

Since 1962, Nor-Cal Products has been improving our valve designs and expanding our product line in order to offer valves for almost every vacuum application. Our valves provide outstanding performance in the most demanding applications such as semiconductor and compound semiconductor processing.

### Valve Applications

PROCESS APPLICATION	VALVE TYPE	UNIQUE FEATURES	SIZES (NOMINAL ID)	SEAT SEAL	TEMPERATURE RANGE	PRESSURE RANGE	ACTUATION	PM CYCLES*
HIGH-VACUUM ROUGHING	<b>Poppet</b>	Large stroke	3/8 to 4	Viton	-20° to 150°C	15 psig to 10 <sup>-9</sup> Torr	Manual or Pneumatic	250,000
	<b>Genesis</b>	Small footprint. Low profile	3/4 to 4	Viton	-20° to 150°C	15 psig to 10 <sup>-9</sup> Torr	Pneumatic	1,000,000
	<b>Bellowless Poppet</b>	O-ring sealed shaft	3/8 to 2	Viton	-20° to 150°C	15 psig to ≥1x 10 <sup>-9</sup> Torr	Pneumatic	250,000
	<b>Butterfly</b>	Low profile. 1/4 swing	3/4 to 1 1/2	Viton	-20° to 150°C	15 psig to 10 <sup>-9</sup> Torr	Manual	30,000
UHV ROUGHING	<b>All-metal</b>	All-metal seals	3/4 & 1 1/2	Copper	-250° to 400°C	15 psig to 10 <sup>-11</sup> Torr	Manual	10,000**
UHV PUMP ISOLATION	<b>Gate</b>	Highest conductance	1 1/2 to 12	Viton	-20° to 150°C	15 psig to 10 <sup>-9</sup> Torr	Manual or Pneumatic	250,000
HIGH-VACUUM PUMP ISOLATION	<b>Pendulum</b>	Low particle generation. Low vibration	6 to 16	Viton	-20° to 150°C	15 psig to 10 <sup>-9</sup> Torr	Pneumatic	200,000
PUMP EXHAUST	<b>Ball</b>	1/4 swing open/close	3/4 to 2	Teflon	20° to 150°C	45 psig to 10 <sup>-9</sup> Torr	Manual	30,000
GAS INTRODUCTION	<b>Leak</b>	Variable leak	N/A	Copper	-250° to 450°C	500 psig to ≥1x 10 <sup>-11</sup> Torr	Manual	300**

\* Cycles before first recommended service

\*\* Cycle life is reduced with high temperature bakeouts

### Poppet Valves

Our poppet valves are fully opening for high conductance and to prevent bellows contamination while the valve is in the open position, reducing particle contamination when the valve is cycled. Our bodies are die-formed from 304 stainless steel to eliminate sharp inside corners and improve conductance. The valves are electropolished for lower outgassing and better corrosion resistance. The welded bellows are made from AM-350 stainless steel to provide excellent corrosion resistance and flexibility. They are designed with additional segments to provide extended life.

### Ball Valves

Ball valves are a low cost, manually operated, straight through isolation device. Their simple, robust design provides high reliability in "dirty" applications. They are commonly used on MOCVD and CVD equipment downstream from the chamber or vacuum pump to isolate traps or abatement tools. A forged 316L stainless steel body and Teflon seat make these valves ideal for corrosive environments. Other applications include vacuum and other facilities requirements.

### Genesis Valves

The Genesis modular vacuum valve system provides semiconductor equipment designers with unlimited possibilities for downstream vacuum subassemblies. Nippleless valve bodies and block fittings can be assembled by two attachment methods using universal ISO-KF centering ring/O-ring hardware, providing maximum flexibility and the smallest footprint possible. Additionally these valves feature million cycle reliability, integrated low-cost soft start circuit and modular heaters.

### Linear Gate Valves

Our linear gate valves have an ultra-slim profile, which makes them perfect for applications where space is limited, and their smaller volume results in lower outgassing and faster pump-down. Larger sizes have a unique feature in the actuator, which dampens the vibration, which can arise when the gate is opened. This makes these valves ideal for semiconductor and other vibration sensitive processes.

### All-Metal Valves

Nor-Cal's bakeable all-metal seal angle valves are intended for use in UHV or cryogenic applications where temperature extremes preclude the use of our elastomer seal valves. Approved for use in beamline facilities, these valves have a temperature operating range from -250°C to 400°C.



Prices subject to change without notice. - International product pricing will vary.

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### New Products

#### Genesis Stainless Steel Valves

These simple, robust valves offer equipment designers the high performance and optimized conductance of Genesis modular valves in Nor-Cal's standard stainless steel poppet valve body. During testing, the valves were cycled millions of times while maintaining vacuum integrity.



