3-WAY CONTROL VALVES

CLASS DLT(S) DIRECT ACTING
DDLT(S) REVERSE ACTING

SECTION I — INSTALLATION

VALVE POSITION

Install control valve in an accessible location. Connect supply and outlet pipe lines to valve as described below. Control valve may be placed in any position but upright is preferable for ease of maintenance.

In converging service (mixing) two fluids are mixed to produce a third fluid. The valve has two inlet supply connections (marked "Upper" and "Lower") and one outlet connection (marked "Common").

Connect supply line to "Upper" and "Lower" connections and outlet to "Common" connection.
See Figure 1.

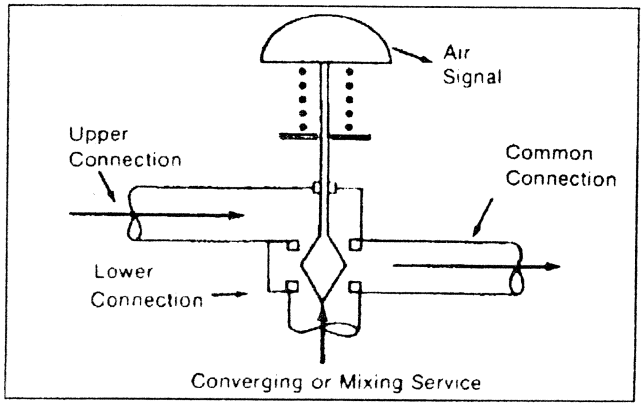

Fig. 1 Double Ported Single Disc Construction

PROBLEM PREVENTING PROCEDURES

1. Provide removal space above, below and around control valve for easy removal of parts during maintenance. See proper offset drawing for dimensions.

2. Blow or flush out pipe lines thoroughly before installing control valve.

3. Protect control valve and 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. Adhere to good piping practice. Install a bypass around the control valve.

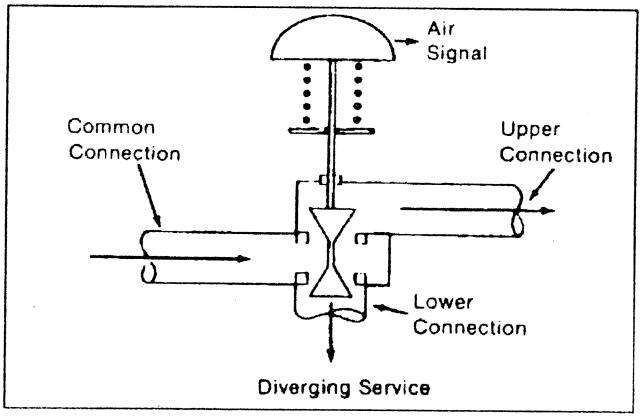

Fig. 2 Double Ported Double Disc Construction

In diverging service the valve has one inlet supply connection (marked "Common") and two outlet connections (marked "Upper" and "Lower").

Connect supply line to "Common" connection and outlet lines to "Upper" and "Lower" connections. See figure 2.

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

IMPORTANT: For piping in other than liquid systems (gas or steam) follow piping practices recommended for the particular fluids and pressures.

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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 OF VALVE BODY SUB-ASSEMBLIES

Consult figures in instruction or appropriate drawings.

DISMANTLING CONTROL VALVE

1. Loosen stem nut (34). Unscrew valve plug stem (52) from actuator stem (25). (In large valves support valve plug stem to prevent valve plug from suddenly falling downward when stem clears). Loosen and remove yoke capscrews (39). Lift actuator from bonnet.
2. Disassemble lower flow connection (48) (with bolts if flanged) and gasket (47) from main body (46). Support valve plug (52) as explained above and take travel indicator (29) and stem nut (34) from valve plug stem. Disassemble bolts and nuts (42/45), bonnet (43) and gasket (44) from main body. Disassemble packing box flange bolts or studs (37), flange (36) and packing follower (38) from bonnet. Remove old packing from bonnet.

NOTE: For maintenance of Actuator consult Section IV.

CLEANING — REPLACING PARTS

Clean all parts thoroughly, including the packing box. Use an approved, non-residue forming solvent. For encrusted material use crocus or a very mild aluminum oxide cloth. Examine all parts. Replace any badly worn or damaged part. **Do not** remove seat ring(s) from main body unless replacement is necessary.

