5-AXIS ULTRA-HIGH PRESSURE (UHP) PNEUMATIC CONTROL VALVE/ACTUATOR ASSEMBLIES

SERVICE AND MAINTENANCE PROCEDURES

1 Overview

The low profile, 5-axis pneumatic control valve assembly is designed for motion along multiple axes.

2 Service and Maintenance

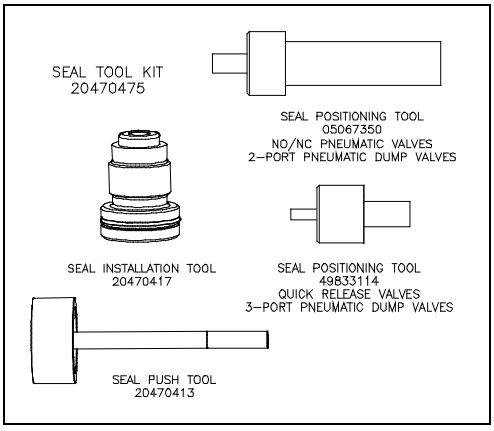
The following procedures are used for servicing the normally closed 5-axis UHP pneumatic control valve assembly. Failure to follow these procedures will cause damage to the stem, valve seat, or both.

Normally Closed Pneumatic Valve

For reliable operation the valve seat, seal assembly, bronze 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 1, Pneumatic Valve Seal Tools, illustrates the specialized tools used to service the pneumatic control valve.

Figure 1: Pneumatic Valve Seal Tools



WARNING

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.

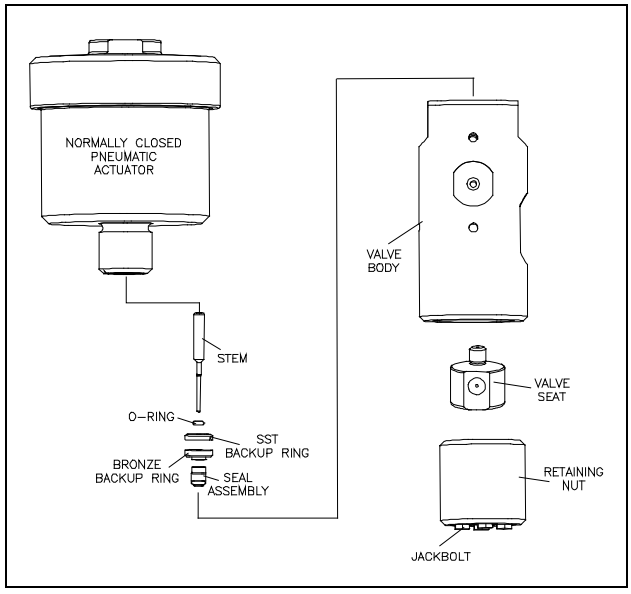
1. Turn the air supply to the actuator on.

CAUTION

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. Unscrew the whip connection and the nozzle tube four or five threads only. This will allow the valve and actuator assembly to be removed from the mounting bracket.
3. With the valve assembly removed from the bracket, and the air supply on, secure the valve body with a wrench and use an Allen wrench to loosen the jackbolts approximately two inches.
4. Use the retainer wrench (P/N 72128656) to loosen and remove the retaining nut from the valve body.
5. Turn the air supply to the actuator off and remove the valve seat from the body.
6. Unthread and remove the actuator from the valve body.
7. Remove the stem, with the o-ring, the SST backup ring and the bronze backup ring. Remove the o-ring and backup rings from the stem. **Discard** the stem, bronze backup ring, o-ring and valve seat.

