

# instructions for CONTROL VALVES SINGLE PORTED

## Installation, Operation and Maintenance

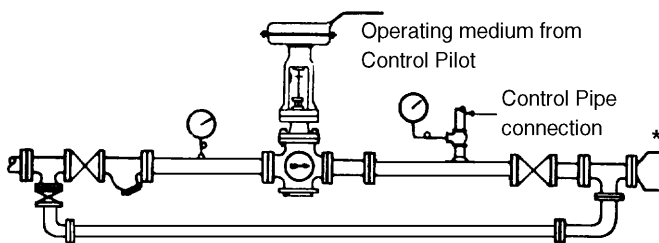
(this instruction covers all classes of Diaphragm Control Valves with class designations beginning as follows: DL, DDL, DOS, DDOS, followed by either letters or numerals.)

NOTE 1: Where noise is a factor follow recommendations for piping and fittings per 5/0.3.1.

### SECTION I—INSTALLATION

#### VALVE POSITION

Install control valve in the highest horizontal line of piping, in an accessible location and with arrow on side of valve body in direction of fluid flow. Control valve may be placed in any position, but upright is preferable for ease of maintenance.



\*Expand as required for fluid flow.

Figure 1 - Typical Installation

#### PROBLEM PREVENTING PROCEDURES

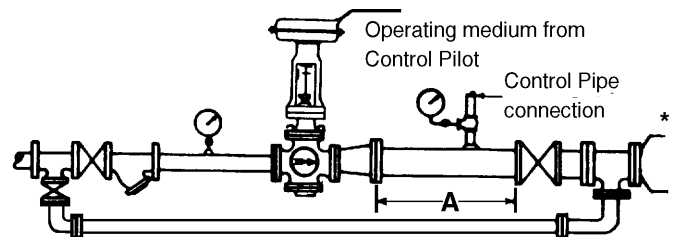
1. Provide removal space above, below and around control valve for easy removal of parts during maintenance. See proper drawing for dimensions.
2. Blow or flush out pipe lines thoroughly before installing control valve.
3. Protect control valve and the following equipment with a self-cleaning strainer.
4. Install stop valves and gauges in inlet and outlet lines to provide means for checking adjustment and operation of equipment.
5. Provide proper inlet and outlet drainage in steam service to prevent water hammer or possible erosion of equipment.
6. Adhere to good piping practice. Install a bypass around the control valve.

Connect operating medium tubing from control pilot, instrument or loading device to diaphragm chamber connection of control valve or to valve positioner, if one is in use.

**Important:** If control valve is fitted with a Thermo-Isolating bonnet, do not lag or insulate bonnet or paint it other than dull black, otherwise its heat emitting efficiency will be impaired and packing will be submitted to excessive temperature.

#### RECOMMENDED PIPING FOR CONTROL OF COMPRESSIBLE FLUIDS AT VALUES OF 25% OR LESS OF INLET PRESSURE.

1. Expand outlet pipe to twice control valve inlet pipe size. Use tapered expander.
2. Connect control pipe for control pilot ahead of outlet stop valve and at least 2' to 3' downstream from end of expander.
3. Make control pipe connection at least 18" to 2' from outlet stop valve, any elbow or other flow direction changing fitting.



\*Expand as required for fluid flow.

Figure 2 - Typical Control Valve Station for Control of Compressible Fluids at 25% or Less of Inlet Pressure

**NOTE:** Where sensing impulse is taken 2' to 3' downstream from control valve (expander), dimension "A" minimum of 6' to 10' will provide lowest noise and velocity factors, accurate pressure sensing and reasonable bypass length.

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### SECTION II—OPERATION

1. Close inlet and outlet stop valves.
2. Check that control valve responds properly through rated travel in relation to changes in operating pressure on the diaphragm. Rated travel is shown by position of travel indicator on valve stem relative to travel indicator scale on yoke.
3. Manually operate control valves fitted with manual operating devices through rated travel to check freedom of movement.
4. Place control valve in operation in accordance with instructions furnished with control pilot or other operating device.

