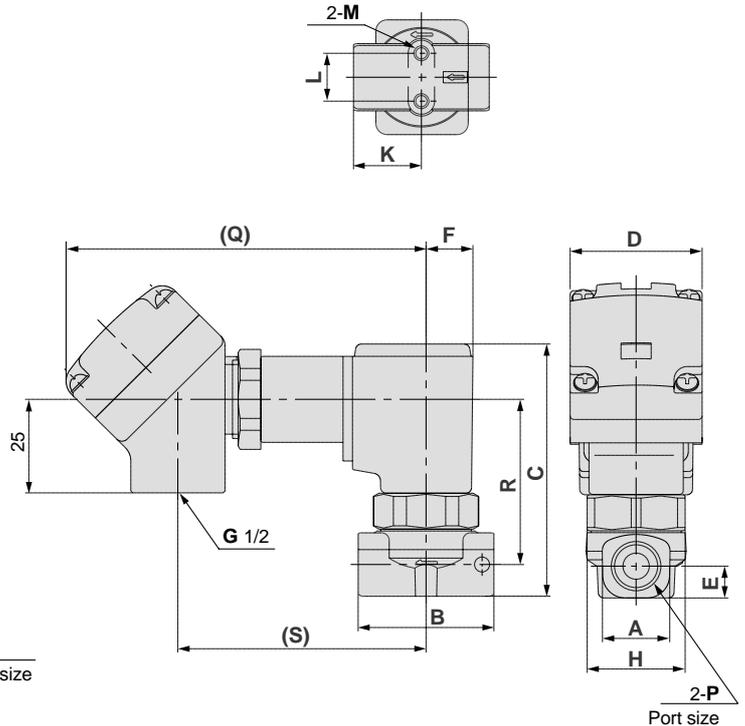
Conduit: C



DIN terminal: D



Conduit terminal: T



N.C. dimensions

Model	P Port size Rc	A	B	C	D	E	F	H	K	L	M	N	Grommet: G			Conduit: C			DIN terminal: D			Conduit terminal: T			
													Q	V	R	Q	R	Q	R	S	Q	R	S	U	
																									Q
VCL21	1/8	13.5	28	64	31	6.5	12.5	28	14	12.8	M4	4.5	22	23	45	44	43	58	40.5	46.5	99	43	66	83	
	1/4	18	36	67	31	8.5	12.5	28	18	12.8	M4	6	22	23	46	44	44	58	41.5	46.5	99	44	66	86	
VCL31	1/4, 3/8	22	40	81.5	36.5	11	15	32	20	19	M5	8	24	25	56.5	46	54.5	60	52	48.5	101	54.5	68	99	
	1/2	30	50	84	36.5	13.5	15	32	25	23	M5	8	24	25	59	46	57	60	54.5	48.5	101	57	68	104	
VCL41	1/4, 3/8	22	45	89	41	11	17	36	22.5	23	M5	8	26	26.5	64.5	48	62.5	62	60	50.5	103	62.5	70	107	
	1/2	30	50	93.5	41	13.5	17	36	25	23	M5	8	26	26.5	66.5	48	64.5	62	62	50.5	103	64.5	70	111.5	
	3/4	35	60	101	41	17.5	17	36	30	28.2	M5	8	26	26.5	70	48	68	62	65.5	50.5	103	68	70	119	

Note) For class H

4.5-44

How to Order Manifolds

VV2C L 2 02 01

For oil •
Manifold material: C37

Series •

2	Class 2
3	Class 3
4	Class 4

Material •

Symbol	Body material	Seal material
Nil	C37	FKM
H	Stainless steel	FKM

Stations •

02	2 stations
:	:
10	10 stations

* Refer to the "L" dimensions on page 4.5-46 regarding the maximum number of stations.

Thread type

Symbol	Thread type
Nil	Rc
N	NPT
T	NPTF
F	G

OUT port size

Symbol	Port size
01	1/8 (6A)
02	1/4 (8A)

* All IN ports are 3/8.



How to Order Manifold Assemblies (Example)

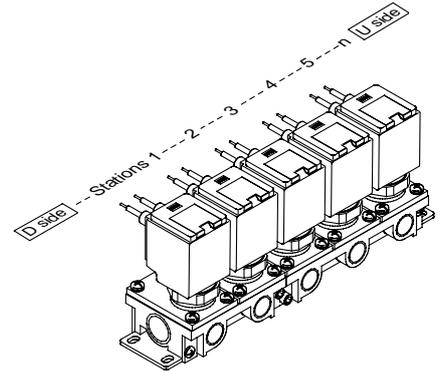
Enter the valve and option models to be mounted under the manifold base part number.

