

Installation, Operation and Maintenance Manual

GENERAL FOUR-WAY DIVERTER VALVE



GENERAL VALVE®

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Four-Way Operators

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INSTALLATION

ORIENTATION

The GENERAL Four-Way Diverter Valve may be installed in any position. However associated pipe work needs to be connected per the valve flange labels i.e. Prover, Inlet and Outlet.

CLEARANCE FOR REPAIR

For ease of repair, when mounted with the valve operator in the vertical plane, space should be allowed below the valve to allow for removal of the lower plate and withdrawal of the slips.

TABLE 1

Clearance required from Lower Plate for Slip removal

| Valve Size | Minimum Clearance | | | |
|------------|-------------------|----------------|----------------|----------------|
| | ASME Class 150 | ASME Class 300 | ASME Class 600 | ASME Class 900 |
| 2" | XX | 5" | 5" | - |
| 3" | XX | 5" | 5" | 5" |
| 4" | XX | 7" | 8" | 8" |
| 6" | XX | 10" | 10" | 9" |
| 8" | XX | 10" | 10" | 10" |
| 10" | XX | 12" | 12" | 12" |
| 12" | 13" | 13" | 10" | XX |
| 16" | 22" | 22" | XX | XX |

Note: Allowing more than the specified minimum amount of clearance will make servicing easier.

TABLE 2

General 4-Way Diverter valves can be hydrostatically pressure tested after installation to full API 6D limits.
NB Do not exceed 100 (psig) differential between valve ports.

PRESSURE TEST

| Valve Figure No | 4711 | | 4721 | 4741 | 4751 | Comments |
|---|-----------------------|-----|------|------|------|---------------------------------------|
| ASME Class | 150 | | 300 | 600 | 900 | |
| Shell Test Pressure (Valve Open) | (psig) | 500 | 1200 | 2250 | 3350 | No Leakage permitted |
| | (kg/cm ²) | 35 | 85 | 158 | 235 | |
| Seat Test Pressure (Valve Closed) | (psig) | 300 | 800 | 1600 | 2400 | Simultaneous seat test per GVMPS 6006 |
| | (kg/cm ²) | 21 | 56 | 113 | 168 | |
| Supplementary (API 598) Air Seat Test Pressure (Valve Closed) | (psig) | 80 | 80 | 80 | 80 | Simultaneous seat test per GVMPS 6006 |
| | (kg/cm ²) | 6 | 6 | 6 | 6 | |

GEAR HEAD ORIENTATION

The gear operator position may be changed as follows:

- (A) Place valve in unseated position.
- (B) Remove gear housing capscrews.
- (C) Turn handwheel to further open the valve; this will turn gear housing. Continue until hand-wheel comes to desired position and gear housing mounting holes are aligned.
- (D) Replace gear housing mounting capscrews. Be sure short capscrew is inserted below worm shaft.

4-WAY DIVERTER VALVE MAINTENANCE

OPERATION

The GENERAL Four-Way Diverter Valve is a non-lubricated, resilient seal valve which has mechanical means of retracting the sealing slips before it is cycled from one seated position to opposite position. In opening the valve, the plug is raised, thus retracting the seating slips through their tapered dovetail connections. Only after the seating slips are fully retracted perpendicularly from the body seat is the plug (which is mounted on trunnions) rotated to the other seating position.

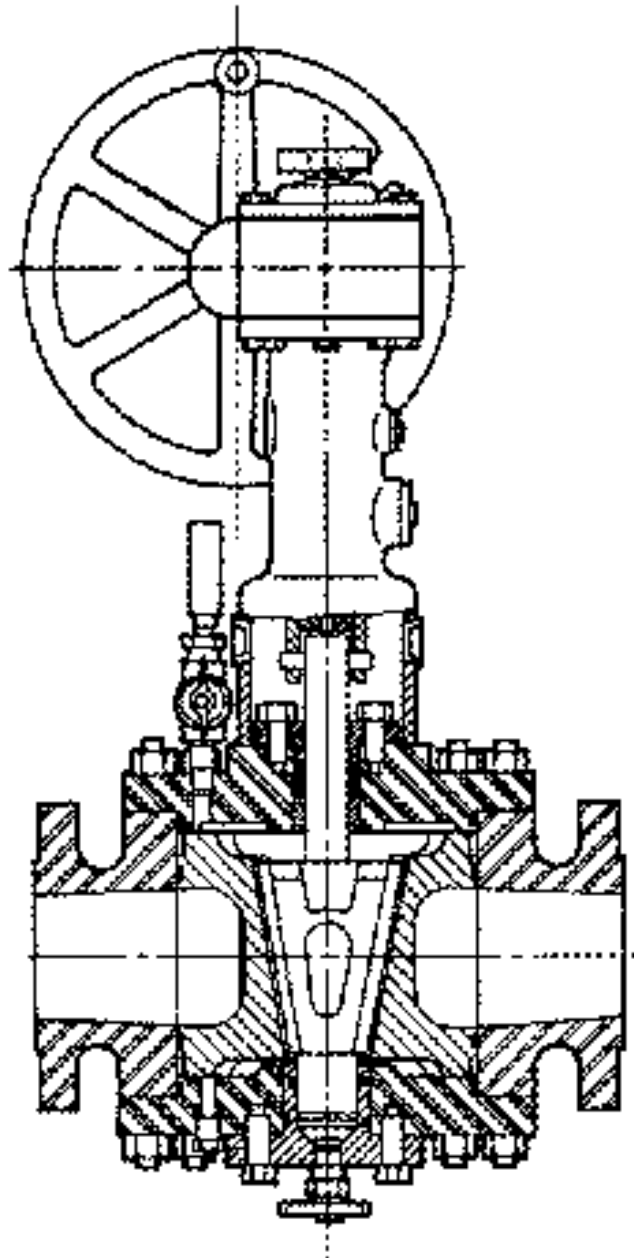
Conversely, in closing the valve, the plug and seating slips cycle freely, with no plug-to-body contact, until the seating segments are positioned over the ports. Then the plug is driven down between the slips and the tapered surfaces wedge out the seating slips for a positive seal.

A position indicator through the upper stem shows the flow direction. The gear operator position may be changed as follows:

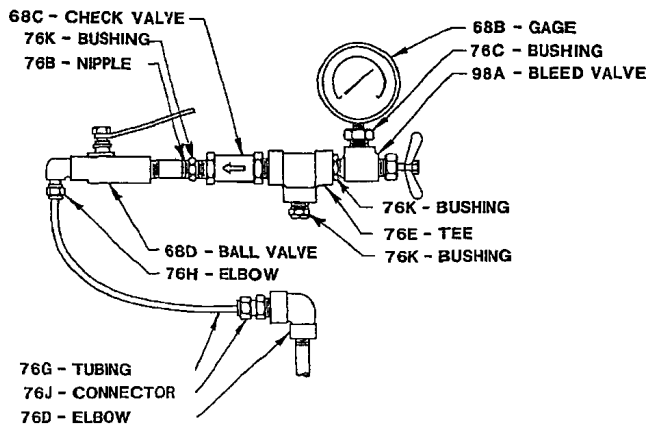
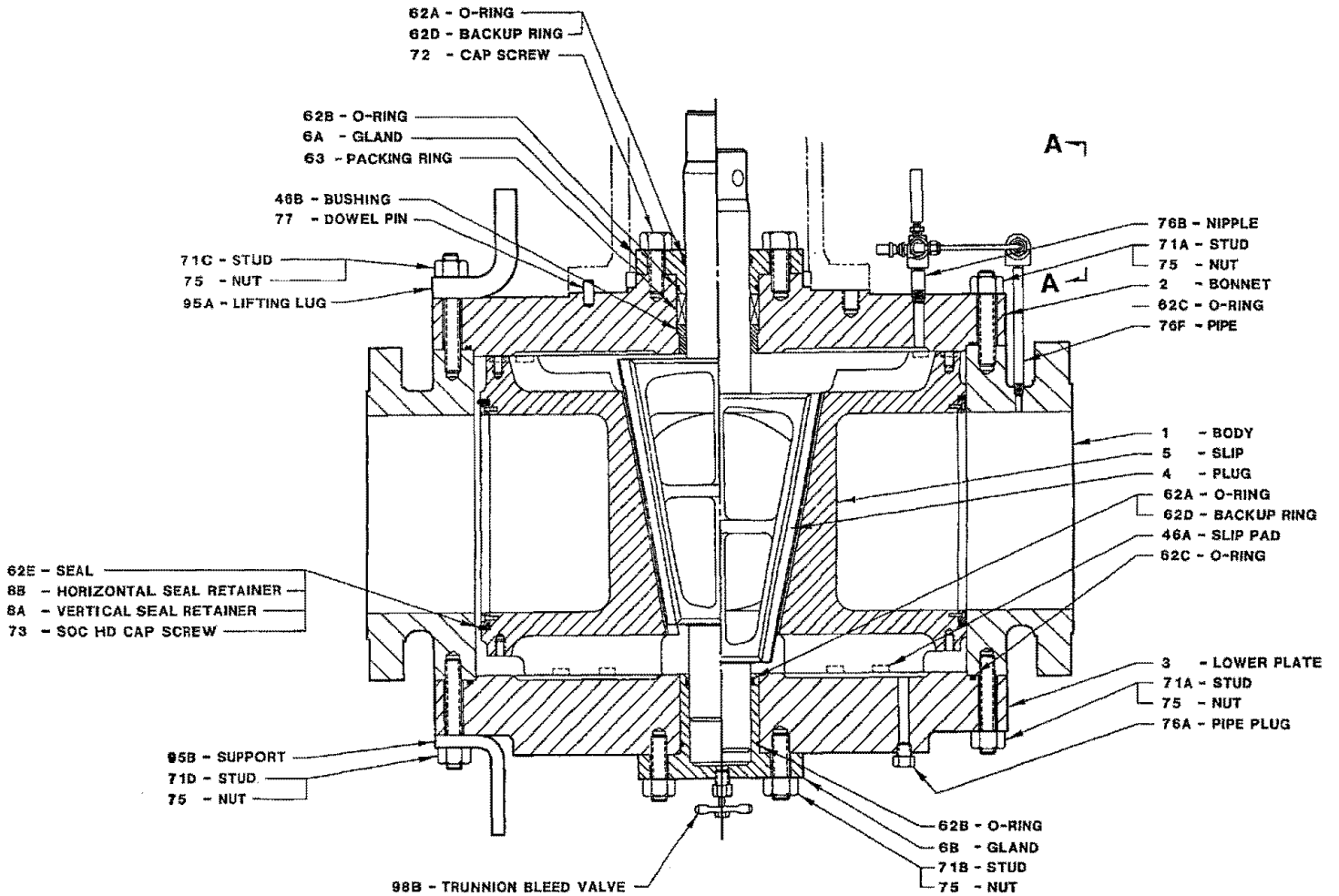
MAINTENANCE

