

**ROTARY PNEUMATIC ACTUATOR – STEEL CYLINDER
INSTALLATION & MAINTENANCE MANUAL**

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1. INTRODUCTION

The Mitech actuator is available with either a double crank mechanism for modulating control or a 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 get disassembled / assembled. 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 steel.

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

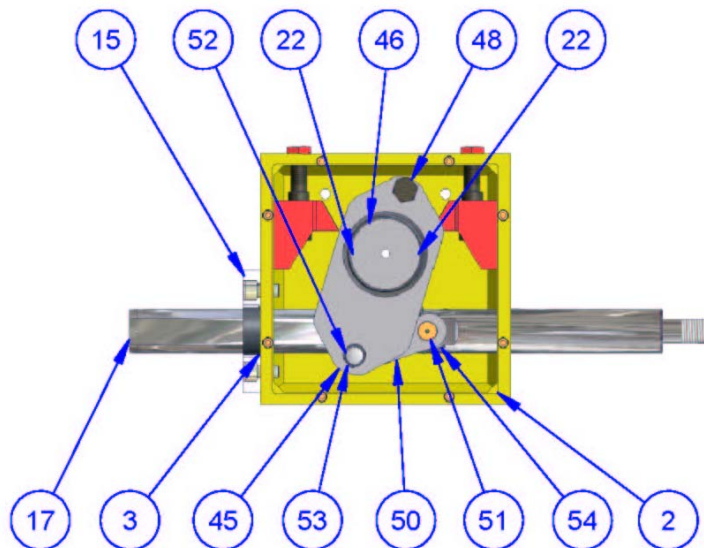
- 2.1. It is important to operate the actuator on a regular basis. If the normal duties do not require the actuator to operate regularly we recommend that a procedure be introduced to stroke the actuator on a weekly basis. The advantage of this is that cylinder lubrication is achieved and any possible problems that may occur are identified before consequential damage can result.
- 2.2. If work is to be carried out on the actuator it is preferable to have the actuator and valve removed from the line.
- 2.3. 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. Remove positioner.
- 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 (37). Release the spring pack tension by unscrewing the central nylok locknut (20). The three tie bars (38) 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 (2).
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.
- 3.1.6. Remove pointer if mounted to the transfer case lid.
- 3.1.7. Remove transfer case lid by unscrewing and removing the cap screws (41).
- 3.1.8. Remove the split pin (54) from the top-connecting arm that holds the shaft pin (51) in position.
- 3.1.9. If the shaft pin is too tight to be removed, loosen yoke bolts (16) to allow movement of the piston shaft (17), and insert a bolt into the tapped hole – tap bolt gently. Remove shaft pin.
- 3.1.10. Carefully withdraw the cylinder with sub assembly after removing the yoke bolts.
- 3.1.11. Remove main shaft (46) and crank arm assembly.
- 3.1.12. Remove the insert bush retainer (11) by removing the cap screws (15)