<Example>

VV2CL2-0501 1 set Manifold part no.

VCL23-5G-2-Q 5 sets Valve part no. (Stations 1 to 5)

Enter together in order, counting from station 1 on the D side.



How to Order Valves (for Manifold)

VC L 2 3 1 G 2 Q

For oil •
When there is no symbol for material and insulation type
• Body material: C37
• Seal material: FKM
• Coil insulation: Class B

Series •

2	Class 2
3	Class 3
4	Class 4

Valve type •

3	N.C. for manifold
---	-------------------

Voltage •

AC*	DC*
1 100VAC	5 24VDC
2 200VAC	6 12VDC
3 110VAC	9 (Other, less than 50VDC)
4 220VAC	
9 (Other, less than 250VAC)	

* AC specifications are only for DIN terminal and conduit terminal type.

Material and insulation type

Symbol	Body material	Seal material	Coil insulation
Nil	C37	FKM	Class B
D	C37		Class H
H	Stainless steel	FKM	Class B
N	Stainless steel		Class H

Orifice size

Symbol	Orifice diameter	Class 2	Class 3	Class 4
2	ø2mm	○	—	—
3	ø3mm	○	○	○
4	ø4mm	○	○	○
5	ø5mm	○	○	○
7	ø7mm	—	○	○

Electrical entry

G	Grommet
C	Conduit
T	Conduit terminal
TL	Conduit terminal with light
D	DIN connector
DL	DIN connector with light
DO	For DIN connector (without connector)

* All class B coils are equipped with surge voltage suppressor.
** Class H coils are available with "G-Grommet" electrical entry only. (Not equipped with surge voltage suppressor.)

Order Usage • Consult SMC regarding other voltages (9). **Protective class** class III (Mark ⚡)..... Grommet, L and M plug connector

