

**LINEAR PNEUMATIC ACTUATORS  
INSTALLATION & MAINTENANCE MANUAL**

<b>Sub Section</b>	<b>Title</b>	<b>Page No.</b>
1	Introduction	3
2	Significant Equipment Details	3
3	Routine Maintenance	3
4	Disassembly of Fail Closed External Spring Actuator	3
5	Disassembly of Fail Open Internal Spring Actuator	4
6	Inspection	5
7	Re assembly of Fail Closed External Spring Actuator	5
8	Re assembly of Fail Open Internal Spring Actuator	7
9	Mounting of Linear Actuator	8
Appendix 1	Trouble Shooting Guide	9
Appendix 2	Torque figures for nylok nut securing Piston	9
Drawing 1	Aluminium Fail Closed External Spring	10
Drawing 1	Aluminium Fail Open Internal Spring	10
Appendix 3	Actuator Parts Identification	11

# LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

## 1. INTRODUCTION

This document is a general maintenance manual intended for the standard Mitech range of linear actuators with fail closed external springs or fail open internal springs. The GA drawing included in this manual does not refer to a particular actuator but is used to show the typical layout. Additional documents are available from your local MITECH branch.

## 2. SIGNIFICANT EQUIPMENT DETAILS

The Mitech Actuator is mounted onto the valve with either a fail closed external spring mounted on top (which cannot be removed without dismantling the actuator sub assembly) or a fail closed internal spring, and therefore disassembly and reassembly for fail open or fail closed actuators will differ.

The actuator cylinder is made from either aluminium for the smaller sizes or from steel for the larger sizes. The steel actuator will have a number of external mounting bars surrounding the cylinder tube. Disassembly and reassembly for these different cylinders will differ.

## 3. ROUTINE MAINTENANCE AND INSPECTION

It is important to operate the actuator on a regular basis. If the normal duties do not require the actuator to operate regularly we recommend that a procedure be introduced to stroke the actuator on a weekly basis. The advantage of this is that cylinder lubrication is achieved and any possible problems that may occur are identified before consequential damage can result.

## 4. DISASSEMBLY OF FAIL CLOSED EXTERNAL SPRING ACTUATOR

The spring unit on a fail-closed actuator cannot be removed until the actuator sub assembly has been dismantled.

**NB: -Under no circumstances remove the spring tie bar nuts. These have been spot welded in place for your safety.**

**Warning:** Depressurise the line to atmospheric pressure and drain all line fluids before working on the valve. Ensure that decontamination procedures have been carried out if necessary. Failure to do so can result in serious injury.

- 4.1. Remove all air connections to actuator. If positioner is fitted, disconnect air connections and linkages.
- 4.2. Evenly loosen and remove actuator-mounting nuts.
- 4.3. Unscrew actuator stem (15) from valve shaft. If there is a grub screw holding the two parts together, remove before unscrewing.
- 4.4. Remove spring cover bolt (26), washer (27) and spring cover (25). The spring pack is a self-contained unit where the three spring tie bars take the pre compression forces. These spring tie bars have been spot-welded – do not break weld.

## LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

### 4.5. *Aluminium Cylinder*

- 4.5.1. Fit actuator and spring pack into a hydraulic press and compress to release the pressure on the circlip (3).
- 4.5.2. Measure the gap between the ends of the cylinder cap circlip and note the dimension.
- 4.5.3. Remove the circlip.
- 4.5.4. Release the pressure from the press. As the circlip is now removed, the spring unit, cylinder cap and push rod can be removed from the cylinder. On newer models there are bushes (28) and "O" ring (29) in the cylinder cap. Due to friction, they will prevent the push rod from sliding out without force. If present, note arrangement, and remove.
- 4.5.5. Remove the cylinder cap "O" ring (4).
- 4.5.6. Withdraw piston (10) and piston shaft sub assembly from cylinder.

### 4.6. *Steel Cylinder*

- 4.6.1. Loosen and remove cylinder tie bar nuts. Remove the end plate top.
  - 4.6.2. The push rod (19) can be removed from the cylinder tube. On newer models there are bushes (28) and "O" ring (29) in end flange. Due to friction, they will prevent the push rod from sliding out without force. If present, note arrangement, and remove.
  - 4.6.3. Remove the end plate top "O" ring.
  - 4.6.4. Withdraw piston (10) and piston shaft sub assembly from cylinder.
  - 4.6.5. Remove cylinder tie bars.
  - 4.6.6. Remove cylinder tube and end plate lower "O" ring.
- 4.7. Loosen nylok piston retaining nut (8). Take care not to damage the actuator stem, slide the piston of the stem.
  - 4.8. Remove the piston stem "O" ring (7) and the piston "O" ring (9).
  - 4.9. Remove stem bushes (13) - only if necessary - and actuator stem "O" ring (12) from the yoke of the cylinder.

