

**ROTARY PNEUMATIC ACTUATORS – ALUMINIUM CYLINDER  
INSTALLATION & MAINTENANCE MANUAL**

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# ROTARY PNEUMATIC ACTUATORS – ALUMINIUM CYLINDER INSTALLATION & MAINTENANCE MANUAL

## 1. INTRODUCTION

The Mitech actuator is available with either double crank mechanism for modulating control or scotch yoke mechanism for on / off control. The main shaft assembly on the double crank design is welded together and therefore does not have to be disassembled or reassembled. The actuator is field reversible from clockwise to close to clockwise to open and has Namur mounting for switch packs or positioners on the top shaft and transfer case lid.

The standard pneumatic actuator is designed as a low maintenance unit. The transfer case and the actuator cylinder are made from anodised aluminium.

The fail mechanism (spring) on the Mitech Actuator is modular and is bolted onto the opposite side of the transfer case to the cylinder.

***NOTE: This maintenance manual consists of 5 drawings with related parts. Please consult the parts identification table on page 13 of this manual for the respective part descriptions.***

## 2. ROUTINE MAINTENANCE

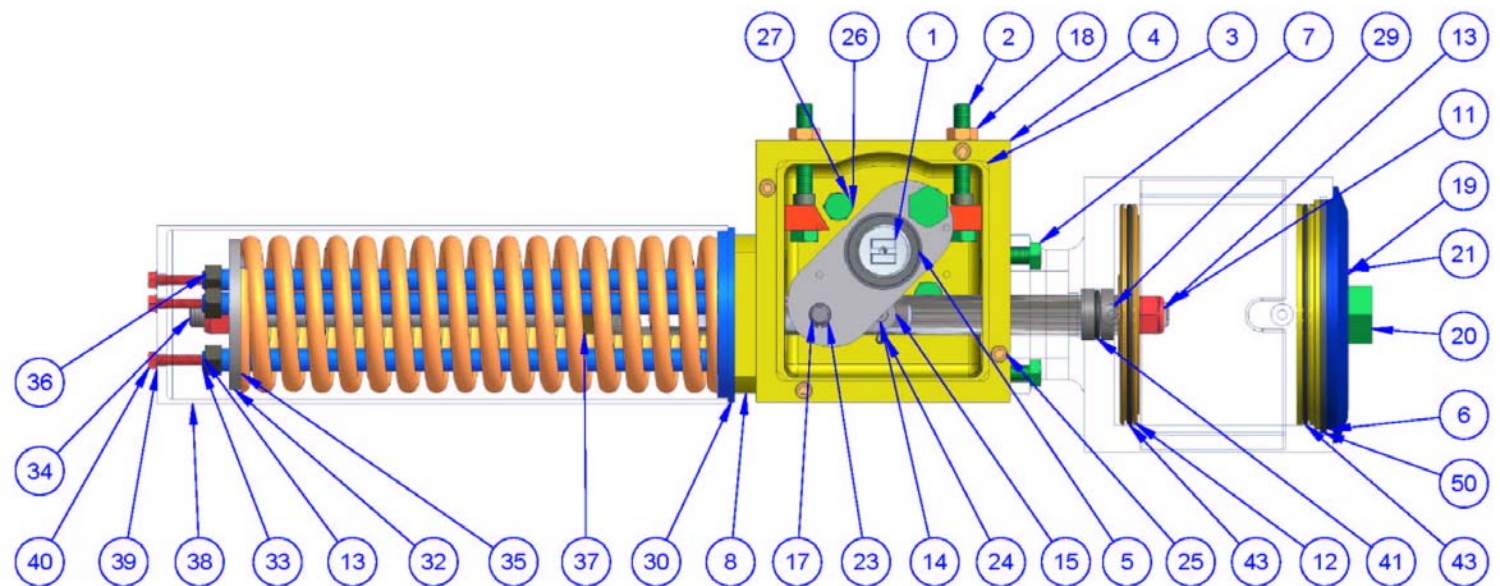
- 2.1. It is important to operate the actuator on a regular basis.
- 2.2. If the normal duties do not require the actuator to operate regularly we recommend that a procedure be introduced to stroke the actuator on a weekly basis. The advantage of this is that cylinder lubrication is achieved and any possible problems that may occur are identified before consequential damage can result.
- 2.3. If work is to be carried out on the actuator it is preferable to have the actuator and valve removed from the line.
- 2.4. If work must be carried out on the actuator with the valve still in the line, ensure that a work permit is obtained prior to commencing any work and that all safety precautions are observed.

