

# ROSS Valves For Vacuum Service



• *Manufacturers of Premium Pneumatic Controls since 1921* •

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# What Are Vacuum Service Valves?

**V**acuum service valves are ideal for lifting, holding, vacuum packaging and moving anything from large objects to tiny particles. They also provide an effective means for leak testing. The vacuum source typically comes from either a vacuum pump or a venturi. In vacuum service applications, the pressure within the valve is reduced below atmospheric pressure. Consequently, atmospheric pressure actually pushes air into the valve, instead of the common belief that air is “sucked” in by the vacuum.

In normal valves, filters exist to clean compressed air, which is then pushed through the valve. In vacuum valves, there is no filter, and the air comes from the atmosphere and enters through the outlet, bringing with it atmospheric and nearby surface dust and dirt. Vacuum valves, in order to function consistently, must therefore be highly tolerant of the particles that freely flow into the valves.

To construct a vacuum service valve system, typically a 3/2 normally closed valve is used. The vacuum is on the inlet, while the exhaust remains open to atmosphere. Port 2 is the working port. However, if there is a need for the vacuum service valve to function as normally open, simply connect the vacuum source to the exhaust and port 1

to atmosphere. Several variations of this construction are effective, including using 2/2 valves.

## “Full Vacuum” Valves

Though there are fewer applications for full vacuum valves than regular vacuum valves, full vacuum valves are ideal for applications where compressed air is unavailable. Full vacuum valves use the difference in force between atmospheric pressure and the vacuum within the valve to actuate the valve. The full vacuum valve performs with atmospheric pressure in port 1 and 10 to 30 inches of Mercury vacuum in the valve body.

## Remote Air or Solenoid-Piloted Vacuum Valves

Pilot vacuum valves provide a greater variety of applications, operating with a combination of vacuum and atmospheric pressure. The pilot must be supplied externally with a minimum of 30 psig. Vacuum valves can be used as either 3/2 normally closed or normally open valves, with vacuum supplied at either port 1 or port 3. Normally closed and normally open 2/2 versions are also available.

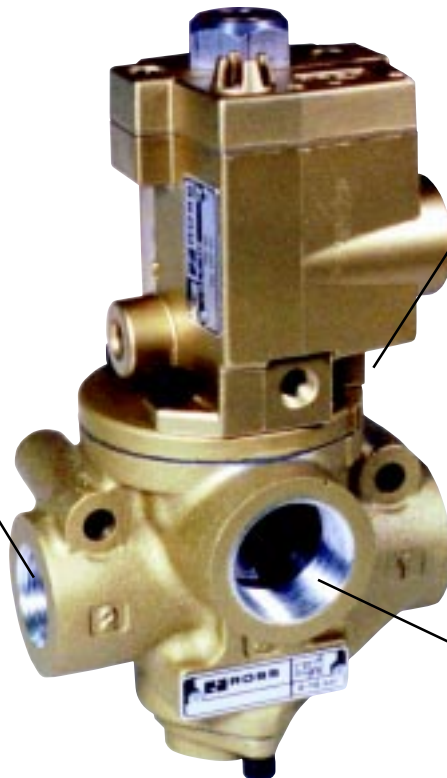
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## Anatomy Of A Vacuum Service Valve

*Special ROSS poppets are the toughest available, ideal for dirty vacuum applications. ROSS poppets also have large flow areas, which allow high flow.*

*Port 2 is the working port.*

*ROSS vacuum valves have larger orifices, allowing greater flow and easing the transport of air even though there is a small differential between the vacuum within the valve and atmospheric pressure outside the valve.*



*Pilot can be fed externally by compressed air. Internally, atmospheric pressure can be used as pilot for “full vacuum” version.*

*ROSS poppet valves have specially designed seals for vacuum service applications that provide reliability and less leakage.*

*Typical applications place vacuum or atmosphere on port 1 (the inlet port in non-vacuum applications).*

*Port 3 is open to atmosphere or vacuum, depending on application.*

# Why A ROSS Vacuum Valve?

In non-vacuum valves, maintaining consistent shift time is easier because clean air flows through the valve. However, the absence of a filter in vacuum service applications means that vacuum valve internals must be able to withstand high levels of dirt and continue shifting. That's why ROSS uses its famous poppet design in its vacuum valves.

