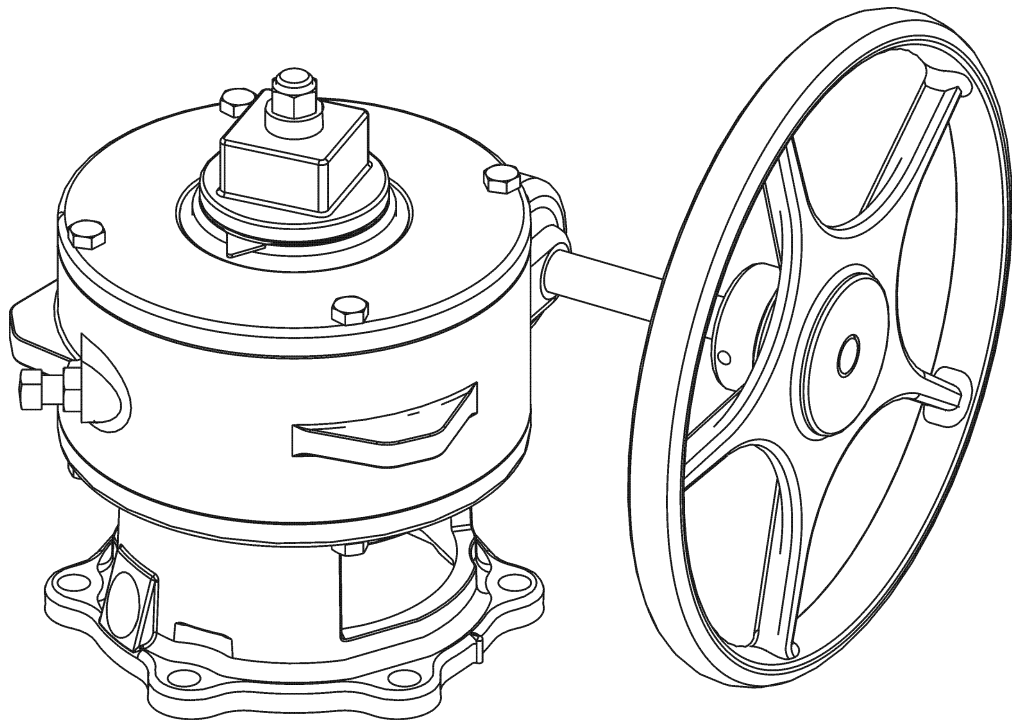




**DeZURIK MANUAL**  
**G-SERIES ACTUATORS**  
**USED ON PEC ECCENTRIC VALVES**



Instruction **D10063**  
August 2012

# DeZURIK

## Manual G-Series Actuators on PEC Eccentric Valves

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### Instructions

These instructions provide information about Manual G-Series Actuators. They are for use by personnel who are responsible for installation, operation and maintenance of Manual G-Series Actuators.

### Safety Messages

All safety messages in the instructions are flagged with an exclamation symbol and the word Caution, Warning or Danger. These messages indicate procedures that must be followed exactly to avoid equipment damage, personal injury or death.

Safety label(s) on the product indicate hazards that can cause equipment damage, personal injury or death. If a safety label becomes difficult to see or read, or if a label has been removed, please contact DeZURIK for replacement label(s).



#### **WARNING!**

**Personnel involved in the installation or maintenance of valves should be constantly alert to potential emission of pipeline material and take appropriate safety precautions. Always wear suitable protection when dealing with hazardous pipeline materials. Handle valves, which have been removed from service with suitable protection for any potential pipeline material in the valve.**

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### Inspection

Your Manual G-Series Actuator has been packaged to provide protection during shipment; however, it can be damaged in transport. Carefully inspect the unit for damage upon arrival and file a claim with the carrier if damage is apparent.

### Parts

Recommended spare parts are listed on the assembly drawing. These parts should be stocked to minimize downtime.

Order parts from your DeZURIK sales representative, or directly from DeZURIK. When ordering parts, please include the 7-digit part number and 4-digit revision number (example: **9999999R000**) located on the data plate attached to the valve assembly. Also include the part name, the assembly drawing number, the balloon number and the quantity stated on the assembly drawing.

### DeZURIK Service

DeZURIK service personnel are available to install, maintain and repair all DeZURIK products. DeZURIK also offers customized training programs and consultation services.

