

Series QR & QRG Posi-Tork® Rotary Actuator Instruction Manual

Contents

General Information	1	Actuator Parts List	4
Storage Requirements	1	Lubrication Instructions	5
Installation Requirements	2	Geared Position Limit Switch Adjustment	6
Electric Motor Operation	2	Torque Limit Switch Setting Procedure	7
Geared Position Limit Switch Operation	2	Optional Equipment	7
Torque Limit Switch Operation	3	Disassembly and Reassembly of Handwheel	9
Disassembly & Reassembly of Actuators	3	Typical Wiring Diagrams	10

NOTICE

The information contained in this manual is essential to safe, successful, long term operation of your Andco Posi-Tork® Rotary Actuator. Read and follow the requirements concerning storage, installation, and adjustment. Failure to do so could void the warranty covering your actuator.



ANDCO ACTUATOR POSI-TORK® ROTARY ACTUATORS

This manual describes the general operating principle of the Posi-Tork® Rotary Actuators and gives instructions for storing, installing, operating, and servicing these actuators.

The Posi-Tork® Rotary Actuator has been designed and manufactured to meet the highest quality standards and was thoroughly tested and inspected before shipment.

Since minimum attention is required to operate and maintain the Posi-Tork® Rotary Actuator under normal operating conditions, it is important that the instructions for installation and maintenance, as outlined in this manual, be followed.

Should questions occur that are not covered in this manual, contact Andco Actuator Products toll free at 1-800-945-9898, 832-590-2306, or e-mail us at andco@dresser.com. Be sure to include the model number, serial number and order number on the name plate of your actuator in all communications and parts orders. The name plate is located on the limit switch compartment cover.

Storage Requirements

1. Preferably, store all actuators indoors in a clean, dry environment.
2. If outdoor storage cannot be avoided, the packaged actuator must be stored high enough to avoid immersion in snow or water.
3. Compartment heaters (optional) should be temporarily wired and energized if the actuator is to be stored in a damp location.
4. All covers must remain in place and securely fastened.
5. All pipe plugs must remain in place and tight.
6. The storage location should be selected so the actuator is not exposed to mechanical damage from mobile equipment, cranes, personnel traffic, etc.
7. For extended storage (over 3 months outdoors or 6 months indoors) desiccant bags must be placed inside of electrical compartments. Tags must be attached to the outside of the compartment covers instructing removal of the bags before start of operation.

WARNING

Disconnect all electrical power before removing the covers of either the position or torque switch compartments.

Installation Requirements

1. The preferred mounting position of the actuator is with the motor and limit switch compartment oriented either horizontal or vertically up. This prevents lubricant pressure against the seals.
2. To prevent premature wear of any drive component, verify proper alignment between actuator and the driven equipment.
3. Before operating the actuator make sure all attachments to the support and driven equipment are properly secured and all covers are properly tightened.
4. The actuator must be installed and wired in accordance with the current edition of the National Electrical Code.
5. Route the electrical conduit up into the actuator to prevent internal condensation from running into the limit switch compartment.
6. Verify proper motor rotation relative to limit switch actuation and push button operation. Motor rotation may be reversed, if necessary, by reversing motor lead connections. (Refer to geared position limit switch adjustment on page 6 and electrical wiring diagram on page 10).
7. Keep position and torque switch compartments dry and clean.
8. Replace the complete geared position limit switch rather than attempting field repairs.
9. Readjust the geared position limit switch before operating the actuator if the switch has been removed from the actuator.
10. Keep the geared position limit switch contacts clean. Use CRC Lectra Clean® or other suitable solvent on a lint free cloth.
11. Do not use abrasive cloth or paper to clean silver contacts on the position limit switch.
12. Position limit switch for rotary actuators other than 90° rotation are not factory preset. This adjustment must be done when the actuator is mounted on the valve or driven equipment.

WARNING

DO NOT defeat the purpose of the torque switch by jumping, by-passing, or disconnecting the switch connection wiring (wire numbers 17, 17A, 18, or 18A per electrical wiring drawing on page 10.) This could cause serious damage to the actuator or the driven equipment.

13. Do not attempt to loosen a jammed valve or gate by rapid reversing of the actuator drive. To do so could damage either the actuator or the driven equipment.
14. Dust-ignition proof actuators must have all covers secured before electrical circuits are energized.
15. Dust-ignition proof actuators must have the grounding lug connected to a suitable grounding system prior to operation.

Electric Motor Operation

The electric motor pinion (102), drives the spur gear (29), keyed to worm shaft (28), which drives the worm gear (8). The worm gear is keyed directly to the drive sleeve (7), which will rotate shaft. Any thrust or radial reaction is absorbed by bearing cup (3), bearing cone (11 & 12) and bearing cup (20).

Increasing driving torque in the last stage worm shaft will cause it to move axially against the Belleville springs (42). The spring combination is selected based on the relationship of a specific deflection equaling a specific torque. The axial displacement of the worm shaft is translated to rotational movement of the lever of the torque switch (114), which, depending on its setting, will interrupt the electrical control circuit to the motor for either the open or close direction.

