



**PNEUMATIC CONTROL VALVES**  
***SERVICE AND MAINTENANCE PROCEDURES***



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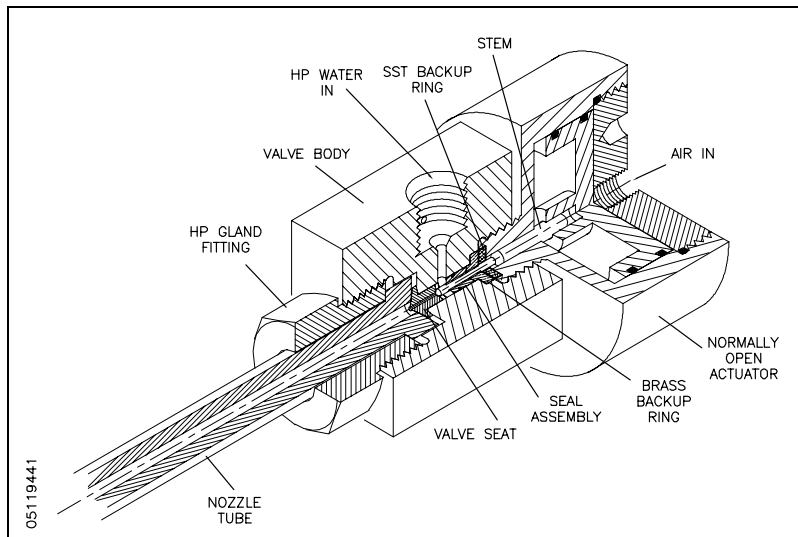
## PNEUMATIC CONTROL VALVES

### SERVICE AND MAINTENANCE PROCEDURES

#### 1. Overview

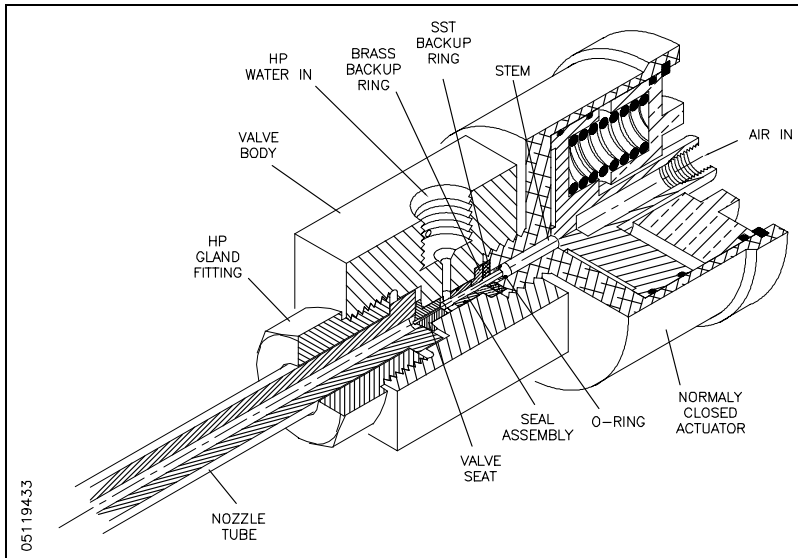
The normally open pneumatic control valve is held open by high pressure water force and requires air pressure to close. When the air supply is interrupted, the valve stem remains in the open position and does not seal the valve seat, allowing the release of stored water pressure. If the application requires a mainly open valve, supply pressure activation is seldom required. The normally open valve is recommended for safety applications, such as a dump valve. If the supply pressure is interrupted for any reason, high pressure water force opens the valve and the high pressure stream is released.

*Figure 1: Normally Open Pneumatic Control Valve*



The normally closed pneumatic control valve is closed by spring force and requires air pressure to open. When the air supply is interrupted, the valve stem is in the closed position and seals the valve seat. The normally closed valve is recommended for cutting head applications, such as a high pressure on/off valve or as a component in a bleed-and-block system. If the air supply pressure is interrupted for any reason, the valve closes automatically, closing the high pressure stream to the cutting nozzle. Because it is normally closed, water pressure is maintained even if air pressure is lost, a safety feature that prevents an unexpected discharge of water.

