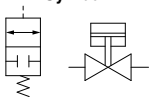
Aluminum
High Vacuum Angle Valve
Normally Closed/Bellows Seal
XLA/XLAV Series

RoHS

XLA

The production of flange sizes 16, 25, 40, 50, 63, and 80 for the XLA(V) series has been discontinued. Please select the new XLA(V)-2 type. See here for details.

Symbol



How to Order

XLA – 16 ① ② ③ ④ – M9N ⑤ A ⑥ – ⑦

① Flange size

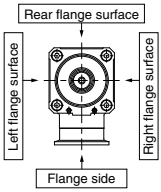
Size
16
25
40
50
63
80
100
160

② Flange type

Symbol	Type	Applicable flange
Nil	KF (NW)	16, 25, 40, 50, 63, 80 100, 160
D	K (DN)	63, 80, 100, 160

③ Indicator/Pilot port direction

Symbol	Indicator	Pilot port direction
Nil	Without indicator	Flange side
A	With indicator	Flange side
F		Left flange surface
G		Rear flange surface
J		Right flange surface
K	Without indicator	Left flange surface
L		Rear flange surface
M		Right flange surface



④ Temperature specifications/Heater

Symbol		Temperature	Heater
Nil		5 to 60°C	—
High temperature type	**H0**	5 to 150°C	—
	H4		With 100°C heater
	H5		With 120°C heater

Note 1) Size 16 is not applicable for H4, H5, Size 25 not for H4.
Note 2) Heater cannot be retrofitted for the H0 type.

⑤ Auto switch type

Symbol	Auto switch model	Remarks
Nil	—	Without auto switch (without built-in magnet)
M9N(M)(L)(Z)	D-M9N(M)(L)(Z)	Solid state auto switch
M9P(M)(L)(Z)	D-M9P(M)(L)(Z)	
M9B(M)(L)(Z)	D-M9B(M)(L)(Z)	
A90(L)	D-A90(L)	Reed auto switch (Not applicable to flange size 16)
A93(M)(L)(Z)	D-A93(M)(L)(Z)	
M9//	—	Without auto switch (with built-in magnet)

Note 1) Auto switches shown above cannot be mounted on the high temperature type. For the high temperature type, a semi-standard product that uses the heat resistant auto switch D-F7NJ* is available. For details, please contact SMC.
Note 2) Standard lead wire length is 0.5 m. Add "L" to the end of the part number when 3 m is desired, "M" when 1 m, and "Z" when 5 m.
Example) -M9NL

⑥ Number of auto switches/Mounting position

Symbol	Quantity	Mounting position
Nil	Without auto switch	—
A	2 pcs.	Valve open/closed
B	1 pc.	Valve open
C	1 pc.	Valve closed

⑦ Body surface treatment/Seal material and its changed part

• Body surface treatment

Symbol	Surface treatment
Nil	External: Hard anodized Internal: Raw material
A	External: Hard anodized Internal: Oxalic acid anodized

• Seal material

Symbol	Seal material	Compound No.
Nil	FKM	1349-80*
N1	EPDM	2101-80*
P1	Barrel Perfluoro®	70W
Q1	Kalrez®	4079
R1	Chemraz®	SS592
R2		SS630
R3		SSE38
S1	VMQ	1232-70*
T1	FKM for Plasma	3310-75*
U1	ULTIC ARMOR®	UA4640
F1	FKM	—**

* Produced by Mitsubishi Cable Industries, Ltd.
** Same specifications as the standard FKM type

• Seal material changed part and leakage

Symbol	Changed part Note 2)	Leakage (Pa·m³/s or less) Note 1)	
		Internal	External
Nil	None	1.3×10^{-10} (FKM)	1.3×10^{-11} (FKM)
A	②, ③	1.3×10^{-8}	1.3×10^{-9}
B	②	1.3×10^{-8}	1.3×10^{-11} (FKM)
C	③	1.3×10^{-10} (FKM)	1.3×10^{-9}

Note 1) Values at normal temperature, excluding gas permeation.
Note 2) Refer to parts number of "Construction" on page 418 for changed part. Number indicates parts number of "Construction" accordingly.
Note 3) For option "F1," only "A" can be selected. The leakage amount is the same as that of "Nil" (standard FKM type).

