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PNEUMATIC Superseal bellows valves

USER MANUAL

KF, CF, ISO-K Flanged and Weldable Tube Series

SSPV-03182025 - V 1.1.4

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SAFETY

Thank you for purchasing this equipment from Ideal Vacuum Products. We want you to operate it safely.

- **Read this manual and all associated equipment manuals before installing or operating this equipment. Failure to follow the warnings and instructions may result in serious injury or equipment damage.**
- **Keep this manual in a safe location for future reference.**
- **This equipment should only be installed and operated by trained, qualified personnel wearing appropriate protective equipment.**
- **Follow all codes that regulate the installation and operation of this equipment.**

DANGER

Use with clean, dry air or inert gases only. Do not use with any process that uses explosive, pyrophoric, corrosive, or toxic gases.

CAUTION

Always wear protective equipment, including safety glasses and gloves. Exercise care when working with vacuum equipment.

WARNING

Disconnect from power source and lockout/tagout BEFORE connecting equipment. AC solenoids must be properly grounded.

NOTICE

Check valve installation for correct gas flow direction and solenoid for function before use. Perform a leak test prior to pumping down.

NOTICE

Super-Seal bellows valves are not suitable for:

- **Temperatures above 150°C (limit of Viton seals)**
- **Differential pressure >15 psi**
- **Torsional stress**
- **Pressure shocks**
- **Rough service conditions**

Inspect valves regularly and use only OEM replacement parts

1. INTRODUCTION

Ideal Vacuum Super-Seal™ pneumatic bellows vacuum valves are primarily designed for high-vacuum (HV) applications. Depending on the valve flange and seal type, they can be used in the high (HV) or ultra high-vacuum (UHV) to 60-80 psig pressure range, and have leak rates of 10^{-9}-to 10^{-10} Torr l/s (He). All Super-Seal valves use 304L stainless steel for the valve body and mechanism, aluminum for the actuator, and Viton® poppet O-ring seals. High-vacuum rated valves use Viton for the bonnet seal. Ultra-high vacuum rated valves use OFHC copper gaskets for the bonnet seal. The valves are bakeable up to 150°C (valve body only-limited by the Viton O-rings) and can tolerate a maximum differential pressure of up to 15 psig. These valves can be mounted in any orientation and function reliably in applications such as semiconductor manufacturing, plasma physics research, and nuclear accelerators. They are a primary component in vacuum process automation, and have a mean time to failure rate (MTTF) of more than one million cycles

The Super-Seal family of valves includes weldable tube, KF, ISO-K, and Conflat (CF) flange options, and many are available in both right angle (90°) and in-line versions. In-line valves have the same closure times as their angled valve counterparts, but have relatively decreased conductance.

Available inlet/outlet sizes include flange types KF-16 to KF-50, ISO-K 63 to ISO-K 250, CF 1.33” to CF 8.0”, and weldable tube sizes 0.75” OD to 8.0” OD (for custom flange configurations). All inlet/outlet configurations are rated for high-vacuum (10^{-8} Torr), with the exception of CF flanged valves with copper bonnet seals which are rated for ultra high-vacuum (up to 10^{-10} Torr).

All Super-Seal pneumatic valves have 1/8" NPT air inlets and require an electrically operated solenoid to operate. Solenoids are available as part of complete kits which include all the hardware needed to connect the solenoid to the valve, and push-to-connect airline connection fittings for 1/4" OD tubing. Low volume, dry, compressed air in the range of 60-to-80 psi is needed for solenoid operation. Small-sized valves (up to 2” welded tube, KF-50, and CF 3.38”) use air to open and have an internal spring for closure. Medium and large-sized valves require air to both open and close as they do not have a spring return.

A selection of four solenoid voltage choices is offered: 12 VDC, 24 VDC, 110 VAC, and 220 VAC. Small valves use a single-acting solenoid. Valves larger than 2” require a double-acting solenoid. In the event of a loss of power Super-Seal valves close automatically and so can be used as failure protection to preserve vacuum inside the chamber. Not that for medium and large Super-Seal valves, if there is a loss of air pressure, the valves will not close automatically.

Three different position indicator sensors are available for Super-Seal valves. These include a mechanical reed switch and two transistor types (NPN and PNP). Each sensor has an LED light which provides visual confirmation of the valve's state (whether it is open or closed). These sensors can also be used to switch or trigger digital or analog devices.

2. VALVE AND SOLENOID COMPONENTS

All Super-Seal pneumatic valves have the same major parts. The lower portion of the valve consists of a valve body with inlet and outlet ports, with or without flanges (i.e., welded tube valves). The bonnet plate and valve head are connected to the valve body.

2.1 SMALL VALVES AND SINGLE ACTING SOLENOIDS

Small valves (≤ 2” tube OD) are spring closing and use single acting solenoids. Single acting solenoids have one air outlet which is connected to the valve bonnet plate with a 1/8” NPT brass nipple (Figure 1). The normally closed small valve is opened by pressurized air flowing into it through a push-to-connect 1/4" OD air line tubing fitting when the solenoid is energized. When de-energized, air flow is discontinued and the valve’s internal spring closes the valve.