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## 3. DISSASSEMBLY

### 3.1. DISSASSEMBLY OF DOUBLE CRANK DESIGN

- 3.1.1. Remove all air connections to actuator and positioner if fitted.
- 3.1.2. Disconnect positioner linkage if fitted.
- 3.1.3. Remove the assembled actuator from the valve unless integrally mounted.
- 3.1.4. For spring return units (external spring), remove spring cover (38). Release the spring pack tension by unscrewing the central nylok nut (13). The three tie bars (33) will take the pre compression forces, so no danger exists in removing the spring pack. The spring pack can then be removed from the transfer case.  
**NB Under no circumstances must the tie bar nuts be removed. These have been spot-welded in place for your safety.**
- 3.1.5. Spring packs incorporating a hand wheel.  
To remove the spring pack from the actuator rotate the spring pack in an anti clockwise direction so that the slotted hole is aligned with the cap screw head. The spring pack can then be disengaged from the insert bush retainer (8).
- 3.1.6. Remove pointer or positioner if mounted to the transfer case lid.
- 3.1.7. Remove transfer case lid (4) by removing the cap screws (25).
- 3.1.8. Remove the split pin (24) from the top-connecting arm that holds the shaft pin (14) in position.
- 3.1.9. If the shaft pin is too tight to be removed, loosen the yoke bolts (7) to allow movement of the piston shaft (11), and insert a bolt into the tapped hole – tap bolt gently. Remove shaft pin.
- 3.1.10. Carefully withdraw the cylinder sub assembly after removing the yoke bolts.
- 3.1.11. Remove main shaft (1) and crank arm assembly.
- 3.1.12. Remove insert bush retainer (8) by removing the cap screws (10).

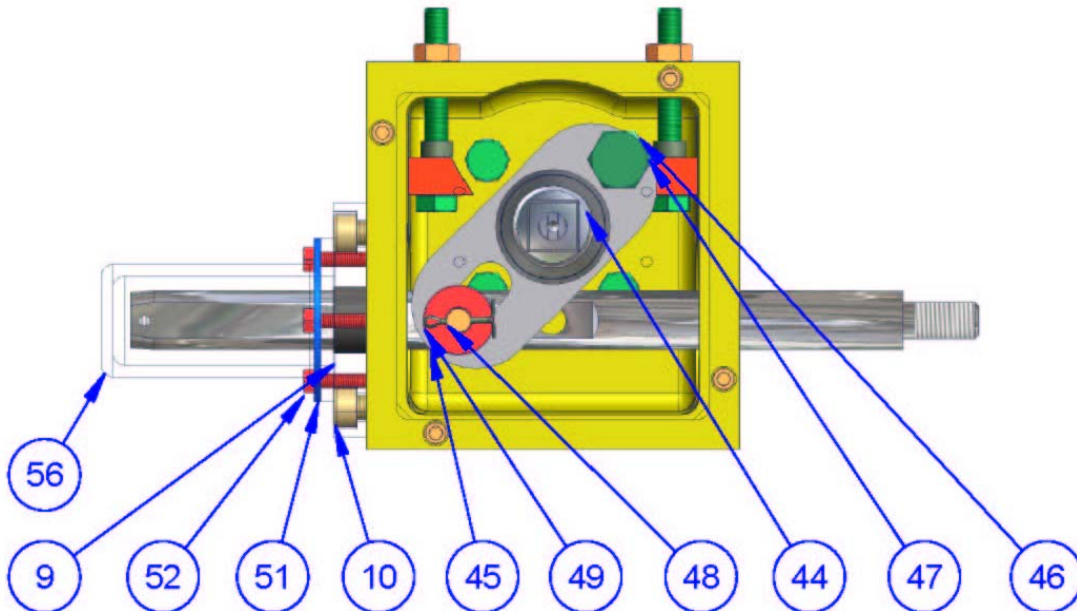


**Figure 1: Rotary Actuator with Double Crank Mechanism**

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### 3.2. DISSASSEMBLY OF SCOTCH YOKE DESIGN

- 3.2.1. Remove all air connections to actuator and positioner if fitted.
- 3.2.2. Disconnect positioner linkage if fitted.
- 3.2.3. Remove the assembled actuator from the valve unless integrally mounted.
- 3.2.4. For spring return units (external spring), remove spring cover (38). Release spring pack tension by unscrewing the central nylok nut (13). The three tie bars (33) will take the pre compression forces, so no danger exists in removing the spring pack. The spring pack can then be withdrawn from the transfer case.  
**NB Under no circumstances must the tie bar nuts be removed. These have been spot-welded in place for your safety.**
- 3.2.5. Spring Packs incorporating a hand wheel.  
To remove the spring pack from the actuator, rotate the spring pack in an anti clockwise direction so that the slotted hole is aligned with the cap screw head. The spring pack can then be disengaged from the insert bush retainer.
- 3.2.6. Remove pointer or positioner if mounted to the transfer case lid.
- 3.2.7. Remove transfer case lid (4) by removing the cap screws (25).
- 3.2.8. Remove top main shaft circlip (22) and the bolt (46) holding the two rocker plates together (45).
- 3.2.9. Remove the split pin (24) and the washer (49) from the shaft pin (48).
- 3.2.10. Lift off top rocker plate.
- 3.2.11. Disengage the lower rocker plate by pushing it down.
- 3.2.12. Remove shaft pin from actuator shaft. Withdraw cylinder sub assembly once the yoke bolts have been removed.
- 3.2.13. Remove main shaft (44) and lower rocker plate.
- 3.2.14. Remove insert bush retainer (8) by removing the cap screws (10).



