



Installation and Maintenance Manual

VX21/22/23 Direct operated

2 Port Solenoid Valve

For Air, Medium Vacuum, Water, Oil, Steam



1 Safety Instructions

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of “Caution”, “Warning” or “Danger”, followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

	Caution	Indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.
	Warning	Indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.
	Danger	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.

Warning

- **The compatibility of equipment is the responsibility of the person who designs the system or decides its specifications.**
Since the products specified here can be used in various operating conditions, their compatibility with a specific system must be based on specifications or after analysis and/or tests to meet specific requirements.
- **Only trained personnel should operate pneumatically operated machinery and equipment.**
The fluid can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of the system should be performed by trained and experienced personnel.
- **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. Measures to prevent danger from the fluid should also be taken.
2) When equipment is to be removed, confirm the safety processes as mentioned above. Release the fluid pressure and be certain there is no danger from fluid leakage or fluid remaining in the system. Switch off electrical supplies.
3) Before machinery/equipment is re-started, ensure all safety measures are being implemented.
- **Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions:**
1) Conditions and environments beyond the given specifications, or if the product is to be used outdoors.
2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3) An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

Caution

- Ensure that the air supply system is filtered to 5 μ m.

2 Specifications

2.1 General Specifications

Valve specifications	Valve construction		Direct operated poppet
	Withstand pressure		2.0 MPa (Resin body type 1.5 MPa)
	Maximum system pressure		1.0 MPa
	Body material		Aluminium, Resin, Brass (C37), Stainless steel
	Seal material ^{Note 3)}		NBR, FKM
	Enclosure		Dust-tight, Water jet-proof type (IP65) ^{Note 1)}
Coil specifications	Environment		Location without corrosive or explosive gases
	Rated voltage	AC	100 VAC, 200VAC, 110VAC, 230VAC, (220VAC, 240VAC, 48VAC, 24VAC) ^{Note 2)}
		DC	24 VDC, (12VDC) ^{Note 2)}
	Allowable voltage fluctuation		±10% of rated voltage
	Allowable leakage voltage	AC	5% or less of rated voltage
		DC	2% or less of rated voltage
	Coil insulation type		Class B, class H

Note 1) Electrical entry, “Faston” type terminal is IP40.
Note 2) Voltage in brackets () indicates special voltage.
Note 3) For seal material EPDM, refer to catalogue for this product.

2.2 Coil Specifications

2.2.1 Normally Closed (N.C.)

DC Specification

Class B

Size	Power consumption (W) ^{Note1)}	Temperature rise (°C) ^{Note2)}
1	4.5	50
2	7	55
3	10.5	65

Class H

Size	Power consumption (W) ^{Note1)}	Temperature rise (°C) ^{Note2)}
1	9	100
2	12	100
3	15	100

Note 1) Power consumption: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)
Note 2) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

2.2.2 Normally Open (N.O.)

DC Specification

Class B

Size	Power consumption (W) ^{Note1)}	Temperature rise (°C) ^{Note2)}
1	7.5	60
2	8.5	70
3	12.5	70

Class H

Size	Power consumption (W) ^{Note1)}	Temperature rise (°C) ^{Note2)}
1	9	100
2	12	100
3	15	100

Note 1) Power consumption: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)
Note 2) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

2.2.3 Normally Closed (N.C.)

AC Specification (Built-in Full-wave Rectifier Type)

Class B

Size	Apparent Power (VA) ^{Note1, 2)}	Temperature rise (°C) ^{Note 3)}
1	7	60
2	9.5	70
3	12	70

Class H

Size	Apparent Power (VA) ^{Note1, 2)}	Temperature rise (°C) ^{Note 3)}
1	9	100
2	12	100
3	15	100

Note 1) Apparent power: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)

2 Specifications (continued)

Note 2) There is no difference in the frequency and the inrush and energized apparent power, since a rectifying circuit is used in the AC.
Note 3) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

2.2.4 Normally Open (N.O.)

AC Specification (Built-in Full-wave Rectifier Type)

Class B

Size	Apparent Power (VA) ^{Note1, 2)}	Temperature rise (°C) ^{Note3)}
1	9	60
2	10	70
3	14	70

Class H

Size	Apparent Power (VA) ^{Note1, 2)}	Temperature rise (°C) ^{Note3)}
1	9	100
2	12	100
3	15	100

Note 1) Apparent power: The value at ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)
Note 2) There is no difference in the frequency and the inrush and energized apparent power, since a rectifying circuit is used in the AC.
Note 3) The value at ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.

2.3 Model/Valve specifications

2.3.1 For AIR / Single Unit

2.3.1.1 Normally closed (N.C.)

Aluminium body type

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa)	Note) Wt. (g)
				C [dm³/ (s.bar)]	b	Cv		
1	1/8, 1/4	2	VX210	0.63	0.63	0.23	1.0	220
		3		1.05	0.68	0.41	0.6	
		5		2.20	0.39	0.62	0.2	

2	1/4, 3/8	4	VX220	1.90	0.52	0.62	1.0	340
		7		3.99	0.44	1.08	0.15	
3	1/4, 3/8	5	VX230	1.96	0.55	0.75	1.0	450
		8		5.67	0.33	1.58	0.3	
		10		5.74	0.64	2.21	0.1	
		10		8.42	0.39	2.21	0.1	

Resin body type (Built-in One-touch fittings)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa)	Note) Wt. (g)
				C [dm³/ (s.bar)]	b	Cv		
1	Ø6	2	VX210	0.82	0.44	0.23	1.0	220
		3		1.25	0.34	0.35	0.6	
		5		1.45	0.43	0.40	0.2	
	Ø8	2		0.82	0.44	0.23	1.0	
		3		1.81	0.40	0.41	0.6	
2	Ø8	4	VX220	2.11	0.32	0.56	0.2	340
		5		1.69	0.40	0.47	1.0	
		7		3.14	0.34	0.84	0.15	
	Ø10	4		1.68	0.49	0.50	1.0	
		7		3.54	0.36	0.90	0.15	
3	Ø10	5	VX230	2.50	0.44	0.70	1.0	460
		8		2.77	0.82	1.22	0.3	
		10		5.69	0.46	1.54	0.1	
	Ø12	5		2.50	0.44	0.70	1.0	
		8		2.56	0.88	1.38	0.3	
		10		5.69	0.64	1.76	0.1	
		10		5.69	0.64	1.76	0.1	

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
-10 ^{Note)} to 60	-20 to 60

Note) Dew point temperature –10°C or less

2 Specifications (continued)

Valve internal leakage rate

Seal material	Leakage rate (Air) ^{Note)}
NBR (FKM)	1 cm³/min or less (Aluminium body)
	15cm³/min or less (Resin body)

Valve external leakage rate

Seal material	Leakage rate (Air) ^{Note)}
NBR (FKM)	1 cm³/min or less (Aluminium body)
	15cm³/min or less (Resin body)

Note) Leakage is the value at ambient temperature 20°C.

