**MAINTENANCE INSTRUCTIONS - P SERIES ROTARY ACTUATORS****MAXIMUM OPERATING PRESSURE: AIR - 125 psig****DISASSEMBLY**

1. Disconnect air lines and be sure the actuator is not under pressure.
  2. Remove the actuator from its mounting within the system.
  3. Place the actuator in a vise.
  4. **MODELS P300 THROUGH P2000**
    - A. Remove cylinder head bolts and lockwashers.
    - B. Remove cylinder heads by pulling from housing.**MODELS P4000 THROUGH P10,000**

For normal maintenance it may not be necessary to replace the cylinder head seals. It is suggested the cylinder head be checked for sealing tightness and if the cylinder head seals need to be replaced use the procedure described in Appendix A.

    - A. Using a strap wrench, unscrew the cylinder tubes from the housing by turning counter-clockwise.
    - B. After the cylinder tube threads have been disengaged, pull straight out on the cylinder tube until it is clear of the piston seal.
  5. Record the orientation of the piston rack assemblies (i.e., left piston/rack on top or beneath pinion).
  6. Remove the pinion shaft retainer ring (snap ring).
  7. Remove the pinion and bearing (retainer ring side) by laying the actuator (retainer ring side) down and pulling down on the pinion while tapping gently on the pinion with a mallet.
  8. Tap out the back bearing (opposite the retainer ring side) in a similar manner.
  9. Remove all seals. DO NOT reuse seals. Replace with new at re-assembly.
  10. Thoroughly clean all parts, inspect for wear or damage and replace as required.
9. Standard Rotation (Counter-Clockwise) Timing
    - 94° unit - Position pinion keyway so it is pointed at the mounting hole in the lower left position (7 o'clock) of the housing face.
    - 184° unit - Position the pinion keyway so it is pointed at the mounting hole in the lower right hand position (5 o'clock) of the housing face.
  10. Orient the racks in the same position as was recorded during disassembly.

**NOTE:** When the actuator is positioned with the retainer ring side of the pinion facing up and the housing side port facing away, the rack closest to you should have the piston to your right and the rack farthest from you should have the piston to your left for standard (counter-clockwise) rotation.
  11. **MODELS P300 THROUGH P2000**
    - A. Start the racks into the housing, one from each end. Be sure the racks start together. Push in until the piston faces are flush with the housing.
    - B. If both are flush, then push in the remainder of the way. If one is flush and the other is not - remove the racks, reposition racks evenly and try again.**MODELS P4000 THROUGH P10,000**
    - A. Start the racks into the housing, one from each end. Be sure the racks start together. Push in until the racks bottom out against each other.
    - B. If both racks have not bottomed out - remove the racks, reposition racks and pinion and try again.
  12. Timing is correct if the pinion keyway is at the 12 o'clock high position when the racks are completely depressed into the housing. If the keyway is out of position - Remove racks, reposition pinion (adjusting slightly one way or the other) depending on which direction you are off from 12 o'clock and try racks again. Do this until you obtain the 12 o'clock high keyway position as noted above.

**NOTE:** For clockwise rotation: Invert the racks from that shown in the drawing, and interchange the 5 o'clock and 7 o'clock positions described in Step 9. Proceed with re-assembly as described in steps 10, 11, and 12.
  13. **MODELS P300 THROUGH P2000**
    - A. Install the small O-ring port seals on each end of the housing.
    - B. Install the O-ring seals in the cylinder heads.
    - C. Select the cylinder head that has the side port and install it on the left end of the housing (i.e., pinion retaining ring up and body side port facing away). Be sure the cross-port hole in the housing is aligned with the cross-port hole in the cylinder head.
    - D. Install the other cylinder head (no port) on the right end of the housing making sure the cross-port opening matches up with the cross-port opening in the housing.
    - E. Install and tighten cylinder head lockwashers and bolts. Torque alternately and evenly to 4 to 6 ft. lbs.**MODELS P4000 THROUGH P10,000**
    - A. Slide cylinder tubes over rack/piston, being careful not to damage the piston seals.
    - B. Slide cylinder tubes into the housing until they bottom out against the housing and tighten with a strap wrench.