The Four-Way Diverter Valve requires no day-to-day maintenance. There are some services which may be needed occasionally.

1. In cold climates, before freezing weather sets in, any possible collection of water below valve plug should be drained out through bottom access plate drain plug.
2. If at any time the pressure gauge system should indicate a leak which cannot be stopped with ordinary force on handwheel, this may be stopped by one of the following:
 - A) Operate valve through open-close cycle while fluid is flowing to try to flush out valve body. If pressure gauge system **still** indicates valve leak, seating segments should be inspected.
 - B) To inspect seating segments line must be drained. Place 4-way valve in unseated position (check pressure gauge system for zero pressure) and open the body bleed. Then remove lower plate. Seating slips can be pulled off dovetails and inspected and replaced if necessary. It is usually best to replace lower plate o-ring any time lower plate is removed.
3. To change gear operator:
 - A) Close 4-way valve as tight as possible.
 - B) Drive out coupling pin (toward guide pin boss).
 - C) Remove housing mounting bolts and lift operator off.
 - D) Replace new operator in reverse order (insert coupling pin from same side as guide pin boss).
 - E) After inserting coupling pin, tap plug trunnion in opposite direction to center.
 - F) Check operation of valve.
4. To order seating slips, give figure number, size, series, serial number, part number on slip and type of resilient seal material.
5. Keep the valve operator filled with lubricant to displace and prevent moisture from accumulating and freezing. The operator is provided with a grease fitting in the gear head. Lubricant should be injected with operator in the **OPEN** position **ONLY**. Under ordinary conditions, a few pumps of the grease gun semi-annually is sufficient. Use lithium 12 hydroxy stearate or lithium base molydisulfide grease.

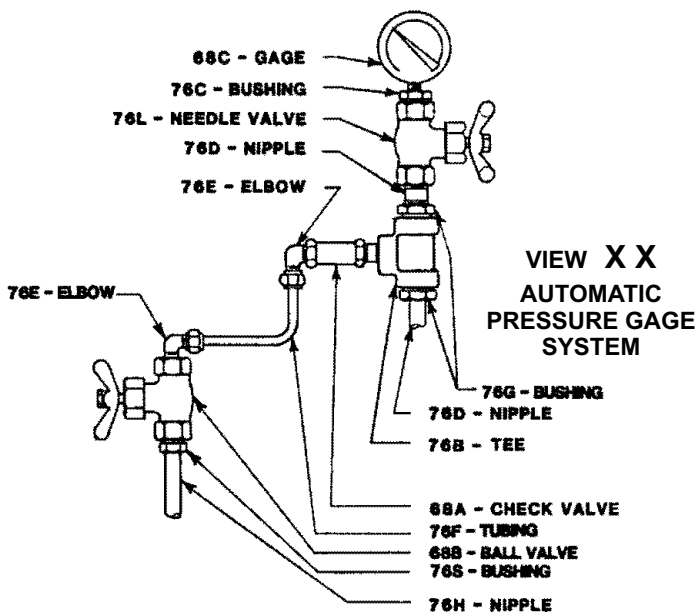
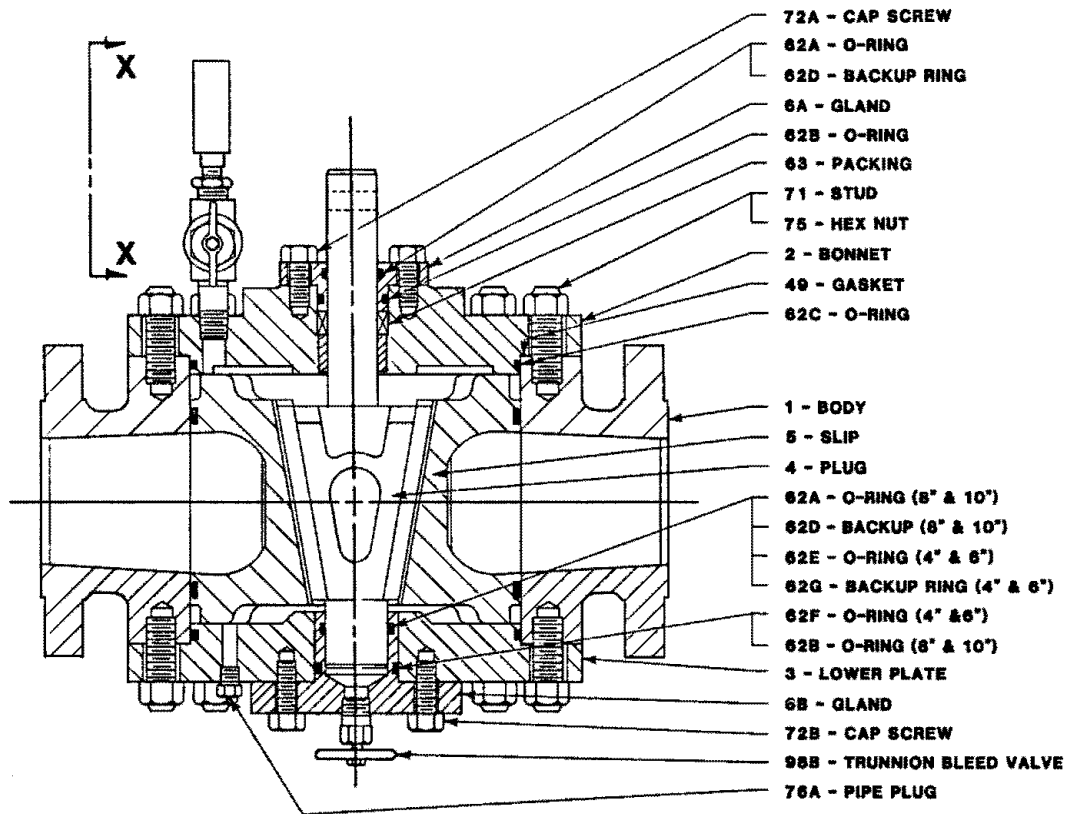