**Drawing 2: Transfer Case with Scotch Yoke Mechanism**

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**3.3. DISASSEMBLY OF CYLINDER**

- 3.3.1. Measure the gap between the ends of the cylinder cap circlip (50) and note the dimension. Remove circlip and cylinder cap (19).
- 3.3.2. Withdraw piston (12) and piston shaft sub -assembly from cylinder. If there is a grub screw in the piston shaft this should be removed before withdrawing the piston shaft.
- 3.3.3. Loosen piston-retaining nut (13). Taking care not to damage the actuator stem, slide the piston of the stem.
- 3.3.4. Remove stem bushes (29) - only if necessary - and stem "O" ring (41) from the yoke of the cylinder.

**4. COMPONENT 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	Bending
"O" Rings				X	
Bushes				X	
Cylinder barrel	X	X	X		
Rocker Arms / Slots		X	X	X	
Piston Shaft		X	X	X	
End Stops				X	X

Any significant area of damage should be reported to Mitech directly.

**5. OVERHAUL**

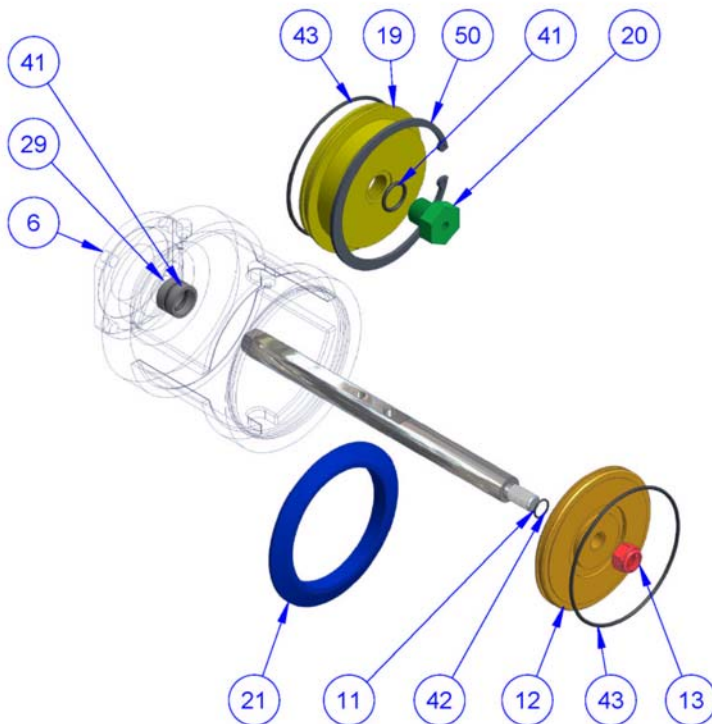
- 5.1. The following parts should always be replaced: -
  - Piston "O" ring (43)
  - Cylinder cap "O" ring (43)
  - Piston stem "O" ring (42)
  - Actuator Stem "O" ring (41)
  - Bush – Shaft Pin (16)
  - Bush – Connecting Arm (23)
  - Insert Bolt "O" ring (41)
  - Drill Bush and bearings (24)
  - Bush (22)
  - Piston Shaft bush (9)
  - Main Shaft bush (5)
  - Circlip – Main Shaft (22)
- 5.2. The following parts should be replaced only if necessary: -
  - Shaft Pin (14 / 48)
  - Yoke Bushes (29)
  - Rocker Plates (45) - Scotch Yoke
  - Connecting Arm (15)

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### 6. RE - ASSEMBLY

#### 6.1. ASSEMBLY OF CYLINDER

- 6.1.1. Ensure that all parts and all necessary tools are available and clean. Clean the workbench and remove any items that are not required.
- 6.1.2. If the stem bushings were removed from the cylinder yoke:
  - 6.1.2.1. Slightly roughen the outer surface of the stem bushes (29) using Emery tape to improve adhesion of the loctite.
  - 6.1.2.2. 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.
  - 6.1.2.3. Insert the actuator stem "O" ring (41).
  - 6.1.2.4. 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.
  - 6.1.2.5. Check if the piston stem slides freely through bushes and the actuator stem "O" ring.
- 6.1.3. Hold the piston stem (11) on the flats in a soft jaw vice. Fit the piston stem "O" ring (42) to the thread end of the stem and then slide the piston over the threads onto the "O" ring. Tighten the nylok nut (13) to the correct torque figure for the particular actuator. See appendix 2 for figures.
- 6.1.4. Put a light smear of silicon grease (Molycoat 55M or Kluber Polylub GLY801) on the piston "O" ring (43).
- 6.1.5. Apply a liberal coating of the same grease to the cylinder bore and Actuator stem "O" ring in the yoke.