Figure 2: Normally Closed Pneumatic Control Valve



## 2. Service and Maintenance

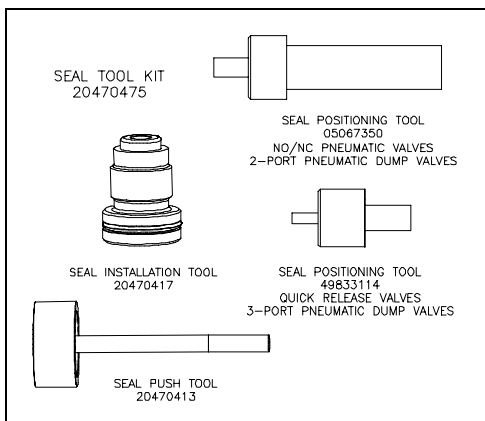
The following procedures are used for servicing the normally open and normally closed pneumatic control valves. Failure to follow these procedures will cause damage to the stem, valve seat, or both.

### Pneumatic Control Valves

**For reliable operation the valve seat, seal assembly, brass backup ring, stem and the o-ring in the normally closed valve shall all be replaced at the same time.** The SST backup ring can be reused. All components must be properly cleaned before assembly. Contamination will reduce component life, and contaminate related downstream components.

Figure 3, Pneumatic Valve Seal Tools, illustrates the specialized tools used to service the pneumatic control valves.

Figure 3: Pneumatic Valve Seal Tools





Severe injury can result if the machine is not properly locked out. Observe electrical Lockout/Tagout procedures before proceeding.

Ensure all pressure is relieved or blocked from the hydraulic and high pressure circuits before proceeding.

### Normally Open Control Valve

1. Turn the air supply to the actuator off.

### Normally Closed Control Valve

1. Turn the air supply to the actuator on.



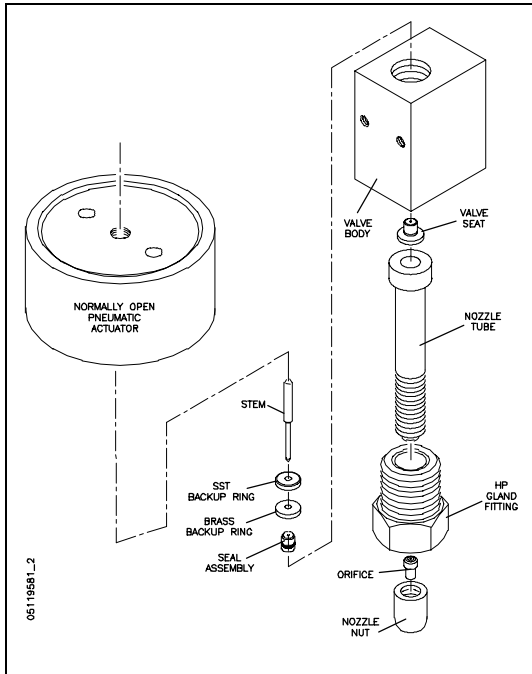
Failure to turn on the air supply to a normally closed actuator prior to unscrewing the HP gland fitting will result in damage to the stem and valve seat.

2. Remove the air supply hose, and the electrical connection to the solenoid valve.
3. Remove the valve and actuator assembly from the system.
4. Loosen the cylinder head on the actuator. Unscrew and remove the actuator from the valve body.
5. Unscrew the high pressure gland, and remove the nozzle nut, nozzle tube and valve seat.
6. Remove the stem, SST backup ring and brass backup ring from the valve body. **Discard** the stem, brass backup ring and valve seat.

2. Unscrew the HP gland fitting **three or four threads only** and turn the air supply off.
3. Unscrew the HP gland fitting completely. Remove the nozzle nut, nozzle tube and valve seat.
4. Remove the air supply hose, and the electrical connection to the solenoid valve.
5. Remove the valve and actuator assembly from the system. Unscrew and remove the pneumatic actuator.
6. Remove the stem, with the o-ring, the SST backup ring and the brass backup ring. Remove the o-ring and backup rings from the stem. **Discard** the stem, brass backup ring, o-ring and valve seat.

### Normally Open Control Valve

Figure 4: Normally Open Valve Components



- Remove the seal assembly by pushing it with the seal push tool (P/N 20470413). **The assembly must be pushed out through the actuator port in the top of the valve body.**

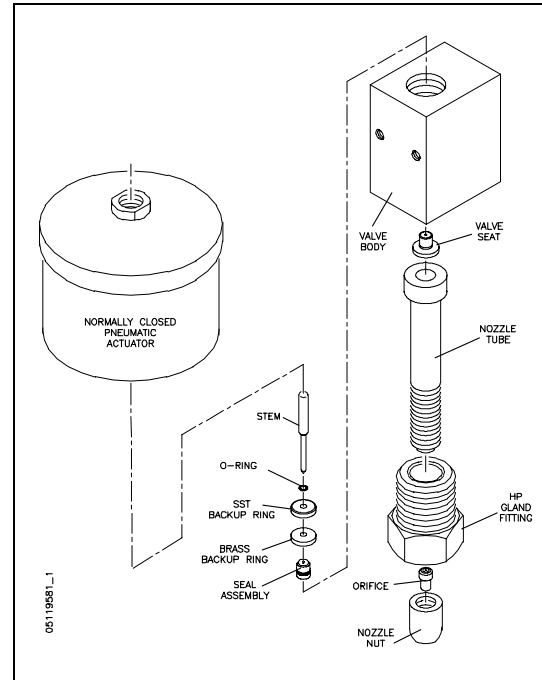
**Discard** the seal assembly.