Figure 2: 5 Axis Valve Components

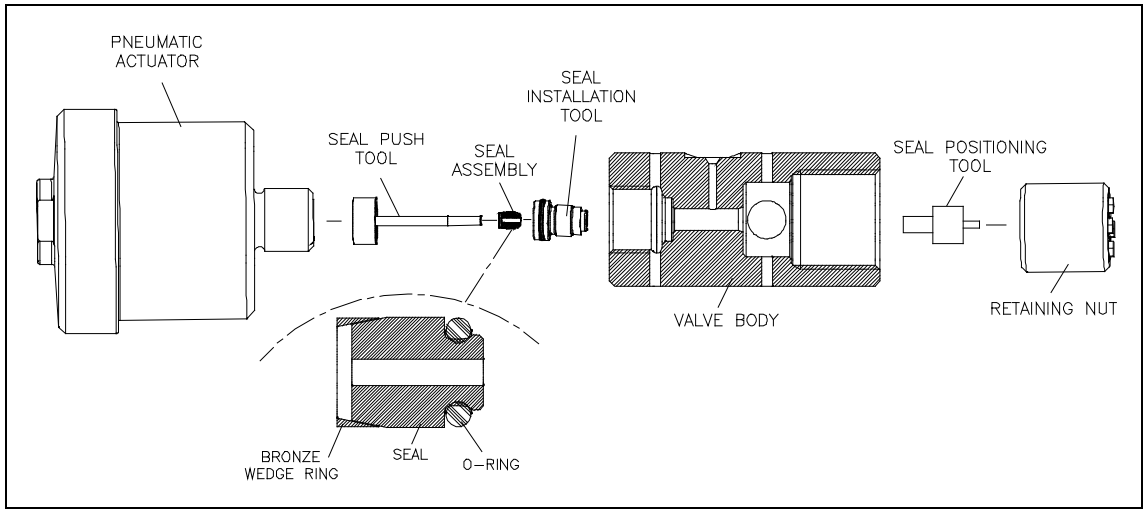


8. Remove the seal assembly by pushing it with the seal push tool (P/N 20470413). **The assembly must be pushed out through the actuator port in the top of the valve body.**

   Discard the seal assembly.
9. Clean and inspect the valve body, being careful not to damage or scratch the bore.

10. Place the seal positioning tool into the end of the valve body. Thread the retaining nut into the valve body until light contact is made with the positioning tool. **Tighten finger-tight only.** See Figure 3, Seal Installation.
11. 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.
12. 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.

Figure 3: Seal Installation



13. 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.
14. Remove the push tool and the installation tool from the valve body.
15. Install a new bronze backup ring into the valve body on top of the seal assembly. The small OD of the bronze backup ring must face toward the seal assembly.
16. Install a new o-ring, the existing SST backup ring on a new stem. The vee groove on the SST backup ring must face toward the bronze backup ring.
17. Apply FML-2 grease to the tip of the stem and insert the stem with the o-ring and backup ring into the top of the valve body so the stem enters the ID of the seal assembly.

    Insert the stem until the chamfer on the stem and the o-ring are seated against the SST backup ring.
18. Remove the retaining nut and the seal positioning tool.
19. 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)**.

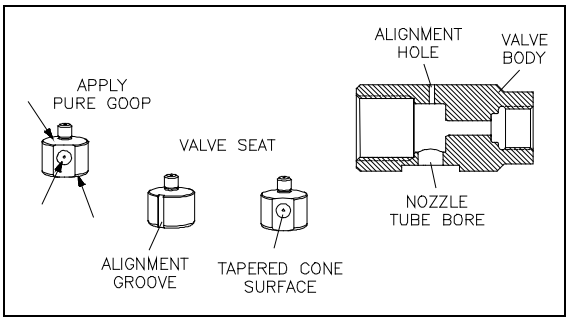
20. Apply Pure Goop anti-seize compound to top, bottom and cone surface of a new valve seat. Inserting the small OD of the valve seat first, install the seat into the opposite end of the valve body.

    Insert a suitably sized allen key into the alignment hole in the body. Slide the grooved side of the seat over the allen key for proper alignment. Ensure the tapered cone discharge side of the seat is also properly aligned with the nozzle tube bore.

CAUTION

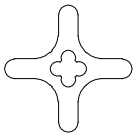
Proper alignment of the valve seat is critical. The valve will not function if the seat is not aligned correctly.