**Drawing 3: Cylinder**

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- 6.1.6. 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
- 6.1.7. Fit "O" ring (43) in cylinder cap groove and apply a light coating of silicon grease.
- 6.1.8. Fit cylinder cap (19) to cylinder (6), taking care not to damage the cylinder cap "O" ring.
- 6.1.9. Fit the circlip (50) to the cylinder cap. Insure it is seated correctly by tapping it lightly.
- 6.1.10. Measure the gap in the circlip, which must correspond with the measurement taken when removing the circlip.
- 6.1.11. Fit "O" ring (41) to insert bolt (20) and tighten bolt into cylinder cap.
- 6.1.12. Check cylinder operation for full and smooth travel using air at 4.5 to 5 bar pressure.
- 6.1.13. 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.

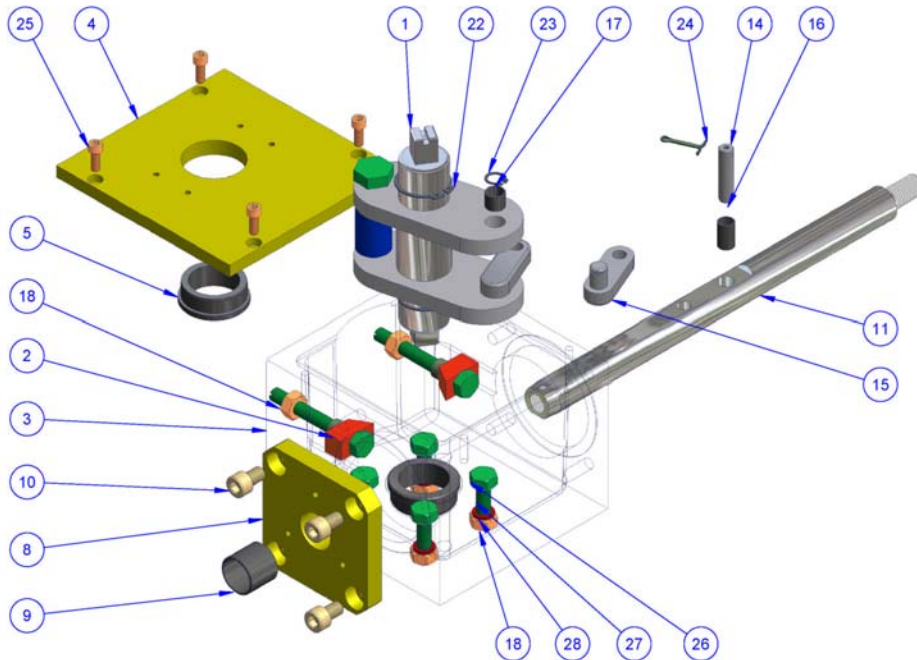
### **6.2. ASSEMBLY OF TRANSFER CASE – DOUBLE CRANK**

- 6.2.1. If the main shaft bushes (5) in the transfer case box (3) and lid (4) are replaced, the shoulder of the bush must be on the inside of the transfer case.
- 6.2.2. Replace the main shaft circlip (22) into the grooves in the main shaft (1).
- 6.2.3. Assemble the rocker plate assembly into the transfer case box with the connecting arms (15) pointing towards the cylinder side.
- 6.2.4. Insert piston shaft (11) of the cylinder sub-assembly into the transfer case (allocated hole) between the connecting arms, until the holes in the connecting arms line up with the upper hole (closest to the cylinder) in the piston shaft.
- 6.2.5. Insert shaft pin (14) through both connecting arms and the piston shaft insuring that the threaded hole is at the top.
- 6.2.6. Insert the split pin (24) through the shaft pin and bend the ends outwards.
- 6.2.7. Fit yoke bolts (7) and tighten evenly.
- 6.2.8. Replace the transfer case lid and tighten the cap screws (25).
- 6.2.9. Check for smooth operation of the actuator by turning the main shaft (1) using a spanner on the flats.
- 6.2.10. Adjust the end stops (2) to achieve a 90-degree movement at right angles to the transfer case. Loosen the lock nut (18) and screw the end stop in or out by using a spanner.
- 6.2.11. If the operation is not smooth strip and check for the following possible faults:
  - Cylinder sub assembly has rough operation
  - Misalignment of the cylinder and transfer case
  - Connecting arms binding on piston shaft
  - Rocker plate fouling on actuator mounting bolt heads.
- 6.2.12. If pointer is to be used, insert "O" ring in groove in pointer and fit pointer in correct position. Tighten centre bolt in pointer.