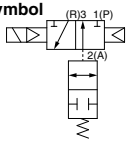
To order something other than "Nil" (standard), list the symbols starting with "X," followed by each symbol for "body surface treatment," "seal material" and then "changed part".

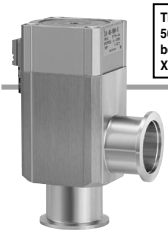
Example) XLA-16-M9NA-XAN1A

Air Operated/with Solenoid Valve

[Option]

Symbol





XLAV

The production of flange sizes 16, 25, 40, 50, 63, and 80 for the XLA(V) series has been discontinued. Please select the new XLA(V)-2 type. See here for details.

How to Order

XLAV – 16 ① ☐ ② G ③ – M9N ④ A ⑤ – 1 ⑥ G ⑦ ☐ ⑧ – ☐ ⑨ – ☐ ⑩

• Air operated/with solenoid valve

① Flange size

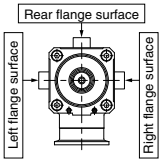
Size
16
25
40
50
63
80
100
160

② Flange type

Symbol	Type	Applicable flange
Nil	KF (NW)	16, 25, 40, 50, 63, 80, 100, 160
D	K (DN)	63, 80, 100, 160

③ Indicator/Pilot port direction

Symbol	Indicator	Pilot port direction
F	With indicator	Left flange surface
G		Rear flange surface
J		Right flange surface
K	Without indicator	Left flange surface
L		Rear flange surface
M		Right flange surface



∗ M type plug connector (AC power supply) not attached for J, M of sizes 16 and 25.

④ Auto switch type

Symbol	Auto switch model	Remarks
Nil	—	Without auto switch (without built-in magnet)
M9N(M)(L)(Z)	D-M9N(M)(L)(Z)	Solid state auto switch
M9P(M)(L)(Z)	D-M9P(M)(L)(Z)	
M9B(M)(L)(Z)	D-M9B(M)(L)(Z)	
A90(L)	D-A90(L)	Reed auto switch (Not applicable to flange size 16)
A93(M)(L)(Z)	D-A93(M)(L)(Z)	
M9//	—	Without auto switch (with built-in magnet)

Standard lead wire length is 0.5 m. Add "L" to the end of the part number when 3 m is desired, "M" when 1 m, and "Z" when 5 m.
Example) -M9N**L**

⑤ Number of auto switches/Mounting position

Symbol	Quantity	Mounting position
Nil	Without auto switch	—
A	2 pcs.	Valve open/closed
B	1 pc.	Valve open
C	1 pc.	Valve closed

⑥ Rated voltage

		CE/UKCA-compliant
1	100 VAC, 50/60 Hz	—
2	200 VAC, 50/60 Hz	—
3	110 VAC, 50/60 Hz	—
4	220 VAC, 50/60 Hz	—
5	24 VDC	○
6	12 VDC	○

⑦ Electrical entry

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

⑧ 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)

∗ S type: Not available for AC.
∗ U type: DC only.

⑩ CE/UKCA-compliant

Nil	—
Q	CE/UKCA-compliant

⑨ Body surface treatment/Seal material and its changed part

• Body surface treatment

Symbol	Surface treatment
Nil	External: Hard anodized Internal: Raw material
A	External: Hard anodized Internal: Oxalic acid anodized

• Seal material

Symbol	Seal material	Compound No.
Nil	FKM	1349-80∗
N1	EPDM	2101-80∗
P1	Barrel Perfluoro®	70W
Q1	Kalrez®	4079
R1	Chemraz®	SS592
R2		SS630
R3		SSE38
S1	VMQ	1232-70∗
T1	FKM for Plasma	3310-75∗
U1	ULTIC ARMOR®	UA4640
F1	FKM	—∗∗

∗ Produced by Mitsubishi Cable Industries, Ltd.
∗∗ Same specifications as the standard FKM type

• Seal material changed part and leakage

Symbol	Changed part Note 2)	Leakage (Pa·m³/s or less) Note 1)	
		Internal	External
Nil	None	1.3×10^{-10} (FKM)	1.3×10^{-11} (FKM)
A	②, ③	1.3×10^{-8}	1.3×10^{-9}
B	②	1.3×10^{-8}	1.3×10^{-11} (FKM)
C	③	1.3×10^{-10} (FKM)	1.3×10^{-9}

Note 1) Values at normal temperature, excluding gas permeation.
Note 2) Refer to parts number of "Construction" on page 418 for changed part. Number indicates parts number of "Construction" accordingly.
Note 3) For option "F1," only "A" can be selected. The leakage amount is the same as that of "Nil" (standard FKM type).