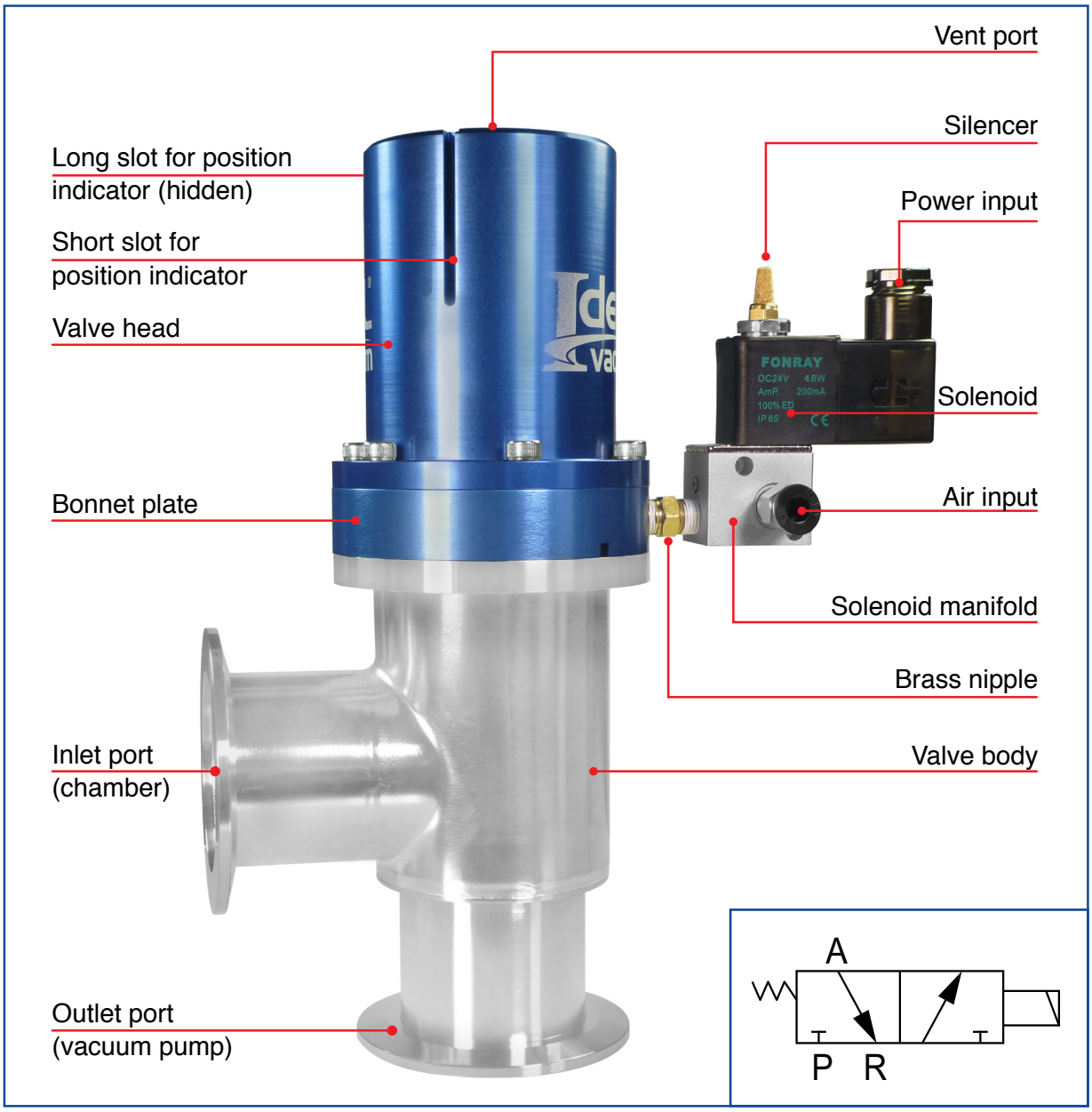

Figure 1 - Small valve and single acting solenoid parts

2.2 MEDIUM AND LARGE VALVES AND DOUBLE ACTING SOLENOIDS

Medium and large Super-Seal valves require air to both open and close. Air is always required to keep the valve in one state or the other. Double acting solenoids with 1/4” NPT ports are used and solenoid kits include push-to-connect fittings for 1/4" OD air line tubing. For medium valves, a 1/8” to 1/4” NPT elbow and a short 1/8” NPT extension are used to connect the solenoid to the valve bonnet plate (Figure 2). Large valves use a 2-1/2” brass extension to connect the solenoid as shown in Figure 3 (next page).

The double acting solenoid has one air inlet and two air outlets. When the solenoid is not energized, air travels through the solenoid manifold, through the blue air line, and into the top of the valve head forcing the valve closed. This is the normal valve state (normally closed-NC). When the solenoid is energized, the manifold redirects air through its alternate air outlet port, through the brass fittings, and into the bonnet plate or valve head. This forces the valve open.

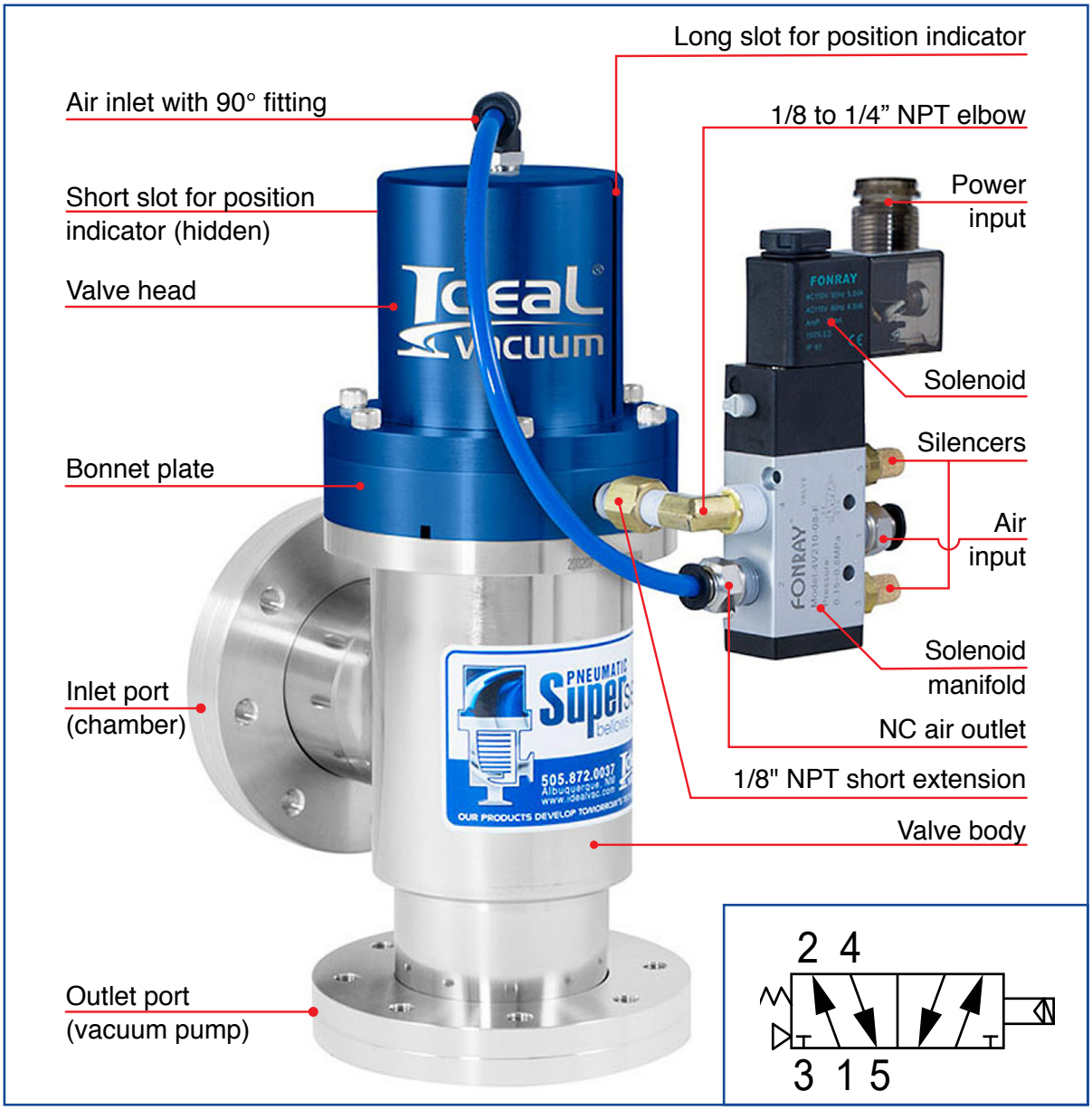

Figure 2 - Medium valve and double acting solenoid parts

Figure 3 - Large valve and double acting solenoid parts

2.3 VALVE FUNCTION

Figures 4 and 5 below show representations of the inner workings of Super-Seal pneumatic bellows valves. Red arrows indicate air flow direction. Blue arrows indicate actuator movement.

Figure 4 illustrates the (simplified) inner workings of a small Super-Seal valve. When its solenoid is energized, pressurized air flows into the valve's bonnet plate which forces the piston and poppet to move towards the top of the valve head opening a passageway between the inlet and outlet ports. Air at the top of the valve head is pushed out the vent port.

Figure 5 illustrates the (simplified) inner workings of a medium or large Super-Seal valve. When the double acting solenoid is not energized, pressurized air flows into the valve through the top of the valve. This forces the piston and poppet away from the top of the valve head towards the outlet port which closes the valve. When the solenoid is energized, air is redirected into the valve through the bonnet plate (medium valves) or the valve head (large valves). This forces the valve's piston and poppet to move towards the top of the valve head. A passageway between the valve inlet and outlet ports is opened. Air at the top of the valve head is pushed out of the air line at the top of the head and vented out of the solenoid manifold.