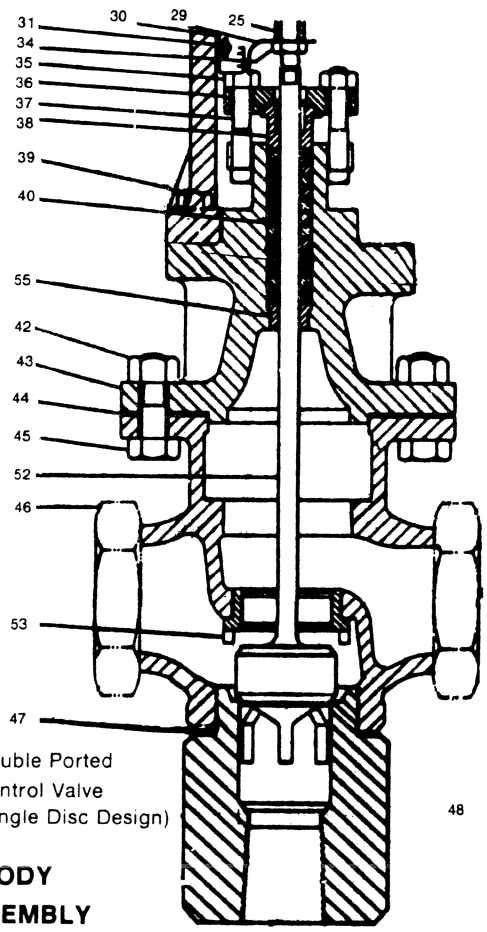

Fig. 3 — Double Ported Control Valve (Single Disc Design)

VALVE BODY SUB-ASSEMBLY

SECTION IV — ACTUATOR MAINTENANCE, REPLACING DIAPHRAGMS, ETC.

GENERAL

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

DISMANTLING — SIZES 35, 55, 85, 135

(See Fig. 4)

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

To examine, clean or replace other internal components lift out diaphragm plate (24) assembled with actuator stem (31), actuator spring (28), washer (34) and unscrew spring adjustor from adjustor 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). Finger-tighten. 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.

DISMANTLING - SIZES 35R, 55R, 85R, & 135R

(See Fig. 5)

Remove bolts/nuts (18/19) and upper diaphragm case (15). Insert rod through holes in yokes (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; capscrews (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 held in place by seal ring (27) and screws (28). Take out these parts and lift out stem seal.

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.