## ROSS Poppet Valves

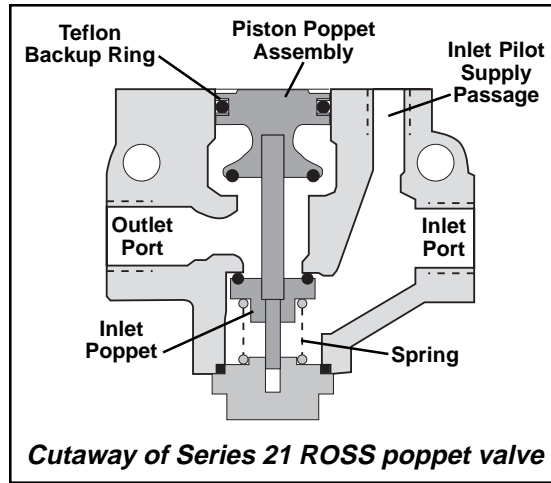
ROSS poppets are known for their ability to withstand the harshest of environments and keep working consistently. What makes ROSS poppets shift so consistently and seal so effectively is its unbalanced design. The areas of the piston, the exhaust poppet and the inlet poppet are precisely designed to produce strong shifting forces in either direction as well as strong forces to keep the poppets sealed. In vacuum valve applications, a stronger spring is used to ensure the necessary shifting and sealing forces are maintained. Sometimes things get lodged between the poppet and the sealing surface. However,

with the ROSS poppet valve design, anything caught inside is forced through the valve by the high velocity air flow within a few cycles. Flow velocity is dependent upon the area through which a volume of air is flowing. The

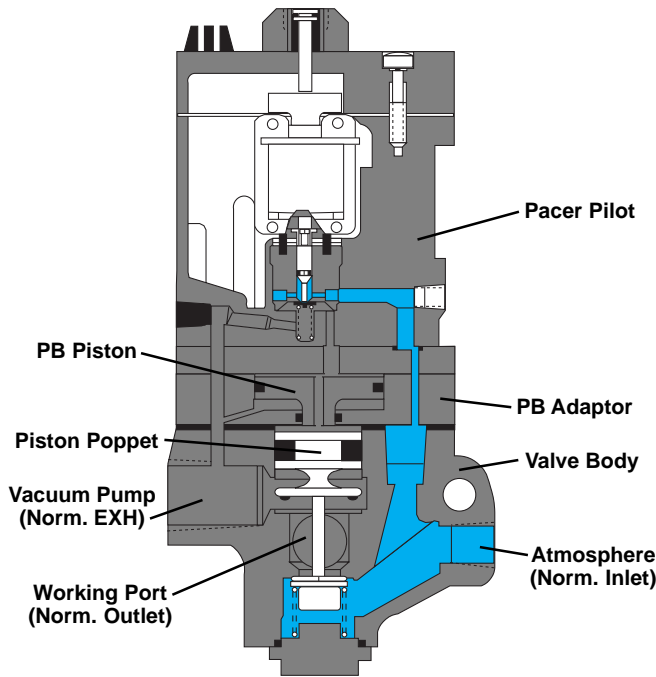
smaller the area is, the greater the velocity will be. In ROSS poppet valves, the smallest flow-through area is across the poppet's seal and seat, momentarily, as the valve shifts. This design allows a high velocity, thereby blowing all dirt and foreign matter out of the seat area to provide a virtually leak-proof seal.

ROSS poppet valves are also effective because they achieve full flow quicker. In addition, ROSS poppet valves have large orifices, which are conducive to greater flow in low pressure differential situations, such as vacuum service.

For more information on vacuum service valves, contact ROSS Technical Services at (888) TEK-ROSS.