**MECHANICALLY RETAINED SLIPS, TYPICAL SIZE ARRANGEMENT
12"- 24" CLASS 150 THROUGH CLASS 900**

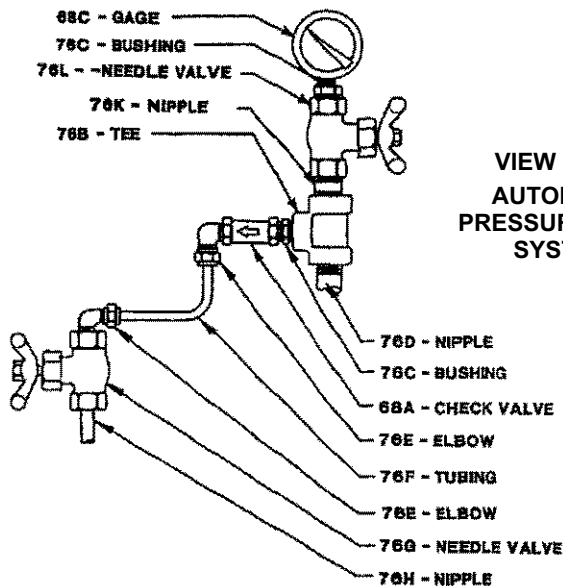
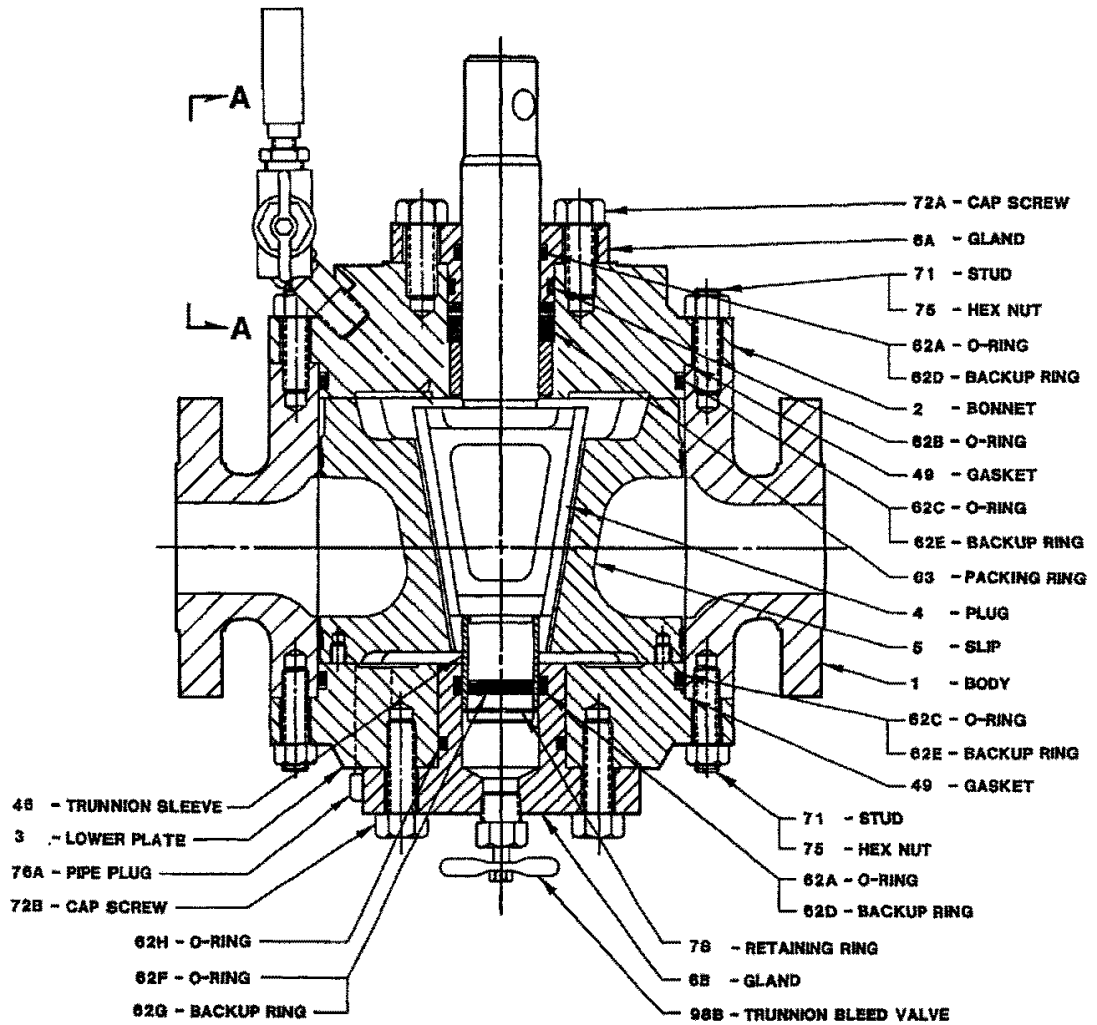


VIEW A-A

**4-WAY DIVERTER VALVE
BOND SLIPS, TYPICAL SIZE ARRANGEMENT, 4" - 10" CLASS 150 THROUGH CLASS 900**

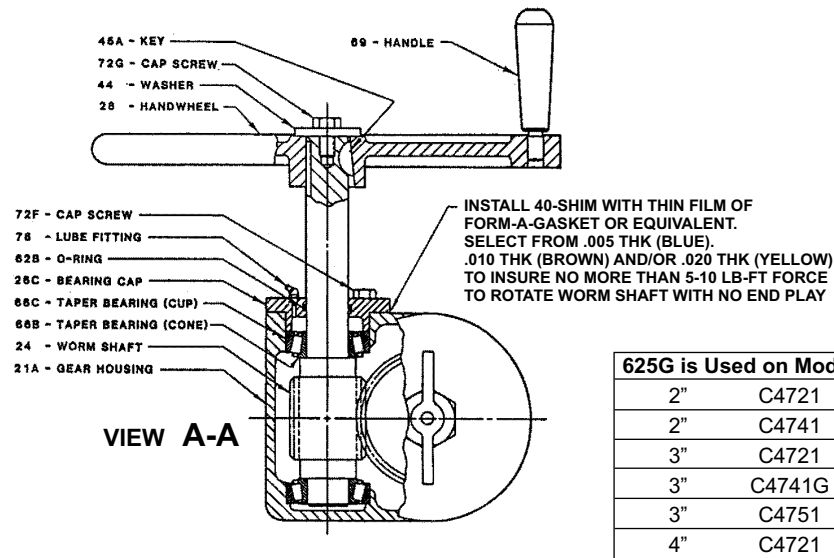
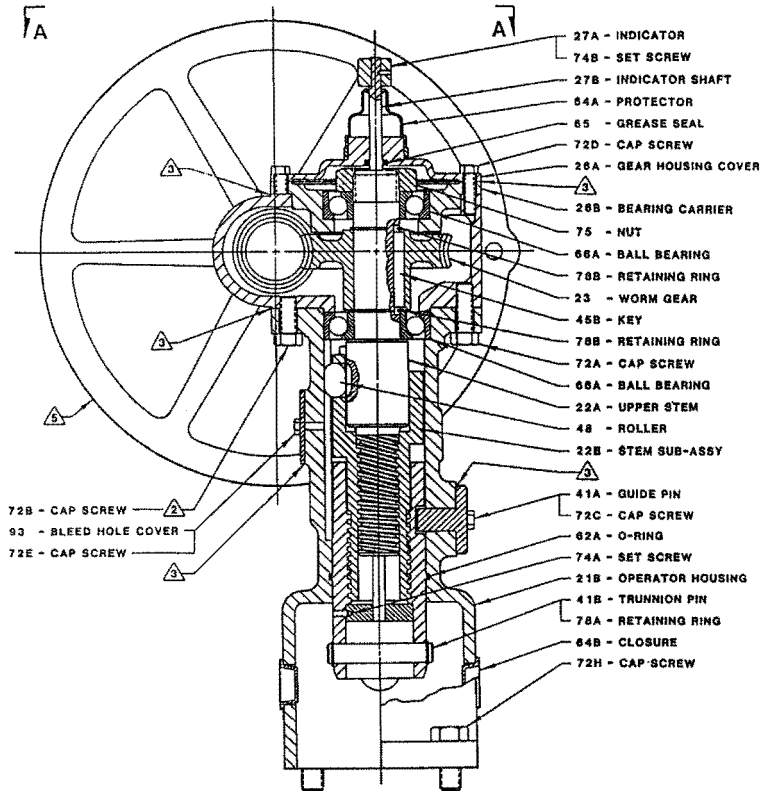


**4-WAY DIVERTER VALVE
 BONDED SLIPS W/REMOVABLE LOWER TRUNNION SLEEVE
 TYPICAL SIZE ARRANGEMENT 2" - 3" CLASS 150 THROUGH CLASS 900**



**VIEW A-A
 AUTOMATIC
 PRESSURE GAGE
 SYSTEM**

625 4-WAY GEAR OPERATOR



625 4-WAY GEAR

| Item No. | Part No. | Qty. | Description |
|----------|----------|------|----------------------|
| 21A | 21-408 | 1 | Gear Housing |
| 21B | 21-472 | 1 | Operator Housing |
| 22A | 22-498 | 1 | Upper Stem |
| 22B | 22-539 | 1 | Stem Sub-Assembly |
| 23 | 23-409 | 1 | Worm Gear |
| 24 | 24-405 | 1 | Worm Shaft |
| 26A | 26-413 | 1 | Gear Housing Cover |
| 26B | 26-412 | 1 | Bearing Carrier |
| 26C | 26-401 | 1 | Bearing Cap |
| 27A | 27-575 | 1 | Indicator |
| 27B | 27-481 | 1 | Indicator Shaft |
| 28 | 28-404 | 1 | Handwheel |
| 41A | 41-407 | 1 | Guide Pin |
| 41B | 41-414 | 1 | Trunnion Pin |
| 44 | 44-401 | 1 | Washer |
| 45A | 45-402 | 1 | Key |
| 45B | 45-403 | 1 | Key |
| 48 | 48-403 | 2 | Roller |
| 49 | 49-420 | A/R | Shim |
| 62A | 62-22-V | 1 | O-Ring |
| 62B | 62-13-V | 1 | O-Ring |
| 64A | 64-411 | 1 | Protector |
| 64B | 64-405 | 4 | Closure |
| 65 | 65-401 | 1 | Grease Seal |
| 66A | 66-412 | 2 | Ball Bearing |
| 66B | 66-401 | 2 | Tapered Bearing Cone |
| 66C | 66-458 | 2 | Tapered Bearing Cup |
| 69 | 69-414 | 1 | Handle |
| 72A | 72-9 | 7 | Capscrew |
| 72B | 72-10 | 1 | Capscrew |
| 72C | 72-4 | 2 | Capscrew |
| 72D | 72-14 | 4 | Capscrew |
| 72E | 72-21 | 2 | Capscrew |
| 72F | 72-5 | 4 | Capscrew |
| 72G | 72-8 | 1 | Capscrew |
| 72H | 72-11 | 4 | Capscrew |
| 74A | 74-2 | 1 | Setscrew |
| 74B | 74-6 | 1 | Setscrew |
| 75 | 75-462 | 1 | Nut |
| 76 | 76-612 | 1 | Lube Fitting |
| 78A | 78-412 | 2 | Retainer Ring |
| 78B | 78-404 | 2 | Retainer Ring |
| 93 | 93-413 | 1 | Bleed Hole Cover |