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6.2.13. If fitting a positioner instead of the pointer: -

- Fit Positioner mounting bracket.
- Fit Positioner to bracket making sure that the positioner drive is engaged in the coupling.



**Drawing 4: Transfer Case with Double Crank Mechanism**

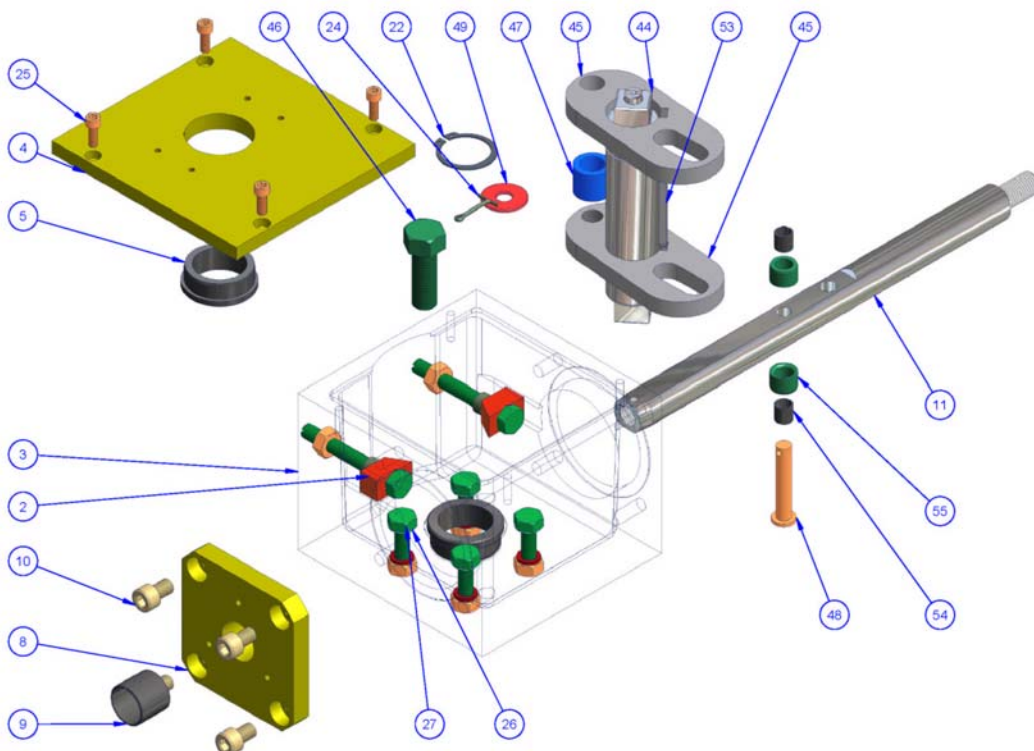
### 6.3. ASSEMBLY OF TRANSFER CASE - SCOTCH YOKE

- 6.3.1. If the main shaft bushes (5) in the transfer case box and lid are replaced, the shoulder of the bush must be on the inside of the transfer case.
- 6.3.2. Check that the drill bushes (55) are not tight in the rocker plate (45) slots, and that the rocker plates can fit (slide) over the main shaft (44).
- 6.3.3. Fit the circlip (22) into main shaft's respective lower groove.
- 6.3.4. Press bush (54) into the drill bush (55).
- 6.3.5. Position main shaft in transfer case with circlip at the bottom.
- 6.3.6. Fit lower rocker plate (45), the one with the tapped hole, onto the main shaft. Apply a liberal coating of grease to both rocker plate slots.
- 6.3.7. For Fail Close and Double Acting actuators the slot must make a more acute angle with the piston shaft when the rocker plate is pointing away from the cylinder. For Fail Open the slot must make a less acute angle.  
*See Rocker Plate Orientation Drawing – Appendix 4*
- 6.3.8. Insert the piston shaft (11) of the cylinder sub assembly into the transfer case (allocated hole) until the hole for the shaft pin is within the cases
- 6.3.9. Insert the shaft pin with one drill bush located against the head of the shaft pin through the small hole in the piston shaft (hole furthest from the cylinder). Leave the bottom rocker plate disengaged from the key (53). Turn the piston shaft so that the shaft pin is resting with its head against the lower rocker plate.
- 6.3.10. Fit the top rocker plate over both the main shaft and the shaft pin.
- 6.3.11. Fit the top drill bush (55) then the washer (49) and split pin (24).