Figure 4: Valve Seat Alignment



21. Apply Pure Goop to the threads on the retaining nut and use the retainer wrench (P/N 72128656) to position the nut.

Retaining Wrench



Install the air supply hose on the actuator and turn the air pressure to the actuator on and hand-tighten the retaining nut until it makes contact with the seat and the tapered cone surface is visible through the nozzle tube bore in the valve body. Remove the allen key.

22. Place the valve assembly in the bracket.

CAUTION

Apply Pure Goop to all threaded and mating surfaces.

23. Hand-tighten the nozzle tube, the inlet water connection and the retaining nut, ensuring all components are properly located with no relative motion between components.
24. Thread the inlet water connection into the valve body and torque to 35 ft/lbs (47 Nm).
25. Tighten the jackbolts and **torque to 5 ft/lbs (7 Nm) only**. The valve will not function if the jackbolts torque is less than 5 ft/lbs (7 Nm).

26. Thread the nozzle tube into the valve body and torque to 50 ft/lbs (68 Nm).
27. Turn the air pressure to the actuator off.
28. Test the valve for leaks and proper operation.

Normally Closed Pneumatic Actuator

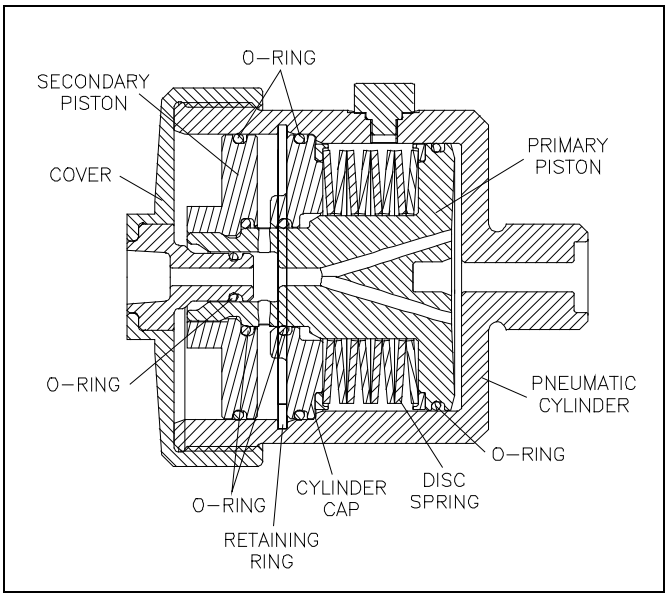
Before servicing the normally closed actuator, carefully read and understand this procedure. Carefully adhere to the following procedure and safety warnings. **Failure to observe the safety warnings described in this procedure could result in injury.**

WARNING

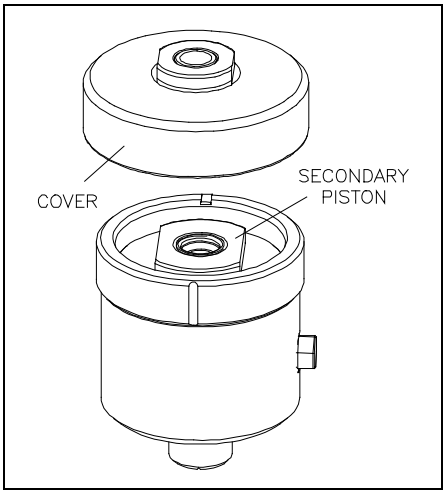
The normally closed pneumatic actuator contains compressed springs with a high level of stored energy. Ejection of these internal springs or other components may cause injury during disassembly and assembly.

Always wear eye protection when performing maintenance on this component.

Figure 5: Normally Closed UHP 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. 

Unscrew and remove the cover. Use the wrench flats to unthread and remove the secondary piston.

2. 

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.

WARNING

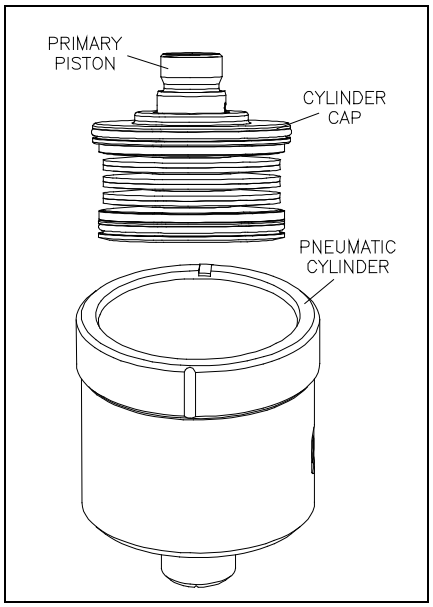
Do not compress the cylinder cap without the protector tools in place. Compress the cap slowly and release the retaining ring carefully.

