



LESLIE
CONTROLS, INC.

A subsidiary of CIRCOR International, Inc.
12501 Telecom Drive • Tampa, FL 33637-0906

Installation, Operating and
Maintenance Instructions

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Rev. 1

ROTARY ON-OFF ELECTRIC/PNEUMATIC CONTROL VALVE LAURENCE SERIES

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WARNING!

Warning: Injury or death can occur due to failure to completely isolate valve from all sources of pressure before beginning disassembly. Do not proceed until valve has been completely isolated from process stream and vented to atmosphere.

INTRODUCTION

This Installation, Operation, and Maintenance Manual is intended to be as complete and up to date as possible. It covers installation, operation, and maintenance procedures for Leslie Controls, Inc. Rotary On-Off Electric/Pneumatic Control Valve. Leslie reserves right to update this manual and other product information concerning installation, operation, and/or maintenance, at any time and without obligation to notify product owners of such changes.

Leslie is not responsible for inaccuracies in specifications, procedures and/or content of other product literature, supplied by manufacturers of components used in Leslie Controls, Inc. Rotary On-Off Electric/Pneumatic Control Valve, Leslie strives to use only highest quality components; however, LESLIE has no direct control over their manufacture, or their consistent quality.

Leslie is not responsible for injury to personnel or product damage due to improper installation, operation, and/or maintenance of Leslie Controls, Inc. Rotary On-Off Electric/Pneumatic Control Valve. Trained/certified personnel should only perform all installation, operation, and maintenance procedures. Personnel should be trained in and familiar with correct piping and electrical procedures and methods, and should be experienced in working with hot/boiler water systems and steam systems. All personnel performing these procedures should completely and carefully read and understand all supplied materials before attempting procedures. All personnel should pay strict attention to all Notes, Cautions, and Warnings that appear within procedures detailed in this manual.

Leslie welcomes user's input as to suggestions for product or manual improvement.

Contact Information

For information concerning warranties, or for questions pertaining to installation, operation or maintenance of LESLIE products, contact:

LESLIE CONTROLS INC.
12501 Telecom Drive
Tampa, FL 33637
USA Phone: (813) 978-1000
USA Fax: (813) 978-0984
www.LESLIECONTROLS.com

To order replacement parts, contact LESLIE CONTROLS at address listed above, or call toll free:

USA/Canada/Caribbean Phone: (800) 323-8366

Note: Please include model and serial number of unit for which parts are being ordered. If ordering by phone, please have this information readily available.

GENERAL NOTES AND WARNINGS

Notes:

- If questions are not answered by this manual, or if specific installation, operation, and/or maintenance procedures are not clearly understood, contact Leslie Controls, Inc. for clarification before proceeding.
- If unit is damaged during installation, operation, or maintenance, complete following steps:
 1. Turn off and lock out electric power supply to unit in an approved manner.
 2. Turn off all incoming valves.
 3. Contact in-house maintenance personnel or Leslie Controls, Inc. for instructions.

Note: Throughout this manual, BOXES will denote warnings and cautions

CAUTION!

Piping system must be adequately designed and supported to prevent extraordinary loads to pressure equipment.

INSTALLATION AND OPERATION

A. INSTALLATION

Install valve with solenoid/e-magnet must be in an upright (vertical) position in a horizontal pipeline. Air cylinder mount must be in an upright position in a horizontal pipeline. Allow sufficient headroom to remove solenoid enclosure. Do not loosen valve body-bonnet bolts unless absolutely necessary to re-orient valve body with respect to solenoid top works. When re-tightening, care must be taken to tighten the bolts gradually and evenly to maintain alignment of inner parts. Verify all bolts are equally and fully tightened. See Torque Values on page 15.

B. PIPE CONNECTION

Connect inlet as directed by arrow or markings on valve body. Ensure pipeline is clean, free from dirt, metal chips, slag, etc., before connecting valve to line to prevent damage to valve seat or clogging. Do not strain valve body or use solenoid for leverage when connecting pipes.

1. **FLANGED (ANSI) CONNECTIONS** - Use proper flange gasket material. Verify all bolts are equally and fully tightened.
2. **SCREWED (NPT) CONNECTIONS** - Use appropriate paste or liquid type sealer. Do not use tape sealers. They may shred and get into valve. Do not seal weld or braze threaded pipe connections at valve body. This may distort seat and cause leakage.

C. ELECTRICAL CONNECTIONS

Connect solenoid directly across line through control switch. House connections in a watertight or explosion proof external box with approved watertight conduit connections for the wires. Do not remove sleeving from solenoid coil leads when making connections. This protects leads from damage inside solenoid enclosure. Valve is equipped with coil rated for continuous, 24-hour energization. It is normal for solenoid housing to become hot to touch when continuously energized. All enclosures have 1/2" or 3/4" NPT conduit connection.

Size control switch contacts accordingly and electrical wire must be adequate to avoid excessive voltage drop when valve operates. Full inrush current at rated voltage must be delivered to valve to insure closing against rated pressure. **RECOMMENDED MAX. AMB. TEMP.:** per solenoid IOM.

D. OPERATING CYLINDER CONNECTIONS

Remove protective plugs and connect air supply from 3-way pilot valve to NPT cylinder supply inlet at base of cylinder. If breather vent has been shipped loose, install carefully in vent connection at top of cylinder.

E. OPERATION: NORMALLY CLOSED

(see Page 15 for 3-way Flow Form)

1. **Fully Electrical, Energize to Open, Fail Close - 500, 510, 600, 613, R2500, 2-way Series and 3300, 3350 3-way Series:** Valve is closed in "normal" or de-energized position. When solenoid is energized (current on), valve opens and remains open as long as current is continuously supplied. Upon de-energization, valve returns to closed position, assisted by main spring, line pressure and weight of inner parts. Upon initial pressurization or re-pressurization of the fluid system piping, slowly open a manual upstream valve to prevent air from being trapped in upper portion of valve. If this is not done then, valve may open momentarily to relieve initial pressure surge.
2. **Cylinder Operated, Pressure to Open, Fail Close - CY500, 2-way Series and CY3300 3-way Series:** Valve is closed in "normal" (cylinder un-pressurized) position. Valve opens when pressure is admitted to cylinder and remains open as long as sufficient pressure is maintained in cylinder. When pilot flow to cylinder is vented, valve returns to closed position, assisted by internal spring, line pressure, and weight of inner parts. Valve will close fully at 0 PSI line pressure.
3. **Solenoid Manual Reset, No Voltage Release, Fail Close - 700, 800, 750, 850, 2-way Series and 3400, 3450 3-way Series:** Valve is opened manually and held open by continuously energized portative magnet type solenoid. When current fails, valve trips to fail-safe, closed position. Valve will not reopen until manually reset, even when current is restored.

CAUTION!

In case of emergency, valve may be opened manually by pulling extremely hard on lever to overcome magnetic holding force.

4. **Solenoid Manual Reset, Electric Trip, Fail Close - 1100, 1150, 1200, 1250, 2-way Series and 3500 3-way Series:** Valve is opened manually by lifting handle and held open by latch. When current flows or handle is released, it trips to fail-safe, closed position. valve will not reopen until manually reset.