- Clean and inspect the valve body, being careful not to damage or scratch the bore.

- Place the seal positioning tool into the end of the valve body as shown above. Thread the high pressure gland fitting into the valve body until light contact is made with the positioning tool. **Tighten finger-tight only.** See Figure 6, Seal Installation.
- Apply Pure Goop anti-seize compound to the threads on the seal installation tool. Screw the seal installation tool into the threads of the valve body. **Tighten finger-tight only.** Do not use any tools to tighten. See Figure 6, Seal Installation.
- Lubricate the seal and the o-ring with FML-2, food grade grease. Insert the seal and o-ring, with the bronze wedge ring, into the seal installation tool. Insert the o-ring end of the seal first so the tapered end of the seal (wedge ring end) faces the actuator. See Figure 6, Seal Installation.

### Normally Closed Control Valve

Figure 5: Normally Closed Valve Components

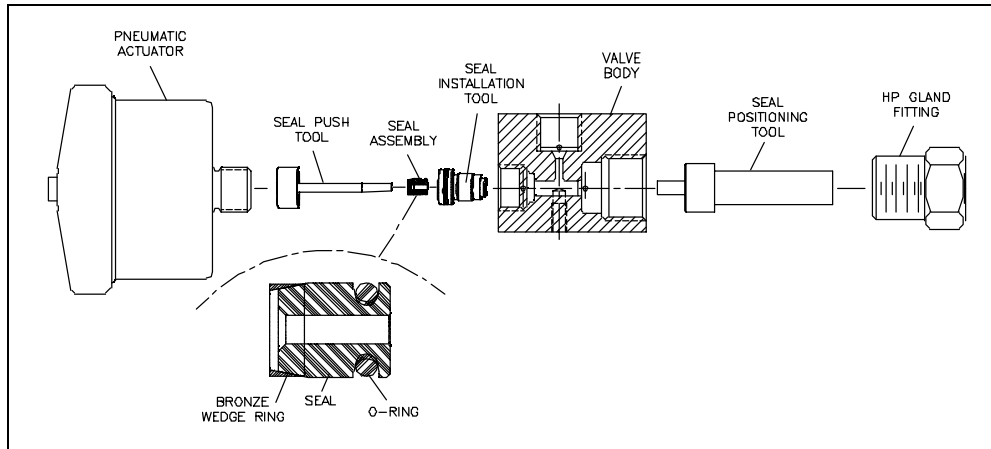


- Remove the seal assembly by pushing it with the seal push tool (P/N 20470413). **The assembly must be pushed out through the actuator port in the top of the valve body.**

**Discard** the seal assembly.

- Clean and inspect the valve body, being careful not to damage or scratch the bore.

Figure 6: Seal Installation



12. Use the seal push tool to push the seal assembly into the bore of the valve body until the seal makes light contact with the positioning tool.
13. Remove the push tool and the installation tool from the valve body.

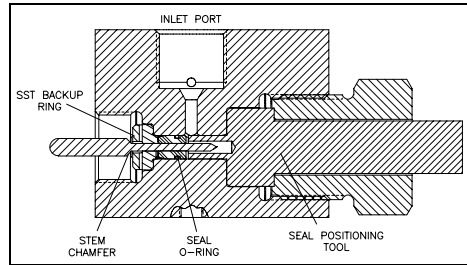
Normally Open Control Valve	Normally Closed Control Valve
<ol style="list-style-type: none"> <li>14. Install the existing SST backup ring and a new brass backup ring on a new stem. The vee groove on the SST backup ring must face toward the brass backup ring. The small OD of the brass backup ring must face toward the seal assembly.</li> <li>15. Apply FML-2 grease to the tip of the stem and insert the stem with the backup rings into the top of the valve body so the stem enters the ID of the seal assembly.</li> </ol> <p><b>Insert the stem until the chamfer on the stem is seated against the SST backup ring. See Figure 7, Stem Placement.</b></p>	<ol style="list-style-type: none"> <li>14. Install a new o-ring, the existing SST backup ring and a new brass backup ring on a new stem. The vee groove on the SST backup ring must face toward the brass backup ring. The small OD of the brass backup ring must face toward the seal assembly.</li> <li>15. Apply FML-2 grease to the tip of the stem and insert the stem with the o-ring and backup rings into the top of the valve body so the stem enters the ID of the seal assembly.</li> </ol> <p><b>Insert the stem until the chamfer on the stem and the o-ring are seated against the SST backup ring. See Figure 8, Stem Placement.</b></p>