**RE-ASSEMBLY**

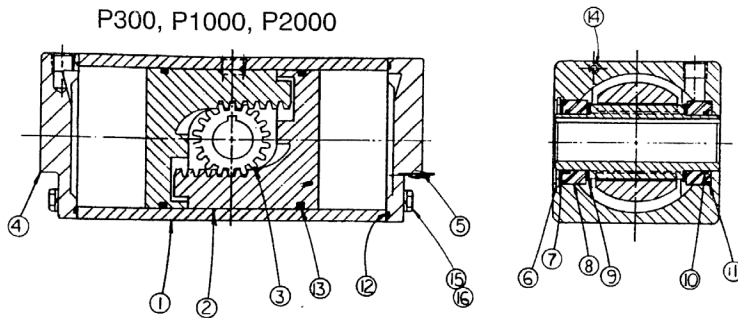
1. Position the actuator housing in a vise so the retainer ring groove is up and the threaded side port is on the side facing away from you.
  2. Lightly lubricate all the new seals with Grade 2 grease or oil.
  3. Install seals as shown in drawings.

**NOTE:** Install the back (side opposite the retainer ring groove) bearing O.D. seal in the housing and the I.D. seal in the bearing before installing the back bearing in the housing.
  4. Install the back bearing (opposite the retainer ring groove) in the housing and check it seals properly (tap lightly).
  5. Grease pinion journals and teeth with Grade 2 grease.
  6. Install pinion in the back bearing.
  7. Install the retainer ring side bearing, making sure both the I.D. and O.D. seals are in their respective grooves. Check to ensure the retainer ring groove is completely exposed above the bearing.
  8. Install the retainer ring (snap ring) to secure the pinion and bearings in place. Check to make sure the retainer ring is properly seated in its groove.
9. Standard Rotation (Counter-Clockwise) Timing
    - 94° unit - Position pinion keyway so it is pointed at the mounting hole in the lower left position (7 o'clock) of the housing face.
    - 184° unit - Position the pinion keyway so it is pointed at the mounting hole in the lower right hand position (5 o'clock) of the housing face.
  10. Orient the racks in the same position as was recorded during disassembly.

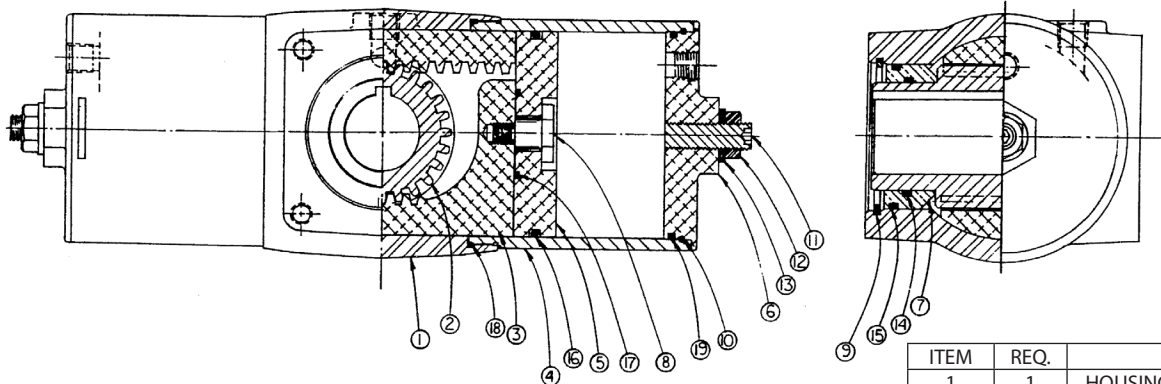
**NOTE:** When the actuator is positioned with the retainer ring side of the pinion facing up and the housing side port facing away, the rack closest to you should have the piston to your right and the rack farthest from you should have the piston to your left for standard (counter-clockwise) rotation.
  11. **MODELS P300 THROUGH P2000**
    - A. Start the racks into the housing, one from each end. Be sure the racks start together. Push in until the piston faces are flush with the housing.
    - B. If both are flush, then push in the remainder of the way. If one is flush and the other is not - remove the racks, reposition racks evenly and try again.**MODELS P4000 THROUGH P10,000**
    - A. Start the racks into the housing, one from each end. Be sure the racks start together. Push in until the racks bottom out against each other.
    - B. If both racks have not bottomed out - remove the racks, reposition racks and pinion and try again.
  12. Timing is correct if the pinion keyway is at the 12 o'clock high position when the racks are completely depressed into the housing. If the keyway is out of position - Remove racks, reposition pinion (adjusting slightly one way or the other) depending on which direction you are off from 12 o'clock and try racks again. Do this until you obtain the 12 o'clock high keyway position as noted above.