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.

3. 

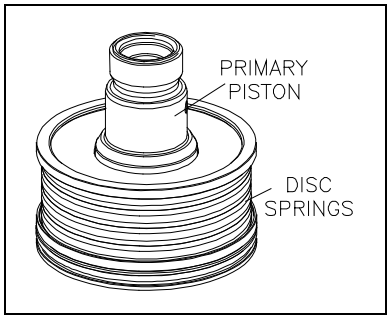
Slowly release the vise tension until the cylinder cap moves to a relaxed position.

The remaining components can now be removed for cleaning and/or replacement.

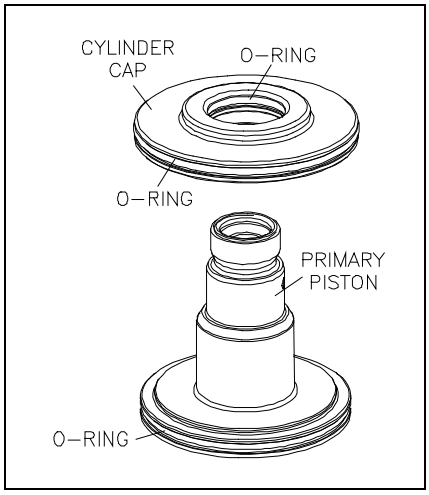
4. 

Pull the primary piston to remove the remaining components from the pneumatic cylinder.

Remove the cylinder cap.

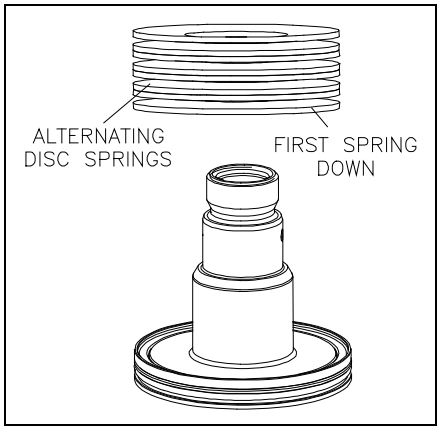
5. 

Remove the belleville disc springs from the primary piston.

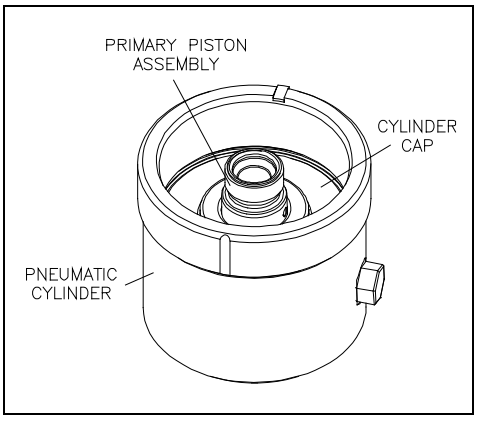
6. 

Remove the o-ring from the primary piston and the two o-rings from the cylinder cap.

Apply Cleanco silicone grease to the new o-rings and install them on the piston and the cap.

7. 

Alternate the installation of the Belleville disc springs on the piston, placing the first spring down, with the coned face up. The second spring should be placed up, with the coned face down. The final spring should be up.

8. 

Place the cylinder cap over the top spring and install the assembly in the pneumatic cylinder.

WARNING

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.

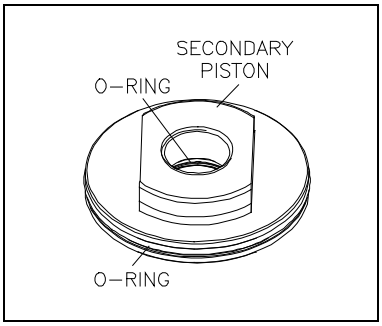
9. 