**Do not** push the o-ring on the seal assembly past the inlet port on the valve body. This will damage the seal o-ring.

### Normally Open Control Valve

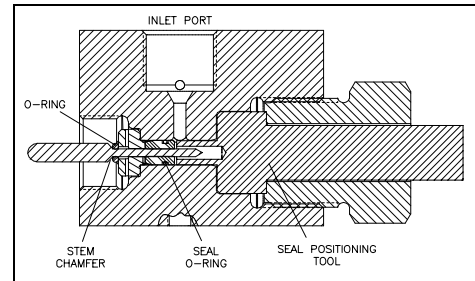
Figure 7: Stem Placement



16. Remove the gland fitting and the seal positioning tool.
17. Apply Pure Goop anti-seize compound to the threads on the actuator and carefully thread it into the valve body, guiding the stem head into the hole in the actuator. Turn the actuator clockwise until resistance is felt. Reverse the actuator 1/4-turn, and give it a quick spin clockwise to seat it. **Hand-tighten only, 5 ft-lbs (7 Nm).**
18. Apply Pure Goop anti-seize compound to all surfaces, except the ID, of a new valve seat. Inserting the small OD of the valve seat first, install the seat into the opposite end of the valve body.
19. Apply Pure Goop to the face of the nozzle tube that contacts the valve seat, and to the shoulder that contacts the high pressure gland. Apply Pure Goop to the threads on the gland. Slide the gland over the nozzle tube, thread the gland into the valve body and torque to 50 ft-lbs (68 Nm).

### Normally Closed Control Valve

Figure 8: Stem Placement



16. Remove the gland fitting and the seal positioning tool.
17. Apply Pure Goop anti-seize compound to the threads on the actuator and carefully thread it into the valve body, guiding the stem head into the hole in the actuator. Turn the actuator clockwise until resistance is felt. Reverse the actuator 1/4-turn, and give it a quick spin clockwise to seat it. **Hand-tighten only, 5 ft-lbs (7 Nm).**
18. Apply Pure Goop anti-seize compound to all surfaces, except the ID, of a new valve seat. Inserting the small OD of the valve seat first, install the seat into the opposite end of the valve body.
19. Apply Pure Goop to the face of the nozzle tube that contacts the valve seat, and to the shoulder that contacts the high pressure gland. Apply Pure Goop to the threads on the gland. Slide the gland over the nozzle tube and thread the gland into the valve body until it makes **light contact** with the stem. **Do not tighten farther. Over tightening will result in damage to the stem or seat.**



**Normally Open Control Valve**

20. Install the air supply hose and the electrical connection to the solenoid valve. Turn the air pressure to the actuator on and test the valve for leaks and proper operation.

**Normally Closed Control Valve**

20. Install the air supply hose and the electrical connection to the solenoid valve. Turn the air pressure to the actuator on, thread the high pressure gland into the valve body and torque to 50 ft-lbs (68 Nm).



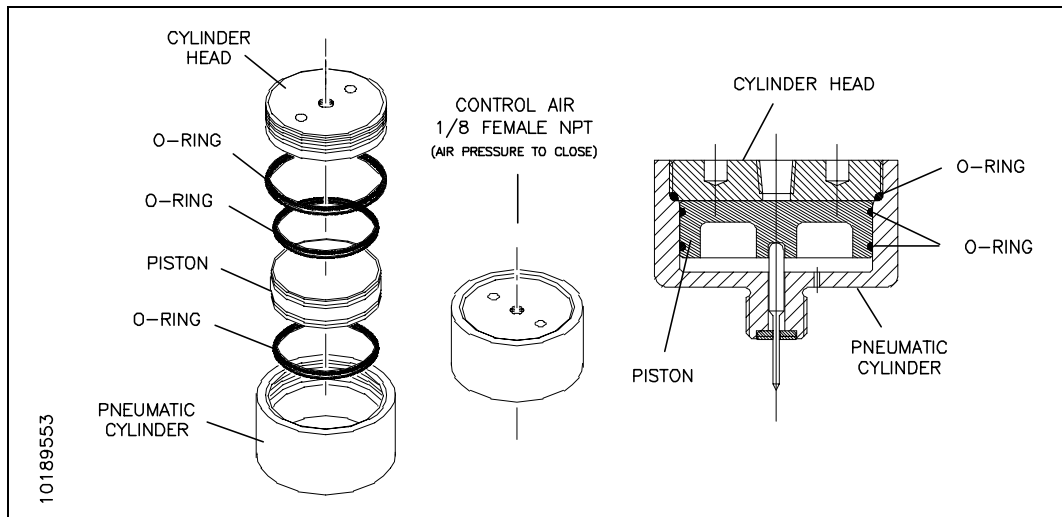
Failure to turn on the air supply to a normally closed actuator prior to tightening the high pressure gland fitting will result in damage to the stem and valve seat.