Geared Position Limit Switch Operation

For most applications, the geared position limit switch controls the operating position of the actuator by interrupting the electrical control circuit of the motor at the completion of the open and close cycle. Rotation of the drive sleeve is transmitted through bevel gear (9), to the geared position limit switch (126). The geared position limit switch normally has two independently adjustable trip points to control the end positions of the open and close cycles. Optional geared position limit switches with four independently adjustable trip points normally use the two intermediate trip points for

signal indication or electrical interlocking with other equipment requiring an electrical signal related to intermediate positions of the open or close cycles. The geared position limit switch is driven by direct gearing on the drive sleeve and is synchronized at all times with the rotary movement of the drive sleeve. After initial setting of the required open and closed trip points, as determined by position of the drive sleeve, the switch will trip repeatedly at these same points.

See separate section on page 6 in this manual for access to and adjustment of the geared position limit switch.

Torque Limit Switch Operation

The factory preset torque switch, (114) protects the actuator and the driven equipment from mechanical overloads. The torque switch has a dial with pointer type settings which can be field adjusted to increase or decrease the torque load at which the electric circuit of the motor is interrupted. The higher the number setting on the torque switch, the higher the external torque force that the switch will sense to interrupt the electric circuit to the motor. See separate section on page 7 in this manual for access to and adjustment of the torque limit switch.

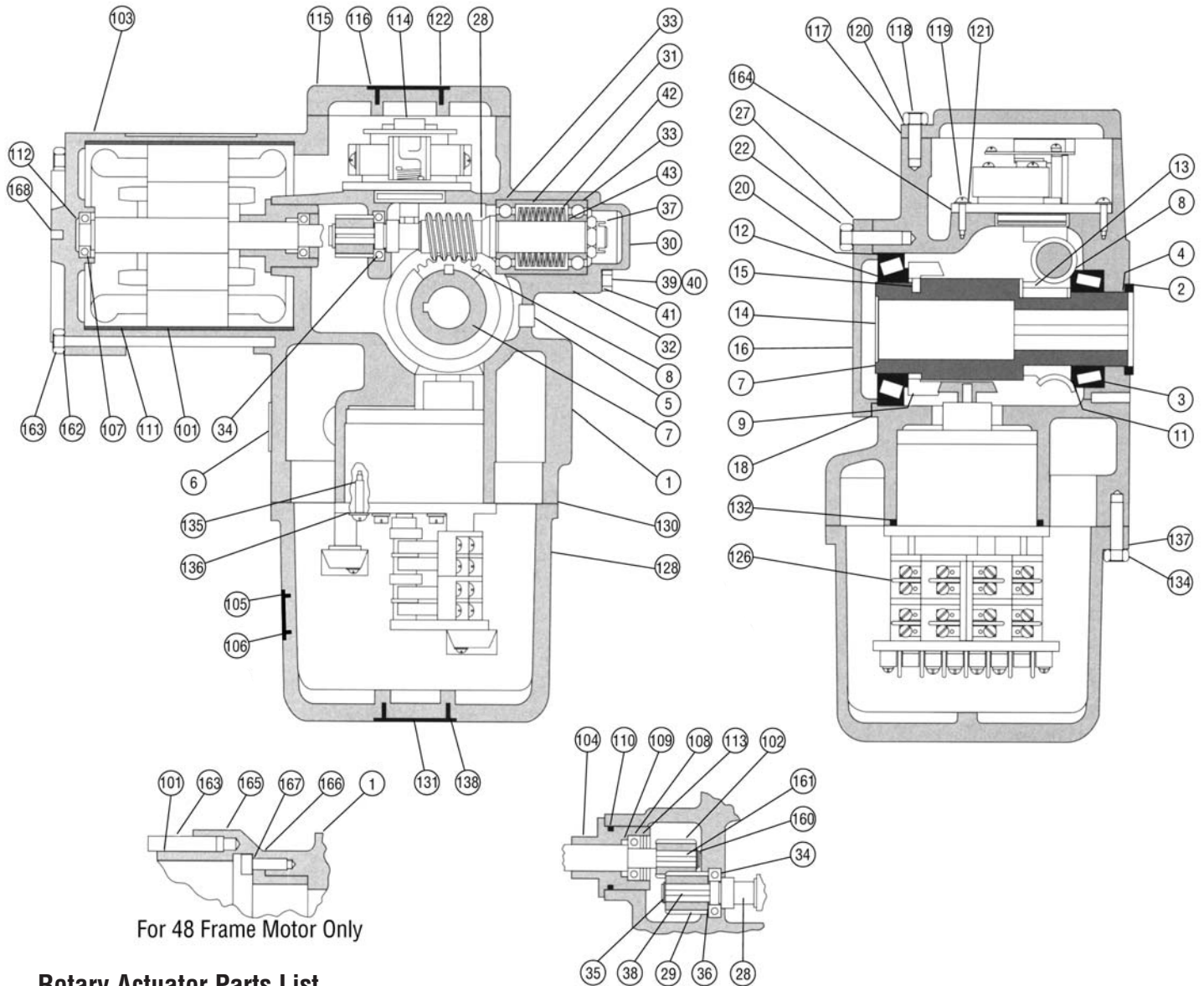
DISASSEMBLY & REASSEMBLY OF POSI-TORK® ROTARY ACTUATORS

WARNING

Disconnect and lock out all electrical power to the actuator.