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- 6.3.12. Manoeuvre the lower rocker plate to engage the key on the main shaft and the lower drill bush inside the lower rocker plate slot. Position the spacer (47) between the rocker plates and fit the bolt (46) through the rocker plate and spacer. Tighten bolt onto taped hole in lower rocker plate.
- 6.3.13. Fit yoke bolts (7) and tighten evenly. Check to ensure smooth operation by first fitting the transfer case lid and then operating the actuator by turning the main shaft (44) with a spanner. Check that all cap screws (25) are fitted in transfer case lid and tightened.
- 6.3.14. Adjust the end stops (2) to achieve a 90-degree movement at right angles to the transfer case. Loosen the lock nut (18) and screw the end stop in or out by using a spanner.
- 6.3.15. If the operation is not smooth strip and check for the following possible faults: -
- Cylinder sub assembly has rough operation
  - Misalignment of the cylinder and transfer case
  - Connecting arms binding on piston shaft
  - Rocker plate fouling on actuator mounting bolt heads
  - Tab washer not pressed down fully and fouling on transfer case lid
- 6.3.16. If pointer is to be used, insert "O" ring in groove in pointer and fit pointer in correct position. Tighten centre bolt in pointer.
- 6.3.17. If fitting a positioner instead of the pointer: -
- Fit Positioner mounting bracket.
  - Fit Positioner to bracket making sure that the positioner drive is engaged in the coupling.



**Drawing 5: Transfer Case with Scotch Yoke Mechanism**

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### 6.4. ASSEMBLY OF SPRINGPACK

- 6.4.1. Replace insert bush retainer (8) and tighten onto the transfer case with cap screws (10). Replace the insert retainer bush (9).
- 6.4.2. Screw tension rod (34) into piston shaft (11) and lock with nut (37).
- 6.4.3. Slide bottom spring end (30) over tension rod.
- 6.4.4. Slide spring pack assembly (*should not have been dismantled as the force in the spring can do considerable damage if released*) over tension rod ensuring that it is centralised.
- 6.4.5. Replace lock nut (13) and tighten nut until the force of the spring has been transferred from the tie bar nuts onto the lock nut.
- 6.4.6. Slide spring cover (38) over the spring and seat in bottom spring end (30).
- 6.4.7. Check for clearance all round between cover and spring.
- 6.4.8. Secure with bolts (40) using plain washers (39) under bolt heads.

## 7. END STOP ADJUSTMENTS

**N.B.** Always use air pressure to take pressure off end stops before adjusting.

### 7.1. BUTTERFLY VALVE

- 7.1.1. The end stops should be used to limit the travel of the valve disk in the closed position.
- 7.1.2. Loosen the lock nut (18) on the end stop (2).
- 7.1.3. Screw end stop out so that disk is just clear of seat.
- 7.1.4. Gradually wind end stop in until disk just seats. Each time an adjustment is made, remove the pressure on the screw by stroking the actuator.
- 7.1.5. Tighten lock nut.
- 7.1.6. Repeat the procedure to set the valve in the fully open position on the opposite end stop.
- 7.1.7. Make adjustment to stop as the seat wears.

### 7.2. BALL VALVE

The open position end stop is very important on ball valves. It should be used to ensure that the ball is exactly in line with the body bore in the open position to avoid damage occurring to the Ball from the medium in the line. The end stops must be adjusted as per the butterfly valve above.

## 8. REVERSING FAIL ACTION

- 8.1. Dismantle the actuator as per section 3.1 or 3.2
- 8.2. Remove the Insert bush retainer from the spring side of the transfer case and re-fit the bush on what was the cylinder side of the transfer case.
- 8.3. On Scotch yoke actuators the rocker plates will have to be removed and re fitted in accordance with the rocker plate orientation drawings- Appendix 4.
- 8.4. Re build the actuator in accordance with section 6.2 or 6.3
- 8.5. Test actuator operation.
- 8.6. Check end stop setting as in section 7.

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**Appendix 1**

**TROUBLE SHOOTING GUIDE**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>ACTION</b>
Actuator won't move	1. Insufficient air pressure	Check air supply pressure Remove spring pack and retry
	2. Actuator by passing air	Check for airflow at cylinder port opposite pressurised port. Check for air from cylinder yoke.
	3. Valve jammed	Remove actuator from valve & check operation of valve and actuator.
	4. Actuator jammed	Remove actuator and strip. Check all bushes and pivot points. Check Transfer case for any indication of fowling.
Jerky movement	1. Low air pressure 2. Piston shaft Binding	1. Check air supply. 2. Loosen yoke bolts and retry. If OK tighten bolts evenly.
	2. Piston binding in cylinder	Remove cylinder. Check piston "O" ring for wear, change if necessary. Grease, reassemble and test.