### SECTION III—MAINTENANCE (DL, DDL, DOS, DDOS—600 lbs. or less)

**NOTE:** To reduce maintenance time refer to proper drawing and follow steps shown below for applicable maintenance operation.

To Renew Valve Plug Stem Packing	Section III
To Dismantle Control Valve - Inspect Parts - Replace or Regrind Valve Plug/Seat ring(s)	Section III Dismantling
To reassembly Control Valve	Section III Reassembly
To Preload Adjusting Spring Set Rated Travel	Section III Reassembly 3 thru 10
To Replace Diaphragm and/or Stem Seal	Section IV
To Change Valve Action Normally Open to Normally Closed or Vice Versa	Section IV

### RENEWING VALVE PLUG STEM PACKING

Renew valve plug stem packing if control valve has been in service beyond normal maintenance and packing shows signs of wear. Wear will be indicated by leakage which cannot be corrected by minor tightening of packing flange.

Where Leslie BRAIDED TEFLON GRAPHITE packing is in use, additional packing rings can be installed to overcome minor leakage without dismantling the control valve or breaking valve plug connection.

### TO INSTALL A COMPLETE SET OF PACKING

1. Disassemble control valve as far as necessary for the work required (See "DISMANTLING"). Remove old packing. Clean valve plug stem and packing box thoroughly. Polish valve plug stem with crocus cloth. Use approved, non-residue forming solvent for cleaning. Wipe dry with clean cloth.
2. Insert a new set of packing in packing box in the order shown on the packing wrapper. Packing wrapper contains complete installation instructions on how to install a set of packing. Each wrapper shows the order in which the various pieces of packing are to be inserted in the particular valve in which they are to be used.
3. After packing is installed, reassemble packing follower, packing box flange and bolts/studs to bonnet. Tighten bolts/studs as shown in instruction on wrapper.

### DISMANTLING

1. Close inlet and outlet stop valves. Operate system on bypass, if necessary.
2. Shut off operating medium and relieve pressure from diaphragm by disconnecting tubing at diaphragm case.

### Removing Actuator from Valve Body Assembly

Loosen valve plug stem nut. Use wrench on flats of valve plug stem and turn valve plug stem out of actuator stem threads until it is disengaged. (In large control valves support valve plug stem

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**SECTION III - MAINTENANCE CONT.**

to prevent valve plug from suddenly falling downward as valve plug stem clears actuator stem). Take travel indicator off valve plug stem.

Remove capscrews holding actuator to bonnet and lift actuator off bonnet.

**Single Ported Unbalanced Types - DL, DOS Types**  
 (See Figure 3 and 4)

Remove nut (34) from valve plug stem. Disassemble bonnet bolts/nuts (42/45). Lift bonnet, valve plug assembly and bonnet gasket (44) off valve body. Loosen and remove bottom cap (flange) (48) and gasket (47) where applicable. Disassemble packing flange bolts/studs (37), packing flange (36) and packing follower (38) from bonnet. Clean out packing box.

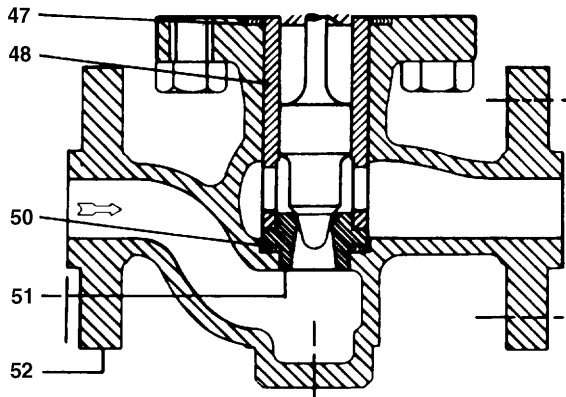


Figure 3 - Cage Trim (DOS) Type

**Valves fitted with Cage Type Trim**  
**(O in Class)**  
 (See figure 3)

Trim components are: Seat retaining guide/cage (48), seat ring insert (51) and seat ring insert gasket (50). In "I" trim types (Class DIS, etc.) body gasket (47), seat retaining guide/cage (48), valve plug guide and throttling sector will come out along with valve plug. Disassemble parts when removing valve plug from bonnet.