VX
VN □
VQ
VDW
VC
LV
PA

Manifold Options

Blanking plate assembly

VVCW 2 0 - 3A - A

Series •

2	Class 2
3	Class 3
4	Class 4

Material

Symbol	Plate material	Seal material
A	C37	FKM
H	Stainless steel	FKM

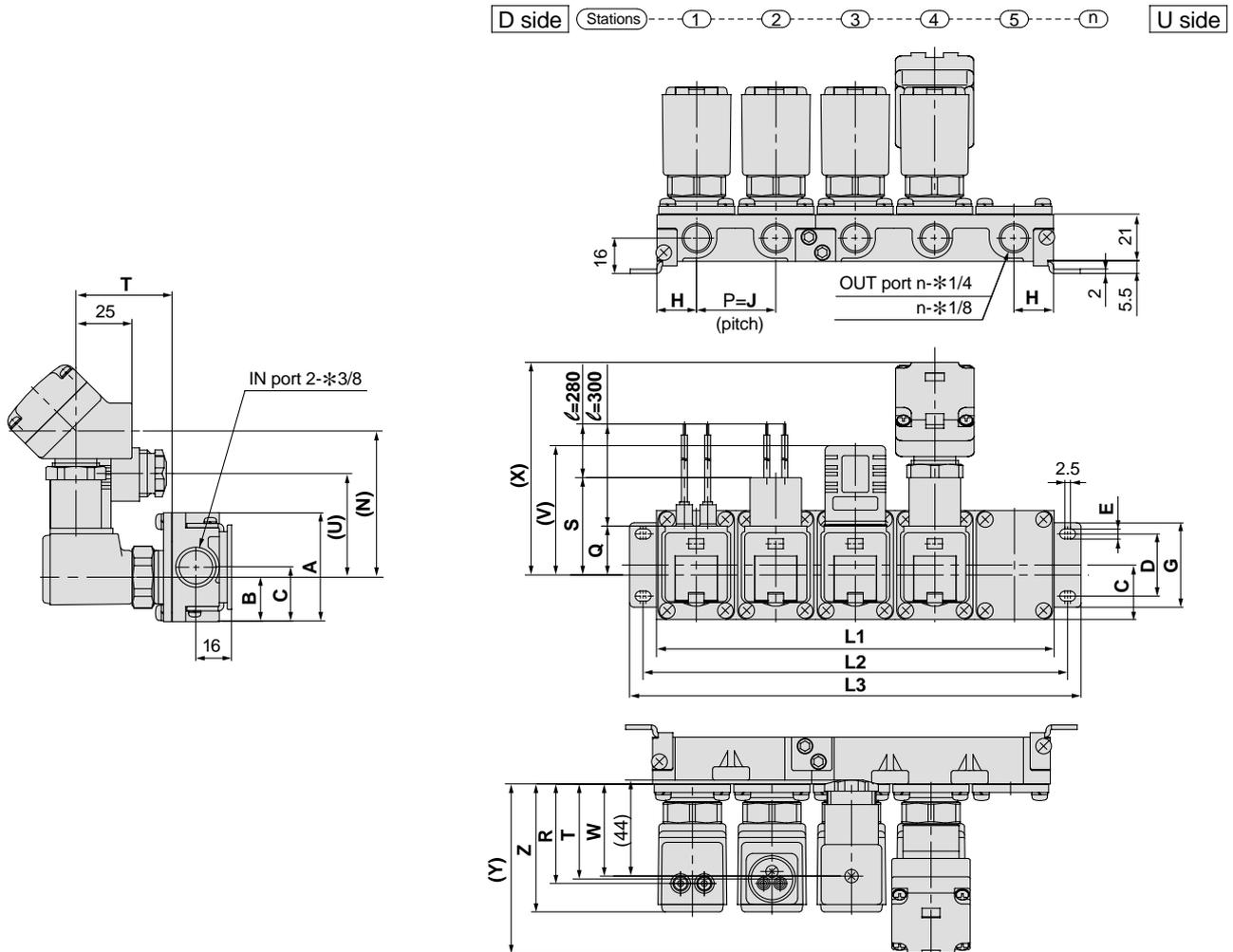
JIS symbol



This is used by mounting it on the manifold block when a valve is removed for maintenance, or when the mounting of an additional valve is planned,

Series VCL

Dimensions (N.C.)



*: Thread type

L dimensions

(mm)

Model	Dimension	n (stations)								
		2	3	4	5	6	7	8	9	10
VV2CL2	L1	69	103.5	138	172.5	207	241.5	276	310.5	345
	L2	81	115.5	150	184.5	219	253.5	288	322.5	357
	L3	93	127.5	162	196.5	231	265.5	300	334.5	369
VV2CL3	L1	77	115.5	154	192.5	231	269.5	308	346.5	385
	L2	89	127.5	166	204.5	243	281.5	320	358.5	397
	L3	101	139.5	178	216.5	255	293.5	332	370.5	409
VV2CL4	L1	83	124.5	166	207.5	249	290.5	332	373.5	415
	L2	95	136.5	178	219.5	261	302.5	344	385.5	427
	L3	107	148.5	190	231.5	273	314.5	356	397.5	439
Manifold composition		2 stns. x 1	3 stns. x 1	2 stns. x 2	2 stns. + 3 stns.	3 stns. x 2	2 stns. x 2 + 3 stns.	2 stns. + 3 stns. x 2	3 stns. x 3	2 stns. x 2 + 3 stns. x 2

Note) Manifold bases are composed by connecting 2 station and 3 station bases.

Dimensions

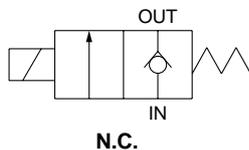
(mm)

Model	A	B	C	D	E	G	H	J	Z	Electrical entry									
										Grommet		Conduit		DIN connector			Conduit terminal		
										Q	R	S	T	U	V	W	N	X	Y
VV2CL2	49	20	24.5	28	4.5	38	17.3	34.5	58	22	45.5	44	43.5	46	58	41.5	66	99	77
VV2CL3	57	25.5	28.5	30	5.5	42	19.3	38.5	68	24	55	45.5	53	48	60	51	68	101	86.5
VV2CL4	57	25.5	28.5	30	5.5	42	20.8	41.5	76	26	62.5	47.5	60.5	50	62	58.5	70	103	94

Series VCL Model Selection

VCL (for oil) 2 port solenoid valve (N.C.)

Model	Material		Class	Port size	Orifice diameter					
	Body	Seal			ø2	ø3	ø4	ø5	ø7	ø10
VCL (for oil) 2 port solenoid valve	Brass (Stainless steel)	FKM	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)	—	—	—	—	—	●



How to find the flow rate for oil

- Formula based on Cv factor

$$Q = 14.2 \cdot C_v \cdot \sqrt{\frac{10.2 \cdot \Delta P}{G}} \dots \ell/\text{min}$$
- Formula based on effective area (Smm²)

$$Q = 0.8 \cdot S \cdot \sqrt{\frac{10.2 \cdot \Delta P}{G}} \dots \ell/\text{min}$$

Q : Flow rate (ℓ/min)
 ΔP: Pressure differential (P1– P2)
 P1: Upstream pressure (MPa)
 P2: Downstream pressure (MPa)
 S : Effective area (mm²)
 Cv: Cv factor
 G : Fluid specific gravity (water = 1)

Note) In case of a viscous fluid, there may be a difference between the flow rate found with the above formulas and the actual flow rate, depending on the viscosity.