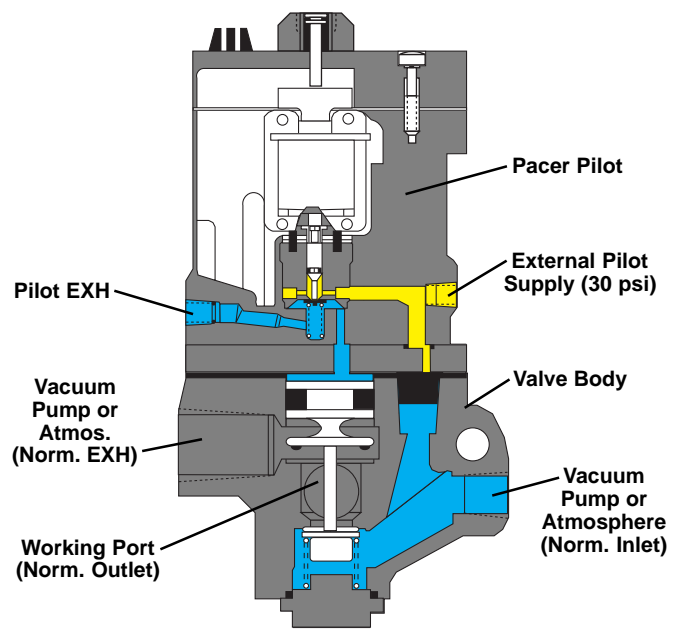


## Solenoid Piloted "Full Vacuum" Valve Cross-Section



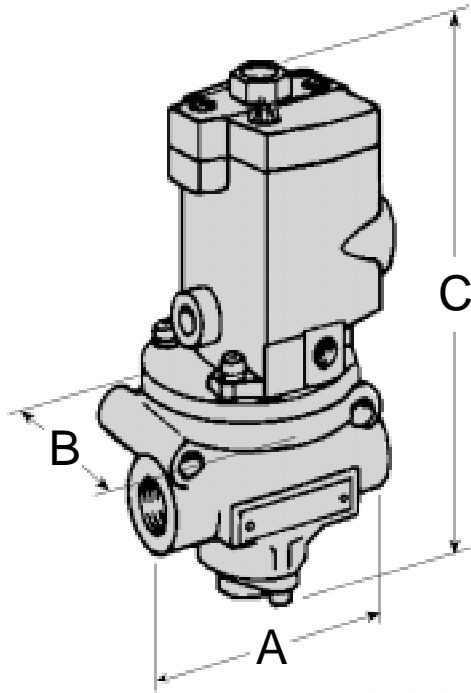
- Vacuum Pump (Norm. Exhaust)
- Atmosphere (Norm. Inlet)

## Solenoid Piloted Valve with External Pilot Supply Cross-Section



- Vacuum Pump (Norm. Exh.)
- Atmosphere (Norm. Inlet)
- Pilot Pressure

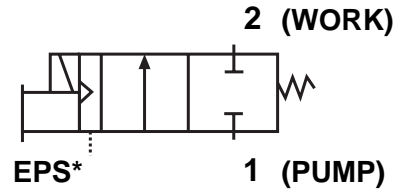
# Series 21 2/2 Solenoid Pilot Vacuum Valves



## STANDARD SPECIFICATIONS

- Solenoids:** Rated for continuous duty.  
Standard voltages 100-110 volts 50 Hz; 100-120 volts 60 Hz; 24, 110 volts d.c.
- Power Consumption:** 87 VA inrush, 30 VA holding on 50 or 60 Hz; 14 Watts on DC.
- Ambient Temperature:** -40 to 120° F (-40 to 50° C).  
(For low temperature valves; High temperature valves also available.)
- Media Temperature:** -40 to 175° F (-40 to 80° C).
- Flow Media:** Vacuum and/or filtered-compressed air.
- Pressure:** Vacuum to 150 psig.
- \*External Pilot Pressure:** Equal or higher than inlet pressure, but not less than 30 psig.

## Normally Closed

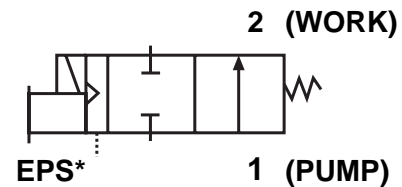


## Piping 2/2 Normally Closed Valves

Pipe the unit into the system by connecting the vacuum source or pump to the normal air pressure inlet port (port 1). The normal outlet port is the work port (port 2).