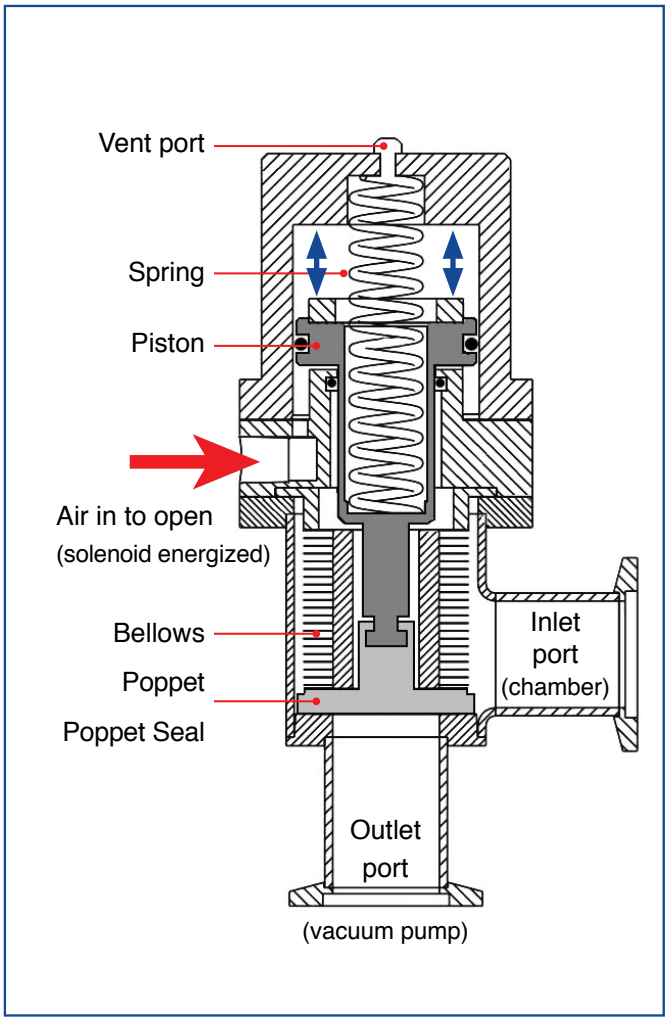

Figure 4 - Single acting valve function

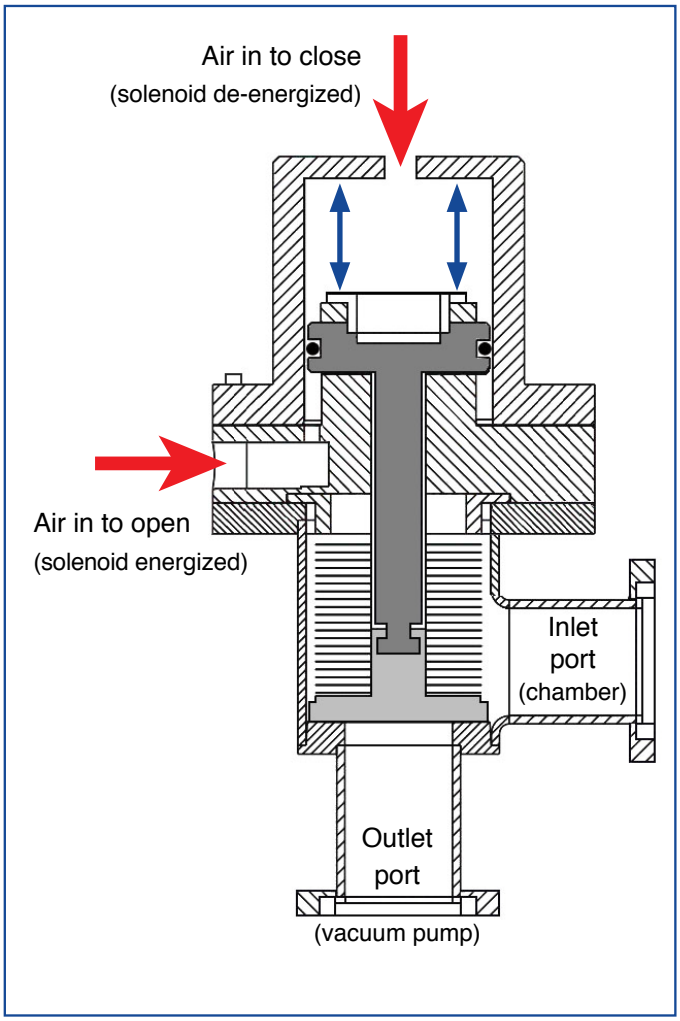

Figure 5 - Double acting valve function

3. VALVE SPECIFICATIONS

3.1 SMALL VALVES - UP TO 2” TUBE OD

KF Flange 90° Angle Valves (HV) - Spring Closure, Uses Single Acting Solenoid				
Flange Size	**KF-16**	**KF-25**	**KF-40**	**KF-50**
Tube OD	**0.75 in.**	**1.0 in.**	**1.5 in.**	**2.0 in.**
A	**2.17 in.** (55 mm)	**2.05 in.** (52 mm)	**2.56 in.** (65 mm)	**3.00 in.** (76 mm)
B	**2.05 in.** (52 mm)	**2.05 in.** (52 mm)	**2.56 in.** (65 mm)	**2.64 in.** (67 mm)
C	**6.34 in.** (161 mm)	**6.14 in.** (156 mm)	**6.93 in.** (176 mm)	**9.37 in.** (238 mm)
D	**2.40 in.** (61 mm)	**2.40 in.** (61 mm)	**3.03 in.** (77 mm)	**3.35 in.** (85 mm)
Open / Close Time	**0.5 sec.**	**0.6 sec.**	**0.8 sec.**	**0.9 sec.**
Conductance	**6 l/s**	**15 l/s**	**48 l/s**	**82 l/s**
Part #	**P103909**	**P103979**	**P103881**	**P103910**

Table 1 - Small KF angle valve specs

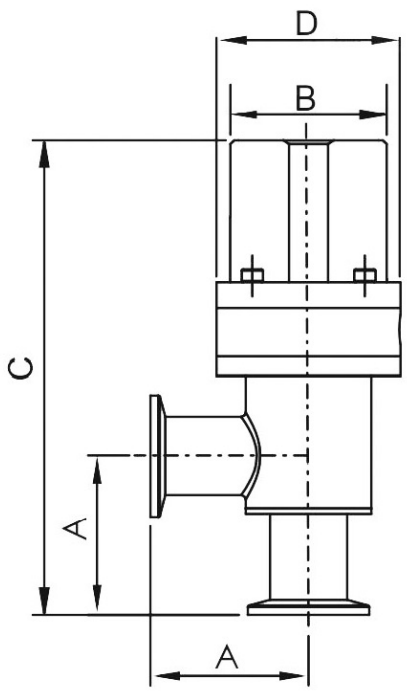

Figure 6 - KF angle valve

KF Flange In-line Valves (HV) - Spring Closure, Uses Single Acting Solenoid				
Flange Size	**KF-16**	**KF-25**	**KF-40**	**KF-50**
Tube OD (in.)	**0.75 in.**	**1.0 in.**	**1.5 in.**	**2.0 in.**
A	**4.02 in.** (102 mm)	**4.21 in.** (107 mm)	**5.12 in.** (130 mm)	**7.01 in.** (178 mm)
B	**2.05 in.** (52 mm)	**2.05 in.** (52 mm)	**2.56 in.** (65 mm)	**2.64 in.** (67 mm)
C	**2.40 in.** (61 mm)	**2.40 in.** (61 mm)	**3.03 in.** (77 mm)	**3.35 in.** (85 mm)
D	**5.20 in.** (132 mm)	**5.28 in.** (134 mm)	**6.38 in.** (162 mm)	**8.78 in.** (223 mm)
Open / Close Time	**0.5 sec.**	**0.6 sec.**	**0.8 sec.**	**0.9 sec.**
Conductance	**5 l/s**	**12 l/s**	**44 l/s**	**66 l/s**
Part #	**P103880**	**P105354**	**P103942**	**P105355**

Table 2 - Small KF in-line valve specs

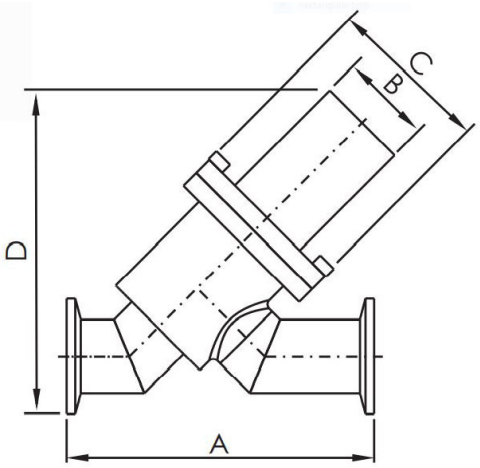

Figure 7 - KF in-line valve

See Chap. 4, p. 17 for solenoid selection. See Chap. 5, p. 20 for position sensor selection.

