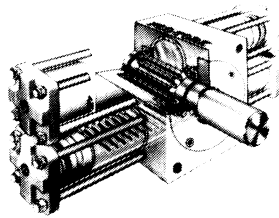
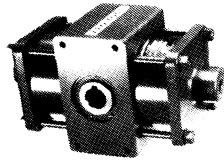




FLO-TORK®



FS105
August 2004

MAINTENANCE INSTRUCTIONS **SERVICE** Hydraulic Rotary Actuators MODELS 900 THROUGH 30,000

FLO-TORK, INC.
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MAINTENANCE INSTRUCTIONS

MAXIMUM OPERATING PRESSURE – 3000 psi NON-SHOCK

KEY CONSIDERATION IN THE DISASSEMBLY OF THE UNIT IS DETERMINING THE PINION SHAFT KEYWAY RELATIONSHIP TO THE RACK POSITION TO MAINTAIN PROPER TIMING AT RE-ASSEMBLY

NOTE: STANDARD UNITS ARE TIMED WITH THE PINION SHAFT KEYWAY AT 12 O'CLOCK WHEN LOOKING AT THE BEARING CAP SIDE, AS SHOWN ON THE ENCLOSED TYPICAL DRAWING

GENERAL

FLO-TORK ROTARY ACTUATORS REQUIRE CLEAN, FILTERED HYDRAULIC OIL FOR SATISFACTORY OPERATION THE SAME AS ANY OTHER HYDRAULIC COMPONENT. THE STANDARD BUNA-N SEALS ARE DESIGNED FOR PETROLEUM BASE FLUIDS. DURING RE-ASSEMBLY, TORQUE ALL BOLTS IN ACCORDANCE WITH TORQUE TABLE.

DISASSEMBLY

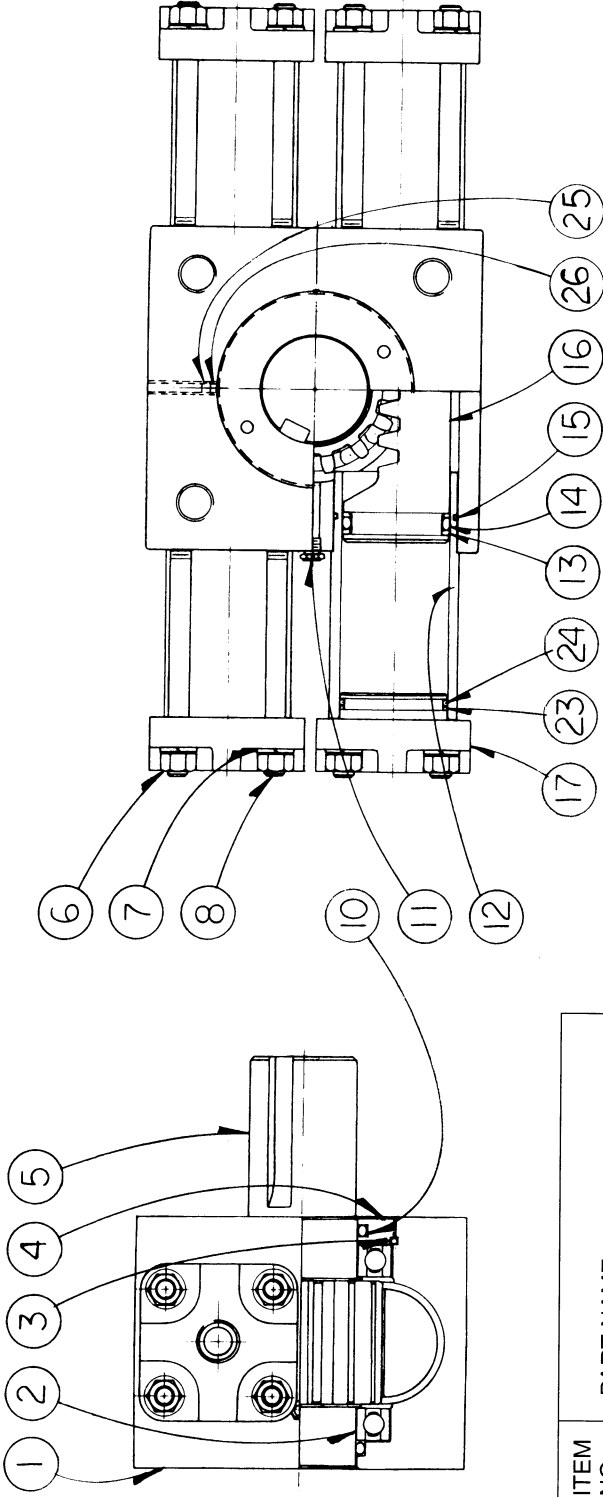
1. Remove all cylinder head tie bolts/tie rods.
2. Remove cylinder heads.
3. Determine that the rack is at mid-point of travel (Equal amounts of rack extended on each side of housing.) Note and record pinion shaft keyway location for re-assembly.
4. Back off the bearing cap set screw. Using a spanner wrench, unscrew the threaded bearing cap from the housing.
5. Remove O-ring from housing.
6. Pull pinion from the housing with the bearing on it. (NOTE: Place unit over a pan or tub before doing this as the unit is filled with gear lubricating oil which will drain from the housing when the pinion is removed.)
7. Remove the cylinder tubes.
8. Remove the piston/rack(s).
9. Remove the back bearing from the housing (if necessary).
10. Remove all remaining O-rings and seals. Replace with new O-rings and seals at re-assembly.
11. Thoroughly clean and inspect all parts for wear or damage. Replace with new parts as required. Lubricate with light oil before re-assembly.