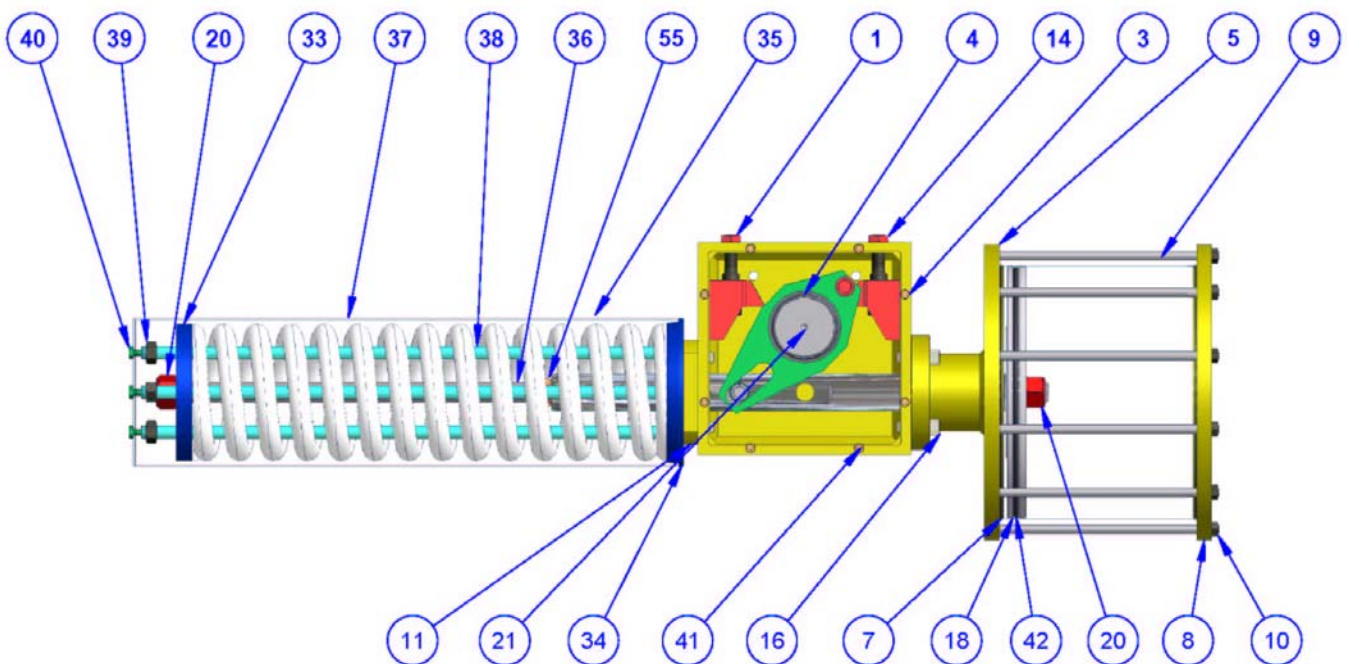


Drawing 1: Transfer Case with Double Crank Mechanism

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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 (37). Release spring pack tension by unscrewing the central nylok locknut (20). The three tie bars (38) 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 by unscrewing and removing the cap screws (41).
- 3.2.8. Remove top main shaft circlip (22) and the bolt (26) holding the two rocker plates (24) together.
- 3.2.9. Remove the split pin (32) then the drill bush (29) and washer (30) off the shaft pin.
- 3.2.10. Lift off top rocker plate (24)
- 3.2.11. Remove the yoke cap screws (16)
- 3.2.12. Disengage the lower Rocker plate (24) by pushing it down.
- 3.2.13. Rotate the piston shaft 180° so that the shaft pin (31) can be removed.
- 3.2.14. Withdraw cylinder sub assembly.
- 3.2.15. Remove main shaft (21).
- 3.2.16. Remove the insert bush retainer (11) by removing the cap screws (15).



Drawing 2: Rotary Actuator with Spring Pack and Scotch Yoke Transfer Case

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3.3. DISASSEMBLY OF CYLINDER

- 3.3.1. Loosen and remove the cylinder tie bar nuts (10).
- 3.3.2. Lift the end plate upper (8) off the cylinder tube (6).
- 3.3.3. Remove the “O” ring (7).
- 3.3.4. Withdraw piston (18) and piston shaft sub -assembly from cylinder. If there is a grub screw in the piston shaft, removed before withdrawing.
- 3.3.5. Loosen piston-retaining nut (20). Taking care not to damage the actuator stem slide the piston of the stem.
- 3.3.6. Remove the cylinder tube (6) and the end plate lower “O” ring (7).
- 3.3.7. Remove stem bushes (only if necessary) and stem “O” ring (13) from the yoke in the lower end plate (5) 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 (42)
 - Flange "O" rings (7)
 - Actuator stem "O" ring (13)
 - Piston Shaft "O" ring (43)
 - Bush - Pivot Pin (49)
 - Bushing in drill bush (27 / 28)
 - Bush - Piston Shaft (44)
 - Bush - Main Shaft (4)
 - Circlip - Pivot pin (52)