CF Flange 90° Angle Valves (UHV) - Spring Closure, Uses Single Acting Solenoid				
Flange Size	**1.33 in.**	**2.12 in.**	**2.75 in.**	**3.38 in.**
Tube OD	**0.75 in.**	**1.0 in.**	**1.5 in.**	**2.0 in.**
A	**2.17 in.** (55 mm)	**2.09 in.** (53 mm)	**2.64 in.** (67 mm)	**3.07 in.** (78 mm)
B	**2.05 in.** (52 mm)	**2.05 in.** (52 mm)	**2.56 in.** (65 mm)	**2.64 in.** (67 mm)
C	**6.38 in.** (162 mm)	**6.14 in.** (156 mm)	**7.01 in.** (178 mm)	**9.45 in.** (240 mm)
D	**2.76 in.** (70 mm)	**2.76 in.** (70 mm)	**3.39 in.** (86 mm)	**4.33 in.** (110 mm)
Open / Close Time	**0.5 sec.**	**0.6 sec.**	**0.8 sec.**	**0.9 sec.**
Conductance	**6 l/s**	**15 l/s**	**48 l/s**	**82 l/s**
Part #	**P1011182**	**P1011184**	**P1011186**	**P1011188**

Table 3 - Small CF angle valve specs

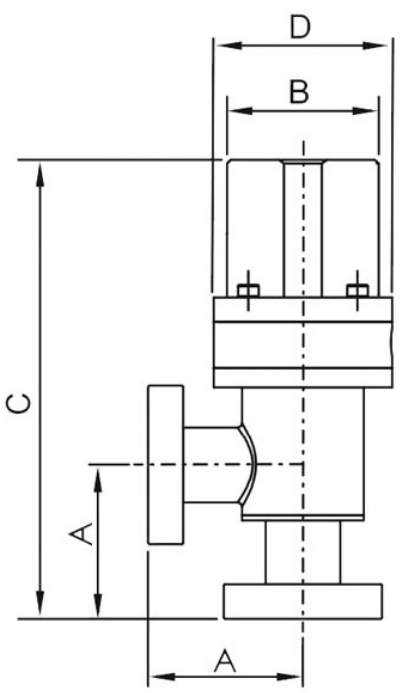

Figure 8 - CF angle valve

CF Flange In-line Valves (UHV) - Spring Closure, Uses Single Acting Solenoid				
Flange Size	**1.33 in.**	**2.12 in.**	**2.75 in.**	**3.38 in.**
Tube OD (in.)	**0.75 in.**	**1.0 in.**	**1.5 in.**	**2.0 in.**
A	**4.69 in.** (119 mm)	**4.49 in.** (114 mm)	**5.24 in.** (133 mm)	**7.17 in.** (182 mm)
B	**2.05 in.** (52 mm)	**2.05 in.** (52 mm)	**2.56 in.** (65 mm)	**2.60in.** (66 mm)
C	**2.76 in.** (70 mm)	**2.76 in.** (70 mm)	**3.39 in.** (86 mm)	**4.33 in.** (110 mm)
D	**5.24 in.** (133 mm)	**5.55 in.** (141 mm)	**6.73 in.** (171 mm)	**8.98 in.** (228 mm)
Open / Close Time	**0.5 sec.**	**0.6 sec.**	**0.8 sec.**	**0.9 sec.**
Conductance	**5 l/s**	**12 l/s**	**44 l/s**	**66 l/s**
Part #	**P1011183**	**P1011185**	**P1011187**	**P1011189**

Table 4 - Small CF in-line valve specs

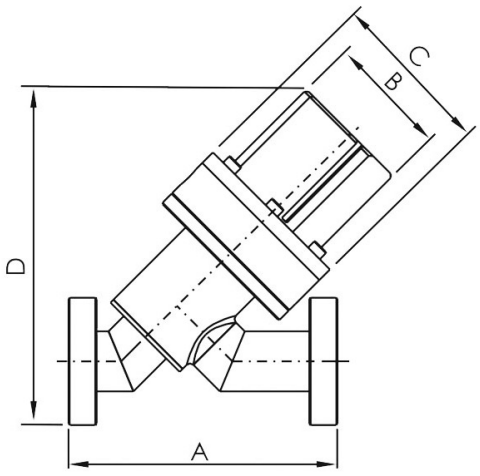

Figure 9 - CF in-line valve

See Chap. 4, p. 17 for solenoid selection. See Chap. 5, p. 20 for position sensor selection.

Welded Tube 90° Angle Valves (HV) - Spring Closure, Uses Single Acting Solenoid				
Flange Size	**N/A**	**N/A**	**N/A**	**N/A**
Tube OD	**0.75 in.**	**1.0 in.**	**1.5 in.**	**2.0 in.**
A	**2.01 in.** (51 mm)	**1.89 in.** (48 mm)	**2.40 in.** (61 mm)	**2.83 in.** (72 mm)
B	**2.40 in.** (61 mm)	**2.40 in.** (61 mm)	**3.03 in.** (77 mm)	**3.35 in.** (85 mm)
C	**6.14 in.** (156 mm)	**5.98 in.** (152 mm)	**6.81 in.** (173 mm)	**9.57 in.** (243 mm)
D	**2.40 in.** (61 mm)	**2.40 in.** (61 mm)	**3.03 in.** (77 mm)	**3.35 in.** (85 mm)
Open / Close Time	**0.5 sec.**	**0.6 sec.**	**0.8 sec.**	**0.9 sec.**
Conductance	**6 l/s**	**15 l/s**	**48 l/s**	**82 l/s**
Part #	**P1010933**	**P1011054**	**P1011056**	**P1011057**

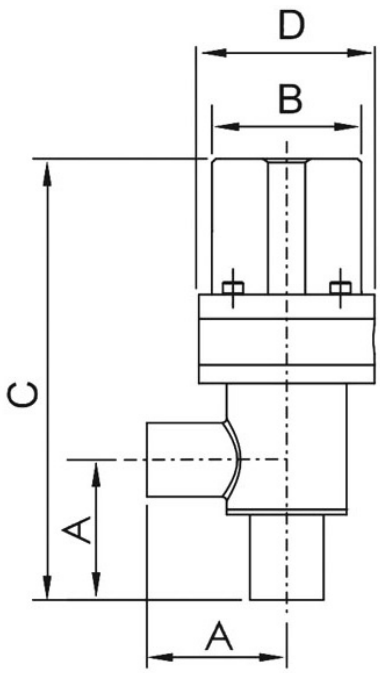

Table 5 - Small tube angle valve specs

Figure 10 - Tube angle valve

See Chap. 4, p. 17 for solenoid selection. See Chap. 5, p. 20 for position sensor selection.

3.2 MEDIUM VALVES - 2-1/2” TO 4” TUBE OD

ISO-K Flange 90° Angle Valves (HV) - Air Closure, Uses Double Acting Medium Solenoid			
Flange Size	**ISO-K 63**	**ISO-K 80**	**ISO K 100**
Tube OD	**2.5 in.**	**3.0 in.**	**4.0 in.**
A	**3.27 in.** (83 mm)	**3.50 in.** (89 mm)	**4.49 in.** (114 mm)
B	**2.76 in.** (70 mm)	**3.23 in.** (82 mm)	**3.50 in.** (89 mm)
C	**9.57 in.** (243 mm)	**11.14 in.** (283 mm)	**13.54 in.** (344 mm)
D	**4.02 in.** (102 mm)	**5.20 in.** (132 mm)	**6.50 in.** (165 mm)
Open / Close Time	**0.7 sec.**	**0.7 sec.**	**0.8 sec.**
Conductance	**170 l/s**	**220 l/s**	**490 l/s**
Part #	**P1010067**	**P1011162**	**P1010068**