To order something other than "Nil" (standard), list the symbols starting with "X," followed by each symbol for "body surface treatment," "seal material" and then "changed part".

Example) XLAV-16-M9NA-1G-XAN1A

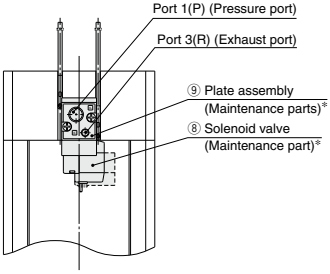
Note 1) Option specifications/Combinations
This model has indicator, auto switch and K(DN) flange options, but high temperature/heater options are not available.
Note 2) Solenoid valves
XLAV-16, 25, 40, 50: SYJ319, XLAV-63, 80, 100, 160: SYJ519
Example) SYJ319-1GS, etc.
∗ For details, consult your SMC sales representative.
∗ For option "Q", the solenoid valve should be a CE/UKCA-compliant product.

Specifications

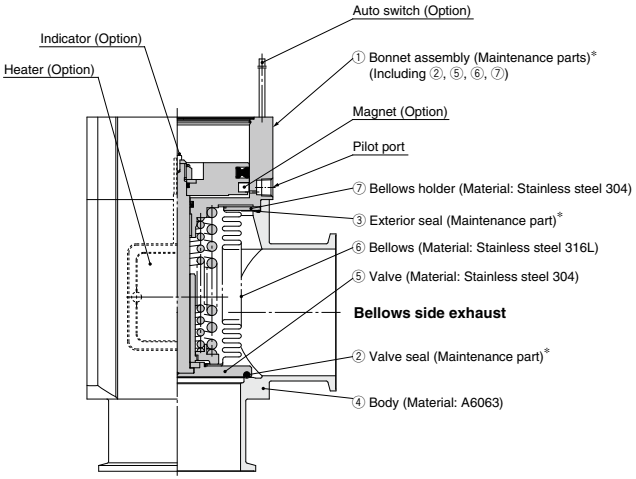
Model		XLA(V)-16	XLA(V)-25	XLA(V)-40	XLA(V)-50	XLA(V)-63	XLA(V)-80	XLA(V)-100	XLA(V)-160
Valve type		Normally closed (Pressurize to open, Spring seal)							
Fluid		Inert gas under vacuum							
Operating temperature (°C)	**XLA**	5 to 60 (High temperature type: 5 to 150)							
	XLAV	5 to 50							
Operating pressure (Pa) (abs)		1×10^{-6} to atmospheric pressure							
Conductance (L/s) Note 1)		5	14	45	80	160	200	300	800
Leakage (Pa·m³/s)	**Internal**	In case of standard material FKM: 1.3×10^{-10} at normal temperature, excluding gas permeation							
	External	In case of standard material FKM: 1.3×10^{-11} at normal temperature, excluding gas permeation							
Flange type		KF (NW)				KF (NW), K (DN)			
Principal materials		Body: Aluminum alloy, Bellows: Stainless steel 316L, Main part: Stainless steel, FKM (Standard seal material)							
Surface treatment		External: Hard anodized Internal: Raw material							
Pilot pressure (MPa) (G)		0.4 to 0.7							
Pilot port size	**XLA**	M5		Rc1/8					Rc1/4
	XLAV	M5: Port 1(P), Port 3(R)				Rc1/8: Port 1(P), M5: Port 3(R)			
Weight (kg)	**XLA**	0.25	0.45	1.1	1.6	2.9	5.0	10.6	18.5
	XLAV	0.29	0.49	1.14	1.64	2.96	5.06	10.7	18.6

Note 1) Conductance is the value for an elbow with the same dimensions.
Note 2) For valve heater specifications, refer to "Common Option [1] Heater" on page 459.