DESCRIPTION

The GENERAL Valve 4-Way Operator is a screw jack device designed to provide the necessary mechanical advantage and the "unseat, lift, turn and reseat" motion and seating force required by the GENERAL 4-Way Diverter Valve. Turning the handwheel clockwise causes the plug to lift and retract the seating slips. When the slips are fully retracted, the plug and slips turn clockwise through 90°. Continued turning of the handwheel causes the plug to descend, seating the slips. The 4-Way Valve now diverts flow to the right (when facing the handwheel). Counter-clockwise rotation of the handwheel repeats the cycle in the opposite direction until the valve diverts flow to the left.

OPERATION

Divert flow to the right:
Turn the handwheel clockwise:

1. The upper stem (22A) and middle stem are locked together by the upper roller (48) and turn as one, clockwise. The lower stem travels vertically upward on the right hand acme threads lifting the plug and retracting the slips. The lower stem is restrained from turning by the guide pin (41A) which is in the left vertical portion of the U-shaped groove in the lower stem. The lower roller (48) is traveling upward in the vertical slot in the housing (21B).

625 4-WAY GEAR OPERATOR

2. When the valve plug is raised and ready to turn 90°, the guide pin is now aligned with the horizontal portion of the U-shaped groove. The lower roller is aligned with the detent pocket in the middle stem. The lower shoulder on the middle stem is in contact with the upper shoulder on the lower stem.
3. Continued clockwise rotation of the handwheel and the upper and middle stems, forces the lower stem to also rotate clockwise, releasing the lower roller (48) out of the housing slot and into the detent pocket of the middle stem. The guide pin (41A) tracks through the horizontal portion of the U-shaped groove as all three stems, now locked together, rotate clockwise as one.
4. After the three stems have rotated 90° they are positioned such that the guide pin is now aligned with the right hand vertical portion of the U-shaped groove and the upper roller is aligned with the vertical slot in the housing (21B). In this position, the middle stem and the lower stem are locked together by the lower roller. The valve plug has been rotated 90° but is still raised.
5. Continued clockwise rotation of the handwheel releases the upper roller out of engagement with the upper stem (22A) and into the housing slot where it is free to travel vertically with the middle stem and the lower stem. As the middle and lower stems are locked together, they now travel down on the acme thread until the slips are seated.

Divert flow to the left:

Turn handwheel counter-clockwise:

1. This operation is similar to diverting flow to the right except the various events occur in the reverse sequence.

REMOVING OPERATOR FROM THE VALVE.

1. Seat the plug and remove the four plastic plugs (64B).
2. Remove the retaining rings (78A) and knock out the trunnion pin (41B). **CAUTION: DO NOT PEEN OR BURR OVER THE EDGES.**
3. Remove nuts (75) attaching operator to valve bonnet.
4. Lift operator off valve by pulling up vertically until it clears the plug trunnion.

OPERATOR DISASSEMBLY

1. Remove set screw (74B) and indicator (27A).
2. Remove the stem protector (64A).
3. Unbolt and remove the gear housing cover (26A).
4. Remove the bearing retainer nut (75).
5. Remove the bearing carrier (26B) and the upper bearing (66A).
6. Remove the upper retaining ring (78B).
7. Remove the capscrew (72G), washer (44), handwheel (28) and Key (45A).
8. Unbolt and remove the bearing cap (26C).
9. Screw out the worm shaft (24). Front bearing cone (66B) and cup (66C) and rear bearing cone will come out with the worm shaft.
10. Remove the worm gear (23) and key (45B).
11. Unbolt and remove the gear housing (21A).
12. Unbolt and remove the guide pin (41A).
13. Pull the upper stem (22A) with middle stem, lower stem rollers (48), lower bearing and indicator shaft (27B) out through the top of the housing (21B). If the bearing is tight in the housing place the worm gear with its key on the upper stem upside down (hub up). Turn the gear to raise the lower stem as far as possible. Insert a 1/2" diameter bar through the two holes in the bottom of the housing. Using a pipe wrench on the gear hub, turn the gear to lower the lower stem and jack the bearing clear of the housing.
14. Remove the set screw (74A) and push the indicator shaft out through the bottom of the lower stem.
15. Separate the three stems.
16. Remove the retaining ring (78B) and lower bearing (66A) from the upper stem.

OPERATOR ASSEMBLY

1. Apply a liberal coat of grease to all surfaces of the middle stem and lower stem. Thread the middle stem into the lower stem such that when the stop shoulders on each stem come together, the roller opening in the lower stem is exactly in line with the detent recess in the middle stem. This may require several attempts as the threads are multiple start and do not always assemble correctly with the first try.
2. Apply a coat of grease to the upper stem (22A) and thread it into the middle stem such that the drive pin in the upper stem is against the shoulder at the top of the middle stem, and the detent recess in the upper stem is exactly in line with the roller opening in the middle stem. This operation may also require several attempts due to the multiple start threads.

This operation may also require several attempts due to the multiple start threads.

3. Place one of the two bearings (66A) on the upper stem.
- NOTE: This bearing is assembled such that the wide surface of the inner race seats on the upper stem shoulder. Install a retaining ring (78B) to lock the bearing in place.**
4. Install the indicator shaft assembly (27B) into the bottom of the lower stem and up through all three stems. Align the detent hole in the indicator disc at the bottom of the indicator shaft with the threaded hole near the bottom of the lower stem and fasten with set screw (74A). Set screw must be below the outside surface of the lower stem.
 5. Install O-ring (62A) in housing (21B).
 6. Place the upper roller (48) and the lower roller (48) in their respective openings in the lower and middle stems. A liberal application of grease will hold them in position.
 7. Place the stem assembly into the top of the housing such that the upper roller is in the vertical groove in the housing. Push the entire assembly down until the bearing rests on the shoulder in the housing.
 8. Apply a coating of Form-A-Gasket to the surface of the guide pin boss on the housing. Insert the guide pin (41A) to fully engage the U-shaped groove in the lower stem and secure with capscrews (72C).
 9. Place the gear key (45B) in the keyway of the upper stem.
 10. Install tapered roller bearing cup (66C) in the rear bearing recess of gear housing (21A) with the large diameter of taper facing out.
 11. Install tapered roller bearing cup (66C) and cone (66B) on handwheel end of worm shaft (24). Place the bearing cone on the opposite end with the large diameter of the taper against the shaft shoulder.
 12. Install the worm shaft with the bearings in the gear housing. Make certain the rear bearing cone has properly entered the rear bearing cup.
 13. Install O-ring (62B) in bearing cap (26C).
 14. Apply a coating of Form-A-Gasket to the bearing cap boss on gear housing (21A). Fasten the bearing cap in place with capscrews (72F). Be sure to install the plastic shims (49) between the gear housing and bearing cap.
 15. Install worm gear (23) in gear housing with hub down (toward smaller opening).
 16. Apply Form-A-Gasket to top flange of operator housing (21B). Place gear housing with assembled parts on top of operator housing guiding worm gear keyway over key (45B) in upper stem. Position the gear housing so that the handwheel end of the worm shaft is on the same side of the operator as the guide pin.
 17. Install retaining ring (78B) to secure worm gear (23).
 18. Fasten the gear housing to the operator housing with capscrews (72A). **CAUTION: NOTE THAT SHORTER CAPSCREW (72B) IS INSTALLED DIRECTLY UNDER THE CENTER OF THE WORM SHAFT.**
 19. Fill gear housing with grease up to the top of the worm gear.
 20. Install bearing (66A) in bearing carrier (26B). **NOTE: The widest surface of the outer race goes against the shoulder in the bearing carrier.**
 21. Apply a smooth even coat of Form-A-Gasket over top surface of the gear housing. Place the bearing carrier (26B) on top of the gear housing.
 22. Install two capscrews (72D) 180° apart to temporarily secure the bearing carrier. They only need to be partially screwed in.
 23. Install nut (75) and tighten snug with wrench. Remove the capscrews.
 24. Install the grease seal (65) in the gear housing cover (26A). Slide the cover over the indicator shaft and secure to top of gear housing with capscrews (72D).
 25. Install the stem protector (64A).
 26. Install the indicator (27) and secure with set screw (74B).
 27. Install handwheel (28) with key (45A), washer (44), and capscrew (72G).