2.3.1.2 Normally open (N.O.)

Aluminium body type

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa)	Note) Wt. (g)
				C [dm³/ (s.bar)]	b	Cv		
1	1/8, 1/4	2	VX240	0.63	0.63	0.23	0.9	240
		3		1.05	0.68	0.41	0.45	
		5		2.20	0.39	0.62	0.2	
2	1/4, 3/8	4	VX250	1.90	0.52	0.62	0.8	370
		7		3.99	0.44	1.08	0.15	
3	1/4, 3/8	5	VX260	1.96	0.55	0.75	0.8	490
		8		5.67	0.33	1.58	0.3	

Resin body type (Built-in One-touch fittings)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating pressure differential (MPa)	Note) Wt. (g)
				C [dm³/ (s.bar)]	b	Cv		
1	Ø6	2	VX240	0.82	0.44	0.23	0.9	240
		3		1.25	0.34	0.35	0.45	
		5		1.45	0.43	0.40	0.2	
	Ø8	2		0.82	0.44	0.23	0.9	
		3		1.81	0.40	0.41	0.45	
2	Ø8	4	VX250	2.11	0.32	0.56	0.2	370
		5		1.69	0.40	0.47	0.8	
		7		3.14	0.34	0.84	0.15	
	Ø10	4		1.68	0.49	0.50	0.8	
		7		3.54	0.36	0.90	0.15	
3	Ø10	5	VX260	2.50	0.44	0.70	0.8	500
		8		2.77	0.82	1.22	0.3	
		10		2.50	0.42	0.70	0.8	
	Ø12	5		2.56	0.88	1.38	0.3	
		8		2.56	0.88	1.38	0.3	

2	Ø8	4	VX250	1.69	0.40	0.47	0.8	370
		7		3.14	0.34	0.84	0.15	
	Ø10	4		1.68	0.49	0.50	0.8	
		7		3.54	0.36	0.90	0.15	
3	Ø10	5	VX260	2.50	0.44	0.70	0.8	500
		8		2.77	0.82	1.22	0.3	
	Ø12	5		2.50	0.42	0.70	0.8	
		8		2.56	0.88	1.38	0.3	

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
-10 ^{Note)} to 60	-20 to 60

Note) Dew point temperature –10°C or less

Valve internal leakage rate

Seal material	Leakage rate (Air) ^{Note)}
NBR (FKM)	1 cm³/min or less (Aluminium body)
	15cm³/min or less (Resin body)

Valve external leakage rate

Seal material	Leakage rate (Air) ^{Note)}
NBR (FKM)	1 cm³/min or less (Aluminium body)
	15cm³/min or less (Resin body)

2 Specifications (continued)

2.3.2.2 Normally open (N.O.)

Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating Pressure differential (MPa)
			C [dm³/(s.bar)]	b	Cv	
1	2	VX2D0	0.63	0.63	0.23	0.9
	3		1.05	0.68	0.41	0.45
	5		2.20	0.39	0.62	0.2
2	4	VX2E0	1.90	0.52	0.62	0.8
	7		3.99	0.44	1.08	0.15
	5	VX2F0	1.96	0.55	0.75	0.8
3	7		3.99	0.44	1.08	0.3

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
-10 ^{Note)} to 60	-20 to 60

Note) Dew point temperature –10°C or less

Valve internal leakage rate

Seal material	Leakage rate (Air) ^{Note)}
NBR (FKM)	1 cm³/min or less

Valve external leakage rate

Seal material	Leakage rate (Air) ^{Note)}
NBR (FKM)	1 cm³/min or less

Note) Leakage is the value at ambient temperature 20°C.

2.3.3 For MEDIUM VACUUM / Single Unit

2.3.3.1 Normally closed (N.C.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			^{Note1)} Operating pressure range (MPa·G)	^{Note2)} Wt. (g)
				C [dm³/(s.bar)]	b	Cv		
1	1/8, 1/4	2	VX214	0.63	0.63	0.23	0 to 1.0	300
		3		1.05	0.68	0.41	0 to 0.6	
		5		2.20	0.39	0.62	0 to 0.2	
2	1/4, 3/8	4	VX224	1.90	0.52	0.62	0 to 1.0	460
		7		3.99	0.44	1.08	0 to 0.15	

3	1/4, 3/8	5	VX234	1.96	0.55	0.75	0 to 1.0	580
		8		5.67	0.33	1.58	0 to 0.3	
		10		5.74	0.64	2.21	0 to 0.1	
		1/2		8.42	0.39	2.21	0 to 0.1	

Note 1)Operating pressure range for Vacuum is 0.1 to Atmospheric pressure (Pa-abs)

Note 2) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

2.3.3.2 Normally open (N.O.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics			Note1) Operating pressure range (MPa·G)	Note2) Wt. (g)
				C [dm³/ (s.bar)]	b	Cv		
1	1/8, 1/4	2	VX244	0.63	0.63	0.23	0 to 0.9	320
		3		1.05	0.68	0.41	0 to 0.45	
		5		2.20	0.39	0.62	0 to 0.2	
2	1/4, 3/8	4	VX254	1.90	0.52	0.62	0 to 0.8	490
		7		3.99	0.44	1.08	0 to 0.15	
3	1/4, 3/8	5	VX264	1.96	0.55	0.75	0 to 0.8	620
		8		5.67	0.33	1.58	0 to 0.3	

Note 1)Operating pressure range for Vacuum is 0.1 to Atmospheric pressure (Pa-abs)

Note 2) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 60 ^{Note)}	-20 to 60

Note) With no freezing

Valve internal leakage rate

Seal material	Leakage rate ^{Note)}
FKM	10 ⁻⁶ Pa·m³/sec or less

Valve external leakage rate

Seal material	Leakage rate ^{Note)}
FKM	10 ⁻⁶ Pa·m³/sec or less

Note) Leakage (10⁻⁶ Pa·m³/sec) is the value at differential pressure 0.1 MPa and ambient temperature 20°C.