**Appendix 2**

**NYLOK NUT TORQUE FIGURES**

<b>Actuator Size</b>	<b>Nut Size</b>	<b>Torque (Nm)</b>
12	M12	38
25	M16	95
50	M20	185

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**Appendix 3:**

**PARTS IDENTIFICATION FOR DRAWINGS 1-5**

<b>Part No.</b>	<b>Description</b>		<b>Part No.</b>	<b>Description</b>
1	Main Shaft Assembly		29	Bushing Stem
2	End Stop		30	Spring End - Polyurethane
3	Transfer Case Box		31	Spring Button - Bottom
4	Transfer Case Lid		32	Spring Button - Top
5	Bush Main Shaft		33	Tie Bar
6	Cylinder		34	Tension Rod
7	Bolt - Yoke		35	Spring
8	Insert Bush Retainer		36	Tie Bar Nut
9	Bush - Piston Shaft		37	Nut
10	Cap screw		38	Spring Cover
11	Piston Shaft		39	Washer
12	Piston		40	Bolt (Set)
13	Nylok Nut - Piston / Tension Rod		41	"O" ring - Act Stem / Insert Bolt
14	Shaft Pin		42	"O" ring - Piston Stem
15	Connecting Arm		43	"O" ring Piston / Cylinder Cap
16	Bush - Shaft Pin		44	Main Shaft
17	Bush		45	Rocker Plate
18	Lock Nut		46	Bolt (set)
19	Cylinder Cap		47	Spacer Busher
20	Insert Bolt		48	Shaft Pin
21	Cover Ring		49	Washer - Large
22	Circlip - Main shaft		50	Circlip - Cylinder Cap
23	Small Circlip		51	End Cap Retainer
24	Split Pin		52	Bolt (Set)
25	Cap screw - Transfer Case Lid		53	Key - main shaft
26	Star Washer		54	Bush
27	Mounting Bolt		55	Drill Bush
28	Spring Washer		56	End Cap

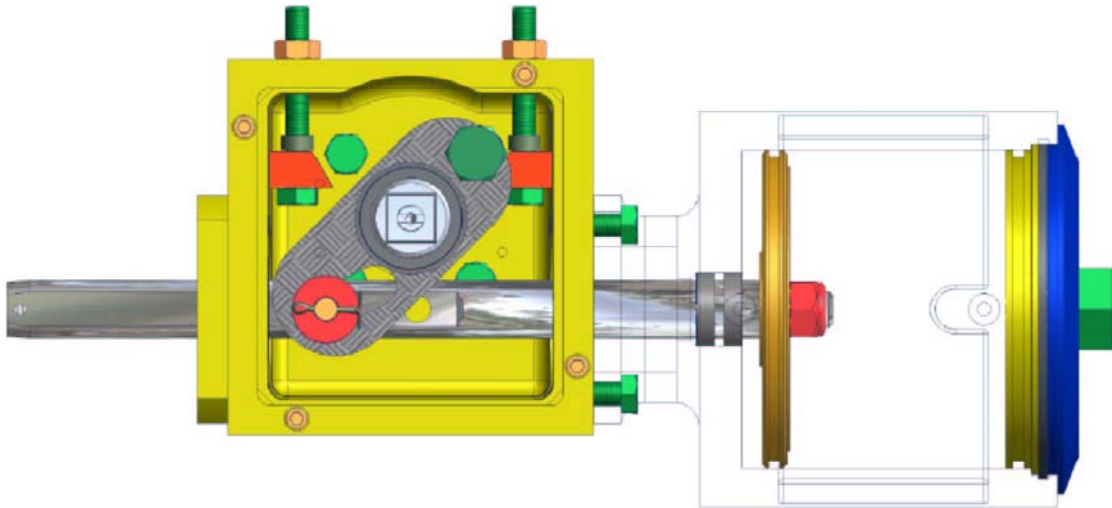
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**Appendix 4:**

