

# CVS

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## CONTROLS

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# Instruction Manual

## CVS 4150 / 4150LE and CVS 4160 / 4160LE Pressure Controllers

### Introduction

CVS 4150 and 4160 controllers are designed to provide years of reliable and accurate service.

These instructions cover maintenance, adjustment, and changes in mode of control.

These instructions are intended for the controllers in general. Any instructions that apply to specific controllers will be indicated by model number in the instruction.

Model numbers are stamped on the nameplate located inside the cover of the controller (Key 29, Figure 4).

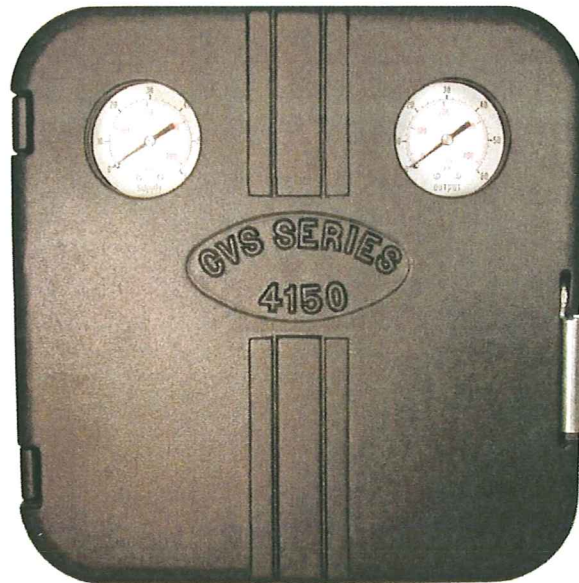
### Controllers

Inspect the controllers for shipping damage and foreign debris when uncrating.

### Valve

Ensure the pipeline is free of welding slag, chips and other debris by blowing out the line prior to installation.

It is recommended that a strainer be installed up stream of the valve to protect the valve from foreign debris in the line. CVS recommends a standard three-valve maintenance bypass be installed. This allows isolation of the control valve without shutting down the pipeline system.



The valve should be positioned on the line so the flow direction indicator corresponds to the direction of the flow of the pipeline.

If the body is flanged, the bolts should be tightened up evenly to reduce risk of damage to the valve body and the flange.

A good quality thread lubricating compound should be used on all male connections if the body has screwed connections.

### Control Line Connectors

The connections should be made in an area of the pipeline that is free of bends and elbows. Piping connections should be made with 1/4" or 3/8" pipe or tubing.

Tap the pipeline as close to the valve body as possible allowing for these limiting factors.

1. The tap area should be an area that is free from abnormal velocities.
2. The ideal distance away from the body should be 10 x the pipeline diameter.

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### **Control Line Connectors cont'd**

The control pressure line is run from the tapped hole in the side or the back of the case to the main pipeline.

Install a lock shield needle valve in the control line to slow down the controlled pressure or to dampen out any pulsations. While the control valve is operational, the needle valve must never be entirely closed.

An air vent is provided on all controllers and works well when air is used as the operating medium. When gas is used the vent can be removed, this allows for an additional 1/4" NPT connection for gas to be piped away.

## **Operation**

Although the output for these controllers are set prior to shipping, upon arrival the following items should be checked.

### **CVS 67 CFR Filter Regulator**

The CVS 67 CFR Filter Regulator is a self-contained filter regulator designed to deliver air or gas to the pilot at a constant pressure. A CVS 67 CFR is designed to handle inlet pressures up to 250 psi.

The CVS Series 4150/4160 delivers an outlet pressure of 3 - 15 psi when the regulator is set to 20 and it will deliver 6-30 psi output when the regulator is set to 35 psi.

The filter component ensures that operation is clean and dry.

The relief valve is geared to open when the pressure is reduced to 1 psi above the regulator set point.

Releasing the lock nut and adjusting the adjusting screw located on the top of the regulator can reduce pressure setting for the regulator.

### **Proportional Controllers**

Most of the proportional controls will be used in applications that require a band set to approximately 15%. The following steps are used to test this setting.

1. The air supply should be connected to CVS 67 CFR filter regulator.
2. Zero the pressure setting dial.
3. Set the proportional band adjustment to 15%
4. There should be no pressure sent to the measuring element.
5. For direct or reverse acting controllers the range and output should be set as follows.

<b>Range</b>	<b>Output</b>
3-15 psi	8-10 psi
6-30 psi	16-20 psi

### **Proportional-Reset Controllers**

1. The reset dial should be set to maximum.
2. The air supply should be connected to CVS 67 CFR filter regulator.
3. Zero the pressure setting dial and proportioned setting dial.
4. There should be no pressure sent to the measuring element.
5. For direct or reverse acting controllers the range and output should be as follows.

<b>Range</b>	<b>Output</b>
3-15 psi	8-10 psi
6-30 psi	16-20 psi

## **Start Up**

### **Proportional Controllers**

1. The air supply should be connected to CVS 67 CFR filter regulator.
2. Connect the control pressure line and open the lock shield needle valve.
3. Ensure all piping and connections are free from leaks.
4. Set the pressure to the desired control point.
5. Proportional band should be set at 15% of the bandwidth.
6. Open the manual control valves that are upstream and downstream, at the same time close the by-pass valves.
7. Set the controller near the desired control point. When it reaches that point, begin to broaden the proportional band. Broaden the band as little as possible. The narrowest band that will not result in cycling provides the best control. This band adjustment will affect the zero. Re-zero the unit.
8. Test the bandwidth by changing the pressure setting adjustment for a moment. If this causes cycling, then broaden the proportional band and test again. This procedure is to be repeated until stability is reached.

### **Proportional-Reset Controllers**

1. The air supply should be connected to CVS 67 CFR filter regulator.
2. Connect the control pressure line and open the lock shield needle valve.
3. Ensure all piping and connections are free from leaks.
4. Set pressure to the desired control point.

### Proportional-Reset Controllers cont'd

5. Proportional band should be set at 100% of bandwidth.
6. Maximize the setting on the reset dial.
7. Open the manual control valves that are upstream and downstream, at the same time close by-pass valves.
8. Set the controller near the desired control point. When it reaches that point, begin to narrow the proportional band until a cycling condition exists. Broaden the band slightly until a stable condition is reached. There is no need to reset the zero in controllers that have reset.
9. Try to obtain the fastest reset time without introducing cycling control carefully by adjusting the reset rate.
10. Test the bandwidth and the reset rate by changing the pressure setting adjustment for a moment. If this causes cycling, then broaden the proportional band and test again. This procedure is to be repeated until stability is reached.

The goal for the controller setting is to have the narrowest proportional band and the fastest reset rate that will not cause cycling.

### Changing Controller Action

One advantage of the CVS 4150/4160 is the ease at which you can change from one mode of control to another. There is a connection for both direct and reverse action in all modes of control. There is also a screw (key 5, figure 6) provided to plug the hole opposite of the nozzle. It will be necessary to follow **INITIAL SETTINGS** after any change in mode of control.

### Adjustments

#### Proportional Band Width Adjustments

The proportional band width adjustment determines the change in control pressure required to cause the control valve to travel full open or full closed.

**Example:** with the proportional band set @ 1 (10%), using a Bourdon tube of 0-1000 psi that is set @ 500 psi on the pressure dial. The full travel of the valve would occur between 450 psi (3 psi output) and 550 psi (15 psi output) to try to maintain the set point.

Using this theory, an input pressure of 500 would give you an output pressure of 9 psi. The greater the proportional band setting is the slower the reaction.

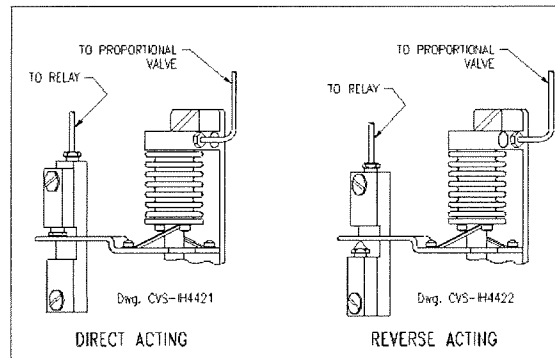


Figure 1: Pressure Connections for Proportional Controller

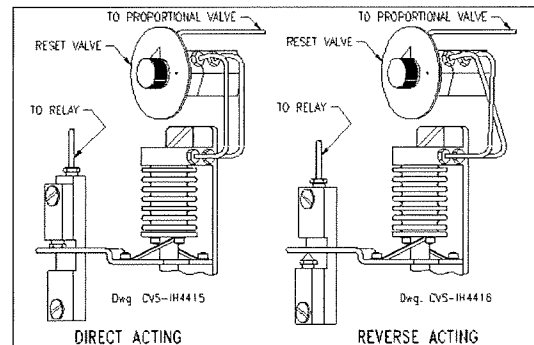


Figure 2: Pressure Connections for Proportional-Reset Controller

### Reset Rate Adjustment

By definition the reset rate is the number of minutes that it takes to adjust the controller to adjust the output pressure up or down by the same amount of proportional change output caused by the process change.

The reset rate is calibrated in minute per repeat.

### Pressure Setting Adjustment

The CVS 4150 and 4160 come with calibrated set point adjustment. The dial is calibrated for pressure ratings of the measurement element. If start up instructions are followed, the pressure setting dial is correct for any settings on proportional-reset controllers.

# CVS Type 4150 Pressure Controller

The theory of operation can be broken down into steps. Refer to the schematic diagram figure 3.

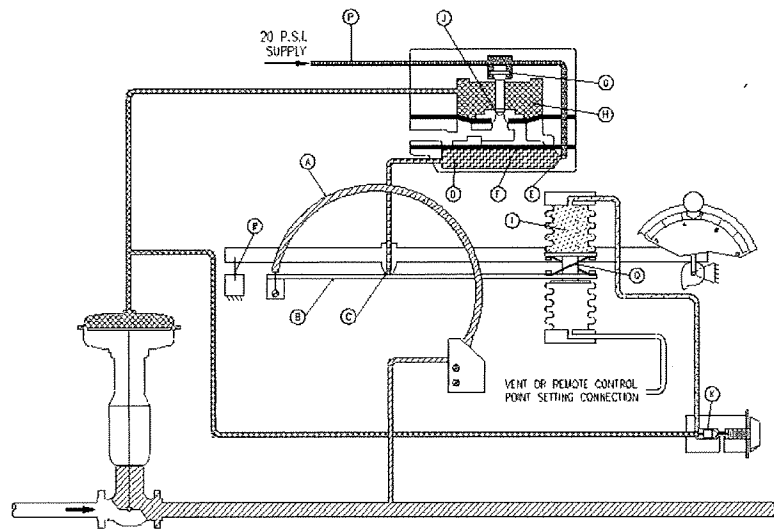
1. The pressure first enters the Bourdon tube. As the pressure increases the Bourdon tube straightens causing the beam (B) attached to the end of the Bourdon tube to move closer to nozzle (C).
2. Closing the nozzle (C) will cause a build up of pressure in chamber (D) from the constant air or gas supply through the orifice (E).
3. The resulting pressure built up in chamber (D) cause the diaphragm (F) to push up and open valve (G).
4. An open Valve (G) will cause the constant air or gas supply to flow into chamber (H).
5. The build up of pressure in chamber (H) causes diaphragm (F) to be pushed back to its original position and therefore closes valve (G).
6. The increase in pressure in chamber (H) sends the supply pressure to flow to the diaphragm of the control valve causing the control valve to start to close.
7. At the same time, the pressure flows through the three-way valve (K) causing an increase in pressure in bellows (I).
8. The increase in the pressure bellows (I) cause the beam (B) to move away from nozzle (C). As a result there will no longer be a build up of pressure in (D). The control valve is now at the desired pressure setting.

If there is a decrease in control pressure the above mentioned steps will proceed in reverse. The control pressure will bleed out through the exhaust vent (J).

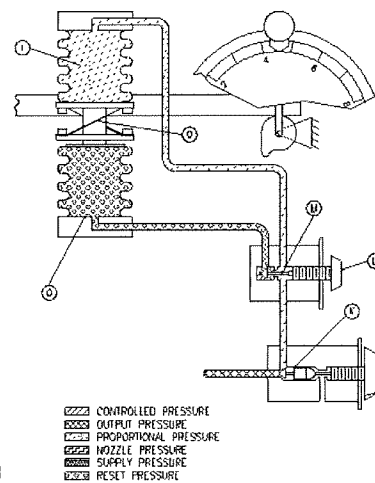
Please note that the changes in pressure are continuous in nature. The process has been explained in steps for ease of explanation.

As seen in the figure 3, schematic illustration of Type 4150, the output pressure from relay chamber (H) goes to both the proportional band adjustment relay three-way valve (K) and the control valve diaphragm. The amount of feedback to the proportional bellows (I) can be adjusted by adjusting the orifice. If valve (K) is fully open, then the total of the diaphragm pressure is sent to the bellows chamber (I).

This causes the beam (B) to move away from nozzle (C) allowing the pressure to be released from chamber (D). The result of this is 100% proportional band based on the rating of the Bourdon tube. Closing the three-way valve (K) will result in a lowering of proportional band response. The proportional band would be approximately 3% when fully closed.



**Figure 3:** Schematic Illustration of CVS Type 4150 Proportional Controller



Schematic Illustration of CVS Type 4150 Proportional-Reset Controller

## CVS Type 4160 Pressure Controller

The operation of CVS Type 4160 - proportional-reset controller, is the same as the CVS Type 4150 with the addition of a reset rate adjustment (L). Follow steps 1-6 from operation of the CVS 4150 then proceed with the following:

1. In step No. 7, for the CVS 4160 the pressure will flow through the three-way valve (K), to reset valve (M) where a portion of pressure will be diverted to the bellows (O).
2. The pressure will be built up in bellows (O) pushing beam (B) to nozzle (C) and therefore increased pressure to valve and to bellows (I). This process will continue until control pressure is equal to the set point.
3. The proportional bandwidth determines how much the pressure will deviate from the set point. The reset determines the amount of time the deviation is away from the set point.

## Maintenance

Two steps should be carried out in regular scheduled maintenance. A cleaner button allows you to clean the passages in the relay orifice. This button should be pushed regularly. The second step is using the drain cock that is located on the underside of the drip well in the CVS 67 CFR. This drip well, should be allowed to bleed off to atmosphere to prevent moisture from contaminating the controller.

## Troubleshooting

The following is a list of suggestions on where to start troubleshooting particularly immediately after installation.

1. The control valve continually cycling or hunting.
  - 1.1. The constant cycling of a controller can occur if the reset rate is set too fast or the band setting is set too narrow.
  - 1.2. Ensure that the controller valve plug is not sticking.
  - 1.3. A control valve always operating near its seat will indicate an oversized control valve.
2. Incomplete Pressure Change on the Diaphragm.
  - 2.1. Ensure an accurate reading is being displayed from the diaphragm pressure gauge.
  - 2.2. Verify that lines and connections are free from leaks.

CVS Series 4150/4160 Bourdon Tubes can be replaced. They may be replaced due to changes in pressure regulations or for maintenance.