RE-ASSEMBLY

1. Install new O-rings, back-up rings and seals in proper grooves (see drawing).
2. Install back bearing in housing.
3. Slide a cylinder tube over one end of the piston/rack assembly. If it is a double rack unit, slide a cylinder tube over one end of the second piston/rack assembly.
4. Slide piston/rack assembly and cylinder tube into the housing. If it is a double rack unit, slide both piston/rack assemblies and cylinder tubes into the same side of the housing.
5. Attach cylinder head(s) and bolts. Snug bolts up but do not torque until re-assembly is complete.
6. Center rack in housing. (Equal spacing of rack on both sides of housing.)
7. Install pinion with the shaft keyway location as noted during disassembly. (Standard unit timing will have keyway at 12 o'clock location when looking at the front mounting face.)
8. Install cylinder tube(s) on the other side of housing.
9. Attach cylinder head(s) and bolts. Snug bolts up but do not torque until re-assembly is complete.
10. Lay unit down and fill housing to top of the rack with ISO grade 68 gear oil or other equivalent gear lubricant.
11. Install front pinion bearing and O-ring.
12. Install bearing cap. Tighten bearing cap until snug, then further tighten slightly to insure a positive seal.
13. Insert nylon locking pellet in bearing cap set screw hole. Tighten set screw locking bearing cap.
14. Torque cylinder head bolts evenly by applying force alternately to opposite corners of the head. Torque values per bolt size are shown in the torque table.

| MODEL NO. | FASTENER SIZE | RECOMMENDED TORQUE FOR CYLINDER HEAD BOLTS |
|-----------------|---------------|--------------------------------------------|
| 900 & 1800 | 1/4 - 20 | 6 ft-lbs |
| 3700 & 7500 | 5/16 - 18 | 12 ft-lbs |
| 15,000 & 30,000 | 7/16 - 14 | 22 ft-lbs |