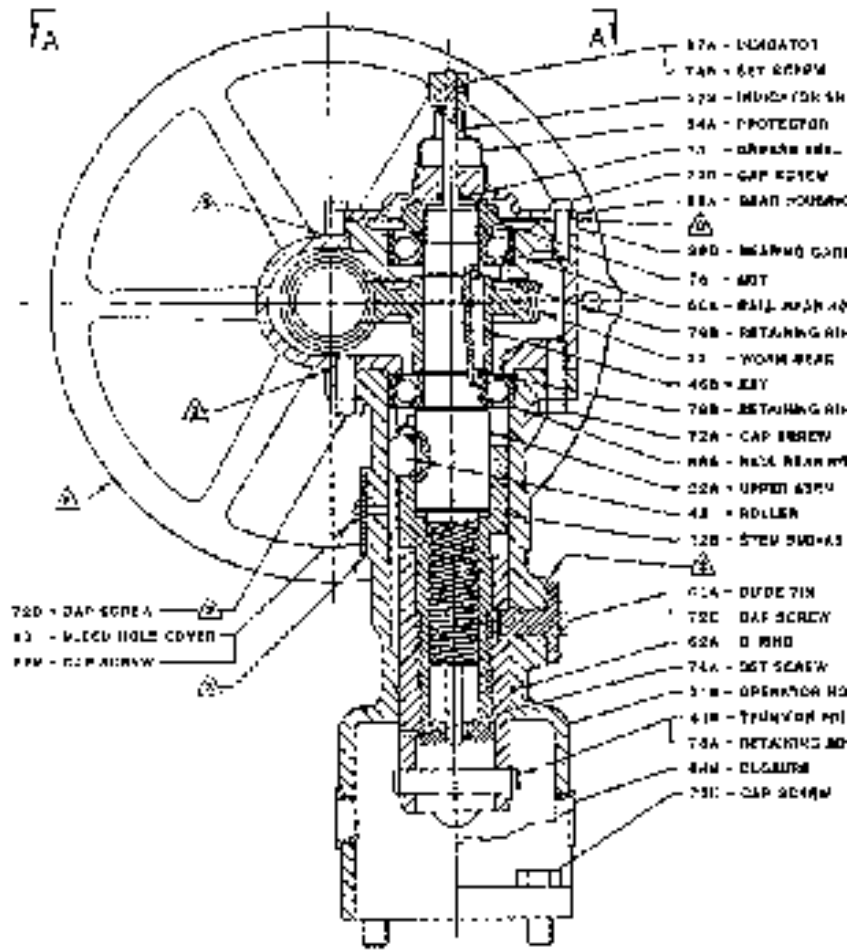
INSTALLATION OF OPERATOR TO VALVE

1. Lift operator over plug trunnion and down on valve bonnet with recess at bottom of operator housing properly aligned to fit over packing gland with handwheel over the body bleed and thermal relief system.
2. Run in capscrews (72H) but do not tighten.
3. Turn the handwheel until lower stem comes down over plug trunnion and trunnion pin holes line up. It may be necessary to cycle operator completely right or left to line up holes. Drive in trunnion pin (41B) and install retaining rings (78A) at each end.
4. Tighten capscrews (72H) securely and install plugs (64A).

MAINTENANCE

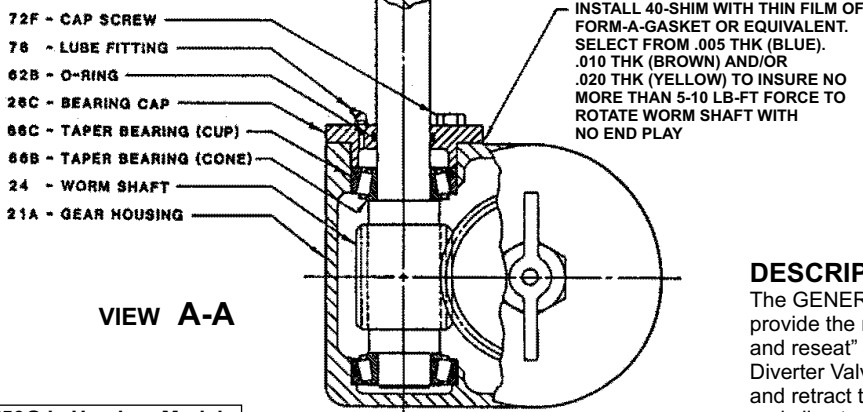
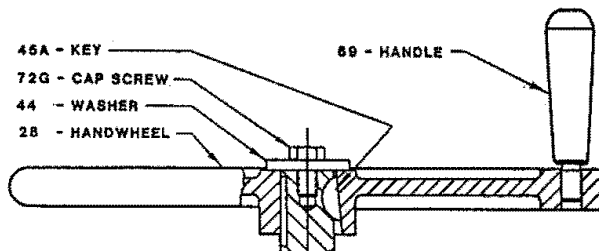
Keep the valve operator filled with lubricant to displace and prevent moisture from accumulating and freezing. The operator is provided with one grease fitting (76). Lubricant should be injected with the operator in the **NEUTRAL POSITION ONLY** (plug raised). Under ordinary conditions, a few pumps of the grease gun once each month is sufficient. Use Lithium 12 Hydroxy Stearate or Lithium Base Moly-Disulfide grease.

750 4-WAY GEAR OPERATOR



750 4-WAY GEAR

| Item No. | Part No. | Qty. | Description |
|----------|----------|------|--------------------|
| 21A | 21-405 | 1 | Gear Housing |
| 21B | 21-471 | 1 | Operator Housing |
| 22B | 22-550 | 1 | Stem Sub-Assembly |
| 23 | 23-418 | 1 | Worm Gear |
| 24 | 24-405 | 1 | Worm Shaft |
| 26 | A26-403 | 1 | Gear Housing Cover |
| 26B | 26-411 | 1 | Bearing Carrier |
| 26C | 26-401 | 1 | Bearing Cap |
| 27A | 27-575 | 1 | Indicator |
| 27B | 27-412 | 1 | Indicator Shaft |
| 28 | 28-404 | 1 | 14" Dia. Handwheel |
| 41A | 41-407 | 1 | Guide Pin |
| 41B | 41-410 | 1 | Trunnion Pin |
| 44 | 44-401 | 1 | Washer |
| 45A | 45-402 | 1 | Key |
| 45B | 45-406 | 1 | Key |
| 48 | 48-404 | 2 | Roller |
| 62A | 62-24-V | 1 | O-Ring |
| 62B | 62-13-V | 1 | O-Ring |
| 64A | 64-411 | 1 | Protector |
| 64B | 64-416 | 4 | Closure |
| 65 | 65-401 | 1 | Grease Seal |
| 66A | 66-412 | 2 | Bearing |
| 66B | 66-401 | 2 | Bearing |
| 66C | 66-458 | 2 | Bearing |
| 69A | 69-414 | 1 | Handle |
| 69B | 69-415 | 1 | Sleeve |
| 72A | 72-9 | 7 | HXHD Screw |
| 69C | 73-248 | 1 | ALHD Screw |
| 72B | 72-10 | 4 | HXHD Screw |
| 72C | 72-4 | 2 | HXHD Screw |
| 72D | 72-14 | 4 | HXHD Screw |
| 72E | 72-21 | 2 | HXHD Screw |
| 72F | 72-5 | 4 | HXHD Screw |
| 72G | 72-8 | 1 | HXHD Screw |
| 72H | 72-11 | 4 | HXHD Screw |
| 74A | 74-3 | 1 | Set Screw |
| 74B | 74-6 | 1 | Set Screw |
| 75 | 75-406 | 1 | HX Nut |
| 76 | 76-612 | 1 | Lube Fitting |
| 78A | 78-406 | 2 | Retainer Ring |
| 78B | 78-408 | 2 | Retainer Ring |
| 93 | 93-413 | 1 | Bleed Valve Cover |



VIEW A-A

| 750G is Used on Models | |
|------------------------|-------|
| 4" | C4741 |
| 4" | C4751 |
| 6" | C4721 |

DESCRIPTION

The GENERAL Valve 4-Way Operator is a screw jack device designed to provide the necessary mechanical advantage and the "unseat, lift, turn and reseat" motion and seating force required by the GENERAL 4-Way Diverter Valve. Turning the handwheel clockwise causes the plug to lift and retract the seating slips. When the slips are fully retracted, the plug and slips turn clockwise through 90°. Continued turning of the handwheel caused the plug to descend, seating the slips. The 4-Way Valve now diverts flow to the right (when facing the handwheel). Counter-clockwise rotation of the handwheel repeats the cycle in the opposite direction until the valve diverts flow to the left.