21. Test the valve for leaks and proper operation.

**Normally Open Pneumatic Actuator**

The following procedure is used to service the normally open pneumatic actuator.

*Figure 9: Normally Open Pneumatic Actuator*



1. Unscrew and remove the cylinder head using a strap wrench and a pin spanner. Remove the piston from the cylinder.



Do not install the pneumatic cylinder in a vise to remove the cylinder head. This may distort the body and seize the piston, preventing proper operation.

2. Remove the o-ring on the cylinder head. Apply FML-2 grease to a new o-ring and install.
3. Remove the two o-rings on the piston. Apply FML-2 grease to two new o-rings and install.
4. Install the piston in the pneumatic cylinder. Apply anti-seize compound to the threads on the cylinder head and screw it into the pneumatic cylinder.

### Normally Closed Pneumatic Actuator

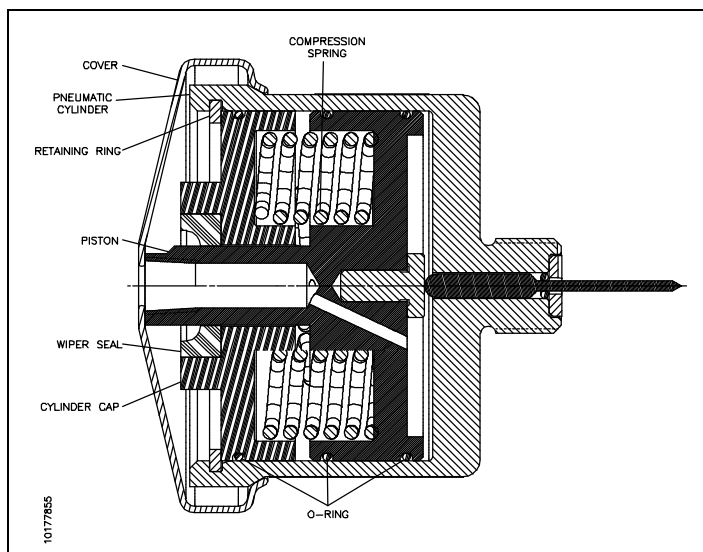
Before servicing the normally closed actuator, carefully read and understand this procedure. Carefully adhere to the following procedure and safety warnings. **Failure to observe the safety warnings described in this procedure could result in injury.**



The normally closed pneumatic actuator contains compressed springs with a high level of stored energy. Ejection of these internal springs or other components may cause injury during disassembly and assembly.

Always wear eye protection when performing maintenance on this component.

Figure 10: Normally Closed Pneumatic Actuator



The following tools are required to service the normally closed pneumatic actuator: top protector tool, bottom protector tool and snap ring pliers. See Section 4, Parts List, for part numbers and ordering information.

1.



Remove the cover and place the pneumatic actuator between the top and bottom protector tools. Position the components in a vise.

Compress the cylinder cap slowly and use the snap ring pliers to carefully release the retaining ring.



**Do not** compress the cylinder cap without the protector tools in place. Compress the cap slowly and release the retaining ring carefully.

The hazards from the release of spring energy increase when the retaining ring is removed. A hazard from the release of spring energy exists until the cap moves to a relaxed position and the spring energy is fully released.

2.



Slowly release the vise tension until the cylinder cap moves to a relaxed position.

The cap can now be removed to access the internal components for cleaning and/or replacement.

3.



Remove the six compression springs.

4.



Thread a 1/8-inch pipe plug into the air port on the pneumatic cylinder and hold the plug in a vise.

Remove the piston from the cylinder by pulling the cylinder up and off, of the piston.



5.



Place the cylinder cap in a vise and use a seal removal tool to remove the old wiper seal.

With the seal removed, clean the seal pocket in the cap. Position and orient the new wiper seal in the cap.