CAUTION!

DO NOT attempt to manually "Trip" latched-in valve by pulling on operating lever as damage to latching mechanism may result.

F. OPERATION: NORMALLY OPEN

(see Page 15 for 3-way Flow Form)

1. **Fully Electrical, Energize to Close - 500, 510, 600, 613, R2500, 2-way Series and 3300, 3350 3-way Series:** Valve is open in “normal” or de-energized position. When solenoid is energized (current on), valve closes and remains closed as long as current is continuously supplied. When current stops, external main spring returns valve to open position. All Laurence Solenoid Valves will operate effectively at 0 PSI.
2. **Cylinder Operated, Pressure to Close - CY500, 2-way Series and CY3300, 3-way Series:** Valve is open in “normal” (cylinder un-pressurized) position. Valve closes when pressure is admitted to cylinder and remains closed as long as sufficient pressure is maintained in cylinder. As air pressure drops, external spring will begin to open valve. Valve will be fully open at 0 PSI.
3. **Solenoid Manual Reset, No Voltage Release - 700, 800, 750, 850, 2-way Series and 3400, 3450 3-way Series:** Valve is open manually and held open by continuously energized portative magnet type solenoid. When current fails, valve trips to fail-safe, closed position. Valve will not re-open until manually reset, even when current is restored.

CAUTION!

In case of emergency, valve may be closed manually by pulling extremely hard on lever to overcome magnetic holding force.

4. **Solenoid Manual Reset, Electric Trip - 1100, 1150, 1200, 1250, 2-way Series and 3500, 3-way Series:** Valve is open manually by lifting handle and held open by latch. When current flows or handle is released, it trips to fail-safe, closed position. Valve will not re-open until manually reset.

Note: Occasionally apply “Never-Seez”, or equal anti-seize compound to latch engaging pin and latch.

GENERAL MAINTENANCE

- A. Periodically check external fasteners for tightness and lockwires that they are properly secured.
- B. Valve should be kept relatively clean and free from accumulations of foreign matter such as dirt, salt, insulation dust, coal dust, etc.

C. Do not paint any moving parts, especially actuator plunger.

D. After any general overhaul or cleaning, apply Never-Seez (or equivalent) anti-seize compound to all internal moving parts and any external sliding or rolling surfaces.

REPLACEMENT PARTS

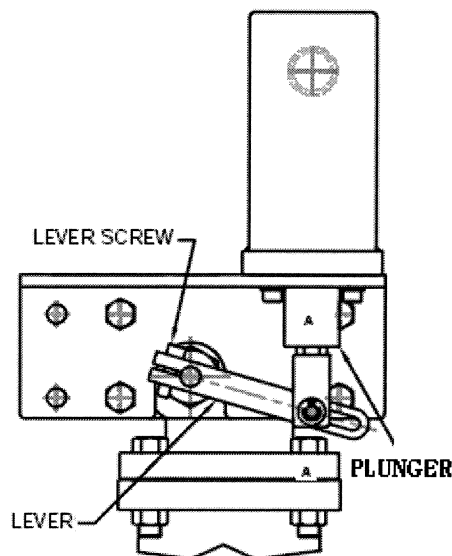


Figure 1 – General View

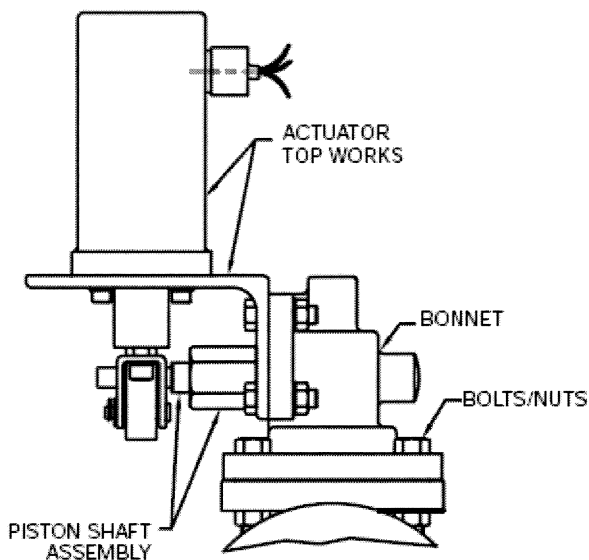


Figure 2 – General View

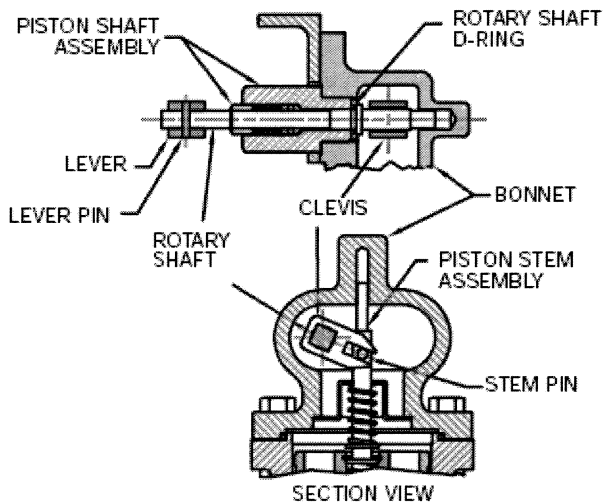


Figure 3 – Sectional Views

A. Body/Bonnet O-Ring - All Series

1. Unbolt valve bonnet from valve body. Lift bonnet and actuator top-works off body, being sure to hold external lever in open position to prevent valve stem (and piston) assembly from disengaging from clevis inside bonnet and falling out. Lie bonnet and actuator top-works down, carefully releasing lever. (Should stem become disengaged, mark side of stem facing clevis for reinstallation in same position).
2. Remove old O-ring and clean recess surfaces on valve body and in valve bonnet.
3. Insert new O-ring over recess on valve body. When installing a new metal, high-temperature O-ring,

apply a liberal coating of “Never-Seez” (or equivalent) anti-seize compound to sealing surfaces.

4. To reinstall bonnet and actuator top-works, hold external lever in open position, maintaining engagement of stem with clevis, and lift carefully over and onto valve body. Be careful not to bruise or pinch O-ring.
5. When re-bolting, make sure bolts are taken up gradually and evenly to prevent misalignment of inner parts. Ensure all bolts are fully and equally tightened.
6. Manually cycle valve to assure smooth operation.

B. Actuator Pneumatic Cylinder - CY500, CY3300 Series

1. Shut off pilot air supply and disconnect from cylinder inlet. Remove linkage cover, if required.
2. Remove cylinder operating rod disc and locknut.
3. Remove cylinder mounting bolts and locknuts. Lift cylinder straight up and off of bracket.
4. Mount new cylinder and replace cylinder rod disc & locknut exactly as removed.
5. Ensure proper “stroke” of valve has been maintained and there is no rubbing or binding at lever/cylinder rod connection. Lubricate cylinder rod and manually cycle valve to assure smooth operation.