## 5. **DISASSEMBLY OF FAIL OPEN INTERNAL SPRING ACTUATOR**

The spring unit on a fail-open actuator is normally situated inside the actuator cylinder, under the piston.

**Warning:** Depressurise the line to atmospheric pressure and drain all line fluids before working on the valve. Ensure that decontamination procedures have been carried out if necessary. Failure to do so can result in serious injury

- 5.1. Remove all air connections to actuator. If positioner is fitted, disconnect air connections and linkages.
- 5.2. Remove the valve from the line.
- 5.3. Evenly loosen and remove actuator-mounting nuts.
- 5.4. Unscrew actuator stem from valve shaft. Check to see if there is any grub screws, if any, remove before unscrewing actuator.
- 5.5. Relieve the spring pressure by removing the spring adjusting screw completely.

## LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

### 5.6. Aluminium Cylinder

- 5.6.1. Measure the gap between the ends of the cylinder cap circlip (3) and record value.
- 5.6.2. Remove the cylinder cap circlip then remove the cylinder cap (5).
- 5.6.3. Remove the cylinder cap "O" ring (4).

### 5.7. Steel Cylinder

- 5.7.1. Loosen and remove external mounting nuts.
  - 5.7.2. Lift the end plate top off from the cylinder tube.
  - 5.7.3. Remove the end plate top "O" ring.
- 5.8. Remove the piston and the actuator stem by sliding it out of the cylinder
- 5.9. Loosen & remove the piston-retaining nut (8) and piston from the actuator stem. Take care not to damage the stem. Remove piston stem "O" ring (7) and piston "O" ring (9).
- 5.10. Withdraw the fail-safe spring (11).
- 5.11. With the steel cylinder, remove the cylinder tube and end plate lower "O" ring.
- 5.12. Remove stem bushing (13)- only if necessary - and stem "O" ring (12) from the base of the cylinder.

## 6. INSPECTION

All parts must be inspected for wear and corrosion. Thoroughly investigate all worn parts to determine the cause of the damage. The particular areas of these components to be inspected includes the following:

Component	Criteria				
	Erosion	Corrosion	Galling	Wear	Scoring
"O" Rings				X	
Bushes				X	
Cylinder barrel	X	X	X		X
Actuator Stem			X	X	X

Any significant area of damage should be reported to Mitech directly. Clean all metal components with a suitable solvent.

## 7. REASSEMBLY OF FAIL CLOSED EXTERNAL SPRING ACTUATOR

- 7.1. The following parts must be replaced:
  - Piston "O"-ring (9)
  - Cylinder cap "O"-ring (4)
  - Piston stem "O"-ring (7)
  - Actuator stem "O"-ring (12)
  - Push Rod "O" –ring (29)
- 7.2. Ensure that all parts and all necessary tools are available and clean. Clean the workbench and remove any items that are not required.
- 7.3. If the stem bushings (13) were removed from the cylinder yoke: -
  - 7.3.1. Slightly roughen the outer surface of the stem bushes using Emery tape to improve adhesion of the loctite.

## LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

- 7.3.2. Apply loctite primer and a thin coat of loctite adhesive "601" to the first bush and press it right to the shoulder of the actuator stem neck.
- 7.3.3. Insert the piston shaft "O" ring (12).
- 7.3.4. Repeat the procedure as per the first bush on the second bush and make sure it does not press too tightly on the "O" ring, leaving +/- 0.5mm clearance. The top of the second bush should be flush with cylinder face.
- 7.3.5. Check if the piston stem slides freely through bushes and the piston shaft "O" ring
- 7.4. Hold the piston stem on the flats in a soft jaw vice. Fit the piston stem "O" ring (7) to the thread end of the stem and then slide the piston over the threads onto the "O" ring. Tighten the nylok nut (8) to the correct torque figure for the particular actuator. See appendix 2 for figures.
- 7.5. Put a light smear of silicon grease (Molycoat 55M or Kluber Polylub GLY801) on the piston "O" ring (9).
- 7.6. Apply a liberal coating of the same grease to the cylinder bore and Actuator stem "O" ring in the yoke.