Table 6 - Medium ISO-K angle valve specs

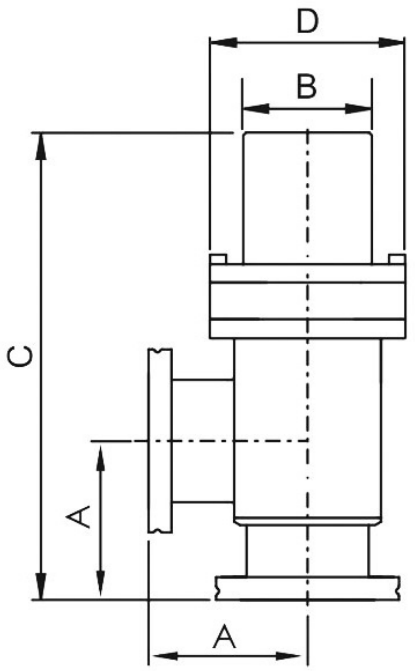

Figure 11 - ISO-K angle valve

CF Flange 90° Angle Valves (UHV) - Air Closure, Uses Double Acting Medium Solenoid				
Flange Size	**4.50 in.**[1]	**4.50 in.**	**4.625 in.**	**6.0 in.**
Tube OD (in.)	**2.5 in.**	**2.5 in.**	**3.0 in.**	**4.0 in.**
A	**8.50 in.** (216 mm)	**3.39 in.** (86 mm)	**3.54 in.** (90 mm)	**4.65 in.** (118 mm)
B	**2.76 in.** (70 mm)	**2.76 in.** (70 mm)	**3.23 in.** (82 mm)	**3.50 in.** (89 mm)
C	**4.80 in.** (122 mm)	**9.69 in.** (246 mm)	**11.30 in.** (287 mm)	**13.70 in.** (348 mm)
D	**9.89 in.** (251 mm)	**4.80 in.** (122 mm)	**5.63 in.** (143 mm)	**6.73 in.** (171 mm)
Open / Close Time	**0.7 sec.**	**0.7 sec.**	**0.7 sec.**	**0.8 sec.**
Conductance	**135 l/s**	**170 l/s**	**220 l/s**	**490 l/s**
Part #	**P1011191**	**P1011190**	**P1011192**	**P1011194**

Table 7 - Medium CF angle valve specs

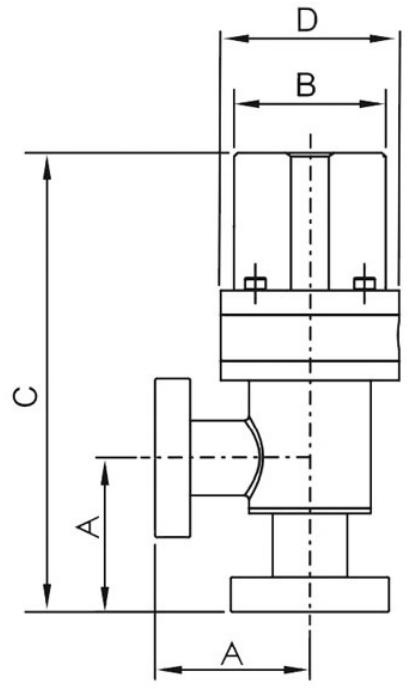

Figure 12 - CF angle valve

[1] This is is an in-line valve. Refer to Figure 4, p. 8 for correct dimensional image.

See Chap. 4, p. 17 for solenoid selection. See Chap. 5, p. 20 for position sensor selection.

Welded Tube 90° Angle Valves (HV) - Air Closure, Uses Double Acting Medium Solenoid			
Flange Size	**N/A**	**N/A**	**N/A**
Tube OD (in.)	**2.5 in.**	**3.0 in.**	**4.0 in.**
A	**2.99 in.** (76 mm)	**3.27 in.** (83 mm)	**4.41 in.** (112 mm)
B	**4.02 in.** (102 mm)	**5.20 in.** (132 mm)	**5.94 in.** (151 mm)
C	**9.29 in.** (236 mm)	**10.91 in.** (277 mm)	**13.07 in.** (332 mm)
D	**4.02 in.** (102 mm)	**5.20 in.** (132 mm)	**6.50 in.** (165 mm)
Open / Close Time	**0.7 sec.**	**0.7 sec.**	**0.8 sec.**
Conductance	**170 l/s**	**220 l/s**	**490 l/s**
Part #	**P1011058**	**P1011059**	**P1011060**

Table 8 - Medium tube angle valve specs

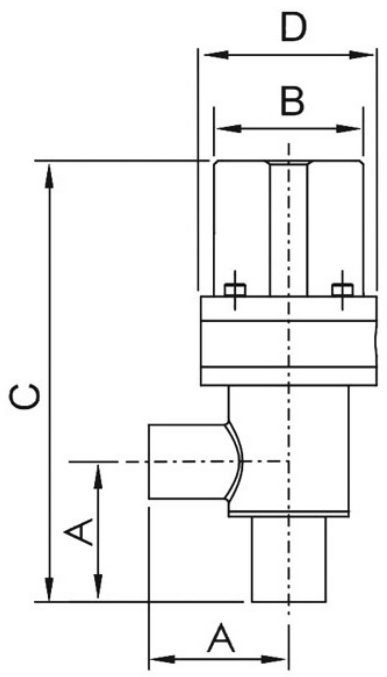

Figure 13 - Tube angle valve

See Chap. 4, p. 17 for solenoid selection. See Chap. 5, p. 20 for position sensor selection.

3.3 LARGE VALVES - 6” TO 10” TUBE OD

ISO-K Flange 90° Angle Valves (HV) - Air Closure, Uses Double Acting Large Solenoid			
Flange Size	**ISO-K 160**	**ISO-K 200**	**ISO K 250**
Tube OD	**6.0 in.**	**8.0 in.**	**10.0 in.**
A	**6.26 in.** (159 mm)	**8.27 in.** (210 mm)	**10.24 in.** (260 mm)
B	**5.51 in.** (140 mm)	**5.51 in.** (140 mm)	**7.95 in.** (202 mm)
C	**18.23 in.** (463 mm)	**25.94 in.** (659 mm)	**28.35 in.** (720 mm)
D	**8.94 in.** (227 mm)	**11.22 in.** (285 mm)	**13.90 in.** (353 mm)
Open / Close Time	**1.5 sec.**	**2.5 sec.**	**2.8 sec.**
Conductance	**1090 l/s**	**1600 l/s**	**2650 l/s**
Part #	**P1011163**	**P1011166**	**P1011167**

Table 9 - Large ISO-K angle valve specs

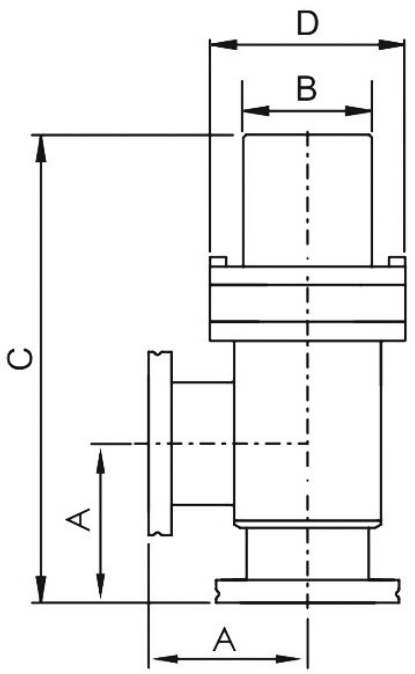

Figure 14 - ISO-K angle valve

CF Flange 90° Angle Valves (UHV) - Air Closure[2]		Welded Tube (UHV) 90° Angle Valves - Air Closure	
Uses Double Acting Large Solenoid			
Flange Size	**CF 8.0 in.**	**N/A**	**N/A**
Tube OD (in.)	**6.0 in.**	**6.0 in.**	**8.0 in.**
A	**6.50 in.** (165 mm)	**4.96 in.** (126 mm)	**6.38 in.** (162 mm)
B	**5.52 in.** (140 mm)	**8.98 in.** (228 mm)	**9.80 in.** (249 mm)
C	**18.46 in.** (469 mm)	**18.82 in.** (478 mm)	**22.76 in.** (578 mm)
D	**8.94 in.** (227 mm)	**8.94 in.** (227 mm)	**11.22 in.** (285 mm)
Open / Close Time	**1.5 sec.**	**1.5 sec.**	**2.5 sec.**
Conductance	**1090 l/s**	**1090 l/s**	**1600 l/s**
Part #	**P1011196**	**P1011061**	**P1011062**

Table 10 - Large CF and Welded Tube angle valve specs

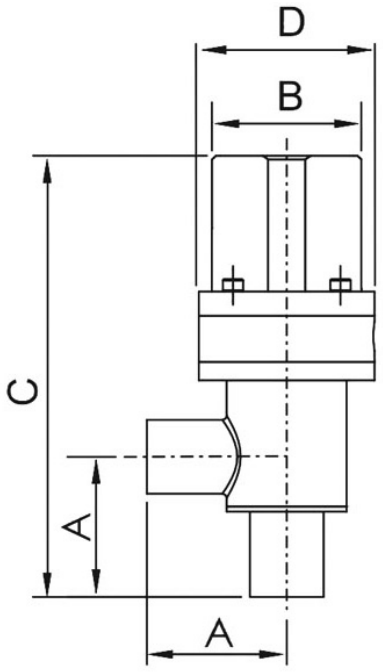

Figure 15 - Tube angle valve

[2] Refer to Figure 12, p. 14 for correct CF dimensional image.