To remove seat ring/insert, place tapered wooden dowel into seat ring/insert and lift out seat ring/insert. Seat ring/insert gasket will follow.

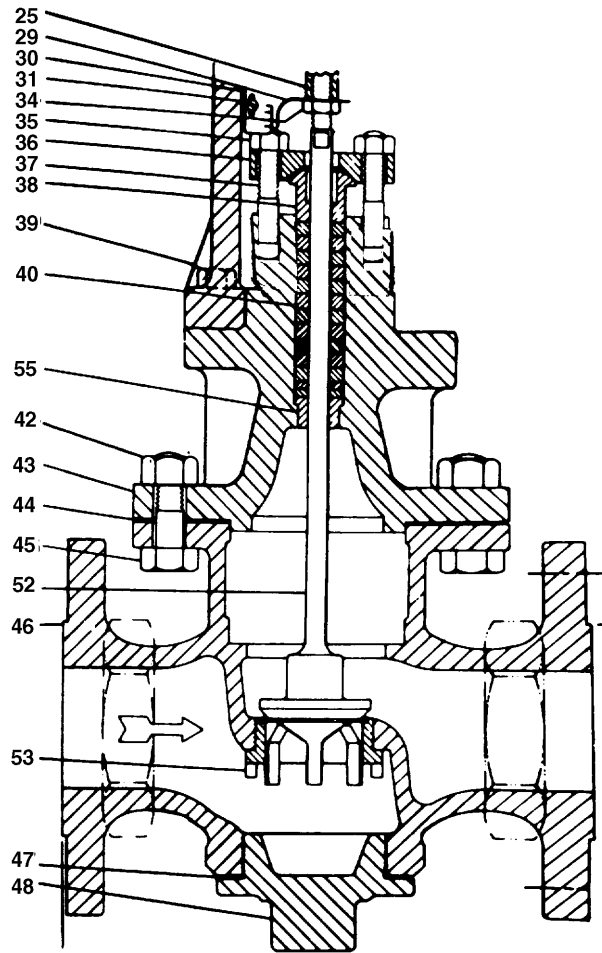


Figure 4 - Single Ported Control Valve Body Assembly (Actuator Removed)

**INSPECTION, CLEANING, REWORKING OR REPLACEMENT OF PARTS.**

Inspect all parts, including valve plug and seat ring/insert(s). Replace any excessively worn or damaged part(s). Do not remove threaded type seat ring(s) from valve body unless necessary to replace.

**ORDERING PARTS**

Order parts from the proper drawing. Give valve type, size and part(s) reference number(s) or part name, valve code number and serial number.

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### CLEANING

Clean all parts thoroughly with an approved, non-residue forming solvent. Remove encrusted material with crocus cloth or very mild aluminum oxide cloth. For parts repair information, consult your local Leslie Representative.

All Leslie control valves are made of the finest material obtainable, time-tested and backed by over 80 years of know-how. Machining is done by expert craftsmen and each valve is inspected and service tested before shipment to you.

Use of other than genuine Leslie parts may impair their ability to serve you. Leslie parts are held to very close tolerance to eliminate field machining and grinding on valve and seat ring/inserts or reaming on (valve plug guide bushings).

### REPLACING SEAT RING(S)/INSERTS

(Threaded Rings Only)

To remove threaded seat ring use seat ring wrench. See figure 5.