6.  Place the cap with the new wiper seal between the top and bottom protector tools and position the components in a vise. Compress the cap until the wiper seal is fully bottomed.
7. Remove the two, old o-rings from the piston. Clean and lubricate two new o-rings with FML-2 food grade grease and install the new o-rings on the piston.
8. Remove the old o-ring from the cylinder cap. Clean and lubricate a new o-ring with FML-2 food grade grease and install the new o-ring on the cap.
9.  Reassemble the piston by placing the compression springs in the pockets. Place the cylinder cap over the piston, aligning the springs.
10. Place the cap, piston and spring assembly into the pneumatic cylinder.



Do not compress the cylinder cap without the protector tools in place. Compress the cap slowly and install the retaining ring carefully, ensuring the ring is properly seated in the groove.

A hazard from the release of spring energy exists until the ring is correctly installed and the spring force is supported against the retaining ring.

11.



Place the assembled actuator between the top and bottom protector tools, install the retaining ring on the protector tool and position the components in a vise. Slowly compress the cylinder cap to allow the installation of the retaining ring.

12.



Use the snap ring pliers to compress, position and install the retaining ring. Ensure the retaining ring is properly seated in the retaining ring groove.





### 3. Specifications

**Table 1**  
**Torque Specifications**

Item	Torque Value
HP Gland Fitting	50 ft-lbs (68 Nm)
3/8" Nozzle Nut	9 ft-lbs (12 Nm)
9/16" Nozzle Nut	15 ft-lbs (20 Nm)
Actuator Assembly	5 ft-lbs (7 Nm)
3/8" Inlet Water Gland Nut	50 ft-lbs (68 Nm)

**Table 2**  
**Valve Specifications**

	Normally Open	Normally Closed
Valve Body Dimensions	2.5" x 2.0" x 1.5"	2.5" x 2.0" x 1.5"
Valve Assembly Weight (with 6" x 9/16" nozzle tube)	78 oz (2.21 kg)	79 oz (2.24 kg)
Actuator Weight	41 oz (1.16 kg)	42 oz (1.19 kg)
<b>High Pressure Operating Range</b>		
Design Pressure	66,000 psi (4,550 bar)	66,000 psi (4,550 bar)
Minimum Water Pressure	10,000 psi (689 bar)	10,000 psi (689 bar)
Maximum Water Pressure	60,000 psi (4,137 bar)	60,000 psi (4,137 bar)
<b>Air Pressure Operating Range</b>		
Minimum Air Pressure	85 psi (5.86 bar)	85-90 psi (5.86-6.20 bar)
Maximum Air Pressure	100 psi (6.90 bar)	120 psi (8.27 bar)
<b>Connections</b>		
Water In Port	3/8" HP	3/8" HP
Water Out Port	3/8" Male	3/8" Male
	9/16" Male	9/16" Male
	3/8" Nozzle	3/8" Nozzle
	9/16" Nozzle	9/16" Nozzle
Air Pressure Port	1/8" -27 Female	1/8" -27 Female



#### 4. Parts List

This section contains a list of parts, maintenance tools and accessories for the normally open and normally closed pneumatic control valves. To facilitate the ordering of replacement parts, item numbers in each table correspond to the identifying numbers in the accompanying figures.

Use the following information to contact the Customer Service Department at KMT Waterjet Systems.

##### USA

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Email [order.spares@kmt-waterjet.com](mailto:order.spares@kmt-waterjet.com)

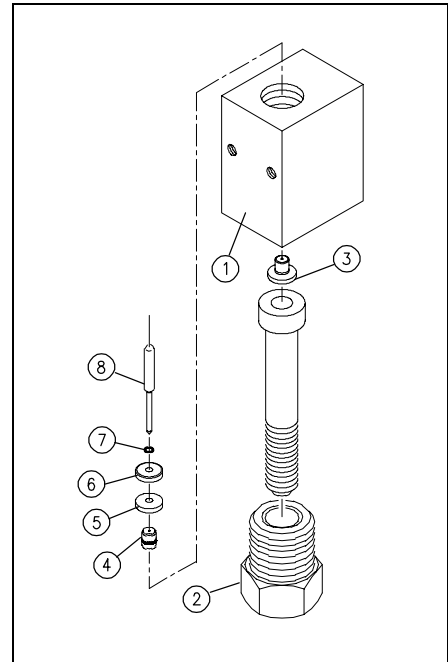
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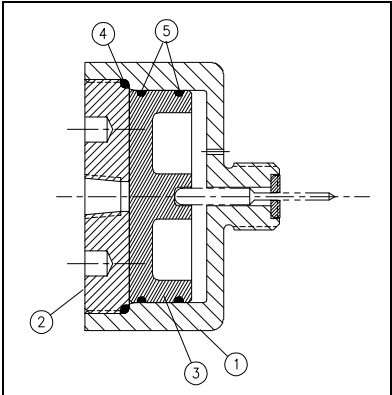
**Table 3**  
**Pneumatic Control Valve**  
**Normally Open 10184760**  
**Normally Closed 10138824**