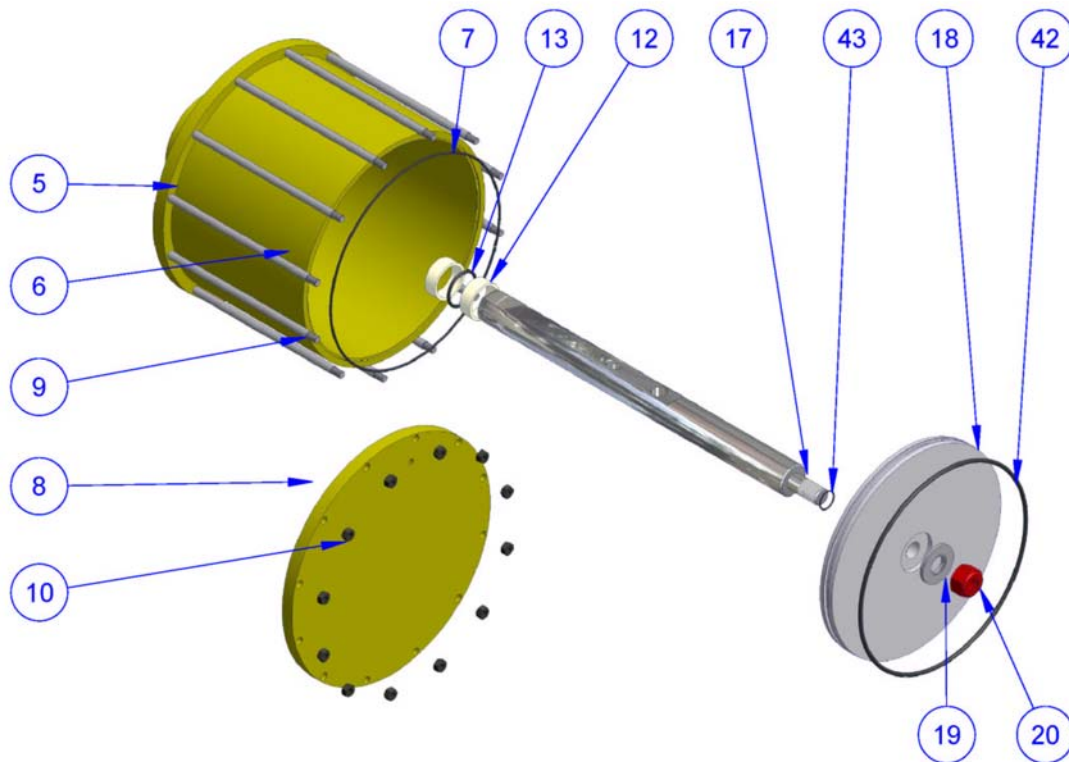
- 5.2. The following parts should be replaced only if necessary: -
 - Pivot Pin (52)
 - Connecting Arm (50)
 - Shaft Pin (31 / 51)
 - Yoke Bushes (12)
 - Rocker Plates (24)
 - Drill Bush – Shaft Pin (29)

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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 (12) 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 (13).
 - 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 piston shaft "O" ring



Drawing 3: Cylinder

- 6.1.3. Hold the piston stem on the flats in a soft jaw vice. Fit the piston stem "O" ring (43) to the thread end of the stem and then slide the piston (18) over the threads onto the "O" ring. Tighten the nylok nut (20) to the correct torque figure for the particular actuator. See appendix 2 for figures.
- 6.1.4. Put a light smear of silicon grease (such as Kluber Poly lub GLY801) on the piston "O" ring (42).

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- 6.1.5. Apply a liberal coating of the same grease to the cylinder bore and piston stem "O" ring in the yoke.
- 6.1.6. Place the end plate lower (5) 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.
- 6.1.7. Replace the end plate lower "O" ring (7) into groove and apply a light coating of silicon grease.
- 6.1.8. At a 45° angle, slide the cylinder tube (6) 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
- 6.1.9. Refit the cylinder tie bars (9).
- 6.1.10. Fit "O" ring (7) in top end flange groove and apply a light coating of silicon grease.
- 6.1.11. Place the end plate upper (8) onto the cylinder tube (6). Ensure that the air port is inline with the lower end plate air port. Between the same tie bars.
- 6.1.12. Replace cylinder tie bar nuts (10) and evenly tighten.
- 6.1.13. Check cylinder operation for full and smooth travel using air at 4.5 to 5-bar pressure.
- 6.1.14. 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.