For more information, contact your local DeZURIK sales representative or visit our website at [www.dezurik.com](http://www.dezurik.com).

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## Manual G-Series Actuators on PEC Eccentric Valves

### Description

The manual operated G-Series actuator is designed to operate a PEC Eccentric valve. Integral stops limit actuator stroke for both the open and closed valve positions. This actuator is available in three sizes: Size 6, Size 12 and Size 16. See Figure 1 to identify which unit you have.



#### CAUTION!

This actuator can be furnished with either cast iron or ductile iron gears.

**The ductile iron gear is necessary for submerged or buried service valves or when a 2" operating nut is installed on the input shaft. Breakage of the gear teeth will occur if cast iron gears are torqued above 200 ft-lb's.**

Cast Iron & Ductile Iron are similar in appearance: To determine if the gear material is ductile iron, remove the cover as described in the ACTUATOR DISASSEMBLY Section. Size 6 gears have "M199" cast in raised letters on the round surface opposite the teeth. Size 12 & Size 16 gears have "M199" cast in raised letters on either the top or under side of the web between the hub and the teeth, removal of the gear is necessary to see the marking. If there is no "M199" on the gear, the material is cast iron.

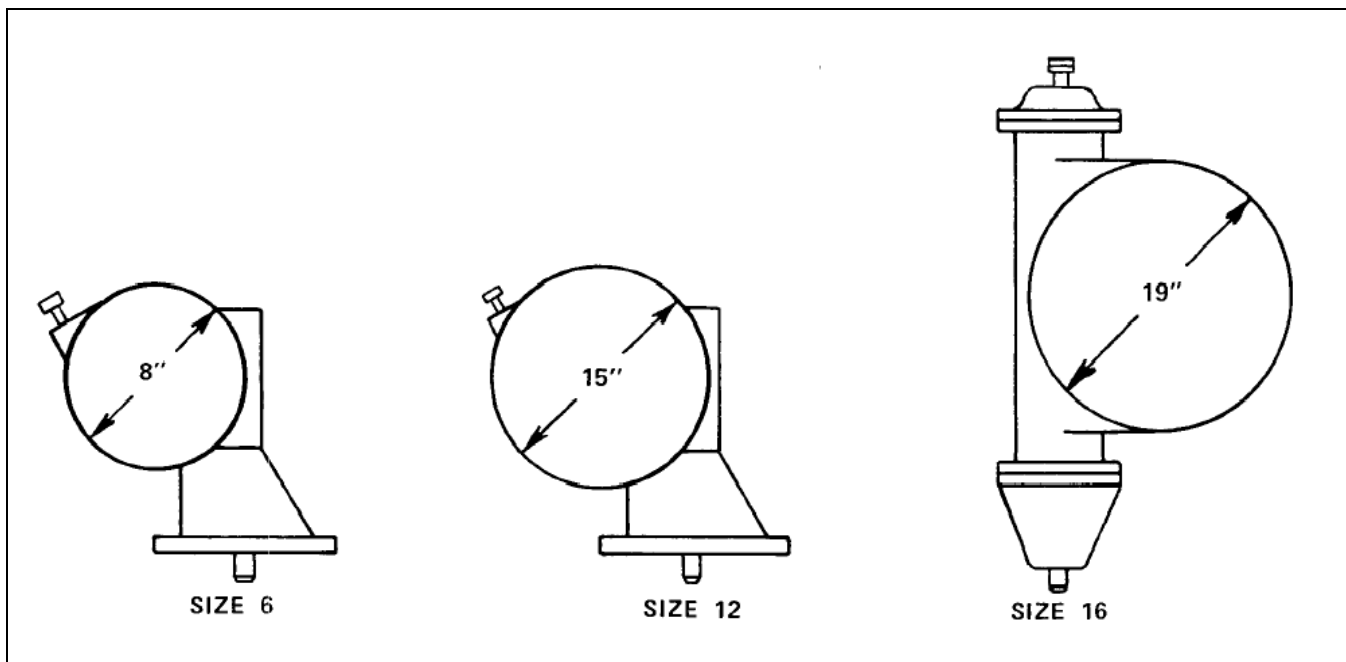


Figure 1— G-Series Actuator Identification

## **Operation**

Rotating the operator (handwheel or chainwheel) clockwise closes the valve. To actuate the valve from full open to full closed (or vice-versa), the Size 6 requires 13 revolutions, the Size 12 requires 19 revolutions and the Size 16 requires 33 revolutions of the operator.