#### Leak Valves

Leak valves are used for controlling gas introduction into high and ultra-high vacuum systems. They utilize an optically flat sapphire poppet and a metal seal seat, allowing bakeout temperatures to 450°C.

#### Manual Butterfly Valves

These Viton O-ring sealed valves provide a low-cost alternative to bellows sealed gate valves. Quarter-turn actuation, small footprint and the shortest possible gas path make manual butterfly valves the preferred choice for many applications.



#### Bellows Poppet Valves

Right angle bellows poppet valves are typically used for applications with large differential pressures or "dirty" processes that cause frequent bellows failures. Poppet shafts are sealed with double O-rings.

#### Pendulum Valves

Nor-Cal's pneumatic pendulum valves offer the user a highly reliable, compact and low cost alternative to competitive designs. In addition, the smooth actuation results in low particle generation and rapid open-to-close speeds.



#### Custom Valves

Nor-Cal frequently provides custom and modified standard isolation valves to meet our customer's specific requirements. Single or multiple valves can be integrated with manifolds, chambers and other components. Many special features can be specified by adding options. See page 99.

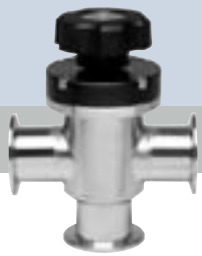
#### Standard Options

- Normally open pneumatic actuation
- Microswitch position indication
- Special O-rings
- Various air solenoid voltages
- Fitting options for bypass lines
- Heater jackets, insulators and controllers

#### Custom Features

- Special port lengths and configurations for drop-in compatibility with other manufacturer's valves
- Custom flange configurations
- Special position indicators
- Pump out ports
- Custom finishes
- Gate shields for linear gate valve O-rings





# Isolation Valves

## Poppet Valve General Information

### SPECIFICATIONS

**Nominal port ODs:** 3/8 to 4 inch

**Body:** Electropolished 304 stainless steel

**Bellows:** Welded AM-350 stainless steel

**Bonnet seal:** Viton or Copper

**Poppet seal:** Viton

*Other O-ring compounds available*

**Flanges:** CF, NW, ISO, ASA or EVAC

**Maximum temperature with Viton seals**

*See bakeability chart this page*

Sustained:  $\leq 150^{\circ}\text{C}$

Intermittent:  $\leq 204^{\circ}\text{C}$

**Helium leak tested:**  $10^{-9}$  std. cc./sec. or less

**Vacuum range**

Viton bonnet seal:  $\geq 1 \times 10^{-9}$  Torr - High Vacuum

Copper bonnet seal:  $\geq 1 \times 10^{-10}$  Torr - UHV

**Manual actuation:** Bronze nuts/ACME threads

**Pneumatic actuation:** Normally closed

Operating Pressure: 60 to 80 psig

3/4 to 2 inch ODs: Air-to-open/spring-to-close

2 1/2 to 4 inch ODs: Air-to-open/air-to-close

**Differential pressure:** Max. 20 psia across valve seat (*External differential pressures greater than 5 psi on the bellows may result in premature bellows failure*)

**Options:** See facing page.

**Thermal:** Heater jackets and controllers available for all valves. *Call for details*

### Construction

Bodies are die-formed from 304 stainless steel to eliminate sharp inside corners and improve conductance. The valves are electropolished for faster pumpdown, lower outgassing and better corrosion resistance. The welded bellows are made from AM-350 stainless steel to provide corrosion resistance and excellent flexibility. The bellows fully retract from the side port when the valve is open, eliminating buildup of by-products on the bellows and subsequent particle generation during operation. They are designed with additional segments to provide extended life. Nor-Cal valves can be operated in any position and actuators can be removed quickly for routine inspection without disassembling the system.

### Models

Our poppet valves are available in most port configurations with CF, NW, ISO, EVAC or ASA flanges. Valves through 3 inch OD's are available with manual or pneumatic actuators and Viton or copper bonnet seals. Valves over three inches are available with pneumatic actuators only. Custom port lengths, flange configurations and bellowsless valves are also available.



### Vacuum Range

Poppet seals have helium leak rates of  $10^{-9}$  std. cc./sec. or less. Viton bonnet sealed valves can be used in the  $10^{-9}$  Torr range, while copper bonnet seal valves are suited for use in the  $10^{-10}$  range.

### Copper Bonnet Seal

Copper bonnet seal poppet valves with CF flanges provide metal seals between the inside of the valve and the atmosphere. They are available in all standard sizes and port configurations.

### Valve Actuation

Manually operated valves utilize Acme threads and a self-lubricating bronze nut for fewer turns and smooth, trouble-free operation. Pneumatic valves are normally air-to-open, spring-to-close in port ODs through 2 inches for immediate closure in case of electrical or air failure. Larger valves are normally air-to-open, air-to-close. This actuation option is available on all valves. Most sizes are available with air-to open, air-to-close with spring assist as an option. Operating air pressure for all pneumatic valves is 60 to 80 psig.