**SECURE SEAT RING WRENCH TO SEAT RING  
 BY TIGHTENING STEM AGAINST CROSSBAR**

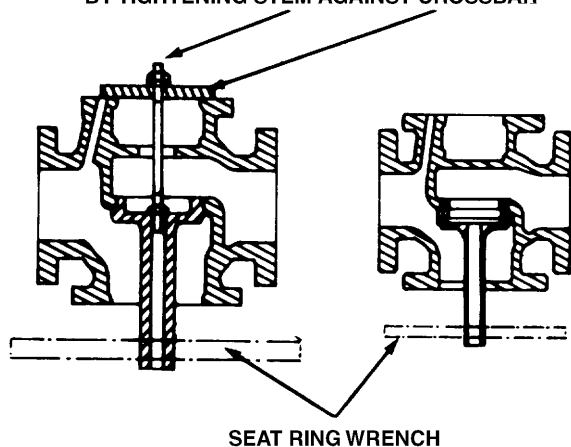


Figure 5 - Use of Seat Ring Wrenches to Remove or Install Seat Rings

### TO INSTALL SEAT RING(S)/INSERTS

1. Carefully clean threads and joint contact surfaces on seat ring(s) and in valve body.

2. Make sure joint surfaces are undamaged.
3. Screw seat ring into valve body threads and pull up tight with wrench.
4. Tap end of seat ring wrench bar with hammer to lock seat ring in place.

### LAPPING IN VALVE PLUG AND SEAT RING/INSERT(S)

Apply superfine lapping compound to valve seating surface and assemble valve plug and bonnet to valve plug body as shown in figure 6. Lap in until a fine continuous ring of contact has been made on both surfaces. Do not lap until a ridge is formed.

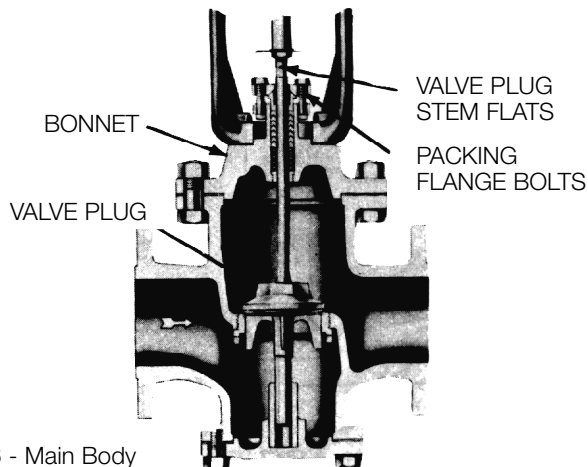


Figure 6 - Main Body Sub-Assembly

1. Bonnet acts as guide when grinding valve plug.
2. Loosen packing flange studs/bolts slightly if packing is installed.
3. Uses wrench on flats of valve plug stem for turning valve plug. Do not bear down on valve plug stem when lapping. Weight of parts is sufficient to cause lapping action.
4. Place lapping compound on valve plug face,
5. As lapping progresses lift valve plug off seat occasionally and rotate 45° to keep compound evenly distributed.
6. Remove all traces of compound after lapping.

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### CONTROL VALVES FITTED WITH CAGE TYPE TRIM

(See figure 7)

Assemble component parts as shown in figure 7. Follow lapping procedure described or use alternate method described below and shown in figure 7.

Place seat ring/insert in a suitable holding device (that will not distort seat ring/insert). Position seat retaining guide/cage on seat ring/insert. (In the case of "O" trim - Classes DOS, etc.- be sure to assemble the valve plug guide/cage in their respective positions before lapping, regardless of procedure followed). Very little lapping is required with cage type trim. A few turns should be sufficient.

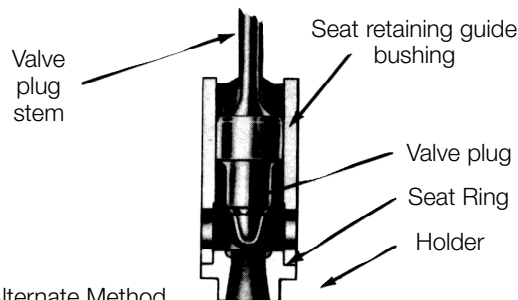


Figure 7 - Alternate Method

### REASSEMBLY

#### Single Ported Control Valves (DL, DOS Types)

(See figures 3 and 4)

1. After all parts have been cleaned and prepared for reassembly, place gasket (47) on bottom cap (flange) (48).
2. Assemble bottom cap (flange) to valve body and tighten.
3. Place bonnet gasket (44) on valve body.
4. Insert valve plug stem through bonnet (43).
5. Position on valve body making sure that valve plug enters seat ring/insert properly.
6. In the case of heavy units, first insert valve plug in seat carefully down over valve plug stem.