## Replacing Bourdon Tube

(Refer to figure 6)

1. Detach the connecting link and bearing (Key 37) from the beam.
2. Unscrew the two fixing screws (Key 8) holding the tube. Detach tube from the sub-assembly.
3. Replace the Bourdon tube by removing the connecting link and bearing from the existing tube. Attach the connecting link and bearing on the new Bourdon tube.
4. Zero the pressure dial.
5. Install the Bourdon tube in the sub-assembly. Reconnect the connecting link and bearing to the beam.
6. Ensure that the tube is in a horizontal position and that there is tension in the connecting link. The tension can be adjusted by bending the cross springs (Key 28).
7. Adjust and calibrate for start-up.

## Replacing Bellows

(Refer to figure 6)

1. Detach sub-assembly from controller.
2. Remove the connecting link and bearing (Key 37) from the beam.
3. Remove the bellows unit from the frame (Key 16)
4. Install the bellows in the control assembly. Begin by ensuring that the beam is horizontal and with the pressure setting dial at zero. Then attach the connecting link and the bearing link to bellows and beam. Ensure that there is tension on the connecting link. Tension can be added by bending the cross springs (Key 28).
5. Adjust and calibrate for start up.

## Calibration of Controllers

1. Move the calibration adjuster (Key 30, Figure 6) to the right or the left.
2. Repeat the nozzle adjustment and step 5 for proportional controller or step 6 for proportional-reset controller.
3. To release the calibration adjuster, loosen the two screws, above and below the beam, to the left of the nozzle.

### Calibrate Zero on Proportional Controllers

1. Depending on the controller type the supply pressure will be 20 or 35 psi. Attach a suitable pressure gauge to the output pressure.
2. Connect the pressure source to the pressure block and set the proportional bandwidth to 15% (1.5).
3. Zero the pressure setting dial.
4. Raise or lower the nozzle (Key 34, Figure 6) to get the desired setting of zero as per chart below. Nylon insert will hold the nozzle in place.
5. Allow maximum pressure to the measuring element. Set the pressure dial to maximum. Output pressure should comply with the zero setting column in the following table, if not go to Note 1.

Control Action	Output Range	Supply Pressure	Zero Setting
Direct	3-15 psi	20 psi	8-10 psi
Direct	6-30 psi	35 psi	16-20 psi
Reverse	15-3 psi	20 psi	8-10 psi
Reverse	30-6 psi	35 psi	16-20 psi

### Calibrate Zero on Proportional –Reset Controllers

1. Depending on the controller type the supply pressure will be 20 or 35 psi. Attach a suitable pressure gauge to the output pressure.
2. Connect the pressure source to pressure block and set the proportional bandwidth to zero.
3. Set the reset dial to .005 minutes per repeat.
4. Zero the pressure setting dial.
5. Raise or lower the nozzle (Key 34, Figure 6) to get the desired setting of zero as per chart below. Nylon insert will hold the nozzle in place.
6. Allowing maximum pressure to the measuring element. Set the pressure dial to maximum. Output pressure should comply with the zero setting column in the following table, if not go to Note 1.

**Note 1** - These steps are to be used if the zero setting pressure or output range is not obtained when maximum pressure is applied to the measuring element.

1. Move the calibration adjuster (Key 30, Figure 6) to the right or the left.
2. Repeat the nozzle adjustment and Step 5 for proportional controller, or Step 6 for proportional-reset controller.
3. To release the calibration adjuster, loosen two screws, above and below the beam, to the left of the nozzle.

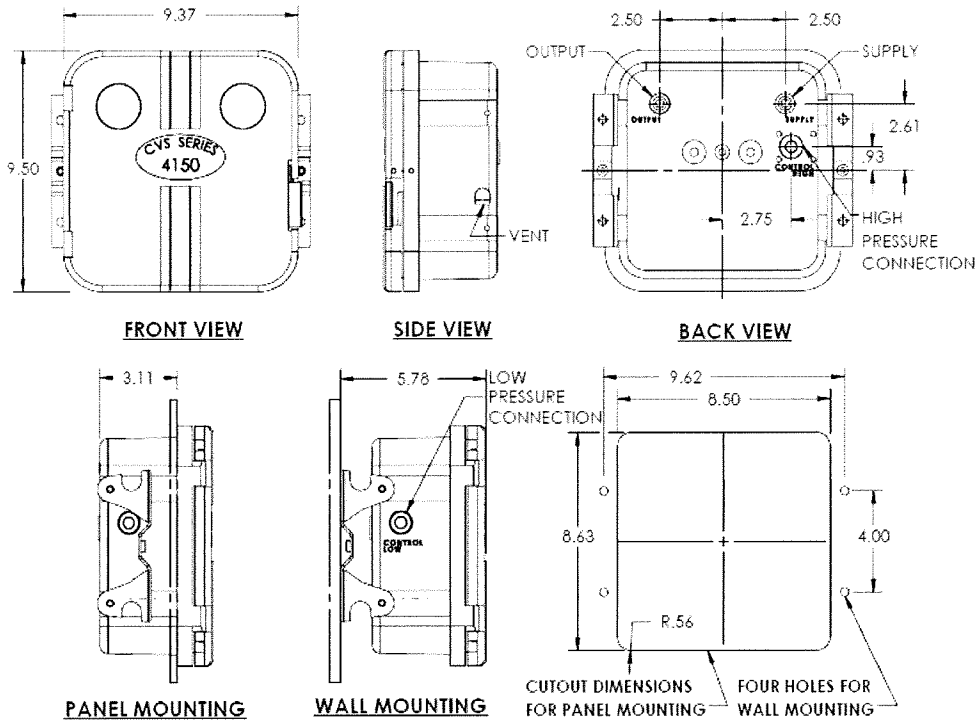
Control Action	Output Range	Supply Pressure	Zero Setting
Direct	3-15 psi	20 psi	8-10 psi
Direct	6-30 psi	35 psi	16-20 psi
Reverse	15-3 psi	20 psi	8-10 psi
Reverse	30-6 psi	35 psi	16-20 psi

### Changing of Controller Output

Controllers having an output range of 3-15 psi, can be converted to having an output range of 6-30 psi. This can be done by changing the two color coded control bellows. The green bellows is for 3-15 range, and yellow bellows for 6-30 psi range.

When the pressure range is changed, it is necessary to change the pressure gauges. This can be completed by unscrewing the old pressure gauges from their boss and screwing in the new gauges.

# Dimensional Data



NOTE: ALL DIMENSIONS ARE IN INCHES.

# Assembly

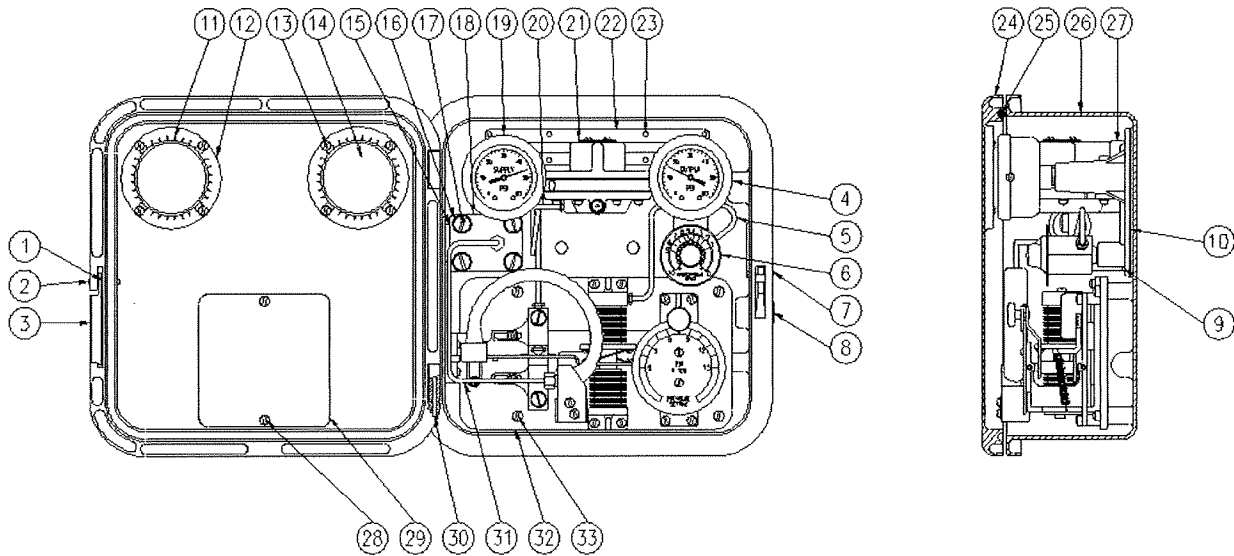
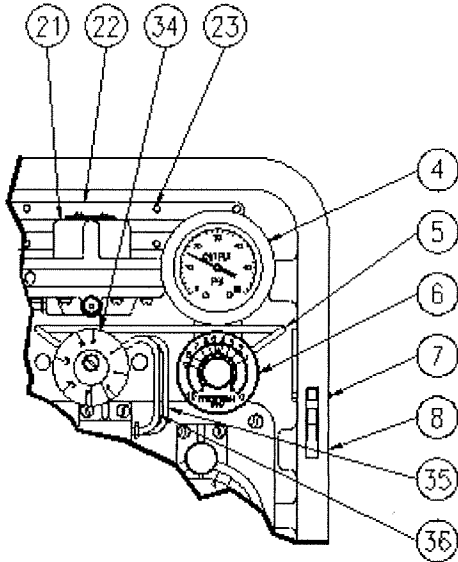


Figure 4: CVS Type 4150 Proportional Pressure Controller with Bourdon Tube Measuring Element



## Parts Reference



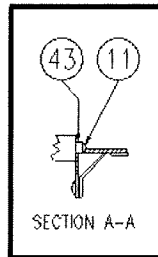
**Figure 5:** Partial view of Type CVS 4160 Pressure Controller Showing the Reset Valve and the Arrangement of Tubing

## Controller Main Assembly (Refer to Figures 4 and 5)

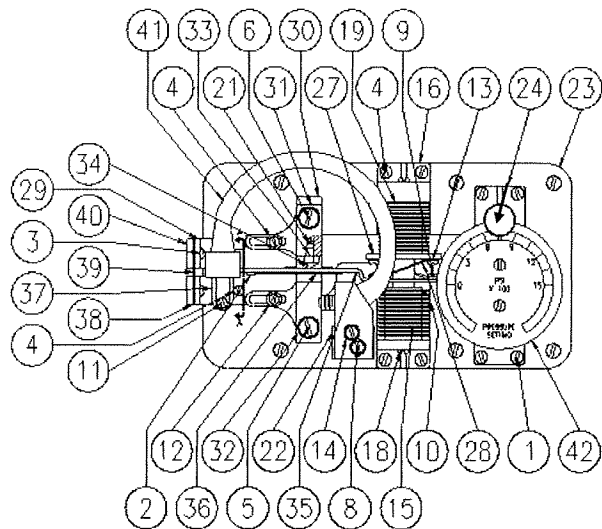
KEY NO.	PART NUMBER	PART DESCRIPTION	MATERIAL
1	CVS1H2889	Spring Washer	Steel Cd. Pl
2	CVS1H2891	Groove Pin	Aluminum
3	CVS1H2886	Cover Latch	Steel Cd. Pl
4	CVS1H2712 CVS1H3048	Output Pres. Gauge 30 psi. Output Pres. Gauge 60 psi	Sub-Assy Sub-Assy
5*	CVS1H6864 CVS1H6866	Compensator Tubing Assy Reset Tubing Assy	304 SST 304 SST
6	CVS367X3	Proportional Band Adj. Assy	Sub-Assy
7	CVS1H2890	Groove Pin	Aluminum
8	CVS1C8937	Screen and Elbow Assy	Sub-Assy
9*	CVS1C3286	Cont. Pres. Block Gasket	Neoprene
10*	CVS1H2887	Relay Base Gasket	Neoprene
11*	CVS0T0191	Glass Gasket, 2 Req'd	Neoprene
12	CVS1A4658	Retaining Ring, 2 Req'd	Galv, Steel Cd. Pl.
13	CVS1A5120	Screw, 8 Req'd	Steel Cd. Pl
14*	CVS0T0192	Gauge Glass, 2 Req'd	Acrylic
15*	CVS1C3762	O-Ring	Buna-N
16	CVS1C2256	Lockwasher, 4 Req'd	Steel Cd. Pl
17	CVS1C3333	Screw, 4 Req'd	Steel Cd. Pl
18	CVS1H2698 CVS1H2895	Cont. Pres. Block Cont. Pres. Block	Steel 316 SST
19	CVS1H3435 CVS1H3436	Supply Pres. Gauge 0-30 psi Supply Pres. Gauge 0-60 psi	Sub-Assy Sub-Assy
20*	CVS1H6861	Relay Tubing Assy	304 SST
21	CVS536X47	Pilot Relay	

KEY NO.	PART NUMBER	PART DESCRIPTION	MATERIAL
22	CVS3H2885	Relay Base	Zinc
23	CVS1H5269	Screw, 17 Req'd	Steel Cd. Pl
24	CVS4H2684	Cover	Aluminum
25*	CVS1J24075	Cover Gasket	Sponge Rubber
26	CVS4H2699	Case	Aluminum
27*	CVS1C8974	Relay Gasket	Neoprene
28	CVS1C9419	Screw, 2 Req'd	Steel Cd. Pl
29	CVS1H2702	Instruction Plate	Aluminum/SST
30	CVS1H2888	Roll Pin, 2 Req'd	Steel Cd. Pl
31*	CVS1H3011 CVS1H4526	Cont. Tubing Assy, 4150, 4160 Cont. Tubing Assy.	304 SST 304 SST
32	CVSML536X	Cont. Sub-Assy. 4150, 4160	Sub-Assy.
33	CVS1A3321	Screw, 6 Req'd	Steel Cd Pl
34	CVS536X61	Reset Valve	
35*	CVS1H6870	Compensator Tubing Assy.	304 SST
36*	CVS1H6870	Compensator Tubing Assy.	304 SST
37	CVS1H5271	Screw, 2 Req'd	Steel Cd. Pl
38	CVS1H5270	Screw, 4160	Steel Cd. Pl
39	CVS1A7675 CVS1A7675	Pipe Plug Pipe Plug	Steel 316 SST
* Recommended Spare Parts			

# Parts Reference



PARTS NOT SHOWN  
7, 17, 20, 25, & 26



**Figure 6 Controller Sub-Assembly for Bourdon Tube Controllers CVS Type 4150 and 4160**

## Controller Sub Assembly (Refer to Figure 6)

KEY NO.	PART NUMBER	PART DESCRIPTION	MATERIAL
1	CVS1C8969	Screw, 4 Req'd	Steel Cd. PI
2	CVS1B2751	Screw	Steel Cd. PI
3	CVS1C8990	Screw, 4 Req'd	Steel Cd. PI
4	CVS1A5733	Screw, 8 Req'd	Steel Cd. PI
5*	CVS1H2674	Screw	Steel Cd. PI
6*	CVS1H2673	Screw	Steel Cd. PI
7	CVS1H2676	Screw, 2 Req'd	Steel Cd. PI
8	CVS1H2677	Screw, 2 Req'd	Steel Cd. PI
9*	CVS1H2678	Screw, 2 Req'd	Steel Cd. PI
10*	CVS1B2776	Screw, 2 Req'd	Steel Cd. PI
11*	CVS1A3319	Screw, 2 Req'd	Steel Cd. PI
12	CVS1E8730	Washer, 2 Req'd	Steel Cd. PI.
13	CVS1H2671	Washer, 4 Req'd	Steel Cd. PI
14*	CVS1H2672	Washer, 4 Req'd	Acrylic
15*	CVS1H2655	Bellows Assy. 3-15 psi, 2 Req'd	
	CVS1H2680	Bellows Assy. 6-30 psi, 2 Req'd	
16	CVS1H2653	Bellows Frame	Aluminum
17	CVS1H2654	Bellows Frame Gasket	Neoprene
18	CVS1D3976	Bellows Screw, 2 Req'd	18-8 SST
19*	CVS1D3970	Bellows Gasket, 2 Req'd	Neoprene
20	CVS1H2658	Bellows Stud	18-8 SST
21*	CVS1E2226	O-Ring	Buna-N
22	CVS1H2650	Bourdon Tube Mounting Bracket	Aluminum
23	CVS2H2651	Mounting Plate	Steel
24	CVS536X4	Pressure Adj. Assy.	
	CVS536X8	Zero Adj. Assy.	
25	CVS1H2652	Adj. Spacer 2 Req'd	Steel
26	CVS1J4234	Rotary Shaft Spring	302 SS
27	CVS1H2659	Spacer	Zinc
28	CVS1H2660	Cross Spring, 2 Req'd	304 SS
29	CVS1H2661	Pressure Set Arm	Steel
31	CVS1U6392	Reversing Block Assy.	