1. Remove the position and torque limit switch compartment covers, (128) and (115).
2. Disconnect all electrical leads to the position and torque limit switches, (126) and (114), making sure they are properly marked for reconnection to the proper terminals.
3. Remove the pipe plug (5) in the housing wall to vent air into the housing as the switches are pulled from their mountings.
4. Remove the two screws (119, 135) retaining each switch and remove the switches by pulling them straight out of the housing.
5. Remove the four bolts (163) and the motor end bell (103). Both the stator and rotor are removed by pulling straight out.
6. Remove spring cap (30) fastened by six screws (39, 40). Remove flexlocnut (37), outermost bearing (33), support washer (43), belleville springs (42) and thrust limit sleeve (31). Removal of these components may be facilitated by rotating the worm shaft (28) counterclockwise out of engagement with the worm gear (8) and withdrawing the worm shaft until the bearing (34) contacts the worm gear.
7. Remove housing cover (16) held by four screws (22). Remove bearing cup (20), bearing cone (12), and bevel gear (9) from drive sleeve (7).
8. Angle worm shaft and drive sleeve away from one another to establish removal clearance. Withdraw drive sleeve and then worm shaft from housing.
9. To reassemble the actuator, reverse the above procedure including the following information:
 - Step 6. Before reinstalling the motor stator into the housing (1) or motor flange adapter (165), make sure the o-ring seals (111) are undamaged and uniformly stretched in the seating grooves. Grease the o-ring lightly to assist proper seating. Carefully slide the stator and end bell squarely into full seating position to prevent o-ring damage.
 - Step 2: When reinstalling the compartment covers, make sure the sealing gaskets are undamaged, in full, flat contact with the seating surfaces and clear of attachment screw holes. Finger tighten the attachment screws uniformly before wrench tightening.

Actuator Configuration



Rotary Actuator Parts List

Item	Description	Item	Description	Item	Description	Item	Description
1.	Housing	11.	Bearing Cone (Lower)	28.	Worm Shaft	38.	Square Key
2.	Seal Retainer	12.	Bearing Cone (Upper)	29.	Spur Gear	39.	Socket Hd Cap Screw
3.	Bearing Cup	13.	Square Key	30.	Spring Cap	40.	Socket Hd Cap Screw
4.	Quad-Ring	14.	Welch Plug	31.	Thrust Limit Sleeve	41.	Lockwasher
5.	Pipe Plug (Lubrication)	15.	Dowel Pin	32.	Gasket	42.	Belleville Spring
6.	Pipe Plug (Conduit Entrance)	16.	Housing Cover	33.	Ball Bearing	43.	Support Washer
7.	Drive Sleeve	18.	Shim Set	34.	Ball Bearing	101.	Motor
8.	Worm Gear	20.	Bearing Cup	35.	Retaining Ring (On Worm Shaft)	102.	Pinion
9.	Bevel Gear	22.	Hex Hd Cap Screw	36.	Bearing Sleeve	103.	Motor End Bell
		27.	Lockwasher	37.	Flexlocnut	104.	Bearing Cartridge
						105.	Nameplate

Rotary Actuator Pars List Continued...

Item	Description	Item	Description	Item	Description	Item	Description
106.	Drive Stud	116.	Warning Plate	128.	Compartment Cover	160.	Flexlocnut or Retaining Ring
107.	Ball Bearing	117.	Gasket	130.	L.S. Cover Gasket	161.	Key
108.	Ball Bearing	118.	Socket Hd Cap Screw	131.	Warning Plate	162.	Lockwasher
109.	Oil Seal	119.	Socket Head Machine Screw	132.	O-Ring	163.	Bolt
110.	O-Ring	120.	Lockwasher	134.	Socket Hd. Cap Screw	164.	Shim
111.	O-Ring	121.	Lockwasher	135.	Socket Head Machine Screw	165.	Motor Flange (48 Frame)
112.	"K" Spring	122.	Drive Studs	136.	Hi-Collar Lockwasher	166.	Gasket
113.	Retaining Ring	126.	Geared Limit Switch Sub-Assembly	137.	Lockwasher	167.	Socket Hd Cap Screw
114.	Torque Switch Sub-Assembly			138.	Drive Stud	168.	Pipe Plug (End Bell)
115.	Torque Switch Cover						

LUBRICATION INSTRUCTIONS

The Andco Rotary actuator operating mechanisms are enclosed in totally sealed housings and have been completely factory lubricated and made ready for immediate service.

Even though the mechanism enclosures are totally sealed internally and the actuator can be mounted in any position, Andco recommends locating the motor and limit switch compartments either horizontal or vertically up. This will minimize leakage of lubricant into electrical compartments should a seal failure occur.

After long term storage, minor lubricant weepage may be noted at enclosure joints or shaft seals. This condition is inconsequential and should have no effect on the performance of the actuator. Once the actuator is put into operating service weepage should cease.

Prior to Operation

Inspect the actuator for proper lubrication prior to start of operation. Remove the pipe plug, (5), located in the housing wall and furthest from the mounting surface

(about 5 inches). Clean lubricant should be present to this level. After verification of proper lubricant quantity, replace pipe plug firmly.

In Service Inspection

As part of a good preventative maintenance practice, inspection for proper lubrication of the actuator should be done on a regular basis.

The required frequency of this inspection should be developed based on the operating conditions the actuator encounters, i.e. load, duty cycle, environment, etc. As a minimum, where operating conditions are not severe, inspection for proper lubrication should be done annually.