Construction/Operation



With solenoid valve



Valve side exhaust

∗ Refer to the back of page 465 for "Maintenance Parts".

<Working principle>

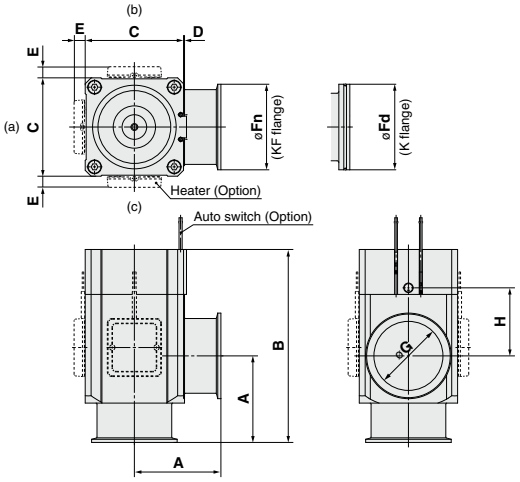
By applying the pilot pressure from the pilot port, the piston-coupled valve overcomes the spring force or operating force by pressure, and the valve opens.
For the XLAV, the pilot pressure is always applied to the port 1(P), and the valve opens when the solenoid valve is turned ON and closes when it is turned OFF.

<Options>

Auto switch: The magnet activates the auto switch. 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).
Heater: Simple heating is performed using thermistors. The valve body can be heated to approximately 100 or 120°C, 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 is a heat resistant structure. This does not apply in cases where a solenoid valve is attached.
Indicator: When the valve is open, an orange marker appears in the center of the name plate.

Dimensions

XLA/Air operated

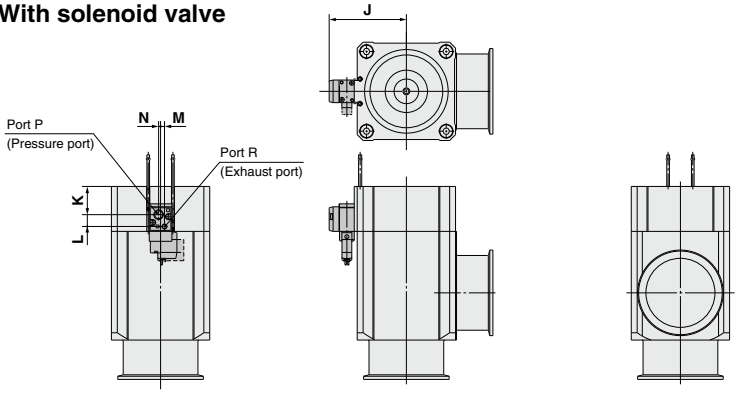


(mm)

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
XLA-100	108	300	154	3	11	134	130	102	131
XLA-160	138	315	200	3	11	190	180	153	112

Note 1) Dimension E applies when heater option is included. (Lead wire length: approx. 1 m)
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" on page 465.

XLAV/With solenoid valve



(mm)

Model	J	K	L	M	N
XLAV-16	35.5	12.3	10.2	3.6	3.6
XLAV-25	40.5	13.8	10.2	3.6	3.6
XLAV-40	50.5	21.6	10.2	3.6	3.6
XLAV-50	57	24.6	10.2	3.6	3.6

∗ Other dimensions are the same as the XLA.
∗ For details, consult your SMC sales representative.

(mm)

Model	J	K	L	M	N
XLAV-63	78.5	28.7	12	4	2
XLAV-80	87	38.7	12	4	2
XLAV-100	105.5	50.7	12	4	2
XLAV-160	128.5	57.7	12	4	2

∗ Other dimensions are the same as the XLA.
∗ For details, consult your SMC sales representative.