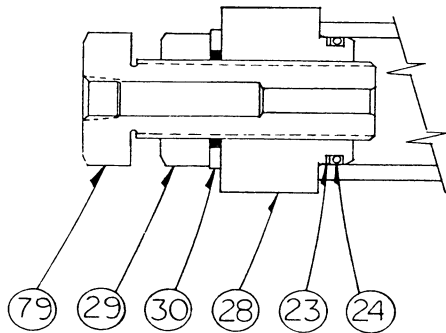
STANDARD MODELS
900 THROUGH 30,000



| ITEM NO. | PART NAME |
|----------|--------------------------|
| 1 | HOUSING |
| 2 | BEARING |
| 3 | O-RING, BEARING CAP |
| 4 | BEARING CAP |
| 5 | PINION |
| 6 | NUT, TIE ROD |
| 7 | LOCKWASHER, TIE ROD |
| 8 | TIE ROD |
| 10 | O-RING, PINION |
| 11 | RELIEF VALVE |
| 12 | CYLINDER TUBE |
| 13 | PISTON - BACK-UP RING |
| 14 | SEAL, PISTON |
| 15 | O-RING, CYL. O.D. |
| 16 | PISTON RACK |
| 17 | CYLINDER HEAD |
| 23 | BACK UP, CYL. HD. |
| 24 | O-RING, CYL. HD. |
| 25 | SET SCREW-BEARING CAP |
| 26 | NYLON PELLET-BEARING CAP |

ALWAYS USE SERIAL NUMBERS AND MODEL NUMBERS WHEN ORDERING PARTS.

0° TO 30° EXTERNAL ADJUSTABLE STOPS (MODELS 900-7500)



| ITEM NO. | PART NAME | QUANTITY |
|----------|----------------------------|----------|
| 23 | BACK UP, CYL. HD. | 1 |
| 24 | O-RING, CYL. HD. | 1 |
| 28 | EXTERNAL ADJUSTOR CYL. HD. | 1 |
| 29 | JAM NUT | 1 |
| 30 | THREAD SEAL | 1 |
| 79 | CUSHION-EXT. ADJ.-FIXED | 1 |

DISASSEMBLY – 0° TO 30° EXTERNAL ADJUSTABLE STOP

1. Loosen jam nut, washer (3700/7500) and thread seal. Screw adjustor out of cylinder head. Remove thread seal, washer (3700/7500) and jam nut.
2. Thoroughly clean and inspect all parts for wear or damage. Replace with new parts as required.

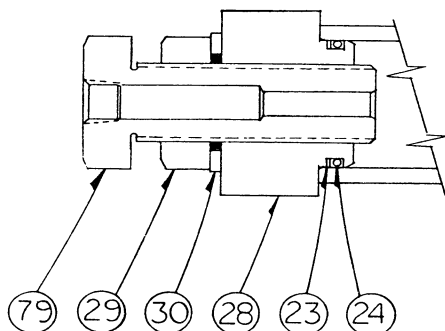
RE-ASSEMBLY - 0° TO 30° EXTERNAL ADJUSTABLE STOPS

1. Install jam nut, washer (3700/7500) and thread seal on adjuster.
2. Screw adjustor into the cylinder head. Thread into head until the adjustor is flush with the inside of the cylinder head (Approx. 6-7 turns).

Adjust rotation at test. Turning adjustor clockwise reduces rotation, counter-clockwise increases rotation.

NOTE: ADJUSTMENTS SHOULD NOT BE DONE WHILE UNIT IS UNDER PRESSURE. FOR DUAL RACK UNITS, BOTH ADJUSTORS AT EACH END OF STROKE MUST BE SET EQUALLY SO THAT END OF STROKE LOAD IS EQUALLY ABSORBED BY (2) CYLINDER HEADS.

0° TO 30° EXTERNAL ADJUSTABLE STOPS (MODELS 15,000 & 30,000)



| ITEM NO. | PART NAME | QUANTITY |
|----------|----------------------------|----------|
| 23 | BACK UP RING, CYL. HD. | 1 |
| 24 | O-RING, CYL. HD. | 1 |
| 28 | EXTERNAL ADJUSTOR CYL. HD. | 1 |
| 29 | JAM NUT | 1 |
| 79 | EXT. ADJ.-FIXED CUSHION | 1 |

DISASSEMBLY – 0° TO 30° EXTERNAL ADJUSTABLE STOPS

NOTE: CYLINDER HEAD MUST BE REMOVED FROM THE CYLINDER TUBE BEFORE DISASSEMBLY.

1. Remove jam nut.
2. Screw adjustor out of the cylinder head. Remove O-ring and back-up ring from adjustor head.
3. Thoroughly clean and inspect all parts for wear or damage. Replace with new parts as required.