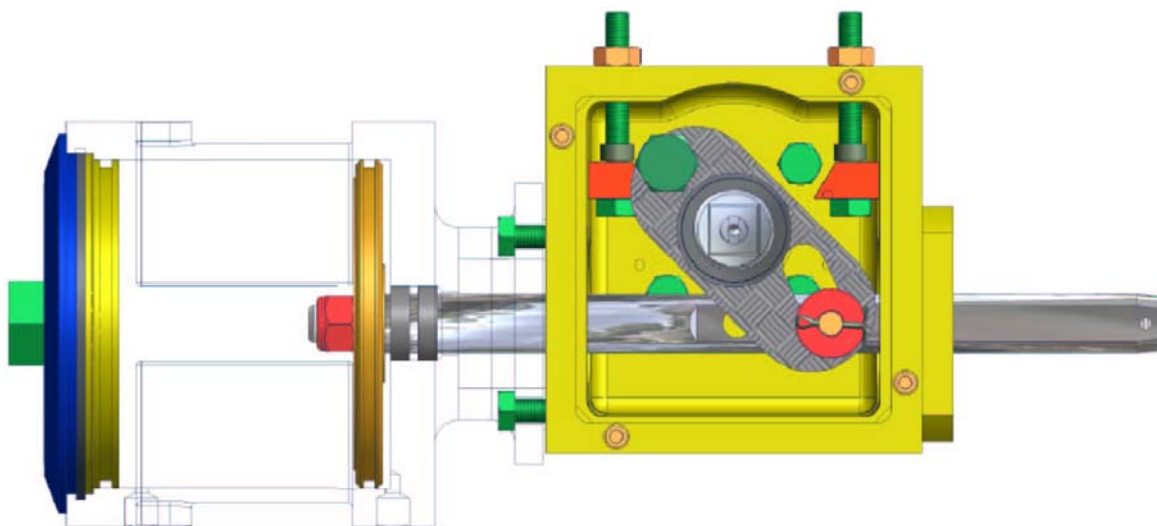
**ROCKER PLATE ORIENTATION**

*(Please note rocker plate slot position)*

**CLOCKWISE TO CLOSE**



Fail Closed – Closed Position



Fail Open – Open Position

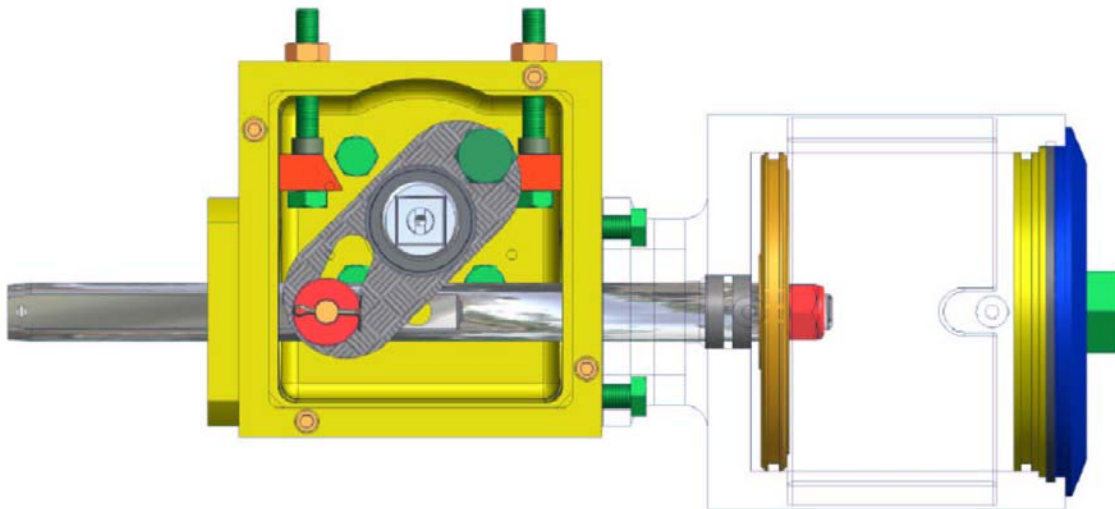
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**Appendix 5:**

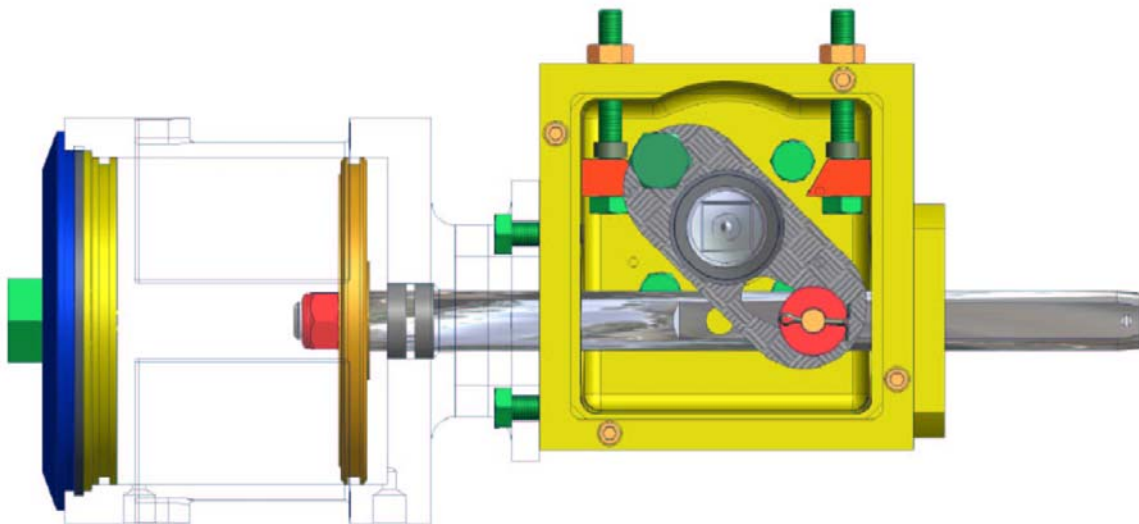
**ROCKER PLATE ORIENTATION**

*(Please note rocker plate slot position)*

**ANTI CLOCKWISE TO CLOSE**



Fail Closed – Closed Position



Fail Open – Open Position