Common Option

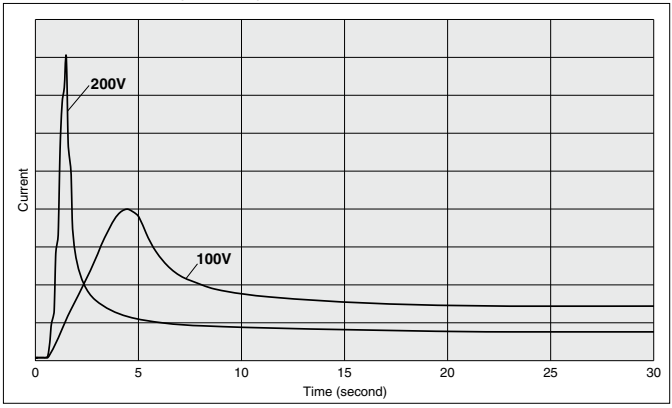
1 Heater

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

Item			XL□-25	XL□-40	XL□-50	XL□-63	XL□-80	XL□-100	XL□-160
Rated heater voltage			90 to 240 VAC						
Heater assembly quantity used Heater power W (Nominal value) In-rush/Power consumption (Option symbol·Operating voltage)	Heater assembly quantity		—	1 pc.	1 pc.	1 pc.	1 pc.	2 pcs.	3 pcs.
	H4 100°C	100V	—	200/40	200/50	400/100	600/150	800/220	1200/350
		200V	—	800/45	800/55	1600/110	2400/165	3200/240	4800/385
	Heater assembly quantity		1 pc.	1 pc.	1 pc.	1 pc.	2 pcs.	3 pcs.	4 pcs.
	H5 120°C	100V	200/40	400/70	400/80	600/130	800/180	1200/300	1600/400
		200V	800/45	1600/90	1600/90	2400/145	3200/200	4800/330	6400/440

∗ The inrush current of the heater flows for several ten seconds when using 100V while it flows for several seconds when using 200V. However, this inrush current decreases momentarily.
∗ When the valve uses multiple heater assemblies, do not turn ON the power to each heater assembly at the same time. Turn ON the power to each heater assembly one-by-one in order at intervals of 30 sec. since the inrush current is large.
∗ The heater temperature will decrease several % from the start of heating and then becomes stable. (The heater temperature may decrease approximately 5 to 10% due to individual differences.)
∗ Refer to "Maintenance Parts" on page 465 for further details regarding quantity and type.
∗ As the stable temperature of the heated product may vary by approx. ±10 to 15% due to instrumental error, be aware that the temperature specifications are to be used as a guide only (H4: 100°C and H5: 120°C).

Inrush current flow time (Reference)



XL□ Series
Glossary

1 Seal Materials

Please note that the following are general features and subject to change depending on processing conditions. For details, please contact sealing component manufacturerers.

FKM (Fluororubber)
With low outgassing, low permanent-setting and low gas permeation rates, this is the most popular seal material for high vacuums. Standard material used by SMC's high vacuum angle valve is Mitsubishi Cable Industries, Ltd. (Compound No. 1349-80).
It is advisable to choose a model depending on its application, because an improved material compound (3310-75) which reduces the weight reduction ratio with O_2 plasma is also available.

Kalrez® * Kalrez® is a registered trademark of E. I. du Pont de Nemours and Company or its affiliates.
This material, perfluoroelastomer (FFKM), has excellent heat and chemical resistance, but its permanent-setting is large, and special caution is required. Variations are available with improved plasma (O_2, CF_4) and particulate resistance; therefore it is advisable to select types based upon the application.
Compound No. 4079: Standard Kalrez®, excellent in gas and heat resistance.

Chemraz® * Chemraz® is a registered trademark of Greene, Tweed Technologies, Inc.
This material, perfluoroelastomer (FFKM), has excellent chemical and plasma resistance and has slightly higher heat resistance than FKM. Several variations of Chemraz® are available and it is advisable to choose based upon the particular plasma being used and other conditions, etc.
Compound No. SS592: Excellent physical properties and especially effective for moving parts.
Compound No. SS630: Applicable to both fixed and moving parts and compatible with a wide variety of applications.
Compound No. SSE38: The cleanest material among Chemraz®, developed for high-density plasma instruments.

Barrel Perfluoro® * Barrel Perfluoro® is a registered trademark of Matsumura Oil Co.,Ltd.
Compound No. 70W: Perfluoroelastomer (FFKM) which does not contain a metal filler. Resistant against NF_3, NH_3. Low particle generation under dry process conditions.

ULTIC ARMOR® * ULTIC ARMOR® is a registered trademark of Nippon Valqua Industries, Ltd.
Fluoro-based rubber which does not contain a metal filler. Seal material which is plasma-resistant and has low gas emittance and heat resistance.