C. Soli-con® Actuator/C, D, E & CI, DI, EI Size Solenoids

1. Complete Assembly
 - a. Turn off power and disconnect actuator leads from electrical supply.
 - b. Loosen 4 actuator assembly mounting screws and lift assembly straight up and clear of solenoid plunger.
 - c. If plunger is rusty or dirty, wipe clean and polish with fine emery cloth. DO NOT paint plunger. This could cause sticking inside plunger tube.
 - d. If plunger is to be replaced, **Soli-con® type:** Remove clevis assembly from existing plunger/clevis assembly and install new plunger. Ensure both nut and locknut are securely installed on new plunger/clevis assembly in same position as on old plunger/clevis assembly. **Solenoid type:** Remove cotter pin/retaining ring from existing plunger-lever pin. Remove old plunger and

install new plunger and pin. Ensure both retaining rings are securely installed on pin.

- e. Lower new actuator assembly over plunger and secure 4 assembly screws. Ensure they are fully and equally tightened.
- f. Cycle valve manually to ensure easy, free movement without binding or rubbing. Binding indicates actuator assembly may not be properly centered on plunger axis.
- g. Reconnect solenoid leads and test electrically. Do not remove lead protector(s) provided which protect wire insulation from damage where wires enter housing.
- h. Multi-Voltage Unit Actuators are Not Polarity Sensitive.

NOTE: If actuator is rated Explosion Proof, also refer to the original Explosion Proof instructions sheet.

For Units marked with Red and Black Leads:

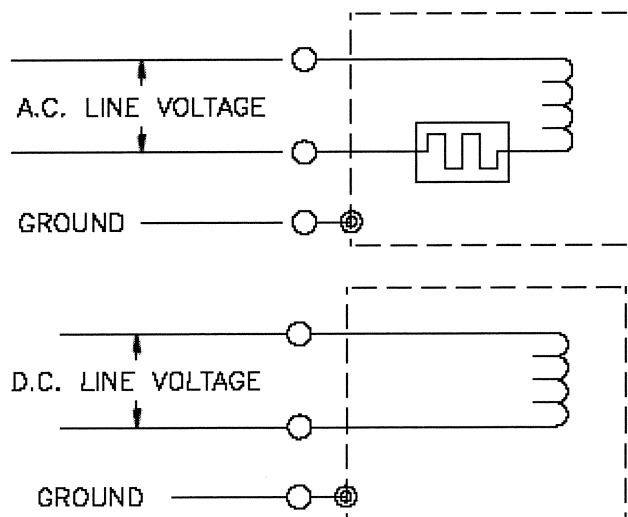
IMPORTANT for DC:

Connect RED LEAD TO (+) POSITIVE Supply Voltage.

Connect BLACK LEAD TO (-) NEGATIVE Supply Voltage.

Reversed Polarity Will Cause COIL BURNOUT !

CIRCUIT DIAGRAMS:



Wire Schematic 1 – C, D, E & CI, DI, EI Size Solenoids

2. Coil, AC (CI, DI & EI Size) & DC (C, D & E Size)
 - a. Ensure current is off.
 - b. Disconnect solenoid leads and remove lead protector(s) from wires.

- c. Remove solenoid housing and cover by removing cover bolt(s). Be careful not to lose coil spacer spring provided between upper coil disc and cover.
- d. Slide entire solenoid unit (solenoid housing, coil, coil gasket and, in some units, laminated coil disc and inner shell) up and off of plunger tube.

(For “AC” units)

1. Remove inner solenoid unit from outer housing, taking care not to damage lead wires as they come through conduit connection.
2. Slide upper coil disc and coil out of inner shell by gently tapping on lower disc with a hammer.
3. Tap lower coil disc back down flush with bottom of inner shell.
4. Insert coil gasket, new coil, other coil gasket and upper coil disc (in that order). Lining coil wires up with slot in inner shell.
- e. Re-insert inner assembly into housing with lead wire direction toward conduit connection, carefully feeding wires through connector.
- f. Replace entire assembly over plunger tube, installing gaskets, if provided, between solenoid housing, base and cover.
- g. Replace solenoid housing cover (and coil spacer spring, where applicable). Replace lead protector(s).

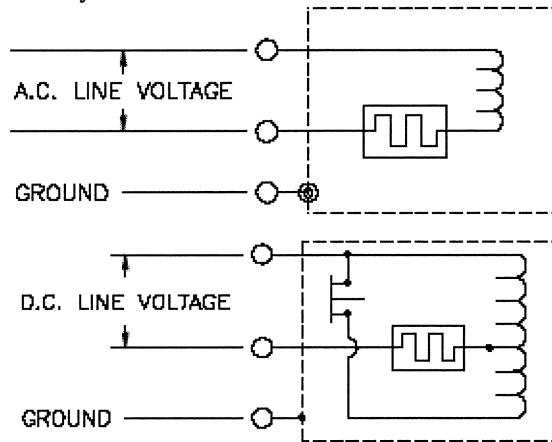
D. T Size Solenoid

1. Complete Assembly
 - a. Turn off power and disconnect solenoid leads from electrical supply.
 - b. Loosen 4 solenoid housing bolts and remove housing cover and housing. Clean out dirt or foreign matter in enclosure.
 - c. Remove 4 socket head bolts securing solenoid to mounting posts.
 - d. Carefully lift solenoid up and off of plunger and replace with new unit.
 - e. If plunger is to be replaced, remove cotter pin from existing plunger pin, remove plunger and install new plunger and pin.

NOTE! When re-installing pin, ensure cotter pins are bent completely around plunger pin and do not hit solenoid

frame. This will prevent plunger from rising all way to stub core within solenoid.

- f. Secure 4 bolts. Ensure they are tightened evenly and fully.
- g. Cycle plunger rod manually to ensure easy, free movement without binding or rubbing. Binding indicates actuator assembly may not be properly centered on plunger axis. Apply "Never-Seez" (or equivalent) anti-seize compound to plunger rod at pin and where it goes through guide bushing.
- h. Replace solenoid housing and cover. Be careful not to damage electrical leads or housing gaskets. If damaged, replace housing gaskets.
- i. Replace 4 solenoid-housing bolts. Tighten gradually and evenly to attain a tight seal around housing. Replace leads protector(s).
- j. Reinsure smooth operation by cycling valve manually.

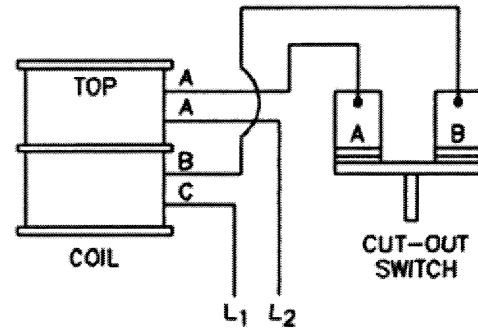


Wire Schematic 2 – T Size Solenoids

2. Solenoid Coil, AC & DC
 - a. Remove Solenoid Assembly (See Section D1.)
 - b. Remove top plate from solenoid housing by removing 4 bolts and 2) screws.
 - c. Lift stub core out of top end.
 - d. Remove plunger guides from bottom of solenoid by inserting screwdriver to lift guides away from lug on enclosure and pulling out at an angle.
 - e. Pull brass plunger guides out of top end.
 - f. Slide solenoid coil out of housing.
 - g. Replace new coil. ("DC" unit) Ensure end of coil marked "Top" is on top end of solenoid

stub core and reconnect marked leads as noted before.

