SMC®

High Vacuum Angle Valve

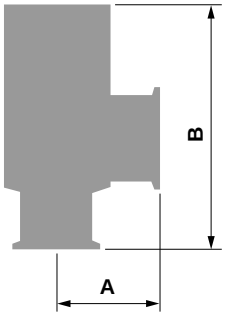
XL Series

Light weight and compact
Uniform baking temperature
High fluorine resistance
Low outgassing
Little heavy metal contamination

Series XL

High Vacuum
Angle Valve

Light weight & compact
Large conductance with a small valve body.



Series XLA (mm)

Model	A * mm	B mm	Weight kg (lb)	Conductance * ℓ/s
XLA-16	40	103	0.25 (0.55)	5
XLA-25	50	113	0.45 (0.99)	14
XLA-40	65	158	1.1 (2.43)	45
XLA-50	70	170	1.6 (3.53)	80
XLA-63	88	196	2.9 (6.39)	160
XLA-80	90	235	5.0 (11.02)	200

∗ Common to all series. 1in=25.4mm

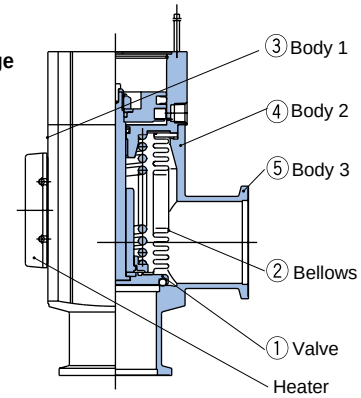
High fluorine resistance
Excellent resistance against fluorine corrosion.

Low outgassing
Low outgassing makes it possible to use a lower capacity pump and also to shorten evacuation time.

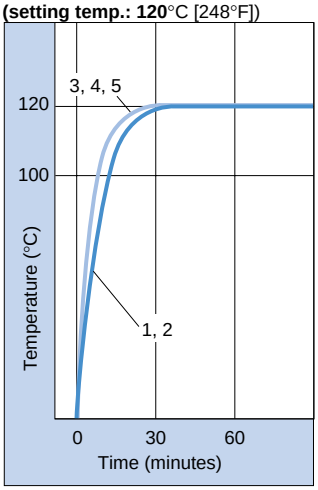
Little heavy metal contamination
The valve does not contain heavy metals such as Ni (nickel) or Cr (chrome) and a low sputtering yield also helps to minimize heavy metal contamination of semiconductor wafers.

Uniform baking temperature
Excellent thermal conductivity results in a uniform temperature for the entire valve body and a marked decrease in the condensation of gases inside the valve.

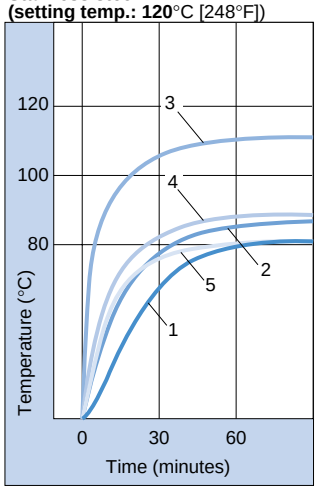
Comparison with KF25 flange



Aluminum (setting temp.: 120°C [248°F])



Stainless steel (setting temp.: 120°C [248°F])



°F=(1.8x°C)+32°

High Vacuum Angle Valve XL □Series Features

XLA/XLAV (Bellows seal, Single acting)
- Bellows type is particulate free and completely cleaned.
- Pressure balance mechanism allows unrestricted exhaust direction.

XLC/XLCV (Bellows Seal, Double acting)
- Bellows type is particulate free and completely cleaned.
- Pressure balance mechanism allows unrestricted exhaust direction.
- Overtravel mechanism maintains constant O-ring compression (size 50, 63, 80).

XLF/XLFV (O-ring seal, Single acting)
- Low gas entrainment with employment of O-ring seal system.
- High speed response and long service life.
- Particulates are reduced through special surface treatment of shaft seal.

XLG/XLGV (O-ring seal, Double acting)
- Low gas entrainment with employment of O-ring seal system.

XLG/XLGV (O-ring seal, Double acting) continued
- High speed response and long service life.
- Overtravel mechanism maintains constant O-ring compression (size 50, 63, 80).
- Particulates are reduced through special surface treatment of shaft seal.

XLD/XLDV (2 stage control, Single acting)
- Initial exhaust valve and main exhaust valve have been integrated (2 stage flow control valve).
- Makes compact system design and reduced piping possible.
- Minimizes particulates by eliminating turbulence during exhaust.
- Prevents pump overload.
- Initial exhaust valve flow is adjustable and adjustment can be locked.

XLH (Bellows seal, Manual operation)
- Bellows type is particulate free and completely cleaned.
- Pressure balance mechanism allows unrestricted exhaust direction.

XLH (Bellows seal, Manual operation) **continued**
- Low actuation torque (0.5N·m or less).
- Spring provides standard sealing load.
- Handle height is the same when valve is open or closed.
- Indicator to confirm opening and closing of valve is standard equipment.

XLS (Bellow pressure balance, Normally closed solenoid)
- Particulates are reduced because there are no sliding metal parts.
- Pressure balance mechanism allows unrestricted exhaust direction.
- A control power supply circuit for solenoid valve drive has been made standard.
- Can be used in portable equipment since air for drive is not necessary.

XSA (Direct solenoid operation)
- Solenoid valve with metal seal fittings (VCR®/Swagelok®)
- Particulates are reduced because there are no sliding metal parts.
- Improved reverse pressure performance.

High Vacuum Angle Valve

Actuation	Application	Shaft seal system	Models	Valve type	Operating pressure Pa	Leakage Pa m³/sec Internal	Leakage Pa m³/sec External	Service life (Million cycles)	Flange size 16	25	40	50	63	80	Options Switch	Heater	Indicator	High temp. specification	
Air operated	Particulate free completely cleaned	Bellows Seal	XLA	Single acting (N.C.)	10^5 to 10^{-6}	10^{-10}	10^{-11}	2	●	●	●	●	●	●	●	●	●	●	P.4 to P.7
			XLAV (With solenoid valve)						●	●	●	●	●	●	●	●	●		
			XLC	Double acting					●	●	●	●	●	●	●	●		●	P.8 to P.11
			XLCV (With solenoid valve)						●	●	●	●	●	●	●	●			
	High speed operation High volume operation	O-ring Seal	XLF	Single acting (N.C.)	2×10^5 to 10^{-5}	10^{-10}	10^{-10}	3 (Size 16, 25, 40)	●	●	●	●	●	●	●	●	●	●	P.12 to P.15
			XLFV (With solenoid valve)						●	●	●	●	●	●	●	●	●		
			XLG	Double acting				2 (Size 50, 63, 80)	●	●	●	●	●	●	●	●		●	P.16 to P.19
			XLGV (With solenoid valve)						●	●	●	●	●	●	●	●			
	Reduces particulates Eliminates pump over loads	Bellows, O-ring Seal	XLD	Single acting (N.C.)	10^5 to 10^{-6}	10^{-10}	10^{-11}	2	●	●	●	●	●	●	●	●	Stan-dard	●	P.20 to P.25
			XLDV (With solenoid valve)						●	●	●	●	●	●	●	●	Stan-dard		
Manual	For portable equipment not requiring air Particulate free completely cleaned	Bellows Seal	XLH	Manual	10^5 to 10^{-6}	10^{-10}	10^{-11}	0.1	●	●	●	●		●	●	●	Stan-dard	Stan-dard	P.26, P.27
Electromagnetic	For portable equipment not requiring air	(Bellows Balance)	XLS	Single acting (N.C.)	2×10^5 to 10^{-6}	10^{-8}	10^{-11}	0.5	●	●									P.28 to P.31

∗ Heater and high temperature specifications are not available with switches.

1Pa=0.145 x 10^{-3}psi

1MPa=145psi

Straight Solenoid Valve (with Metallic Seal Fitting)

Model	Valve type	Piping size	Orifice mmø	Effective sectional area mm²	Operating pressure Differential pressure MPa	Operating pressure Port A Pa	Leakage Pa m³/sec Internal	Leakage Pa m³/sec External	Leakage Pa m³/sec Fitting	Service life million cycles	
XSA1-12	Direct solenoid operation (N.C.)	1/4	2	3	0.8	10^{-6}	10^{-9}	10^{-11}	VCR® 10^{-11} SWJ® 10^{-10}	2	P.32 to P.34
XSA1-22			3	6	0.3						
XSA2-22					1.0						
XSA2-32			4.5	11	0.3						
XSA3-32					0.8						
XSA3-43		3/8	6	19	0.3						

∗ Differential Pressure: Indicates the maximum operable pressure difference between port P and port A. In the case of 0.8MPa, when port A is a vacuum, port P can be pressurized to 0.8MPa (7kgf/cm²G).

∗ VCR® Fitting and Swagelok® Fitting are registered trade marks of the Cajon Company and the Crawford Fitting Company Inc. respectively.

How to Order

XLA — 16 □ □ □ □ — F9N □

High vacuum angle valve
(Normally closed, bellows seal, air operated type)

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Indicator/Actuation port direction

Nil	Without indicator/Flange side
A	With indicator/Flange side
F	With indicator/Left flange surface
G	With indicator/Rear flange surface
J	With indicator/Right flange surface
K	Without indicator/Left flange surface
L	Without indicator/Rear flange surface
M	Without indicator/Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Temperature specifications/Heater

Symbol		Temp. range	Heater
Nil		5 to 60°C (41 to 140°F)	None
High temp. type	H0	5 to 150°C (41 to 302°F)	None
	H1		With heater for 80°C (176°F)
	H2		With heater for 100°C (212°F)
	H3		With heater for 120°C (248°F)

Switch quantity/ Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL

Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.


XLA

Option specifications/Combination table

Option specifications		Symbol	Model					
			XLA-16	XLA-25	XLA-40	XLA-50	XLA-63	XLA-80
Indicator		A	•	•	•	•	•	•
High temp. type	Without heater	H0	•	•	•	•	•	•
	With heater for 80°C (176°F)	H1	—	•	•	•	•	•
	With heater for 100°C (212°F)	H2	—	—	•	•	•	•
	With heater for 120°C (248°F)	H3	—	•	•	•	•	•

Note) Auto switches cannot be mounted in the case of high temperature types.

How to Order

XLAV — 16 ☐ F — F9N ☐ — 1 G ☐

High vacuum angle valve

Normally closed, bellows seal, air operated type with solenoid valve

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Solenoid valve/Indicator direction

F	With indicator/Left flange surface
G	With indicator/Rear flange surface
J	With indicator/Right flange surface
K	Without indicator/Left flange surface
L	Without indicator/Rear flange surface
M	Without indicator/Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m. For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL
Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	—	—
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	valve closed

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3	110VAC, 50/60Hz
4	220VAC, 50/60Hz
5	24VDC
6	12VDC

Electrical entry

G	Grommet (lead wire length 300mm)
H	Grommet (lead wire length 600mm)
L	L type plug connector
M	M type plug connector

Light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (non-polar type)

∗ The S type is not available for AC.
∗ The U type is DC only.

Note 1) Option specifications/Combinations
This model has indicator, auto switch and K(DN) flange options, but high temperature/heater options are not available.
Note 2) Solenoid valves
XLAV-16, 25, 40, 50: SYJ319 XLAV-63, 80: SYJ519
Example) SYJ319-1GS, etc.
For further details on solenoid valves, refer to the SMC solenoid valve catalog "SYJ 300, 500, 700" (E143-B).
Note 3) Solenoid valves are shipped facing downward (flange side), but can be rotated to face upward.

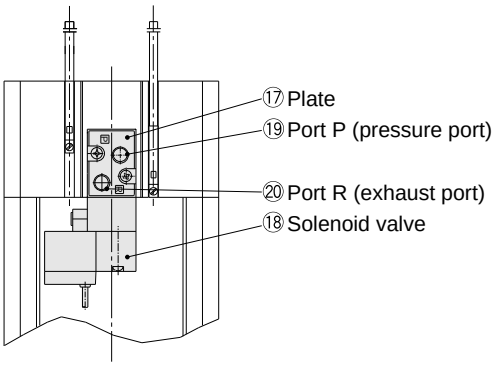
XLAV

Specifications

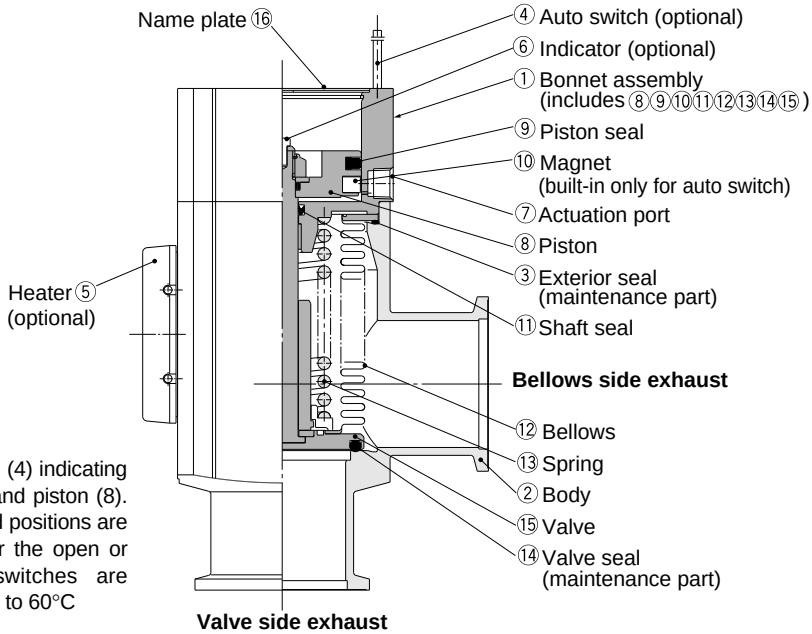
Model		XLA(V)-16	XLA(V)-25	XLA(V)-40	XLA(V)-50	XLA(V)-63	XLA(V)-80
Valve type		Normally closed (pressurize to open, spring seal)					
Fluid		Non-corrosive gas for aluminum alloy (A6063) and SUS304/316					
Operating temperature °C	XLA	5 to 60°C (41 to 140°F) [high temperature type: 5 to 150°C (41 to 302°F)]					
	XLAV	5 to 50°C (41 to 122°F)					
Operating pressure Pa {Torr}		Atmospheric pressure to 1 x 10^{-6} {760 to 7.5 x 10^{-9}}					
Conductance ℓ/s Note 1)		5	14	45	80	160	200
Leakage Pa m^3/s {Torr ℓ/s}	Internal	1.3 x 10^{-10} {1 x 10^{-9}} at ordinary temperatures, excluding gas transmission					
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas transmission					
Operating time s Note 2)		0.05	0.1	0.21	0.24	0.26	0.28
Flange type		KF (NW)				KF (NW), K (DN)	
Principle materials		Body: Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)					
Surface treatment		Exterior: Hard anodized Interior: Machined for clean environment					
Actuation pressure MPa		0.4 to 0.7 (58 to 101psi)					
Actuation port size	XLA	M5 (10-32 nominal)		Rc(PT) 1/8			
	XLAV	M5 (10-32 nominal) Ports P, R_1/R_2				Rc(PT) 1/8(Port P): M5(10-32 nominal) Ports R_1/R_2	
Actuating solenoid valve recommended Cv factor (XLC)		0.05≤	0.06≤	0.09≤	0.11≤	0.3≤	0.35≤
Service life (Million cycles)		2					
Weight kg (lb)	XLA	0.25 (0.55)	0.46 (1.01)	1.1 (2.43)	1.6 (3.52)	2.9 (6.39)	5.0 (11.02)
	XLAV	0.29 (0.64)	0.49 (1.08)	1.14 (2.51)	1.64 (3.61)	2.96 (6.52)	5.06 (11.16)

Note 1) Conductance is the same as that of an elbow with the same dimensions.
Note 2) The time required for 90% valve movement when an actuation pressure of 0.5MPa {72psi} is applied. There is a difference of about 20% in this value at the upper and lower pressure limits.
Note 3) For valve heater specifications, refer to "Common Option Specifications, [1] Heaters" on page 37.

Construction /Operation



With solenoid valve



Valve side exhaust

Options

④ Auto switch: The magnet (10) actuates the auto switch (4) indicating the position of the integrated valve (15) and piston (8). With 2 auto switches, the open and closed positions are detected, and with 1 auto switch, either the open or closed position is detected. Auto switches are applicable at ordinary temperatures only 5 to 60°C (41 to 140°F).

⑤ Heater: Simple heating is performed using thermistors. The valve body can be heated to approximately 80, 100 or 120°C (176, 212 or 248°F) depending on the heater option and the valve size. The type and number of thermistors to be used will vary depending upon size and setting temperature. In the case of high temperature specifications, the bonnet assembly (1) is a heat resistant structure.