750 4-WAY GEAR OPERATOR

OPERATION

Divert flow to the right:

Turn the handwheel clockwise:

1. The upper stem (22A) and middle stem are locked together by the upper roller (48) and turn as one, clockwise. The lower stem travels vertically upward on the right hand acme threads lifting the plug and retracting the slips. The lower stem is restrained from turning by the guide pin (41A) which is in the left vertical portion of the U-shaped groove in the lower stem. The lower roller (48) is traveling upward in the vertical slot in the housing (21B).
2. When the valve plug is raised and ready to turn 90°, the guide pin is now aligned with the horizontal portion of the U-shaped groove. The lower roller is aligned with the detent pocket in the middle stem. The lower shoulder on the middle stem is in contact with the upper shoulder on the lower stem.
3. Continued clockwise rotation of the handwheel and the upper and middle stems, forces the lower stem to also rotate clockwise, releasing the lower roller (48) out of the housing slot and into the detent pocket of the middle stem. The guide pin (41A) tracks through the horizontal portion of the U-shaped groove as all three stems, now locked together, rotate clockwise as one.
4. After the three stems have rotated 90° they are positioned such that the guide pin is now aligned with the right hand vertical portion of the U-shaped groove and the upper roller is aligned with the vertical slot in the housing (21B). In this position, the middle stem and the lower stem are locked together by the lower roller (48). The valve plug has been rotated 90° but is still raised.
5. Continued clockwise rotation of the handwheel releases the upper roller out of engagement with the upper stem (22A) and into the housing slot where it is free to travel vertically with the middle stem and the lower stem. As the middle and lower stems are locked together, they now travel down on the acme thread until the slips are seated.

Divert flow to the left:

Turn handwheel counter-clockwise:

1. This operation is similar to diverting flow to the right except the various events occur in the reverse sequence.

REMOVING OPERATOR FROM THE VALVE

1. Seat the plug and remove the two plastic plugs (64B).
2. Remove the retaining rings (78A) and knock out the trunnion pin (41B). **CAUTION: DO NOT PEEN OR BURR OVER THE EDGES.**
3. Remove hex nuts (75A) attaching operator to valve bonnet.
4. Lift operator off valve by pulling up vertically until it clears the plug trunnion.

OPERATOR DISASSEMBLY

1. Remove set screw (74B) and indicator (27A).
2. Remove the stem protector (64A).
3. Unbolt and remove the gear housing cover (26A).
4. Remove the bearing retainer nut (75).
5. Remove the bearing carrier (26B) and the upper bearing (66A).
6. Remove the upper retaining ring (78B).
7. Remove the capscrew (72G), washer (44), handwheel (28) and key (45A).
8. Unbolt and remove the bearing cap (26C).
9. Screw out the worm shaft (24). Front bearing cone (66B) and cup (66C) and rear bearing cone will come out with the worm shaft.
10. Remove the worm gear (23) and key (45B).
11. Unbolt and remove the gear housing (21A).
12. Unbolt and remove the guide pin (41A).
13. Pull the upper stem (22A) with middle stem, lower stem rollers (48), lower bearing, and indicator shaft (27B) out through the top of the housing (21B). If the bearing is tight in the housing place the worm gear with its key on the upper stem upside down (hub up). Turn the

gear to raise the lower stem as far as possible. Insert a 1/2" diameter bar through the two holes in the bottom of the housing. Using a pipe wrench on the gear hub, turn the gear to lower the lower stem and jack the bearing clear of the housing.

14. Remove the set screw (74A) and push the indicator shaft out through the bottom of the lower stem.
15. Separate the three stems.
16. Remove the retaining ring (78B) and lower bearing (66A) from the upper stem.

OPERATOR ASSEMBLY

1. Apply a liberal coat of grease to all surfaces of the middle stem and lower stem. Thread the middle stem into the lower stem such that when the stop shoulders on each stem come together, the roller opening in the lower stem is exactly in line with the detent recess in the middle stem. This may require several attempts as the threads are multiple start and do not always assemble correctly with the first try.
2. Apply a coat of grease to the upper stem (22A) and thread it into the middle stem such that the drive pin in the upper stem is against the shoulder at the top of the middle stem and the detent recess in the upper stem is exactly in line with the roller opening in the middle stem. This operation may also require several attempts due to the multiple start threads.
3. Place one of the two bearings (66A) on the upper stem (22A).

NOTE: This bearing is assembled such that the wide surface of the inner race seats on the upper stem shoulder. Install a retaining ring (78B) to lock the bearing in place.

4. Install the indicator shaft assembly (27B) into the bottom of the lower stem and up through all three stems. Align the detent hole in the indicator disc at the bottom of the indicator shaft with the threaded hole near the bottom of the lower stem and fasten with set screw (74A). Set screw must be below the outside surface of the lower stem.
5. Install O-ring (62A) in housing (21B).
6. Place the upper roller (48) and the lower roller (48) in their respective openings in the lower and middle stems. A liberal application of grease will hold them in position.
7. Place the stem assembly into the top of the housing such that the upper roller is in the vertical groove in the housing. Push the entire assembly down until the bearing rests on the shoulder in the housing.
8. Apply a coating of Form-A-Gasket to the surface of the guide pin boss on the housing. Insert the guide pin (41A) to fully engage the U-shaped groove in the lower stem and secure with capscrews (72C).
9. Place the gear key (45B) in the keyway of the upper stem.
10. Install tapered roller bearing cup (66C) in the rear bearing recess of gear housing (21A) with the large diameter of taper facing out.
11. Install tapered roller bearing cup (66C) and cone (66B) on handwheel end of worm shaft (24). Place the bearing cone on the opposite end with the large diameter of the taper against the shaft shoulder.
12. Install the worm shaft with the bearings in the gear housing. Make certain the rear bearing cone has properly entered the rear bearing cup (66C).
13. Install O-ring (62B) in bearing cap (26C).
14. Apply a coating of Form-A-Gasket to the bearing cap boss on gear housing (21A). Fasten the bearing cap (26C) in place with capscrews (72F). Be sure to install the plastic shims (49) between the gear housing and bearing cap (26C).
15. Install worm gear (23) in gear housing with hub down (toward smaller opening).
16. Apply Form-A-Gasket to top flange of operator housing (21B). Place gear housing (21A) with assembled parts on top of operator housing guiding worm gear keyway over key (45B) in upper stem.

750 4-WAY GEAR OPERATOR

Position the gear housing so that the handwheel end of the worm shaft is on the same side of the operator as the guide pin.

17. Install retaining ring (78B) to secure worm gear (23).
18. Fasten the gear housing to the operator housing with capscrews (72A).

CAUTION: NOTE THAT SHORTER CAPSCREW (72B) IS INSTALLED DIRECTLY UNDER THE CENTER OF THE WORM SHAFT.

19. Fill gear housing with grease up to the top of the worm gear.
20. Install bearing (66A) in bearing carrier (26B).
NOTE: The widest surface of the outer race goes against the shoulder in the bearing carrier.
21. Apply a smooth even coat of Form-A-Gasket over top surface of the gear housing. Place the bearing carrier (26B) on top of the gear housing.
22. Install two capscrews (72D) 180° apart to temporarily secure the bearing carrier. They only need to be partially screwed in.
23. Install hex nut (75) and tighten snug with wrench. Remove the two capscrews (72D).
24. Install the grease seal (65) in the gear housing cover (26A). Slide the cover over the indicator shaft and secure to top of gear housing with capscrews (72D).
25. Install the stem protector (64A).
26. Install the indicator (27A) and secure with set screw (74B).
27. Install handwheel (28) with key (45A), washer (44), and capscrew (72G).

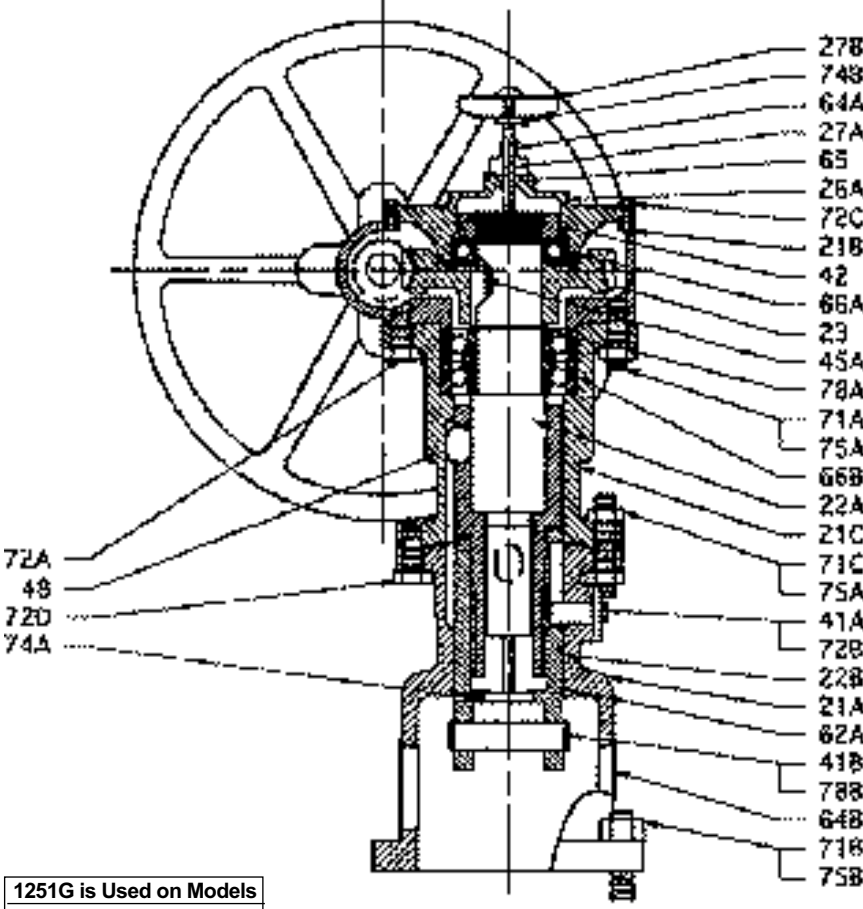
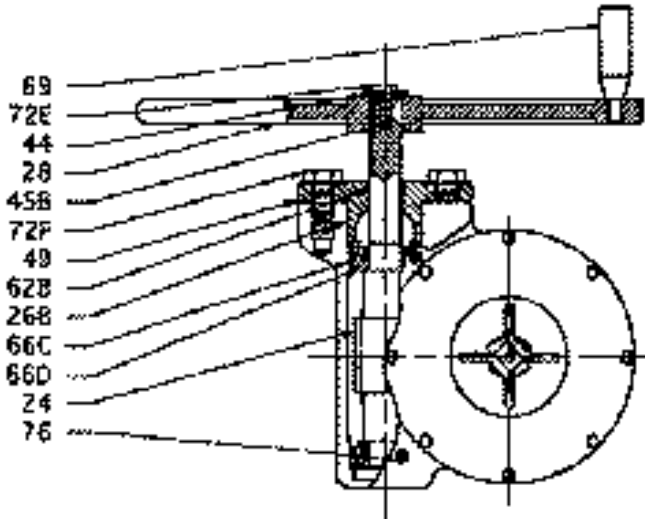
INSTALLATION OF OPERATOR TO VALVE