**Note:** 2/2 vacuum valves provide only on/off control and do not have an exhaust function.

## Normally Open



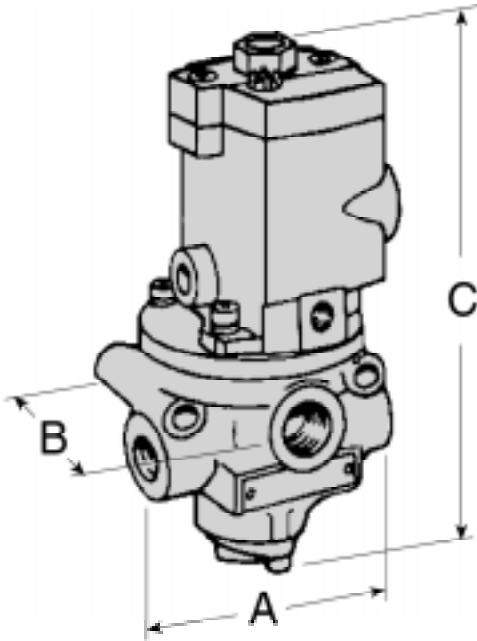
## Piping 2/2 Normally Open Valves

Pipe the unit into the system by connecting the vacuum source or pump to the normal air pressure inlet port (port 1). The normal outlet port is the work port (port 2).

**Note:** 2/2 vacuum valves provide only on/off control and do not have an exhaust function.

Port Size	Average Cv	Valve Model Numbers	Function	A	B	C
1/4	2.1	2171B2901	N.C.	3.6 (91)	3.1 (79)	7.1 (180)
1/4	2.1	2171A2908	N.C.	3.6 (91)	3.1 (79)	7.1 (180)
3/8	2.6	2171A3906	N.C.	3.6 (91)	3.1 (79)	7.1 (180)
3/4	7.8	2171B5905	N.C.	4.6 (116)	3.1 (79)	7.8 (198)
1	8.3	2171B6904	N.C.	4.6 (116)	3.1 (79)	7.8 (198)
1	20	2171A6915	N.C.	6.7 (169)	4.1 (104)	10.6 (270)
1-1/4	30	2171B7901	N.C.	6.7 (169)	4.1 (104)	10.6 (270)
1-1/2	31	2171B8906	N.C.	6.7 (169)	4.1 (104)	10.6 (270)
1-1/2	21	2172B8900	N.O.	6.7 (169)	4.1 (104s)	11.8 (300)
2	57	2171A9900	N.C.	8.7 (219)	5.2 (131)	11.8 (300)
2	57	2172B9901	N.O.	8.7 (219)	5.2 (131)	11.8 (300)
2-1/2	64	2171B9901	N.C.	8.7 (219)	5.2 (131)	11.8 (300)

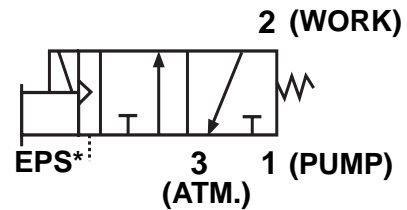
# Series 21 3/2 Solenoid Pilot Vacuum Valves



## STANDARD SPECIFICATIONS

- Solenoids:** Rated for continuous duty.  
Standard voltages 100-110 volts 50 Hz; 100-120 volts 60 Hz; 24, 110 volts d.c.
- Power Consumption:** 87 VA inrush, 30 VA holding on 50 or 60 Hz; 14 Watts on DC.
- Ambient Temperature:** -40 to 120° F (-40 to 50° C).  
(For low temperature valves; High temperature valves also available.)
- Media Temperature:** -40 to 175° F (-40 to 80° C).
- Flow Media:** Vacuum and/or filtered-compressed air.
- Pressure:** Vacuum to 150 psig.
- \*External Pilot Pressure:** Equal or higher than inlet pressure, but not less than 30 psig.

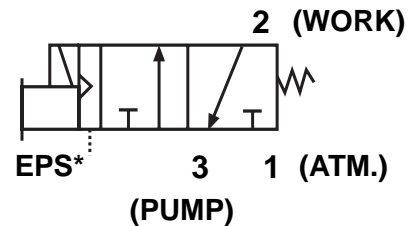
## Normally Closed



## Piping 3/2 Normally Closed Valves

In this valve configuration, pipe the unit into the system by connecting the vacuum source or pump to the normal air pressure inlet port (port 1). The normal outlet port is the work port (port 2), and the normal air pressure exhaust port becomes the atmosphere port (port 3).