Explanation of Terminology

Pressure Terminology

1. Maximum operating pressure differential

This indicates the maximum pressure differential (upstream and downstream pressure differential) 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 system pressure

This indicates the 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. Withstand pressure

The pressure which must be withstood without a drop in performance after returning to the operating pressure range. (value under the prescribed 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.

2. Symbols

In the JIS symbol (□□□□) IN and OUT are in a blocked condition (⊘), but actually in the case of reverse pressure (OUT>IN), there is a limit to the blocking capability. (□□□□) is used to indicate that blocking of reverse pressure is not possible.

VX

VN□

VQ

VDW

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LV

PA



Series VCL

2 Port Solenoid Valve for Fluid Control

Be sure to read before handling.

Wiring

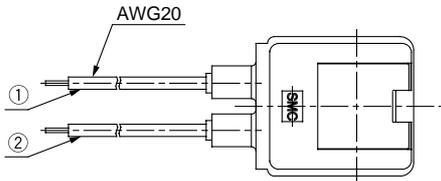
⚠ Caution

- As a rule, use electrical wire of 0.5 to 1.25mm².
Further, 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 using class H coils where the electrical circuit system does not allow solenoid surge, install a surge absorber, etc., in parallel with the solenoid.

Electrical Connections

⚠ Caution

Grommet/Conduit

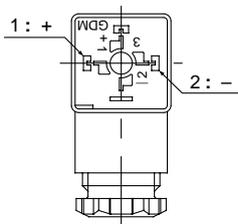


Rated voltage	Lead wire color	
	①	②
DC	Black	Red

* DC does not have polarity.

DIN connector

Since internal connections are as shown below for the DIN connector, make connections to the power supply accordingly.



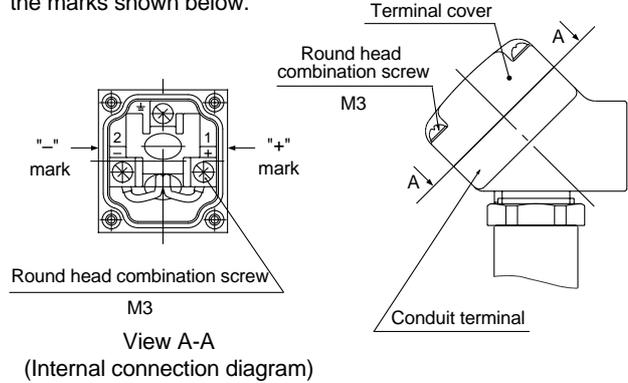
Terminal No.	1	2
DIN terminal	+	-

* There is polarity only when equipped with light.

Note) Tighten the DIN connector mounting screws and terminal screws with a torque of 0.5N-m.

Conduit terminal

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



* There is polarity only when equipped with light.

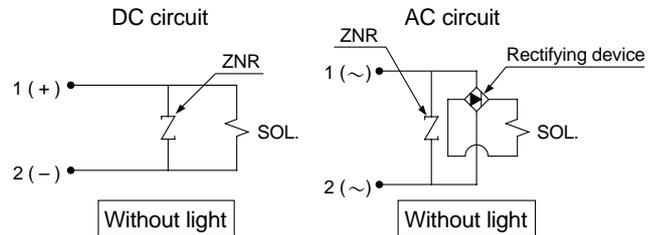
Note) Tighten the terminal cover mounting screws and terminal screws with a torque of 0.5N-m.

Electrical Circuits

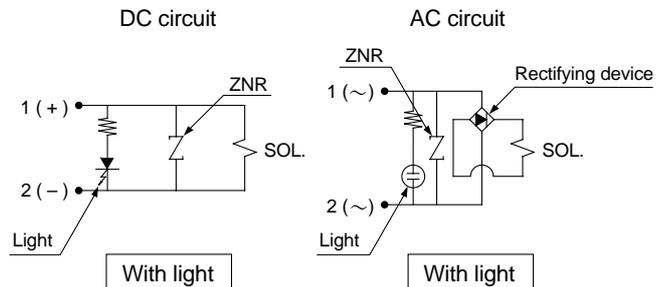
⚠ Caution

Class B

Grommet, Conduit, Conduit terminal, DIN connector

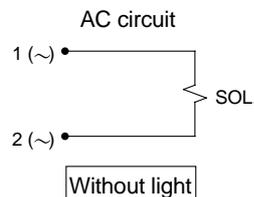


Conduit terminal, DIN connector



Class H

Grommet





Series VCL

2 Port Solenoid Valve for Fluid Control

Be sure to read before handling.