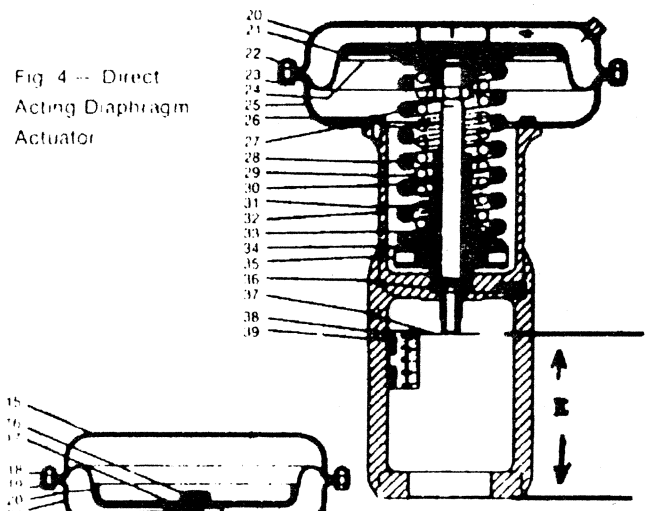

Fig. 4 — Direct Acting Diaphragm Actuator

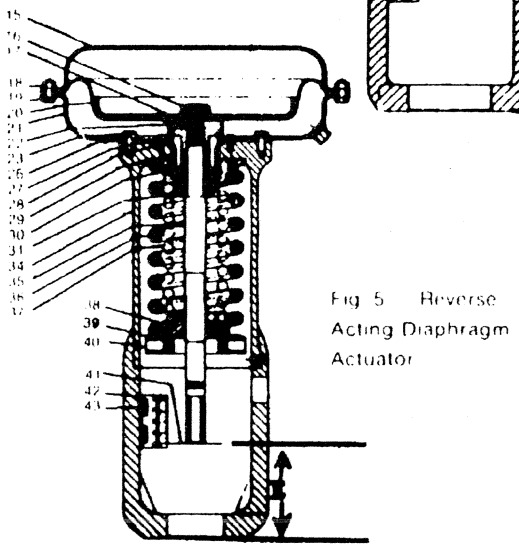

Fig. 5 — Reverse Acting Diaphragm Actuator

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WHEN ASSEMBLING ACTUATOR MAINTAIN DIMENSION "E"	
Actuator Size	**Dimension "E"**
35	5-1/2"
55	5-1/2"
85	6-7/16"
85-135	7-1/16"
135	8-9/16"
35R	4"
55R	4"
85R	4-15/16"
85-135R	4-15/16"
135R	5-9/16"

REASSEMBLY

Reasemble 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 (29) on stem seal collar (22). 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 presetting stem seal as described below.

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

PRE-SETTING 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 (18/19). Tighten as described previously.

PRE-SETTING STEM SEAL — (35R)

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 nuts (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 preform as described below.

PREFORMING 35(R) ACTUATOR DIAPHRAGMS

Flat stock material is used for diaphragm in 35(R) actuators. When assembling first finger-tighten 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

NOTE: Final valve action in response to air signal on diaphragm depends on whether valve plug is positioned above or below the seat ring.

PROCEDURE

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.

REASSEMBLING CONTROL VALVE
(Refer to Figure 3)

1. Reassemble bonnet gasket (44), bonnet (43) and bolts and nuts (42/45) to main body (46). Insert valve plug stem (52) through main body (46) and into bonnet (43). Support valve plug on stem and assemble lower flow connection (48) (with bolts and nuts, if flanged) and gasket (47) to main body.

2. Install a new set of packing in the manner described on the packing wrapper.

3. Reassemble packing follower (38), packing flange (36) and bolts/nuts (35/37) to bonnet or studs/nuts. Finger-tighten bolts/studs. Tighten bonnet and lower connection bolts firmly. (Or lower connection if screwed type). Reassemble stem nut (34) and travel indicator to valve plug stem. Turn nut (34) downward most of the way on threads.

4. Position actuator on bonnet (43). Insert capscrews (39) through yoke and into threads in bonnet. Tighten capscrews firmly.

5. Lift valve plug stem and engage its threads with those of actuator stem (25). Screw into actuator stem one to two diameters. Then proceed, as described below, to adjust control valve for starting pressure preload, rated travel and positive compression force.

ADJUSTING ACTUATOR SPRING PRELOAD (Starting Pressure)

HOW TO MAKE PRELOAD ADJUSTMENT

1. Connect controlled air line to diaphragm case impulse connection.

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.

4. To compress actuator spring screw spring adjustor upward.

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

HOW TO ADJUST CONTROL VALVE FOR RATED TRAVEL AND POSITIVE COMPRESSION FORCE

In all cases full valve travel is mechanically predetermined by the distance between seats. Valves must be adjusted to make full contact with seat in either direction.

In **direct acting** actuators spring force brings valve plug in contact with upper seat, air force with lower.

In **reverse acting** actuators air force brings valve plug in contact with upper seat, spring force with lower.

CONTROL VALVES WITH DIRECT ACTING ACTUATORS
(Air pressure moves valve plug stem downward.)

1. Screw valve plug stem upward into actuator stem until valve plug contacts upper seat.

2. Connect air line to actuator. Supply sufficient air pressure to move valve plug slightly away from seat.

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seat.

3. Then turn valve plug stem one full turn further into actuator stem to make positive compression contact of valve plug with upper seat at rated travel.
4. Tighten stem nut (34) and travel indicator (29) against actuator stem (25). Tighten packing flange bolts/studs.

CONTROL VALVES WITH REVERSE ACTING ACTUATORS

(Air pressure moves valve plug stem upward).

1. Screw valve plug stem upward into actuator stem approximately one diameter (thickness of stem).
2. Connect air line to actuator impulse connection. Supply 20 psig air pressure to actuator diaphragm to move actuator through full travel.
3. Turn valve plug stem upward into actuator stem until valve plug contacts upper seat.
4. Reduce air pressure on diaphragm to permit valve plug to move slightly off seat.
5. Then turn valve plug stem one full turn further into actuator stem to make positive compression contact with upper seat at rated travel.
6. Tighten stem nut (34) and travel indicator (29) against actuator stem (25). Tighten packing flange bolts/studs.