### Thermal Products

All Nor-Cal poppet valves and gate valves can be provided with silicone foam or fiberglass insulated heater jackets to reduce resident time of corrosives or particle buildup in semiconductor applications. These jackets are available with PID controllers or thermostats with high temperature shutoffs. Jacket and control specifications can be tailored to meet your specific needs. Call for price and model number. Refer to Section 11, Thermal Products, for more information.

ESVP  
cutaway  
view



### Bakeability

The valve's bakeout temperature should not exceed that of the elastomer that is used in it. See chart below. Standard Viton sealed valves are bakeable to  $150^{\circ}\text{C}$  sustained and  $204^{\circ}\text{C}$  for intermittent periods. However, the Viton O-rings begin to take a set at  $150^{\circ}\text{C}$ . High temperature Kalrez O-rings are available as an option and allow these valves to be baked to  $220^{\circ}\text{C}$  for intermittent periods and  $170^{\circ}\text{C}$  for extended periods.

BONNET/POPPET SEAL	APPLICATION	PNEUMATIC VALVES		MANUAL VALVES	
		OPEN	CLOSED	OPEN	CLOSED
Viton	General purpose	$150^{\circ}\text{C}$	$120^{\circ}\text{C}$	$150^{\circ}\text{C}$	$100^{\circ}\text{C}$
Kalrez 4079	High temperature	$280^{\circ}\text{C}$	$220^{\circ}\text{C}$	$280^{\circ}\text{C}$	$150^{\circ}\text{C}$
Kalrez 2037	Chemical resistant	$218^{\circ}\text{C}$	$218^{\circ}\text{C}$	$218^{\circ}\text{C}$	$218^{\circ}\text{C}$
Chemraz	Chemical resistant	$210^{\circ}\text{C}$	$210^{\circ}\text{C}$	$210^{\circ}\text{C}$	$210^{\circ}\text{C}$
Silicone	High temperature	$232^{\circ}\text{C}$	$232^{\circ}\text{C}$	$232^{\circ}\text{C}$	$232^{\circ}\text{C}$

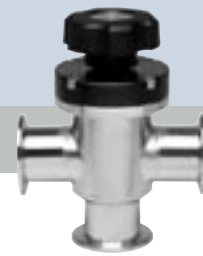
### Poppet Valve Conductance (Liters per second)

The conductance values in the table below have been calculated for air at room temperature using the formulas for tubes and elbows presented in the third edition of Roth's Vacuum Technology:  $C_v = 182(D^4/L)\bar{P}$  for viscous flow or  $C_m = 12(D^3/L)$  for molecular flow. Port lengths without flanges and inner diameters for the valve sizes and configurations were used. This method is an approximation, use values accordingly.

PORT NOM. OD	ANGLE OR TEE		ANGLE-IN-LINE		IN-LINE		STRAIGHT-THROUGH	
	VISCOUS	MOLECULAR	VISCOUS	MOLECULAR	VISCOUS	MOLECULAR	VISCOUS	MOLECULAR
1/2	60	3	-	-	45	2	-	-
3/4	135	5	120	4	105	4	90	4
1	391	12	286	9	270	8	-	-
1 1/8	-	-	-	-	-	-	436	11
1 1/2	1925	37	1324	25	1263	24	1203	23
2	4677	65	3459	48	3113	44	-	-
2 1/2	12332	136	7505	83	7610	84	-	-
3	23263	217	12558	115	14258	130	-	-
4	57994	396	-	-	34577	236	-	-

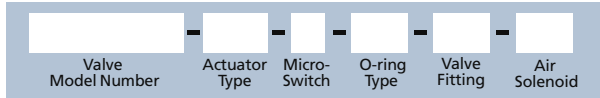
Note:  $\bar{P}$ =air at 1 Torr.  $L'$ =Laxial +1.33(9/180)D for elbows.

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One or more options can be added to a particular valve by adding the option suffix to the basic valve model number as shown below. Heater jackets and controllers are also available for all poppet valves. Call for details and pricing.

**Add option suffixes in the following order:**



**Example of a model number with options: ESVP-1502-CF-AS-M-S11**

### Actuation Option

OPTION	DESCRIPTION	ADD TO PRICE
-A	Air-to-open/air-to-close	N/C
-AS	Air-to-open/air-to-close with spring assist	CALL
-SA	Spring-to-open/air-to-close	CALL

Pneumatic valves with port ODs through 2 inches are normally air-to-open/spring-to-close for immediate closure in case of electrical or air failure. Larger valves are normally air-to-open/air-to-close. These actuation options are available on nearly all sizes and port configurations of Nor-Cal pneumatically actuated poppet valves.