Operating Environment

Warning

1. Do not use valves in atmospheres of corrosive gases, chemicals, salt water, water or steam, or where there is direct contact with same.
2. Do not use in an explosive atmosphere.
3. Do not use in locations subject to vibration or impact.
4. Do not use in a location where radiated heat will be received from a heat source in the vicinity.
5. Employ suitable protective measures in locations where there is contact with water droplets, oil or welding spatter, etc.

Maintenance

Warning

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

Improper handling can cause damage or malfunction of equipment and devices, etc.

2. Demounting of the product

1. Shut off the fluid supply and release the fluid pressure in the system.
2. Shut off the power supply.
3. Demount the product.

3. Low frequency operation

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

Caution

1. Filters and strainers

1. Be careful regarding clogging of filters and strainers.
2. Replace filters after one year of use, or earlier if the amount of pressure drop reaches 0.1MPa.
3. Clean strainers when the amount of pressure drop reaches 0.1MPa.

VX

VN□

VQ

VDW

VC

LV

PA

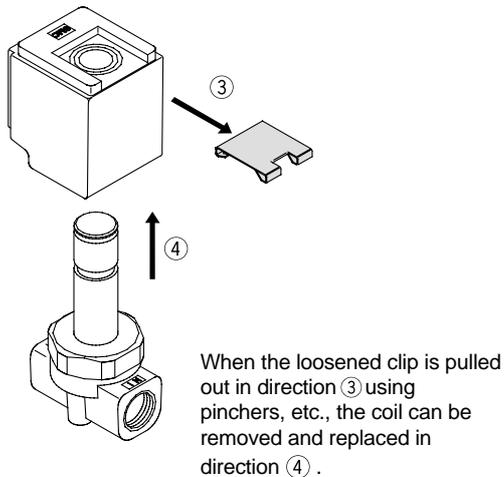
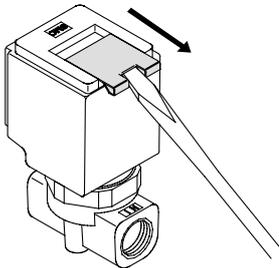
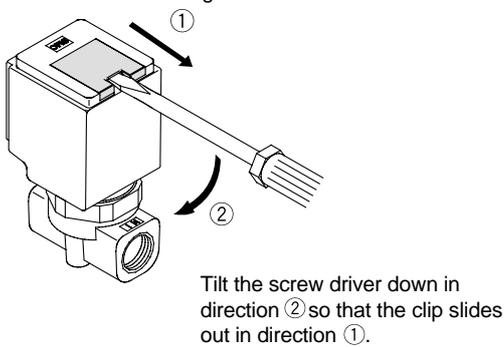
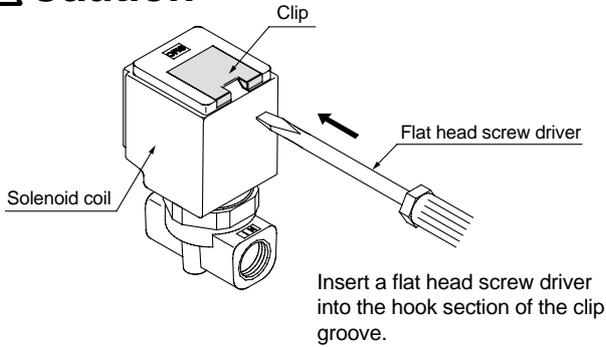


Series VCL Specific Product Precautions

Be sure to read before handling.

How to Replace the Solenoid Coil

Caution



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 (Class B)

VCW 20 — 1 G —

Series

20	Class 2
30	Class 3
40	Class 4

Voltage

1	100VAC
2	200VAC
3	110VAC
4	220VAC
5	24VDC
6	12VDC
36	230VAC

Lead wire length

Nil	300mm
L1	600mm
L2	1000mm
L3	1500mm
L4	3000mm

Electrical entry

G	Grommet
D	DIN connector
DL	DIN connector with light
DO	For DIN connector (without connector)
C	Conduit
T	Conduit terminal
TL	Conduit terminal with light

*AC specifications are only for the DIN terminal type

Clip part numbers

AZ-T-VCL How to Order Valves → Page 4.5-41 Valve model
Page 4.5-45 Valve model

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