## **Required Tools**

This actuator is assembled using only SAE fasteners. To service this unit, you should have a full set of combination wrenches, Allen wrenches, a flat tipped screwdriver, a pin punch and a dead blow hammer.

## **Lubrication**

The G-Series actuator has been lubricated at the factory and requires no routine maintenance lubrication. If the actuator is disassembled, apply a liberal amount of lubricant to the gear sector, bearings and worm gear (size 6 and Size 12) or the rack (Size 16) using one of these lubricants:

- Keystone Zeniplex-1 (**recommended**)
- Amoco Amolith Grease #1-EP (alternate)
- Amsoil GHD (alternate)
- Mobil Mobilux EP 1 (alternate)
- Petro-Canada Vultrex MPG EP 1 (alternate)
- Shell Alvania EP 1 (alternate)
- Texaco Multifak EP 1 (alternate)

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## Manual G-Series Actuators on PEC Eccentric Valves

### Stop Adjustments

This actuator has a stop to limit valve stroke at each end of the cycle. The open position stop is an integral, non-adjustable stop in the actuator cover; the closed position stop is an adjustable stop screw located in the side of the actuator housing (Size 6 and Size 12) or in the end of the extension cap (Size 16). To adjust the closed position stop, follow these steps:

1. Relieve pipeline pressure.
2. Loosen the jam nut on the closed position stop screw, then turn the closed position stop screw counterclockwise about 1 ½”.
3. Close the valve with the torque specified in Table A.
4. While maintaining the torque from Table A, turn the closed position stop adjusting screw in just until resistance is felt as it contacts the gear.
5. Lock the stop in this position by tightening the jam nut against the actuator.

**Table A: Valve Closing Torques**

Valve Size	Actuator Size	Seating Torque (ft lbs)										
		Direct Pressure Drop (psi)	Reverse Pressure Drop									
			25	50	75	100	125	150	175	200	230	
4	G6	4	4	4	5	5	5	5	5	5	5	
5	G6	8	8	9	10	11	11	11	11	11	11	
6	G6	8	8	9	10	11	11	11	11	11	11	
8	G6	15	15	17	19	20	21	21	21	21	21	
10	G6	22	22	25	29	33	36	N/A	N/A	N/A	N/A	
10	G12	11	11	18	18	18	18	18	18	18	18	
12	G6	29	29	29	29	N/A	N/A	N/A	N/A	N/A	N/A	
12	G12	15	15	15	15	15	15	15	15	15	15	
14	G12	18	18	24	29	34	34	34	34	34	34	
16	G12	22	22	29	37	45	45	45	45	N/A	N/A	
16	G16	19	19	26	26	26	26	26	26	26	26	
18	G12	26	26	35	45	55	55	N/A	N/A	N/A	N/A	
18	G16	21	21	29	29	29	29	29	29	29	29	
20	G12	29	29	44	55	55	N/A	N/A	N/A	N/A	N/A	
20	G16	22	22	32	32	32	32	32	32	32	32	
24.00	G16	24	24	29	34	39	N/A	N/A	N/A	N/A	N/A	
24.50 & 30.00	G16	26	26	35	42	49	N/A	N/A	N/A	N/A	N/A	
30.50 & 36.00	G16	57	57	72	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

*Note: The “N/A” designation in Table A indicates that the Valve/Actuator combination cannot be used for that particular reverse pressure.*

## Stop Adjustments *(continued)*

**Direct Pressure** - When the higher pressure is at the end opposite the seat. See Figure 2.

**Reverse Pressure** - When the higher pressure is at the seat end of the valve. See Figure 2.

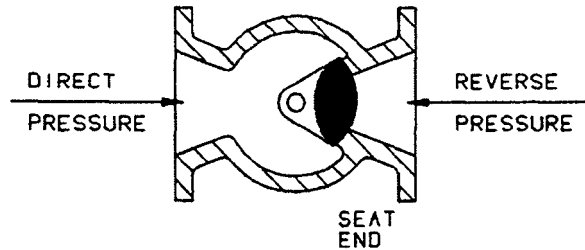


Figure 2 – Pressure Direction

## Actuator Removal

The actuator removal procedure is dependent upon whether or not the actuator is built for submerged service. Follow the correct section to properly and safely remove the actuator.