- h. Replace Solenoid Assembly (See Section D.1.)



Wire Schematic 3 – AC & DC

** NOTE: Examine plunger rod and bushing to ensure there is no reason for binding and for a coating of anti-seize compound, such as "Never-Seez" on travel portion of rod. Also, when re-inserting plunger guides, ensure guides have about 1/64" freedom of movement lengthwise and widthwise to allow for temperature expansion. If not, file guide where it is notched out, as needed. Before reassembly, examine "mating" surfaces of plunger and stub core to ensure they are free of foreign matter such as dirt, rust, paint, etc. If not, emery or wire brush surfaces clean and smooth. Do not paint plunger or stub core under any circumstances as this can lead to binding. Coil is equipped with thermal cut-off to interrupt circuit at 192° C. This prevents a "melt-down" of coil within unit, which could render it useless. (For "DC" unit) Ensure cut-out switch is actuating properly and nothing interferes with plunger, preventing it from rising completely to meet stub core.*

NOTE: If actuator is rated Explosion Proof, also refer to original Explosion Proof instructions sheet.

E. CMR/CM Size Electromagnet - 700, 800, 750, 850, 3450 Series

1. Complete Assembly
 - a. Turn off power to solenoid and remove top cover bolts.
 - b. Remove top cover and disconnect electrical supply leads from solenoid rectifier. (CMR Size only)
 - c. Loosen 4 solenoid assembly mounting screws and remove existing solenoid from bracket.
 - d. Reconnect electrical supply leads to new rectifier push-on terminals. Connect supply leads to terminals marked "AC". Connect coil leads to terminal marked + and -. Polarity of coil leads is not important.

CAUTION!

Proper connection of coil and supply leads wires is imperative. Improper connection may cause damage to rectifier assembly.

- e. Re-install top cover with gasket (if furnished) and replace bolts. Tighten evenly to 10 ft-lbs.
- f. Restore power to solenoid and test holding properties.

NOTE: If your actuator is rated Explosion Proof, also refer to original Explosion Proof instructions sheet.

2. COIL - CMR/CM Size

- a. Turn off power to solenoid.
- b. Loosen solenoid bolts and remove top cover.
- c. Disconnect push-on terminals from rectifier. (CMR size only)
- d. Remove rectifier, coil disc and coil gasket. (CMR size only)
- e. Slide coil up and off solenoid core.
- f. Install new coil, cutting leads to proper length and attaching solderless terminals.
- g. Replace coil gasket and coil disc.
- h. Reinstall rectifier in housing on top of coil disc. Use a thread locking compound such as "Loctite" on socket head bolt. (CMR size only)
- i. Reconnect terminals to rectifier. Connect supply leads to terminals marked "AC". Connect coil leads to terminals marked + & -. Polarity of coil leads is not important. (CMR size only)
- j. Reinstall top cover with gasket (if furnished) and replace bolts. Tighten evenly to 10 ft/lbs.

3. RECTIFIER CMR Size

- a. Turn off power to solenoid.
- b. Loosen solenoid bolts and remove top cover.
- c. Disconnect push-on terminals from rectifier.
- d. **For Standard Rectifier:** Remove cover and rectifier from solenoid assembly. Install new rectifier in housing on top of coil disc. Use thread locking compound such as "Loctite" on socket head bolt. **For Rectifier with Remote Housing:** Remove wires and rectifier from housing. Install new rectifier in housing with

socket head bolt. Use thread locking compound such as "Loctite" on socket head bolt.

- e. Reconnect terminals to rectifier. Connect supply leads to terminals marked "AC". Connect coil leads to terminals marked + & -. Polarity of coil leads is not important.
- f. Reinstall top cover with gasket (if furnished) and replace bolts. Tighten evenly to 10 ft/lbs.

F. 2-way Piston & Stem Assembly

- 1. Direct Operated Piston & Stem - 500, 510, 700, 750, 1100, 1150 Series
 - a. **If valve body is not removed from pipeline,** unbolt valve bonnet and actuator top-works from valve body. When lifting bonnet and actuator top-works away from body, hold external lever in up or energized position to prevent inner piston and stem assembly falling out. To remove piston and stem assembly, carefully release external lever, allowing it to slip out of engagement from inner lifting clevis. Mark side of valve stem facing inner clevis for reassembly. **If entire valve is removed from pipeline,** place entire valve upside down in a vise and unbolt valve body. Hold external lever in down or energized position when lifting body away. To remove piston and stem assembly, carefully lift external lever and lift out. Mark side of valve stem facing inner clevis for reassembly. If piston has resilient Disc, skip steps b. and c

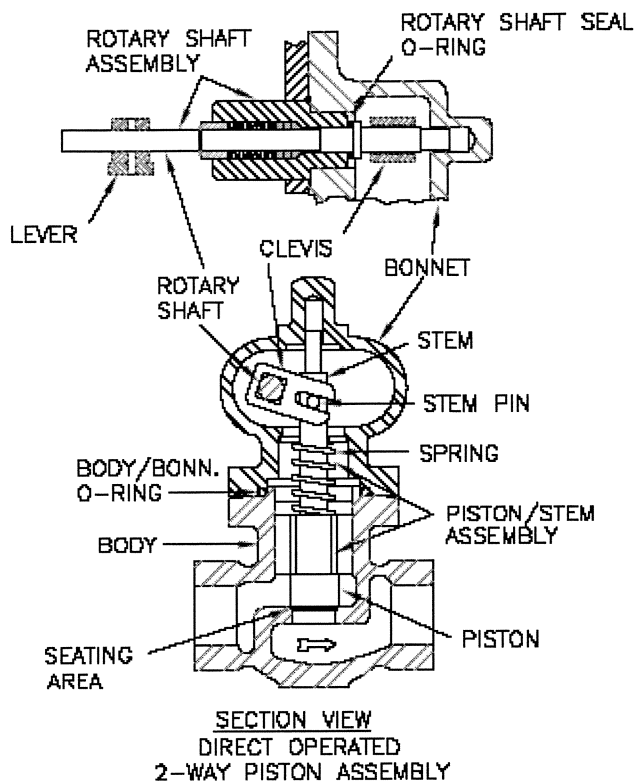


Figure 4 – Sectional Parts

- b. All metal to metal seating surfaces must be “lapped in” to provide tight shut-off. Use lapping and grinding compound made by Clover Manufacturing Co. of Norwalk, CT. Grade #4-A or equal. To lap piston seating surface, apply a very slight amount of compound to seat surface, insert into valve body and lap in by turning back and forth approximately 10-15 times; lifting occasionally to assure circular uniformity of grind line in valve body. Do not over grind.
- c. Remove piston and stem from body and clean all compound from it and from seat in valve body to prevent additional wear in seating area.
- d. Re-engage new piston and stem assembly with valve clevis according to mark on stem and reassemble valve. **If valve body is still in pipeline**, hold external lever in up or energized position (maintaining engagement of stem pin) while lifting bonnet and actuator top-works onto body. **If valve body is loose**, hold external lever in down or energized position to maintain engagement of stem pin while placing body on bonnet and actuator topworks (while upside down in vise).
- e. Tighten bolts gradually and evenly to prevent misalignment of inner part. Ensure all bolts are fully and equally tightened.

f. Manually cycle valve to assure smooth operation. Check all “mating” surfaces of valve internal parts, such as stem engagement with bonnet hole, clevis engagement with stem pin and piston guide area for smoothness and cleanliness and coat with “Never- Seez” or equivalent anti-seize lubricant before reassembly.