### 7.7. **Aluminium Cylinder**

- 7.7.1. Fit piston and shaft assembly into the cylinder taking care not to damage any of the "O" rings. Once fitted, ensure that it moves freely without fouling
- 7.7.2. If the cylinder cap had an "O" ring (29) and bushes (28) when disassembling, replace according to the noted sequence.
- 7.7.3. Fit "O" ring (4) in cylinder cap (5) groove and apply a light coating of silicon grease.
- 7.7.4. Insert push rod (19) through the cylinder cap and locate the push rod onto the actuator stem (15). The recess in the push rod will fit over the actuator stem.
- 7.7.5. Fit cylinder cap (5) to cylinder, taking care not to damage the cylinder cap "O" ring.
- 7.7.6. Place the unit into the hydraulic press and insert the cylinder cap circlip into the groove and tap it to ensure that it is properly seated in the groove. Measure the gap in the circlip, which should correspond with the measurement taken when removing the circlip.
- 7.7.7. Remove unit form hydraulic press.

### 7.8. **Steel Cylinder**

- 7.8.1. Place the end plate lower onto a hollow stand then insert the piston sub assembly through it so that there will be a +/-100mm gap between the end plate lower and the piston (10).
- 7.8.2. Replace the end plate lower "O" ring into groove and apply a light coating of silicon grease.
- 7.8.3. At a 45° angle, slide the cylinder tube over the piston and piston "O" ring. **Do not damage the "O" ring.** Once the piston is located in the tube, straighten the tube and slide it onto the end plate lower and "O" ring.
- 7.8.4. Refit the cylinder tie bars.
- 7.8.5. If the end plate top had an "O" ring (29) and bushes (28) when disassembling, replace according to the noted sequence.

## LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

- 7.8.6. Fit "O" ring in top end flange groove and apply a light coating of silicon grease.
  - 7.8.7. Re-bolt the spring pack onto the top end flange.
  - 7.8.8. Insert push rod (19) through the top end flange and locate the push rod onto the actuator stem (15).
  - 7.8.9. Fit end plate top with spring pack assembly onto cylinder, taking care not to damage the "O" ring. Ensure the push rod locates onto the Actuator stem.
  - 7.8.10. Replace cylinder tie bar nuts and evenly tighten
- 7.9. Check cylinder operation for full and smooth travel using air at 4.5 to 5 bar pressure.
  - 7.10. Pour soap water into the cylinder neck and check for leaks at this end by pressurising the cylinder using the hole nearest the neck. If the "O" ring on this side leaks, the cylinder must be dismantled and the second bush pressed further in to compress the "O" ring slightly.

### **8. REASSEMBLY OF FAIL OPEN INTERNAL SPRING ACTUATOR**

- 8.1. The following parts must be replaced:
  - Piston "O"-ring (9)
  - Cylinder cap "O"-ring (4)
  - Piston stem "O"-ring (7)
  - Actuator stem "O"-ring (12)
  - Insert Bolt "O" ring (2)
- 8.2. If the stem bushings (13) were removed: -
  - 8.2.1. Slightly roughen the outer surface of the stem bushes using Emery tape to improve adhesion of the loctite
  - 8.2.2. Apply loctite primer and a thin coat of loctite adhesive "601" to the first bush and press it right to the shoulder of the actuator stem neck.
  - 8.2.3. Insert the actuator stem "O" ring.
  - 8.2.4. Repeat the first bush procedure on the second bush and make sure it does not press too tightly on the "O" ring, leaving +/- 0.5mm clearance. The top of the second bush should be flush with cylinder face.
  - 8.2.5. Check if the piston shaft slides freely through bushes and the actuator stem "O" ring.
- 8.3. Hold the actuator stem (15) on the flats in a soft jaw vice. Fit the piston stem "O" ring (7) onto the actuator stem.
- 8.4. Assemble the piston (10) to the actuator stem making sure the groove of the piston would face the actuator yoke not the nylok nut side.
- 8.5. Place the spring button on top of the piston – upside down.
- 8.6. Place the nylok nut (8) above the spring button onto the actuator stem and tighten. See appendix 2 for torque figures.
- 8.7. Put light smear of silicon grease on the piston "O" ring and fit to the piston.

## LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

### 8.8. *Aluminium Cylinder*

- 8.8.1. Invert actuator assembly and place on table with piston shaft facing up. (The nylok nut must rest on table on the table)
- 8.8.2. Place spring (11) onto the piston (10) and locate it into the piston groove.
- 8.8.3. Apply liberal coating of grease to the bore of the cylinder.
- 8.8.4. Fit the cylinder (14) over the piston / piston shaft assembly until the spring rests on the bottom of the cylinder. Turn the actuator the correct way up.
- 8.8.5. Ensure that the piston assembly moves freely without fouling.
- 8.8.6. Fit the cylinder cap "O" ring (4) to the cap with a light smear of grease, and fit the cylinder cap (5) to the cylinder, taking care not to damage the cylinder cap "O" ring.
- 8.8.7. Insert the circlip (3) and tap it to ensure that it is properly seated. Measure the gap; it should correspond to the measurement taken when disassembling.

### 8.9. *Steel Cylinder*

- 8.9.1. Place the end plate lower onto a hollow stand
  - 8.9.2. Replace the end plate lower "O" ring into groove and apply a light coating of silicon grease.
  - 8.9.3. Place the spring (11) onto the end plate lower and slide the actuator stem (15) of the piston sub assembly through the end plate lower yoke. Locate the spring into the groove on the bottom side of the piston.
  - 8.9.4. Apply liberal coating of grease to the bore of the cylinder.
  - 8.9.5. At a 45° angle, slide the cylinder tube over the piston and piston "O" ring. **Do not damage the "O" ring.** Once the piston is located in the tube, straighten the tube and slide it onto the end plate lower and "O" ring.
  - 8.9.6. Refit the cylinder tie bars.
  - 8.9.7. Fit the end plate top "O" ring and apply a light smear of grease. Fit flange onto the cylinder tube.
  - 8.9.8. Replace cylinder tie bar nuts and tighten evenly.
- 8.10. Fit "O" ring (2) to the insert bolt (6) and tighten the bolt to the cap / end plate top.
  - 8.11. Check cylinder operation using an air line. Pressure should be approximately 5 Bar.
  - 8.12. Check for leaks at cap end by pouring soap water onto the cap and pressurising cylinder using hole nearest the cap.
  - 8.13. Pour soap water into the cylinder neck and check for leaks at this end by pressurising the cylinder using the hole nearest the neck. If the "O" ring on this side leaks, the cylinder must be dismantled and the second bush pressed further in to compress the "O" ring slightly.
  - 8.14. Stroke the actuator to ensure smooth operation of the actuator

## LINEAR PNEUMATIC ACTUATORS INSTALLATION & MAINTENANCE MANUAL

### 9. MOUNTING OF LINEAR ACTUATOR

- 9.1. The fail action of the actuator will affect the procedure of mounting it to the valve.
  - 9.1.1. For fail closed units, air should be used to retract actuator stem after its been screwed onto the connecting stem.
  - 9.1.2. For fail open units, air should be used to extend the actuator stem before it is screwed onto the connecting stem.
  - 9.1.3. In all cases, the grub screw must be tightened to lock the actuator stem to the connecting stem.
- 9.2. The mounting of linear actuators to valves is by means of the four bolts that pass through the mounting flange of the cylinder casting. Depending on the valve and the control system required the mounting can be:
  - 9.2.1. Directly onto the valve provided it has a suitable mounting flange and no control or indication is required.
  - 9.2.2. By means of mounting bars attached to the valve. If mounting bars are used, ensure they are all of the same length so to ensure that the actuator is in alignment with the valve stem.
  - 9.2.3. By means of mounting bars attached to the valve and a mounting flange for the actuator.
  - 9.2.4. Depending on the type of control or indication required, the set of mounting bars are available in different lengths to allow for fitting of Proximity Switches, Mechanical limit switches or a positioner.
- 9.3. The connection of the actuator to the valve will vary dependant on the valve type and type of control specified.
  - 9.3.1. Normally for control valves the valve stem will be screwed into the actuator stem and the stem clamp will lock the valve stem to the actuator stem.
  - 9.3.2. Diaphragm valves and Pinch valves are usually connected to the actuator stem utilising a stem connector that is locked by a grub screw in the actuator stem. If a grub screw is used, ensure that it will not damage the actuator stem seal or bushes when the actuator is stripped. It should either be below the surface of the actuator stem or must be removed.