### **WARNING!**

When Eccentric valves are mounted in a vertical pipeline, or mounted in a horizontal pipeline with the plug stem horizontal, there is a chance that gravity will cause the plug to swing to a lower position in the valve body when the actuator is removed. To avoid this hazard, place the plug in the lowest position before removing the actuator.

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## ***Submerged Service Actuators***

1. Discontinue flow and relieve pipeline pressure.
- 



### **WARNING!**

The valve is a pressure vessel. Pressure must be completely released before removing the bonnet bolts on the 4", 5", 6" and 10" valves.

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2. Scribe corresponding lines on the valve and actuator to be used for alignment during actuator installation.

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## Manual G-Series Actuators on PEC Eccentric Valves

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### Actuator Removal (Continued)

3. Scribe corresponding lines on the actuator housing and top cover so the cover can be reinstalled in the correct position.
4. Remove the screws attaching the top cover on the actuator and lift the cover from the housing.
5. If the valve is a size 4" thru 20", remove the lock nut, spring washers and flat washers from the plug stud and go to Step 9. If the valve is a size 24" thru 36", do not remove anything, go to the next step.
6. Loosen lockscrew #1 about 6 to 8 turns. Loosen lockscrews #2 about 3 turns. See Figure 3.

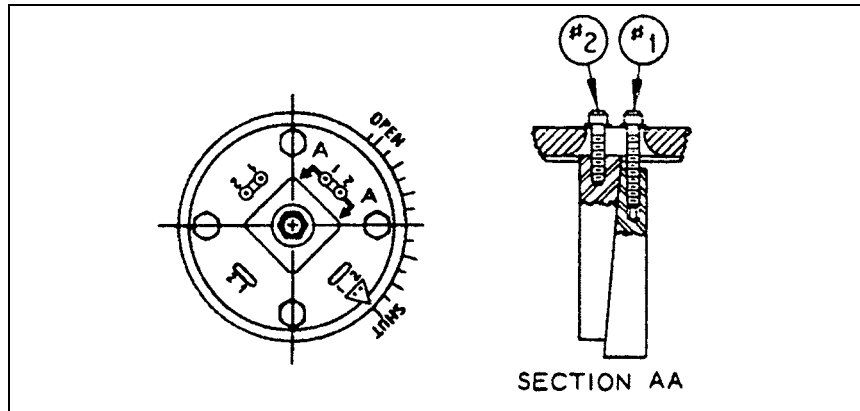


Figure 3 – 24" thru 36" Key and Lockscrew Arrangement

7. Using a soft hammer, tap the heads of the #1 lockscrews to loosen the keys.
8. Remove the four screws holding the washer to the gear sector, then remove the stud, locknut, spring washers and the washer with the keys attached.
9. Remove the 6 screws fastening the adaptor to the valve. On the 4", 5", 6" and 10" valves, these screws also hold the bonnet to the valve body.
10. Lift the actuator and adaptor off the valve.
11. Scrape the old gasket material from the valve bonnet and the bottom of the adaptor.
12. Scrape the gasket material from the actuator cover and housing.

### Non-Submerged Service Actuators

1. Discontinue flow and relieve pipeline pressure.



#### **WARNING!**

**The valve is a pressure vessel. Pressure must be completely released before removing the bonnet bolts on the 4", 5", 6" and 10" valves.**

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2. Scribe corresponding lines on the valve and actuator to be used for alignment during actuator installation.
3. If the valve is a size 4" thru 20", remove the lock nut, spring washers, wrenching nut and pointer from the plug stud, then go to Step 7. If the valve is a size 24" thru 36", do not remove anything and go to the next step.