KEY NO.	PART NUMBER	PART DESCRIPTION	MATERIAL
32*	CVS1H2664	O-Ring, 3 Req'd	Viton
33	CVS16A0976	Nylon Insert	Nylon
34*	CVS1U6391	Nozzle	316 SS
35	CVS1H2668	Beam	Steel
36*	CVS1H2669	Flapper	Spring Steel
37	CVS1L3796	Connecting Link	316 SS
38	CVS1C8977	Flexure Strip Base	Steel, Cd PI
39	CVS1C8978	Flexure Base	Spring Steel
40	CVS1C8975	Flexure Strip Nut, 2 Req'd	Steel, Cd PI
41*	CVS 1R8729	Bourdon Tube, 0-30 psi	316 SS
	CVS 1R8730	Bourdon Tube, 0-60 psi	
	CVS 1R8731	Bourdon Tube, 0-100 psi	
	CVS 1R8732	Bourdon Tube, 0-200 psi	
	CVS1R8733	Bourdon Tube, 0-300 psi	
	CVS1R8734	Bourdon Tube, 0-600 psi	
	CVS1R8735	Bourdon Tube, 0-1000 psi	
	CVS1R8736	Bourdon Tube, 0-1500 psi	
	CVS1R8737	Bourdon Tube, 0-3000 psi	
	CVS1R8738	Bourdon Tube, 0-5000 psi	
42	CVS1H3044	Press. Adj. Dial, 0-30 psi	Aluminum
	CVS1H3034	Press. Adj. Dial, 0-60 psi	
	CVS1H3035	Press. Adj. Dial, 0-100 psi	
	CVS1J5237	Press. Adj. Dial, 0-200 psi	
	CVS1H3036	Press. Adj. Dial, 0-300 psi	
	CVS1H3037	Press. Adj. Dial, 0-600 psi	
	CVS1H3038	Press. Adj. Dial, 0-1000 psi	
	CVS1H3039	Press. Adj. Dial, 0-1500 psi	
	CVS1H3040	Press. Adj. Dial, 0-3000 psi	
	CVS1H3041	Press. Adj. Dial, 0-5000 psi	

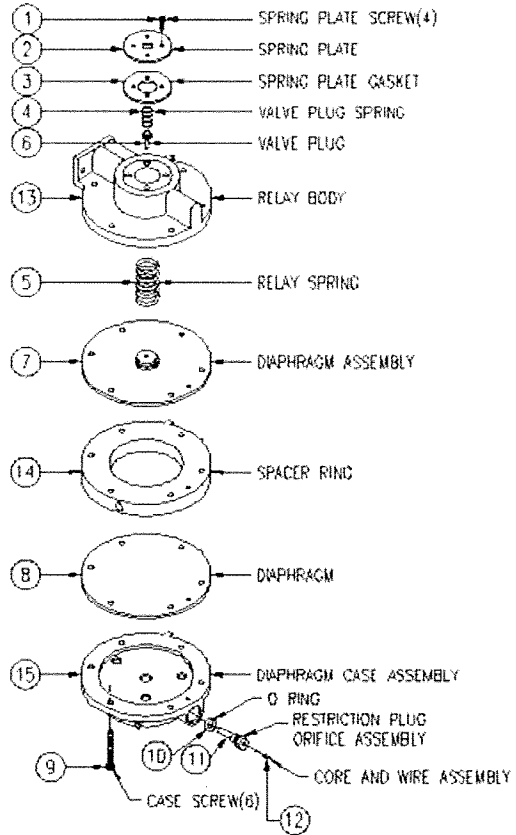
\* Recommended Spare Part

# Parts Reference

## Pilot Relay Assembly

KEY NO.	PART NUMBER	PART DESCRIPTION	MATERIAL
1	CVS1A3319	Screw, 4 Req'd	Steel
2	CVS1H2697	Spring Plate	Steel
3*	CVS1H2696	Spring Plate Gasket, Temp. To 150°F	Neoprene
4	CVS0X0836	Valve Plug Spring	Inconel
5*	CVS1C8961	Relay Spring	Inconel
6*	CVS0Y0617	Valve Plug	316 SS
	CVS0Y0617B		Brass
7	CVS1C9370	Dia. Assy. Temp To 150°F	Sub Assy.
8	CVS1L5556	Top Dia., Temp 150°F	Buna-N
9*	CVS1C8969	Screw Temp to 150°F 6 Req'd	Steel
10*	CVS1D6875	O-Ring	Syn. Rubber
11*	CVS1H8266	Restriction Plug Orifice Assy.	Sub Assy.
12	CVS1E2303	Core & Wire Assy.	Sub Assy.
13	CVS2H2693	Relay Body	Zinc
14*	CVS2K4404	Spacer Ring	Zinc
15*	CVS1C9369	Diaphragm Case Assy	Sub Assy.
16			
17	CVS1P8261	Washer, 6 Req'd (Not Shown)	Steel

\* Recommended Spare Part



**Figure 7: Exploded View of Pilot Relay used in CVS Type 4150 and 4160 Controllers**

## Supply Pressure Data

CVS 4150 and CVS 4160							
Output Signal Range		Normal Operating Supply Pressure (*)		Maximum Allowable Supply Pressure to Prevent Internal Damage		Steady State Air Consumption SCFH of Air at 60°F and 14.7PSIA (Normal M <sup>3</sup> /Hr of Air at 0°C and 1.01325 Bar)	
Psig	Bar	Psig	Bar	Psig	Bar	Min <sup>A</sup>	Max <sup>B</sup>
3 to 15 or 0 & 20 (on-off)	0.2 to 1.0 or 0 & 20 (on-off)	20	1.4	50	3.4	4.2 (0.12)	27 (0.76)
6 to 30 or 0 & 30 (on-off)	0.4 to 2.0 or 0 & 2.4 (on-off)	35	2.4	50	3.4	7 (0.20)	42 (1.2)
* Stability and control may be compromised if pressure is exceeded. A Proportional Band setting of 0-10 B Proportional Band setting of 5							
CVS 4150 LE and CVS 4160 LE – Low Emission Controllers							
3 to 15 or 0 & 20 (on-off)	0.2 to 1.0 or 0 & 20 (on-off)	20	1.4	50	3.4		2.61 (0.075)
6 to 30 or 0 & 30 (on-off)	0.4 to 2.0 or 0 & 2.4 (on-off)	35	2.4	50	3.4		4.20 (0.12)

## Specifications

### Supply:

Air or Natural Gas\*

\*natural gas should contain no more than 20ppm of Hydrogen Sulphide

### Supply and Output Connections:

1/4" NPT Female

### Supply Pressure:

-Normal operating pressure for 3 to 15 psig output signal range is 20 psig.

-Normal operating pressure for 6 to 30 psig output signal range is 35 psig.

### Operating Temperature Limits:

-40°F to 200°F (-40°C to 93°C)\*

\*Standard Construction

### Operating Temperature Influence:

-Proportional Control:

Output pressure changes  $\pm 3\%$  of sensing element range for each 50°F (28°C) change in temperature between -40°F and 160°F (-40°C and 71°C) if the controller is set at 100% proportional band.

-Reset Control:

Output pressure changes  $\pm 2\%$  of sensing element range for each 50°F (28°C) change in temperature between -40°F and 160°F (-40°C and 71°C) if the controller is set at 100% proportional band.

### Performance:

-Repeatability:

0.5% of sensing element range

-Deadband:

0.1% of output span

-Frequency response at 100% proportional band:

Output to actuator: 0.7 Hz and 110° phase shift with 113 inches<sup>3</sup> (1850 cm<sup>3</sup>) volume, actuator at mid stroke.

Output to positioner bellows: 9 Hz and 130° phase shift with 3 -15 psig (0.2 to 1.0 bar) output to 2 inches<sup>3</sup> (33cm<sup>3</sup>) bellows.

### Output Signal:

3 to 15 psig (0.2 to 1.0 bar) or 6 to 30 psig (0.4 to 2.0 bar) pneumatic pressure signal.

### Action:

The control action is easily reversible from **direct acting** (increasing sensed pressure produces increasing output signal) to **reverse acting** (increasing sensed pressure produces decreasing output signal) without the need for additional parts.

### Proportional Band Adjustment:

Full output pressure change is adjustable from 3 to 100% for a 3 to 15 psig (0.2 to 1.0 bar), or 6 to 100% for a 6 to 30 psig (0.4 to 2.0 bar) of the sensing element range.

### Reset Adjustment:

Adjustable from 0.01 to 74 minutes per repeat (100 to 0.01 repeats per minute)

## Severe-Service Union-Bonnet Needle Valves



### N Series and HN Series

- Working pressures up to 10 000 psig (689 bar)
- Temperatures from -65 to 450°F (-53 to 232°C) with PTFE packing; up to 1200°F (648°C) with Grafoil® packing
- 316 stainless steel; 316/316L dual certified stainless steel (SSD), alloys 400, 600, and C-276; and titanium materials
- Low Emissions certification per API 624 available

## Features

### Stem Designs

- Ball tip (NB)—3N, 6N, 12N, and 6HN
- Regulating (NR)—all models
- PCTFE soft-seat regulating (NKR)—all models
- PTFE soft-seat regulating (NTR)—3N, 6N, 3HN, and 6HN

### Orifice Sizes

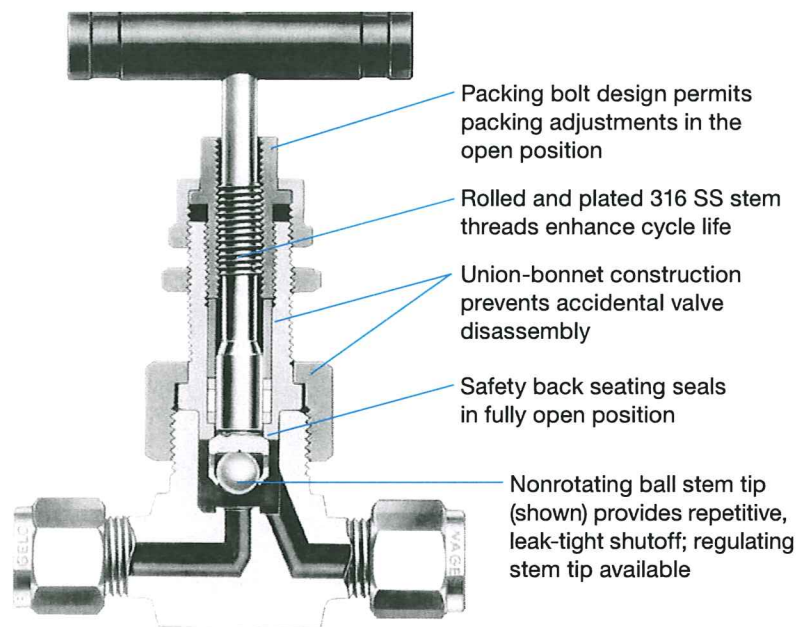
- 0.156 in. (4.0 mm)—3N and 3HN
- 0.250 in. (6.4 mm)—6N and 6HN
- 0.437 in. (11.1 mm)—12N

### Flow Coefficients (C<sub>v</sub>)

- From 0.35 to 2.4

### Flow Patterns

- Straight—all models
- Angle—3N, 6N, and 12N



## Pressure-Temperature Ratings

Ratings are based on manual valves with optional Grafoil® packing. Ratings are limited to:

- 200°F (93°C) max with PCTFE stem tip (NKR).
- 250°F (121°C) max with UHMWPE stem packing.
- 450°F (232°C) max with PTFE stem tip (NTR) or stem packing.
- 600°F (315°C) max with PEEK stem packing and 316 SS, 316/316L SSD, alloy 600, alloy C-276, or titanium; 500°F (260°C) max with PEEK stem packing and alloy 400 (alloy 400 available in N series only).
- 1000°F (537°C) max with 316/316L SSD body, bonnet and stem components.

See **Stem Packing Materials**, page 10, for more information about packing materials.