See Chap. 4, p. 17 for solenoid selection. See Chap. 5, p. 20 for position sensor selection.

4. SOLENOID SPECIFICATIONS AND CONNECTIONS

Refer to Figures 1, 2 and 3, pages 7, 8, and 9, for solenoid plumbing connections. Use thread tape or sealant on all fittings to ensure a good seal.

Available solenoid voltages are: 12 VDC, 24 VDC, 110 VAC, and 220 VAC. All solenoids are rated for 100% duty cycle (ED).

Note that for single acting solenoids the air input connector can be threaded into either side of the manifold (Figure 16), which can help with more tidy air line routing. A 1/8” NPT plug is included in the fittings kit to seal off the opposite manifold orifice.

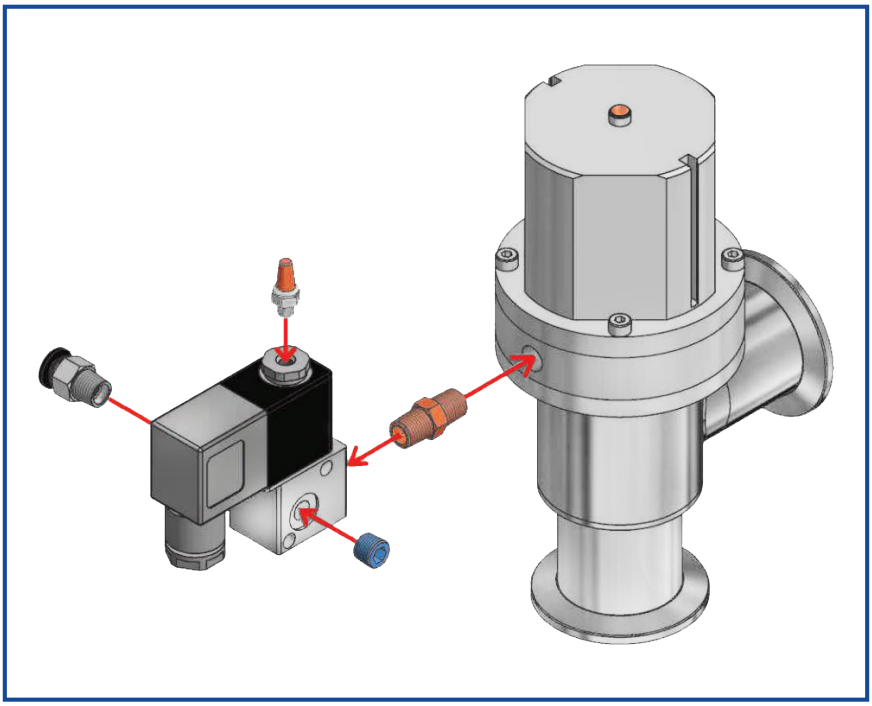

Figure 16 - Small valve solenoid fittings

4.1 SOLENOID SELECTION

Voltage	Maximum Current	Part Numbers		
		Small Valves (≤ 2” tube OD)	Medium Valves (2-1/2” - 4.0” tube OD)	Large Valves (≥ 6.0" tube OD)
12 VDC	425 mA	P104183	P1011092	P1011234
24 VDC	200 mA	P104182	P1011093	P1011235
110 VAC	70 mA	P104181	P1011094	P1011236
220 VAC	35 mA	P104180	P1011095	P1011237

Table 11 - Solenoid selector

4.2 SOLENOID PREPARATION

Each solenoid is delivered without a power cable and with the connector housing reversed (to fit into a smaller box). It must be wired and the housing orientation reversed before use.

1. Use a #1 Phillips screwdriver to remove the connector housing screw (Figure 17).

Figure 17 - Remove connector screw

2. Detach the connector housing from the solenoid.

Figure 18 - Separate housing from manifold

3. Use a jeweler's screwdriver or probe to pry the connector out of its housing.

Figure 19 - Pry out connector

4. The connector has three terminals: Positive, negative, and ground (Figure 20). Back out the (+) and (-) terminal screws with the #1 Phillips screwdriver.

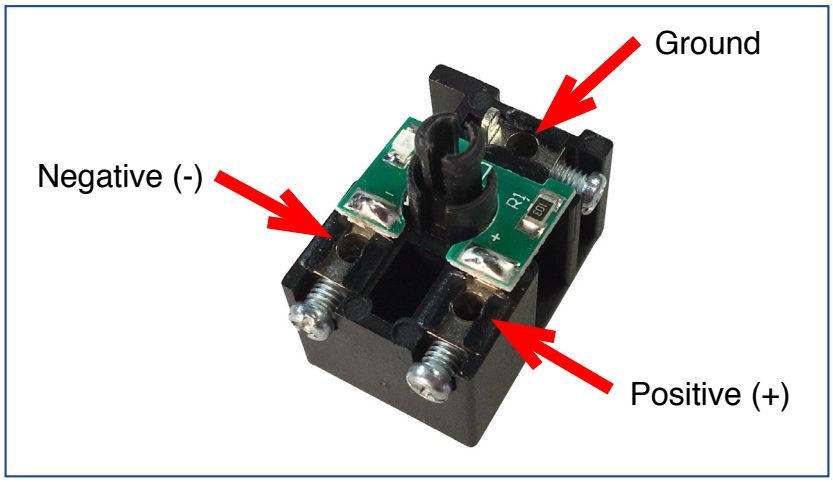

Figure 20 - Connector terminals

5. Pass the power cable through the housing BEFORE making connections. Insert the appropriate wire into its terminal and tighten each terminal screw.

⚠ CAUTION **AC solenoids must be properly grounded!**

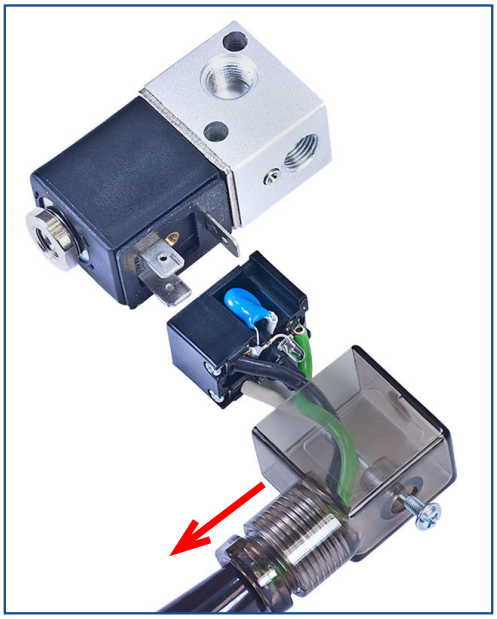

Figure 21 - Make Connections

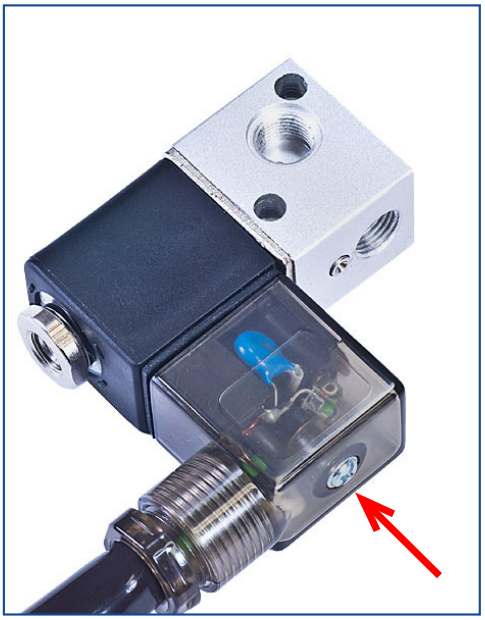

Figure 22 - Secure housing

6. Reverse the housing so that it points away from the solenoid manifold (Figure 21).

7. Snap the connector back into the housing.

8. Replace and secure the connector housing screw (Figure 22).

9. The solenoid is ready to attach to the valve. Refer to Figures 1, 2, and 3, pages 7, 8, and 9.

5. POSITION INDICATOR SENSORS

5.1 FUNCTION AND INSTALLATION

The top of the valve's actuator is magnetic. These position indicator sensors detect and are activated when the magnetic field generated by the top of the valve actuator aligns with the sensor.