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

10. 

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.

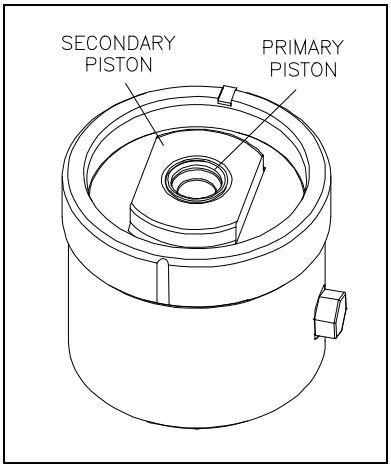
11.



Remove the o-rings from the secondary piston.

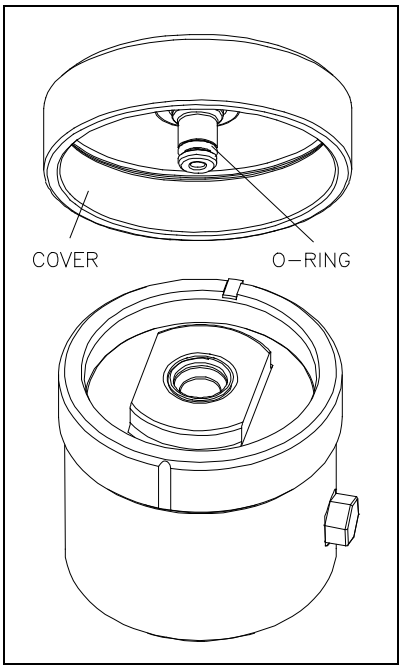
Apply Clearco silicone grease to the new o-rings and install them on the piston.

12.



Thread the secondary piston onto the primary piton until the tops are flush.

13.



Remove the o-ring from the cap. Apply Clearco silicone grease to the new o-ring and install.

Apply FML-2 to the threads on the pneumatic cylinder. Thread the cover onto the cylinder hand-tight.

3 Specifications

Table 1
Torque Specifications

Item	Torque Value
Nozzle Tube	50 ft-lbs (68 Nm)
Actuator Assembly	5 ft-lbs (7 Nm)
1/4” UHP Inlet Water Gland Nut	35 ft-lbs (47 Nm)

Table 2
Valve Specifications

High Pressure Operating Range	
Minimum Water Pressure	12,000 psi (827 bar)
Maximum Water Pressure with Valve Closed	90,000 psi (6,205 bar)
Air Pressure Operating Range	
Minimum Air Pressure	85-90 psi (5.86-6.20 bar)
Maximum Air Pressure	120 psi (8.27 bar)
Connections	
Water In Port	1/4” UHP
Water Out Port	3/4” Nozzle
Air Pressure Port	1/8” -27 Female

4 Parts List

This section contains a list of spare parts and maintenance tools for the 5-axis normally closed ultra-high pressure pneumatic control valve. To facilitate the ordering of replacement parts, item numbers in the 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

Customer Service Department
KMT Waterjet Systems
PO Box 231
635 West 12th Street
Baxter Springs, KS 66713-0231
USA

Phone (800) 826-9274
Fax (620) 856-2242
Email wj.service@kmtwaterjet.com
wj.parts@kmtwaterjet.com

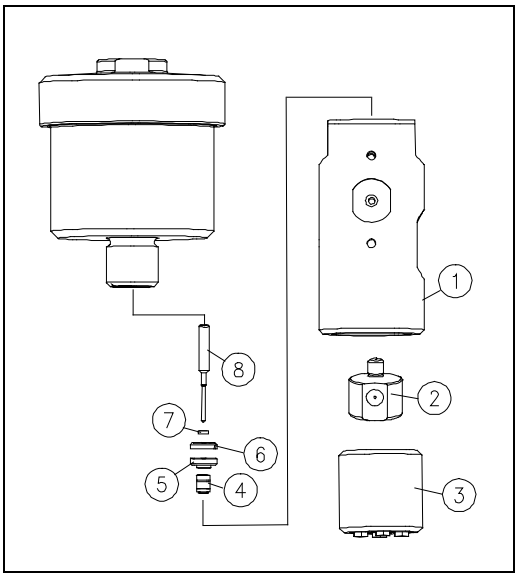
Europe

Spare Parts Manager
KMT Waterjet Systems GmbH
Hohe Strasse 4-6
D-61231 Bad Nauheim
Germany