**NOTE:** For clockwise rotation: Invert the racks from that shown in the drawing, and interchange the 5 o'clock and 7 o'clock positions described in Step 9. Proceed with re-assembly as described in steps 10, 11, and 12.
  13. **MODELS P300 THROUGH P2000**
    - A. Install the small O-ring port seals on each end of the housing.
    - B. Install the O-ring seals in the cylinder heads.
    - C. Select the cylinder head that has the side port and install it on the left end of the housing (i.e., pinion retaining ring up and body side port facing away). Be sure the cross-port hole in the housing is aligned with the cross-port hole in the cylinder head.
    - D. Install the other cylinder head (no port) on the right end of the housing making sure the cross-port opening matches up with the cross-port opening in the housing.
    - E. Install and tighten cylinder head lockwashers and bolts. Torque alternately and evenly to 4 to 6 ft. lbs.**MODELS P4000 THROUGH P10,000**
    - A. Slide cylinder tubes over rack/piston, being careful not to damage the piston seals.
    - B. Slide cylinder tubes into the housing until they bottom out against the housing and tighten with a strap wrench.

P300, P1000, P2000



P4000 thru P10,000



ITEM	REQ.	PART NAME
1	1	HOUSING
2	2	PISTON RACK
3	1	PINION
4	1	L.H. CYLINDER HEADS
5	1	R.H. CYLINDER HEADS
6	1	RETAINER RING BRG.
7	1	SEAL WASHER
8	2	BEARINGS
9	2	THRUST WASHER
10	2	O-RING - PINION
11	2	O-RING - BEARING
12	2	O-RING - END CAP
13	2	O-RING - PISTON RACK
14	2	O-RING - BODY PORTS
15	8	BOLTS - CYLINDER HEAD
16	8	LOCK WASHERS - END CAPS

ITEM	REQ.	PART NAME
1	1	HOUSING
2	1	PINION
3	2	RACK
4	2	CYLINDER TUBE
5	2	PISTON
6	2	CYLINDER HEAD - ADJUSTOR
7	2	SLEEVE BEARING
8	2	HEX SHOULDER BOLT
9	2	RETAINING RING - BEARING
10	2	KEY WIRE - CYLINDER HEAD
11	2	ADJUSTOR SCREW
12	2	LOCKNUT - ADJUSTOR
13	2	THREAD SEAL - ADJUSTOR
14	2	O-RING - PINION
15	2	O-RING - BEARING
16	2	O-RING - PISTON O.D.
17	2	O-RING - PISTON
18	2	O-RING - CYLINDER
19	2	O-RING - CYLINDER HEAD

## APPENDIX A - REPLACING CYLINDER HEAD SEALS

MODELS P4000 THROUGH P10,000

### DISASSEMBLY

1. Disconnect air lines and be sure the actuator is not under pressure.
2. Place wrench on hex of cylinder head and turn counter-clockwise until the end of the head retainer wire can be seen through the slot in the cylinder tube.

**NOTE:** It may be necessary to hold the cylinder tube while turning to prevent the cylinder tube from unthreading from the housing.

3. Using a small standard screw driver, lift the end of the head retainer wire without bending or deforming it. Turn the cylinder head counter-clockwise until the retainer wire starts to extend out of the slot in the cylinder tube. Continue turning the cylinder head until the retainer wire is completely exposed.

**CAUTION NOTE:** Do not turn the cylinder head past the point where the retainer wire is inserted into the hole in the cylinder wall. If this is done the end of the retainer wire will snap off.

4. Remove retainer wire from hole in cylinder head.
5. Save the retainer wire, as they are re-usable.

### RE-ASSEMBLY

1. Lightly oil the cylinder head seals and install.
2. Check cylinder tube to make sure it is threaded tightly into the housing.
3. Lightly oil the inside of the cylinder tube. Insert the cylinder head in the cylinder tube. Turn the cylinder head until the drilled hole in the cylinder head is visible through the slot in the cylinder tube. Place hook end of the cylinder head retainer wire through the slot and into the drilled hole in the cylinder head. Turn cylinder head clockwise until the retainer wire is pulled completely through the slot.

### NOTE:

P<sub>1</sub> - Central Ports  
P<sub>2</sub> - End Port(s)

## BENCH TEST PRIOR TO INSTALLATION

### 1. Internal Leakage

- A. Check to ensure the cylinder heads are fastened securely.
- B. Pressurize P<sub>1</sub> port, disconnect connection at the P<sub>2</sub> port and check for air leakage.
- C. Reverse connections, pressurize the P<sub>2</sub> port and check for air leakage at the P<sub>1</sub> port.

### 2. Performance Check

- A. Connect air lines to ports.
- B. Slowly increase the air pressure and note the minimum pressure required to start rotation of the shaft. Minimum pressure should not exceed 10 psi. If the pressure exceeds 10 psi, disassemble and check for binding.
- C. Increase air pressure to normal operating pressure (125 psi max.) alternately on the P<sub>1</sub>, then the P<sub>2</sub> ports. Check for external leaks at each position. External leakage should be zero.

### 3. Installation

Install actuator in system ensuring proper alignment of shaft to coupling and mounting.