⑥ Indicator: When the valve is open, an orange marker about 1mm in height appears in the center of the name plate (16).

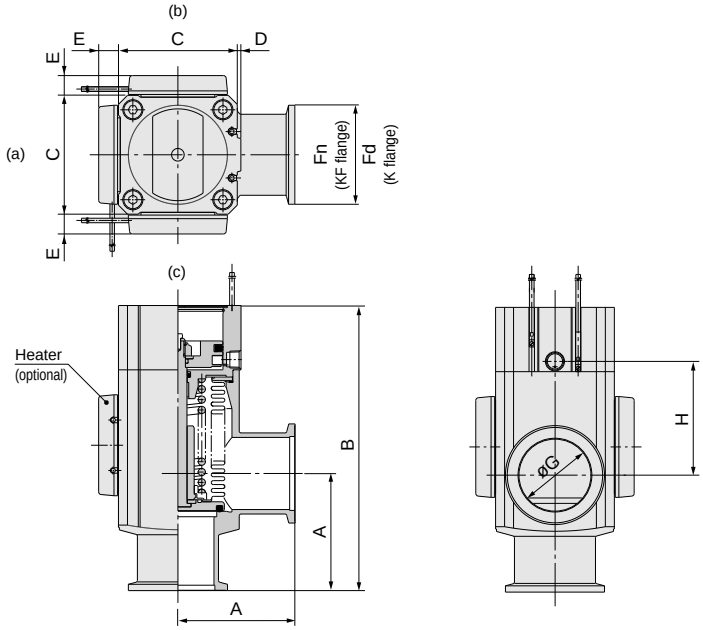
Operation principle

By applying pressure from the actuation port (7), the piston (8), which is sealed by the shaft seal (11) and the piston seal (9), overcomes the force of the spring (13), and the valve (15) opens.
With the exhaust of air pressure, the valve (15) is closed by the force of the spring (13) and is sealed by the valve seal (14).
In the case of the XLAV, port P(19) is normally pressurized, and the valve (15) opens when the solenoid valve (18) is turned ON and closes when it is turned OFF. Operation is the same as that of the XLA.

Dimensions (mm)

1in = 25.4mm

XLA/Air operated type

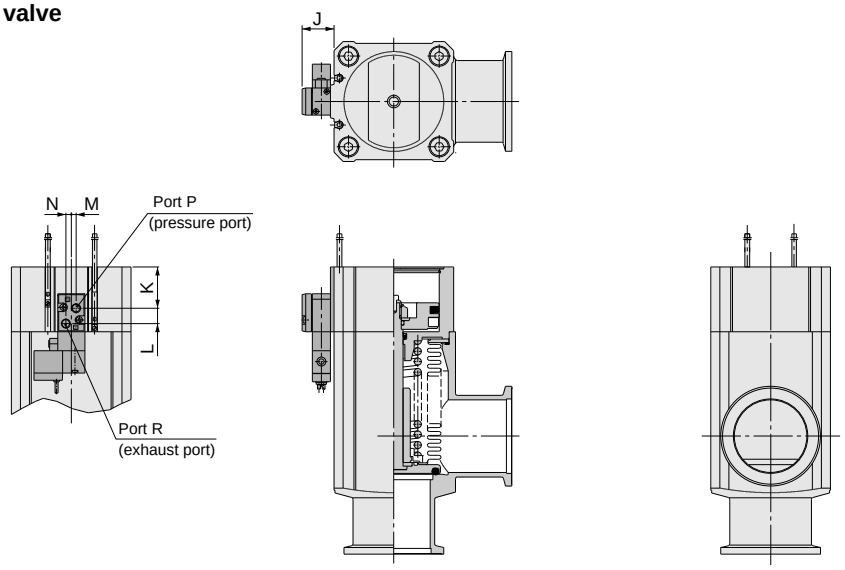


(mm)

Model	A	B	C	D	E Note 1)	Fn	Fd	G	H
XLA-16	40	103	38	1	—	30	—	17	40
XLA-25	50	113	48	1	12	40	—	26	39
XLA-40	65	158	66	2	11	55	—	41	63
XLA-50	70	170	79	2	11	75	—	52	68
XLA-63	88	196	100	3	11	87	95	70	69
XLA-80	90	235	117	3	11	114	110	83	96

Note 1) Dimension E applies when heater option is included. (lead wire length: approx. 1m)
Note 2) (a), (b) and (c) in the above drawing indicate heater mounting positions.
Moreover, heater mounting positions will differ depending on the type of heater.
For further details, refer to mounting positions under Replacement heaters/Part Nos. on page 46.

XLAV/With solenoid valve



(mm)

Model	J	K	L	M	N
XLAV-16	16.5	13	8.5	3	3
XLAV-25	16.5	14	8.5	3	3
XLAV-40	17.5	23	8.5	3	3
XLAV-50	17.5	25	8.5	3	3
XLAV-63	29	29	12	4	2
XLAV-80	29	39	12	4	2

∗ Other dimensions are the same as XLA.

How to Order

XLC — 16 □ □ □ — F9N □

High vacuum angle valve
(Double acting, bellows seal, air operated type)

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Actuation port direction

Nil	Flange side
K	Left flange surface
L	Rear flange surface
M	Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Temperature specifications/Heater

Symbol		Temp. range	Heater
Nil		5 to 60°C (41 to 140°F)	None
High temp. type	H0	5 to 150°C (41 to 302°F)	None
	H1		With heater for 80°C (176°F)
	H2		With heater for 100°C (212°F)
	H3		With heater for 120°C (248°F)

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL

Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

XLC

High temperature type combination table

High temperature specifications	Symbol	Model					
		XLC-16	XLC-25	XLC-40	XLC-50	XLC-63	XLC-80
Without heater	H0	•	•	•	•	•	•
With heater for 80° (176°F)	H1	–	•	•	•	•	•
With heater for 100°C (212°F)	H2	–	–	•	•	•	•
With heater for 120°C (248°F)	H3	–	•	•	•	•	•

Note) Auto switches cannot be mounted in the case of high temperature types.

How to Order

XLCV — 16 ☐ K — F9N ☐ — 1 ☐ G ☐

High vacuum angle valve
Double acting, bellows seal, air operated type with solenoid valve

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Solenoid valve direction

K	Left flange surface
L	Rear flange surface
M	Right flange surface

Note) Solenoid valve direction
(Example) Left flange surface: Indicates that the direction of the solenoid valve is to the left side when the flange surface is viewed from the front.

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL
Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3	110VAC, 50/60Hz
4	220VAC, 50/60Hz
5	24VDC
6	12VDC

Solenoid valve action

Nil	2 position single
W	2 position double

Electrical entry

G	Grommet (lead wire length 300mm)
H	Grommet (lead wire length 600mm)
L	L type plug connector
M	M type plug connector

Light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (non-polar type)

∗ The S type is not available for AC.
∗ The U type is DC only.

XLCV

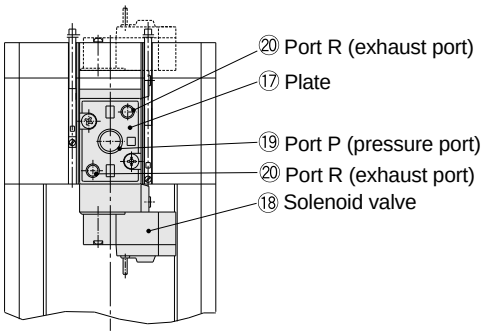
Note 1) Option specifications/Combinations
This model has auto switch and K(DN) flange options, but high temperature/heater options are not available.
Note 2) Solenoid valves
2 position single : XLCV-16, 25, 40, 50 : SYJ3190 XLCV-63, 80 : SYJ5190
2 position double: XLCV-16, 25, 40, 50 : SYJ3290 XLCV-63, 80 : SYJ5290
Examples) SYJ3190-1GS SYJ3290-1GS
For further details on solenoid valves, refer to the SMC solenoid valve catalog "SYJ 3000, 5000, 7000" (N237).
Note 3) The direction of solenoid valve coils cannot be changed.

Specifications

Model		XLC(V)-16	XLC(V)-25	XLC(V)-40	XLC(V)-50	XLC(V)-63	XLC(V)-80
Valve type		Double acting (dual operation), pressurize to open/close					
Fluid		Non-corrosive gas for aluminum alloy (A6063) and SUS304/316					
Operating temperature °C	XLC	5 to 60°C (41 to 140°F) [high temperature type: 5 to 150°C (41 to 302°F)]					
	XLCV	5 to 50°C (41 to 122°F)					
Operating pressure Pa {Torr}		Atmospheric pressure to 1 x 10^{-6} {760 to 7.5 x 10^{-9}}					
Conductance ℓ/s Note 1)		5	14	45	80	160	200
Leakage Pa m³/s {Torr ℓ/s}	Internal	1.3 x 10^{-10} {1 x 10^{-9}} at ordinary temperatures, excluding gas permeation					
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas permeation					
Operating time s Note 2)		0.08	0.15	0.35	0.4	0.54	0.7
Flange type		KF (NW)				KF (NW), K (DN)	
Principle materials		Body: Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)					
Surface treatment		Exterior: Hard anodized Interior: Machined for clean environment					
Actuation pressure MPa		0.3 to 0.6 {43 to 87psi}					
Actuation port size	XLC	M5 (10-32 nominal)		Rc(PT) 1/8			
	XLCV	M5 (10-32 nominal) Ports P, R1/R2				Rc(PT) 1/8(Port P): M5(10-32 nominal) Ports R1/R2	
Actuating solenoid valve recommended Cv factor (XLC)		0.05≤	0.06≤	0.09≤	0.11≤	0.3≤	0.35≤
Service life (Million cycles)		2					
Weight kg (lb)	XLC	0.28 (0.62)	0.46 (1.01)	1.1 (2.43)	1.7 (3.75)	3.1 (6.83)	5.1 (11.24)
	XLCV	0.32 (0.71)	0.5 (1.10)	1.15 (2.54)	1.74 (3.84)	3.16 (6.97)	5.16 (11.38)

Note 1) Conductance is the same as that of an elbow with the same dimensions.
Note 2) The time required for 90% valve movement when an actuation pressure of 0.5MPa {72psi} is applied. There is a difference of about 20% in this value at the upper and lower pressure limits.
Note 3) For valve heater specifications, refer to "Common Option Specifications, [1] Heaters" on page 37.

Construction/Operation



With solenoid valve

Operating principle

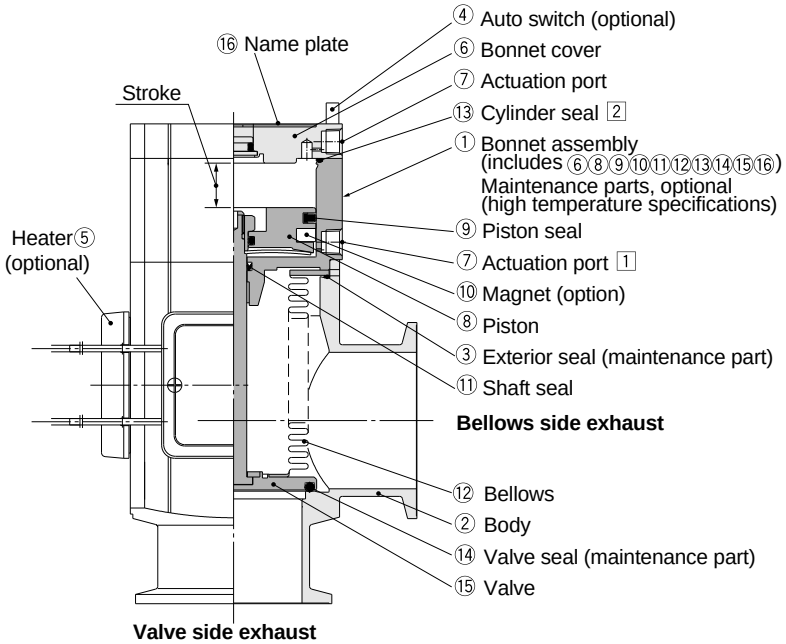
By applying pressure from the actuating port [1]-(7), the piston (8), sealed by the shaft seal (11) and the piston seal (9), is operated opening the valve. (actuation port [2]-(7) is released)

Conversely, by applying pressure to actuation port [2]-(7), the piston (8), sealed by the cylinder seal (13) and the piston seal (9), is operated closing the valve (15) which is sealed by the valve seal (14). (actuation port [1]-(7) is released)

In the case of the XLCV, port P (19) is normally pressurized, and the valve (15) opens when the solenoid valve (18) is turned ON, and closes when it is turned OFF.

Moreover, in the case of a double solenoid, the valve moves to the side where the solenoid valve (18) is turned ON. Operation is the same as that of the XLC.

For sizes 50, 63 and 80, the valve is sealed with a standard load by means of an overrun mechanism.



Options

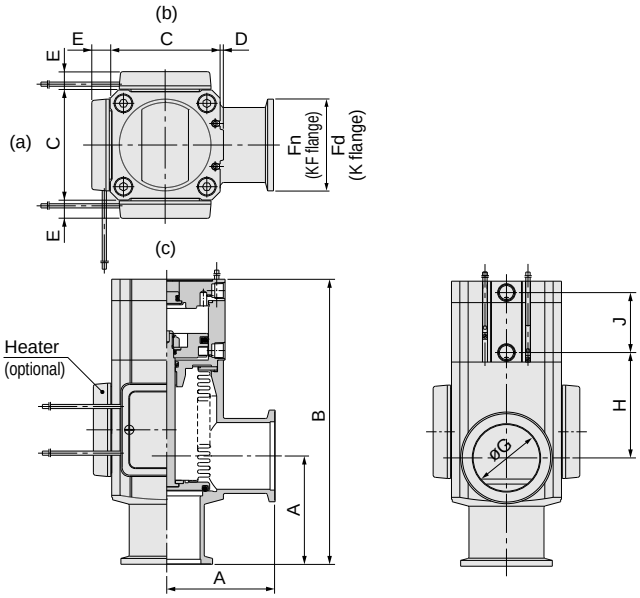
④ Auto switch: The magnet (10) actuates the auto switch (4) indicating the position of the integrated valve (15) and piston (8). With 2 auto switches, the open and closed positions are detected, and with 1 auto switch, either the open or closed position is detected. Auto switches are applicable at ordinary temperatures only 5 to 60°C (41° to 140°F).

⑤ Heater: Simple heating is performed using thermistors. The valve body can be heated to approximately 80, 100 or 120°C (176, 212, 248°F), depending on the heater option and the valve size. The type and number of thermistors to be used will vary depending upon size and setting temperature. In the case of high temperature specifications, the bonnet assembly (1) is a heat resistant structure.

Dimensions (mm)

1in = 25.4mm

XLC/Air operated type

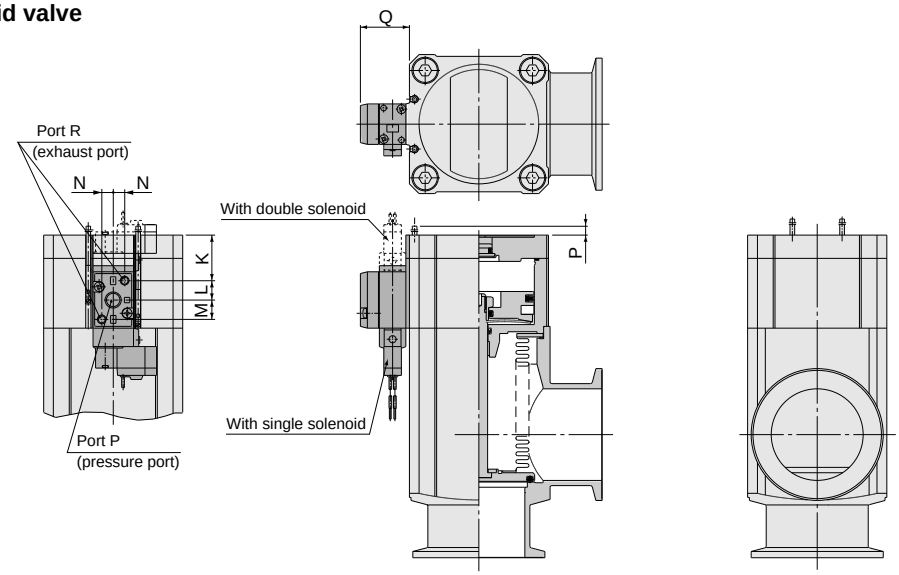


(mm)

Model	A	B	C	D	E Note 1)	Fn	Fd	G	H	J
XLC-16	40	110	38	1	—	30	—	17	40	26
XLC-25	50	120	48	1	12	40	—	26	39	28
XLC-40	65	171	66	2	11	55	—	41	63	36
XLC-50	70	183	79	2	11	75	—	52	68	38
XLC-63	88	209	100	3	11	87	95	70	69	45
XLC-80	90	250	117	3	11	114	110	83	96	56

Note 1) Dimension E applies when heater option is included. (lead wire length: approx. 1m)
Note 2) (a), (b) and (c) in the above drawing indicate heater mounting positions.
Moreover, heater mounting positions will differ depending on the type of heater.
For further details, refer to mounting positions under Replacement heaters/Part Nos. on page 46.