2 Specifications (continued)

2.3.4 For MEDIUM VACUUM / Manifold

2.3.4.1 Normally closed (N.C.)

Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating Pressure differential (MPa)
			C [dm³/(s.bar)]	b	Cv	
1	2	VX2A4	0.63	0.63	0.23	1.0
	3		1.05	0.68	0.41	0.6
	5		2.20	0.39	0.62	0.2
2	4	VX2B4	1.90	0.52	0.62	1.0
	7		3.99	0.44	1.08	0.15
3	5	VX2C4	1.96	0.55	0.75	1.0
	7		3.99	0.44	1.08	0.3

2.3.4.2 Normally open (N.O.)

Size	Orifice Dia. (mm)	Model	Flow characteristics			Max. operating Pressure differential (MPa)
			C [dm³/(s.bar)]	b	Cv	
1	2	VX2D4	0.63	0.63	0.23	0.9
	3		1.05	0.68	0.41	0.45
	5		2.20	0.39	0.62	0.2
2	4	VX2E4	1.90	0.52	0.62	0.8
	7		3.99	0.44	1.08	0.15
3	5	VX2F4	1.96	0.55	0.75	0.8
	7		3.99	0.44	1.08	0.3

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 60 ^{Note)}	-20 to 60

Note) With no freezing

Valve internal leakage rate

Seal material	Leakage rate ^{Note)}
FKM	10 ⁻⁶ Pa·m³/sec or less

Valve external leakage rate

Seal material	Leakage rate ^{Note)}
FKM	10 ⁻⁶ Pa·m³/sec or less

Note) Leakage (10⁻⁶ Pa·m³/sec) is the value at differential pressure 0.1 MPa and ambient temperature 20°C.

2.3.5 For WATER / Single Unit

2.3.5.1 Normally closed (N.C.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa)	Wt. (g) ^{Note)}
				AV (x 10 ⁻⁶ m²)	Conversion Cv		
1	1/8, 1/4	2	VX212	5.5	0.23	1.0	300
		3		10.0	0.42	0.6	
		5		15.0	0.63	0.2	
2	1/4, 3/8	4	VX222	15.0	0.63	1.0	460
		7		26.0	1.08	0.15	
3	1/4, 3/8	5	VX232	18.0	0.75	1.0	580
		8		38.0	1.58	0.3	
		10		53.0	2.21	0.1	
	1/2	10		53.0	2.21	0.1	630

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

2.3.5.2 Normally open (N.O.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa)	Wt. (g) ^{Note)}
				AV (x 10 ⁻⁶ m²)	Conversion Cv		
1	1/8, 1/4	2	VX242	5.5	0.23	0.9	320
		3		10.0	0.42	0.45	
		5		15.0	0.63	0.2	
2	1/4, 3/8	4	VX252	15.0	0.63	0.8	490
		7		26.0	1.08	0.15	
3	1/4, 3/8	5	VX262	18.0	0.75	0.8	620
		8		38.0	1.58	0.3	

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

2 Specifications (continued)

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
1 to 60 ^{Note)}	-20 to 60

Note) With no freezing

Valve internal leakage rate

Seal material	Leakage rate (Water) ^{Note)}
NBR (FKM)	0.1 cm³/min or less

Valve external leakage rate

Seal material	Leakage rate (Water) ^{Note)}
NBR (FKM)	0.1 cm³/min or less

Note) Leakage is the value at ambient temperature 20°C.

2.3.6 For OIL / Single Unit

2.3.6.1 Normally closed (N.C.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa)	Wt. (g) ^{Note)}
				AV (x 10 ⁻⁶ m²)	Conversion Cv		
1	1/8, 1/4	2	VX213	5.5	0.23	1.0	300
		3		10.0	0.42	0.6	
		5		15.0	0.63	0.2	
2	1/4, 3/8	4	VX223	15.0	0.63	1.0	460
		7		26.0	1.08	0.15	
3	1/4, 3/8	5	VX233	18.0	0.75	1.0	580
		8		38.0	1.58	0.3	
		10		53.0	2.21	0.1	
	1/2	10		53.0	2.21	0.1	630

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

2.3.6.2 Normally open (N.O.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa)	Wt. (g) ^{Note)}
				AV (x 10 ⁻⁶ m²)	Conversion Cv		

1	1/8, 1/4	2	VX243	5.5	0.23	0.9	320
		3		10.0	0.42	0.45	
		5		15.0	0.63	0.2	
2	1/4, 3/8	4	VX253	15.0	0.63	0.8	490
		7		26.0	1.08	0.15	
3	1/4, 3/8	5	VX263	18.0	0.75	0.8	620
		8		38.0	1.58	0.3	

Note) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type.

Ambient and fluid temperature

Fluid temperature (°C)	Ambient temperature (°C)
-5 ^{Note)} to 60	-20 to 60

Note) Kinematic viscosity: 50mm²/s or less

Valve internal leakage rate

Seal material	Leakage rate (Oil) ^{Note)}
FKM	0.1 cm³/min or less

Valve external leakage rate

Seal material	Leakage rate (Oil) ^{Note)}
FKM	0.1 cm³/min or less

Note) Leakage is the value at ambient temperature 20°C.

2.3.7 For STEAM / Single Unit

2.3.7.1 Normally closed (N.C.)

Size	Port Size	Orifice Dia. (mm)	Model	Flow characteristics		Max. operating pressure differential (MPa)	Wt. (g) (Note)
				AV (x 10 ⁻⁶ m ²)	Conversion Cv		
1	1/8, 1/4	2	VX215	5.5	0.23	1.0	300
		3		10.0	0.42	0.6	
		5		15.0	0.63	0.2	
2	1/4, 3/8	4	VX225	15.0	0.63	1.0	460
		7		26.0	1.08	0.15	
3	1/4, 3/8	5	VX235	18.0	0.75	1.0	580
		8		38.0	1.58	0.3	
		10		53.0	2.21	0.1	
	1/2	10		53.0	2.21	0.1	630

3 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.