## N Series

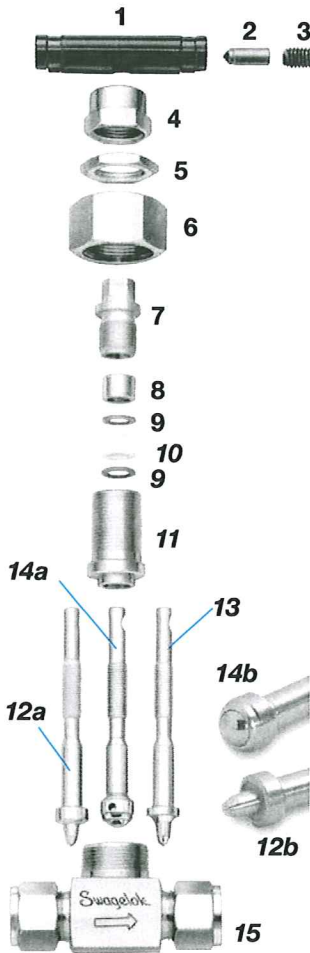
ASME Class	2500				N/A	
Material Group	2.2	N/A	3.4	3.5	N/A	N/A
Material Name	316 SS	316/316L SSD	Alloy 400	Alloy 600	Alloy C-276	Titanium
Temperature, °F (°C)	Working Pressure, psig (bar)					
-65 (-53) to 100 (37)	6000 (413)	6000 (413)	5000 (344)	6000 (413)	6000 (413)	3570 (245)
200 (93)	5160 (355)	5160 (355)	4400 (303)	5600 (385)	6000 (413)	3110 (214)
250 (121)	4910 (338)	4910 (338)	4260 (293)	5460 (376)	6000 (413)	2840 (195)
300 (148)	4660 (321)	4660 (321)	4120 (283)	5320 (366)	6000 (413)	2570 (177)
350 (176)	4470 (307)	4470 (307)	4050 (279)	5220 (359)	5975 (411)	2385 (164)
400 (204)	4280 (294)	4280 (294)	3980 (274)	5120 (352)	5880 (405)	2200 (151)
450 (232)	4130 (284)	4130 (284)	3970 (273)	5030 (346)	5710 (393)	2055 (141)
500 (260)	3980 (274)	3980 (274)	3960 (272)	4940 (340)	5540 (381)	1885 (129)
600 (315)	3760 (259)	3760 (259)	—	4780 (329)	5040 (347)	1625 (111)
650 (343)	3700 (254)	3700 (254)	—	4700 (323)	4905 (337)	—
700 (371)	3600 (248)	3600 (248)	—	4640 (319)	4730 (325)	—
750 (398)	3520 (242)	3520 (242)	—	4430 (305)	4430 (305)	—
800 (426)	3460 (238)	3460 (238)	—	4230 (291)	4230 (291)	—
850 (454)	3380 (232)	3380 (232)	—	4060 (279)	4060 (279)	—
900 (482)	3280 (225)	3280 (225)	—	3745 (258)	3745 (258)	—
950 (510)	3220 (221)	3220 (221)	—	2725 (187)	3220 (221)	—
1000 (537)	3030 (208)	3030 (208)	—	1800 (124)	3030 (208)	—
1050 (565)	3000 (206)	—	—	1155 (79.5)	3000 (206)	—
1100 (593)	2685 (184)	—	—	770 (53.0)	2685 (184)	—
1150 (621)	2285 (157)	—	—	565 (38.9)	2285 (157)	—
1200 (648)	1715 (118)	—	—	515 (35.4)	1545 (106)	—

## HN Series (High Pressure)

ASME Class	N/A	N/A
Material Group	N/A	N/A
Material Name	316 SS	316/316L SSD
Temperature °F (°C)	Working Pressure psig (bar)	
-65 (-53) to 100 (37)	10 000 (689)	10 000 (689)
200 (93)	9 290 (640)	9 290 (640)
250 (121)	8 840 (609)	8 840 (609)
300 (148)	8 390 (578)	8 390 (578)
350 (176)	8 045 (554)	8 045 (554)
400 (204)	7 705 (530)	7 705 (530)
450 (232)	7 435 (512)	7 435 (512)
500 (260)	7 165 (493)	7 165 (493)
600 (315)	6 770 (466)	6 770 (466)
650 (343)	6 660 (458)	6 660 (458)
700 (371)	6 480 (446)	6 480 (446)
750 (398)	6 335 (436)	6 335 (436)
800 (426)	6 230 (429)	6 230 (429)
850 (454)	6 085 (419)	6 085 (419)
900 (482)	5 905 (406)	5 905 (406)
950 (510)	5 795 (399)	5 795 (399)
1000 (537)	5 450 (375)	5 450 (375)
1050 (565)	5 400 (372)	—
1100 (593)	4 835 (333)	—
1150 (621)	4 115 (283)	—
1200 (648)	3 085 (212)	—

For more information about pressure ratings of valves with tube fitting end connections, refer to Swagelok® *Tubing Data* catalog, [MS-01-107](#). Pressure ratings of valves with VCR® or VCO® fitting end connections are based on the ratings of the mating fitting; refer to Swagelok *VCR Metal Gasket Face Seal Fittings* catalog, [MS-01-24](#), and Swagelok *VCO O-Ring Face Seal Fittings* catalog, [MS-01-28](#), (VCR and VCO fittings available in N series only).

## Materials of Construction



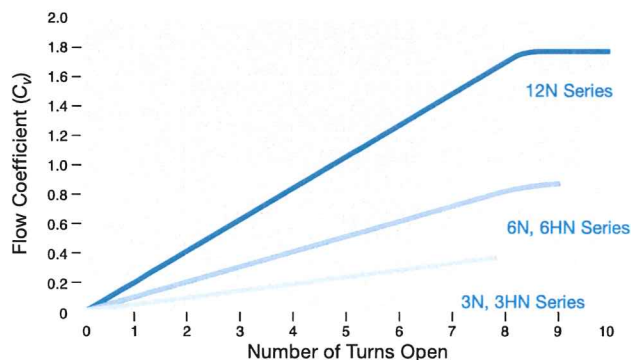
Component	Valve Body Material					
	316 SS	316/316L SSD	Alloy 400	Alloy 600	Alloy C-276	Titanium
	<b>Material Grade/ASTM Specification</b>					
1 Handle	Anodized aluminum 2024T4/B211					
2 Handle pin	Nickel cadmium-plated steel/A108					
3 Set screw	Nickel cadmium-plated steel					
4 Lock nut	316 SS/A276 or A479					
5 Panel nut	316 SS/B783					
6 Union nut	316 SS/A276					
7 Packing bolt						
8 Gland	316 SS/A276	316 SS/A479 or B895	Alloy 400/B164	Silver-plated alloy 600/B166	Alloy C-276/B574	Ti grade 4/B348
9 Packing supports	Glass-filled PTFE					
10 Packing	PTFE/D1710					
11 Bonnet	316 SS/A479	316/316L SSD/A479	Alloy 400/B164	Alloy 600/B166	Alloy C-276/B574	Ti grade 4/B348
12a NTR or NKR soft-seat regulating stem shank	Silver-plated 316 SS/A276	Silver-plated 316/316L SSD/A276	Alloy 400/B164	Silver-plated alloy 600/B166	Alloy C-276/B574	Ti grade 4/B348
12b Soft-seat tip	NTR stem—PTFE/D1710; NKR stem—PCTFE					
13 NR regulating stem	Silver-plated 316 SS/A276	Silver-plated 316/316L SSD/A276	Alloy 400/B164	Silver-plated alloy 600/B166	Alloy C-276/B574	Ti grade 4/B348
14a NB ball tip stem shank						
14b NB ball stem tip	Cobalt-based alloy	Cobalt-based alloy	Material must be selected; see <b>Ball Stem Tip Materials</b> , page 6.			
15 Body	316 SS/A479	316/316L SSD/A479	Alloy 400/B164, B127, or B564	Alloy 600/B166 or B564	Alloy C-276/B564	Ti grade 4/B348 or Ti grade F4/B381
Lubricant	Nickel antiseize with hydrocarbon carrier (all valves); hydrocarbon-based (NB ball tip)					

Wetted components listed in *italics*.

## Flow Data at 100°F (37°C)

### NR, NTR, and NKR Regulating Stems

#### Flow Coefficient at Turns Open



### NB Ball Stem Tip

The NB stem is designed to be used in a fully open or fully closed position. See **Dimensions** for flow coefficients.

## Testing

Every N series and HN series needle valve is factory tested with nitrogen at 1000 psig (69 bar). Seats have a maximum allowable leak rate of 0.1 std cm<sup>3</sup>/min. Shell testing is performed to a requirement of no detectable leakage with a liquid leak detector.

## Cleaning and Packaging

All N series and HN series needle valves are cleaned and packaged in accordance with Swagelok *Standard Cleaning and Packaging (SC-10)* catalog, [MS-06-62](#). Cleaning and packaging in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* catalog, [MS-06-63](#), to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C are available as an option.

## Low Fugitive Emissions

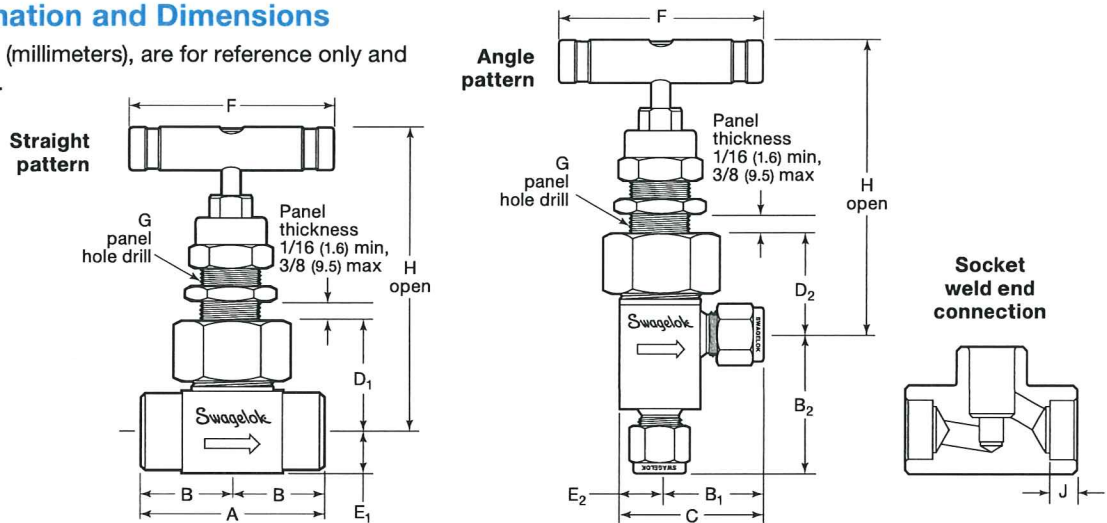
The American Petroleum Institute's API 624 tests for fugitive emissions to atmosphere for rising stem valves. The tests are conducted at a third party lab and certify that at no point in the test did the valve leak in excess of 100 ppm of methane. Certificates stating that the valve is certified for Low Emissions service are available for valves with PTFE packing. For more information, contact your authorized Swagelok sales and service representative.



### Ordering Information and Dimensions

Dimensions, in inches (millimeters), are for reference only and are subject to change.

#### N Series



End Connections		C <sub>v</sub>	Ordering Number	Dimensions, in. (mm)																	
Inlet/Outlet	Size			A	B	B <sub>1</sub>	B <sub>2</sub>	C	D <sub>1</sub>	D <sub>2</sub>	E <sub>1</sub>	E <sub>2</sub>	F	G	H Straight	H Angle	J				
<b>3N Series: 0.156 in. (4.0 mm) Orifice</b>																					
Female NPT	1/8 in.	0.35	SS-3NBF2	2.00 (50.8)	1.00 (25.4)	0.89 (22.6)	1.00 (25.4)	1.27 (32.3)	1.09 (27.7)	1.28 (32.5)	0.38 (9.7)	0.38 (9.7)	1.75 (44.4)	19/32 (15.1)	3.05 (77.5)	3.23 (82.0)					
	1/4 in.		SS-3NBF4	2.06 (52.3)	1.03 (26.2)	1.00 (25.4)		1.38 (35.1)		1.09 (27.7)	0.38 (9.7)					3.05 (77.5)					
Male NPT	1/4 in.		SS-3NBM4	2.00 (50.8)	1.00 (25.4)	1.00 (25.4)	1.27 (32.3)	1.09 (27.7)		0.38 (9.7)	0.38 (9.7)					3.23 (82.0)					
Male/female NPT	1/4 in.		SS-3NBM4-F4	2.03 (51.6)	1.03 (26.2)	0.89 (22.6)	1.27 (32.3)	1.28 (32.5)		0.39 (9.9)	3.05 (77.5)										
Swagelok tube fittings	1/4 in.		SS-3NBS4	2.40 (61.0)	1.20 (30.5)	1.16 (29.5)	1.48 (37.6)	1.54 (39.1)		1.09 (27.7)	0.38 (9.7)					0.38 (9.7)	1.75 (44.4)	19/32 (15.1)	3.05 (77.5)	3.05 (77.5)	
	6 mm		SS-3NBS6MM			—	—	—		—										—	—
	8 mm		SS-3NBS8MM			—	—	—		—										—	—
Tube socket welds	1/4 in.		SS-3NBSW4T	1.82 (46.2)	0.91 (23.1)	0.88 (22.4)	1.19 (30.2)	1.25 (31.8)		1.09 (27.7)	0.38 (9.7)					0.38 (9.7)	3.05 (77.5)	0.28 (7.1)			
Male VCO fittings	1/4 in.		SS-3NBVCO4	2.06 (52.3)	1.03 (26.2)	—	—	—		—	—					—	—	—	—	—	
Male VCR fittings	1/4 in.		SS-3NBVCR4	—	—	—	—	—		—	—					—	—	—	—	—	
<b>6N Series: 0.250 in. (6.4 mm) Orifice</b>																					
Female NPT	1/4 in.	0.86	SS-6NBF4	2.25 (57.2)	1.12 (28.4)	1.00 (25.4)	1.12 (28.4)	1.50 (38.1)	1.34 (34.0)	1.47 (37.3)	0.50 (12.7)	0.50 (12.7)	2.50 (63.5)	25/32 (19.8)	3.70 (94.0)	3.82 (97.0)					
	3/8 in.		SS-6NBF6	2.83 (71.9)	1.41 (35.8)	1.29 (32.8)	1.66 (42.2)	1.79 (45.5)		1.22 (31.0)						3.57 (90.7)					
Swagelok tube fittings	3/8 in.		SS-6NBS6	3.04 (77.2)	1.52 (38.6)	1.40 (35.6)	1.65 (41.9)	1.90 (48.3)		1.34 (34.0)						0.50 (12.7)	3.70 (94.0)				
	1/2 in.		SS-6NBS8	2.85 (72.4)	1.42 (36.1)	1.30 (33.0)	1.55 (39.4)	1.80 (45.7)		1.34 (34.0)						0.50 (12.7)	3.70 (94.0)				
	10 mm		SS-6NBS10MM	3.04 (77.2)	1.52 (38.6)	1.40 (35.6)	1.65 (41.9)	1.90 (48.3)		1.34 (34.0)						0.50 (12.7)	3.70 (94.0)				
	12 mm		SS-6NBS12MM	—	—	—	—	—		1.34 (34.0)						—	—	0.31 (7.9)			
Tube socket welds	3/8 in.		SS-6NBSW6T	2.25 (57.2)	1.12 (28.4)	1.00 (25.4)	1.25 (31.8)	1.50 (38.1)		1.40 (35.6)						0.50 (12.7)	0.50 (12.7)	2.50 (63.5)	25/32 (19.8)	3.70 (94.0)	3.76 (95.5)
	1/2 in.		SS-6NBSW8T				1.00 (25.4)			1.00 (25.4)											1.50 (38.1)
Pipe socket welds	1/4 in.		SS-6NBSW4P	—	—	—	1.12 (28.4)	—		1.47 (37.3)						—	—	—	—	—	3.82 (97.0)
Male VCO fittings	1/2 in.		SS-6NBVCO8	—	—	—	—	—		—						—	—	—	—	—	—
Male VCR fittings	1/2 in.	SS-6NBVCR8	3.12 (79.2)	1.56 (39.6)	—	—	—	1.53 (38.9)	—	0.62 (15.7)	—	—	—	—	3.89 (98.8)						

Dimensions shown with Swagelok tube fitting nuts finger-tight.

## Ordering Information and Dimensions

### N Series

Select an ordering number.

To order other valve body materials, replace **SS** in the ordering number with a material designator.

Example: **M-3NBF2**

Material	Designator
Alloy 400	M
Alloy 600	INC
Alloy C-276	HC
Titanium	TI
316/316L	SSD

### Ball Stem Tip Materials

Ordering numbers specify a cobalt-based alloy ball stem tip. N series valves of 316 SS are standard with this stem tip and require no designator.

To specify ball stem tip material for valves of other materials, add a designator to the ordering number.

Example: **INC-6NBF4-HC**

### Angle-Pattern Valves

Ordering numbers that list C dimensions are available in angle patterns. To order, add **-A** to the ordering number.