The lubricant quality should be inspected to verify proper consistency and quality. If the lubricant level is obviously low or visibly contaminated, the actuator should be further inspected to determine the cause.

FACTORY LUBRICANTS

Standard lubricants for use in the actuator are charted below. Some substitute lubricants of the same base are acceptable and are listed.

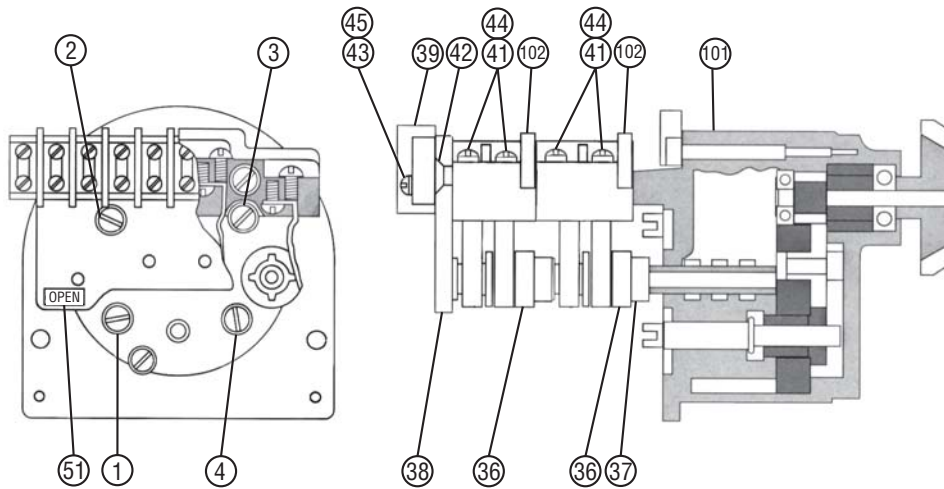
Standard Lubricants

Actuator Area	Name	Base	Temperature Range, °F	Manufacturer
Housing, Gear Box Handwheel	Aeroshell 6	Mineral Oil	-40 to 250	Shell
Geared Limit Switch	Mobil Grease #28	Synthetic Hydrocarbon	-40 to 200	ExxonMobil
Motor Rotor	Sealed, Lubricated for Life Bearings			

Substitute Lubricants

Name	Manufacturer
Litholene HEP1	Arco
Mobilux EP1	Mobil
Gulfcrown EP1	Gulf

Geared Position Limit Switch



Item	Description
1-4.	Slotted Adjustment Shaft
36.	Rotor Sub-Assembly
37.	Rotor Driver
38.	Rotor Plate
39.	Terminal Block
41.	Fillister Hd. Machine Screw
42.	Flat Hd. Machine Screw
43.	Socket Hd. Machine Screw
44.	Hi-Collar Washer
45.	Lockwasher
51.	Decal – Open
101.	Gear Frame Sub-Assembly
102.	Finger Base Sub-Assembly

Geared Position Limit Switch Adjustment

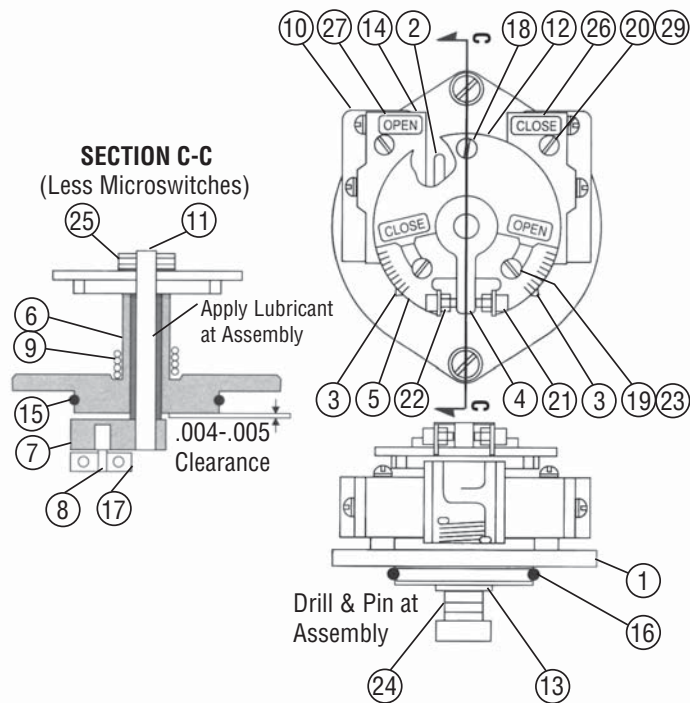
NOTE: The geared position limit switch is not factory pre-set to trip at any specific position. Trip point setting must be made after the actuator is installed in place on the driven equipment or valve.

WARNING

Disconnect all electrical power to actuator prior to removing position limit switch compartment cover and performing any setting adjustment.