A mechanical reed switch and two transistor types (NPN and PNP) of position indicator sensors are available for Super-Seal pneumatic valves. Each sensor has an LED which illuminates when the sensor is triggered. In addition to providing visual confirmation of the valve's state (whether it is open or closed), these sensors can also be used to switch or trigger auxiliary devices.

Super-Seal valves have two position indicator sensor slots in their valve heads, one long, one short. Each of the three available sensors illuminates when:

- the valve is open and the sensor is in the short slot.
- the valve is open and the sensor is positioned at the top of the long slot.
- the valve is closed and the sensor is positioned at the bottom of the long slot.

To correctly adjust the sensor to indicate a valve open state, slide it into one of the sensor slots (set screw facing out). Energize the solenoid to open the valve. Slide the sensor up and down in the slot until the LED illuminates. With a small flat head jeweler's screwdriver, tighten the sensor set screw to secure it in place.

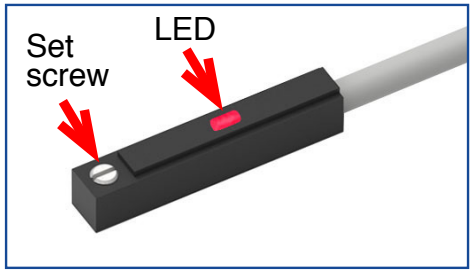

Figure 23 - Position indicator sensor

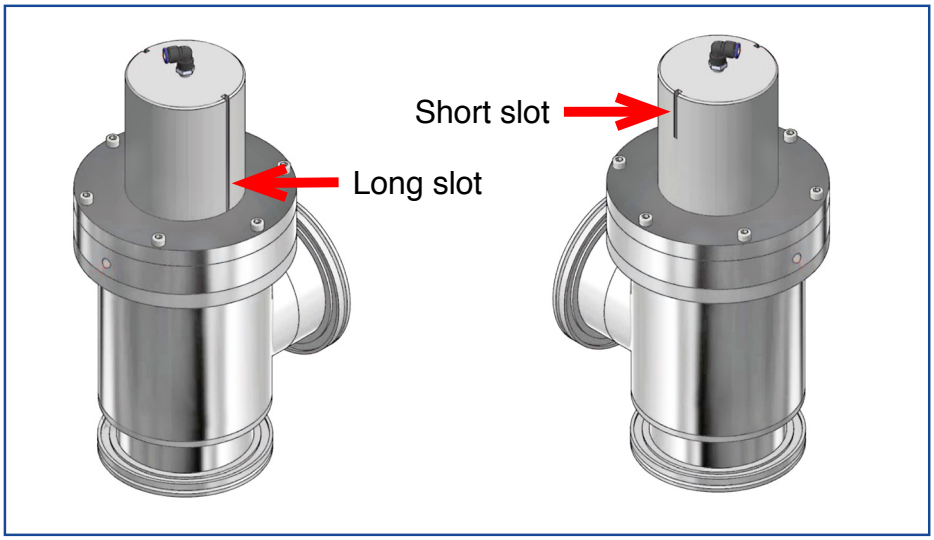

Figure 24 - Long and short sensor slots

5.1 SPECIFICATIONS

Figure 25 - Reed switch sensor

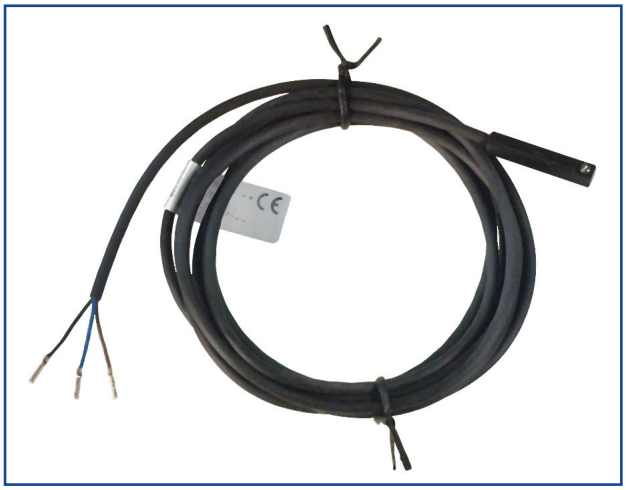

Figure 26 - NPN and PNP sensors

Sensor Type	Reed Switch	NPN (current sinking)	PNP (current sinking)
Switching	SPST (Normally open)	Solid State Output (Normally open)	Solid State Output (Normally open)
LED Color	Red	Red	Green
Operating Voltage	5 - 120V, DC/AC	5 - 30 VDC	5 - 30 VDC
Switching Current (max.)	100mA	200mA	200mA
Contact Rating (max.)	10W	6W	6W
Current Consumption (max. when off)	-	8mA@24 VDC	8mA@24 VDC
Voltage Drop (max.)	3.5V	1V@200mA	1V@200mA
Number of Conductors	2	3	3
Cable Length	2 m (6.5 ft.)	2 m (6.5 ft.)	2 m (6.5 ft.)
Part Number	P104194	P104195	P104196

Table 12 - Sensor technical specifications

5.1 MECHANICAL REED SWITCH SENSOR

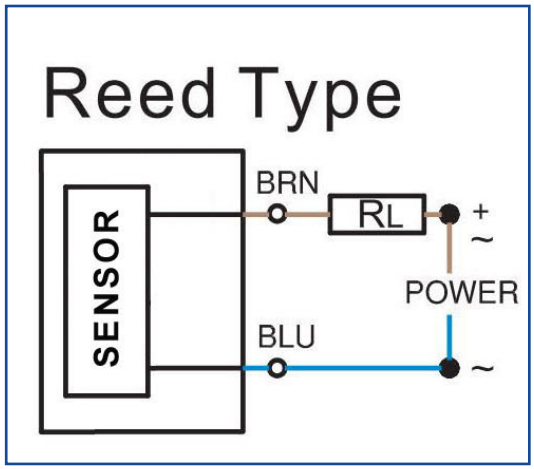

Figure 27 - Mechanical reed switch sensor wiring schematic

The mechanical reed switch sensor has a red LED and has two conductors, brown (+), and blue (-). It may be powered with 5 to 120 volts, AC or DC, and can switch or trigger a maximum load of 100mA. The reed switch sensor is recommended to trigger a digital device, such as a PLC, since it has limited current capability.

When wiring, a series resistor on the positive conductor is required to limit the current through the LED (maximum 20mA). As voltage increases, so does the value and power rating of the required resistor. The LED can be driven with reduced current (≈ 2mA minimum), which decreases the resistor's wattage rating, albeit at reduced LED brightness. For example, at 120 VAC a 2.7kΩ, 2W resistor is needed for maximum brightness. A 1/4W, 56kΩ resistor may be substituted, but the LED would pull only 2mA and brightness would be diminished significantly.

The basic calculation for the correct resistor value (at 20mA) for a DC voltage source is:

$$R = 50\ (E-2)$$

and for an AC voltage source (to obtain similar brightness) is:

$$R = 25\ (E-2.7)$$

where R is the resistor value needed, and E is the operating voltage.

Below are suggested resistor values for several common voltage supplies. The values listed are for standard value resistors closest to the actual calculated value. Note that resistor values in highlighted fields supply maximum LED brightness.