Example: **SS-12NBF8-A**

Ball Stem Tip Material/ ASTM Specification	Designator
Cobalt-based alloy	-STE
440C SS/A276	-440C
Alloy 400/B127 or B164	-M
Alloy C-276/B574 or B575	-HC
Titanium/B348 or B265	-TI

### Options and Accessories

See page 10 for information about optional stem packings, stem designs, handles, and sour gas valves.

End Connections			Ordering Number	Dimensions, in. (mm)													
Inlet/Outlet	Size	C <sub>v</sub>		A	B	B <sub>1</sub>	B <sub>2</sub>	C	D <sub>1</sub>	D <sub>2</sub>	E <sub>1</sub>	E <sub>2</sub>	F	G	H Straight	H Angle	J
<b>12N Series: 0.437 in. (11.1 mm) Orifice</b>																	
Female NPT	1/2 in.	2.4	SS-12NBF8	3.12 (79.2)	1.56 (39.6)	1.31 (33.3)	1.56 (39.6)	2.00 (50.8)	1.82 (46.2)	2.00 (50.8)	0.62 (15.7)	0.69 (17.5)	3.50 (88.9)	1 1/32 (26.2)	4.78 (121)	4.97 (126)	-
	3/4 in.		SS-12NBF12	3.25 (82.6)	1.62 (41.1)	-	-	-	1.91 (48.5)	-	0.78 (19.8)	-			4.88 (124)	-	
	1 in.		SS-12NBF16	3.62 (91.9)	1.81 (46.0)	-	-	-	2.13 (54.1)	-	1.00 (25.4)	-			5.10 (129)	-	
Male/ female NPT	1/2 in.	1.9	SS-12NBM8-F8	3.12 (79.2)	1.56 (39.6)	1.31 (33.3)	1.56 (39.6)	2.00 (50.8)	1.82 (46.2)	2.00 (50.8)	0.62 (15.7)	0.69 (17.5)	3.50 (88.9)	1 1/32 (26.2)	4.78 (121)	4.97 (126)	-
	3/4 in.		SS-12NBM12-F12	3.25 (82.6)	1.62 (41.1)	-	-	-	1.91 (48.5)	-	0.78 (19.8)	-			4.88 (124)	-	
	1 in.		SS-12NBM16-F16	3.62 (91.9)	1.81 (46.0)	-	-	-	2.13 (54.1)	-	1.00 (25.4)	-			5.10 (129)	-	
Swagelok tube fittings	1/2 in.	2.1	SS-12NBS8	3.92 (99.6)	1.96 (49.8)	1.68 (42.7)	2.08 (52.8)	2.37 (60.2)	1.82 (46.2)	1.88 (47.8)	0.62 (15.7)	0.69 (17.5)	3.50 (88.9)	1 1/32 (26.2)	4.78 (121)	4.85 (123)	0.38 (9.7)
	3/4 in.		SS-12NBS12														
	1 in.	SS-12NBS16	4.09 (104)	2.04 (51.8)	-	-	-	1.88 (47.8)	-	0.69 (17.5)	-						
Tube socket welds	1/2 in.	2.2	SS-12NBSW8T	3.12 (79.2)	1.56 (39.6)	1.31 (33.3)	1.69 (42.9)	2.00 (50.8)	1.82 (46.2)	1.88 (47.8)	0.62 (15.7)	0.69 (17.5)	3.50 (88.9)	1 1/32 (26.2)	4.78 (121)	4.97 (126)	0.44 (11.2)
	3/4 in.		SS-12NBSW12T			-	-	-	-	-	-						
Pipe socket welds	1/2 in.	2.4	SS-12NBSW8P	3.12 (79.2)	1.56 (39.6)	1.31 (33.3)	1.56 (39.6)	2.00 (50.8)	1.88 (47.8)	2.00 (50.8)	0.69 (17.5)	0.69 (17.5)	3.50 (88.9)	1 1/32 (26.2)	4.85 (123)	4.97 (126)	0.38 (9.7)
Male VCO fittings	3/4 in.	2.2	SS-12NBVCO12	-	-	-	-	-	1.82 (46.2)	-	0.62 (15.7)	-	3.50 (88.9)	1 1/32 (26.2)	4.78 (121)	-	-
Male VCR fittings	1/2 in.	1.9	SS-12NBVCR8	-	-	-	-	-	-	-	-	-	3.50 (88.9)	1 1/32 (26.2)	-	-	-

## Ordering Information and Dimensions

### HN Series (High Pressure)

Select an ordering number.

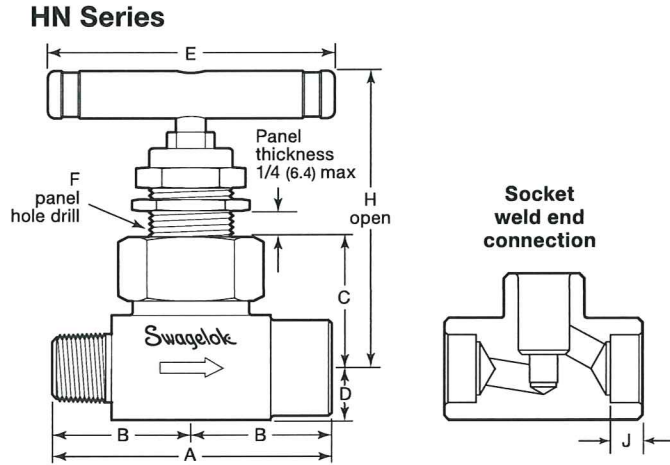
Ordering numbers specify a regulating stem tip. Cobalt-based alloy ball stem tips are available for 6HN series valves. To order, replace **NR** in the ordering number with **NB**.

Example: 6HNBF4

### Options and Accessories

See page 10 for information about optional stem designs, stem packings, and sour gas valves.

Dimensions, in inches (millimeters), are for reference only and are subject to change.



End Connections		Ordering Number	Dimensions, in. (mm)							
Inlet/Outlet	Size		A	B	C	D	E	F	H	J
<b>3HN Series: 0.156 in. (4.0 mm) Orifice; 0.35 C<sub>v</sub></b>										
Female NPT	1/8 in.	SS-3HNRF2	2.25 (57.2)	1.13 (28.7)	1.34 (34.0)	0.50 (12.7)	2.50 (63.5)	0.81 (20.6)	3.43 (87.1)	—
	1/4 in.	SS-3HNRF4								
Male NPT	1/4 in.	SS-3HNRM4								
Male/ female NPT	1/4 in.	SS-3HNRM4-F4								
Swagelok tube fittings	1/4 in.	SS-3HNRS4	2.82 (71.6)	1.41 (35.8)	2.25 (57.2)	1.13 (28.7)	0.28 (7.1)			
Tube socket welds	1/4 in.	SS-3HNRSW4T								
<b>6HN Series: 0.250 in. (6.4 mm) Orifice; 0.86 C<sub>v</sub></b>										
Female NPT	1/4 in.	SS-6HNRF4	3.13 (79.5)	1.56 (39.6)	1.81 (46.0)	0.63 (16.0)	3.50 (88.9)	1.06 (26.9)	4.27 (108)	—
	1/2 in.	SS-6HNRF8	3.25 (82.6)	1.63 (41.4)	1.90 (48.2)	0.78 (19.8)			4.36 (111)	
Male NPT	1/2 in.	SS-6HNRM8	3.13 (79.5)	1.56 (39.6)	1.81 (46.0)	0.63 (16.0)			4.27 (108)	
Male/ female NPT	1/2 in.	SS-6HNRM8-F8	3.25 (82.6)	1.63 (41.4)	1.90 (48.2)	0.78 (19.8)			4.36 (111)	

Dimensions shown with Swagelok tube fitting nuts finger-tight.

## Pneumatic Actuators

Swagelok 3N and 6N series valves can be equipped with pneumatic actuators in normally closed, normally open, and double-acting models.

### Actuator Technical Data

#### Pressure-Temperature Ratings

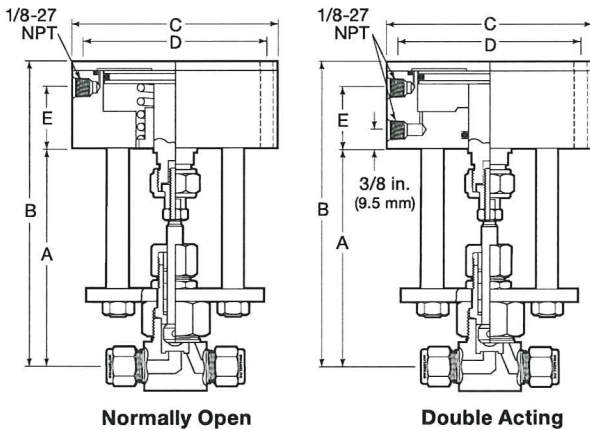
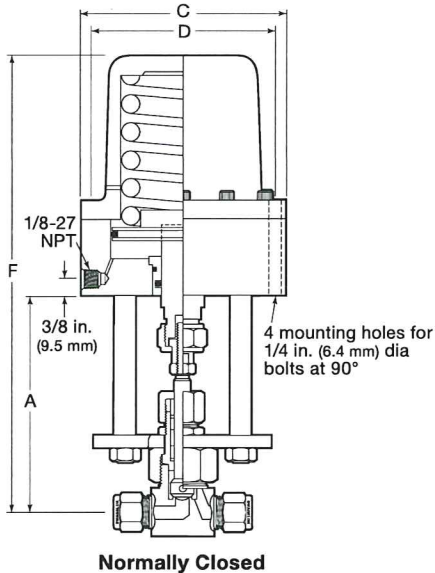
Normally closed:

150 psig at -20 to 300°F  
(10.3 bar at -28 to 148°C)

Normally open and double acting:

150 psig at -20 to 400°F  
(10.3 bar at -28 to 204°C)

### Dimensions



Valve Series	Dimensions, in. (mm)					
	A	B	C	D	E	F
3N	4.22 (107)	5.91 (150)	3.75 (95.3)	3.25 (82.6)	1.12 (28.4)	8.47 (215)
6N	4.47 (114)	6.22 (158)	4.25 (108)	3.81 (96.8)	1.19 (30.2)	9.41 (239)

Dimensions are for reference only and are subject to change.

## Pneumatic Actuator Performance

Minimum actuator pressures and maximum system pressures shown in the graphs below are based on factory adjustment of packing and stems lubricated with a silicone-based lubricant.

Packing nut adjustment may affect actuator performance. If the load is too low, the packing may leak. **If the load is too high, the actuator may stall and the valve will not cycle.**

### Normally Closed Actuators

Adjustment of the actuator stem drive nut affects actuator spring force, which in turn affects:

- the maximum system pressure that can be shut off by the valve
- the minimum actuator pressure required to open the valve.

Figures 1 and 2 show the minimum actuator pressure required to open a normally closed actuator at system pressure.

Maximum system pressure for a 3N valve with normally closed actuator:

- NR, NTR, or NKR stem—3000 psig (206 bar).
- NB stem—4400 psig (303 bar).

Maximum system pressure for a 6N valve with normally closed actuator:

- NR, NTR, or NKR stem—3600 psig (248 bar).
- NB stem—4600 psig (316 bar).

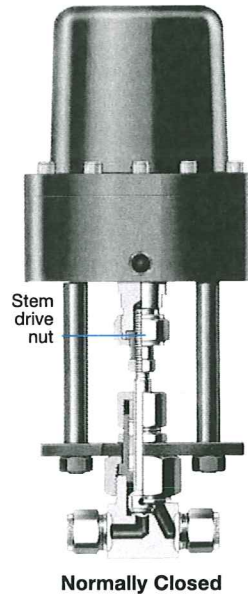


Fig. 1—3N Series with Normally Closed Actuator

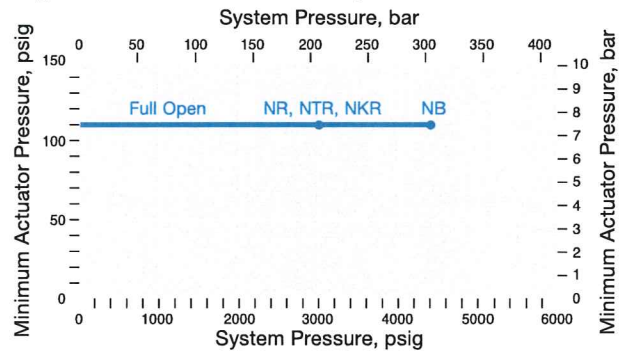
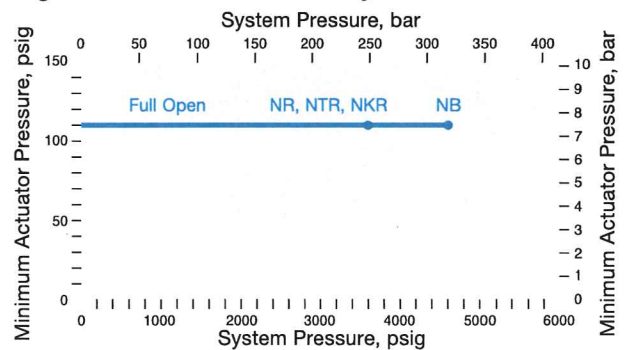


Fig. 2—6N Series with Normally Closed Actuator



## Pneumatic Actuators

### Ordering Information

To order a 3N or 6N series valve equipped with a pneumatic actuator, add a designator to the valve ordering number.

Example: SS-3NBS4-95C

Valve Series	Actuator Designator		
	Normally Closed	Normally Open	Double Acting
3N	-95C	-95O	-95D
6N	-96C	-96O	-96D

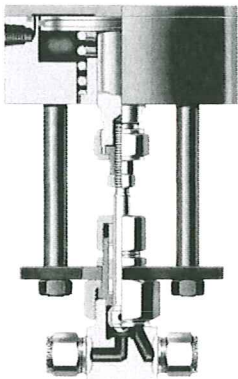
### Normally Open Actuators

The amount the stem orifice opens beyond the cracked-open position depends on system pressure, flow characteristics, and valve packing nut adjustment.

Figures 3 and 4 show the minimum actuator pressure required to close a normally open actuator at system pressure.

Minimum system pressure required to assist the spring in opening the valve:

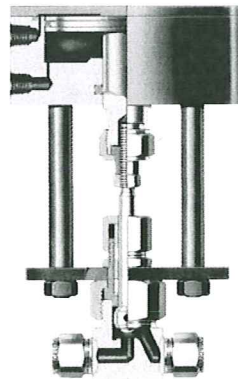
- 3N series with normally open actuator—1000 psig (69.0 bar).
- 6N series with normally open actuator—500 psig (34.5 bar).



Normally Open

### Double-Acting Actuators

Figures 5 and 6 show the minimum actuator pressure required to open or close a 3N or 6N series valve with a double-acting actuator at system pressure.