7. Tighten evenly and firmly.
8. Install packing in packing box.
9. Replace actuator on bonnet. Insert capscrews (39) and tighten.
10. Reassemble nut (34) and travel indicator (31) to valve plug stem.
11. Lift valve plug stem and engage its threads with those in actuator stem (25).
12. Screw valve plug stem at least one diameter into actuator stem.
13. Adjust actuator spring preload and rated travel of valve. (See Adjusting Actuator Spring Preload) .

### Cage Type Trim

1. Install internal components in valve body before assembling bonnet to body.
2. Place rod in valve body and down through body bridge to prevent seat ring/insert or gasket from falling into body throat when assembling.
3. Place new gasket (50) in recess in valve body.
4. Follow with seat ring/insert (51), with valve plug seating face toward bonnet end of body.
5. Position seat retaining guide (48) on seat ring/insert.

**NOTE:** With "I" type trim, assemble throttling sector and valve plug guide bushing on shoulder of valve plug disc and pass threaded end of valve plug stem through seat retaining guide before inserting parts in valve body. Direct window throttling end of seat retaining guide bushing toward valve plug disc and engage keyways of valve plug guide and seat retaining guide with their respective keys.

### ADJUSTING ACTUATOR SPRING PRELOAD (Starting Pressure)

1. Connect controlled air line to diaphragm case connection at "A".

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2. Supply 3 psig air pressure to actuator diaphragm.
3. Compress actuator spring until travel indicator begins to move when air pressure is raised above 3 psig.

TO COMPRESS ACTUATOR SPRING  
SCREW SPRING ADJUSTOR UPWARD

**NOTE:** Alternately add compression and check starting pressure slightly above 3 psig until correct adjustment is attained. After each check return air pressure to 3 psig.

### **SINGLE PORTED UNBALANCED CONTROL VALVES (DL, DOS Types)** **Control Valves with Direct Acting Actuators**

Actuator spring preload adjustment can be made either with or without pressure in valve body. Once correct compression is made no further adjustment is necessary.

### **SINGLE PORTED CONTROL VALVES (DDL, DDOS Types)** **With Reverse Acting Actuators** **Spring Closing Types**

In a single ported unbalanced control valve (reverse acting actuator), the valve plug is closed against upward fluid thrust by actuator spring force. Total compression placed on actuator spring must be sufficient to provide the 3 psig preload plus force required to close the valve.

If preload adjustment is made with no pressure in valve body, when the control valve is placed in operation, additional compression must be placed on the actuator spring to provide valve closure force. With proper adjustment valve will close tightly and will not begin to open until the 3 psig operation pressure is exceeded.

**NOTE A:** A control valve which has been adjusted to provide 3 psig starting pressure plug valve closure force (with pressure in body) will have a considerably higher start-pressure than 3 psig, when tested at 0 body pressure.

**NOTE B:** Air pressure quoted are relative. Actual pressures required- in operation may vary with pressure drop conditions existing and/or actuator springs used.

### **ADJUSTED CONTROL VALVE FOR RATED TRAVEL** **(Indicator scale show,vs rated travel of a valve)**

### **SINGLE PORTED UNBALANCED (DL, DOS Types)** **With Direct Acting Actuators**

With valve plug and actuator stem threads engaged as described in "REASSEMBLY," supply 20 psig operating pressure to actuator diaphragm. Observe travel obtained as shown by travel indicator and indicator scale. Readjust as follows:

**Overtravel** — If travel is too great, loosen stem locknut and turn valve plug stem out of actuator stem the amount necessary to obtain correct travel.

**Undertravel** — If travel is too short, loosen stem locknut and turn valve plug stem further into actuator stem the amount necessary to obtain correct travel.

### **Positive Compression Force**

When correct travel has been obtained reduce operating pressure sufficiently to move valve plug away from seat ring/insert(s). Then turn valve plug stem one full turn out of actuator stem threads until valve plug just contacts seat ring/insert again.