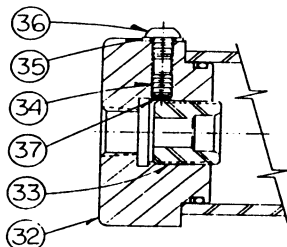
RE-ASSEMBLY – 0° TO 30° EXTERNAL ADJUSTABLE STOPS

NOTE: MUST BE RE-ASSEMBLED BEFORE CYLINDER HEAD IS MOUNTED TO CYLINDER TUBE.

1. Install new back-up ring and O-ring on adjustor head making sure the flat of the back-up ring is on the cylinder head side of the seal groove and the curved side is toward the O-ring and cylinder tube side. Make sure the O-ring is installed in the curved portion of the back-up ring.
2. Screw adjustor into the cylinder head from inside of the cylinder head. Screw adjustor all the way in so that rotation can be adjusted at test.
3. Adjust rotation at test. Turning adjustor clockwise reduces rotation, counter-clockwise increases rotation.
4. Tighten jam nut.

NOTE: ADJUSTMENT SHOULD NOT BE DONE WHILE UNIT IS UNDER PRESSURE. FOR DUAL RACK UNITS, BOTH ADJUSTORS AT EACH END OF STROKE MUST BE SET EQUALLY SO THAT END OF STROKE LOAD IS EQUALLY ABSORBED BY (2) CYLINDER HEADS.

0° TO 5° INTERNAL ADJUSTABLE STOPS (MODELS 3700-30,000)



| ITEM NO. | PART NAME | QUANTITY |
|----------|-----------------------------|----------|
| 32 | INTERNAL ADJUSTOR-CYL. HD. | 1 |
| 33 | 0° TO 5° INTERNAL ADJ. STOP | 1 |
| 34 | SET SCREW-ADJ. STOP | 1 |
| 35 | THREAD SEAL-COVER SCREW | 1 |
| 36 | COVER SCREW | 1 |
| 37 | NYLON LOCKING PELLET | 1 |

DISASSEMBLY – 0° TO 30° EXTERNAL ADJUSTABLE STOPS

1. Remove cover screw and cover screw seal.
2. Loosen the adjustable stop-set screw.
3. With cylinder head removed from cylinder tube the adjustor can be removed by screwing out towards the inside of the cylinder head with a hex wrench.
4. Remove nylon pellet and inspect for wear and damage. Replace with new pellet if required.

RE-ASSEMBLY - 0° TO 5° INTERNAL ADJUSTABLE STOPS

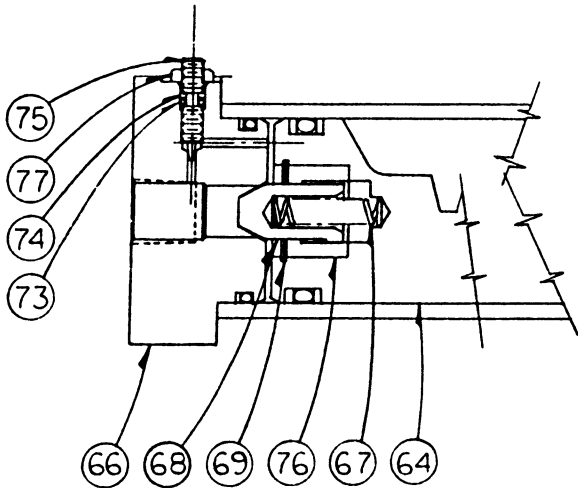
NOTE: MUST BE RE-ASSEMBLED BEFORE CYLINDER HEAD IS MOUNTED TO CYLINDER TUBE.

1. Screw adjustor into cylinder head from inside of cylinder head face. Screw adjustor in until flush or below the surface of the cylinder head so that rotation can be adjusted at test.
2. Install nylon pellet and set screw but do not tighten until adjustment is set.
3. Adjust rotation at test. Turning adjustor clockwise reduces rotation, counter-clockwise increases rotation.
4. When adjustment is complete, tighten set screw to lock position.
5. Install cover screw seal and cover screw.