### **Actuator Removal** *(Continued)*

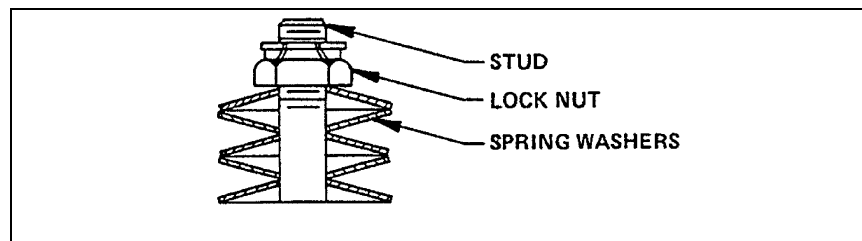
4. Loosen lockscrew #1 about 6 to 8 turns. Loosen lockscrews #2 about 3 turns. See Figure 3.
5. Using a soft hammer, tap the heads of the #1 lockscrews to loosen the keys.
6. Remove the four screws holding the wrenching nut to the gear sector, then remove the stud, locknut, spring washers and the wrenching nut with the keys attached.
7. Remove the 6 screws fastening the adaptor to the valve. On the 4", 5", 6" and 10" valves, these screws also hold the bonnet to the valve body.
8. Lift the actuator and adaptor off the valve.

### **Actuator Installation**

The actuator installation procedure is dependent upon whether or not the actuator is built for submerged service. Follow the correct section to properly install the actuator.

#### ***Submerged Service Actuators***

1. Place the valve in the position it was in when the actuator was removed. Normally this will be so the plug is in the lowest position in the valve body.
2. Place a new gasket on the valve bonnet, lining up the holes in the bonnet and gasket.
3. Line up the scribe marks on the valve and actuator made during actuator removal, then set the actuator on the valve so the valve shaft slides into the actuator gear sector.
4. Fasten the actuator adaptor to the valve with six screws.
5. Slide the flat washer down the plug stud so it rests on top of the gear sector. If the valve is a size 24" thru 36", hold the keys in position when you slide the washer over the plug stud and guide the keys into the gear sector and stem slots. Then install the four screws fastening the washer to the gear sector.
6. Place the spring washers on the plug stud as shown in Figure 4.



**Figure 4—Spring Washer Stackup**

7. Screw the lock nut down the plug stud until it is tight and the spring washers are completely compressed, then back the nut off one full turn.
8. If the valve is a size 24" thru 36", tighten the #2 lockscrews and then the #1 lockscrews to hold the keys in place. Skip this step if the valve is a size 4" thru 20".
9. Line up the scribe marks on the cover and housing, then set the cover on the actuator. Fasten the cover in place.
10. Check the closed position stop setting and readjust if necessary.
11. Pipeline flow may now be restored.

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## Manual G-Series Actuators on PEC Eccentric Valves

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### Actuator Installation (Continued)

#### **Non-Submerged Service Actuators**

1. Place the valve in the position it was in when the actuator was removed. Normally this will be so the plug is in the lowest position in the valve body.
2. Line up the scribe marks on the valve and actuator made during actuator removal, then set the actuator on the valve so the valve shaft slides into the actuator gear sector.
3. Fasten the actuator adaptor to the valve with six screws.
4. Slide the pointer and wrenching nut down the plug stud so it rests on top of the gear sector; the pointer should point to indicate the correct valve position. If the valve is a size 24" thru 36", hold the keys in position when you slide the wrenching nut over the plug stud and guide the keys into the gear sector and stem slots. Then install the four screws fastening the wrenching nut to the gear sector.
5. Place the spring washers on the plug stud as shown in Figure 4.
6. Screw the lock nut down the plug stud until the spring washers are completely compressed, then back the nut off until the washers return to their normal unstressed shape.
7. If the valve is a size 24" thru 36", tighten the #2 lockscrews and then the #1 lockscrews to hold the keys in place. Skip this step if the valve is a size 4" thru 20".
8. Pipeline flow may now be restored.

### **Recommended Spare Parts Replacement**

Follow these steps to replace the recommended spare parts in this actuator. This procedure is dependent upon the actuator size (see Figure 1); make sure you are using the correct section for your actuator.



#### **WARNING!**

**When Eccentric valves are mounted in a vertical pipeline, or mounted in a horizontal pipeline with the plug stem horizontal, there is a chance that gravity will cause the plug to swing to a lower position in the valve body when the actuator is removed. To avoid this hazard, place the plug in the lowest position before removing the actuator.**

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#### **Size 6 and Size 12 Actuators**

1. Remove the actuator from the valve as described in the ACTUATOR REMOVAL Section of this Instruction.
2. Scribe corresponding lines on the actuator cover and housing, then remove the cover screws and cover from the top of the actuator (non-submerged units).
3. Note the position of the gear sector in the housing, then lift the gear sector out.
4. Remove the pipe plug in the side of the housing.
5. Reaching in thru the hole where the pipe plug was, drive out the pin connecting the worm gear to the actuator drive shaft. Take the pin out of the housing.