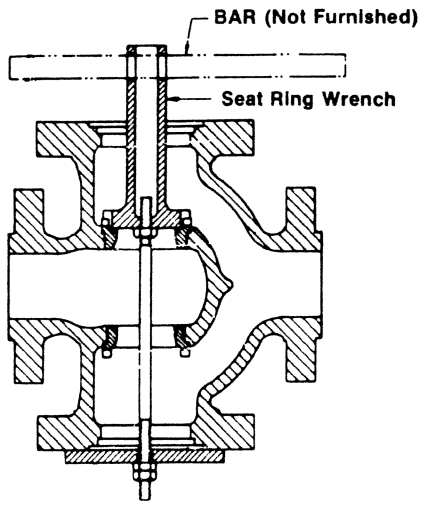
SHORT VALVE TRAVEL

If valve travel is too short when required maximum air pressure is supplied to actuator diaphragm, incorrect adjustment is indicated. To correct, loosen stem nut (34) and turn valve plug stem out of actuator stem (25) amount necessary to obtain full travel. Travel indicator on yoke shows full travel. Recheck positive compression force then tighten stem nut (34).

REPLACING SEAT RING(s)

To remove seat ring(s) use special wrench (available on request). See Figures 6 and 7.

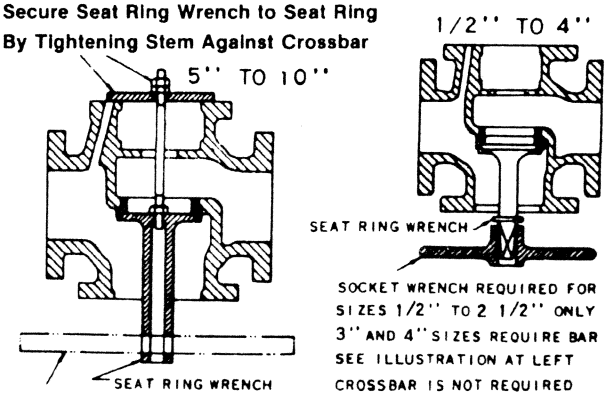
Fig. 6 — Use of Seat Ring Wrench



Secure seat ring wrench to seat ring by tightening stem against crossbar for sizes 4" to 10" (not required for smaller sizes).

DOUBLE DISC DESIGN

Fig. 7 — Use of Seat Ring Wrenches to Remove of Install Seat Rings



SINGLE DISC DESIGN

TO INSTALL SEAT RING(s)

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(s) into valve body threads and pull up tight with wrench.
4. Tap end of socket wrench or seat ring wrench bar with hammer to lock seat ring(s) in place.

NOTE: In Cast Iron and Steel Valves (with removable seat ring) coat body threads and seating faces with a small, smooth, even coating of John Crane Co. Lead Seal #2.

LAPPING IN VALVE PLUG AND SEAT RINGS — SINGLE DISC DESIGN

UPPER SEAT

Assemble bonnet and gasket to main body. Position bottom end upward, allowing clearance beneath for valve plug stem.

Apply a small amount of superfine lapping compound, evenly distributed, to upper valve seat face. Insert valve plug in body assembly with stem through bonnet. Lap in until a fine continuous line of contact is made on both surfaces. DO NOT lap until a ridge is formed.

LOWER SEAT

Place compound on lower seating face of valve plug. Assemble lower flow connection to main body. Position body assembly upright. Lap in as described above using valve plug stem to turn valve plug.

DOUBLE DISC DESIGN

UPPER DISC

Assemble upper guide and bonnet gasket over valve plug stem. Assemble valve plug and parts in bonnet. Apply lapping compound to valve plug seating face. Assemble parts to main body. Lap in as described above.

LOWER DISC

Apply lapping compound to valve disc seating face. Assemble disc to lower end of valve plug post as described in REASSEMBLY. Lap in as described above.

NOTES —

- Bonnet acts as guide when grinding valve plug.
- Loosen packing flange bolts/studs slightly if packing is installed.
- Use 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.
- Place lapping compound on valve plug face only.
- As lapping progresses lift valve plug off seat occasionally and rotate 45° to keep compound evenly distributed.
- Remove all traces of compound after lapping.
- Retighten packing flange bolts/studs if loosened.