3.1 VX Valve Mounting Bracket

3.1.1 Resin body – One touch fittings

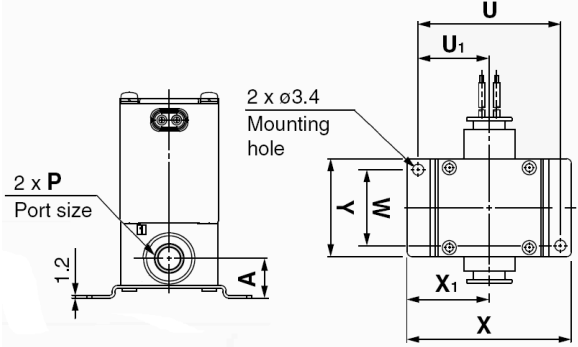


Figure 1

Size	One-touch Fitting P	A (mm)	Bracket Mounting (mm)					
			U	U ₁	W	X	X ₁	Y
1	Ø6, Ø8	13.5	45	22.5	22	52	26	30
2	Ø8, Ø10	15	53	26.5	27	62	31	35
3	Ø10, Ø12	16.5	58	29	31	67	33.5	40

Table 3

3.1.2 Metal body – Aluminium, C37, Stainless steel (Bracket optional)

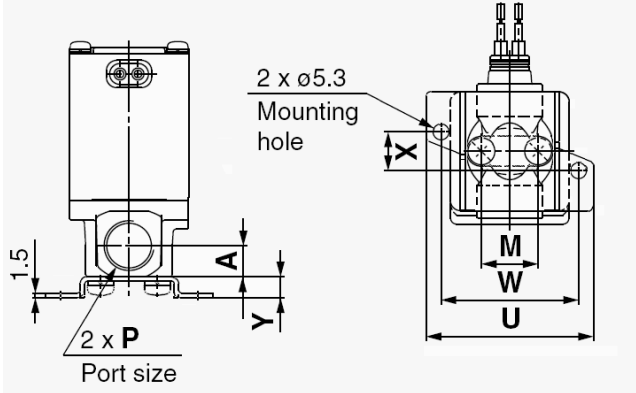


Figure 2

Size	Port size P	A (mm)	Bracket Mounting (mm)				
			M	U	W	X	Y
1	1/8, 1/4	9.5	12.8	46	36	11	6
2	1/4, 3/8	10.5 (12)	19	56	46	13	7
3 (Note)	1/4, 3/8	10.5 (12)	19	56	46	13	7

Dimensions in brackets () are for Aluminum body.

Note) Bracket not available for Port size 1/2.

Table 4

3 Installation (continued)

3.2 VX Manifold (Aluminium) Mounting

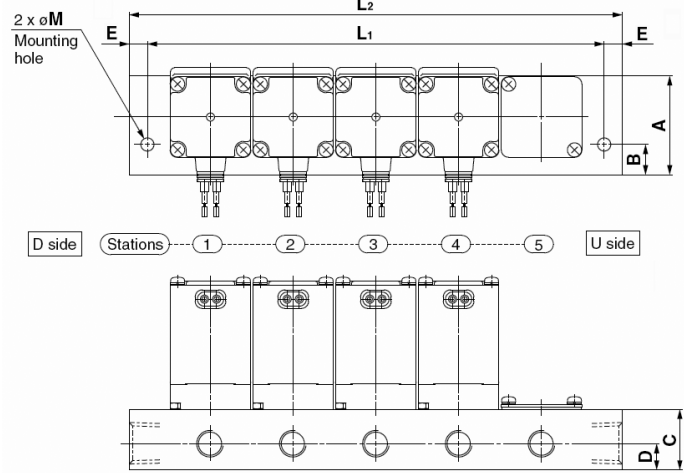


Figure 3

Size	Manifold Mounting (mm)					
	A	B	C	D	E	M
1	38	12	25	11	7	6.5
2	49	15	30	13	9	8.5
3	49	15	30	13	9	8.5

Size	Dimn (mm)	n Stations								
		2	3	4	5	6	7	8	9	10
1	L1	86	122	158	194	230	266	302	338	374
	L2	100	136	172	208	244	280	316	352	388
2	L1	90	126	162	198	234	270	306	342	378
	L2	108	144	180	216	252	288	324	360	396

3	L1	103	144	185	226	267	308	349	390	431
	L2	121	162	203	244	285	326	367	408	449

Table 5

- To assemble valve to manifold, ensure the valve is correctly positioned and all gaskets are present.
- Tighten mounting screws to appropriate tightening torque shown in Table 6

Manifold Exploded View

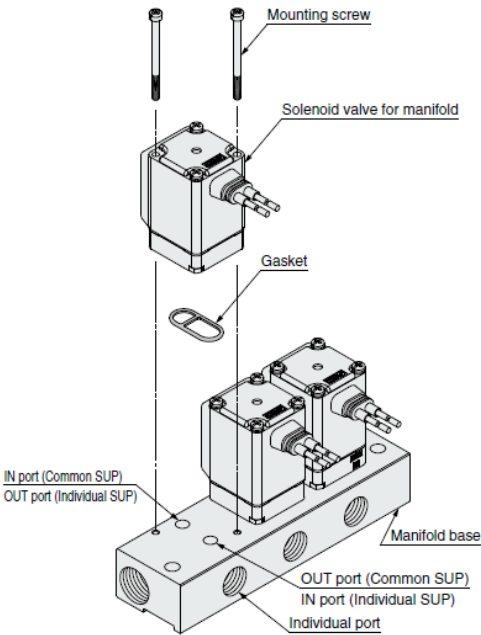


Figure 4

3 Installation (continued)

Size	Thread	Tightening Torque N·m
1	M3	0.45 to 0.55
2	M4	0.65 to 0.75
3	M4	0.65 to 0.75

Table 6

Caution

- Be aware of mounting orientation when mounting valves onto manifold base. Mount as shown in Figure 5.
- Take extra care when special electrical entry direction (XC) is used.

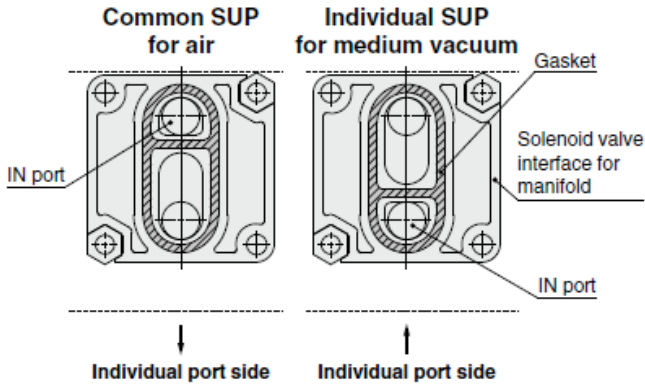


Figure 5

3.3 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present or where there is direct contact with any of these.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact. Check the

product specifications.