- Remove the position limit switch compartment cover (128) to gain access to the position switch.
- Rotary actuators (without handwheel option) — remove the motor end bell pipe plug (168), for access to the slot located in the end of the motor shaft.
- Rotary actuators (without handwheel option) — with a manual or power screw driver rotate the motor shaft in a clockwise direction to rotate the output shaft or sleeve of the actuator clockwise to the desired position.
- If the bridge type contact on the rotor (36) is in contact with the two fingers (closed position), adjust the rotor contact setting to the open position by pushing down slotted shaft (1) and turning clockwise until the rotor turns about 90° counter-clockwise to break the electrical contact and interrupt the control circuit to the motor for the full clockwise position. If the rotor has turned so the contacts are already open, push and turn the slotted shaft (1) counterclockwise until the rotor rotates about 90° and the contacts close. Then push and turn slotted shaft, clockwise until the rotor, turns to open the contacts.
- Rotate the output shaft or sleeve counterclockwise to the desired position by rotating the handwheel (if provided) or motor shaft (without handwheel option) in a counterclockwise direction. Follow the same procedure for the setting of the rotor, for the selected position, with the difference now being that all the directions of rotation described in No. 4 are reversed.
- If the switch has been supplied with four rotors, the additional rotors with their corresponding slotted shafts (2) and (3) are for intermediate tripping points of other electrical circuits. These slotted shafts adjust rotors respectively for the clockwise and counter-clockwise directions to trip the rotor contacts. Follow the procedure described in No. 4 to set rotors at desired intermediate rotational positions.
- Make sure mating surfaces of the cover and housing are clean. Replace compartment cover (128) and gasket (130) and secure tightly in place with attachment hardware.
- Without handwheel option — replace motor end bell pipe plug tightly.
- Re-energize all electrical power to the actuator. It is ready for use.

Torque Limit Switch



Item Description	Item Description
1. Torque Switch Base	16. O-Ring
2. Torque Switch Arm	17. Ball Bearing
3. Pointer	18. Round Hd. Mach. Screw
4. Adjusting Arm	19. Socket Head Machine Screw
5. Torque Switch Dial	20. Socket Head Machine Screw
6. Torque Switch Bushing	21. Socket Screw
7. Bearing Lever	22. Hex Nut
8. Bearing Lever Pin	23. Hi-Collar Lockwasher
9. Torsion Spring	24. Groove Pin
10. Insulator	25. Groove Pin
11. Torque Switch Shaft	26. Decal – Close
12. Torque Limiter Plate	27. Decal – Open
13. Thrust Washer	29. Lockwasher
14. Microswitch	
15. O-Ring	

Torque Limit Switch Setting Procedure

The torque switch has been preset at the factory according to the torque information provided by the customer. However, for field adjustment to decrease or increase the torque force that will trip the torque limit switch to interrupt the electric circuit to the motor, follow the procedure below:

WARNING

Disconnect all electrical power to actuator prior to performing any torque limit switch adjustment.

1. Remove the torque limit switch compartment cover (115) to gain access to the torque switch.
2. To set torque load tripping point for the open or close direction, loosen screw (19) and move the appropriate pointer (3) to change torque setting. The higher the number, the higher the torque and/or thrust output of the actuator
3. Tighten screw.
4. Make sure mating surfaces of the cover and housing are clean. Replace compartment cover (115) and gasket (117) and secure tightly in place with attachment hardware.
5. A maximum torque limiter plate (12) is furnished on all actuators. **DO NOT REMOVE OR EXCEED THE SETTING ALLOWED BY THIS PLATE WITHOUT CONSULTING THE FACTORY.**

Optional Equipment

Dust-Ignition Proof Enclosure

Class II, Division 1, Groups E, F and G Indoor and Outdoor Hazardous Locations

Actuators provided to comply with NEC specifications must have properly designed and installed electrical compartment access covers to exclude ignitable amounts of dust. When installing these covers the mating seating surfaces and gaskets must be clean and all attachment fasteners securely tightened. If the motor end bell pipe plug has been removed to adjust the actuator, that plug must be reinstalled tightly.

The actuators must be able to operate at full rating without developing surface temperatures high enough to cause excessive dehydration or gradual carbonization of any organic dust deposits on the actuator enclosure.

The motor thermal overload switch must be series wired in the motor starter coil circuit as shown and noted in the electrical wiring diagram provided with the actuator.

The grounding lug on the actuator enclosure exterior must be wired to a suitable ground system with minimum #10 AWG wire as noted in the electrical wiring diagram provided with the actuator.

QRG Output Gear Box

The addition of this gear reduction assembly to the output of the QR Rotary Actuator comprises the QRG actuator, used for increased output torque at lower rotational speeds. The integral flange of the gear housing casting is used to mount the complete QRG actuator. The input pinion to the gear box low speed gear set is retained in and driven by the output drive sleeve of the QR actuator. Output drive of the gear box low speed gear set is retained in and driven by the output drive sleeve of the QRG actuator. Output drive of the gear box can be either a bore and key drive sleeve or an optional stub shaft. The bearing supported gearing is lubricated as noted in the lubrication information section on page 5.

Limit Switch Compartment Heater

In applications where ambient conditions or project specifications require, an optional space heater mounted within the geared position limit switch compartment, is available. The heater is powered by 120 VAC. The input voltage is continuous unless externally interrupted.

Gear Driven Potentiometer

This potentiometer assembly is direct driven by the operation of the actuator and gives the capability of providing a continuous linear output control signal directly proportional to the actuator's position. The signal can be interfaced with automatic control equipment to position or sense the actuator at any desired position between fully opened and fully closed. The potentiometer assembly is mounted directly to and driven by the geared position limit switch.