Resistor power rating	5 VDC	6VDC	12VDC	24VDC	12 VAC	24 VAC	48 VAC	120 VAC
1/4W	150Ω	180Ω	470Ω	1.8kΩ	220Ω	1.8kΩ	8.2kΩ	56kΩ
1/2W	-	-	-	1.2kΩ	-	560Ω	3.9kΩ	27kΩ
1W	-	-	-	-	-	-	1.2kΩ	15kΩ
2W	-	-	-	-	-	-	-	2.7kΩ

Table 13 - Resistor values for common voltage supplies

5.2 NPN AND PNP SEMICONDUCTOR SENSORS

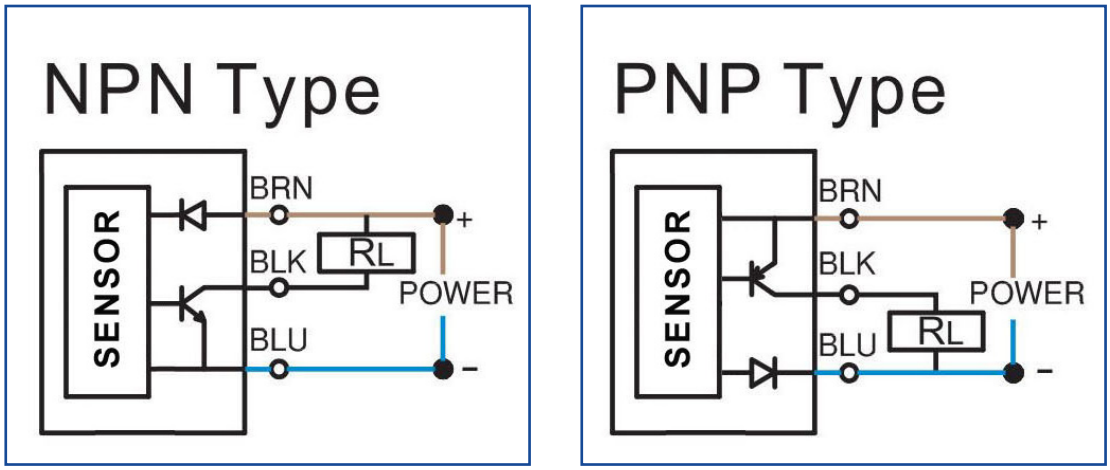

Figure 28 - NPN and PNP sensor wiring schematics

Two semiconductor position indicator sensors, NPN and PNP, are available. Similar to the mechanical reed switch sensor, these sensors are triggered magnetically, and require a current limiting load for the LED (maximum 20mA). The NPN sensor has a red LED and the PNP sensor has a green LED. The load is connected between DC positive and the collector for the NPN circuit, and between DC negative and the emitter for the PNP circuit. The DC resistor calculation used for the reed switch may be applied for these sensors [R=50(E-2)].

The load on these sensors need not be a resistor. It can be any load, such as a fan or a relay, as long as the load is rated for the same voltage as that supplied to the sensor, and the load's current draw is less than 200mA, the maximum allowable. For example, if the sensor is supplied with 12 VDC, a 12 VDC rated fan can be substituted for a resistor, as long as the fan's inrush current does not exceed 200mA. A protection diode is needed for inductive loads. These semiconductor sensors are recommended to switch or trigger auxiliary devices through relays, since most small relays have coils which require less than 200mA. There is little perceived reduction of LED intensity when using a non-resistor load.

5.3 USING MULTIPLE SENSORS

Two sensors, one valve:

Two sensors can be used on the same valve, since all Super-Seal valves have two sensor slots. The installation of two sensors on one valve could be used to indicate if a valve is not functioning correctly. For example, if the valve is in-between states (neither open nor closed).

Two sensors, two valves:

Two sensors may be wired in series or in parallel. This could be useful to sense various two valve scenarios. For two sensors in series, only when both valves are in the proper states would the sensor circuit be completed and the switch or trigger activated. For two sensors in parallel, only when one and/or both valves are in the proper state(s) would the sensor circuit be completed and the switch or trigger activated.

Examples of series and parallel wiring schemes for all three sensors are on the following page.

NOTE

Do not exceed more than two sensors in either a series or parallel circuit. Excessive voltage drop or excessive leakage current will cause improper or non-operation of the sensor. Dim and/or no LED illumination may also occur.

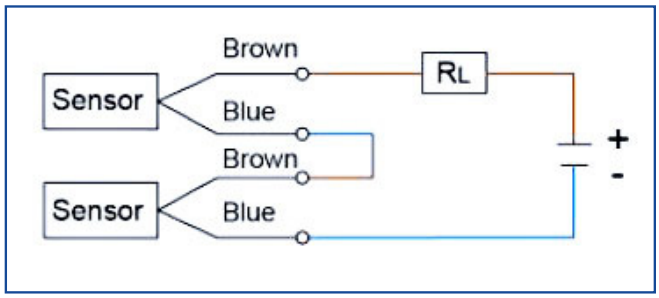

Figure 29 - Reed sensor series connections

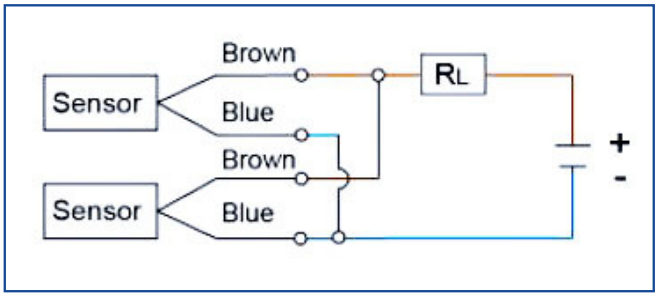

Figure 30 - Reed sensor parallel connections

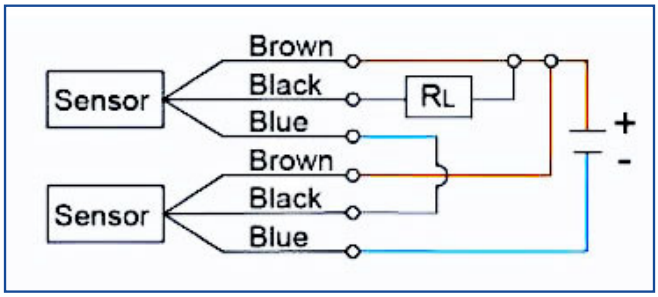

Figure 31 - NPN sensor series connections

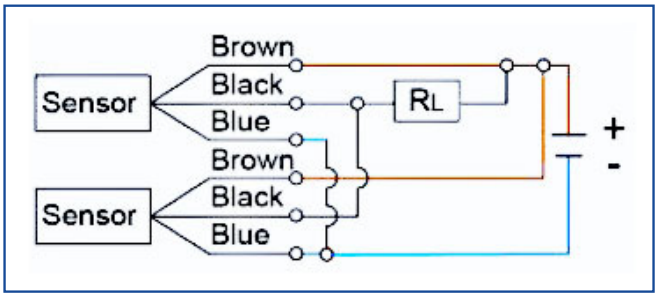

Figure 32 - NPN sensor parallel connections

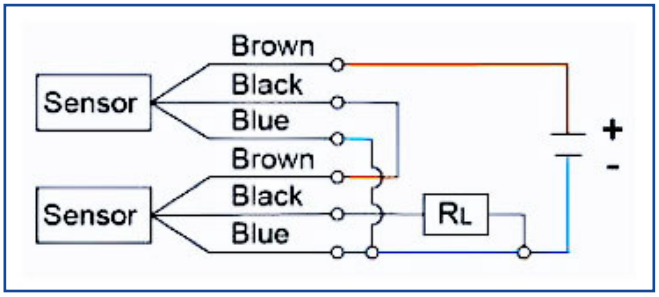

Figure 33 - PNP sensor series connections

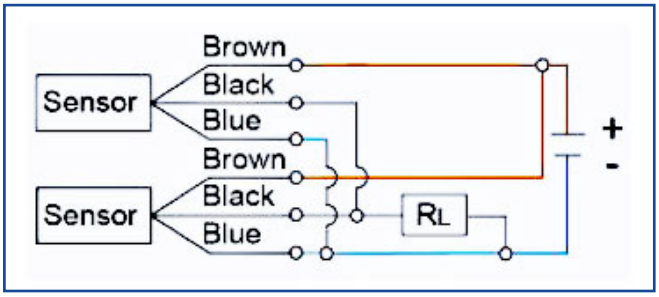

Figure 34 - PNP sensor parallel connections

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