## Normally Open

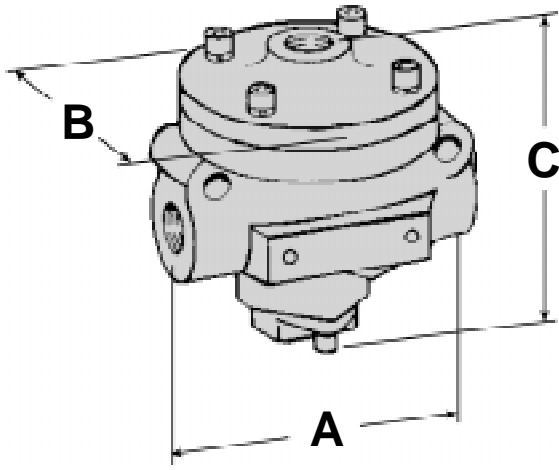


## Piping 3/2 Normally Open Valves

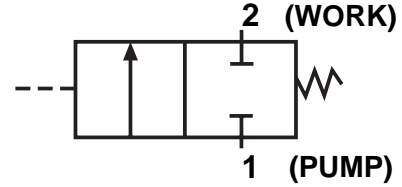
To obtain a 3/2 normally open ROSS vacuum valve, simply pipe the 3/2 normally closed body slightly differently. Connect the vacuum source or pump to port 3, the normal exhaust. Leave port 1 open to atmosphere, and the normal outlet remains as the work port (port 2).

Port Sizes		Average Cv*		Valve Model Numbers	Function	A	B	C
In-Out	Exh.	In-Out	Out-Exh.					
1/4	1/2	2.4	3.4	2173B2900	N.C.	3.6 (91)	3.1 (79)	7.4 (187)
3/8	1/2	3.0	5.8	2173B3900	N.C.	3.6 (91)	3.1 (79)	7.4 (187)
3/8	1/2	3.0	5.8	2174B3900	N.C.	3.6 (91)	3.1 (79)	7.4 (187)
3/8	1/2	3.0	5.8	2173A3908	N.O.	3.6 (91)	3.1 (79)	7.4 (187)
1/2	1/2	3.0	5.2	2173B4901	N.C.	3.6 (91)	3.1 (79)	7.4 (187)
1/2	1	6.6	12	2173B4902	N.C.	4.6 (116)	3.6 (92)	8.1 (206)
1/2	1	6.5	7.0	2174A4912	N.C.	4.6 (116)	3.6 (92)	8.1 (206)
3/4	1	7.8	13	2173B5900	N.C.	4.6 (116)	3.6 (92)	8.1 (206)
3/4	1	7.5	7.5	2174B5903	N.C.	4.6 (116)	3.6 (92)	8.1 (206)
1	1	7.5	12	2173B6901	N.C.	4.6 (116)	3.6 (92)	8.1 (206)
1	1-1/2	24	40	2173B6902	N.C.	6.7 (169)	4.9 (123)	10.6 (270)
1	1-1/2	15	17	2174A6914	N.O.	6.7 (169)	4.9 (123)	10.6 (270)
1-1/4	1-1/2	29	39	2173B7901	N.C.	6.7 (169)	4.9 (123)	10.6 (270)
1-1/4	1-1/2	29	39	2173A7917	N.O.	6.7 (169)	4.9 (123)	10.6 (270)
1-1/2	1-1/2	30	38	2173A8911	N.C.	6.7 (169)	4.9 (123)	10.6 (270)
1-1/2	2-1/2	68	70	2173A8915	N.C.	8.7 (219)	6.4 (161)	12.4 (313)
2	2-1/2	70	70	2173A9905	N.C.	8.7 (219)	6.4 (161)	12.4 (313)
2-1/2	2-1/2	70	71	2173A9906	N.C.	8.7 (219)	6.4 (161)	12.4 (313)

# Series 21 2/2 Air Pilot Vacuum Valves



## Normally Closed

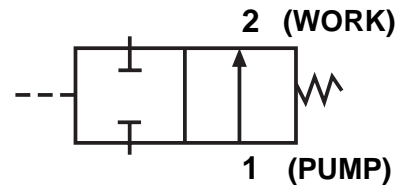


### Piping 2/2 Normally Closed Valves

Pipe the unit into the system by connecting the vacuum source or pump to the normal air pressure inlet port (port 1). The normal outlet port is the work port (port 2).

**Note:** 2/2 vacuum valves provide only on/off control and do not have an exhaust function.

## Normally Open



### Piping 2/2 Normally Open Valves

Pipe the unit into the system by connecting the vacuum source or pump to the normal air pressure inlet port (port 1). The normal outlet port is the work port (port 2).