2. Pilot Operated Piston & Stem - 600, 613, 800, 850, 1200, 1250 Series (See Fig. 4)

- a. See part 1-a.
- b. See part 1-b.
- c. If piston and stem assembly is “two-piece”, and stem is not pinned to piston, stem must be removed from piston so piston can be held in order to rotate it inside body. Remove stem retaining ring, lift stem out of piston. Insert and wedge tightly a proper sized wood dowel in pilot hole of piston (from which stem was removed). Using wood dowel as a grip, rotate piston back and forth on valve seat, approximately 10-15 times; lifting occasionally to ensure circular uniformity of grind line in valve body. Do not over grind.
- d. Remove piston from body and clean all compound from piston and seat in body to prevent additional wear in seating area. Replace stem in piston, making sure retaining ring is fully in place.
- e. See part 1-d.
- f. See part 1-e.
- g. Manually cycle valve to assure smooth operation.

G. 2-way Piston Valve Disc

1. Remove Piston & Stem Assembly (See Section F.)
2. Place valve piston and stem snugly in a vise. Use rubber or leather vise gloves to remove disc nut cotter pin, disc nut or lock nut (as applicable (and remove valve disc. For Screwed Valve Disc - Use rubber or leather vise gloves to remove disc.
3. Insert new disc and reinstall disc nut & cotter pin or locknut. On stem (and pistons) having a disc nut and cotter pin, screw disc nut until hole in disc nut lines up with hole in shank of stem (or piston). Insert and spread cotter pin. On stems and pistons with a locknut, screw locknut down to its' position before removal or until snug against disc, with last thread of nut engaged with male thread on shank. For Screwed

Valve Disc - Insert new disc using epoxy sealant on threads.

4. If possible, entire piston and stem assembly should be held in a lathe on major (guide) diameter and indicated. Once indicated running perfectly concentric, take a very light cut on seating surface of valve disc to assure concentricity with its guide and with seat in valve body.
5. Replace Piston & Stem Assembly (See Section F.)

H. 2-way Main Piston Spring and/or Pilot Spring - 600, 800, 850, 1200, 1250 Series

1. Remove Piston and Stem Assembly (See Section F.)
2. Hold valve stem and piston assembly in a vise at upper part of stem. Support piston in your hand and punch stem pin out lightly with a hammer. Do not bend or unduly strain stem.
3. **For Main Spring**, remove valve main spring retainer and spring and install new spring. **For Pilot Spring**, remove valve main spring retainer and spring. Remove internal type retaining ring from center of piston insert. Pilot stem will now come out of piston. Install new pilot spring and reassemble stem assembly.
4. Reassemble piston and stem assembly and valve, following these precautions:
 - a. Fully support stem as described above when reinstalling stem pin.
 - f. Reinstall piston and stem assembly according to mark made on stem.
5. Replace Piston & Stem Assembly (See Section F.)

I. 3-way "ORS" Piston & Stem Assembly - 3350, 3450 Series

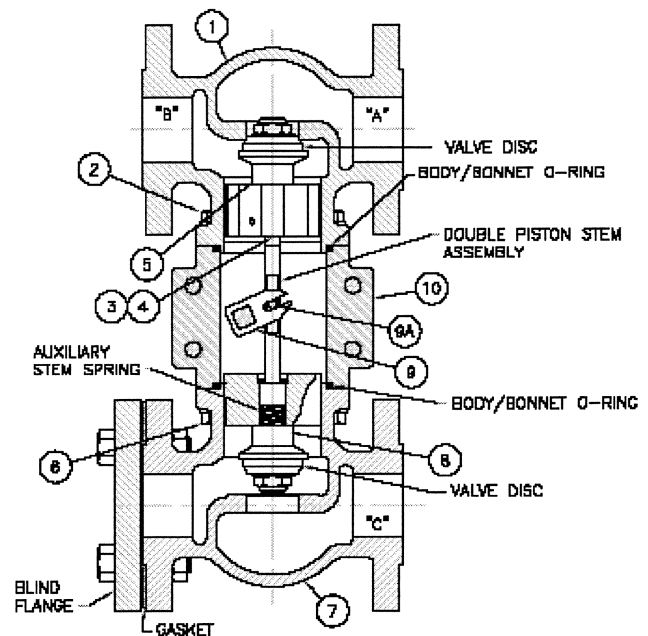


Figure 5 – 3 Way "ORS" Piston & Stem Assembly

1. Turn off pressure and electrical supply to valve.
2. Remove 4 body bolts "2" from upper valve body "1".
3. Carefully remove upper valve body "1".
4. Grasp upper piston "5" firmly and remove lock pin.
5. Upper piston "5" may now be removed.
6. Remove 4 body bolts "6" from lower valve body "7".
7. Carefully remove lower body "7".
8. Grasp lower valve piston "8", lift external lever guide and remove lower piston and stem assembly "8" from valve bonnet "10". Caution: Do not force.
9. Remove upper piston "5" by removing lock pin from new stem and piston assembly.
10. While holding external lever in upper position, insert new lower piston and stem assembly into valve bonnet "10" making sure that stem pin "9A" engages clevis. When pin is engaged, allow external lever to return to unlatched position. Stem pin should be engaged in clevis.
11. Replace lower body "7" and tighten body bolts "6".

12. Replace new upper piston "5". When piston is positioned correctly, replace lock pin.
13. Replace upper valve body in proper position and tighten body bolts "6".
14. Cycle valve manually to check for smooth operation.

Note: Failure to perform this step accurately and in correct sequence may result in damage, which can only be corrected at factory.