NOTE: ADJUSTMENTS SHOULD NOT BE MADE WHILE UNIT IS UNDER PRESSURE. FOR DUAL RACK UNITS, BOTH ADJUSTORS AT EACH END OF STROKE MUST BE SET EQUALLY SO THAT END OF STROKE LOAD IS EQUALLY ABSORBED BY (2) CYLINDER HEADS.

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CUSHION DETAILS MODEL 900 THROUGH 30,000



| PART NO. | PART NAME | QUANTITY |
|----------|-----------------------------|----------|
| 64 | CUSHION PISTON RACK | 1 |
| 66 | CUSHION CYL. HD.-ADJUSTABLE | 1 |
| 67 | COMPRESSION SPRING | 1 |
| 68 | CUSHION CHECK | 1 |
| 69 | RETAINING RING | 1 |
| 73 | O-RING – CUSHION NEEDLE | 1 |
| 74 | BACK-UP RING-CUSHION NEEDLE | 1 |
| 75 | CUSHION NEEDLE | 1 |
| 76 | CUSHION CHECK RETAINER | 1 |
| 77 | JAM NUT | 1 |

DISASSEMBLY – ADJUSTABLE CUSHIONS

NOTE: DO NOT REMOVE CUSHION NEEDLE WHILE UNIT IS UNDER PRESSURE.

1. Remove cushion needle jam nut and cushion needle from cylinder head.
2. Remove O-ring and back-up ring. Replace with new parts during re-assembly.
3. Remove cylinder head.
4. Remove cushion check retaining ring from piston rack.
5. Remove cushion check retainer, cushion check and compression spring from piston rack.
6. Thoroughly clean and inspect all parts for wear or damage, replace parts as required.

RE-ASSEMBLY - ADJUSTABLE CUSHIONS

1. Install compression spring, cushion check, and cushion check retainer in piston rack.
2. Secure in place with the retaining ring.
3. Install new back-up ring on cushion needle making sure that the curved side faces toward the needle end.
4. Install a new O-ring on the cushion needle making sure that the O-ring fits into the curved side of the back-up ring.
5. Re-install cylinder head.
6. Insert the cushion needle in the cylinder head, being careful not to damage the seals. Tighten as far as possible, then loosen 1/2 turn. Install jam nut. Adjust cushion at test.

CUSHION ADJUSTMENT

NOTE: DO NOT ADJUST WHILE UNIT IS UNDER PRESSURE.

1. The control needles of the cushion are installed and locked 1 1/2 turns from closed when assembled at the factory to prevent premature damaging of the actuator during installation and start-up.
2. Increase cushioning – loosen cushion needle jam nut 1/2 to 1 turn. Turn cushion needle clockwise 1/8 turn. Lock jam nut and check cushion action.

NOTE: NEVER COMPLETELY CLOSE CUSHION NEEDLES.

3. Decrease cushioning – loosen cushion needle jam nut 1/2 to 1 turn. Turn cushion needle counter-clockwise 1/8 turn. Lock jam nut and check cushion action.

NOTE: CAUTION IS TO BE TAKEN WHEN ADJUSTING THE CUSHION NEEDLE THAT IT HAS ADEQUATE THREAD ENGAGEMENT AND WILL NOT BLOW OUT OF HOLE.

4. Continue adjusting cushion needles in the above described manner until the desired cushioning effect is obtained.

SEAL LEAKAGE

FLO-TORK ROTARY ACTUATORS MAY BE CHECKED FOR PISTON SEAL LEAKAGE AS FOLLOWS:

1. SET UP ACTUATOR WITH RELIEF FITTING UP.
2. PRESSURIZE CYLINDER PORTS INDIVIDUALLY.
3. IF OIL FLOWS FROM RELIEF PORT AFTER PISTON RACK HAS COMPLETED IT'S TRAVEL AND SET 3 MINUTES UNDER PRESSURE, ALL PISTON SEALS SHOULD BE REPLACED.

FOR FURTHER MAINTENANCE INFORMATION CONTACT YOUR NEAREST FLO-TORK REPRESENTATIVE OR
FLO-TORK, INC., ORRVILLE, OHIO 44667

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