**Note:** 2/2 vacuum valves provide only on/off control and do not have an exhaust function.

## STANDARD SPECIFICATIONS

**Media Temperature:** -40 to 175° F (-40 to 80° C).

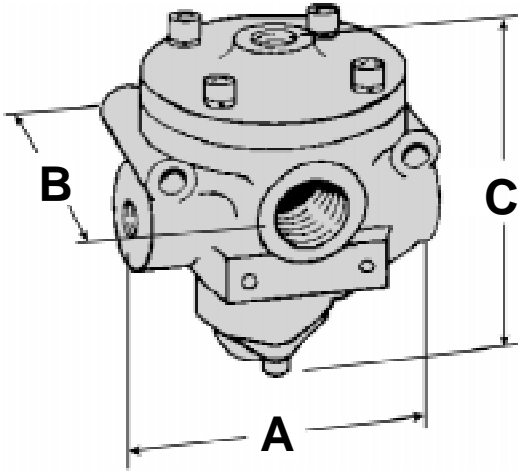
**Flow Media:** Vacuum and/or filtered-compressed air.

**Pressure:** Vacuum to 150 psig.

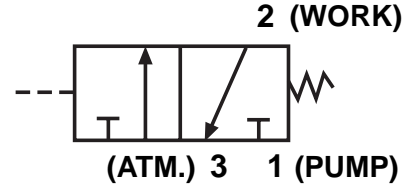
**Signal Pressure:** Equal or higher than inlet pressure, but not less than 30 psig.

Port Size	Average Cv	Valve Model Numbers	Function	A	B	C
1/4	2.1	2151A2901	N.C.	3.6 (91)	3.1 (79)	3.8 (95)
1/2	6.9	2151B4904	N.C.	4.6 (116)	3.1 (79)	4.5 (113)
1/2	3.0	2151A4910	N.C.	3.6 (91)	3.1 (79)	3.8 (95)
3/4	7.8	2151A5913	N.C.	4.6 (116)	3.1 (79)	4.5 (113)
3/4	7.8	2151A5914	N.C.	4.6 (116)	3.1 (79)	4.5 (113)
3/4	7.0	2152A5901	N.O.	4.6 (116)	3.1 (79)	4.5 (113)
1	8.3	2151B6900	N.C.	4.6 (116)	3.1 (79)	4.5 (113)
1-1/4	30	2151A7909	N.C.	6.7 (169)	4.1 (104)	7.5 (190)
1-1/2	31	2151B8900	N.C.	6.7 (169)	4.1 (104)	7.5 (190)
1-1/2	23	2152B8900	N.O.	6.7 (169)	4.1 (104)	7.5 (190)

# Series 21 3/2 Air Pilot Vacuum Valves



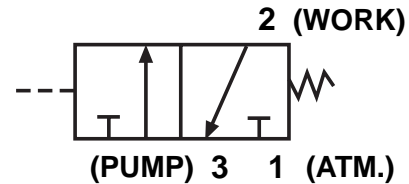
## Normally Closed



### Piping 3/2 Normally Closed Valves

In this valve configuration, pipe the unit into the system by connecting the vacuum source or pump to the normal air pressure inlet port (port 1). The normal outlet port is the work port (port 2), and the normal air pressure exhaust port becomes the atmosphere port (port 3).

## Normally Open



### Piping 3/2 Normally Open Valves

To obtain a 3/2 normally open ROSS vacuum valve, simply pipe the 3/2 normally closed body slightly differently. Connect the vacuum source or pump to port 3, the normal exhaust. Leave port 1 open to atmosphere, and the normal outlet remains as the work port (port 2).

## STANDARD SPECIFICATIONS

**Media Temperature:** -40 to 175° F (-40 to 80° C).

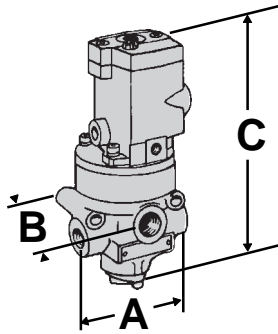
**Flow Media:** Vacuum and/or filtered-compressed air.