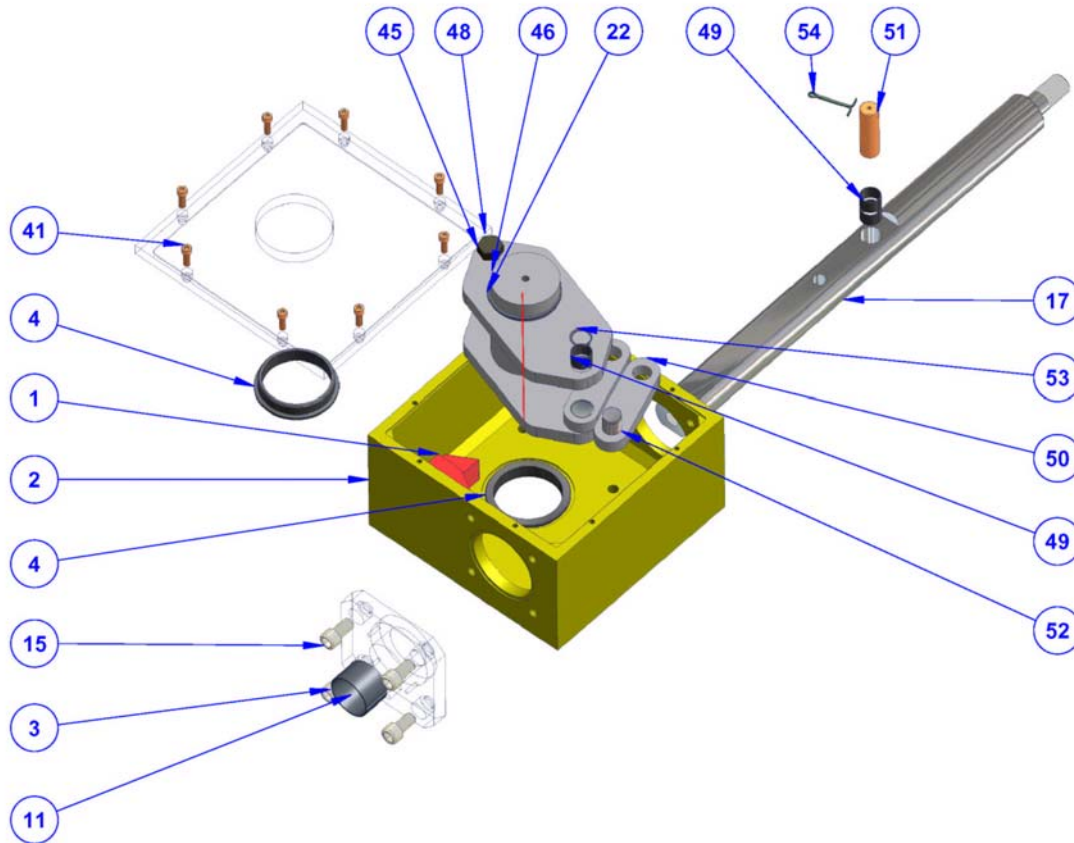
6.2. ASSEMBLY OF TRANSFER CASE – DOUBLE CRANK