Item	Part Number	Description
1	10189181	Valve Body
2	BV701184	HP Gland
3	10178697	Valve Seat
4	20428052	Seal Assembly
5	10188233	Brass Backup Ring
6	10187250	SST Backup Ring
7	49895584	O-Ring, NC valve only
8	20435636	Valve Stem
	20470417	Seal Installation Tool
	05067350	Seal Positioning Tool
	49833114	Seal Positioning Tool, Quick Release
	20470413	Seal Push Tool
	20470475	Seal Tool Kit
<b>05116017</b>	<b>Repair Kit, Normally Open Valve</b>	Includes Items 3, 4, 5 and 8, and Items 4 and 5 from Table 4
<b>05116025</b>	<b>Repair Kit, Normally Closed Valve</b>	Includes Items 3, 4, 5, 7 and 8



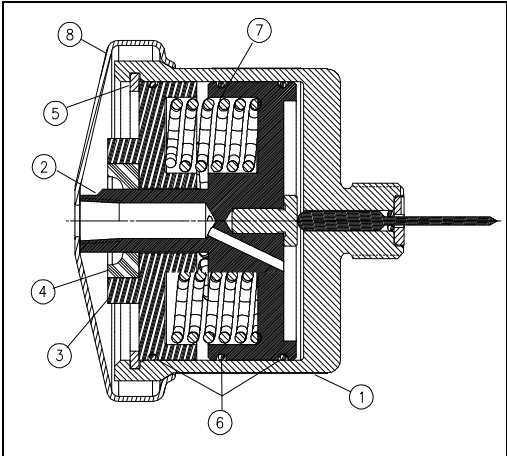
**Table 4**  
**Normally Open Pneumatic Actuator**

Item	Part Number	Description
	10189553	NO Actuator Assembly
1	BV401184	Pneumatic Cylinder
2	BV601184	Cylinder Head
3	BV501184	Piston
4	10074714	O-Ring
5	10074565	O-Ring

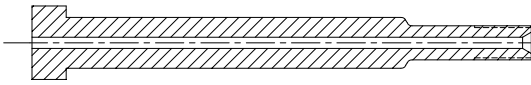
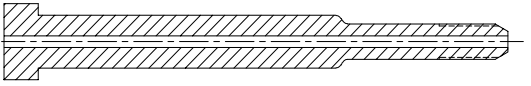


**Table 5**  
**Normally Closed Pneumatic Actuator**

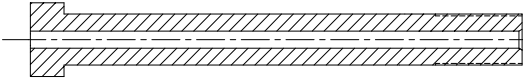
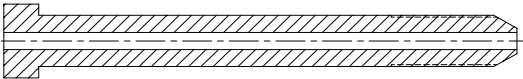
Item	Part Number	Description
	10177855	NC Actuator Assembly
1	10176543	Pneumatic Cylinder
2	05145990	Piston
3	20411554	Cylinder Cap
4	10177780	Wiper Seal
5	10177772	Retaining Ring
6	10177806	O-Ring
7	05054119	Compression Spring
8	00080028	Cover
	80077787	Top Protector Tool
	80077779	Bottom Protector Tool
	80077837	Snap Ring Pliers
	80077795	Actuator Tool Kit



**Table 6**  
**3/8" Diameter Nozzle Tubes**

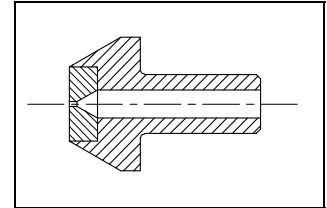
<b>Part Number</b>	<b>Description</b>	<b>Actual in (mm)</b>	<b>Nominal in (mm)</b>	
10181113		2.65 (67.31)	3.00 (76.20)	
10138402		3.65 (92.91)	4.00 (101.60)	
10138410		4.65 (118.11)	5.00 (127.0)	
10138428		5.65 (143.51)	6.00 (152.40)	
05131784		5.91 (150.11)	6.25 (158.75)	
10138436		6.65 (168.91)	7.00 (177.80)	
10138444		7.65 (194.31)	8.00 (203.20)	
05106224		8.10 (205.74)	8.45 (214.63)	
10138451		8.65 (219.71)	9.00 (228.60)	
05136023		9.15 (232.41)	9.50 (241.30)	
10138469		9.65 (245.11)	10.00 (254.0)	
05106224		10.15 (257.81)	10.50 (266.70)	
05136031		10.65 (270.51)	11.00 (279.40)	
05013735		11.65 (295.91)	12.00 (304.80)	
05086913		14.65 (372.11)	15.00 (381.0)	
<b>3/8" Nozzle Tube, Nozzle Nut Connection</b>				
				