### **SINGLE PORTED UNBALANCED CONTROL VALVES (DDL, DDOS Types)** **(With Reverse Acting Actuators)**

Loosen stem locknut, apply air to diaphragm. Turn valve plug stem into actuator stem threads until valve plug is out of contact with seat ring, with air removed from diaphragm. Then turn valve plug stem out of actuator stem threads until valve plug just contacts seat ring again.

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Supply sufficient operating pressure to actuator diaphragm to move valve plug away from seat ring/insert. Then turn valve plug stem one full turn out of actuator stem threads. Diaphragm plate determines travel. With proper diaphragm plate correct travel will result from adjustment. For under or overtravel, proceed as described above.

### Positive Closing Force

The one full turn toward the seat ring/insert made after obtaining travel, provides the positive closing force required to obtain tight valve closure in single ported valves. In all cases be sure to make this final adjustment.

### All Actuators

Tighten stem locknut and travel indicator against actuator stem. Reconnect operating medium tubing from the sensing element or manual loading device to the diaphragm case.

## SECTION IV - ACTUATOR MAINTENANCE REPLACING DIAPHRAGMS, STEM SEALS, ETC.

Remove compression on actuator spring by screwing adjuster counterclockwise until actuator spring is free.

### DISMANTLING - SIZES 35, 55, 85, 135

(See figure 3)

### Direct Acting

(See page 8, Valve Action)

Remove bolts/nuts (23/22), upper diaphragm case (20) and old diaphragm (21).

To examine, clean or replace other internal components lift off diaphragm plate (24) assembled with actuator stem (31), actuator spring (28), washer (34) and unscrew spring adjuster from adjuster sleeve (36).

### REASSEMBLY

Replace internal parts. Install new diaphragm. In sizes 35, 55 and 85 line up holes with those in lower diaphragm case. In size 135 place bead on diaphragm in

recess in lower diaphragm case. Replace upper diaphragm case on diaphragm.

Assemble four bolts and nuts through parts (90° apart). Fignertighten. Assemble balance of bolts/nuts to actuator. Tighten evenly and alternately across diaphragm case. (Before tightening bolts in 35 actuators or where flat stock diaphragm material is used in other sizes as an emergency measure) consult note relating to preforming diaphragms.

### Reverse Acting

(See Page 8, Valve Action)

Remove bolts/nuts (19/18) and upper diaphragm case (15). Insert rod through holes in yoke (34) and actuator stem (35) to prevent twisting of stem seal (29) when removing self-locking nut (16). (In size 35R use wrench on flats on actuator stem.) Remove self-locking nut (16), diaphragm plate (17), diaphragm (20), collar (22) and stem seal (29). Remove stem seal as follows:—In 35R and 135R Actuators, remove stud nuts (24) in 135R, cap-screws (23) in 35R and disassemble lower diaphragm base (21) from yoke (34). Lift out stem seal. In 55R and 85R DO NOT remove lower diaphragm base unless gasket (26) is to be replaced. Stem seal (29) is held in place by seal ring (27) and screws (28). Take out these parts and lift out stem seal.

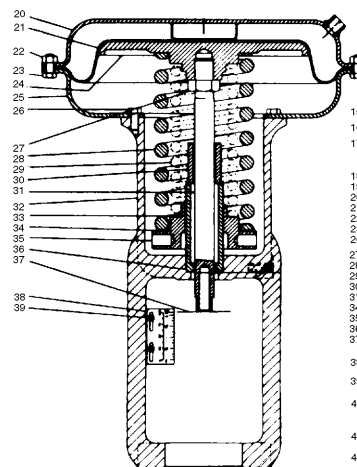


Figure 8 - Direct Acting  
 Diaphragm Actuator

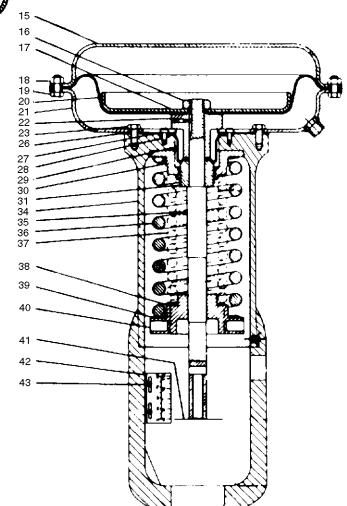


Figure 9 - Reverse Acting  
 Diaphragm Actuator

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**NOTE:** To check actuator spring and other components in size 135R disassemble spacer (33) and lift out parts. In 35R, 55R and 85R parts are taken out from the underside.