Input gearing to the potentiometer has been factory selected to accommodate the full range of actuator revolutions. The potentiometer has been factory adjusted so the 0 and 1000 ohm resistance points correspond, respectively, to the fully closed and fully opened positions specified by customer. Field adjustment may be done by loosening the set screw in the drive pinion on the potentiometer shaft, rotating the shaft as required and retightening the set screw.

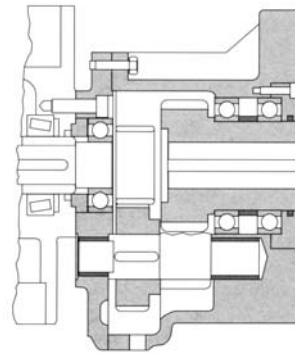
Integral Motor Starter

For information concerning the integral motor starter and any other related control components provided, refer to the electric wiring diagram provided with the actuator.

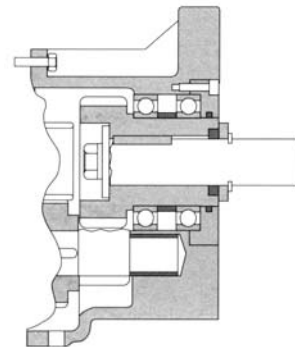
Manual Handwheel Clutch Assembly

The manual handwheel clutch assembly permits manual operation of the actuator for installation, adjustments and during an electrical power failure. The handwheel clutch assembly is readily engaged for handwheel operation and will automatically disengage from the handwheel and re-engage to the electric motor when electric power is restored.

For manual operation, rotate the declutch lever counter-clockwise until a definite "click" is felt. This is indicating the tripper (361) has been retained by the eccentric (321) and the clutch sleeve (317) has been separated from the main worm gear (8). At the other end of the clutch sleeve, the two lugs are extending to engage with the handwheel worm gear (336). Now, the drive sleeve is totally controlled by the manual handwheel. When the power is resumed, the main worm gear will drive the eccentric to release the tripper and the clutch spring (319) will push the clutch sleeve to engage with the eccentric. The eccentric is connected to the main worm gear by the dowel pin (330). At the other end of the clutch sleeve, the lugs are retracting to dis-engage with the handwheel worm gear and the actuator is now returning to motor operated position.



Gear Box For QRG (Bore and Key)



Stub Shaft (Optional)

Disassembly and Reassembly of Manual Handwheel Clutch Assembly

Item	Description	Item	Description
8.	Main Worm Gear Ass'y	342.	Handwheel Shaft
20.	Bearing Cone (Upper)	343.	Quad Ring
315.	Needle Bearing	344.	Oil-Lite Bushing
317.	Clutch Sleeve	345.	Thrust Washer
318.	Clutch Spring Retainer	346.	Needle Bearing
319.	Clutch Spring	347.	Thrust Washer
320.	Thrust Washer	348.	Square Key
321.	Eccentric	350.	Retaining Ring
330.	Dowel Pin	351.	Thrust Washer
331.	Cover	352.	Needle Bearing
332.	Housing	353.	Thrust Washer
333.	Quad Ring	354.	Oil-Lite Bushing
334.	Quad Ring	355.	Pipe Plug
335.	Quad Ring	356.	Housing Cap
336.	Worm Gear	357.	Cap Screw
337.	Needle Bearing	358.	Lockwasher
338.	Thrust Washer	359.	Cap Screw
339.	De-clutch Lever Sub-Assembly	360.	De-clutch Shaft Sub-Assembly
340.	De-clutch Cap Sub-Assembly	361.	Tripper
341.	Handwheel Sub-Assembly	362.	Gasket

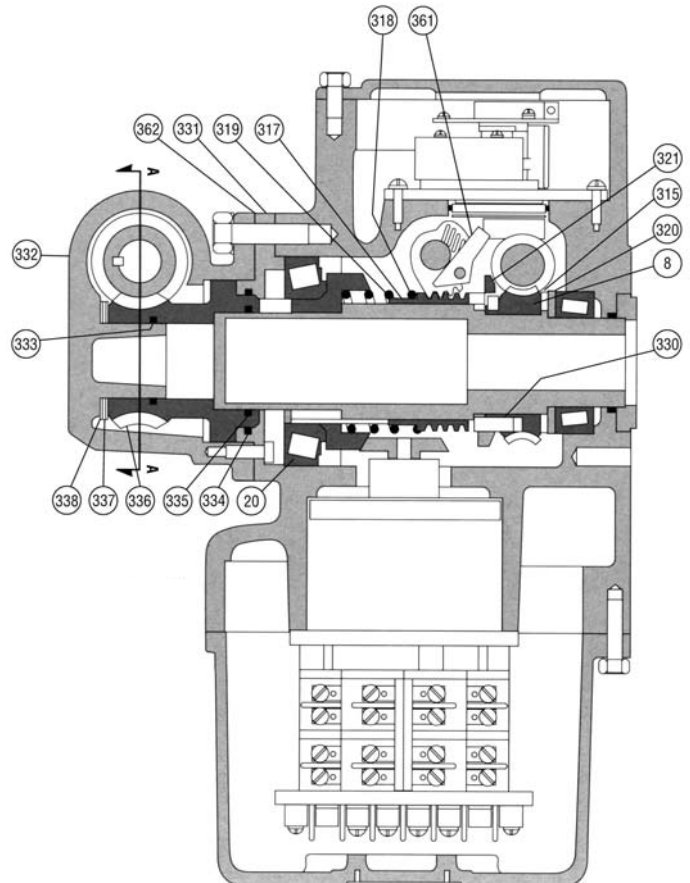
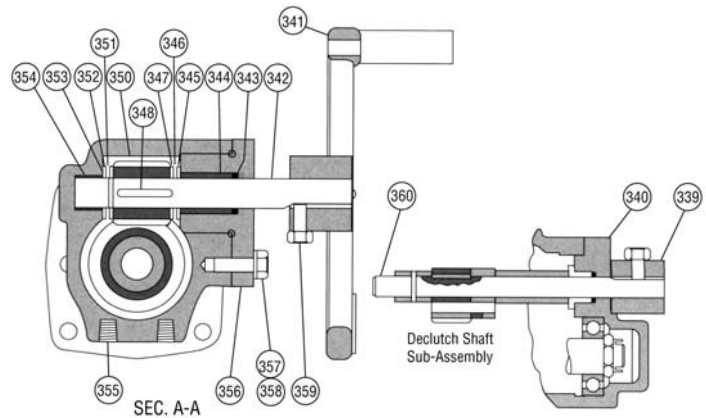
WARNING