10138584		3.64 (92.46)	4.00 (101.60)	
10138592		4.64 (117.86)	5.00 (127.0)	
10138600		5.64 (143.26)	6.00 (152.40)	
10138618		6.64 (168.66)	7.00 (177.80)	
10138634		7.64 (194.06)	8.00 (203.20)	
10138642		8.64 (219.46)	9.00 (228.60)	
10138659		9.64 (244.86)	10.00 (254.0)	
20432414		13.64 (346.46)	14.00 (355.60)	
<b>3/8" Nozzle Tube, HP Connection</b>				
				

**Table 7**  
**9/16" Diameter Nozzle Tubes**

<b>Part Number</b>	<b>Description</b>	<b>Actual in (mm)</b>	<b>Nominal in (mm)</b>	
10138477		2.65 (67.31)	3.00 (76.20)	
10138485		3.65 (92.91)	4.00 (101.60)	
10138493		4.65 (118.11)	5.00 (127.0)	
10138501		5.65 (143.51)	6.00 (152.40)	
10138519		6.65 (168.91)	7.00 (177.80)	
10138527		7.65 (194.31)	8.00 (203.20)	
10138535		8.65 (219.71)	9.00 (228.60)	
10181105		9.65 (245.11)	10.00 (254.0)	
10193100		11.65 (295.91)	12.00 (304.80)	
<b>9/16" Nozzle Tube, Nozzle Nut Connection</b>				
				
10138667		3.65 (92.91)	4.00 (101.60)	
10138675		4.65 (118.11)	5.00 (127.0)	
10138683		5.65 (143.51)	6.00 (152.40)	
10138691		6.65 (168.91)	7.00 (177.80)	
10138709		7.65 (194.31)	8.00 (203.20)	
10138717		8.65 (219.71)	9.00 (228.60)	
10138725		9.65 (245.11)	10.00 (254.0)	
80074446		10.65 (270.51)	11.00 (279.40)	
<b>9/16" Nozzle Tube, HP Connection</b>				
				

**Table 8**  
**Standard Sapphire Orifice**

Part Number	Description	Part Number	Description
A2260001	0.001" (0.025 mm)	A2260013	0.013" (0.330 mm)
A2260002	0.002" (0.051 mm)	A2260014	0.014" (0.356 mm)
A2260003	0.003" (0.076 mm)	A2260015	0.015" (0.381 mm)
A2260004	0.004" (0.102 mm)	A2260016	0.016" (0.406 mm)
A2260005	0.005" (0.127 mm)	A2260018	0.018" (0.457 mm)
A2260006	0.006" (0.152 mm)	A2260019	0.019" (0.483 mm)
A2260007	0.007" (0.178 mm)	A2260020	0.020" (0.508 mm)
A2260008	0.008" (0.203 mm)	A2260021	0.021" (0.533 mm)
A2260009	0.009" (0.229 mm)	A2260022	0.022" (0.559 mm)
A2260010	0.010" (0.254 mm)	A2260024	0.024" (0.610 mm)
A2260011	0.011" (0.279 mm)	A2260028	0.028" (0.711 mm)
A2260012	0.012" (0.305 mm)	A2260032	0.032" (0.813 mm)



**Table 9**  
**Standard Diamond Orifice**

Part Number	Description	Part Number	Description
49888852	0.003" (0.076 mm)	49836786	0.013" (0.330 mm)
49888860	0.004" (0.102 mm)	49888944	0.014" (0.356 mm)
49888878	0.005" (0.127 mm)	49888951	0.015" (0.381 mm)
49888886	0.006" (0.152 mm)	49888969	0.016" (0.406 mm)
49888894	0.007" (0.178 mm)	49888977	0.018" (0.457 mm)
49888902	0.008" (0.203 mm)	20436198	0.019" (0.483 mm)
49888910	0.009" (0.229 mm)	49888985	0.020" (0.508 mm)
49888928	0.010" (0.254 mm)	49888993	0.022" (0.559 mm)
49888936	0.012" (0.305 mm)		