- 6.2.1. If the main shaft bushes (4) in the transfer case base and lid are replaced the shoulder of the bush must be on the inside of the transfer case.
- 6.2.2. Assemble the main shaft sub assembly (welded together) into the transfer case box with the connecting arms (50) pointing towards the cylinder side.
- 6.2.3. Insert piston shaft (17) of the cylinder sub-assembly into the transfer case between the connecting arms, until the holes in the connecting arms line up with the upper hole in the piston shaft.
- 6.2.4. Insert shaft pin (51) through both connecting arms and the piston shaft insuring that the threaded hole is at the top.
- 6.2.5. Insert the split pin (54) through the shaft pin and bend the ends outwards.
- 6.2.6. Rotate the cylinder on the actuator stem "O" ring so that the air port are at the top.
- 6.2.7. Fit yoke cap screws (16) and tighten evenly.
- 6.2.8. Replace the transfer case lid and tighten the cap screws (41).
- 6.2.9. Check for smooth operation of the actuator by turning the main shaft (46) with a spanner.
- 6.2.10. Adjust the end stops (1) to achieve a 90-degree movement at right angles to the transfer case. Use a spanner on the main shaft flats. 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.
- 6.2.11. 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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6.2.12. 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.



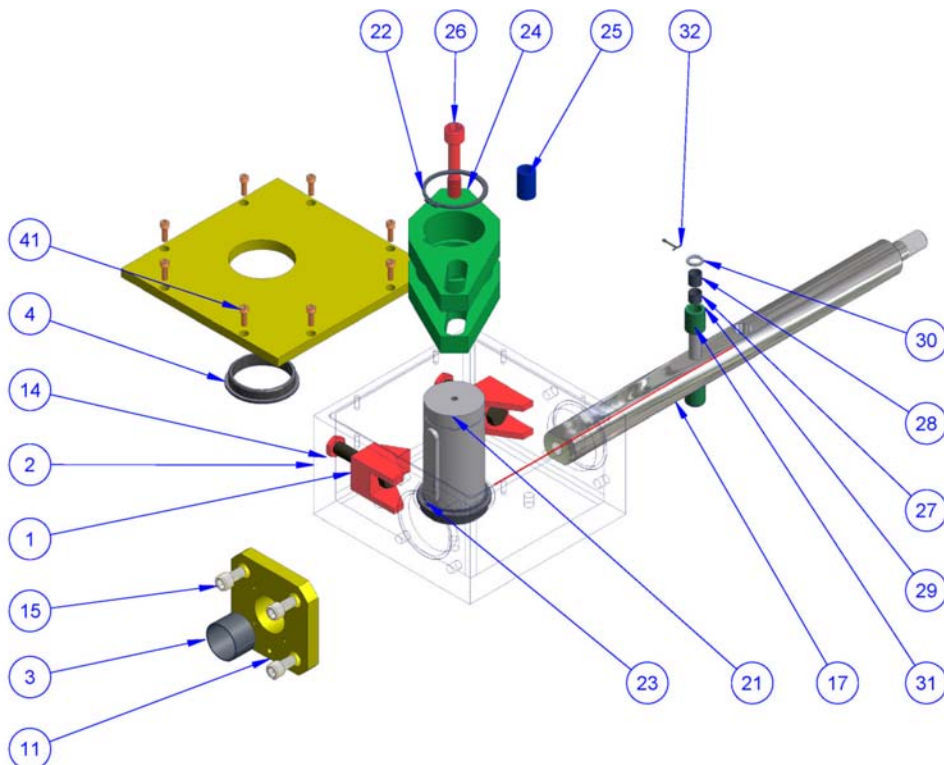
Drawing 4: *Transfer Case with Double Crank Mechanism*

6.3. ASSEMBLY OF TRANSFER CASE - SCOTCH YOKE

- 6.3.1. Check that the drill bushes (29) are not tight in the Rocker Plate (24) slots, and that the rocker plates can fit (slide) over the main shaft (21).
- 6.3.2. Fit the circlip (22) into main shaft lower groove.
- 6.3.3. Press bushes (27 / 28) into the drill bush (31).
- 6.3.4. Position main shaft in transfer case with circlip at the bottom.
- 6.3.5. Fit lower rocker plate (24), the one with the tapped hole, onto the main shaft.
- 6.3.6. 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 Appendix 4 - Rocker Plate Orientation.
- 6.3.7. Take the cylinder sub assembly and insert the piston shaft (17) through the transfer case bush.
- 6.3.8. Insert the shaft pin (31) with one drill bush located against the head of the shaft pin through the small top hole in the piston shaft. Leave the bottom rocker plate disengaged from the keyway. Rotate the Piston shaft 180° so