**Recommended Spare Parts Replacement** *(Continued)*

6. Slide the drive shaft (complete with operator) out of the actuator.
7. Reach into the housing and remove the worm gear, thrust bearing(s) and bearing races. The Size 6 actuator has one thrust bearing and two bearing races; the Size 12 has two bearings and four bearing races.
8. Remove the gear sector seals from the top cover and adaptor.
9. Remove the drive shaft seal from the housing.
10. Scrape the gasket material from the top cover and actuator housing.
11. Grease the new seals and press them into the top cover and adaptor.
12. Push a new drive shaft seal into the housing.
13. **Size 6 Actuators** - Slide the drive shaft into the housing and thru these components in the following order: bearing race, bearing, bearing race, worm gear, and then into the bearing in the housing.  
  
**Size 12 Actuators** - Slide the drive shaft into the housing and thru these components in the following order: bearing race, bearing, bearing race, worm gear, bearing race, bearing, bearing race, and then into the bearing in the housing.
14. Turn the drive shaft and worm gear until the holes in them line up with the pipe plug hole in the housing.
15. Reaching in thru the pipe plug hole, insert the pin to connect the drive shaft and worm gear.
16. Screw the pipe plug into the hole in the housing.
17. Place the gear sector on the valve shaft in the same position noted before it was removed.
18. Apply a liberal amount of grease to the gear sector, bearings and worm gear.
19. Set a new cover gasket on the housing, then install and fasten the top cover on the housing; make sure the scribe marks line up (non-submerged units only).
20. Install the actuator on the valve as described in the ACTUATOR INSTALLATION Section of this Instruction.

**Size 16 Actuators**

1. Remove the actuator from the valve as described in the ACTUATOR REMOVAL Section of this Instruction.
2. Scribe corresponding lines on the actuator cover and housing, then remove the cover screws and cover from the top of the actuator (non-submerged units).
3. Note the position of the gear sector in the housing, then lift the gear sector out.
4. Mark one tooth on the rack with a center punch, then mark two adjacent teeth on the gear so the rack and gear can be re-installed in the correct position.
5. Remove the four screws that hold the drive shaft housing assembly to the actuator housing.
6. Turn the operator clockwise to remove the drive shaft housing assembly from the actuator housing.
7. Lift the gear sector and rack from the housing.
8. Drive the pin out that holds the rack guide in place, then remove the rack guide and pin from the housing.

### Recommended Spare Parts Replacement *(Continued)*

9. Remove the gear sector seals from the top cover and adaptor.
10. Scrape the gasket material from the top cover, actuator housing and drive shaft housing.
11. Rebuild the drive shaft housing assembly as follows:
  - a. Remove the set screw inside the housing and turn the threaded collar out. The bearing and two bearing faces will also come out.
  - b. Remove the pin securing the operator to the drive shaft and slide the operator off the shaft.
  - c. Push the housing off the operator end of the drive shaft. The remaining bearing and two races will come out at this time.
  - d. Pull the seal out of the drive shaft housing.
  - e. Lightly grease the new seal and slide it into the drive shaft housing.
  - f. Sandwich the bearing between the two races and slide them down the operator end of the drive shaft until they sit on the sleeve.
  - g. Apply a liberal amount of grease to the bearing and races.
  - h. Carefully push the operator end of the drive shaft thru the seal from inside the housing.
  - i. Slide the operator onto the shaft, line up the holes in the operator and shaft, then install the pin.
  - j. Sandwich the bearing between the two races and slide them against the sleeve inside the housing.
  - k. Apply a liberal amount of grease to the bearings.
  - l. Screw the threaded collar into place and secure with the set screw.
12. Grease the new seals and press them into the top cover and adaptor.
13. Pin the rack guide in position in the housing.
14. Place the gear sector and rack in the housing, carefully aligning the teeth marked during disassembly.
15. Place a new gasket on the drive shaft housing, then push the drive shaft housing assembly into the actuator housing.
16. Turn the operator counterclockwise to screw the drive shaft into the rack until the drive shaft housing is tight against the actuator housing.
17. Fasten the drive shaft housing to the actuator housing with four screws.
18. Apply a liberal amount of grease to the gear sector and rack.
19. Set a new cover gasket on the housing, then install and fasten the top cover on the housing; make sure the scribe marks line up (non-submerged units only).
20. Install the actuator on the valve as described in the ACTUATOR INSTALLATION Section of this Instruction.