**LINEAR PNEUMATIC ACTUATORS  
INSTALLATION & MAINTENANCE MANUAL**

**Appendix 1**

**LINEAR ACTUATOR TROUBLE SHOOTING GUIDE**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>CORRECTIVE ACTION</b>
Actuator does not move	Insufficient air pressure Spring pack faulty  Valve jammed  Actuator seized Actuator faulty	Check air supply to cylinder. Remove cylinder pack and check for movement Remove actuator from valve and check operation of actuator and valve independently Remove actuator, strip and check for damage to piston, cylinder or actuator stem bushes
Actuator does not move	Piston bypassing air	Apply air pressure to one cylinder port and check if air exhausts from the other port. Strip actuator and check of cylinder damage. Replace piston "O" ring
Jerky Movement	Low air supply pressure or volume Piston fouling cylinder or stem bushes binding Rough finish on actuator bore	Check air supply at cylinder ports  Strip actuator and check for damage in cylinder or stem bushes. Polish bore with 600-grade water paper
Actuator extends but does not retract	Actuator stem "O" ring damaged	Supply air to bottom port and check for leak at cylinder neck. Replace "O" ring
Actuator retracts but does not extend	Cylinder cap "O" ring damaged	Check for leaks from cylinder cap circumference and if fitted from end stop bolt in centre of cylinder cap. Replace "O" ring

**Appendix 2:**

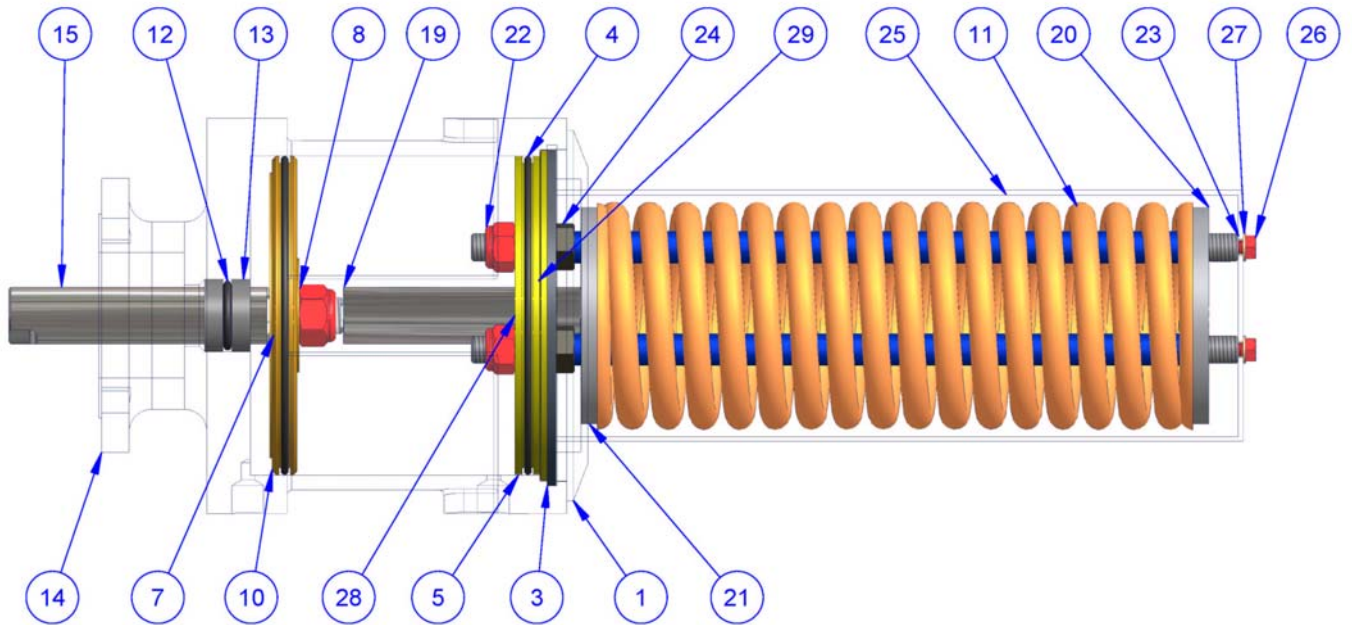
**TORQUE FIGURES FOR NYLOK NUT SECURING PISTON**