XLCV/With solenoid valve



(mm)

Model	K	L	M	N	P	Q
XLCV-16	14	9	6.5	3	17	16.5
XLCV-25	16	9	6.5	3	15	16.5
XLCV-40	29	9	6.5	3	2	17.5
XLCV-50	42	9	6.5	3	6	17.5
XLCV-63	32	11	11	6.5	–	29
XLCV-80	45	11	11	6.5	–	29

∗ Other dimensions are the same as XLA.

How to Order

XLF — 16 □ □ □ — F9N □

High vacuum angle valve
(Normally closed, O-ring seal, air operated type)

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Indicator/Actuation port direction

Nil	Without indicator/Flange side
A	With indicator/Flange side
F	With indicator/Left flange surface
G	With indicator/Rear flange surface
J	With indicator/Right flange surface
K	Without indicator/Left flange surface
L	Without indicator/Rear flange surface
M	Without indicator/Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL
Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

Temperature specifications/Heater

Symbol		Temp. range	Heater
Nil		5 to 60°C (41 to 140°F)	None
High temp. type	H0	5 to 150°C (41 to 302°F)	None
	H1		With heater for 80°C (176°F)
	H2		With heater for 100°C (212°F)
	H3		With heater for 120°C (248°F)

XLF

Option specifications/Combination table

Option specifications		Symbol	Model					
			XLF-16	XLF-25	XLF-40	XLF-50	XLF-63	XLF-80
Indicator		A	•	•	•	•	•	•
High temp. type	Without heater	H0	•	•	•	•	•	•
	With heater for 80°C (176°F)	H1	–	•	•	•	•	•
	With heater for 100°C (212°F)	H2	–	–	•	•	•	•
	With heater for 120°C (248°F)	H3	–	•	•	•	•	•

Note) Auto switches cannot be mounted in the case of high temperature types.

How to Order

XLFV — 16 ☐ F — F9N ☐ — 1 G ☐

High vacuum angle valve
Normally closed, O-ring seal, air operated type with solenoid valve

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Solenoid valve/Indicator direction

F	With indicator/Left flange surface
G	With indicator/Rear flange surface
J	With indicator/Right flange surface
K	Without indicator/Left flange surface
L	Without indicator/Rear flange surface
M	Without indicator/Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL

Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	—	—
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3	110VAC, 50/60Hz
4	220VAC, 50/60Hz
5	24VDC
6	12VDC

Electrical entry

G	Grommet (lead wire length 300mm)
H	Grommet (lead wire length 600mm)
L	L type plug connector
M	M type plug connector

Light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (non-polar type)

∗ The S type is not available for AC.
∗ The U type is DC only.

XLFV

Note 1) Option specifications/Combinations
This model has indicator, auto switch and K(DN) flange options, but high temperature/heater options are not available.

Note 2) Solenoid valves
XLFV-16, 25, 40: SYJ319 XLFV-50, 63, 80: SYJ519 Example) SYJ319-1GS
For further details on solenoid valves, refer to the SMC solenoid valve catalog "SYJ300, 500, 700" (N220).

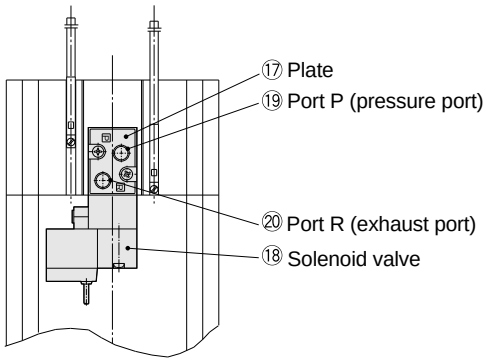
Note 3) Solenoid valves are shipped facing downward (flange side), but can be rotated to face upward.

Specifications

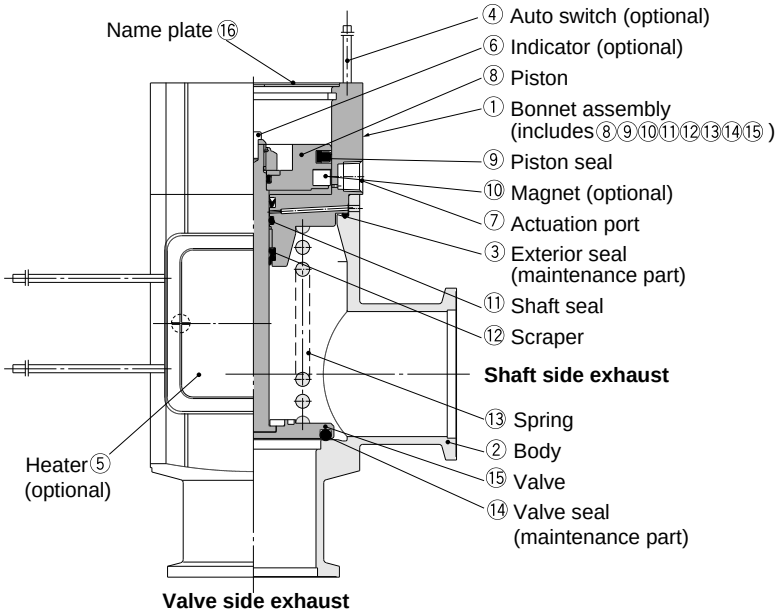
Model		XLF(V)-16	XLF(V)-25	XLF(V)-40	XLF(V)-50	XLF(V)-63	XLF(V)-80
Valve type		Normally closed (pressurize to open, spring seal)					
Fluid		Non-corrosive gas for aluminum alloy (A6063) and SUS304/316					
Operating temperature °C	XLF	5 to 60°C (41 to 140°F) [high temperature type: 5 to 150°C (41 to 302°F)]					
	XLFV	5 to 50°C (41 to 122°F)					
Operating pressure Pa {Torr}		Atmospheric pressure to 1 x 10^{-6} {760 to 7.5 x 10^{-9}}					
Conductance ℓ/s Note 1)		5	14	45	80	160	200
Leakage Pa m^3/s {Torr ℓ/s}	Internal	1.3 x 10^{-10} {1 x 10^{-9}} at ordinary temperatures, excluding gas transmission					
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas transmission					
Operating time ms Note 2)	XLF	30	35	40	45	65	85
	XLFV	30	35	60	60	100	130
Flange type		KF (NW)				KF (NW), K (DN)	
Principle materials		Body: Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)					
Surface treatment		Exterior: Hard anodized Interior: Machined for clean environment					
Actuation pressure MPa		0.4 to 0.7 (58 to 101psi)					
Actuation port size	XLF	M5 (10-32 nominal)		Rc(PT) 1/8			
	XLFV	M5 (10-32 nominal) Ports P, R				Rc(PT) 1/8(Port P): M5(10-32 nominal) (Port)	
Actuating solenoid valve recommended Cv factor (XLF)		0.06≤	0.09≤	0.11≤	0.15≤	0.4≤	0.5≤
Service life (Million cycles)		3			2		
Weight kg (lb)	XLF	0.25 (0.55)	0.45 (0.99)	1.1 (2.43)	1.6 (3.52)	3.0 (6.61)	4.8 (10.58)
	XLFV	0.29 (0.64)	0.49 (1.08)	1.14 (2.51)	1.66 (3.65)	3.06 (6.75)	4.86 (10.72)

Note 1) Conductance is represented by the value of an elbow with the same dimensions.
Note 2) The operating time with no solenoid valve (XLF) is the same value as the case of the solenoid valve piped directly to the bonnet, where the actuation pressure is 0.5MPa (72psi). The operating time becomes faster under high pressure.
Note 3) For valve heater specifications, refer to "Common Option Specifications, [1] Heaters" on page 37.

Construction/Operation



With solenoid valve



Valve side exhaust

Operating principle

By applying pressure from the actuation port (7), the piston (8), which is sealed by the shaft seal (11) and the piston seal (9), overcomes the force of the spring (13), and the valve (15) opens.

With the exhaust of air pressure, the valve (15) is closed by the force of the spring (13) and is sealed by the valve seal (14).

In the case of the XLFV, port P (19) is normally pressurized, and the valve (15) opens when the solenoid valve (18) is turned ON, and closes when it is turned OFF. Operation is the same as that of the XLF.

Options

For selections, refer to item 3, model number and option symbol table.

④ Auto switch: The magnet (10) actuates the auto switch (4) indicating the position of the integrated valve (15) and piston (8). With 2 auto switches, the open and closed positions are detected, and with 1 auto switch, either the open or closed position is detected. Auto switches are applicable at ordinary temperatures only 5 to 60°C (41 to 140°F).

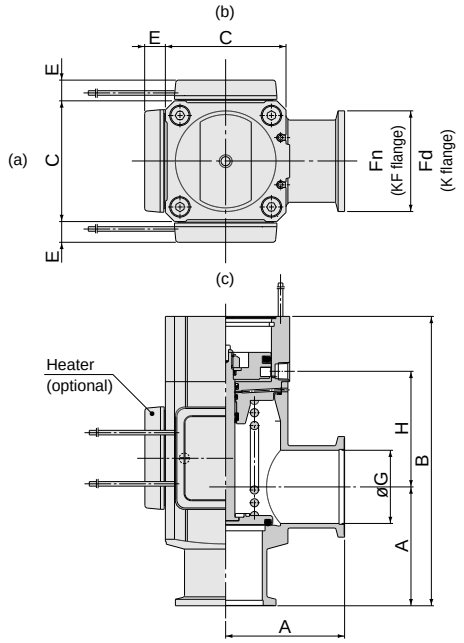
⑤ Heater: Simple heating is performed using thermistors. The valve body can be heated to approximately 80, 100 or 120°C (176, 212, or 248°F), depending on the heater option and the valve size. The type and number of thermistors to be used will vary depending upon size and setting temperature. In the case of high temperature specifications, the bonnet assembly (1) is a heat resistant structure. This is not available with solenoid valve.

⑥ Indicator: When the valve is open, an orange marker about 1mm in height appears in the center of the name plate (16).

Dimensions (mm)

1in=25.4mm

XLF/Air operated type

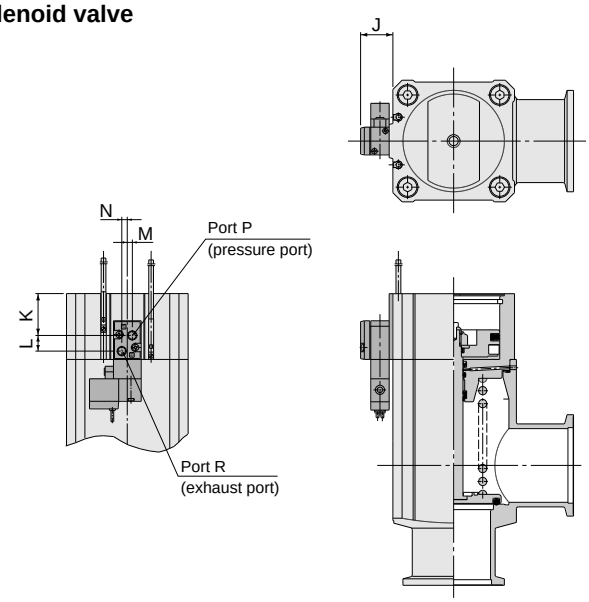


(mm)

Model	A	B	C	D	E Note 1)	Fn	Fd	G	H
XLF-16	40	103	38	1	–	30	–	17	40
XLF-25	50	113	48	1	12	40	–	26	39
XLF-40	65	158	66	2	11	55	–	41	63
XLF-50	70	170	79	2	11	75	–	52	68
XLF-63	88	196	100	3	11	87	95	70	69
XLF-80	90	235	117	3	11	114	110	83	96

Note 1) Dimension E applies when heater option is included. (lead wire length: approx. 1m)
Note 2) (a), (b) and (c) in the above drawing indicate heater mounting positions.
Moreover, heater mounting positions will differ depending on the type of heater.
For further details, refer to mounting positions under Replacement heaters/Part Nos. on page 46.

XLFV/With solenoid valve



(mm)

Model	J	K	L	M	N
XLFV-16	16.5	13	8.5	3	3
XLFV-25	16.5	14	8.5	3	3
XLFV-40	17.5	23	8.5	3	3
XLFV-50	28	23	12	4	2
XLFV-63	29	29	12	4	2
XLFV-80	29	39	12	4	2

∗ Other dimensions are the same as XLF.

How to Order

XLG — 16 □ □ □ — F9N □

High vacuum angle valve
(Double acting, O-ring seal, air operated type)

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Actuation port direction

Nil	Flange side
K	Left flange surface
L	Rear flange surface
M	Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Temperature specifications/Heater

Symbol		Temp. range	Heater
Nil		5 to 60°C (41 to 140°F)	None
High temp. type	H0	5 to 150°C (41 to 302°F)	None
	H1		With heater for 80°C (176°F)
	H2		With heater for 100°C (212°F)
	H3		With heater for 120°C (248°F)

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL

Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

XLG

High temperature type combination table

High temperature specifications	Symbol	Model					
		XLG-16	XLG-25	XLG-40	XLG-50	XLG-63	XLG-80
Without heater	H0	•	•	•	•	•	•
With heater for 80° (176°F)	H1	–	•	•	•	•	•
With heater for 100°C (212°F)	H2	–	–	•	•	•	•
With heater for 120°C (248°F)	H3	–	•	•	•	•	•

Note) Auto switches cannot be mounted in the case of high temperature types.

How to Order

XLGV — 16 ☐ K — F9N ☐ — 1 ☐ G ☐

High vacuum angle valve
Double acting, O-ring seal, air operated type with solenoid valve

Flange size

16
25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	16, 25, 40, 50, 63, 80
D	K(DN)	63, 80

Solenoid valve direction

K	Left flange surface
L	Rear flange surface
M	Right flange surface

Note) Solenoid valve direction
(Example) Left flange surface: Indicates that the direction of the solenoid valve is to the left side when the flange surface is viewed from the front.

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL

Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3	110VAC, 50/60Hz
4	220VAC, 50/60Hz
5	24VDC
6	12VDC

Solenoid valve action

Nil	2 position single
W	2 position double

Electrical entry

G	Grommet (lead wire length 300mm)
H	Grommet (lead wire length 600mm)
L	L type plug connector
M	M type plug connector

Light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (non-polar type)

∗ The S type is not available for AC.
∗ The U type is DC only.

XLGV

Note 1) Option specifications/Combinations
This model has auto switch and K(DN) flange options, but high temperature/heater options are not available.

Note 2) Solenoid valves
2 position single: XLGV-16, 25, 40: SYJ3190 XLGV-50, 63, 80: SYJ5190
2 position double: XLGV-16, 25, 40: SYJ3290 XLGV-50, 63, 80: SYJ5290
Examples) SYJ3190-1GS SYJ3290-1GS
For further details on solenoid valves, refer to the SMC solenoid valve catalog "SYJ 3000, 5000, 7000" (N237).

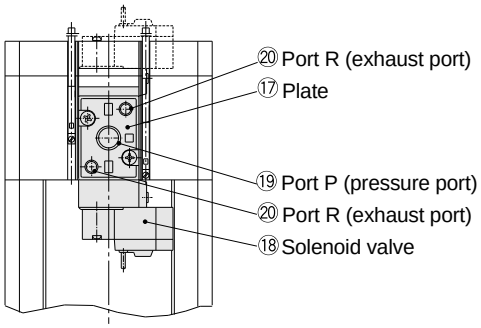
Note 3) The direction of solenoid valves cannot be changed.