J.3-way Top Poppet Assembly - 3300, 3400, 3500 Series

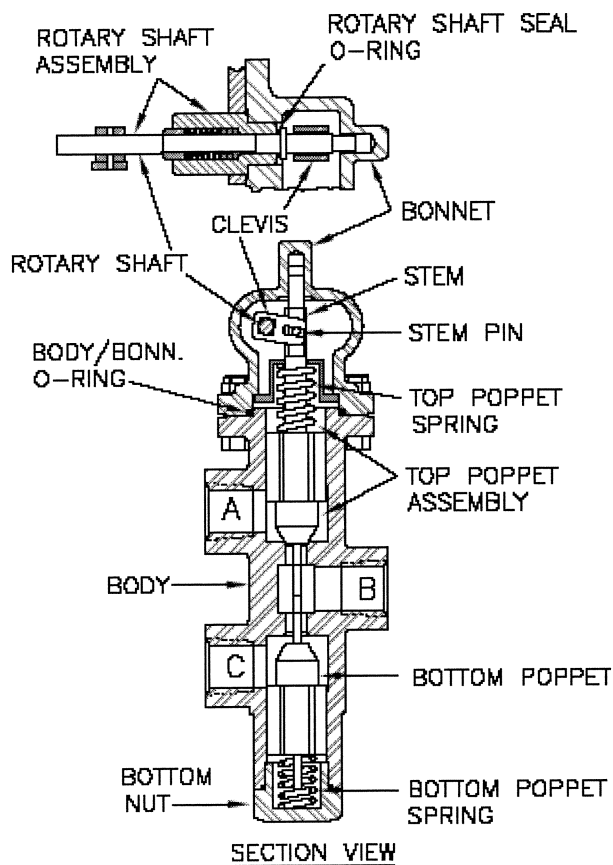


Figure 6 – 3 Way Top Pop

1. **If valve body is not removed from pipeline**, unbolt valve bonnet and actuator top-works from valve body. When lifting bonnet and actuator top-works away from body, be sure to hold external lever in up or energized position to prevent inner poppet and stem assembly falling out. To remove poppet and stem assembly, carefully release external lever, allowing it to slip out of engagement from inner lifting clevis. **If entire valve body is removed from pipeline**, place entire valve upside down in a vise and unbolt valve body. Hold external lever in down or energized position when lifting body away. To

remove stem or poppet assembly, carefully lift external lever and lift out. If Poppet and stem has a Resilient Disc, skip steps 2. and 3.

2. See part F-1-b.
3. Remove poppet stem from body and clean all compound from it and seat in valve body to prevent additional wear to seating area.
4. Reengage new poppet and stem assembly with valve clevis and reassemble valve.
 - a. **If valve body is still in pipeline**, hold external lever in up position (maintaining engagement of stem pin) while lifting bonnet and actuator top-works onto body. **If valve body is loose**, hold external lever down to maintain engagement of stem pin while placing body on bonnet and actuator top-works (upside down in vise).
5. See part F-1-e.
6. See part F-1-f.

K. 3-way Top Poppet Spring - 3300, 3400, 3500 Series

1. Remove Top Poppet Assembly (See Section J.)
2. Hold poppet assembly in a vise at upper part of poppet with vise jaws on each side of stem pin. Hold lower part of poppet in your hand and tap lightly with a small hammer to punch stem pin out, do not bend or strain poppet.
3. Remove spring disc and actuator top poppet spring.
4. Install new top poppet spring, spring disc and replace stem pin using same caution as in step No. 2 above.
5. Replace Top Poppet Assembly (See Section J.)

L.3-way Bottom Poppet Spring - 3300, 3400, 3500 Series

1. Loosen and remove valve bottom nut. Do not let bottom poppet drop out.
2. Remove bottom poppet spring and replace with new spring.
3. Ensure bottom poppet is aligned properly and tighten bottom nut. Apply a small amount of pipe thread compound, if needed.
4. Manually cycle valve to assure smooth operation.

M. Rotary Shaft Assembly

1. **IMPORTANT:** Before disassembling valve, mark actuator plunger position with respect to bottom edge of plunger tube while in upright position and with external lever in fully down position.
2. Remove actuator from bracket.
 - a. 500, 600, 2500, 3300 Series Fully Electric: Loosen 4 bolts and nuts holding bonnet. Remove actuator top works and bonnet assembly as one unit, holding actuator plunger up against stop (energized position), to prevent piston and stem assembly from dropping out.
 - b. 1100, 1150, 1200, 1250, 2500, 3500 Series Manual Reset, Electric Trip: Do not remove latch from bracket or loosen nuts on plunger rod. To remove actuator top works and bonnet assembly from valve body as one unit, loosen 4 bolts and nuts holding bonnet to valve body. Lift complete assembly from valve body, holding lever up against actuator or in latched position to prevent piston and stem assembly from dropping out.
 - c. 700, 750, 800, 850, 3400 Series Manual Reset, No Voltage Trip: To remove actuator top works and bonnet assembly from valve body as one unit, loosen 4 bolts and nuts holding bonnet to valve body. Lift complete assembly from valve body, holding lever up against actuator or in latched position to prevent piston and stem assembly from dropping out.
3. Clamp actuator and bonnet assembly upside down in a vise. For 500, 600, 2500 and 3300 Series disconnect actuator plunger from lever.
4. Remove piston and stem assembly by lifting lever to disengage piston stem pin from clevis.
5. Unscrew rotary Teflon shaft seal assembly with lever attached from bonnet.
6. Remove lever taper pin by punching out on same side as lever screw head. Loosen lever screw and remove lever from shaft (insert screw driver to expand slot slightly, if necessary).
7. Using suitable pipe compound on threads, screw new rotary shaft unit into bonnet, inserting square shank of shaft into clevis.
8. Insert lever on new shaft and tighten lever screw snug. Reconnect plunger to lever.
9. Reengage piston and stem assembly with clevis. Hold lever in up position to maintain engagement and remount bonnet and actuator top works on body, tightening body bolts gradually and evenly. See Torque Values on back cover
10. Loosen lever screw and ensure piston and stem assembly has assumed fully closed position. Move lever until mark is lined up and tighten lever screw moderately. Look at side of valve to verify center of lever is in line with center-line of actuator. Double check stroke setting mark on plunger is still even with bottom edge of plunger tube). Gently work lever back and forth to check for smooth operation. If everything checks out, tighten lever screw as much as possible.
11. If valve body cannot be removed from line, remove bonnet and actuator top works from body again and place upside down in a drill press vise and mount on drill press. Use #22 drill. Hold lever horizontal or line up lever so drill is true with hole already in lever. Place wood blocks under lever and shaft for support when drilling to prevent misalignment of shaft in rotary shaft unit. Place rag around opening between actuator plunger and plunger tube and bonnet opening to protect from chips. Drill through rotary shaft. Clear all chips away.
12. Hold valve with shaft against a rigid support (such as a bar held in a vise) insert taper pin into lever and tap in with small hammer. Check for smooth operation.
13. It is imperative to maintain good rigid support on valve shaft when drilling and when inserting taper pin to assure a tight sealing unit.
14. Hold lever in up position to maintain engagement of piston and stem assembly. Lift bonnet and actuator topworks assembly back onto valve body. Install new o-ring, if needed. Tighten nuts gradually and evenly to prevent misalignment of inner parts. Do not pinch o-ring. Ensure all nuts are fully and equally tightened.
15. Check for smooth operation and proper stroke by lifting lever up and down.