Double Acting

Fig. 3—3N Series with Normally Open Actuator

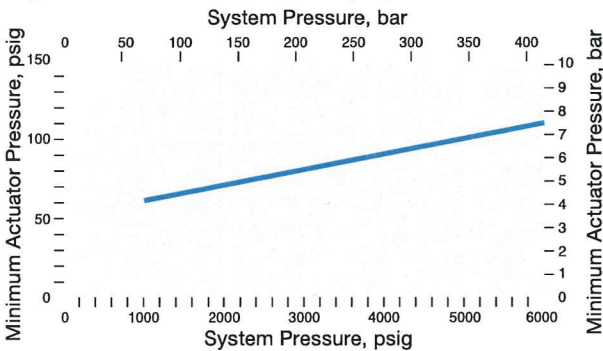


Fig. 4—6N Series with Normally Open Actuator

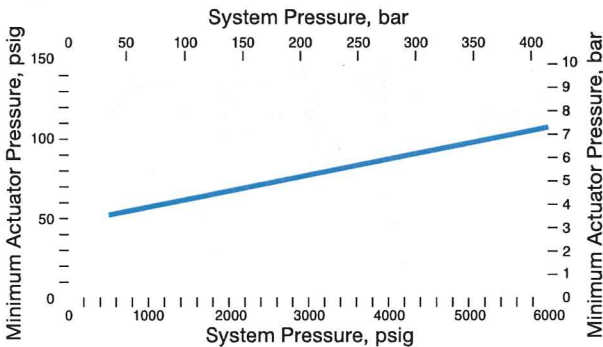


Fig. 5—3N Series with Double-Acting Actuator

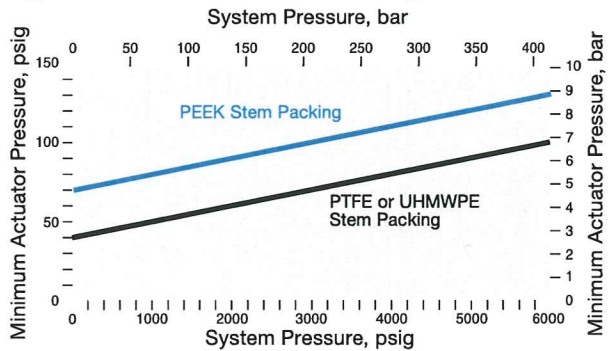
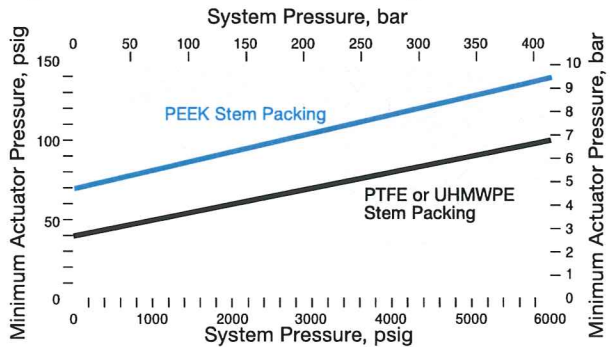


Fig. 6—6N Series with Double-Acting Actuator



## Options and Accessories

### N Series and HN Series

#### Stem Packing Materials

PTFE packing is standard. To order an optional stem packing material, add a stem packing material designator to the valve ordering number. See page 2 for pressure-temperature ratings of valves with optional stem packing materials.

Stem Packing Material	Designator
UHMWPE	-P
PEEK	-PK
Grafoil	-G

**UHMWPE (ultrahigh-molecular weight polyethylene)** is intended for service where fluorocarbons are not acceptable. UHMWPE packing is lubricated with nickel antiseize with hydrocarbon carrier; it does not require packing supports.

**PEEK (polyetheretherketone)** packing material is a 2-piece chevron design including PEEK packing supports and molybdenum disulfide, fluorinated tungsten disulfide-based lubricant; stem packing replacement kits also contain nickel antiseize with hydrocarbon carrier. PEEK packing is not available in normally open or normally closed pneumatically actuated N series valves.

**Grafoil** is a high-temperature packing material that does not require packing supports. Factory assemblies contain fluorinated tungsten disulfide-based lubricant and nickel antiseize with hydrocarbon carrier; stem packing replacement kits contain only nickel antiseize with hydrocarbon carrier. Grafoil is not available in pneumatically actuated N series valves or 12N series valves with colored phenolic knobs.

Examples: SS-3HNRF4-**P**  
SS-6NBS8-**PK**  
SS-12NBF8-**G**

#### Stem Packing Kits

PTFE, UHMWPE, PEEK, and Grafoil stem packing kits are available. Kits contain stem packing(s), lubricant(s), and instructions.

Valve Series	Seal Material and Kit Ordering Number			
	PTFE	UHMWPE	Grafoil	PEEK
3N, 3HN	T-9K-3N	PE-9K-3N	G-9K-3N	PK-9K-3N
6N, 6HN	T-9K-6N	PE-9K-6N	G-9K-6N	PK-9K-6N
12N	T-9K-12N	PE-9K-12N	G-9K-12N	PK-9K-12N
Lubricant	Nickel antiseize with hydrocarbon carrier			Nickel antiseize with hydrocarbon carrier and fluorinated tungsten disulfide-based; molybdenum disulfide-based coating

#### Stem Designs

N series valve ordering numbers specify NB ball stem tips. HN series valve ordering numbers specify NR regulating stem tips. To order valves with other stem designs, replace **NB** or **NR** in the ordering number with the desired stem design designator.

Examples: SS-3NRF2  
SS-3HNKRF2

Stem Design	Designator
Regulating <sup>①</sup>	NR
PCTFE soft-seat regulating	NKR
PTFE soft-seat regulating <sup>②</sup>	NTR

<sup>①</sup> Not intended for repetitive shutoff in gas applications.

<sup>②</sup> Not available in 12N series.

#### Sour Gas Valves

Valves with female pipe ends are available for sour gas service. Materials are selected in accordance with NACE MR0175/ISO 15156. The body and bonnet are annealed 316 stainless steel; the stem is alloy 400. To order, add **-SG** to the valve ordering number.

Examples: SS-3NBF2-**SG**  
SS-3HNRF2-**SG**

#### Special Cleaning and Packaging (SC-11)

To order N series and HN series valves with optional cleaning and packaging to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C, add **-SC11** to the valve ordering number.

Example: SS-3NBF2-**SC11**

## Options and Accessories

### N Series Handles

Anodized black aluminum bar handles are standard. Colored phenolic (with brass insert) and 316 stainless steel bar handles are available.

Exception: 12N series valves with Grafoil packing are not available with colored phenolic knobs.

To order, add a handle designator to the valve ordering number.

Examples: SS-3NBS4-**BKP**  
SS-12NBF8-**SH**

Handle	Designator
Black phenolic knob	-BKP
Blue phenolic knob	-BLP
Green phenolic knob	-GRP
Orange phenolic knob	-OGP
Red phenolic knob	-RDP
Yellow phenolic knob	-YWP
Stainless steel bar	-SH

### Oxygen Service Hazards

For more information about hazards and risks of oxygen-enriched systems, refer to *Oxygen System Safety* technical report, [MS-06-13](#).

- ⚠ **A packing adjustment may be required periodically to increase service life and to prevent leakage.**
- ⚠ **Valves that have not been cycled for a period of time may have a higher initial actuation torque.**
- ⚠ **To increase service life, ensure proper valve performance, and prevent leakage, apply only as much torque as is required to achieve positive shutoff.**

**⚠ WARNING**  
Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.

### HN Series Ball Stem Tip Materials

Cobalt-based alloy is standard. To specify other ball tip materials, add a ball stem tip material designator to the valve ordering number:

Example: SS-6HNBF4-**M**

Ball Tip Material/ ASTM Specification	Designator
440C SS/A276	-440C
Alloy 400/B127 or B164	-M
Alloy C-276/B574 or B575	-HC

### Additional Valve Materials

Alloy 625, alloy 825, Alloy 2507 super duplex stainless steel, and 6-moly materials are available for N and HN series valves. Refer to *Severe-Service Union-Bonnet Needle Valves—Special Alloy Materials* catalog, [MS-02-365](#).

## Introduction

Since 1947, Swagelok has designed, developed, and manufactured high-quality, general-purpose and specialty fluid system products to meet the evolving needs of global industries. Our focus is on understanding our customers' needs, finding timely solutions, and adding value with our products and services.

We are pleased to provide this global edition of the book-bound *Swagelok Product Catalog*, which compiles more than 100 separate product catalogs, technical bulletins, and reference documents into one convenient, easy-to-use volume. Each product catalog is up to date at the time of printing, with its revision number shown on the last page of the individual catalog. Subsequent revisions will supersede the printed version and will be posted on the Swagelok website and in the Swagelok electronic Desktop Technical Reference (eDTR) tool.

For more information, visit your Swagelok website or contact your authorized Swagelok sales and service representative.

## Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit [swagelok.com](http://swagelok.com) or contact your authorized Swagelok representative.

### Safe Product Selection

**When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.**

### WARNING

**Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.**

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Swagelok, Cajon, Ferrule-Pak, Goop, Hinging-Colleting, IGC, Kenmac, Micro-Fit, Nupro, Snoop, Sno-Trik, SWAK, VCO, VCR, Ultra-Torr, Whitey—TM Swagelok Company  
15-7 PH—TM AK Steel Corp.  
AccuTrak, Beacon, Westlock—TM Tyco International Services  
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AutoCAD—TM Autodesk, Inc.  
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DeviceNet—TM ODVA  
Dyneon, Elgiloy, TFM—TM Dyneon  
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FM—TM FM Global  
Grafoil—TM GrafTech International Holdings, Inc.  
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MAC—TM MAC Valves  
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NACE—TM NACE International  
PH 15-7 Mo, 17-7 PH—TM AK Steel Corp  
picofast—Hans Turck KG  
Pillar—TM Nippon Pillar Packing Company, Ltd.  
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## Integral-Bonnet Needle Valves



### O, 1, 18, 20, and 26 Series

- Live-loaded packing system
- Compact design
- Working pressures up to 6000 psig (413 bar)
- Temperatures up to 600°F (315°C)

## Features

### Stem Designs

- Vee—all series
- Soft-seat—all series
- Regulating—O, 1, and 18 series

### Orifice Sizes

- From 0.080 to 0.375 in. (2.0 to 9.5 mm)

### Flow Coefficients (C<sub>v</sub>)

- From 0.09 to 1.80

### Flow Patterns

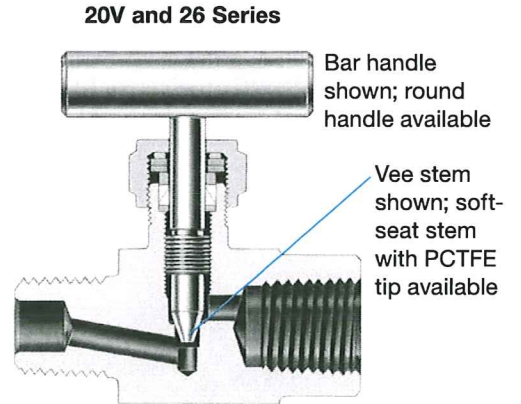
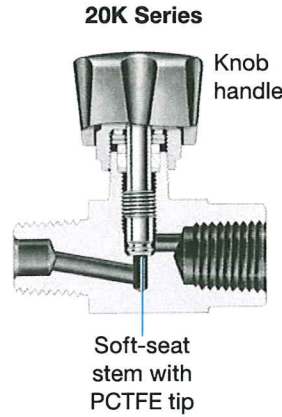
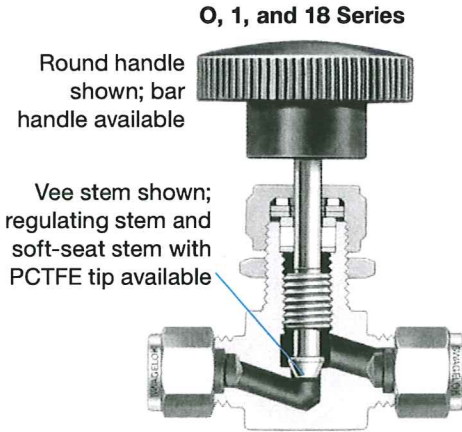
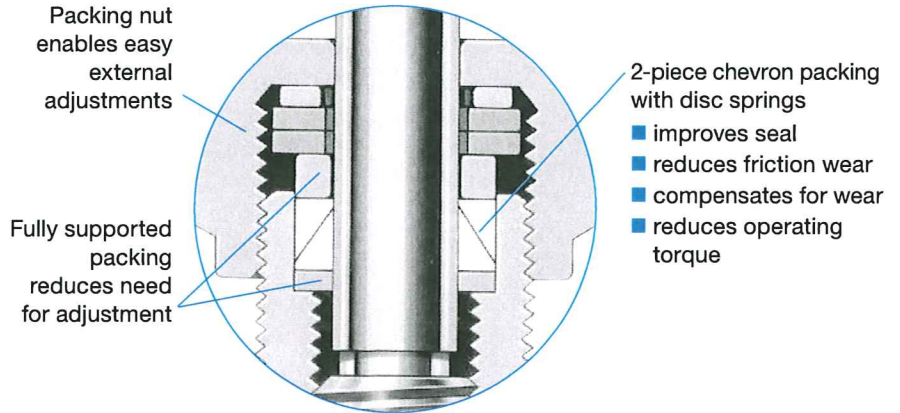
- Straight, angle, and cross patterns

### Panel Mounting

- O, 1, and 18 series

### Live-Loaded Packing System

Low Emissions certification per API 624 available



## Pressure-Temperature Ratings

Ratings are limited to:

- 200°F (93°C) max with soft-seat stem with PCTFE stem tip.
- 250°F (121°C) max with UHMWPE packing.
- 450°F (232°C) max with PFA packing.
- 600°F (315°C) max with PEEK packing.

To order a valve with soft-seat stem and PCTFE stem tip, see **Ordering Information and Dimensions**, page 4 and 6.

To order a valve with UHMWPE or PEEK packing, see **Options and Accessories**, page 7.

### O, 1, and 18 Series

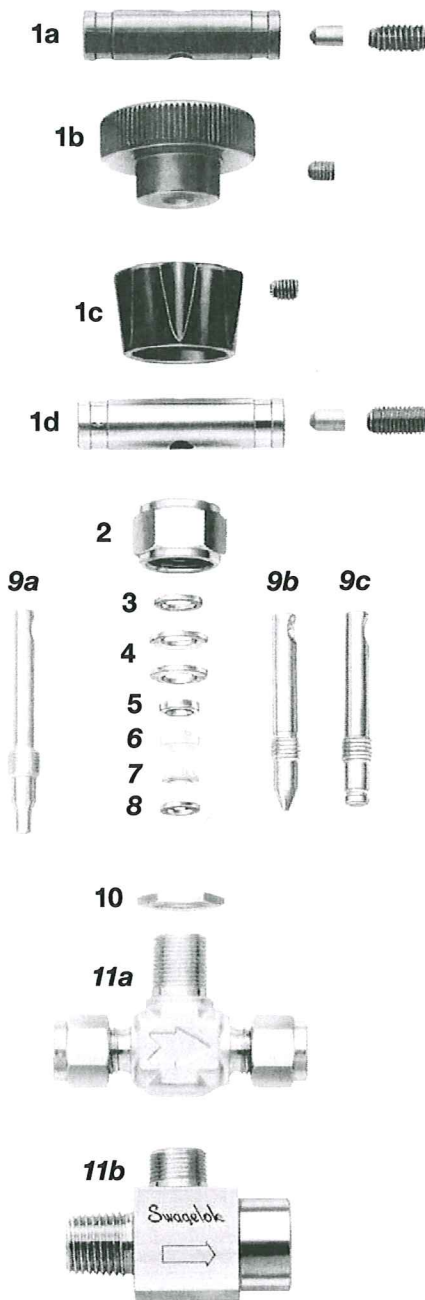
ASME Class	2080	N/A		1500
Material Group	2.2	N/A		3.4
Material Name	316 SS	Brass	Steel	Alloy 400
Temperature, °F (°C)	Working Pressure, psig (bar)			
-65 (-53) to -20 (-28)	5000 (344)	3000 (206)	—	3000 (206)
-20 (-28) to 100 (37)	5000 (344)	3000 (206)	3000 (206)	3000 (206)
200 (93)	4295 (295)	2350 (161)	2730 (188)	2640 (181)
250 (121)	4085 (281)	2200 (151)	2695 (185)	2555 (176)
300 (148)	3875 (266)	2050 (141)	2660 (183)	2470 (170)
350 (176)	3715 (255)	1470 (101)	2615 (180)	2430 (167)
400 (204)	3560 (245)	390 (26)	—	2390 (164)
450 (232)	3435 (236)	—	—	2380 (163)
500 (260)	3310 (228)	—	—	2375 (163)
600 (315)	3130 (215)	—	—	—

### 20 and 26 Series

ASME Class	2500
Material Group	2.2
Material Name	316 SS
Temperature °F (°C)	Working Pressure psig (bar)
-65 (-53) to 100 (37)	6000 (413)
200 (93)	5160 (355)
250 (121)	4910 (338)
300 (148)	4660 (321)
350 (176)	4470 (307)
400 (204)	4280 (294)
450 (232)	4130 (284)
500 (260)	3980 (274)
600 (315)	3760 (259)

For more information about pressure ratings of valves with tube fitting end connections, refer to *Tubing Data* catalog, MS-01-107.