Specifications

Model		XLG(V)-16	XLG(V)-25	XLG(V)-40	XLG(V)-50	XLG(V)-63	XLG(V)-80
Valve type		Double acting (dual operation), pressurize to open/close					
Fluid		Non-corrosive gas for aluminum alloy (A6063) and SUS304/316					
Operating temperature °C	XLG	5 to 60°C (41 to 140°F) [high temperature type: 5 to 150°C (41 to 302°F)]					
	XLGV	5 to 50°C (41 to 122°F)					
Operating pressure Pa {Torr}		Atmospheric pressure to 1 x 10^{-6} {760 to 7.5 x 10^{-9}}					
Conductance ℓ/s Note 1)		5	14	45	80	160	200
Leakage Pa m^3/s {Torr ℓ/s}	Internal	1.3 x 10^{-10} {1 x 10^{-9}} at ordinary temperatures, excluding gas transmission					
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas transmission					
Operating time ms Note 2)	XLG	40	45	60	60	95	105
	XLGV	45	50	85	90	132	150
Flange type		KF (NW)				KF (NW), K (DN)	
Principle materials		Body: Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)					
Surface treatment		Exterior: Hard anodized Interior: Machined for clean environment					
Actuation pressure MPa		0.3 to 0.6 (43 to 87psi)					
Actuation port size	XLG	M5 (10-32 nominal)		Rc(PT) 1/8			
	XLGV	M5 (10-32 nominal) Ports P, R1/R2				Rc(PT) 1/8(Port P): M5(10-32 nominal) (Ports R1/R2)	
Actuating solenoid valve recommended Cv factor (XLG)		0.06≤	0.09≤	0.11≤	0.15≤	0.4≤	0.5≤
Service life (Million cycles)		3			2		
Weight kg (lb)	XLG	0.28 (0.62)	0.46 (1.01)	1.1 (2.43)	1.7 (3.74)	3.1 (6.83)	5.1 (11.24)
	XLGV	0.32 (0.71)	0.5 (1.10)	1.14 (2.51)	1.76 (3.88)	3.16 (6.97)	5.16 (11.38)

Note 1) Conductance is the same as that of an elbow with the same dimensions.
Note 2) The operating time with no solenoid valve (XLG) is the same value as the case of the solenoid valve piped directly to the bonnet, where the actuation pressure is 0.5MPa (72psi). The operating time becomes faster under high pressure.
Note 3) For valve heater specifications, refer to "Common Option Specifications, [1] Heaters" on page 37.

Construction/Operation



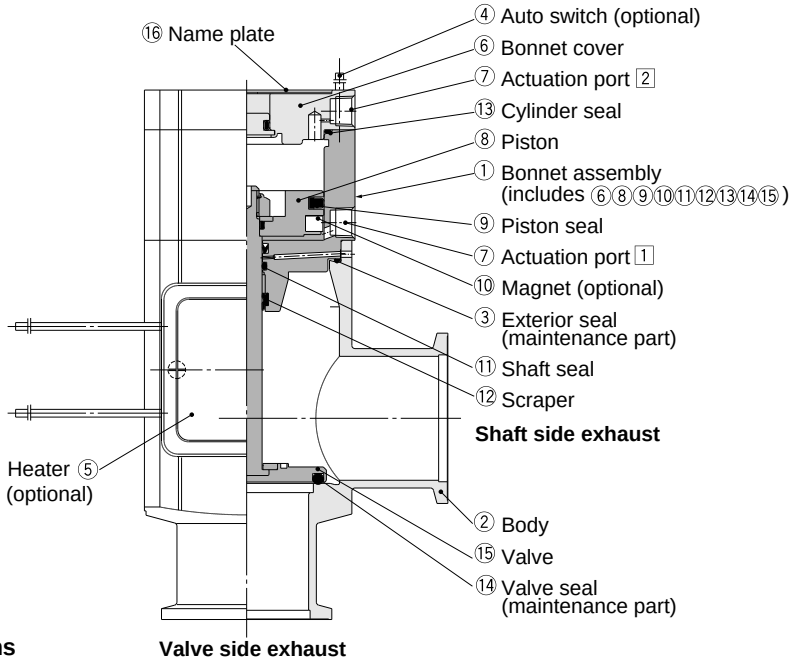
Operating principle

By applying pressure from the actuating port [1]-(7), the piston (8), sealed by the shaft seal (11) and the piston seal (9), is operated opening the valve (actuation port [2]-(7) is released). Conversely, by applying pressure to actuation port [2]-(7), the piston (8), sealed by the cylinder seal (13) and the piston seal (9), is operated closing the valve (15) which is sealed by the valve seal (14) (actuation port [1]-(7) is released). In the case of the XLCV, port P (19) is normally pressurized, and the valve (15) opens when the solenoid valve (18) is turned ON, and closes when it is turned OFF.

Moreover, in the case of a double solenoid, the valve moves to the side where the solenoid valve (18) is turned ON.

Operation is the same as that of the XLC.

For sizes 50, 63 and 80, the valve is sealed with a standard load by means of an overrun mechanism.



Options

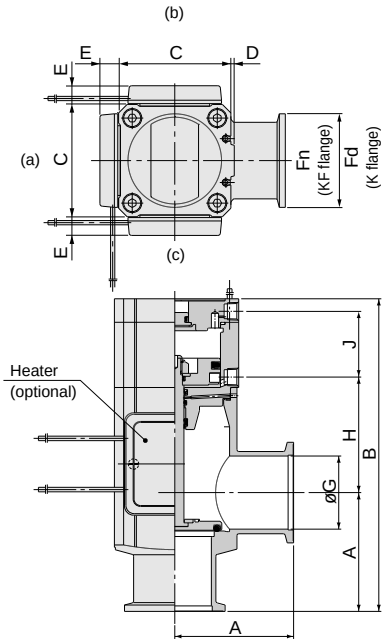
④ Auto switch: The magnet (10) actuates the auto switch (4) indicating the position of the integrated valve (15) and piston (8). With 2 auto switches, the open and closed positions are detected, and with 1 auto switch, either the open or closed position is detected. Auto switches are applicable at ordinary temperatures only 5 to 60°C (41 to 140°F).

⑤ Heater: Simple heating is performed using thermistors. The valve body can be heated to approximately 80, 100 or 120°C (176, 212, 248°F) depending on the heater option and the valve size. The type and number of thermistors to be used will vary depending upon size and setting temperature. In the case of high temperature specifications, the bonnet assembly (1) is a heat resistant structure. This is not available with solenoid valve.

Dimensions (mm)

1in=25.4mm

XLG/Air operated type



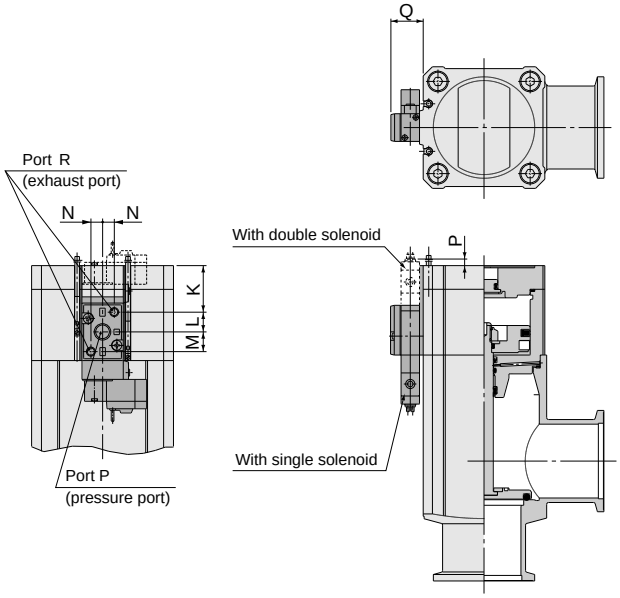
(mm)

Model	A	B	C	D	E Note 1)	Fn	Fd	G	H	J
XLG-16	40	110	38	1	—	30	—	17	**40**	26
XLG-25	50	120	48	1	12	40	—	26	**39**	28
XLG-40	65	171	66	2	11	55	—	41	**63**	36
XLG-50	70	183	79	2	11	75	—	52	**68**	38
XLG-63	**88**	209	100	3	11	87	95	70	**69**	45
XLG-80	90	250	117	3	11	114	110	83	**96**	56

Note 1) Dimension E applies when heater option is included. (lead wire length: approx. 1m)

Note 2) (a), (b) and (c) in the above drawing indicate heater mounting positions.
Moreover, heater mounting positions will differ depending on the type of heater.
For further details, refer to mounting positions under Replacement heaters/Part Nos. on page 46.

XLGV/With solenoid valve



(mm)

Model	K	L	M	N	P	Q
XLGV-16	14	9	6.5	3	17	16.5
XLGV-25	16	9	6.5	3	15	16.5
XLGV-40	29	9	6.5	3	2	17.5
XLGV-50	26	11	11	6.5	6	28
XLGV-63	32	11	11	6.5	–	29
XLGV-80	45	11	11	6.5	–	29

∗ Other dimensions are the same as XLG.

How to Order

XLD — 25 □ □ □ — F9N □

High vacuum angle valve
Smooth exhaust valve, normally closed, air operated type

Flange size

25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	25, 40, 50, 63, 80
D	K(DN)	63, 80

Actuation port direction

Nil	Flange side
K	Left flange surface
L	Rear flange surface
M	Right flange surface

Note) Actuation port direction
(Example) Left flange surface: Indicates that the direction of the actuation port is to the left side when the flange surface is viewed from the front.

Temperature specifications/Heater

Symbol		Temp. range	Heater
Nil		5 to 60°C (41 to 140°F)	None
High temp. type	H0	5 to 150°C (41 to 302°F)	None
	H1		With heater for 80°C (176°F)
	H2		With heater for 100°C (212°F)
	H3		With heater for 120°C (248°F)

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Both sides
B	1pc.	Valve open
C	1pc.	Valve closed

Auto switch type

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL

Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

XLD

High temperature type combination table

High temp. specifications	Symbol	Model				
		XLD-25	XLD-40	XLD-50	XLD-63	XLD-80
Without heater	H0	•	•	•	•	•
With heater for 80°C (176°F)	H1	•	•	•	•	•
With heater for 100°C (212°F)	H2	–	•	•	•	•
With heater for 120°C (248°F)	H3	•	•	•	•	•

Note) Auto switches cannot be mounted in the case of high temperature types.

How to Order

XLDV — 25 ☐ K — F9N ☐ — 1 G ☐

High vacuum angle valve

Smooth exhaust valve, normally closed, air operated type with solenoid valve

Flange size

25
40
50
63
80

Flange type

Symbol	Type	Applicable flange size
Nil	KF(NW)	25, 40, 50, 63, 80
D	K(DN)	63, 80

Solenoid valve direction

K	Left flange surface
L	Rear flange surface
M	Right flange surface

Note) Solenoid valve direction
(Example) Left flange surface: Indicates that the direction of the solenoid valve is to the left side when the flange surface is viewed from the front.

Auto switch type (for main exhaust valve)

Nil	Without auto switch (without built-in magnet)
Solid state auto switches	
F9N	D-F9N
F9P	D-F9P
F9B	D-F9B

Note 1) The standard lead wire length is 0.5m.
For 3m, "L" is added at the end of the part number.
(Example) F9NL: D-F9NL
Note 2) An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or secured against a stopper or the valve body (depending on the valve size) for detection of valve closing.

Switch quantity/Mounting position

Symbol	Quantity	Mounting position
Nil	–	–
A	2pcs.	Valve open/closed
B	1pc.	Valve open
C	1pc.	Valve closed

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3	110VAC, 50/60Hz
4	220VAC, 50/60Hz
5	24VDC
6	12VDC

Electrical entry

G	Grommet (lead wire length 300mm)
H	Grommet (lead wire length 600mm)
L	L type plug connector
M	M type plug connector

Light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (non-polar type)

∗ The S type is not available for AC.
∗ The U type is DC only.

XLDV

Note 1) Option specifications/Combinations
This model has indicator, auto switch and K(DN) flange options, but high temperature/heater options are not available.
Note 2) Solenoid valves

Model	Initial exhaust valve	Main exhaust valve	Example
XLDV-25	SY114		SY114-1GS
XLDV-40, 50, 63, 80	SY114	SYJ314	SYJ314-1GS

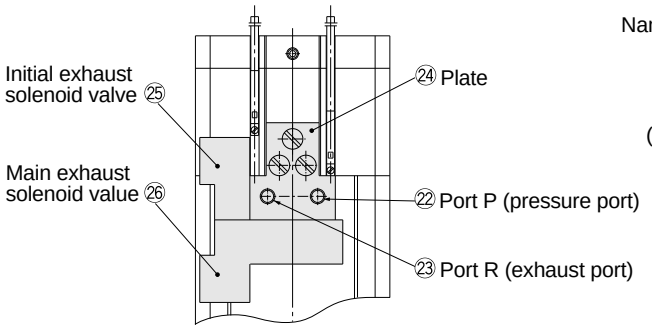
For further details on solenoid valves, refer to the SMC solenoid valve catalogs "SY100" (N219) and "SYJ 300, 500, 700" (N220)

Specifications

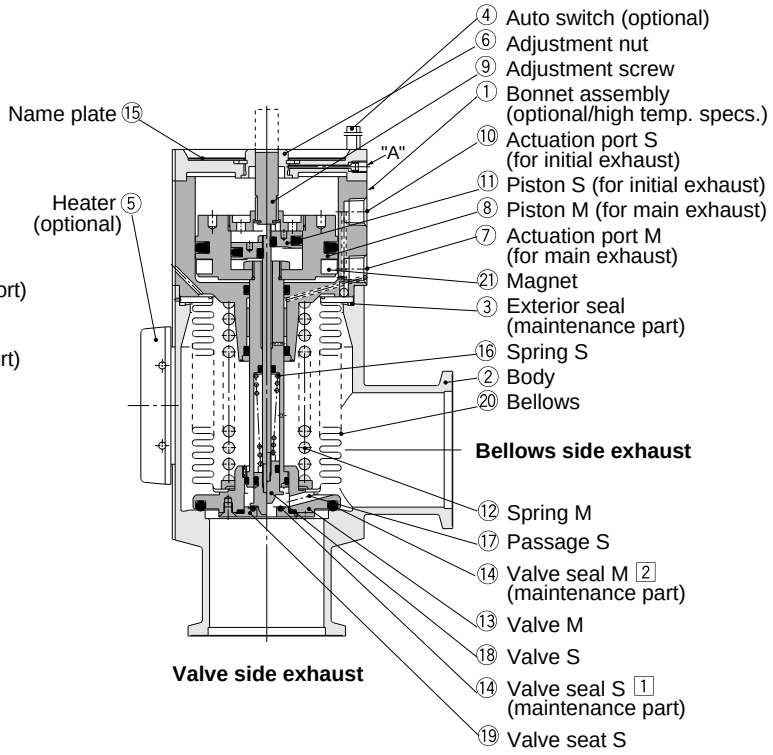
Model		XLD(V)-25	XLD(V)-40	XLD(V)-50	XLD(V)-63	XLD(V)-80
Valve type		Normally closed (spring return & seal) [both main & initial exhaust valves]				
Fluid		Non-corrosive gas for aluminum alloy (A6063) and SUS304/316				
Operating temperature °C	XLD	5 to 60°C (41 to 140°F) [high temperature type: 5 to 150°C (41 to 302°F)]				
	XLDV	5 to 50°C (41 to 122°F)				
Operating pressure Pa {Torr}		Atmospheric pressure to 1 x 10^{-6} {760 to 7.5 x 10^{-9}}				
Conductance ℓ/s Note 1)	Main exhaust valve	14	45	80	160	200
	Initial exhaust valve	0.5 to 3	2 to 8	2.5 to 11	4 to 18	4 to 18
Leakage Pa m³/s {Torr ℓ/s}	Internal	1.3 x 10^{-10} {1 x 10^{-9}} at ordinary temperatures, excluding gas permeation				
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas permeation				
Operating time s Note 2)	Main exhaust valve	0.10	0.21	0.24	0.26	0.28
	Initial exhaust valve	0.07	0.08	0.09	0.23	0.27
Flange type		KF (NW)			KF (NW), K (DN)	
Principle materials		Body: Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)				
Surface treatment		Exterior: Hard anodized Interior: Machined for clean environment				
Actuation pressure MPa		0.4 to 0.7 (58 to 101.50psi) [both main & initial exhaust valves]				
Actuation port size	XLD	M5(10-32 nominal)	Rc(PT) 1/8			
	XLDV	M5(10-32 nominal) Ports P, R				
Actuating solenoid valve recommended Cv factor (XLD)	Main exhaust valve	0.06 ≤	0.09 ≤	0.11 ≤	0.3 ≤	0.35 ≤
	Initial exhaust valve	0.01 ≤	0.01 ≤	0.02 ≤	0.02 ≤	0.03 ≤
Service life (Million cycles)		2				
Weight kg (lb)	XLD	0.5 (1.10)	1.2 (2.65)	1.8 (3.97)	3.4 (7.50)	5.6 (12.35)
	XLDV	0.57 (1.26)	1.3 (2.87)	1.9 (4.19)	3.5 (7.72)	5.7 (12.57)

Note 1) The main exhaust valve conductance is the value for the molecular flow of an elbow having the same dimensions. The initial exhaust valve conductance is the value for the viscous flow.
Note 2) The time required for 90% valve movement when an actuation pressure of 0.5MPa (72psi) is applied. There is a difference of about 20% in this value at the upper and lower pressure limits.
Note 3) For valve heater specifications, refer to "Common Option Specifications, [1]Heaters" on page 37.