## Changing Actuator Mounting Position

On **4–20" (100–500mm)** valves, the actuator can be mounted in 60° increments around the valve shaft. 90° or 270° position changes require changing the gear sector on Size 6 & Size 12 actuators or the timing between the gear sector and the rack on Size 16 actuators; 60° position changes do not require changing the gear sector or timing.

On **24–36" (600–900mm)** valves, handwheel/chainwheel sizes will limit actuator mounting positions. However, the actuator can be mounted in 45° increments around the valve shaft. 45° position changes require changing the timing between the gear sector and the rack; 90° position changes do not require changing the timing.

### **Mounting Actuator in 60° Increments on 4–20" (100–500mm) Valves and 90° Increments on 24–36" (600–900mm) Valves**

1. Remove the actuator from the valve. See "*Removing Actuator*" section.



#### **WARNING!**

**This valve is a pressure vessel. On 4, 5, 6 and 10" (100, 125, 150 and 250mm) valves, the same bolts hold both the actuator and the bonnet.**

**Removing the bolts on 4, 5, 6 and 10" (100, 125, 150 and 250mm) valves before relieving pipeline pressure can result in personal injury or equipment damage.**

**Always relieve pipeline pressure before removing the actuator.**

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2. Rotate the actuator into position.
3. Install the actuator on the valve. See "*Installing Actuator*".

### **Changing Actuator to 90°/270° Positions on 4–20" (100–500mm) Valves with Size 6 & Size 12 Actuators Only (Requires a different gear sector)**

When eccentric valves are mounted in a vertical pipeline, or mounted in a horizontal pipeline with the plug stem horizontal, gravity can cause the plug to swing to a lower position in the valve body when the gear sector is removed. To avoid this problem, place the plug in the lowest position before removing the gear sector.

1. Discontinue flow and relieve pipeline pressure.
2. If possible, put the valve in the closed position just so the plug is touching the valve seat.
3. Remove the lock nut, spring washers, wrenching nut and pointer from the plug stud.
4. Scribe corresponding lines on the actuator cover and housing, then remove the cover screws and cover from the top of the actuator.
5. Note that one edge of the gear is either against or close to the stop screw in the side of the gear housing, this is where the other gear should be after the actuator has been rotated 90° and the new gear installed. Now lift the gear sector out of the actuator.
6. Remove the 4 screws fastening the gear housing to the adaptor.
7. Pry the gear housing loose from the valve adaptor and turn it 90° clockwise or counterclockwise to suit your need. Line up the bolt holes and install and tighten the 4 screws.

### Changing Mounting Positions *(Continued)*

8. Make sure the plug is still touching the valve seat, then using the new gear, liberally grease the teeth and journals then drop the gear in over the plug hex making sure the edge of the gear is close to or will touch the stop screw.  
  
NOTE: The gear has two different length journals. The longer journal must engage the plug and the shorter journal must stick up thru the actuator cover.
9. Set a new cover gasket on the housing, then install and fasten the top cover on the housing; make sure the scribe marks line up.
10. Test actuate the valve by turning the handwheel to open the valve. The valve plug must go 90° from the seat and stop as the gear sector hits the stop lug that is cast in the cover. Now turn the handwheel to close the valve, the plug should contact the seat before the gear hits the stop screw. If the valve does not operate as described, remove the cover from the gear housing and make sure the edge of the gear is touching or very close to the stop screw when the plug is in the closed position.
11. When you are satisfied that the valve is operating properly, put the valve in the closed position. With the cover bolted in place, slide the pointer and wrenching nut down the plug stud so it rests on top of the gear sector; the pointer should point to indicate the correct valve position.
12. Place the spring washers on the plug stud as shown in Figure 5.
13. Screw the lock nut down the plug stud until it is tight and the spring washers are completely compressed, then back the nut off one full turn.
14. Adjust the position stops. See "*Position Stops*" section.