1. Lift operator over plug trunnion and down on valve bonnet with recess at bottom of operator housing properly aligned to fit over packing gland with handwheel over the body bleed and thermal relief system.
2. Install hex nuts (75A) hand tight.
3. Turn the handwheel until lower stem comes down over plug trunnion and trunnion pin holes line up. It may be necessary to cycle operator completely right or left to line up holes. Drive in trunnion pin (41B) and install retaining rings (78A) at each end.
4. Tighten hex nuts (75) securely and install plugs (64A).

MAINTENANCE

Keep the valve operator filled with lubricant to displace and prevent moisture from accumulating and freezing. The operator is provided with a grease fitting (76). Lubricant should be injected with the operator in the **NEUTRAL POSITION ONLY** (plug raised). Under ordinary conditions, a few pumps of the grease gun once each month is sufficient. Use Lithium 12 Hydroxy Stearate or Lithium Base Moly-Disulfide grease.

1251 4-WAY OPERATOR



1251G 4-WAY AND SEAT & RESEAT

| Item No. | 4-WAY Part No. | S & RG Part No. | Description |
|----------|----------------|-----------------|----------------------|
| 21A | 21-511 | 21-511 | Gear Housing |
| 21B | 21-518 | 21-518 | Gear Housing |
| 21C | 21-538 | 21-538 | Upper Housing |
| 22A | 22-500 | 22-500 | Upper Stem |
| 22B | 22-549 | 22-549 | Stem Sub-Assembly |
| 23 | 23-493 | 23-473 | Worm Gear |
| 24 | 24-433 | 24-428 | Worm Shaft |
| 26A | 26-513 | 26-513 | Gear Housing Cover |
| 26B | 26-514 | 26-514 | Bearing Cap |
| 27A | 27-473 | 27-473 | Indicator Shaft |
| 27B | 27-575 | 27-406 | Indicator |
| 28 | 28-402 | 28-402 | Handwheel |
| 41A | 41-409 | 41-409 | Guide Pin |
| 41B | 41-411 | 41-411 | Trunnion Pin |
| 42 | 42-403 | 42-403 | Upper Stem Nut |
| 44 | 44-401 | 44-401 | Washer |
| 45A | 45-402 | 45-402 | Key |
| 45B | 45-404 | 45-404 | Key |
| 48 | 48-402 | 48-402 | Roller |
| 49 | 49-649 | 49-649 | Shim |
| 62A | 62-23-V | 62-23-V | O-Ring |
| 62B | 62-13-V | 62-13-V | O-Ring |
| 64A | 64-411 | 64-411 | Protector |
| 64B | 64-416 | 64-416 | Closure |
| 65 | 65-401 | 65-401 | Grease Seal |
| 66A | 66-404 | 66-404 | Ball Bearing |
| 66B | 66-411 | 66-411 | Ball Bearing |
| 66C | 66-465 | 66-465 | Tapered Bearing Cup |
| 66D | 66-466 | 66-466 | Tapered Bearing Cone |
| 69 | 69-414 | 69-415 | Spinner Handle |
| 71A | 71-13 | 71-13 | Stud |
| 71B | 71-63 | 71-63 | Stud |
| 71C | 71-80 | 71-80 | Stud |
| 72A | 72-3 | 72-3 | Capscrew |
| 72B | 72-4 | 72-4 | Capscrew |
| 72C | 72-7 | 72-7 | Capscrew |
| 72D | 72-13 | 72-13 | Capscrew |
| 72E | 72-10 | 72-10 | Capscrew |
| 72F | 72-2 | 72-2 | Capscrew |
| 74A | 74-4 | 74-4 | Set Screw |
| 74B | 74-6 | 74-6 | Set Screw |
| 75A | 75-406 | 75-406 | Hex Nut |
| 75B | 75-407 | 75-407 | Hex Nut |
| 76 | 76-412 | 76-412 | Lube Fitting |
| 78A | 78-405 | 78-405 | Retainer Ring |
| 78B | 78-407 | 78-407 | Retainer Ring |

| 1251G is Used on Models | |
|-------------------------|-------|
| 6" | C4741 |
| 6" | C4751 |
| 8" | C4721 |
| 8" | C4741 |
| 8" | C4751 |
| 10" | C4721 |
| 10" | C4741 |
| 12" | B4711 |
| 12" | B4721 |

1251 4-WAY OPERATOR

REMOVING OPERATOR FROM THE VALVE

1. Seat the plug and remove the four plastic closures (64B).
2. Remove the retaining rings (78B) and knock out the trunnion pin (41B). **CAUTION: DO NOT PEEN OR BURR OVER THE EDGES.**
3. Remove hex nuts (75B) attaching operator to valve bonnet.
4. Lift operator off valve by pulling up vertically until it clears the plug trunnion.

OPERATOR DISASSEMBLY

1. Remove set screw (74B) and indicator (27B).
2. Remove the stem protector (64A).
3. Unbolt and remove the gear housing cover (26A).
4. Remove the upper stem nut (42).
5. Remove upper bearing (66A).
6. Remove the capscrew (72E), washer (44), handwheel (28) and key (45A).
7. Unbolt and remove the bearing cap (26B).
8. Screw out the worm shaft (24). Front bearing cone (66C) and cup (66D) and rear bearing cone (66C) will come out with the worm shaft.
9. Remove the worm gear (23) and key (45B).
10. Remove the retaining ring (78A).
11. Unbolt and remove the gear housing (21B).
12. Unbolt and remove the guide pin (41A).
13. Pull the upper stem (22A) with middle stem lower stem, roller (48), lower bearing and indicator shaft (27B) out through the top of the housing (21C). If the bearings are tight in the housing, place the worm gear with its key on the upper stem upside down (hub up). Turn the gear to raise the lower stem as far as possible. Insert a 1/2" diameter bar through the two holes in the bottom of the housing (21A). Using a pipe wrench on the gear hub, turn the gear to lower the lower stem and jack the bearings clear of the housing (21C).
14. Remove the set screw (74A) and push the indicator shaft (27A) out through the bottom of the lower stem.
15. Separate the three stems.
16. Remove the bearings (66B) from the upper stem.

OPERATOR ASSEMBLY

Stem Assembly

1. Apply a liberal coat of grease to all surfaces of the middle stem and lower stem. Thread the middle stem into the lower stem such that when the stop shoulders on each stem come together, the roller opening in the lower stem is exactly in line with the detent recess in the middle stem. This may require several attempts as the threads are multiple start and do not always assemble correctly with the first try.
2. Apply a coat of grease to the upper stem (22A) and thread it into the middle stem such that the drive pin in the upper stem is against the shoulder at the top of the middle stem, and the detent recess in the upper stem is exactly in line with the roller opening in the middle stem. This operation may also require several attempts due to the multiple start threads.
3. Place the two bearings (66B) on the upper stem (22A). **CAUTION: THESE ARE RADIAL THRUST BEARINGS AND MUST BE INSTALLED SUCH THAT THE WIDEST SURFACES OF THE INNER RACEWAYS ARE BACK TO BACK. INCORRECT INSTALLATION WILL RESULT IN SERIOUS DAMAGE.**
Install the retaining ring (78A) to lock the bearings in place.

Operator Body Assembly

4. Install the indicator shaft assembly (27A) into the bottom of the lower stem and up through all three stems. Align the detent hole in the indicator disc at the bottom of the lower stem and up through all three stems. Align the detent hole in the indicator disc at the bottom of the indicator shaft with the threaded hole near the bottom of the lower stem and fasten with set screw (74A). Set screw must be below the outside surface of the lower stem.
5. Install O-ring (62A) in housing (21A).