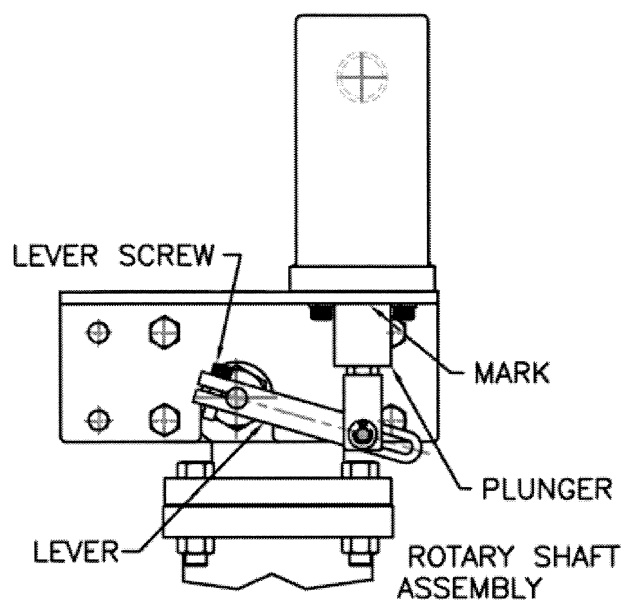


Figure 7

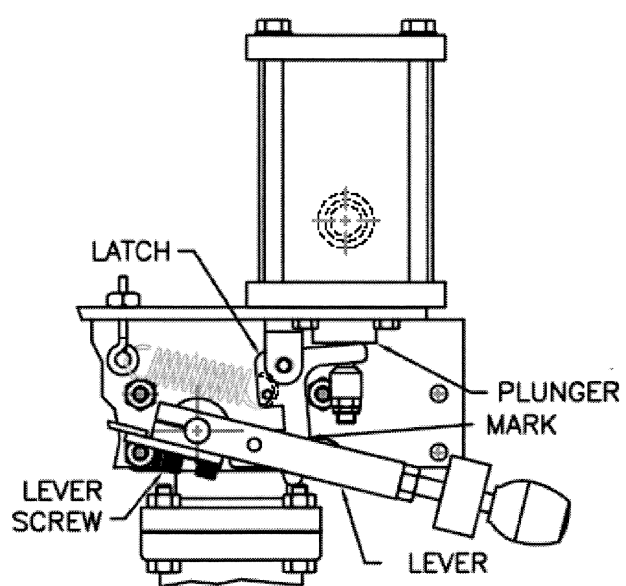


Figure 9

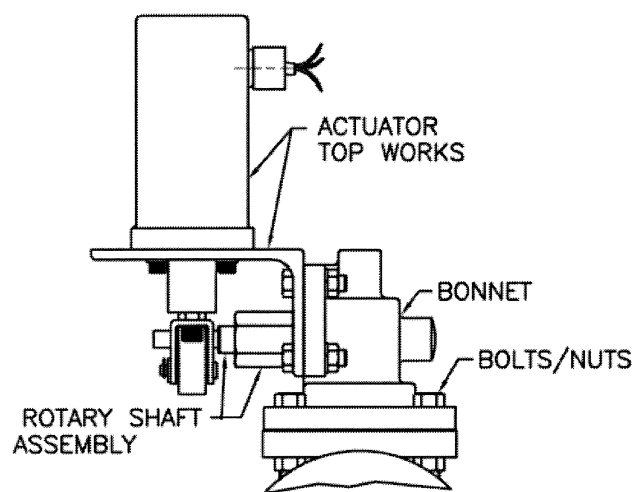


Figure 8

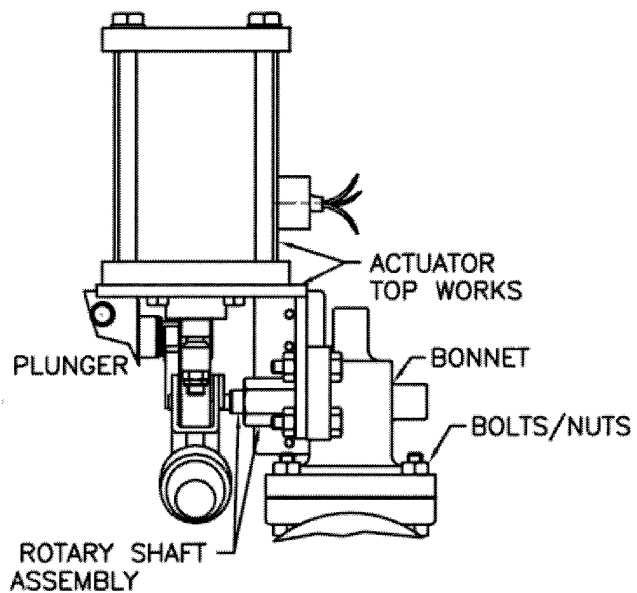


Figure 10

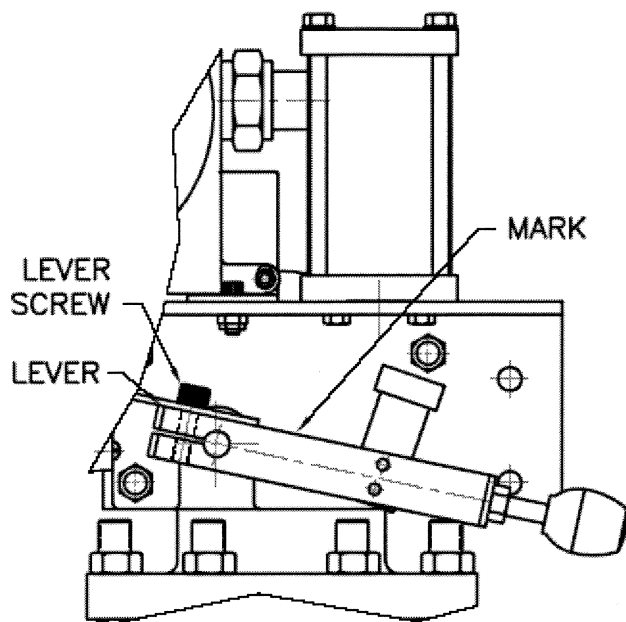


Figure 11

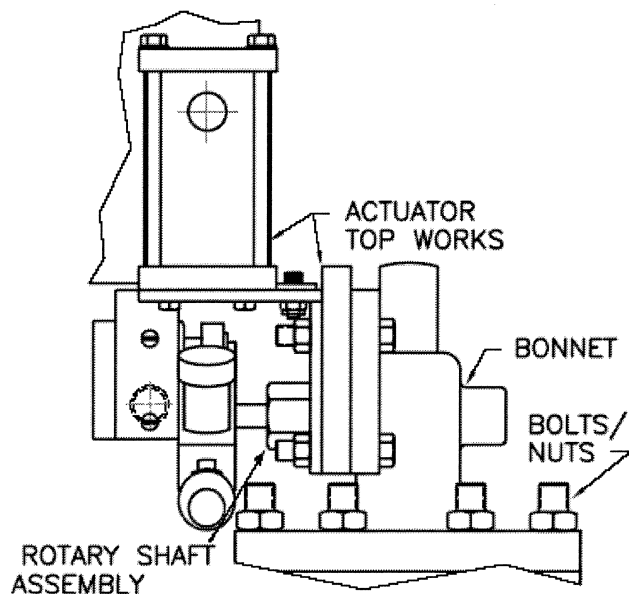


Figure 12

N. Rebuilding Rotary Shaft Assembly.

A HIGH DEGREE OF CLEANNESS MUST BE MAINTAINED IN PERFORMING FOLLOWING STEPS.