Construction/Operation



With solenoid valve



Operating principle

1 **Initial exhaust valve opening adjustment**

The initial exhaust rate should be adjusted before operation. With actuation port S (10) in an unpressurized state on model XLD, or with initial exhaust solenoid valve (25) in the OFF state on model XLDV, the initial exhaust rate is set to zero by gently turning the adjustment nut (6) to the right until it stops. After confirming the position of the angle adjustment scale on the name plate (15) and the angle adjustment mark on the adjustment nut (6), the initial exhaust rate is adjusted by turning the nut to the left. The pitch of the adjustment screw (9) is 1mm. The number of turns and initial exhaust conductance should be confirmed referring to the figure on the right.

A space is established between the end of the adjustment screw (9) and the shaft of valve S (18), which regulates the amount of movement of the piston S (11). The initial exhaust conductance is determined by the amount of opening between valve S (18) and the valve seal S [1]-(14). Further turning is prevented by locking after adjustment. When the initial exhaust rate will not be adjusted, or when it will be set at a fixed rate, it can be locked by tightening the Section "A" screw with a torque of approximately 5kgf·cm.

2 **Operation of the initial exhaust valve**

The left section in the drawing shows the initial exhaust valve in a closed condition.

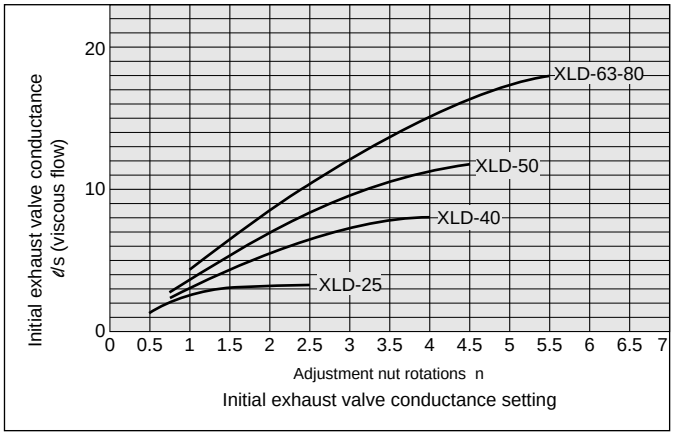
When pressure is applied to the actuation port S (10) on model XLD, or the initial exhaust solenoid valve (25) is turned ON with port P (22) in a pressurized state on model XLDV, air follows the dotted line passing through the space by the shaft and fills the area below the piston S (11). Piston S (11) is stopped when it strikes the adjustment screw (9). Through the movement of piston S (11), the valve S (18) is removed from the valve S seal assembly [1]-(14), and initial exhaust takes place through the passage S(17).

3 **Operation of the main exhaust**

When pressure is applied the the actuation port M (7) on model XLD, or the main exhaust solenoid valve (26) is turned ON with port P in a pressurized state on model XLDV, the piston M (8) moves upward opening valve M (13). Port S (10) remains pressurized and valve S (18) remains open.

4 **Closing of both valves**

By removing pressure from actuation port S (10) and actuation port M (7) on model XLD, or turning OFF initial exhaust solenoid valve (25) and main exhaust solenoid valve (26) on model XLDV, the force of spring S (16) and spring M (12) cause valve S (18) and valve M (13) to contact their respective valve seats and seals, thereby sealing them.



Options

④ Auto switch: (for main exhaust valve)

The magnet (21) actuates the auto switch (4) indicating the position of the integrated valve M (13) and the piston M (8). With two auto switches, the open and closed positions are detected, and with one auto switch, either the open or closed position is detected. Auto switches are applicable at ordinary temperatures only 5 to 60°C (41 to 140°F).

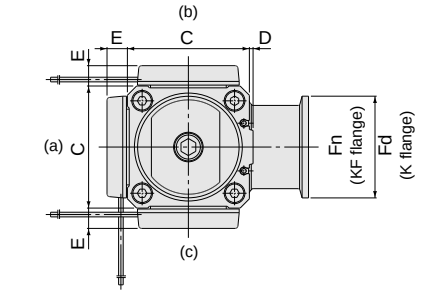
⑤ Heater:

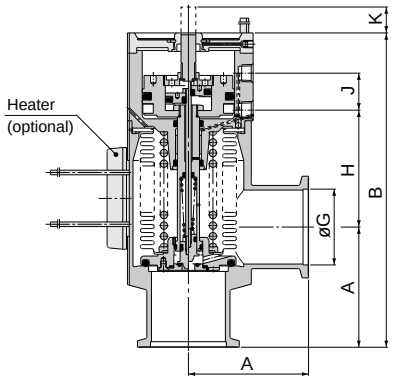
Simple heating is performed using thermistors. The valve body can be heated to approximately 80, 100 or 120°C (176, 212, or 248°F), depending on the heater option and valve size. The type and number of thermistors to be used will vary depending upon size and setting temperature. In the case of high temperature specifications, the bonnet assembly (1) is a heat resistant structure. This is not available with solenoid valve.

Dimensions (mm)

1in=25.4mm

XLD/Air operated type





(mm)

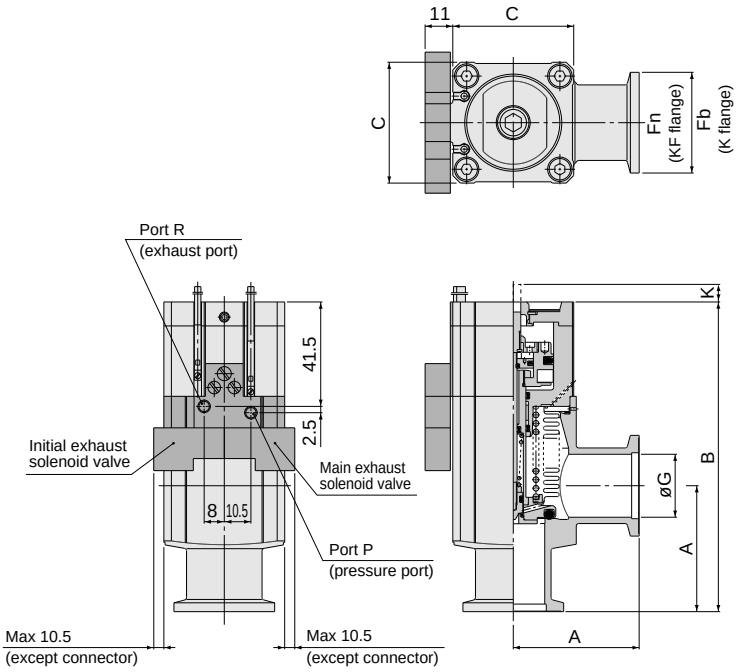
Model	A	B	C	D	E	Fn	Fd	G	H	J	K
XLD-25	50	123	48	1	12	40	—	26	41	16	6.5
XLD-40	65	170	66	2	11	55	—	41	63	20	14
XLD-50	70	183	79	2	11	75	—	52	68	20	16.5
XLD-63	88	217	100	3	11	87	95	70	72	20	18.5
XLD-80	90	256	117	3	11	114	110	83	98	20	26.5

Note 1) Dimension E applies when heater option is included. (lead wire length: approx. 1m)
Note 2) (a), (b) and (c) in the above drawing indicate heater mounting positions.
Moreover, heater mounting positions will differ depending on the type of heater.
For further details, refer to mounting positions under Replacement heaters/Part Nos. on page 46.

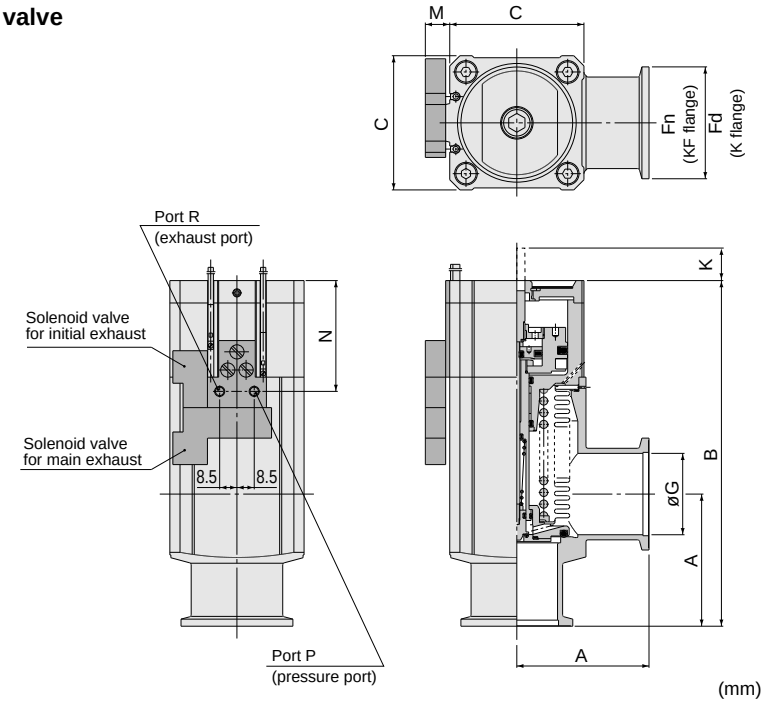
Dimensions (mm)

1in=25.4mm

XLDV-25/With solenoid valve



XLDV-40 to 80/With solenoid valve



(mm)

Model	A	B	C	Fn	Fd	G	M	N	K
XLDV-25	50	123	48	40	–	26	–	–	6.5
XLDV-40	65	170	66	55	–	41	12	54.5	14
XLDV-50	70	183	79	75	–	52	12	58.5	16.5
XLDV-63	88	217	100	87	95	70	13	73.2	18.5
XLDV-80	90	256	117	114	110	83	13	83.6	25.5

How to Order

XLH — 16 ☐

High vacuum manual angle valve
(Bellows seal)

Flange size

16
25
40
50

Heater

Symbol	Heater type
Nil	None
H1	With heater for 80°C (176°F)
H2	With heater for 100°C (212°F)
H3	With heater for 120°C (248°F)

Heater combination table

Setting temperature	Symbol	Model			
		XLH-16	XLH-25	XLH-40	XLH-50
80°C (176°F)	**H1**	–	•	•	•
100°C (212°F)	**H2**	–	–	•	•
120°C (248°F)	**H3**	–	•	•	•

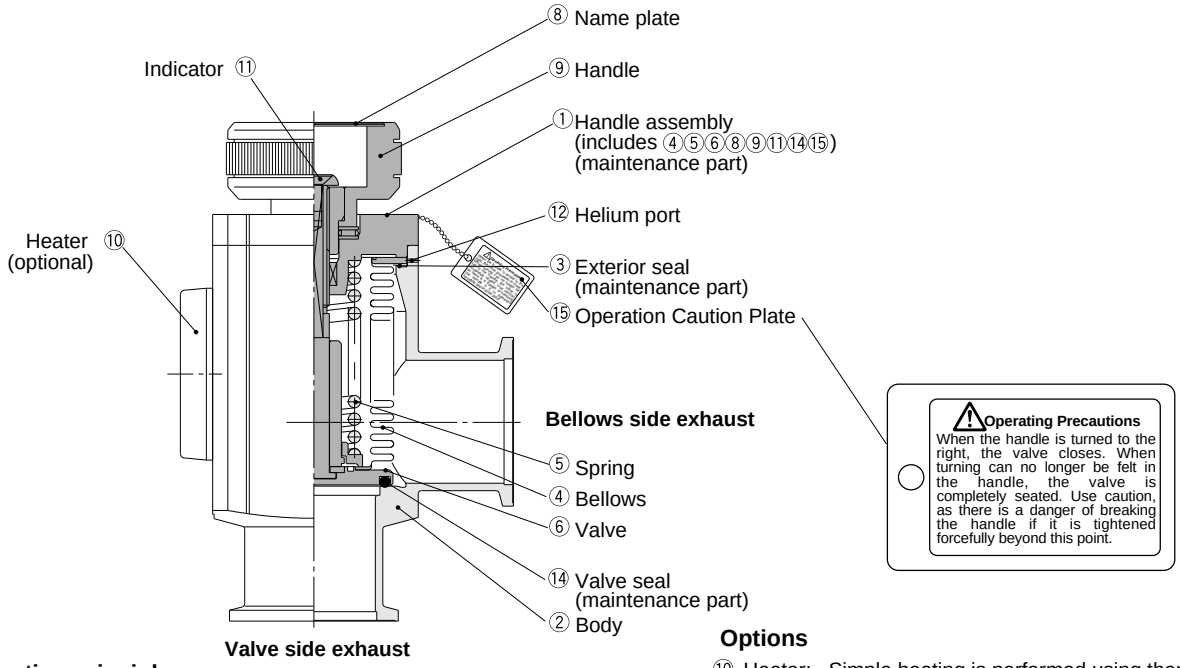
Note) Heater cannot be retrofitted.

Specifications

Model		XLH-16	XLH-25	XLH-40	XLH-50
Fluid		Non-corrosive gas for aluminum alloy (A6063) and SUS304/316			
Operating temperature °C		5 to 150°C (41 to 302°F)			
Operating pressure Pa {Torr}		Atmospheric pressure to 10^{-6} {760 to 7.5 x 10^{-9}}			
Conductance ℓ/s Note 1)		5	14	45	80
Leakage Pa m³/s {Torr ℓ/s}	Internal	1.3 x 10^{-10} {1 x 10^{-9}} at ordinary temperatures, excluding gas transmission			
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas transmission			
Flange type		KF (NW)			
Principle materials		Body: Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)			
Surface treatment		Exterior: Hard anodized Interior: Machined for clean environment			
Actuation torque N·m {kgf·cm}		0.1≤{1≤}	0.15≤{1.5≤}	0.35≤{3.5≤}	0.5≤{5≤}
Handle revolutions		5	7	10	13
Service life (Million cycles)		0.1			
Weight kg (lb)		0.23 (0.51)	0.41 (0.90)	1.05 (2.31)	1.62 (3.57)

Note 1) The conductance is the same as that of an elbow of the same dimensions.
Note 2) For valve heater specifications, refer to "Common Option Specifications, [1] Heaters" on page 37.

Construction/Operation



Operating principle

By turning the handle (9) to the left, the valve (6) opens. The handle (9) does not move up and down, but the indicator (11) shows the open or closed position of the valve. As the handle (9) is turned to the right, the valve (6) closes, and when the turning force of the handle (9) suddenly ceases to be felt, the valve (6) is sealed. The sealing force for the valve (6) comes from the spring (5) , and is constant.

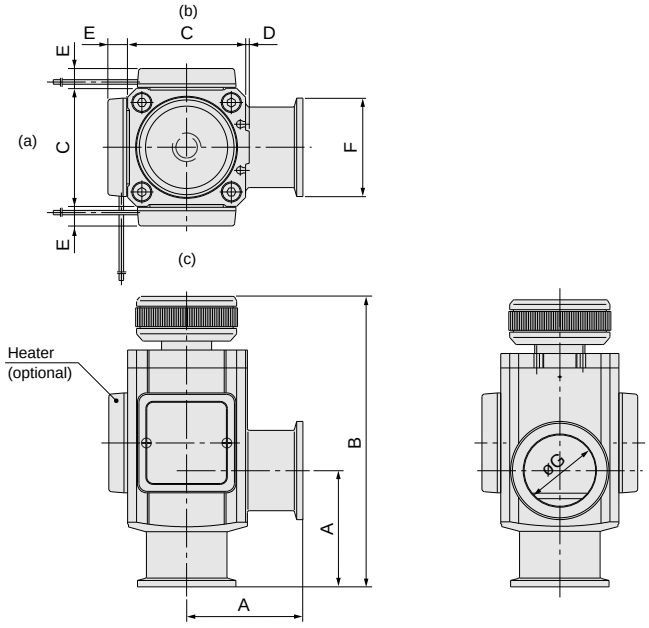
Options

⑩ Heater: Simple heating is performed using thermistors. The valve body can be heated to approximately 80, 100 or 120°C (176, 212 or 248°F), depending on the heater option and the valve size.
The type and number of thermistors to be used will vary depending upon size and setting temperature.

⑪ Indicator: When the valve is open, an orange marker appears in the center of the name plate (8).

Dimensions (mm)

1in=25.4mm



(mm)

Model	A	B	C	D	E Note 1)	F	G
XLH-16	40	100.5	38	1	–	30	17
XLH-25	50	114	48	1	12	40	26
XLH-40	65	162.5	66	2	11	55	41
XLH-50	70	179.5	79	2	11	75	52

Note 1) Dimension E applies when heater option is included. (lead wire length: approx. 1m)
Note 2) (a), (b) and (c) in the above drawing indicate heater mounting positions.
Moreover, heater mounting positions will differ depending on the type of heater.
For further details, refer to mounting positions under Replacement heaters/Part Nos. on page 46.