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- that the head of the shaft pin with the drill bush is resting against the lower Rocker plate.
- 6.3.9. Position the top rocker plate over the shaft pin, fit the top drill bush with the washer (30) and split pin (32).
 - 6.3.10. Manoeuvre the lower rocker plate to engage the key (23) on the main shaft and the lower drill bush inside the lower rocker plate slot. Position spacer (25) between the rocker plates and fit and tighten the cap screw (26).
 - 6.3.11. Apply a liberal coating of grease to the rocker plate slots.
 - 6.3.12. Fit yoke bolts and tighten evenly. Check to ensure smooth operation by fitting lid and operating the actuator by turning the main shaft (21) with a spanner. Check that all cap screws (41) are fitted in transfer case lid and tightened.
 - 6.3.13. Adjust the end stops (1) to achieve a 90-degree movement at right angles to the transfer case. Use a spanner on the main shaft flats. 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
 - 6.3.14. If pointer is to be used, insert "O" ring in groove in pointer and fit pointer in correct position. Tighten centre bolt in pointer.
 - 6.3.15. 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 (11) and tighten onto the transfer case with cap screws (15). Replace the bush (3)
- 6.4.2. Screw tension rod (36) into piston shaft (17) and lock with nut (55).
- 6.4.3. Slide bottom spring end (34), over tension rod and piston shaft.
- 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 (20) 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 tube (37) over the spring and seat in bottom spring end.
- 6.4.7. Check for clearance all round between cover and spring.
- 6.4.8. Secure with 3 bolts (40) using plain washers 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 (14) on the end stop (1).
- 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 locknut.
- 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

PROBLEM	POSSIBLE CAUSE	ACTION
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

Cylinder Size	Nut Size	Torque (Nm)
100R	M24	320
100S	M30	633
200	M30	633
300	M36	1110

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Appendix 3:

PARTS IDENTIFICATION FOR DRAWINGS 1-5

Parts No.	Description	Parts No.	Description
1	End Stop	29	Drill Bush - Shaft Pin
2	Transfer Case	30	Washer - Shaft Pin
3	Bush - Insert Bush Retainer	31	Shaft Pin
4	Bush Main Shaft	32	Split Pin
5	End Plate Lower	33	Spring Button - Top
6	Cylinder Tube	34	Spring Button - Bottom
7	O" Ring - Flange	35	Spring
8	End Plate Upper	36	Tension Rod
9	Tie Bar - Cylinder	37	Spring Cover
10	Tie Bar Nut	38	Tie Bar - Spring pack
11	Insert Bush Retainer	39	Tie Bar Nut
12	Bushing Stem	40	Bolt Set - Spring Pack
13	"O" ring - Act Stem	41	Cap screw - Transfer Case Lid
14	Lock Nut	42	"O" ring Piston
15	Cap screw - Insert Bush Retainer	43	"O" ring - Piston Stem
16	Cap screw - Yoke	44	Bush Long - Spring Pack
17	Piston Shaft	45	Rocker Plate
18	Piston	46	Main Shaft Assembly
19	Piston Support Washer	47	Spacer Bush
20	Nylok Nut - Piston / Tension Rod	48	Bolt Modified
21	Main Shaft	49	Bush - Pivot Pin
22	Circlip - Main shaft	50	Connecting Arm
23	Key - main shaft	51	Shaft Pin
24	Rocker Plate	52	Pivot Pin
25	Spacer Bush	53	Small Circlip
26	Cap screw - Rocker Plate	54	Split Pin
27	Bush - shaft pin short	55	Nut
28	Bush - shaft pin long		