Silicone (Silicone rubber, VMQ)
This material is relatively inexpensive, has good plasma resistance, but its gas permeation rate is high.
Optional seal material used by SMC's high vacuum angle valve is Mitsubishi Cable Industries, Ltd. (Compound No. 1232-70, White)
It has a low weight-reduction ratio and low particle generation within O_2 plasma and NH_3 gas environments.

EPDM (Ethylenepropylene rubber)
Relatively lower priced and excellent in weatherability, chemical and heat resistance, but with no resistance at all to general mineral oil. Optional seal material used by SMC's high vacuum angle valve is Mitsubishi Cable Industries, Ltd. (Compound No. 2101-80)
Resistant to NH_3 gas, etc.

2 Shaft Sealing Method

Bellows
Bellows offer cleaner sealing with reduced particle generation and less outgassing. The two major bellow types are: Formed-bellows and Welded-bellows. Formed-bellows produce less dusts and offer higher dust resistance. Welded-bellows allow longer strokes, but generate more dust particles and offer less dust resistance. Please note, the endurance depends on length and speed of the strokes.

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. In general, fluorinated grease is affixed to the shaft seal portion.

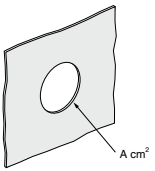
3 Response Time/Operation Time

Valve opening
The time from the application of voltage to the actuation solenoid valve (XL□) until 90% of the valve 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 (XL□) until 90% of the valve 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.

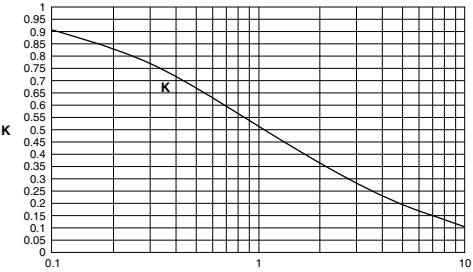
4 Molecular Flow Conductance

Orifice conductance
In the case of a øA (cm^2) hole in an ultra-thin plate, 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=11.6A (L/sec) at an air tempearture 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=12.1 D^3/L (L/sec) at an air temperature of 20°C.

Short pipe conductance
From the Clausing's factor "K" and hole conductance "C" in Graph 1. (Clausing's factor drawing), the short pipe conductance C_K is easily found as C_K=KC.



Graph 1. Clausing's factor

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

5 He Leakage

Surface leakage
This leakage occurs between surfaces of the sealing and the seal material. In the case of elastic body seal (elastomer), leakage values are confirmed within minutes of operation. Leakage rate is measured at room temperature (20 to 30°C).

Gas permeation
This is leakage caused by diffusion through the elastic body seal material. As 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 (distance between the atmosphere and the vacuum side). In the case of metal gaskets, only hydrogen diffusion should be considered.

6 Outgassing

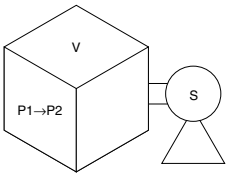
This is a phenomenon where gases adhered or adsorbed to the metallic surface or its inside parts are released from the surface and drawn into the vacuum according to the pressure decrease. The smoothness of the surface and closeness of the oxidized layer can effect (increase/decrease) this.

7 Ultimate Pressure

Ultimate pressure P (Pa) is P=Q/S, where the sum of Weight flow rates for outgassing (Qg) and leakage Q(L) is Q(Pa·m^3/s), and the exhaust speed is S(m^3/s). The ultimate pressure is measured with Qg, Q(L)S shown as above, and the ultimate pressure of the pump itself. In the case of very low pressure, the exhaust characteristics of the actual pump can be the limiting factor. In particular, a deterioration of exhaust characteristics due to an unclean pump and invasion of the atmospheric moisture can be the major factor.

8 Exhaust Time (Low/Medium Vacuum)

The time (△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 vacuum, 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 (T: absolute temperature) is raised to shorten residence time. This time is characterized as $\tau=\tau 0\ \exp(E/RT)$ where R is the ideal gas constant and τ0=(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 about 200 times shorter. The objective of baking is to exhaust water with long adsorption residence time more quickly.