Phone +49-6032-997-0
Fax +49-6032-997-270
Email order.spares@kmt-waterjet.com

Table 3
5-Axis UHP Valve/Actuator Assembly

Item	Part Number	Description
	72125559	**Valve/Actuator Assembly**
1	72113563	Valve Body
2	72118100	Valve Seat
3	72126179	Retaining Nut Assembly
	72113731	Retaining Nut
	72117397	Jackbolt
4	72112069	Seal Assembly
5	20475874	Bronze Backup Ring
6	20475882	SST Backup Ring
7	49895584	O-Ring
8	20475878	Valve Stem
	72113571	Nozzle Bracket, not shown
	20454351	HP Gland, not shown

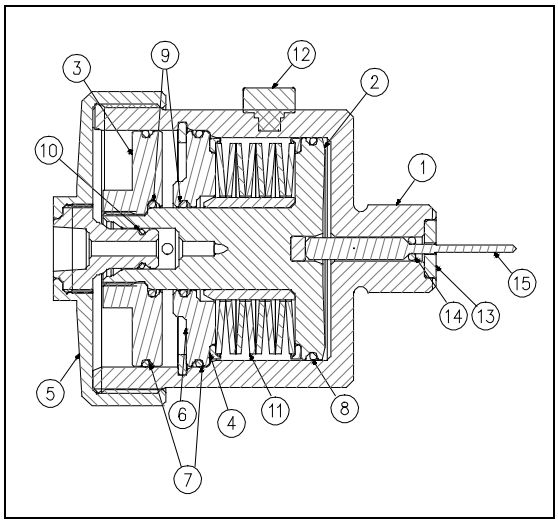


	72132134	**Valve/Actuator Assembly**
1	72113563	Valve Body
2	72118100	Valve Seat
3	72126179	Retaining Nut Assembly
	72113731	Retaining Nut
	72117397	Jackbolt
4	72112069	Seal Assembly
5	20475874	Bronze Backup Ring
6	20475882	SST Backup Ring
7	49895584	O-Ring
8	20475878	Valve Stem
	72132142	Nozzle Bracket, not shown
	72130986	HP Gland, not shown

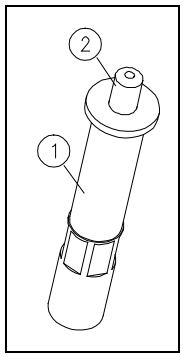
20477521	Repair Kit
	Includes items 4,5, 6, 7 and 8

Table 4
Actuator Assembly
72126145

Item	Part Number	Description
1	72124849	Cylinder
2	72129151	Primary Piston
3	72117439	Secondary Piston
4	72124781	Cover
5	72129143	Cap Assembly
6	72117504	Retaining Ring
7	72117538	O-Ring, 1.88 x 2.0 x .06
8	05070909	O-Ring, 1.75 x 1.88 x .06
9	72117512	O-Ring, .69 x .81 x .06
10	20464517	O-Ring, .22 x .34 x .06
11	72129500	Spring Assembly
12	72117530	Breather Vent
13	20475882	Backup Ring
14	49895584	O-Ring, .08 x .20 x .06
15	20475878	Valve Stem



	72114191	**Nozzle Tube Assembly, 4.0”**
1	72114216	Body, 4.0”
2	72114209	Nipple



	7219005470	**Nozzle Tube Assembly, 4.5”**
1	7219005391	Body, 4.5”
2	72114209	Nipple

80077795	Actuator Tool Kit
80077787	Top Protector Tool
80077779	Bottom Protector Tool
80077837	Snap Ring Pliers
72128656	Retainer Wrench