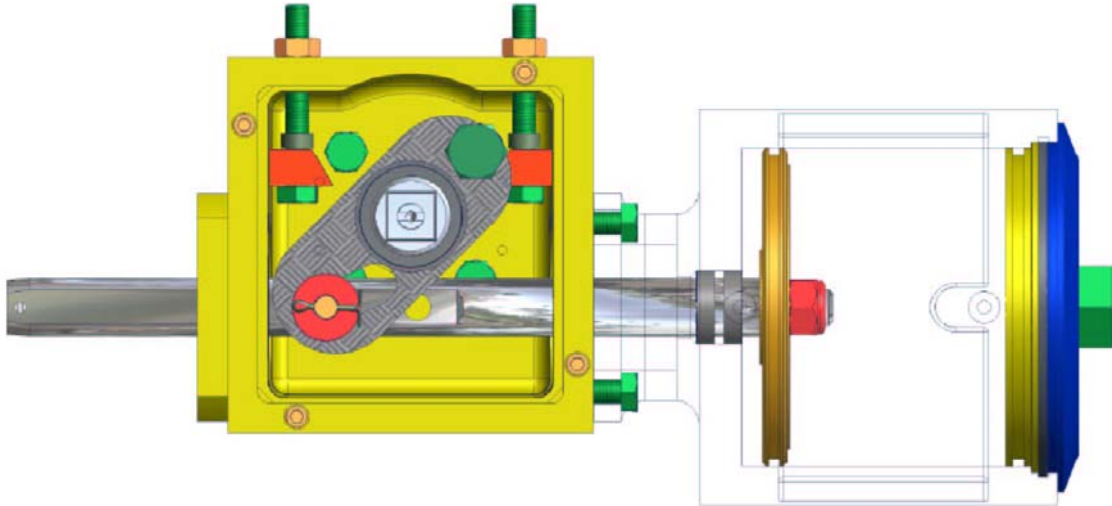
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Appendix 4:

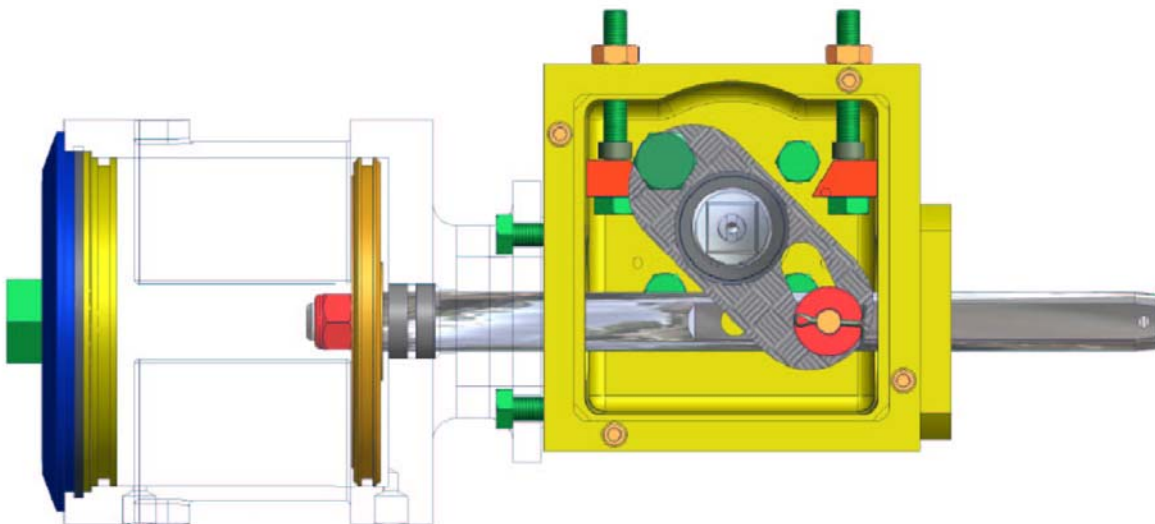
ROCKER PLATE ORIENTATION

(Please note rocker plate slot position)