- Do not mount in a location exposed to radiant heat.
- Employ suitable protective measures in locations where there is contact with water droplets, oil or welding splatter, etc.

3.4 Piping

Caution

- Before connecting piping, it should be thoroughly blown out with air (flushed) or washed to remove chips, cutting oil and other debris from inside the pipe.
- Avoid connecting ground lines to piping, as this may cause electrolytic corrosion of the system.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.
- Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.
- When connecting piping, avoid mistakes regarding the supply port.
- In applications such as vacuum and non-leak specifications, use caution against contamination of foreign objects and air tightness of fittings.
- Steam generated by a boiler contains a large amount of water vapour, ensure to operate with a drain trap installed.

Thread	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

Table 7

3 Installation (continued)

3.4.1 Valve Ports

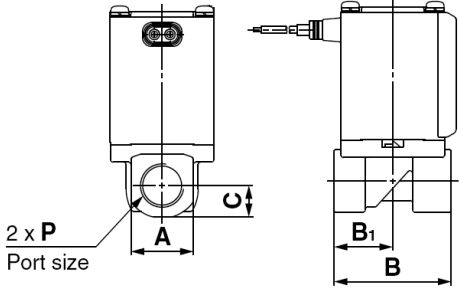


Figure 6

Size	Port size P (Rc)	Valve Ports (mm)			
		A	B	B1	C
1	1/8, 1/4	19	43	21	9.5
2	1/4, 3/8	22 (24)	45	22.5	10.5 (12)
3	1/4, 3/8	22 (24)	45	22.5	10.5 (12)
	1/2	29.5 (30)	50	25	14 (15)

Dimensions in brackets () are for Aluminium body

Table 8

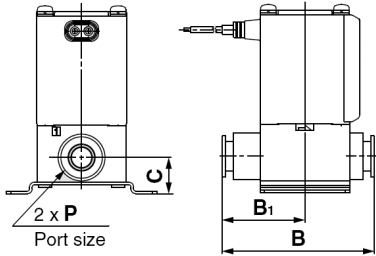


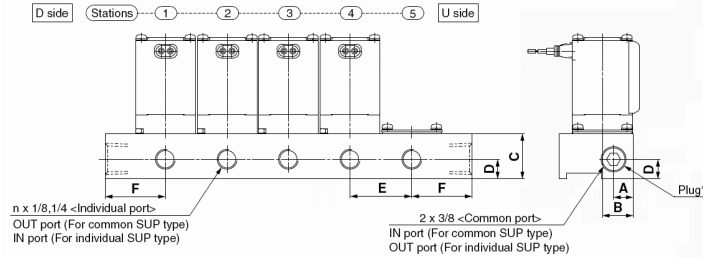
Figure 7

Size	One-touch Fitting P (mm)	Valve Ports (mm)		
		B	B1	C
1	Ø6, Ø8	53.5	29	13.5
2	Ø8, Ø10	66	36	15
3	Ø10, Ø12	68	37	16.5

Note: Resin body type only

Table 9

3.4.2 Manifold Ports



* D side port does not have a plug.

Figure 8

Size	Manifold Ports (mm)					
	A	B	C	D	E	F
1	10.5	15.5	25	11	36	32
2	13	18	30	13	36	36
3	13	20.5	30	13	41	40

Table 10

- When using a DIN terminal that faces downwards, be careful of interference between the electrical wires and piping.

3.4.3 Precautions for One-touch fittings

3.4.3.1 Attaching of tube.

- Use a tube having no flaws on its periphery and cut it off at a right angle.

3 Installation (continued)

- When cutting the tube use cutters TK-1, 2, or 3. Do not use pinchers, nippers or scissors, etc. If cutting is done with tools other than tube cutters, the tube may be cut diagonally or become flattened etc., making a secure installation impossible, and causing problems such as the tube pulling out after installation or air leakage. Allow some extra length in the tube.
- Grasp the tube and push it in slowly, inserting it securely all the way into the fitting.
- After inserting the tube, pull on it lightly to confirm that it will not come out. If it is not installed securely all the way into the fitting, this can cause problems such as air leakage or the tube pulling out.
- After connecting the tubing, care should be taken not to put excessive force (tensile force, compression, bending etc.) on the tubing.

3.4.3.2 Detaching the tube.

- Push in the release bushing sufficiently, and push the collar equally at the same time.
- Pull out the tube while holding down the release bushing so that it does not come out. If the release bushing is not pressed down sufficiently there will be an increased bite on the tube and it will become more difficult to pull out.
- When the removed tube is to be used again, cut off the portion what has been chewed before re-using it. If the chewed portion is used as is, this can cause trouble such as air leakage or difficulty in removing the tube.

3.4.3.3 Other Tube Brands

- When tubing brands other than SMC's are used, verify the tubing O.D. satisfies the following accuracy;
Polyolefin tubing: Within ±0.1 mm
Polyurethane tubing: Within +0.15 mm, within -0.2 mm
Nylon tubing: Within ±0.1 mm
Soft nylon tubing: Within ±0.1 mm
- Do not use tubing what does not meet these outside diameter tolerances. It may not be possible to connect them or they may cause other problems such as air leakage or the tube pulling out of the connection.

3.4.3.4 Recommended piping conditions

- When connecting tubes using one-touch fittings, provide some spare tube length as shown in Figure 99.

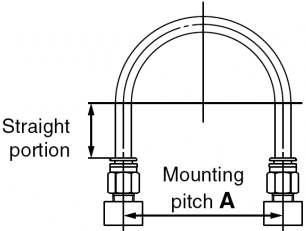


Figure 9

Tube Size	Mounting pitch A (mm)			Straight portion length (mm)
	Nylon tube	Soft nylon tube	Polyurethane tube	
Ø6 mm	84 or more	39 or more	39 or more	30 or more
Ø8 mm	112 or more	58 or more	52 or more	40 or more
Ø10 mm	140 or more	70 or more	69 or more	50 or more
Ø12 mm	168 or more	82 or more	88 or more	60 or more

Table 11

- Do not apply external force to the fitting when binding tubes with bands, etc. see Figure 1010.