### Micro-Switch Option

OPTION	ADD TO PRICE
-M	CALL

Micro-switches are available on all pneumatically actuated Nor-Cal valves. A pair of 5-amp micro-switches are opened or closed by the movement of the valve stem. One switch closes when the valve is fully open and the other when it is fully closed. These can be connected to control panels with alarms or lights for positive position indication. Electrical leads are approximately 10 inches long, but may be cut to any length upon request.



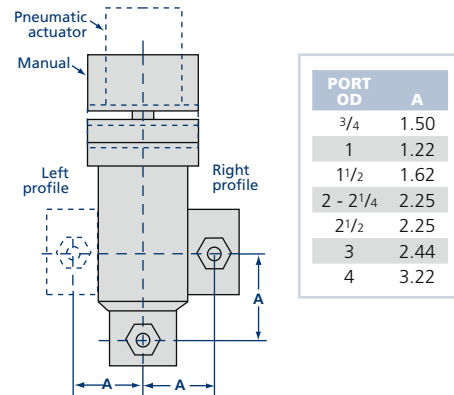
PORT OD	A
3/8	2.06
1/2	2.06
3/4	2.06
1	2.06
1 1/2	2.06
2	3.54
3	3.54
4	5.01

### Right Angle Valve Fitting Option

OPTION	PROFILE	DESCRIPTION	VALVE PORTS	ADD TO PRICE
-F1	Left	1/4 female VCR	Both	CALL
-F2	Left	3/8 female VCR	Both	CALL
-F3	Left	1/8 female NPT	Bottom	CALL
-F4	Right	1/4 female VCR	Both	CALL
-F5	Right	3/8 female VCR	Both	CALL
-F6	Right	1/8 female NPT	Bottom	CALL

**Note:** Available on ESV, ESVP, CSV and CSVP models only.

All Nor-Cal right angle valves (ESV, CSV, ESVP and CSVP models) are available with the six fitting options described in the table above. These options are designed to make it easy for our customers to retrofit our valves with thermocouple gauges, leak valves, up-to-air valves or gas introduction lines. Other fittings or configurations are available.



### Air Solenoid Option

OPTION	KIT	PORT OD	DESCRIPTION	PRICE
-S11	S11-K	3/8 to 2	3-way, 120VAC, 50/60 Hz	CALL
-S21	S21-K	3/8 to 2	3-way, 24VDC	CALL
-S31	S31-K	3/8 to 2	3-way, 240VAC, 50/60 Hz	CALL
-S41	S41-K	3/8 to 2	3-way, 24VAC, 50/60 Hz	CALL
-S12	S12-K	2 1/2 to 3	4-way, 120VAC, 50/60 Hz	CALL
-S22	S22-K	2 1/2 to 3	4-way, 24VDC	CALL
-S32	S32-K	2 1/2 to 3	4-way, 240VAC, 50/60 Hz	CALL
-S42	S42-K	2 1/2 to 3	4-way, 24VAC, 50/60 Hz	CALL

**Note:** Use 4-way solenoid option for 1.12 and 1.5 OD STVP and CSTVP models.

All pneumatic poppet valves can be provided with air solenoids with several current ratings for electropneumatic actuation. Valves with air-to-open, spring-to-close actuation require three-way air solenoids, while air-to-open, air-to-close actuators require four-way solenoids. Both three and four-way air solenoids are available in four current ratings. A pneumatic valve ordered with this option will arrive with an air solenoid installed. Fourteen inch long electrical leads are provided for connection to the power supply.

Air solenoids can be purchased separately in a kit complete with instructions for installation by the customer.

When placing your order please specify the model number of the valve that the air solenoid will be installed on, so that our sales staff can confirm whether a three-way or four-way solenoid is required.



### O-ring Option

OPTION	COMPOUND	TEMPERATURE MIN.	TEMPERATURE MAX.	APPLICATION	ADD TO COST
Standard	Viton	-29°C	204°C	Industry standard	N/C
-KT	Kalrez 4079	-50°C	316°C	High temperatures	Call
-KC	Kalrez 2037	-54°C	220°C	Chemical resistant	Call
-CR	Chemraz 513	-30°C	210°C	Chemical resistant	Call
-S	Silicone	-55°C	232°C	High temperatures	Call

Standard Nor-Cal valves use chemical resistant Viton O-rings. Viton O-rings should not be heated to above 204°C. Even prolonged exposures of 150°C may degrade the O-rings. High temp Kalrez O-rings allow valve bakeouts to 220°C intermittently or 170°C for extended periods. Silicone O-rings provide adequate sealing performance in thermal cycling from -55°C to 230°C.