1. Turn pressure off and de-energize actuator.
2. 500, 550, 600, 2500, 3300 Series Fully Electric only:
 - a. Disconnect lever from actuator plunger and rod. Loosen valve bonnet bolts and nuts.
3. 1100, 1150, 1200, 1250, 2500, 3500 Series Manual Reset, Electric Trip only:
 - a. When present, remove linkage cover and external operating lever. Do not remove latch from bracket or loosen nuts on plunger rod.
 - b. Remove 4 bracket bonnet fasteners and lift entire actuator top-works from valve. Do not damage latch assembly or switch.
4. Unscrew shaft seal assembly from valve bonnet by putting a wrench on housing hex.
 - a. 500, 550, 600, 2500, 3300 Series Fully Electric only: Lift plunger/plunger rod clear of valve operating lever while unscrewing shaft seal assembly. It may be necessary to remove bracket bonnet bolts and nuts, and then swing entire actuator top-works to one side for lever to completely clear plunger/plunger rod.
5. Pull shaft seal assembly out of bonnet, marking position of square on inner end of shaft with respect to stem lifting clevis inside bonnet.
6. Mark position of lever with respect to square on inner end of shaft. Do not flip lever 180° or upside down. This will affect preset valve stroke.
7. Support shaft well and remove lever shaft tapered lock pin by punching out on same side as set screw head. Loosen screw and remove lever from shaft. Insert screwdriver to expand slot slightly, if necessary.
8. Remove snap ring from shaft.
9. Remove shaft bushing, spring washer and spring. Do not disturb factory installed packing in housing.
10. Carefully pull shaft out of housing and remove old o-ring from shaft. Remove existing packing from housing.
11. Replace new o-ring and apply a light film of "Anti-Seize" lubricant to o-ring surface and all other bearing surfaces.
12. Reinsert shaft into housing. Wrap new packing around shaft to create a ring. Cut packing ends on a 45° angle, facing each other. Insert packing ring into housing. Repeat process (most rotary shaft assemblies take two rings). When inserting second

ring, rotate packing ring abutments 180° from each other to ensure no leaks through packing. Replace spring washers, spring and bushing in proper order.

13. While compressing spring, press bushing in until retaining ring snaps in groove on shaft.
14. Holding housing, grab shaft on square and rotate back and forth to check for smooth operation. If not smooth, repeat steps f through j. This is an indication of dirt or a burr inside assembly, which will cause leakage or galling or both.
15. Insert assembly with shaft in exact same position as was marked when removed. Apply a slight amount of suitable pipe compound to threads of housing and tighten assembly fully.
16. Reverse above steps to reassemble valve.

17. Cycle valve manually to check for smooth operation.

TORQUE VALUES* FOR BODY/BONNET BOLTING

Bolt Size (in)	Torque Value (Ft-Lbs)
1/4-20	1.6
5/16-18	3.3
3/8-16	6
7/16-14	9.6
1/2-13	15
5/8-11	30
1-8	130

*For lubricated bolts

3-WAY FLOW FORM CHART

	FLOW FORM M INLET AT A OUTLET AT B VENT AT C	FLOW FORM N INLET AT C OUTLET AT B VENT AT A	FLOW FORM O INLET AT B NORMALLY CLOSED OUTLET AT A NORMALLY OPEN OUTLET AT C	FLOW FORM P NORMALLY CLOSED INLET AT A NORMALLY OPEN INLET AT C OUTLET AT B
(ACTUATED) LATCHED POSITION				
(NORMAL) DE-ENERGIZED UN-LATCHED POSITION				

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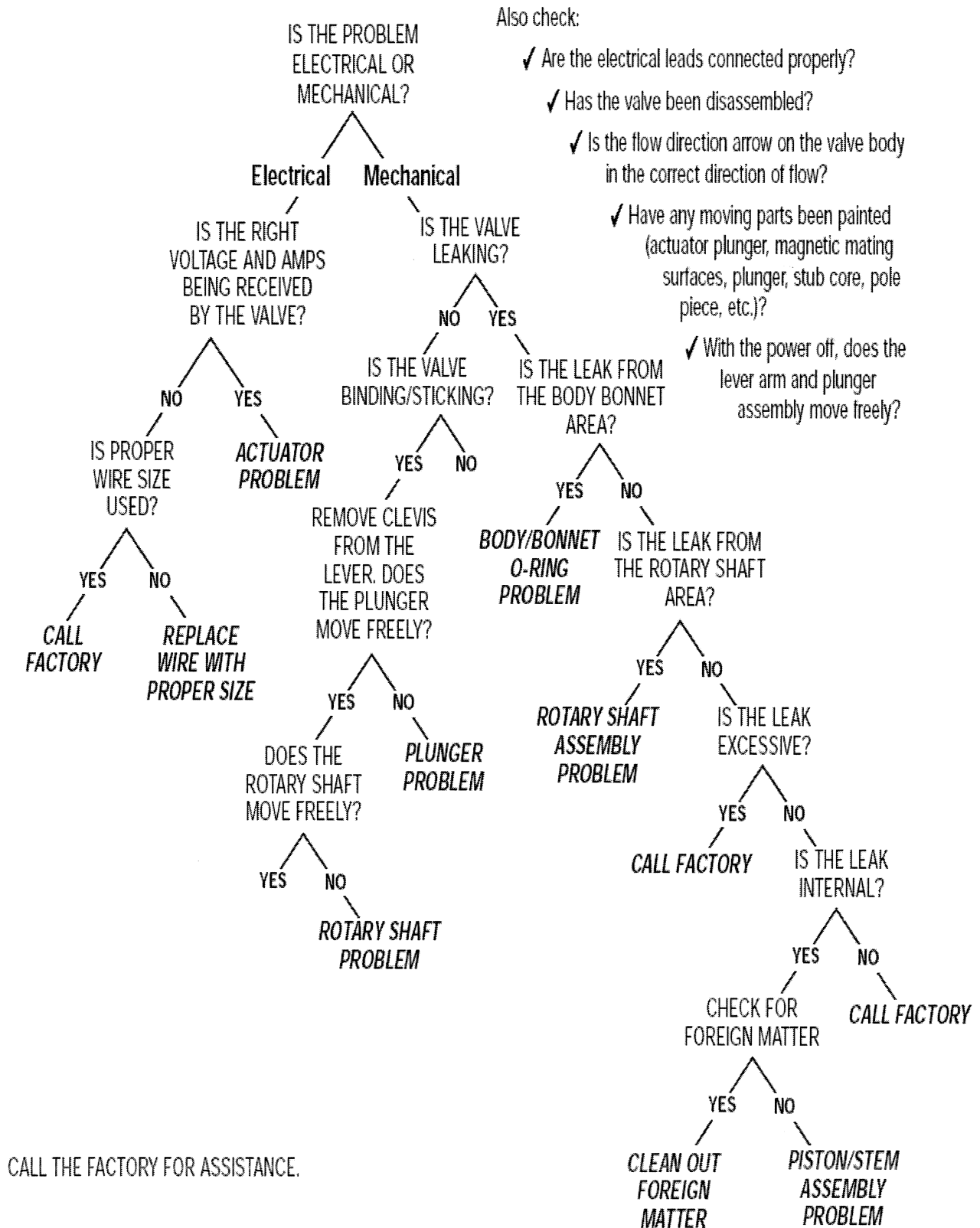
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