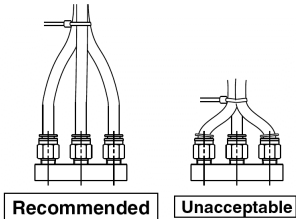


Figure 10

3 Installation (continued)

3.5 Electrical connection

Caution

- Avoid mis-wiring, as this can cause malfunction, damage and fire to the product.
- To prevent noise and surge in signal lines, keep all wiring separate from power lines and high voltage lines. Otherwise this can cause malfunction.
- When a surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid. Or, use an option that comes with surge voltage protection circuit.
- Use electrical circuits that do not generate chattering in their contacts.
- Use voltage that is within ±10% of the rated voltage. In cases with a DC power supply where responsiveness is important, stay within ±5% of the rated value. (The voltage drop is the value in the lead wire section connecting the coil).
- Generally use electrical wire with cross sectional area 0.5 to 1.25 mm².
- Do not bend or pull cables repeatedly.
- Do not allow excessive force to be applied to the lines.
- Do not apply AC voltage to Class H coil AC type unless it has a built in full-wave rectifier or it will be damaged.

3.5.1 Grommet

Class B coil: AWG20 Outside insulator diameter of 2.5 mm

Class H coil: AWG18 Outside insulator diameter of 2.1 mm

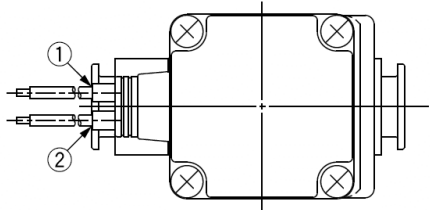


Figure 11

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

Note: There is no polarity

Table 12

3.5.2 DIN Terminal

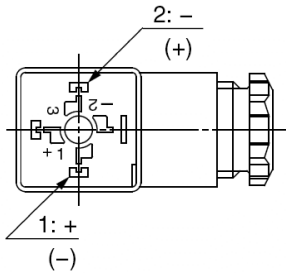


Figure 12

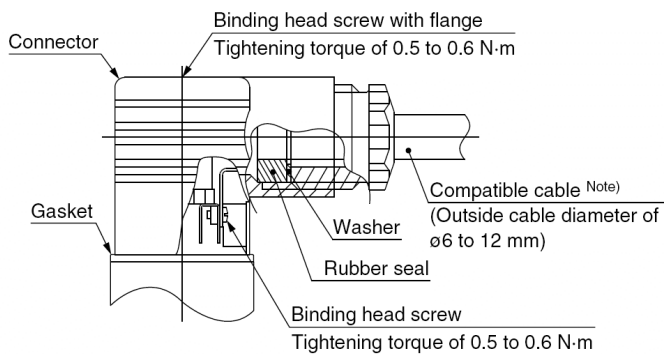
Terminal no.	1	2
Din Terminal	+(-)	-(+)

Note: There is no polarity

Table 13

- Use a heavy-duty cord with an outside cable diameter of Ø6 to 12 mm.
- Tighten screws and fittings according to Figure 13

3 Installation (continued)



Note) For an outside cable diameter of ø9 to 12 mm, remove the internal parts of the rubber seal before using.

Figure 13

Caution

- For class H coil, surge voltage suppressor and full-wave rectifier (for AC) are on DIN connector side. **A SMC DIN connector must be used.** Part numbers can be found in product catalogue.

3.5.3 Conduit Terminal

- Make connections according to the marking shown in Figure 14.
- Tighten screws and fittings according to Figure 14.
- Properly seal the terminal connection (G1/2) with special wiring conduit, etc.

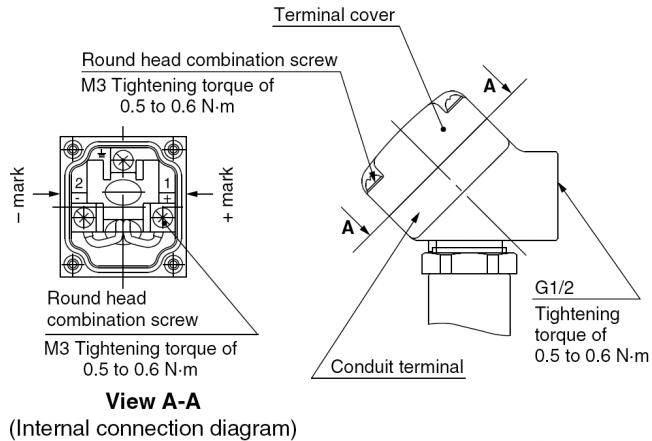


Figure 14

3.5.4 Conduit

- When used as an IP65 equivalent use seal (VCW20-15-6) to install the wiring conduit.
- Tighten conduit to torque shown in Figure 15.

Class B coil: AWG20 Outside insulator diameter of 2.5 mm
Class H coil: AWG18 Outside insulator diameter of 2.1 mm

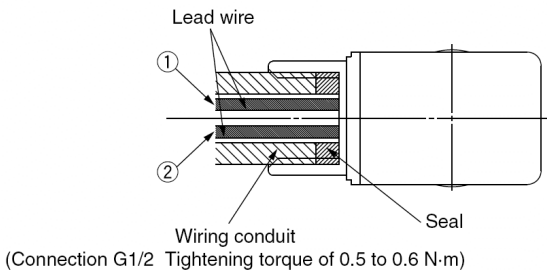


Figure 15

3 Installation (continued)

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

Note: There is no polarity

Table 14

3.5.5 'Faston' Terminal

- Faston™ is a trademark of Tyco Electronics Corporation.
- Use 'Amp/Faston' connector/250 series or equivalent.

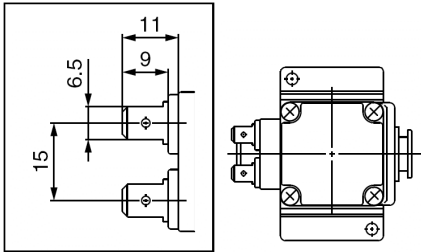
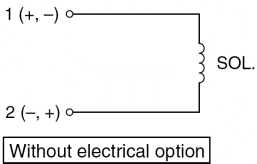


Figure 16

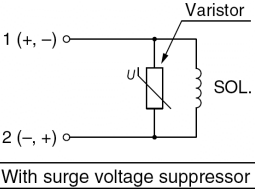
3.6 Electrical circuits

3.6.1 DC circuit

Grommet, Faston terminal



Grommet, DIN terminal, Conduit terminal, Conduit



DIN terminal, Conduit terminal

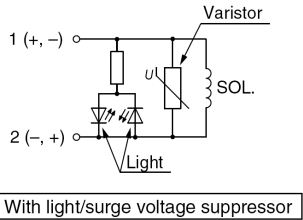
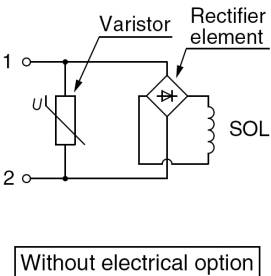


Figure 17

3.6.2 AC circuit

- For AC (Class B), the standard product is equipped with surge voltage suppressor.