## Materials of Construction



Component	Series	Valve Body Materials			
		Material Grade/ASTM Specification			
		316 SS	Brass	Steel	Alloy 400
1a Bar handle Handle pin Set screw	18	Anodized aluminum 2024/B221 or A209			
		Steel/A108			
		Nickel cadmium-plated steel			
1b Round handle Set screw	O and 1 <sup>①</sup>	Phenolic with brass insert			
		18-8 SS			
Round handle Set screw	1 <sup>②</sup>	Phenolic with brass insert			
		Nickel cadmium-plated steel			
1c Knob handle Set screw	20K	Anodized aluminum 7129/B221	—		
		Nickel cadmium-plated steel	—		
1d Bar handle Handle pin, set screw	20V and 26	316 SS/A276	—		
		S17400/A564	—		
2 Packing nut	All	316 SS/A276	Brass 360/ B16	12L14/ A108	Alloy 400/ B164
3 Gland	O, 1 <sup>①</sup> , and 20	304 SS/A240, A167			
4 Packing springs	All <sup>③</sup>	S17700/A693			
5 Packing gland	All	316 SS/A240, A276, B783			
6 Upper packing	All	PFA/D3307			
7 Lower packing					
8 Lower gland	All	316 SS/A240			Alloy 400/ B127
9a Regulating stem	O, 1, and 18	Chrome-plated <sup>④</sup> 316 SS/A276	316 SS/A276		Alloy 400/ B164
9b Vee stem	All				
9c Soft-seat stem Stem tip	All	PCTFE/D1430			
10 Panel nut	O, 1, and 18	316 SS	Brass 360/ B16	316 SS	
11a Body	O, 1, and 18	316 SS/A182	Brass 377/ B283	Cadmium- plated 11L17/A108	Alloy 400/ B564
11b Body	20 and 26	316 SS/A479	—		
Lubricant	All	Tungsten disulfide- and fluorocarbon-based			

Wetted components listed in *italics*.

Valve series listed with standard handles. For handle options, see **Handles**, page 8.

① 1 series valves with orifice of 0.172 in. (4.4 mm).

② 1 series valves with orifice of 0.250 in. (6.4 mm).

③ O, 20 and 1 series with orifice of 0.172 (4.4 mm)—2 springs;  
18, 26, and 1 series with orifice of 0.250 (6.4 mm)—3 springs.

④ Regulating and vee stem tip and threads; soft-seat stem threads.

## Cleaning and Packaging

All integral-bonnet needle valves are cleaned and packaged in accordance with Swagelok Standard *Cleaning and Packaging* (SC-10) catalog, [MS-06-62](#). Cleaning and packaging in accordance with Swagelok *Special Cleaning and Packaging* (SC-11) catalog, [MS-06-63](#), to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C are available as an option.

## Low Fugitive Emissions

The American Petroleum Institute's API 624 tests for fugitive emissions to atmosphere for rising stem valves. The tests are conducted at a third party lab and certify that at no point in the test did the valve leak in excess of 100 ppm of methane. Certificates stating that the valve is certified for Low Emissions service are available for valves with PFA and PEEK packing. For more information, contact your authorized Swagelok sales and service representative.

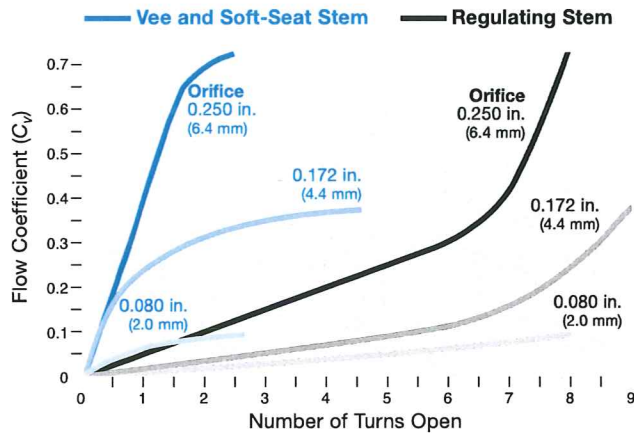
### Testing

Every integral-bonnet needle valve is factory tested with nitrogen at 1000 psig (69 bar). Seats have a maximum allowable leak rate of 0.1 std cm<sup>3</sup>/min. Shell testing is performed to a requirement of no detectable leakage with a liquid leak detector.

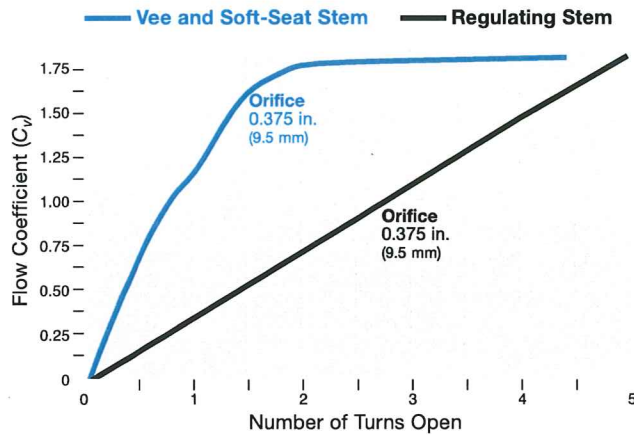
### Flow Data at 100°F (37°C)

#### Flow Coefficient at Turns Open

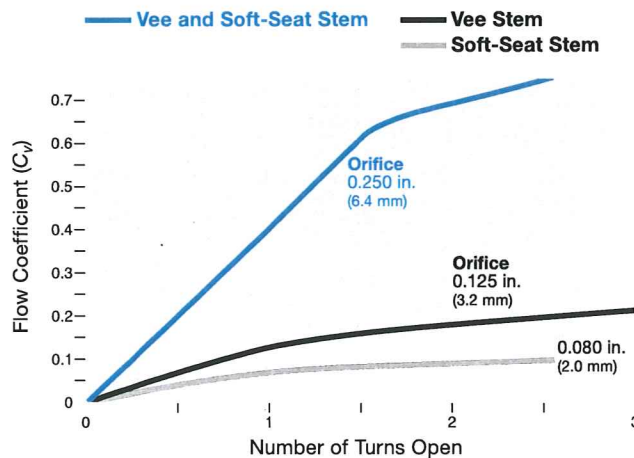
##### O and 1 Series



##### 18 Series



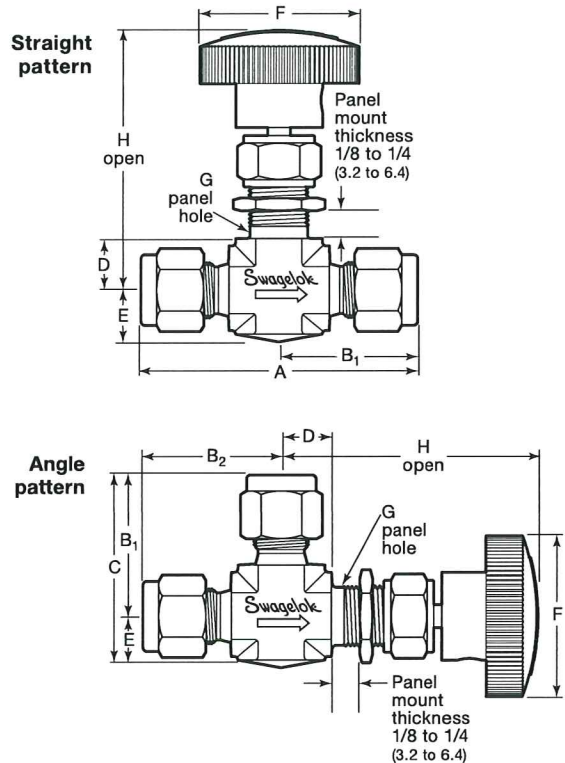
##### 20 and 26 Series



### Ordering Information and Dimensions

#### O, 1, and 18 Series

Dimensions, in inches (millimeters), are for reference only and are subject to change.



#### Stainless Steel Valves with Regulating Stems

Select an ordering number.

#### Alloy 400, Brass, and Steel Valves with Regulating Stems

Replace **SS** in the ordering number with a material designator.

Example: **M-ORS2**

Material	Designator
Alloy 400	M
Brass	B
Steel	S

#### Vee and Soft-Seat Stems

Replace **R** in the ordering number with **V** for a vee stem or **K** for a soft-seat stem with PCTFE stem tip.

Examples: **SS-OVS2**  
**SS-OKS2**

#### Angle-Pattern Valves

Add **-A** to the ordering number.

Example: **SS-ORS2-A**

#### Cross-Pattern Valves

Certain 1 series valves are available with cross-pattern bodies, which provide continuous flow between the side ports and on-off or regulating flow through the bottom port. Shown at right: **SS-1RS4-X**

Contact your authorized Swagelok sales and service representative for more information and additional ordering numbers.



## Ordering Information and Dimensions

End Connections		C <sub>v</sub>	Orifice in. (mm)	Ordering Number	Dimensions, in. (mm)								
Inlet/Outlet	Size				A	B <sub>1</sub>	B <sub>2</sub>	C	D	E	F	G	H
Fractional Swagelok tube fittings	1/8 in.	0.09	0.080 (2.0)	SS-ORS2	1.94 (49.3)	0.98 (24.9)		1.29 (32.8)	0.44 (11.2)	0.31 (7.9)	1.00 (25.4)	0.47 (11.9)	2.28 (57.9)
	1/4 in.	0.37	0.172 (4.4)	SS-1RS4	2.27 (57.6)	1.13 (28.7)		1.51 (38.4)		0.38 (9.7)	1.38 (35.1)	0.53 (13.5)	2.50 (63.5)
	3/8 in.	0.73	0.250 (6.4)	SS-1RS6	2.58 (65.5)	1.29 (32.8)		1.79 (45.5)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	1/2 in.			SS-1RS8	2.80 (71.1)	1.40 (35.6)		1.90 (48.3)					
	1/2 in.	1.80	0.375 (9.5)	SS-18RS8	3.80 (96.5)	1.90 (48.3)		2.65 (67.3)	0.75 (19.1)	3.00 (76.2)	1.03 (26.2)	3.91 (99.3)	
	3/4 in.			SS-18RS12									
Metric Swagelok tube fittings	3 mm	0.09	0.080 (2.0)	SS-ORS3MM	1.94 (49.3)	0.98 (24.9)		1.29 (32.8)	0.44 (11.2)	0.31 (7.9)	1.00 (25.4)	0.48 (12.2)	2.28 (57.9)
	6 mm	0.37	0.172 (4.4)	SS-1RS6MM	2.27 (57.6)	1.13 (28.7)		1.51 (38.4)		0.38 (9.7)	1.38 (35.1)	0.53 (13.5)	2.50 (63.5)
	8 mm			SS-1RS8MM	2.34 (59.4)	1.17 (29.7)		1.54 (39.1)					
	10 mm	0.73	0.250 (6.4)	SS-1RS10MM	2.60 (66.0)	1.30 (33.0)		1.80 (45.7)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	12 mm			SS-1RS12MM	2.80 (71.1)	1.40 (35.6)		1.90 (48.3)					
	12 mm	1.80	0.375 (9.5)	SS-18RS12MM	3.80 (96.5)	1.90 (48.3)		2.65 (67.3)	0.75 (19.1)	3.00 (76.2)	1.03 (26.2)	3.91 (99.3)	
	18 mm			SS-18RS18MM									
Female NPT	1/8 in.	0.09	0.080 (2.0)	SS-ORF2	1.88 (47.8)	0.94 (23.9)		1.25 (31.8)	0.44 (11.2)	0.31 (7.9)	1.00 (25.4)	0.47 (11.9)	2.28 (57.9)
	1/8 in.	0.37	0.172 (4.4)	SS-1RF2	1.62 (41.1)	0.81 (20.6)		1.19 (30.2)		0.38 (9.7)	1.38 (35.1)	0.53 (13.5)	2.50 (63.5)
	1/4 in.	0.73	0.250 (6.4)	SS-1RF4	2.12 (53.8)	1.06 (26.9)		1.56 (39.6)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	3/8 in.	1.80	0.375 (9.5)	SS-18RF6	3.00 (76.2)	1.50 (38.1)		2.25 (57.2)	0.75 (19.1)	3.00 (76.2)	1.03 (26.2)	3.88 (98.6)	
	1/2 in.			SS-18RF8									
Male NPT	1/8 in.	0.09	0.080 (2.0)	SS-ORM2	1.50 (38.1)	0.75 (19.1)		1.06 (26.9)	0.44 (11.2)	0.31 (7.9)	1.00 (25.4)	0.47 (11.9)	2.28 (57.9)
	1/8 in.	0.37	0.172 (4.4)	SS-1RM2	1.62 (41.1)	0.81 (20.6)		1.19 (30.2)		0.38 (9.7)	1.38 (35.1)	0.53 (13.5)	2.50 (63.5)
	1/4 in.			SS-1RM4	1.97 (50.0)	0.98 (24.9)		1.36 (34.5)					
	3/8 in.	0.73	0.250 (6.4)	SS-1RM6	2.25 (57.2)	1.12 (28.4)		1.62 (41.1)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	1/2 in.	1.80	0.375 (9.5)	SS-18RM8	3.00 (76.2)	1.50 (38.1)		2.25 (57.2)	0.75 (19.1)	3.00 (76.2)	1.03 (26.2)	3.88 (98.6)	
Male NPT/ Swagelok tube fitting	1/8 in.	0.09	0.080 (2.0)	SS-ORM2-S2	1.73 (43.9)	0.98 (24.9)	0.75 (19.1)	1.29 (32.8)	0.44 (11.2)	0.31 (7.9)	1.00 (25.4)	0.47 (11.9)	2.28 (57.9)
	1/4 in.	0.37	0.172 (4.4)	SS-1RM4-S4	1.95 (49.5)	1.13 (28.7)	0.98 (24.9)	1.51 (38.4)		0.38 (9.7)	1.38 (35.1)	0.53 (13.5)	2.50 (63.5)
	1/4/ 3/8 in.	0.73	0.250 (6.4)	SS-1RM4-S6	2.42 (61.5)	1.29 (32.8)	1.12 (28.4)	1.79 (45.5)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	3/8 in.			SS-1RM6-S6									
	3/8/ 1/2 in.			SS-1RM6-S8	2.52 (64.0)	1.40 (35.6)	1.90 (48.3)						
Male/ female NPT	1/4 in.	0.73	0.250 (6.4)	SS-1RM4-F4	2.19 (55.6)	1.06 (26.9)	1.12 (28.4)	1.56 (39.6)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	1/2 in.	1.80	0.375 (9.5)	SS-18RM8-F8	3.00 (76.2)	1.50 (38.1)		2.25 (57.2)	0.75 (19.1)	3.00 (76.2)	1.03 (26.2)	3.88 (98.6)	
Female ISO <sup>①</sup>	1/4 in.	0.73	0.250 (6.4)	SS-1RF4RT	2.12 (53.8)	1.06 (26.9)		1.56 (39.6)	0.55 (14.0)	0.50 (12.7)	1.88 (47.8)	0.78 (19.8)	2.97 (75.4)
	3/8 in.	1.80	0.375 (9.5)	SS-18RF6RT	3.00 (76.2)	1.50 (38.1)		2.25 (57.2)	0.75 (19.1)	3.00 (76.2)	1.03 (26.2)	3.88 (98.6)	
	1/2 in.			SS-18RF8RT									

Dimensions determined using valves with regulating stems and standard handles. Dimensions are shown with Swagelok nuts finger-tight.