How to Order

Starting voltage

5	24VDC
9	Other (48VDC, 100VDC)

Note) Holding voltage is 25% of starting voltage.

Electrical entry

G	Grommet
C	Conduit
T	Terminal
D	DIN terminal

Without control power supply XLS — 25 — 5 G

With control power supply XLS — 25 — P 1 G

High vacuum angle valve
(Bellows pressure balance, 2 stage voltage switching type)

Valve size

16	KF16
25	KF25

Control power supply

P	With control power

Voltage

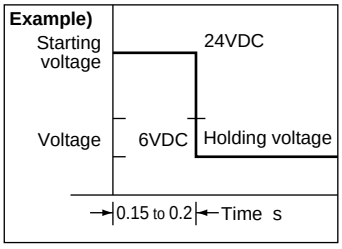
1	100VAC
2	200VAC
5	24VDC

Electrical entry

G	Grommet

⚠ Warning

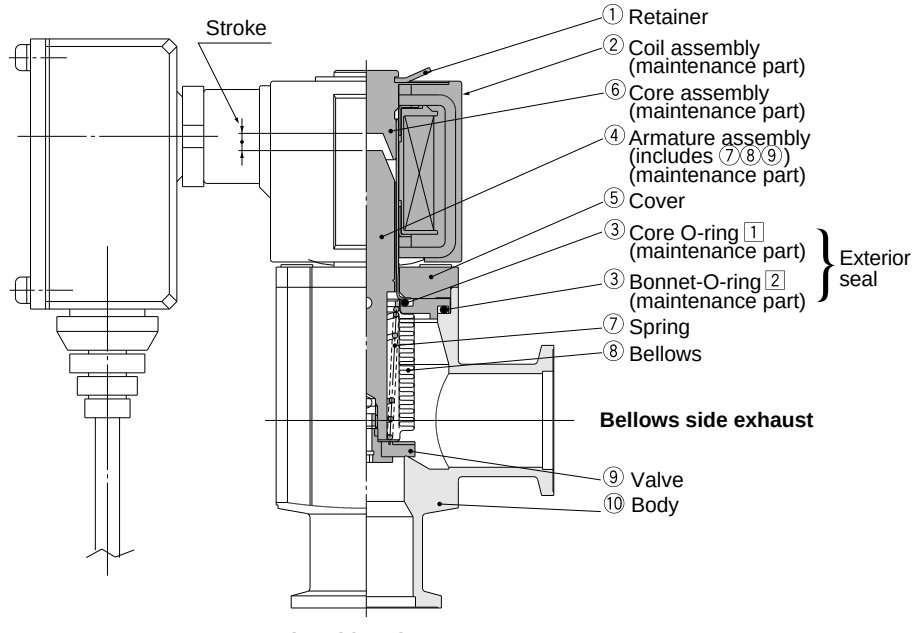
(1) In case there is no control power supply (XLS-25-□□: 24/48/100VDC), starting voltage should be applied for only 0.15 to 0.2s, in accordance with the prescribed method (indicated on the back of the coil). Continuously applying starting voltage can cause overheating of the coil and fire. Holding voltage is 25% of the starting voltage (the application method is shown on the back of the solenoid coil).



Specifications

Model		XLS-16	XLS-25	XLS-16-P□G	XLS-25-P□G
Valve type		Normally closed (N.C.)			
Fluid		Non-corrosive gas for aluminum alloy (A6063) and stainless steel (SUS405 equiv.)			
Operating temperature °C		5 to 40°C (41 to 104°F)			
Operating pressure Pa {Torr}		0.2M to 1 x 10^{-6} {1.5k to 7.5 x 10^{-9}}			
Conductance ℓ/s		5	8	5	8
Leakage Pa m^3/s {Torr ℓ/s}	Internal	1.3 x 10^{-8} {1 x 10^{-7}} at ordinary temperatures, excluding gas permeation			
	External	1.3 x 10^{-11} {1 x 10^{-10}} at ordinary temperatures, excluding gas permeation			
Flange type/size		KF16	KF25	KF16	KF25
Principle materials		Body : Aluminum alloy Bellows: Stainless steel Seal: FKM (fluoro rubber)			
Surface treatment		Exterior: Hard anodized Interior Machined for clean environment			
Control power supply		No		Yes	
Operating power supply voltage		24/6, 48/12, 100/24VDC		24VDC 100/200VAC	
Allowable voltage fluctuation %		±10			
Power consumption W	Initial	35	45	35	45
	Holding	6.5	7.5	6.5	7.5
Current consumption A	Initial	1.5	2.0	1.5	2.0
	Holding	0.4	0.5	0.4	0.5
Electrical entry		G, C, D, T type		G type only	
Coil insulation		Class B			
Maximum operating frequency		10 c.p.m			
Service life (Million cycles)		0.5			
Weight kg (lb)		0.4 (0.88)	0.7 (1.54)	0.7 (1.54)	1.0 (2.20)

Construction/Operation



Operating principle

By energizing the coil assembly (2) for 0.15 to 0.2s with the starting voltage, the armature assembly (4) overcomes the reactive force of the spring (7) and is adsorbed to the core assembly (6), opening the valve (9). After that, it is held with 25% of the starting voltage (when there is no power supply). (When there is a power supply, the activating voltage only is applied to the coil assembly (2).) When energizing of the coil assembly (2) is canceled, the armature assembly (4) is separated from the core assembly (6) by the reactive force of the spring (7), closing the valve (9).

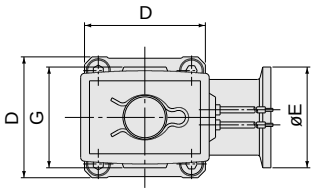
Note 1) The fixed seals between the interior of the body (10) and the atmosphere are the exterior seals (3), and the drive section is sealed by the bellows (8).

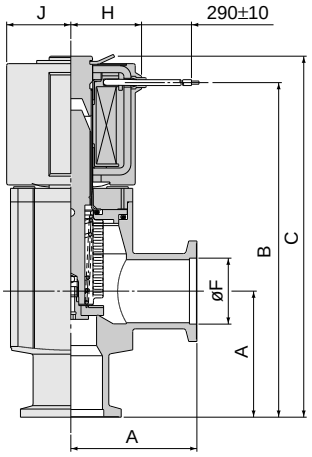
Note 2) Since the seal diameter of the valve (9) and the effective pressure receiving diameter of the bellows (8) are the same, pressure is in balance and the bellows side can also be used for exhaust.

Dimensions (mm)

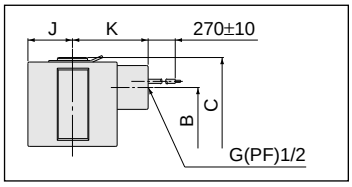
1in=25.4mm

XLS/Without control power supply
Grommet (G)

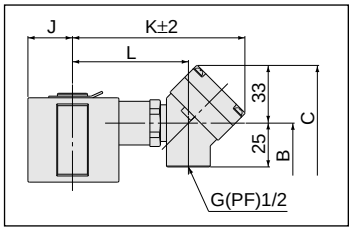




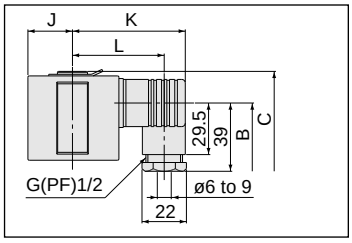
Conduit (C)



Terminal (T)



DIN terminal (D)



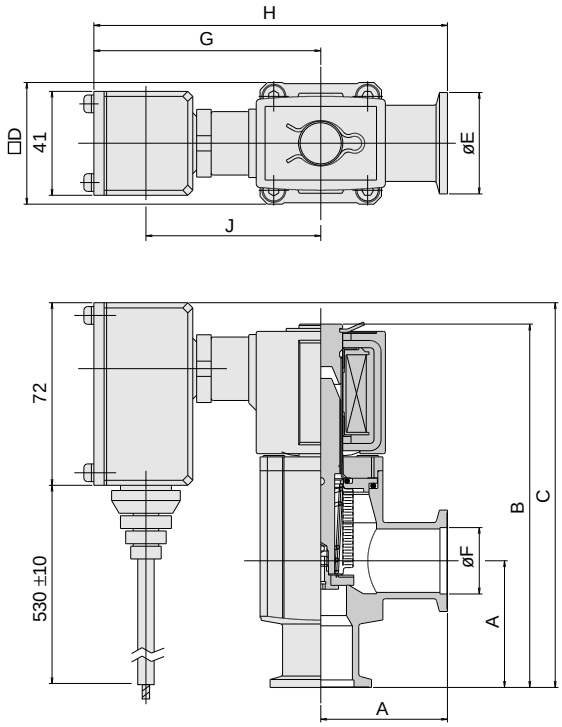
(mm)

Model	A	B	C	D	E	F	G	H	J	K	L
XLS-16-□G	40	104	113	38	30	17.1	35	25.5	23	–	–
XLS-16-□C		96								41	–
XLS-16-□D										60	48
XLS-16-□T			129							95	62
XLS-25-□G	50	128.5	138.5	48	40	26.2	40	28	25.5	–	–
XLS-25-□C		121.5								43	–
XLS-25-□D		120.5								63	51
XLS-25-□T		121.5	154.5							97	66

Dimensions (mm)

1in=25.4mm

XLS/With control power supply
Grommet (G)



(mm)

Model	A	B	C	D	E	F	G	H	J
XLS-16-P□G	40	113	121	38	30	17.1	87	110	66.5
XLS-25-P□G	50	138.5	147	48	40	26.2	89.5	115	69

How to Order

XSA **1** — **1** **2** **S** — **5** **G** ☐ — ☐

Normally closed high vacuum straight solenoid valve

Solenoid size

1	No.1
2	No.2
3	No.3

Orifice symbol

1	ø2
2	ø3
3	ø4.5
4	ø6

∗ Refer to table 1 below for applications.

Fitting size

2	1/4 B
3	3/8 B

∗ Refer to table 1 below for applications.

Fitting Type

V	VCR®
S	Swagelok®

∗ VCR® Fitting and Swagelok® Fitting are registered trademarks of the Cajon Company and the Crawford Fitting Company Inc. respectively.

Voltage

1	100VAC (with rectifier)
5	24VDC
6	12VDC
9	Other (6VDC, 48VDC, 100VDC)

∗ Refer to Table 2 below for applications.

Electrical entry

G	Grommet
C	Conduit
T	Terminal
D	DIN terminal

∗ Refer to Table 2 below for applications.

Electrical options

Nil	None
S	With surge voltage suppressor
L	With light
Z	With light/Surge voltage suppressor

∗ Refer to Table 2 below for applications.

Spacer

Nil	None
A	With spacer

∗ Refer to Table 3 below in case spacers only are required separately.

Table 1: Model, Fitting size, Orifice

Solenoid valve model (fitting size)			Orifice symbol (diameter)			
			1 (ø2)	2 (ø3)	3 (ø4.5)	4 (ø6)
XSA1	**XSA2**	**XSA3**				
2(1/4)	–	–	•	•	–	–
–	2(1/4)	–	–	•	•	–
–	–	2(1/4)	–	–	•	–
–	–	3(3/8)	–	–	–	•

Table 3: Spacer part nos.

Model	Part No.
XSA1	XSA122-8-4
XSA2	XSA232-8-4
XSA3	

Table 2: Voltage, Electrical entry, Electrical options

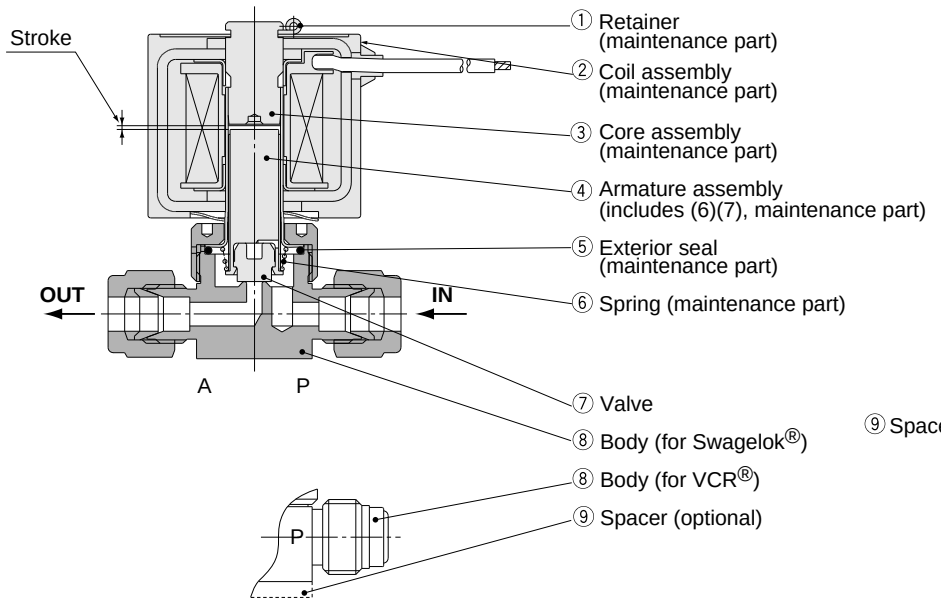
Electrical entry		G	G	C	D, T		
Electrical options		–	S	–	–	S	L, Z
AC	1(100V)	•	–	–	–	–	–
DC	5(24V)	•	•	•	•	•	•
	6(12V)	•	•	•	•	•	–

Specifications

Model			XSA1-12	XSA1-22	XSA2-22	XSA2-32	XSA3-32	XSA3-43
Action			Normally closed direct acting 2 port solenoid valve					
Fluid			Non corrosive gas for stainless steel (SUS405 equivalent)					
Orifice diameter mmø			2	3		4.5		6
Cv factor			0.17	0.33		0.6		1.05
Actuation pressure difference MPa Note 1)			0.8	0.3	1.0	0.3	0.8	0.3
Reverse pressure potential MPa Note 2)			0.5	0.25	0.4	0.2	0.2	0.15
Port A pressure Pa			1×10^{-6}					
Leakage Pa m³/s {Torr ℓ/s}	Internal		1.3×10^{-9} {1×10^{-8}} at ordinary temperatures, excluding gas permeation					
	External		1.3×10^{-11} {1×10^{-10}} at ordinary temperatures, excluding gas permeation					
	Fitting	VCR®	1.3×10^{-11} {1×10^{-10}}					
		Swagelok®	1.3×10^{-10} {1×10^{-9}}					
Piping connection system			VCR®/SWJ (Swagelok)®					
Connection size			1/4B					3/8B
Operating temperature °C			5 to 40°C (41 to 104°F)					
Rated voltage			100VAC (with full wave rectifier) 6/12/24/48/100VDC					
Power consumption W			5		8		11	
Allowable voltage fluctuation %			±10					
Weight kg (lb)			0.3 (0.66)		0.5 (1.10)		0.6 (1.32)	
Service life (Million cycles)			2					

Note 1) The actuation pressure difference indicates the difference between Port P (high pressure side) and Port A (low pressure side).
Example) In the case of 0.3MPa, Port A is a vacuum (1Torr or less), while Port P can be pressurized to 0.2MPa (29psi).
Note 2) Reverse pressure potential indicates the pressure which can be applied from Port A when Port P is at atmospheric pressure.
Note 3) Indicates case of grommet type electrical entry.

Construction/Operation



Operating principle

By energizing the coil assembly (2), the armature assembly (4) overcomes the composite force, consisting of the force acting on the valve (7) due to differential pressure and the reactive force of the spring (6), and is adsorbed to the core assembly (3), opening the valve (7).
When energizing of the coil assembly (2) is canceled, the armature assembly (4) is separated from the core assembly (3) by the reactive force of the spring (6), closing the valve (7).

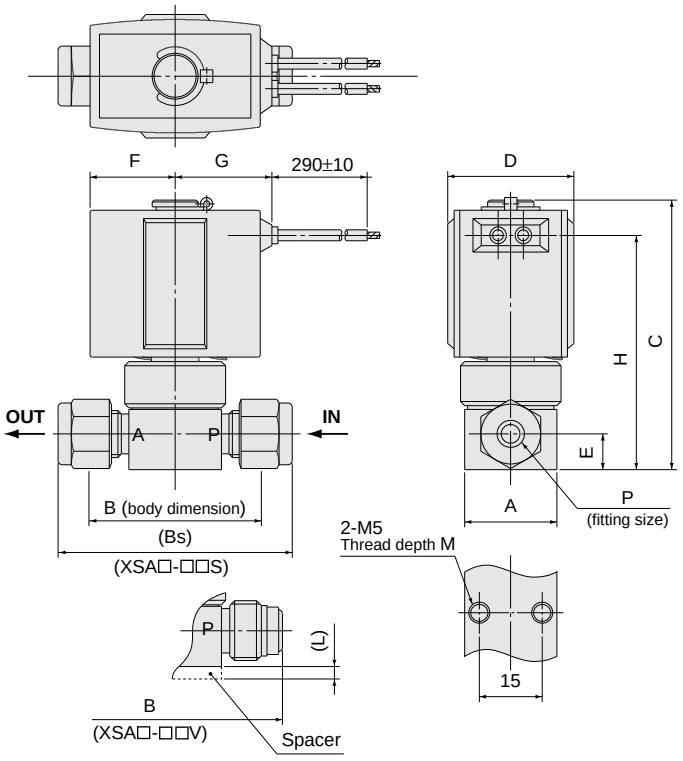
Options

⑨ Spacer: A spacer used to raise the body when fastening it onto a flat area.