Grommet, DIN terminal, Conduit terminal, Conduit



DIN terminal, Conduit terminal

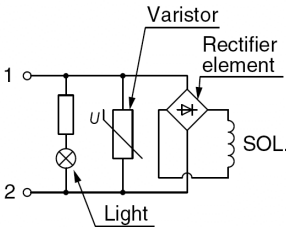


Figure 18

3.7 Mounting

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

3 Installation (continued)

- Avoid sources of vibration, or adjust the distance from the body to a minimum length so that resonance will not occur.
- 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.
- Do not apply external force to the coil section:
When tightening fittings, apply a wrench or other tool to the outside of the piping connection parts.
- Do not install with the coil downwards.
If a valve is mounted with the coil positioned downwards, foreign objects in the fluid will adhere to the iron core leading to a malfunction. Especially for strict leakage control, such as with vacuum applications and non-leak specifications, the coil must be positioned upwards.
- Do not warm the coil assembly with a heat insulator, etc.
Use tape, heaters, etc, for freeze prevention on the piping and body only. They can cause the coil to burn out.
- Painting and coating:
Warnings or specifications printed or labeled on the product should not be erased, removed or covered up.

3.8 Lubrication

Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, use turbine oil Class 1 (no additive), ISO VG32. But do not lubricate valves with EPDM seals.
- Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

4 How to Order

Refer to the catalogue for this product.

5 Outline Dimensions (mm)

Refer to the catalogue for this product.

6 Maintenance

6.1 General Maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous. Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- Do not make any modification to the product.
- Exhaust the drainage from the piping periodically.

Warning

6.2 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 danger of being burned.
 1. Shut off the fluid supply and release the fluid pressure in the system.
 2. Shut off the power supply.
 3. Remove the valve, ensuring any seals are retained.

6 Maintenance (continued)

6.3 Low frequency operation:

- Switch valves at least once every 30 days to prevent malfunction. Also, in order to use it under the optimum state, conduct a regular inspection once every 6 months.

Caution

6.4 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 0.1 MPa.
- Clean strainers when the pressure drop reaches 0.1MPa.

6.5 Lubrication:

- When using after lubricating, never forget to lubricate continuously.

6.6 Storage:

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

6.7 Disassembly/Assembly Procedures

Caution

- Before starting the disassembly work, be sure to shut off the power supply and pressure supply, and release the residual pressure.

6.7.1 Disassembly

- < NC >
Loosen the mounting screws.
The coil assembly, seal, return spring, armature assembly and body can be removed.
- < NO >
Loosen the mounting screws.
The coil assembly, push rod assembly, O-rings, adaptor and body can be removed.

6.7.2 Assembly – common to N.C. and N.O.

- Mount the components on the body in the reverse order of disassembly. Refer to Figure 20.
- Push the coil assembly against the body and tighten the screws two or more rounds diagonally (Figure 19b). There must be no gaps between the coil assembly and the body (Figure 19a).
- Tighten screws in the order of “1, 2, 3, 4, 1, 2, 3, 4”.
- See Table 15 for tightening torque.

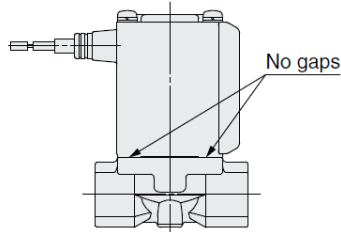


Fig.19a

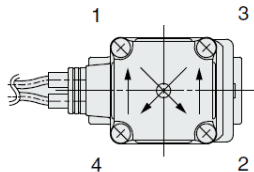


Fig.19b

- * After tightening the screws, make sure that there are no gaps between the coil and body (Fig. 19a).
- * After the disassembly and assembly have been completed, make sure that no leak occurs from the seal. Additionally, when restarting the valve, make sure that the valve operates correctly after checking the safety.

Figure 19

Model	Tightening Torque N•m
VX21	0.5
VX22	0.7
VX23	

Table 15

6 Maintenance (continued)

Caution

<N.C.>

<N.O.>

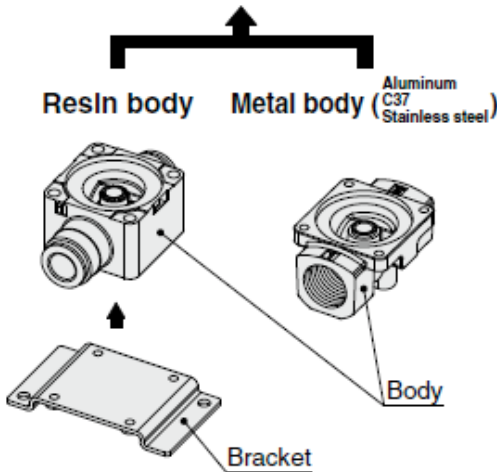
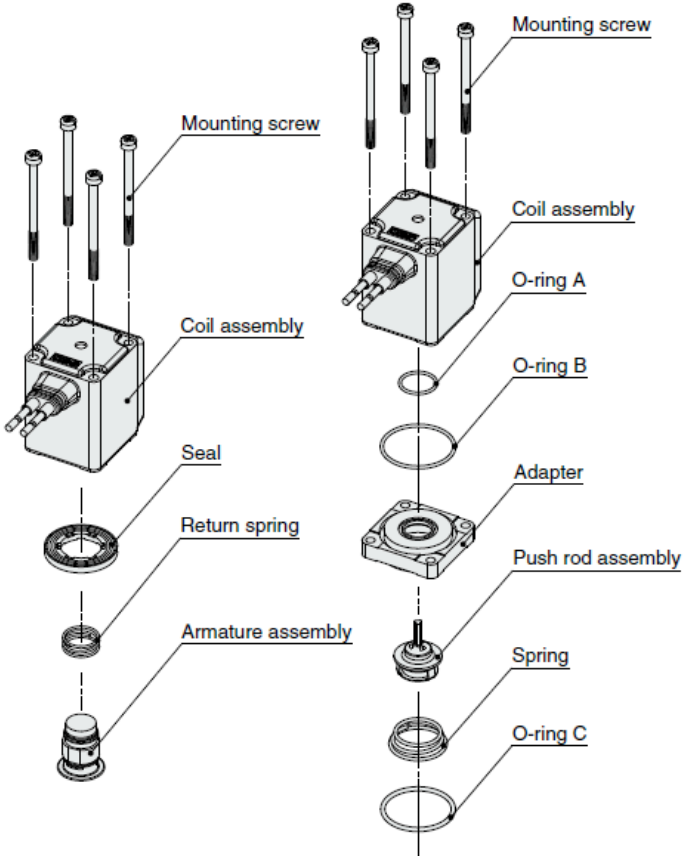


Figure 20

7 Limitations of Use

Warning

- Do not exceed any of the specifications laid out in section 2 of this document or the specific product catalogue.