Disconnect and lockout all electrical power to the actuator.

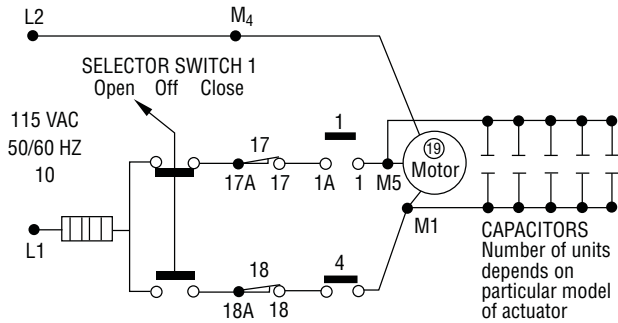
1. Remove the four fasteners to separate the worm gear housing (332) from the actuator housing.
2. Remove the limit switch and the torque switch.
3. First remove the de-clutch lever sub-assembly (339). Then remove the de-clutch cap sub assembly (340) and de-clutch shaft sub-assembly (360) can be removed.
4. Remove the thrust bearing cone (20) and the complete drive sleeve assembly can be removed from the actuator housing.
5. Loosen the cap screw (359) to remove the handwheel sub-assembly (341) and remove the fasteners.

6. Remove the cap screws to separate the cover (331) from the worm gear housing, the complete handwheel shaft assembly (342) will be able to slide out. Watch the sequences of thrust washers and needle bearings.

Reassembly is done by reversing above procedure. Upon completion of reassembly, liberally grease all sliding and rotating components before reinstalling manual handwheel clutch assembly on the actuator.

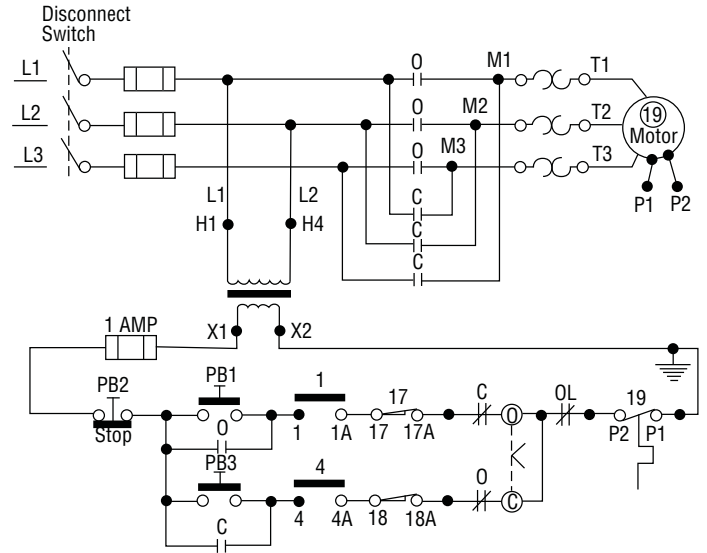


SINGLE PHASE POWER



NOTE:
 1. Thermal wires, P1 and P2, must be wired to motor starter coils for Class II, Division 1, Groups E, F, and G enclosure.
Failure to meet this requirement will void warranty.