### **Changing Actuator to 90°/270° Positions on 12"–20" (300–500mm) Valves with Size 16 Actuator Only**

When eccentric valves are mounted in a vertical pipeline, or mounted in a horizontal pipeline with the plug stem horizontal, gravity can cause the plug to swing to a lower position in the valve body when the gear sector is removed. To avoid this problem, place the plug in the lowest position before removing the gear sector.

1. Discontinue flow and relieve pipeline pressure.
2. Remove the lock nut, spring washers, wrenching nut and pointer from the plug stud.
3. Scribe corresponding lines on the actuator cover and housing, then remove the cover screws and cover from the top of the actuator.
4. Mark which teeth of the rack and gear are engaged and lift the gear sector out of the actuator.
5. Remove the screws fastening the adapter to the valve.
6. Take out the screws fastening the actuator housing to the adapter.
7. Rotate the adapter on the valve, and the actuator on the adapter until the holes line up and the actuator is in the desired position. Replace all of the screws.
8. Find the tooth that was marked on the gear sector and count over clockwise five teeth. This is the tooth that will engage with the marked tooth on the rack. Install the gear sector using the new tooth engagement, and be sure the gear sector fits on the plug stem properly.

## Changing Mounting Positions *(Continued)*

9. Set a new cover gasket on the housing, then install and fasten the top cover on the housing; make sure the scribe marks line up.
10. Slide the pointer and wrenching nut down the plug stud so it rests on top of the gear sector; the pointer should point to indicate the correct valve position.
11. Place the spring washers on the plug stud as shown in Figure 5.
12. Screw the lock nut down the plug stud until it is tight and the spring washers are completely compressed, then back the nut off one full turn.
13. Adjust the position stops. See “*Position Stops*” section.

## **Mounting Actuator in 45° Increments on 24–36” (600–900mm) Valves Only**

When eccentric valves are mounted in a vertical pipeline, or mounted in a horizontal pipeline with the plug stem horizontal, gravity can cause the plug to swing to a lower position in the valve body when the gear sector is removed. To avoid this problem, place the plug in the lowest position before removing the gear sector.

1. Discontinue flow and relieve pipeline pressure.



### **WARNING!**

**When Eccentric valves are mounted in a vertical pipeline, or mounted in a horizontal pipeline with the plug stem horizontal, there is a chance that gravity will cause the plug to swing to a lower position in the valve body when the gear sector is removed. To avoid this hazard, place the plug in the lowest position before removing the gear sector.**

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2. Loosen lockscrews #1 about 6 to 8 turns. Loosen lockscrews #2 about 3 turns. See Figure 4.
3. Using a soft hammer, tap the heads of the #1 lockscrews to loosen the keys.
4. Remove the four screws that hold the wrenching nut to the gear sector, then remove the stud locknut, spring washers and the wrenching nut with the keys.
5. Scribe corresponding lines on the actuator cover and housing, then remove the cover screws and cover from the top of the actuator.
6. Mark which teeth of the rack and gear are engaged, and lift the gear sector out of the actuator.
7. Remove the screws fastening the adapter to the valve.
8. Remove the screws fastening the actuator housing to the adapter.
9. Rotate the adapter on the valve and the actuator on the adapter until the holes line up and the actuator is in the desired position. Replace all of the screws.
10. Note the tooth that was marked on the gear sector and count clockwise five teeth on the size 16 actuator. This is the tooth that will engage with the marked tooth on the rack. Install the gear sector using the new tooth engagement, and be sure the keyways in the gear sector match the keyways in the plug stem.
11. Set a new cover gasket on the housing, then install the top cover on the housing, making sure the scribe marks line up.

### Changing Mounting Positions *(Continued)*

12. Hold the keys in position and slide the wrenching nut over the plug stud, then guide the keys into the gear sector and stem slots.
13. Install the four screws fastening the wrenching nut to the gear sector.
14. Place the spring washers on the plug stud as shown in Figure 5.
15. Screw the lock nut down the plug stud until it is tight and the spring washers are completely compressed, then back the nut off one full turn.
16. Tighten the #2 lockscrews, and then the #1 lockscrews to hold the keys in place.
17. Adjust the position stops—see “*Position Stops*” section.