**Pressure:** Vacuum to 150 psig.

**Signal Pressure:** Equal or higher than inlet pressure, but not less than 30 psig.

Port Sizes		Average Cv*		Valve Model Numbers	Function	A	B	C
In-Out	Out-Exh.	In-Out	Out-Exh.					
1/4	1/2	2.4	3.4	2153B2900	N.O.	3.6 (91)	3.1 (79)	4.0 (101)
1/2	1/2	3.0	5.2	2153B4903	N.C.	3.6 (91)	3.1 (79)	4.0 (101)
3/4	1	7.8	13	2153B5903	N.C.	4.6 (116)	3.6 (92)	4.8 (121)
1	1-1/2	24	40	2153C6905	N.O.	6.7 (169)	4.9 (123)	7.5 (190)
1	1	7.5	12	2153A6906	N.C.	4.6 (116)	3.6 (92)	4.8 (121)
1-1/4	1-1/2	29	39	2153A7906	N.O.	6.7 (169)	4.9 (123)	7.5 (190)
1-1/2	1-1/2	30	38	2153B8900	N.C.	6.7 (169)	4.9 (123)	7.5 (190)
2-1/2	2-1/2	70	71	2153A9902	N.C.	8.7 (219)	6.4 (161)	9.5 (241)
2	2-1/2	58	61	2154A9900	N.C.	8.7 (219)	6.4 (161)	9.5 (241)

# Full Vacuum Valves



## STANDARD SPECIFICATIONS

**Solenoids:** Rated for continuous duty.  
 Standard voltages 100-110 volts 50 Hz; 100-120 volts 60 Hz; 24, 110 volts d.c.  
**Power Consumption:** 87 VA inrush, 30 VA holding on 50 or 60 Hz; 14 Watts on DC.  
**Ambient Temperature:** -40 to 120° F (-40 to 50° C).  
 (For low temperature valves; High temperature valves also available.)  
**Media Temperature:** -40 to 175° F (-40 to 80° C).  
**Flow Media:** Vacuum and/or filtered-compressed air.  
**Pressure:** Vacuum to 150 psig.  
**\*External Pilot Pressure:** Equal or higher than inlet pressure, but not less than 30 psig.



### Full Vacuum — 3-Way Normally Closed

This valve functions as a **normally open** valve. Pipe the unit into the system by connecting the vacuum source or pump to port 3, the normal exhaust. Leave port 1 open to atmosphere, and the normal outlet remains as the work port (port 2).



### Full Vacuum — 3-Way Normally Open

This valve functions as a **normally closed** valve. Pipe the unit into the system by connecting the vacuum source or pump to port 3, the normal exhaust. Leave port 1 open to atmosphere, and the normal outlet remains as the work port (port 2).

Port Sizes		Average Cv*		Valve Model Numbers	Function	A	B	C
In-Out	Exh.	In-Out	Out-Exh.					
1/2	1/2	3.0	5.2	2173B4914	N.C.	3.6 (91)	3.1 (79)	7.4 (187)
1/2	1/2	2.9	2.8	2174B4900	N.C.	3.6 (91)	3.1 (79)	7.4 (187)
1-1/4	1-1/2	29	39	2173B7904	N.C.	6.7 (169)	4.9 (123)	10.6 (270)
1-1/4	1-1/2	21	23	2174A7903	N.O.	6.7 (169)	4.9 (123)	10.6 (270)



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## WARRANTY

Products manufactured by ROSS are warranted to be free of defects in material and workmanship for a period of one year from the date of purchase. ROSS' obligation under this warranty is limited to repair or replacement of the product or refund of the purchase price paid solely at the discretion of ROSS and provided such product is returned to ROSS freight prepaid and upon examination by ROSS such product is found to be defective. This warranty shall be void in the event that product has been subject to misuse, misapplication, improper maintenance, modification or tampering. THE WARRANTY EXPRESSED ABOVE IS IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES AND ROSS EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES EITHER EXPRESSED OR IMPLIED WITH RESPECT TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ROSS MAKES NO WARRANTY WITH RESPECT TO ITS PRODUCTS MEETING THE PROVISIONS OF ANY GOVERNMENTAL OCCUPATIONAL SAFETY AND/OR HEALTH LAWS OR REGULATIONS. IN NO EVENT SHALL ROSS BE LIABLE TO PURCHASER, USER, THEIR EMPLOYEES OR OTHERS FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES WHICH MAY RESULT FROM A BREACH OF THE WARRANTY DESCRIBED ABOVE OR THE USE OR MISUSE OF THE PRODUCTS. NO STATEMENT OF ANY REPRESENTATIVE OR EMPLOYEE OF ROSS SHALL EXTEND THE LIABILITY OF ROSS AS SET FORTH HEREIN.