7.1 Confirm the specifications:

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

7.2 Fluid:

- Type of fluid;
Before using a fluid, confirm whether it is compatible with the materials for each model by referring to the fluids listed in the catalogue. Use a fluid with a dynamic viscosity of 50 mm²/s or less.

7 Limitations of Use (continued)

- Flammable oil, Gas;
Confirm the specification for leakage, internal and/or external.
- Corrosive gas;
Cannot be used since it will cause cracks by stress corrosion or result in other incidents.
- When a brass body is used, then depending on water quality, corrosion and internal leakage may occur. If such abnormalities occur, exchange the product for stainless steel body.
- Use an oil-free specification when any oily particles must not enter the system.
- Applicable fluid in the catalogue list may not be suitable depending on the operating conditions. Give adequate consideration and then determine a suitable model, as the compatibility list is for general case.

7.3 Fluid: Water

- The use of water that 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.
- Tap water pressure. The water pressure for tap water is normally 0.4MPa or less. However, in places like high-rise buildings, the pressure may be 1.0MPa. When selecting tap water, be careful of the maximum operating pressure differential.
- When using water or heated water, poor operation or leaks maybe caused by dezincification, erosion, corrosion, etc.
- The brass (C37) body of this product uses dezincification-resistant material as standard and a stainless steel body type will give improved corrosion resistance. Please select the most suitable for the application.
- When the valve is used to supply water to boilers, substances such as calcium and magnesium, which generate hard scale and sludge, are present. Since this scale and sludge can cause the valve to malfunction, install water softening equipment and a filter (strainer) directly upstream from the valve to remove these substances.

7.4 Fluid: Oil

- Generally FKM is used as seal material, as it is resistant to oil.
- The resistance of the seal material may deteriorate depending on the type of oil, manufacturer, or additives. Check the resistance before using.
- The kinematic viscosity must not exceed 50 mm²/s.

7.5 Air quality:

- Use clean air;
Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction of the valve.
- Install air filters;
Install air filters upstream, close to the valves. A filtration of 5 μm or less should be selected.
- Install an air drier or after cooler;
- Compressed air that includes excessive drainage may cause malfunction of valves and other pneumatic equipment. To prevent this, install an air drier or after cooler, etc.
- If excessive carbon powder is generated, eliminate it by installing mist separators upstream of the valves. If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction.

7.6 Vacuum:

- Please be aware there is a range of pressure that can be used.
- Do not use for applications such as holding the pressure (including vacuum) inside a pressure vessel because of air leakage in the valve.
- Vacuum piping direction:
If the system uses a vacuum pump, install the pump on the secondary side.
Also, install a filter on the primary side, ensuring no foreign material is admitted.
- Please replace the valve after 300,000 cycles.

7 Limitations of Use (continued)

7.7 Fluid: Steam

- The use of steam what 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.
- However, the size and shape of foreign objects that occur depends on the operating environment. Check the fluid state and choose an appropriate mesh size.
- Supply water to boilers may contain substances such as calcium and magnesium, which generate hard scale and sludge. Since this scale and sludge can cause the valve to malfunction, install water softening equipment and a filter (strainer) directly upstream from the valve to remove these substances.
- Do not use steam which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases etc., as these can cause damage or deterioration.

7.8 FKM for high temperature

- For steam and heated water, FKM for high temperature is used. FKM for high temperature is a special FKM which improves the alkali- resistance compared to general FKM. Resistance to other chemicals is the same as general FKM. Material compatibility must be checked before use.

7.9 Leakage voltage:

When connecting C-R element parallel to switching element, leakage current flows through C-R element and the leakage voltage increases.

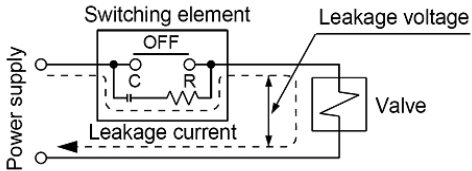


Figure 21

Ensure that the voltage leakage across the coil is as follows:

AC coil: 5% or less of rated voltage.

DC coil: 2% or less of rated voltage.

7.10 Low temperature operation:

- The valve can be used in an ambient temperature of between -10 to – 20°C. However, take measures to prevent the water from freezing or solidification of impurities, etc.
- When using valves for water application in cold environments, take appropriate countermeasures to prevent water freezing in the system, after the water supply from the pump is cut off, by draining the water, etc.
- When warming by a heater, etc, be careful not to expose the coil assembly to the heater.
- For air, installation of a drier and heat retaining of the body is recommended to prevent a freezing condition in which the dew point temperature is higher than the ambient temperature.

7.11 Cannot be used as an emergency shut-off valve etc.

- This product is not designed for safety applications such as an emergency shut-off valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

7.12 Extended periods of continuous energization

- The solenoid coil will generate heat when continuously energized, so avoid installing in an enclosed space. Install in a well-ventilated area.
- Do not touch the coil while it is being energized or immediately after energization.
- Be especially careful when using three or more adjacent valves with manifolds and keeping them continuously energized for extended periods, as this may result in dramatic increases in temperature.

7.13 Liquid circuits

- In cases with flowing liquid, provide a bypass valve in the system to prevent the formation of a sealed circuit.

7 Limitations of Use (continued)

7.14 Water hammer

- When problems are caused by water hammer, install water hammer relief equipment (accumulator, etc.), or use a SMC water hammer relief valve (e.g. VXR series).

7.15 Back pressure

- If there is a possibility of back pressure being applied to the valve, take countermeasures such as mounting a check valve on the downstream side of the valve.

8 Contacts

AUSTRIA	(43) 2262 62280-0	LATVIA	(371) 781 77 00
BELGIUM	(32) 3 355 1464	LITHUANIA	(370) 5 264 8126
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