CLOCKWISE TO CLOSE



Fail Closed – Closed Position



Fail Open – Open Position

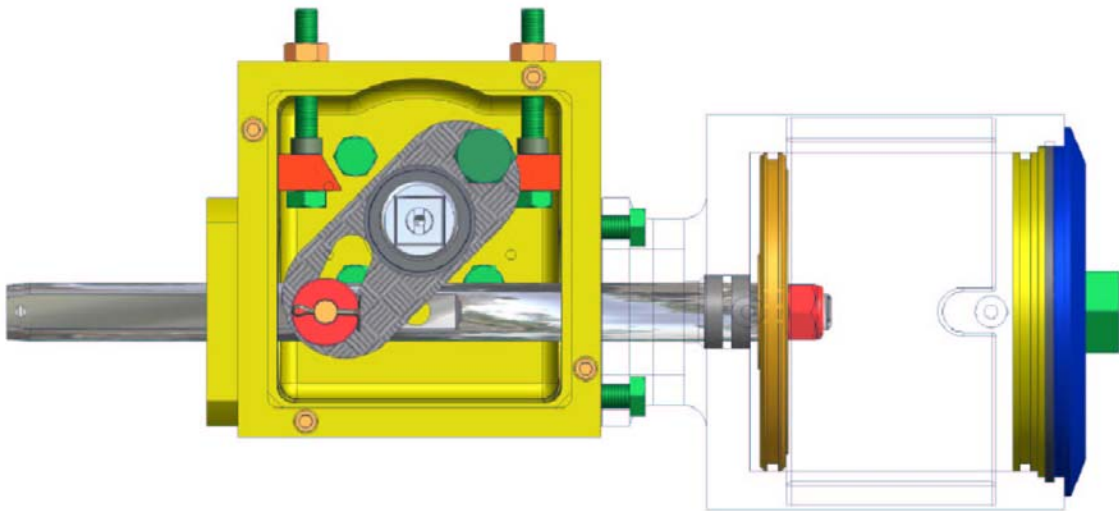
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Appendix 5:

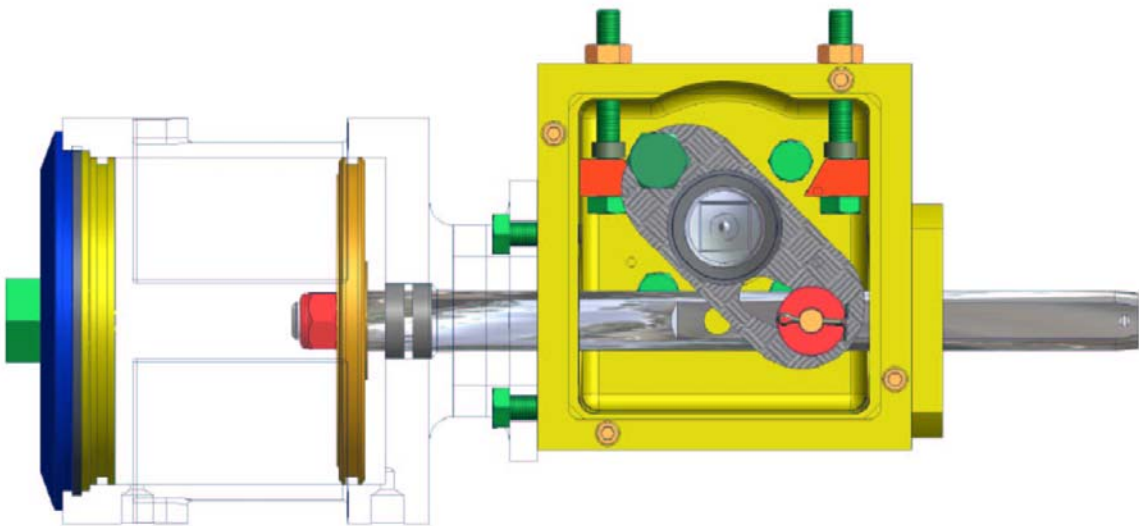
ROCKER PLATE ORIENTATION

(Please note rocker plate slot position)

ANTI CLOCKWISE TO CLOSE



Fail Closed – Closed Position



Fail Open – Open Position