THREE PHASE POWER



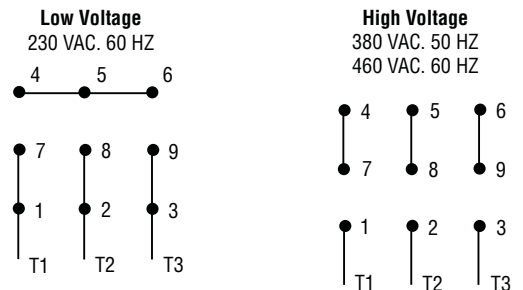
Rotor	Contact	Geared Limit Switch Contact Development			Function
		Actuator Position			
		Fully Closed	Intermediate	Fully Opened	
Open	1	—————	—————	-----	Full Open Position
	5	-----	-----	—————	Indicating Light
Inter-mediate	2	—————	-----	-----	Spare
	6	-----	—————	-----	Spare
Inter-mediate	3	-----	-----	—————	Spare
	7	—————	-----	-----	Spare
Close	4	-----	—————	-----	Full Close Position
	8	-----	-----	-----	Indicating Light

ACTUATOR SHOWN IN FULLY OPEN POSITION

- Switch Contact Closed
 - - Switch Contact Open
 - ⑰ Open torque switch interrupts control circuit if mechanical overload occurs during open cycles.
 - ⑱ Close torque switch interrupts control circuit if mechanical overload occurs during close cycles.
- Trip points of contacts 2, 6, 3, & 7 are adjustable between the fully closed and fully opened positions. Contacts on each rotor can be arranged for identical operation.

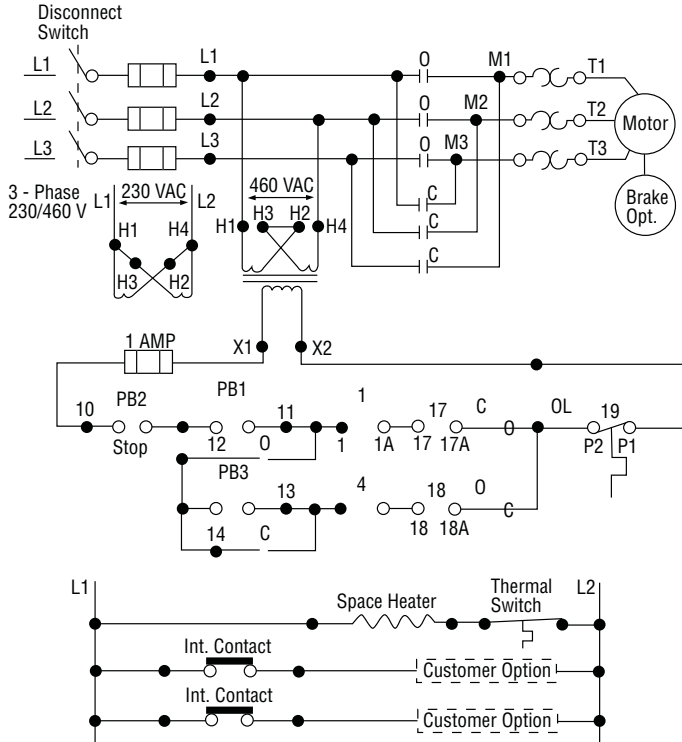
LEGEND

- — Switch Contacts
- — Wiring Connections
- ⑰ — Open Position Limit Switch
- ⑱ — Close Position Limit Switch
- ⑰ — Open Torque Limit Switch
- ⑱ — Close Torque Limit Switch
- ⑲ — Thermal Overload
- OL — Overload Relay
- ⊙ — Open Coil
- ⊙ — Close Coil
- ⌞ — Mechanical Interlock
- PB — Pushbutton
- — Fuses or Circuit Breakers
- ⌵ — Disconnect Switch



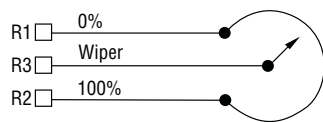
3 - PHASE MOTOR CONNECTIONS

INTEGRAL STARTER

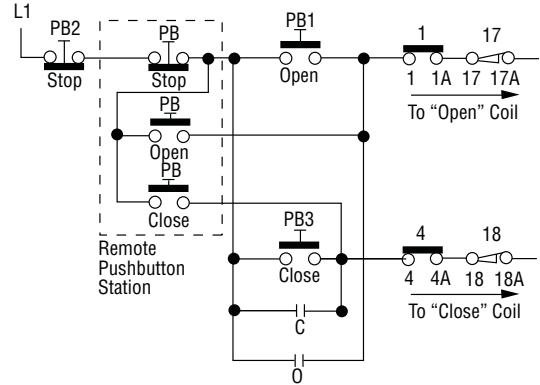


Note: These wiring diagrams are general information. For your particular application check the specified wiring diagram.

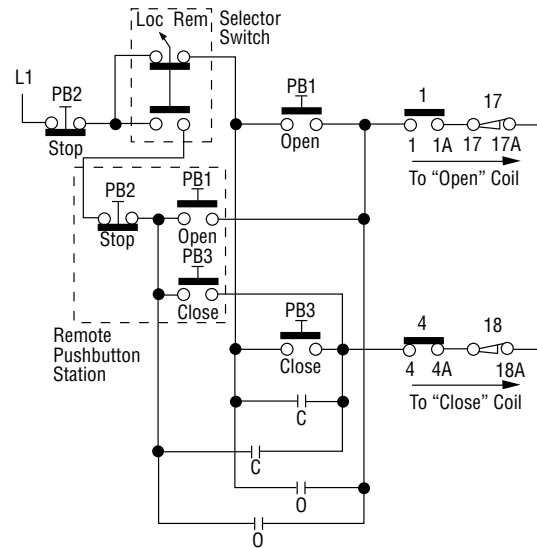
OPTIONAL POTENTIOMETER



LOCAL AND REMOTE OPERATION



SELECTOR SWITCH FOR LOCAL OR REMOTE OPERATION





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