Dimensions (mm)

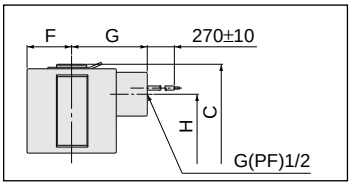
1in=25.4mm

Electrical entry
Grommet (G)

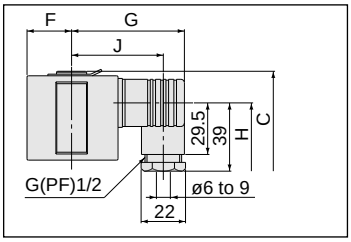


Electrical entry

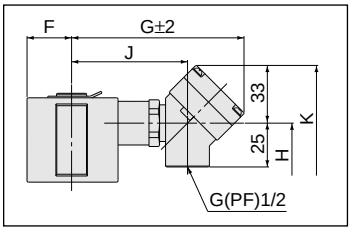
Conduit (C)



DIN terminal (D)



Terminal (T)

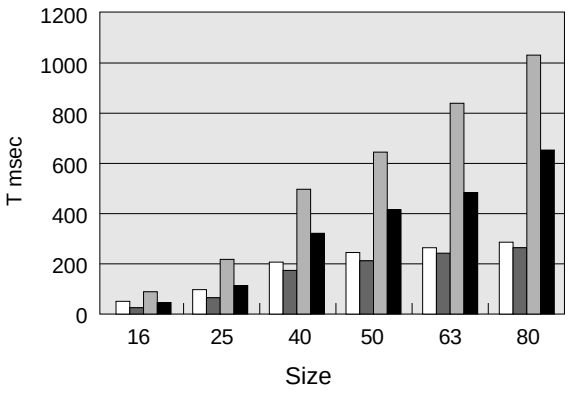
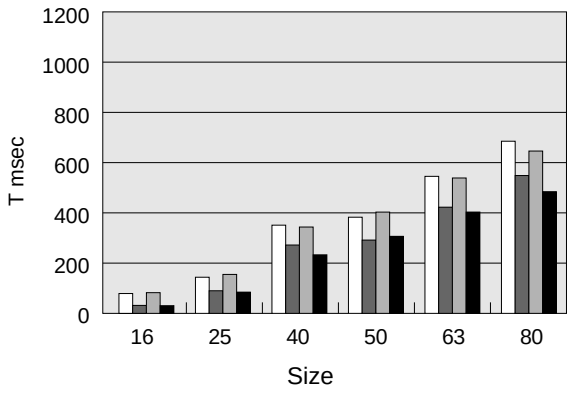


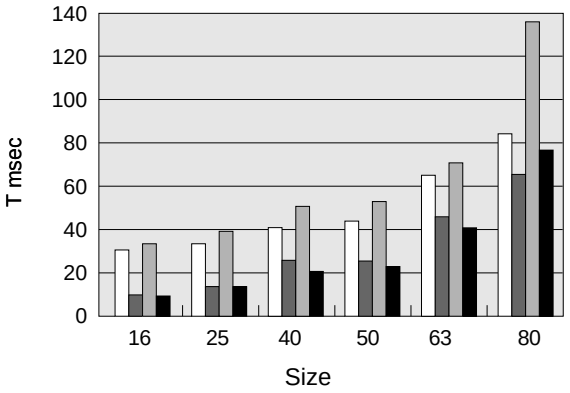
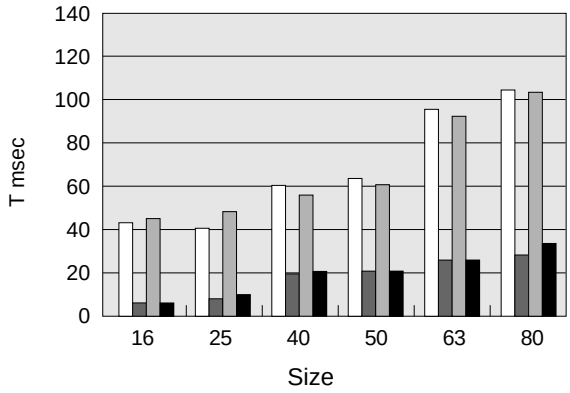
(mm)

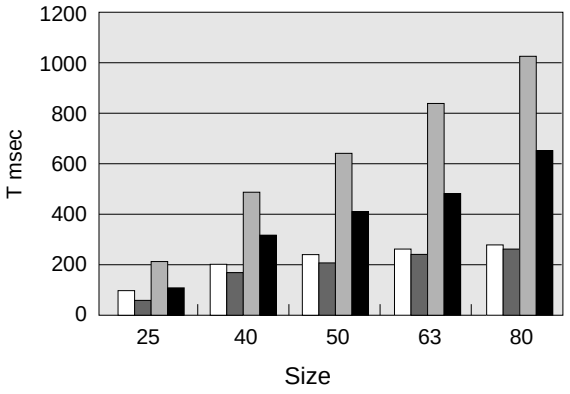
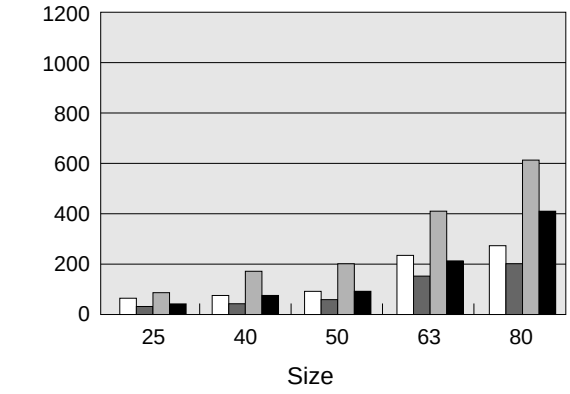
Model	A	B	Bs	C	D	E	F	Grommet		Conduit		Terminal			
		( ) are VCR® type	Swagelok® type					G	H	G	H	G	H	J	K
XSA1-□2S(V)	22	41(51)	56	64	30	8.5	20	23	56	39	48	92	48	59	81
XSA2-□2S(V)	25	46.5(57)	61	75.5	35	11.5	23	25.5	66	41	58.5	95	58.5	62	91.5
XSA3-32S(V)	25	46.5(57)	61	82	40	11.5	25.5	28	72	43	64	97	64	66	97
XSA3-43S(V)	25	50(66)	65	82	40	11.5	25.5	28	72	43	64	97	64	66	97

Model	DIN terminal			L	M	P
	G	H	J			(Unit: inch)
XSA1-□2S(V)	59	48	47	3	8	1/4
XSA2-□2S(V)	60	58.5	48	5	10	1/4
XSA3-32S(V)	63	64	51	5	10	1/4
XSA3-43S(V)	63	64	51	5	10	3/8

1 With pilot pressure at 0.5MPa (72psi)

Valve type	Normally closed	Double acting (dual operation)
Model	XLA	XLC
Bellows seal		

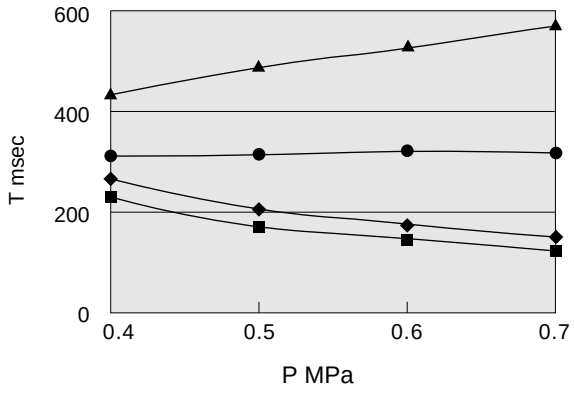
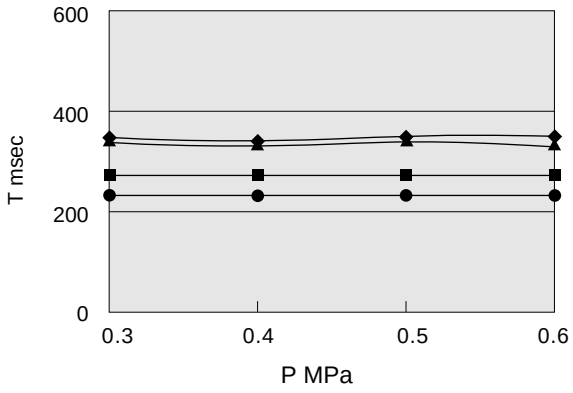
Valve type	Normally closed	Double acting (dual operation)
Model	XLF	XLG
O-ring seal		

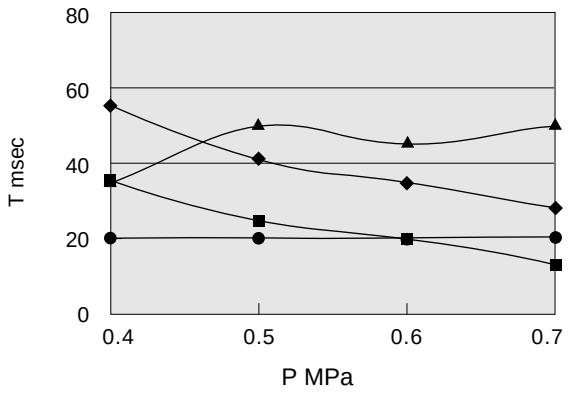
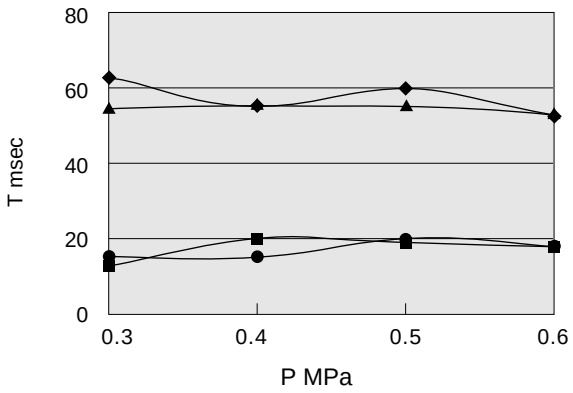
Valve type	Normally closed	
Model	XLD	
	Exhaust	Initial exhaust valve
Smooth exhaust valve		

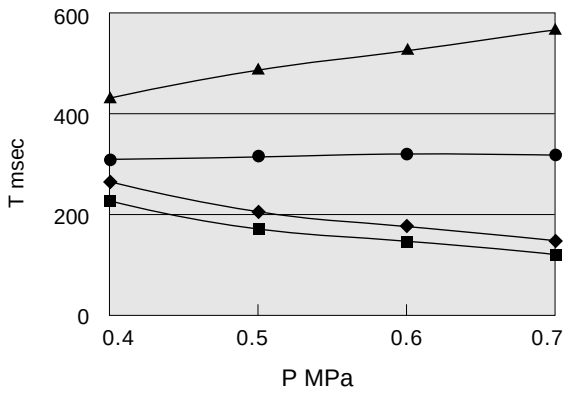
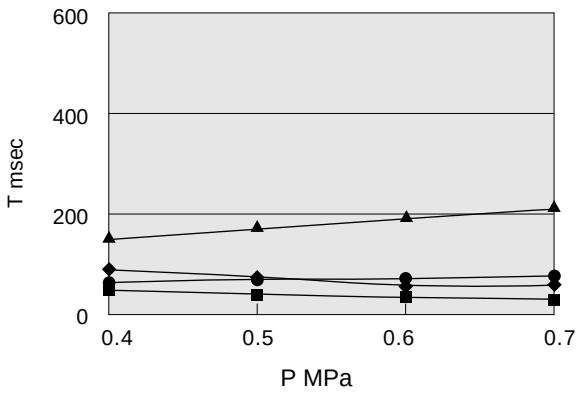
Response time when open (including pneumatic valve)
Response time when closed (including pneumatic valve)
Operation time when open (vacuum valve only)
Operation time when closed (vacuum valve only)

2 As a function of pilot pressure

1MPa = 145 psi

Valve type	Normally closed	Double acting (dual operation)
Model	XLA-40	XLC-40
Bellows seal		

Valve type	Normally closed	Double acting (dual operation)
Model	XLF-40	XLG-40
O-ring seal		

Valve type	Normally closed	
Model	XLD-40	
	Main valve	Initial exhaust valve
Smooth exhaust valve		

◆— Response time when open (including pnematic valve)
▲— Response time when closed (including pnematic valve)
■— Operation time when open (vacuum valve only)
●— Operation time when closed (vacuum valve only)

1 Heaters

Valve heaters are common for models XLA, XLC, XLD, XLF, XLG and XLH. Power consumption specifications are shown in the table below.

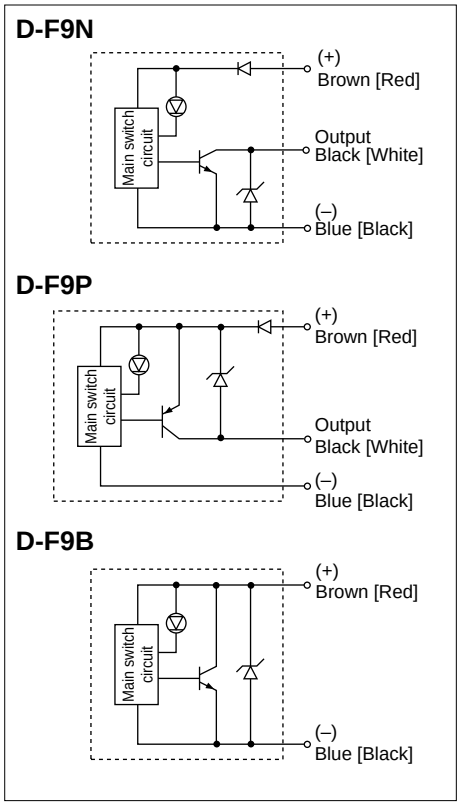
Item		XL□-25	XL□-40	XL□-50	XL□-63	XL□-80
Rated heater voltage		90 to 125VAC				
Heater power W (nominal value) In-rush/Normal (Option symbol)	H1 80°C (176°F)	200/10	200/20	400/40	400/60	600/100
	H2 100°C (212°F)	–	200/40	200/60	400/100	600/150
	H3 120°C (248°F)	200/30	400/70	400/80	600/130	800/180

Note) In-rush current will flow to the heater for approximately 30 seconds and will then subside.
Refer to Maintenance Parts on page 46 for further details regarding quantity and type.

2 Solid State Auto Switches

Specifications of applicable auto switches are shown below. An auto switch should be secured against a stopper in the auto switch groove for detection of valve opening, or at a position where it lightly touches a stopper or the valve body (depending on the valve size) for detection of valve closing.