Reassemble spring adjustor (40), washer (39), actuator spring (36), top spring seat (30) to actuator stem (35) (if they have been removed). Replace assembled parts in yoke (34). Place stem seal collar (31) on actuator stem (35). Reassemble spacer (33) to yoke in 135R. Position stem seal collar (31) on actuator stem (35). In sizes 55R, 85R and 135R place bead of stem seal in recess of stem seal collar.

In 35R and 135R actuators reassemble lower diaphragm base (21) to yoke (34). Assemble nuts (24) to spacer studs (32) in 135R. Tighten. In 35R insert capscrews (23) through holes in lower diaphragm case and diaphragm and into threads in yoke. Tighten after pre-setting stem seal as described below.

In 55R and 85R actuators replace sealing ring (27) and screws (28). Tighten.

### **Presetting Stem Seal (55R, 85R & 135R)**

Place collar (22) on stem seal (29) making sure that bead on stem seal enters recess in collar. Reassemble diaphragm (20) over actuator stem (35). Fit center hole in diaphragm around raised face of collar (22). Replace diaphragm plate (17), and self-locking nut (16). Hold actuator stem steady with rod through yoke and stem (55R, 85R, 135R) or with wrench on flats on actuator stem (35R) then tighten self-locking nut. Replace upper diaphragm case (15) and bolts/nuts. Tighten as described previously. See Instruction Sheet 10/0.5.8 for precautions to observe when replacing seals.

### **Presetting Stem Seal - (135R)**

Place collar (22) on stem seal (29), assemble self-locking nut (16) to actuator stem (35) and tighten down against parts. Then press actuator stem downward to make stem seal move to taut position. Tighten capscrews and remove self-locking nut (16).

### **ALL ACTUATORS**

Set preload on actuator spring, reassemble actuator to

valve body assembly, if it has been removed, adjust valve for rated travel and reconnect operating medium tubing.

### **SOME IMPORTANT NOTES**

#### **FLAT SHEET RUBBER MATERIAL**

Flat sheet rubber material may be used in 55(R), 85(R) and 135(R) actuators as emergency replacement material but for guaranteed results it should be replaced at the earliest opportunity with the LESLIE ROLLING ACTION DIAPHRAGM designed specifically for these actuators. When flat material is used in emergency perform as described below.

#### **PREFORMING 35(R) ACTUATOR DIAPHRAGMS**

Flat stock material is used for diaphragms in 35(R) actuators. When assembling first fingertighten all diaphragm case bolts. Then compress actuator spring sufficiently to move diaphragm through full travel to the upper or lower diaphragm case (depending on whether actuator is direct or reverse acting). This preforms diaphragm and permits full movement through rated travel without resistance from a taut diaphragm.

### **TO CHANGE VALVE ACTION FROM NORMALLY OPEN TO NORMALLY CLOSED OR VICE-VERSA.**

To reverse the action of a single ported diaphragm control valve it is only necessary to replace the actuator in use with one having the opposite action. A single "D" in the control valve class indicates actuator is "DIRECT ACTING" — Air moves diaphragm downward. A double D ("DD") indicates actuator is "REVERSE ACTING" — Air moves diaphragm upward. NOTE: Final valve action in response to air signal on diaphragm depends on whether valve plug is positioned above or below the seat ring.

To change actuator, loosen valve plug stem locknut under travel indicator and turn valve plug stem all the way out of the actuator stem. Remove capscrews securing actuator to bonnet. Replace actuator with one having desired action. Re-insert and tighten capscrews. Reconnect valve plug stem to actuator stem. Adjust actuator spring preload and set valve for rated travel. For more detailed instruction consult general instruction pertaining to the particular type of control valve.

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