① See specifications ISO 7/1, BS EN 10226-1, DIN-2999, JIS B0203.

## Ordering Information and Dimensions

### 20 and 26 Series

Dimensions are for reference only and are subject to change.

Select an ordering number.

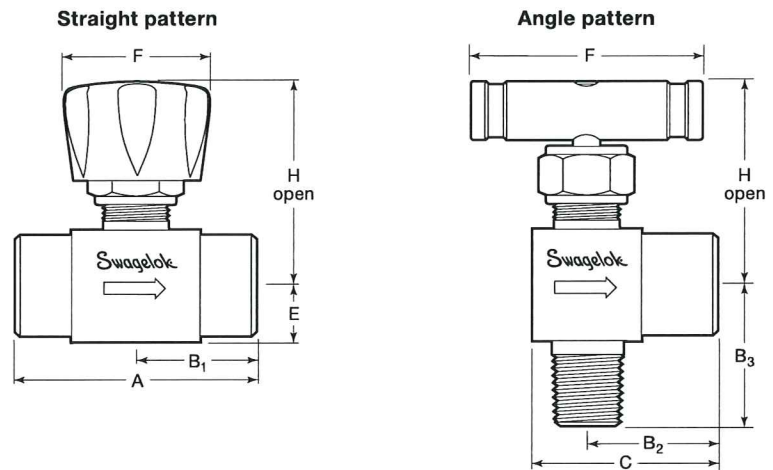
For soft-seat stems and PCTFE stem-tips in valves that are standard with vee stems, replace **V** with **K**.

Example: SS-20KS4

### Angle-Pattern Valves

Angle-pattern bodies are available for valves with C dimensions listed. To order, add **-A** to the ordering number.

Example: SS-20KM4-F4-A



End Connections		C <sub>v</sub>	Orifice in. (mm)	Ordering Number	Dimensions, in. (mm)							
Inlet/Outlet	Size				A	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	C	E	F	H
<b>20 series with soft-seat stem and PCTFE stem tip</b>												
Female NPT	1/4 in.	0.09	0.080 (2.0)	SS-20KF4	1.88 (47.8)	0.94 (23.9)	—	—	—	0.42 (10.7)	1.12 (28.4)	1.66 (42.2)
Male NPT	1/4 in.			SS-20KM4	1.94 (49.3)	0.97 (24.6)	—	—	—			
Male/ female NPT	1/4 in.			SS-20KM4-F4	1.91 (48.5)	0.94 (23.9)	1.00 (25.4)	1.03 (26.2)	1.44 (36.6)			
<b>20 and 26 series with vee stem</b>												
Swagelok tube fittings	1/4 in.	0.21	0.125 (3.2)	SS-20VS4	2.46 (62.5)	1.23 (31.2)	1.13 (28.7)	1.16 (29.5)	1.57 (39.9)	0.42 (10.7)	1.75 (44.4)	1.66 (42.2)
	3/8 in.	0.73	0.250 (6.4)	SS-26VS6	3.08 (78.2)	1.54 (39.1)	—	—	—	0.66 (16.8)	2.50 (63.5)	2.31 (58.7)
	1/2 in.			SS-26VS8	3.30 (83.8)	1.65 (41.9)	—	—	—	—	—	—
Female NPT	1/4 in.	0.21	0.125 (3.2)	SS-20VF4	1.88 (47.8)	0.94 (23.9)	1.00 (25.4)		1.44 (36.6)	0.42 (10.7)	1.75 (44.4)	1.66 (42.2)
	3/8 in.	0.73	0.250 (6.4)	SS-26VF6	2.50 (63.5)	1.25 (31.8)	—	—	—	0.66 (16.8)	2.50 (63.5)	2.31 (58.7)
	1/2 in.			SS-26VF8	2.50 (63.5)	1.25 (31.8)	1.41 (35.8)		2.06 (52.3)	—	—	—
Male NPT	1/4 in.	0.21	0.125 (3.2)	SS-20VM4	1.94 (49.3)	0.97 (24.6)	—	—	—	0.42 (10.7)	1.75 (44.4)	1.66 (42.2)
Male NPT/ Swagelok tube fittings	1/4 in.			SS-20VM4-S4	—	—	1.13 (28.7)	1.00 (25.4)	1.57 (39.9)	—		
	1/4 in.			SS-20VM4-F4	1.91 (48.5)	0.94 (23.9)	1.00 (25.4)	1.03 (26.2)	1.44 (36.6)	0.42 (10.7)		
Male/ female NPT	1/4 in.	0.73	0.250 (6.4)	SS-26VM6-F6	2.50 (63.5)	1.25 (31.8)	1.41 (35.8)	1.22 (31.0)	2.06 (52.3)	0.66 (16.8)	2.50 (63.5)	2.31 (58.7)
	1/2 in.			SS-26VM8-F8	2.55 (64.8)	1.25 (31.8)	1.41 (35.8)					
	3/4 to 1/2 in.			SS-26VM12-F8	2.50 (63.5)	1.25 (31.8)	—	—				
Female ISO <sup>ⓐ</sup>	1/4 in.	0.21	0.125 (3.2)	SS-20VF4RT	1.88 (47.8)	0.94 (23.9)	—	—	—	0.42 (10.7)	1.75 (44.4)	1.66 (42.2)
	1/2 in.	0.73	0.250 (6.4)	SS-26VF8RT	2.50 (63.5)	1.25 (31.8)	—	—	—	0.66 (16.8)	2.50 (63.5)	2.31 (58.7)

Dimensions are shown with Swagelok nuts finger-tight.

ⓐ See specifications ISO 7/1, BS EN 10226-1, DIN-2999, JIS B0203.

## Options and Accessories

### Stem Packing Materials

Two-piece chevron-style PFA packing is standard. For an optional stem packing, add **-P** for UHMWPE or **-PK** for PEEK to the ordering number. See **Pressure-Temperature Ratings**, page 2, for ratings of valves with optional stem packings. See the table at right for lubricants used with optional stem packing materials.

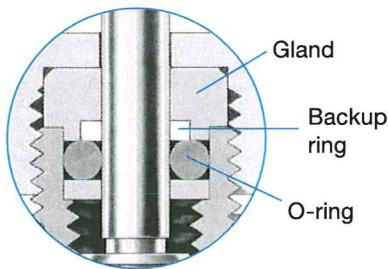
Examples: SS-ORS2-**P**  
SS-20KF4-**PK**

### Stem Packing Kits

PFA, UHMWPE, and PEEK packing kits are available. Kits contain stem packings, springs, lubricant, and instructions.

Valve Series	Orifice in. (mm)	Stem Packing Material, Kit Ordering Number		
		PFA	UHMWPE	PEEK
O	All	PFA-91K-O	PE-91K-O	PK-91K-O
1	0.172 (4.4)	PFA-91K-14	PE-91K-14	PK-91K-14
	0.250 (6.4)	PFA-91K-16	PE-91K-16	PK-91K-16
18	All	PFA-91K-18	PE-91K-18	PK-91K-18
20	All	PFA-91K-20	PE-91K-20	PK-91K-20
26	All	PFA-91K-16	PE-91K-16	PK-91K-16
Lubricant		Tungsten disulfide and fluorocarbon based	Molybdenum disulfide and hydrocarbon based	Molybdenum disulfide, tungsten disulfide, and fluorocarbon based

### O-Ring Stem Seals



O-ring stem seals include:

- 316 SS/ASTM A276 gland for 316 SS, steel, and alloy 400 valves, or brass 360 gland for brass valves
- PTFE/ASTM D1710 backup ring and silicone-based lubricant for all O-rings except ethylene propylene, which requires a polyethylene/ASTM D4020 backup ring, and molybdenum disulfide with hydrocarbon-based lubricant
- O-ring.

O-Ring Material	Temperature Rating °F (°C)	O-Ring Designator	Kit Designator	Kit Basic Ordering Number
Buna C	-65 to 250 (-53 to 121)	-BC	BC70	-9K-O (O and 20 series) -9K-14 (1 series, 0.172 in. orifice) -9K-16 (1 series, 0.250 in. orifice) -9K-18 (18 series)
Buna N	-20 to 250 (-28 to 121)	-B	BN70	
Ethylene propylene		-E	EP70	
Fluorocarbon FKM	-20 to 450 (-28 to 232)	-V	VA70	
Kalrez®	10 to 350 (-12 to 176)	-KZ	KZ00	
Silicone	-20 to 250 (-28 to 121)	-SI	SI70	

### Valves with O-Ring Stem Seals

Add an O-ring designator to the ordering number.

Examples: SS-ORS2-**BC**  
SS-20KF4-**B**

### O-Ring Maintenance Kits

Maintenance kits contain O-ring, backup ring, lubricant, and instructions.

To order, add a kit designator to a kit basic ordering number.

Example: **BC70-9K-O**

## Options and Accessories

### Handles

- O and 1 series valves—black phenolic round handles are standard; colored phenolic, 316 SS bar, and anodized black aluminum bar handles are optional.
- 18 series valves—anodized black aluminum bar handles are standard; phenolic round and 316 SS bar handles are optional.

### Valves with Optional Handles

Add a handle designator to the ordering number.

Handle	Designator (O and 1 Series)	Designator (18, 20, and 26 Series)	Kit Color Designator
Black phenolic	-BK	-BKP	-BK
Blue phenolic	-BL	-BLP	-BL
Green phenolic	-GR	-GRP	-GR
Orange phenolic	-OG	-OGP	-OG
Red phenolic	-RD	-RDP	-RD
Yellow phenolic	-YW	-YWP	-YW
316 SS bar	-SH	-SH	—
Anodized black aluminum bar	-BKB	-BKB	—

Examples:

SS-ORS2-**BL**

SS-20KF4-**SH**

### Sour Gas Service

Integral-bonnet needle valves with female NPT, female ISO, and male NPT end connections are available for sour gas service. Stem and lower gland are alloy 400. Materials are selected in accordance with NACE MR0175/ISO 15156. See the NACE specification for information on stainless steel tube fitting requirements.

To order, add **-SG** to the ordering number.

Example: SS-ORF2-**SG**

### Special Cleaning and Packaging (SC-11)

To order integral-bonnet needle valves cleaned and packaged in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* catalog, [MS-06-63](#), to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C, add **-SC11** to the valve ordering number.

Example: SS-ORS2-**SC11**

- 20K series valves—anodized black aluminum knob handles are standard; phenolic round, 316 SS bar, and anodized black aluminum bar handles are optional.
- 20V and 26 series valves—316 SS bar handles are standard; phenolic round and anodized black aluminum bar handles are optional.

### Handle Kits

Handle kits contain handle and instructions. Select a handle kit ordering number.

For colored phenolic handles, replace **BK** in the ordering number with a kit color designator.

Valve Series	Orifice in. (mm)	Handle Kit Ordering Numbers		
		Black Phenolic	Black Aluminum Bar	316 SS Bar
O	All	PH-5K-OK-BK	A-5K-14B-BK	SS-5K-14B
1	0.172 (4.4)	PH-5K-14K-BK	A-5K-14B-BK	SS-5K-14B
	0.250 (6.4)	PH-5K-4K-BK	A-5K-6NB-BK	SS-5K-6NB
18	All	PH-5K-7K-BK	A-5K-18B-BK	SS-5K-7B
20	All	PH-5K-14K-BK	A-5K-14B-BK	SS-5K-14B
26	All	PH-5K-4K-BK	A-5K-6NB-BK	SS-5K-6NB

Example: PH-5K-OK-**BL**

To order an anodized black aluminum knob handle kit for the 20K series valve, use ordering number **A-5K-20K-BK**.

### Oxygen Service Hazards

For more information about hazards and risks of oxygen-enriched systems, refer to *Oxygen System Safety* technical report, [MS-06-13](#).

- ⚠ **A packing adjustment may be required periodically to increase service life and to prevent leakage.**
- ⚠ **Valves that have not been cycled for a period of time may have a higher initial actuation torque.**
- ⚠ **To increase service life, ensure proper valve performance, and prevent leakage, apply only as much torque as is required to achieve positive shutoff.**

#### ⚠ WARNING

**Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.**



## Introduction

Since 1947, Swagelok has designed, developed, and manufactured high-quality, general-purpose and specialty fluid system products to meet the evolving needs of global industries. Our focus is on understanding our customers' needs, finding timely solutions, and adding value with our products and services.

We are pleased to provide this global edition of the book-bound *Swagelok Product Catalog*, which compiles more than 100 separate product catalogs, technical bulletins, and reference documents into one convenient, easy-to-use volume. Each product catalog is up to date at the time of printing, with its revision number shown on the last page of the individual catalog. Subsequent revisions will supersede the printed version and will be posted on the Swagelok website and in the Swagelok electronic Desktop Technical Reference (eDTR) tool.

For more information, visit your Swagelok website or contact your authorized Swagelok sales and service representative.

## Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit [swagelok.com](http://swagelok.com) or contact your authorized Swagelok representative.

### Safe Product Selection

**When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.**

### WARNING

**Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.**

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15-7 PH—TM AK Steel Corp.  
AccuTrak, Beacon, Westlock—TM Tyco International Services  
Aflas—TM Asahi Glass Co., Ltd.  
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DeviceNet—TM ODVA  
Dyneon, Elgiloy, TFM—TM Dyneon  
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FM—TM FM Global  
Grafoil—TM GrafTech International Holdings, Inc.  
Honeywell, MICRO SWITCH—TM Honeywell  
MAC—TM MAC Valves  
Microsoft, Windows—TM Microsoft Corp.  
NACE—TM NACE International  
PH 15-7 Mo, 17-7 PH—TM AK Steel Corp  
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