Auto Switch Internal Circuits



Auto Switch Specifications

Auto switch part no.	D-F9N	D-F9P	D-F9B
Electrical entry	Lateral		
Wiring system	3 wire		2 wire
Output system	NPN type	PNP type	–
Applicable load	24VDC relay, PLC		
Power supply voltage	12/24VDC (10 to 28VDC)		–
Current consumption	8mA or less	10mA or less	–
Load voltage	28VDC or less	–	24VDC (10 to 28VDC)
Load current	50mA or less		5 to 30mA
Internal voltage drop	0.4V or less	1.5V or less	4.5V or less
Leakage current	10μA or less at 24VDC		1mA or less at 24VDC
Indicator light	Red LED lights up when ON		

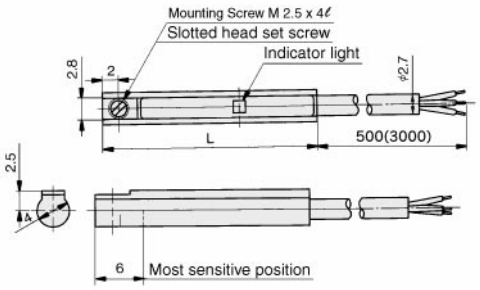
- Operating time ..... 1ms or less
- Lead wires ..... Oil resistant heavy duty vinyl cord, ø2.7, 0.5m
  D-F9N, D-F9P 0.15mm² x 3 wires (brown, black, blue [red, white, black])
  D-F9B 0.18mm² x 2 wires (brown, blue [red, black])
- Impact resistance ..... 1000m/s²{102G}
- Insulation resistance ..... 50MΩ or more with 500VDC between lead wire and case
- Withstand voltage..... 1000VAC for 1 min. (between lead wire and case)
- Ambient temperature..... –10 to 60°C (14 to 140°F)
- Indicator light ..... Lights up when ON
- Enclosure ..... IEC529 Standard IP67 watertight (JISCO920)

∗ For a lead wire length of 3m, "L" is added at the end of the part number. Example) D-F9NL

Auto Switch Dimensions (mm)

1in=25.4mm

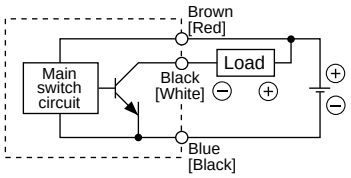
D-F9N, **D-F9P**, **D-F9B**



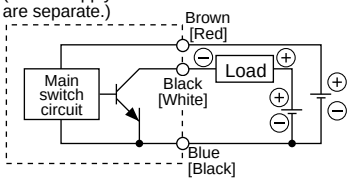
Part No.	L dimension (mm)
D-F9N	22
D-F9P	26.5
D-F9B	26.5

Basic Wiring

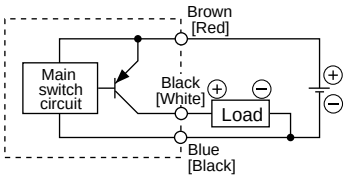
Solid state 3 wire, NPN



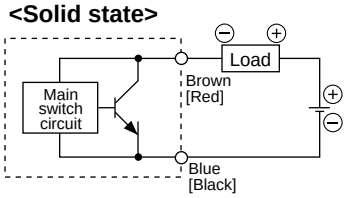
(Power supply for switch and load are separate.)

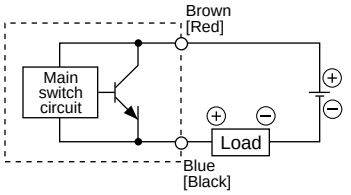


Solid state 3 wire, PNP



2 wire
<Solid state>

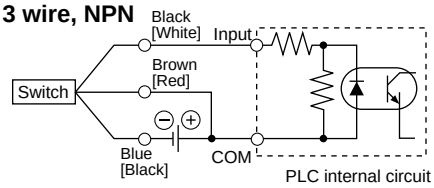




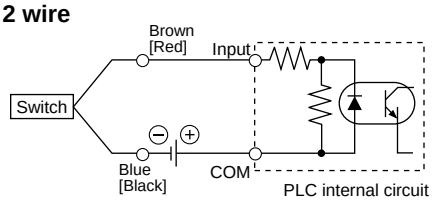
Examples of Connection to PLC or Programmable Logic Controller

Specification for sink input

3 wire, NPN

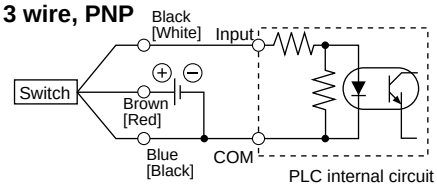


2 wire

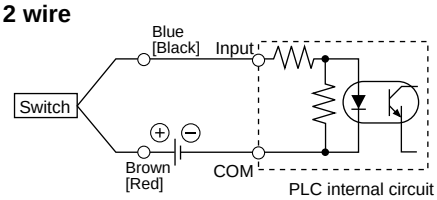


Specification for source input

3 wire, PNP



2 wire

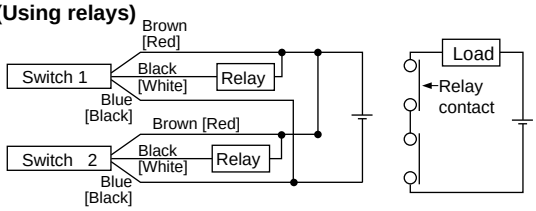


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

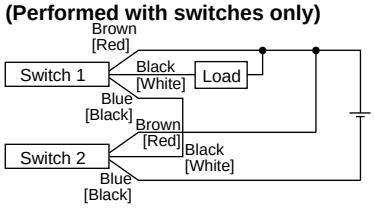
Connection Examples for AND (Series) and OR (Parallel)

3 wire

AND connection for NPN output (Using relays)

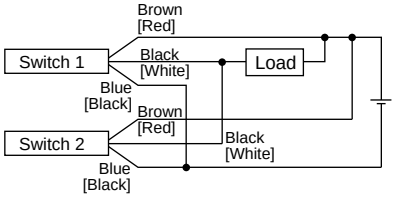


AND connection for NPN output (Performed with switches only)

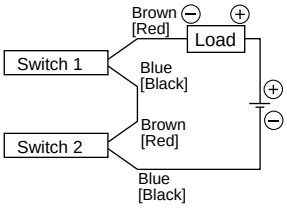


The indicator lights will light up when both switches are turned ON.

OR connection for NPN output



2 wire with 2 switch AND connection

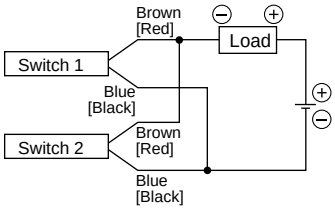


When two switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state.
The indicator lights will light up if both of the switches are in the ON state.

Load voltage at ON = (Power supply voltage - Residual voltage) x 2 pcs.
= 24V - 4V x 2 pcs.
= 16V

Example: Power supply is 24VDC
Voltage decline in switch is 4V

2 wire with 2 switch OR connection



<Solid state>
When two switches are connected in parallel, malfunction may occur because the load voltage will increase when in the OFF state.

Load voltage at OFF = leakage current x 2 pcs. x load impedance
= 1mA x 2 pcs. x 3kΩ
= 6V

Example: Load impedance is 3kΩ
Leakage current from switch is 1mA

<Reed switch>
Because there is no current leakage, the load voltage will not increase when turned OFF, but due to the number of switches in the ON state, the indicator lights will sometimes get dark or not light up, because of dispersion and reduction of the current flowing to the switches.

1 Seal Materials Available

FKM (fluoro rubber)
With low outgassing, low permanent-set and low gas permeation rate, this is the most popular seal material for high vacuum. SMC's seal material has undergone a high vacuum degassing process, and at normal temperatures can exhibit performance equivalent to metal seals. For usage in the tens of thousands of hours, a temperature ceiling of 180°C is recommended. When baking under high vacuum, mass numbers 18, 28 and 44 exceed the hydrogen peak, however, after returning to room temperature, these are undetectable, comparable to vacuums with metal sealing. (from SMC data)

Kalrez®
This is an elastomer with the most outstanding resistance to heat and chemicals, but its permanent-set is large, and special caution is required when used in other than static applications. Keeping other conditions the same as in the case of FKM, the recommended temperature ceiling is 250°C. Variations are available with improved plasma (O_2, CF_4) and particulate resistance. Therefore, it is advisable to select types based upon the application.
∗ Kalrez® is a registered trade mark of DuPont, Inc.

Chemraz®
This material has excellent chemical and plasma resistance and has slightly higher heat resistance than FKM. The recommended operating temperature ceiling is 200°C. Several variations of Chemraz® are available and it is advisable to make a selection based upon the particular plasma being used and other conditions, etc.
∗ Chemraz® is a registered trade mark of Greene, Tweed & Co.

Silicone
This material is relatively inexpensive, has good plasma resistance and can be used at high temperatures, but its gas permeation rate is large. It is most useful in differentially pumped applications where permeation is not an issue.

2 Shaft Sealing Method

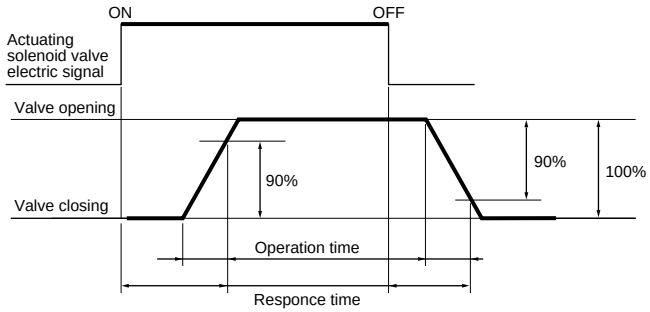
Bellows
SMC valves employ formed-bellows that produce few particulates yet have very long life. Welded-bellows are not used despite their longer life because they generate many more particulates. The cleaning and durability of SMC bellows have been improved through consistent control of surface treatment and handling.

O-ring, etc.
Due to entrainment of gases and generation of particulates, vacuum performance is somewhat inferior to the bellows type. However, high speed operation is possible and durability is comparatively high. The SMC sealing system has an especially long life because, it employs seals that are specially designed to retain the low vapor pressure grease while keeping particulates out.

3 Response time/Operation time

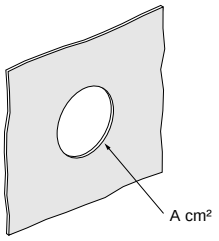
Valve opening
The time from the application of voltage to the actuation solenoid valve until 90% of the valve (XL□) stroke has been completed is the valve opening response time. Valve opening operation time indicates the time from the start of the stroke until 90% of movement has been completed. Both of these become faster as the operating pressure is increased.

Valve closing
The time from the cut off of power to the actuation solenoid valve until 90% of the valve (XL□) return stroke has been completed is the valve closing response time. Valve closing operation time indicates the time from valve opening until 90% of return movement has been completed. Both of these become slower as the operating pressure is increased.



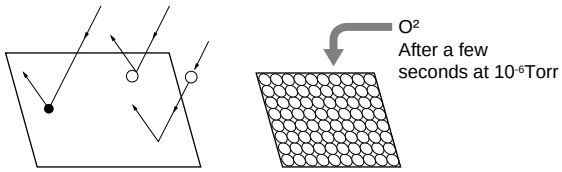
4 Molecular flow conductance

Orifice conductance
In the case of a øA (cm^2) hole in an ultra-thin plate, the conductance "C" results from "V" the average velocity of the gas, "R" the gas constant, "M" the molecular weight and "T" the absolute temperature. From the formula $C=VA/4=(RT/2\pi M)^{0.5}A$, the conductance for 1$cm^2$ is C=11.6A ℓ/sec, at an air temperature of 20°C.



Cylinder conductance
With length "L" (cm) and diameter "D" (cm) where L>>D, from the formula $C=(2\pi RT/M)^{0.5}D^3/6L$, the conductance $C=12.1D^3/L$ ℓ/sec, at an air temperature of 20°C.

Short pipe conductance
From the Clausing's factor "K" and the hole conductance "C" in the drawing below (Clausing's factor drawing), the short pipe conductance C_K is easily found as $C_K=KC$.



Conductances combined
When each of the separate conductances are given as C_1, C_2 and Cn, the composite conductance ∑C is expressed as:
$\sum C=1/(1/C_1+1/C_2+...1/Cn)$ when in series, and $\sum C=C_1+C_2+...Cn$, when in parallel.

5 He leakage

Surface leakage
Leakage that occurs between the deformable seal material and the sealing surface at room temperature (20 to 30°C). This is read within a few minutes after the start of the test.

Gas permeation
This is leakage caused by diffusion through the deformable seal material. As the temperature increases, the diffusion rate increases, and in many cases, becomes greater than surface leakage. The diffusion rate is proportional to the cross-sectional area (cm^2) of the seal, and inversely proportional to the seal width (the distance between the vacuum side and the atmosphere). In the case of metal gaskets, only hydrogen diffusion needs to be considered.

6 Outgassing

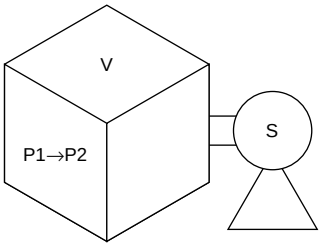
This is a phenomenon in which gases that are absorbed or adsorbed to chamber surfaces and/or its pores are released into the vacuum. It is lowest on smooth surfaces with a fine oxidize layer. The process of forming the oxidize layer has a particularly large effect. Reductions in outgassing can be achieved by methods such as EL processing to control the oxidation process in the case of aluminum alloys, and anhydrous high temperature oxidation in the case of stainless steel. Processes, such as anodization, can entrap gases in pores causing high outgassing rates. However, after high vacuum baking, the difference in the ultimate pressure with or without anodization is extremely minute.

7 Ultimate pressure

The ultimate pressure P(Torr) is P=Q/S, where the sum of the mass flow rates for outgassing (Qg) and leakage (Qℓ) is Q(Torr ℓ/sec) and the exhaust pumping speed is S (ℓ/sec). In cases of very low pressure, the exhaust characteristics of the pump itself may be the limiting factor. In particular, deterioration of pumping speed due to contamination of the pump by atmospheric moisture can be a major factor.

8 Exhaust time (low/medium vacuum)

The time ($\triangle$t) required to exhaust a chamber at low vacuum with volume V (ℓ), from pressure P1 to P2, using a pump with pumping speed S (ℓ/sec) is $\triangle t=2.3(V/S)\log(P1/P2)$. In high vacuums, this is subject to the ultimate pressure limit imposed by outgassing and leakage as characterized above.



9 Baking

Gases such as oxygen and nitrogen, which have a small adsorption activation energy (E) and a short adsorption residence time (τ), are evacuated quickly. However, in the case of water, which has a high activation energy, evacuation does not progress quickly unless the temperature is raised to shorten residence time. This time may be characterized as $\tau=\tau o \exp(E/RT)$ where R is the ideal gas constant and τo=(approx.)10^{-13}sec.
Residence time of water at 20°C is 5.5 x 10^{-6} sec, whereas at 150°C it is 2.8 x 10^{-8} sec, or 200 times shorter.
As an example, it took 800 minutes to evacuate moist air from a ø150mm x 500mm SMC test chamber to 10^{-9}Torr. The same process took only 4 minutes with dry (20ppb) nitrogen.

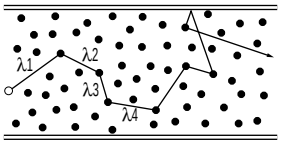
10 Body materials

Stainless steel has been the traditional material for vacuum systems but the use of aluminum alloys is becoming more common. Stainless steel has good corrosion resistance and strength, but poor thermal conductivity causes large temperature variations, and heavy metal contamination is a problem. Aluminum offers superior temperature uniformity (with 12 times higher thermal conductivity) and in many cases better gas corrosion resistance. Also, it has lower sputter yields from stray energetic particles and contributes no heavy metal contamination. Special anodization and electroless nickel plating are made available by SMC for highly corrosive gases.

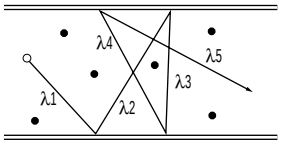
11 Flow classification

The relation of the average free path of gas molecules λ and the pipe diameter D expressed as λ/D is the Knudsen number, and the relation of the pressure p(Torr) converted to air at 20°C is expressed as pD. These are the flow classifications shown in the table below.

Item / Classification	λ/D (Knudsen number)	pD(Torr·cm)
Viscous flow	<0.01	>0.5
Intermediate flow	0.01 to 0.3	0.5 to 0.015
Molecular flow	>0.3	<0.015



(a) When the pressure is high, there are many collisions among the molecules.



(b) When the pressure is low, collisions are mainly against the walls.

12 Partial pressure

This indicates the residual gas constituents in a vacuum (usually measured with a quadrupole mass spectrometer). At 10^{-7} to 10^{-9}Torr, 90% or more is moisture, at 10^{-12}Torr or below, 98% or more is hydrogen. The other main residual gases have mass numbers of 28 and 35. (from SMC data)

13 Total pressure

This is the sum of all partial pressures and is equal to P=nkT, where the pressure is P, the number of gas molecules is n, Boltzmann's constant is k, and the absolute temperature is T.

14 Average free path

This is the average flight distance (λcm) that gas molecules travel between collisions with one another. It is inversely proportional to the molecular density (pressure) and may be characterized as $\lambda=0.7/\pi n\delta^2$ or $\lambda=2.33 \times 10^{-20}T/P\delta^2$. Here δ is the molecular diameter (cm), n is the molecular density (units/cm^3), T is the absolute temperature (K), and P is the pressure (Torr). In the case of air, for example, this becomes approximately 5cm at room temperature with 10^{-3} Torr. (Refer to the drawing in section [11] Flow classification.)

15 Impingement frequency

The impingement frequency of gas molecules on a unit surface area is $Z=3.53 \times 10^{22}P/(MT)^{1/2}$ collisions/sec cm^2 where M is the quantity of molecules, T is the absolute temperature (K), and P is the pressure. In the case of oxygen at room temperature and 10^{-6}Torr, one atomic layer impinges in a few seconds.