<b>Actuator Size</b>	<b>Nut Size</b>	<b>Torque (Nm)</b>
MT-12	M12	80
MT-25	M16	150
MT-50	M20	180
MT-100	M24	220
MT-200	M30	280
MT-300 reduced stem	M30	280
MT -300	M36	300

**LINEAR PNEUMATIC ACTUATORS  
INSTALLATION & MAINTENANCE MANUAL**

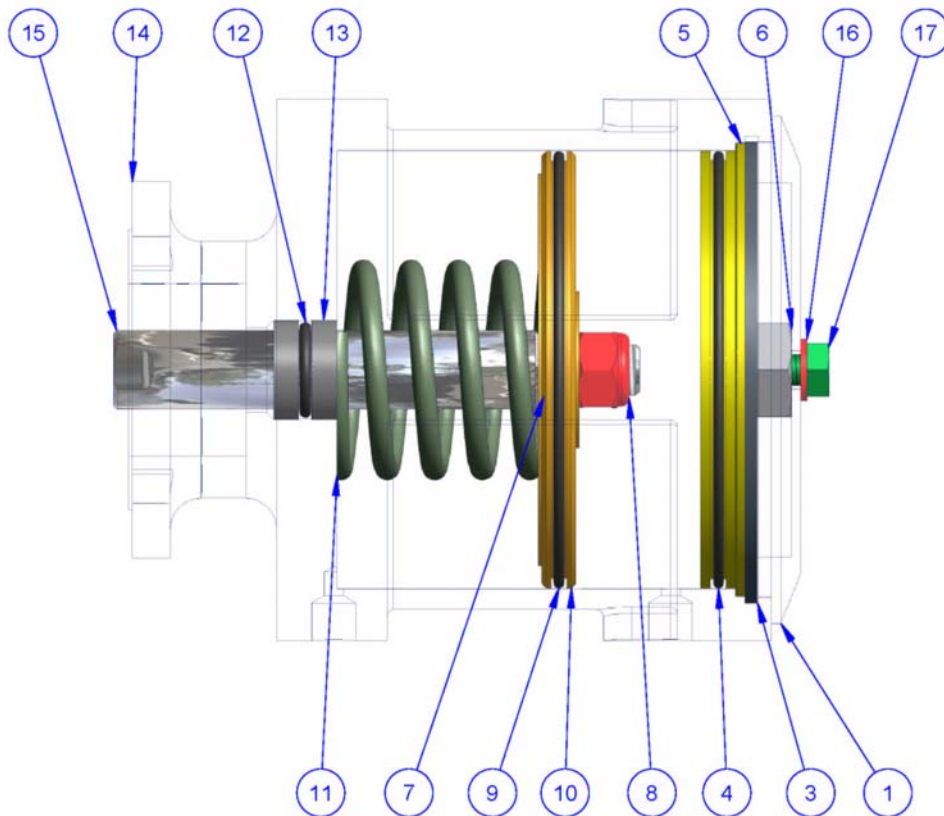
**Drawing 1:**

**Aluminium Fail Closed External Spring Actuator**



**Drawing2:**

**Aluminium Fail Open Internal Spring Actuator**



**LINEAR PNEUMATIC ACTUATORS  
INSTALLATION & MAINTENANCE MANUAL**

**Appendix 3  
ACTUATOR PARTS IDENTIFICATION**

<b>Number</b>	<b>Parts Description</b>	<b>Number</b>	<b>Parts Description</b>
1	Cover Ring	16	Washer
2	“O” Ring – Insert Bolt	17	Bolt
3	Circlip	18	Grub Screw
4	“O” ring Cylinder Cap	19	Push Rod
5	Cylinder Cap	20	Spring Button – Bottom
6	Insert Bolt	21	Spring Button – Top
7	“O” Ring – Piston Stem	22	Nylok Nut – Spring
8	Nylok Nut - Piston	23	Tie Bar
9	“O” Ring - Piston	24	Nut – Tie Bar
10	Piston	25	Spring cover
11	Spring	26	Bolt - Spring cover
12	“O” Ring – Act Stem	27	Washer - Spring cover
13	Bushing - Stem	28	Bush Stem – Push Rod
14	Cylinder	29	“O” ring - Push Rod
15	Actuator Stem		