6. Place the upper roller (48) and the lower roller (48) in their respective openings in the lower and middle stems. A liberal application of grease will hold them in position.
7. Place the stem assembly into the top of the housing such that the upper roller is in the vertical groove in the housing. Push the entire assembly down until the bearings rest on the shoulder in the housing.
8. Apply a coating of Form-A-Gasket to the surface of the guide pin boss of the housing. Insert the guide pin (41A) to fully engage the U shaped groove in the lower stem and secure with capscrews (72B).
9. Place the gear key (45A) in the key way of the upper stem.

Bearing Assembly

10. Install tapered roller bearing cup (66D) in the rear bearing recess of the gear housing (21B) with large diameter of taper facing out.
11. Install tapered roller bearing cup (66D) and cone (66C) on handwheel end of worm shaft (24). Place bearing cone (66C) on the opposite end with large diameter of taper against shaft shoulder.
12. Install worm shaft with bearings in gear housing. Make certain the rear bearing cone has properly entered rear bearing cup.
13. Install O-ring (62B) in bearing cap (26B).
14. Apply a coating of Form-A-Gasket to the bearing cap boss on the gear housing (21B). Fasten bearing cap (26B) in place with capscrews (72F). Be sure to install the plastic shims (49) between gear housing and bearing cap. Select shims so no more than 5-10 lb/ft force is required to rotate worm shaft with no apparent end play.

Gear Assembly

15. Install worm gear (23) in gear housing with hub down (toward smaller opening).
16. Apply Form-A-Gasket to top flange of operator housing (21C). Place gear housing (21B) with assembled parts on top of operator housing guiding worm gear keyway over key (45B) in upper stem. Position the gear housing so that the handwheel end of the worm shaft is on the same side of the operator as the guide pin.
17. Fasten the gear housing to the operator housing with studs (71A) and nuts (75A). **CAUTION: NOTE THAT SHORTER CAPSCREW (72A) IS INSTALLED DIRECTLY UNDER THE CENTER OF THE WORM SHAFT.**
18. Fill gear housing with grease up to the top of the worm gear.
19. Install bearing (66A).
20. Install hex nut (42) and tighten snug with wrench.
21. Apply a smooth even coat of Form-A-Gasket over top surface of the gear housing.
22. Install the grease seal (65A) in the gear housing cover (26A). Slide the cover over the indicator shaft and secure to top of gear housing with capscrews (72C).

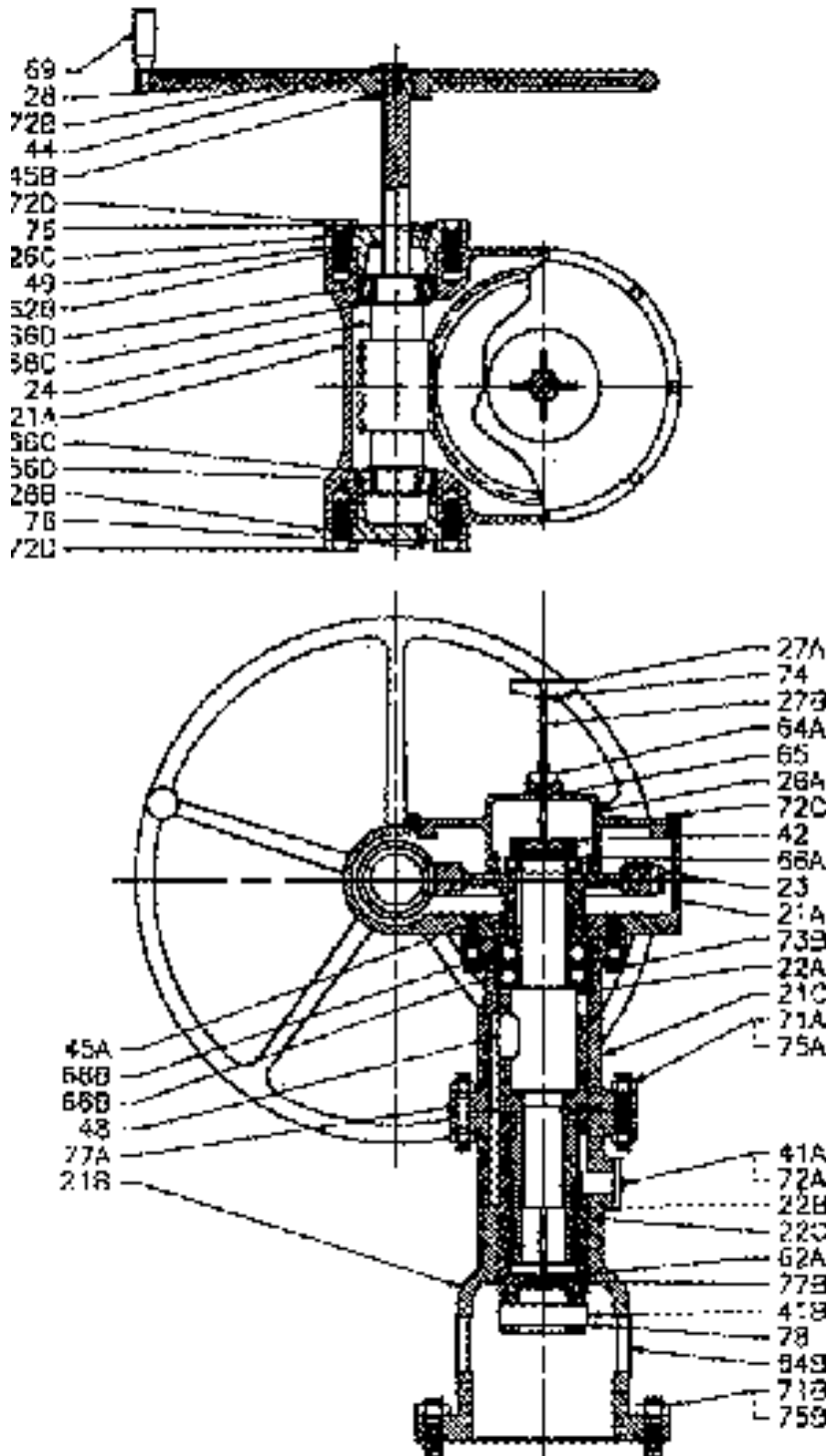
Indicator and Handwheel Assembly

23. Install the stem protector (64A).
24. Install the indicator flag (27B) and secure with set screw (74B).
25. Install handwheel (28) with key (45A), washer (44), and capscrew (72E).

INSTALLATION OF OPERATOR TO VALVE

1. Lift operator over plug trunnion and down on valve bonnet with recess at bottom of operator housing properly aligned to fit over packing gland.
- For a Four-Way operator position the handwheel over "in" port of valve.
- For a Seat & Reseat operator position the handwheel parallel to the valve flanges.
2. Install hex nuts (75B) hand tight.
3. Turn the handwheel until lower stem comes down over plug trunnion and trunnion pin holes line up. It may be necessary to cycle operator completely right or left to line up holes. Drive in trunnion pin (41B) and install retaining rings (78B) at each end.
4. Tighten hex nuts (75B) securely and install closures (64B).

1277 4-WAY OPERATOR



| 1277G is Used on Models | |
|-------------------------|--------|
| 10" | C4751 |
| 12" | CA4711 |
| 12" | CA4721 |
| 12" | CA4741 |

1277G 4-WAY AND SEAT & RESEAT

| Item No. | 4-WAY Part No. | S & RG Part No. | Description |
|----------|----------------|-----------------|----------------------|
| 21A | 21-505 | 21-505 | Gear Housing |
| 21B | 21-626 | 21-581 | Lower Housing |
| 21C | 21-582 | 21-582 | Upper Housing |
| 22A | 22-519 | 22-519 | Upper Stem Sub Assy. |
| 22B | 22-561 | 22-556 | Lower Stem |
| 23 | 23-493 | 23-461 | Worm Gear |
| 24 | 24-430 | 24-425 | Worm Shaft |
| 26A | 26-513 | 26-513 | Gear Housing Cover |
| 26B | 26-514 | 26-514 | Bearing Cap |
| 26C | 26-489 | 26-489 | Bearing Cap |
| 27A | 27-575 | 27-406 | Indicator |
| 27B | 27-585 | 27-541 | Indicator Shaft |
| 28 | 28-432 | 28-432 | Handwheel |
| 41A | 41-480 | 41-480 | Guide Pin |
| 41B | 41-495 | 41-476 | Trunnion Pin |
| 42 | 42-403 | 42-403 | Upper Stem Nut |
| 44 | 44-401 | 44-401 | Washer |
| 45A | 45-428 | 45-428 | Key |
| 45B | 45-402 | 45-402 | Key |
| 48 | 48-410 | 48-410 | Roller |
| 49 | 49-649 | 49-649 | Shim |
| 62A | 62-215-V | 62-215-V | O-Ring |
| 62B | 62-20-V | 62-20-V | O-Ring |
| 64A | 64-412 | 64-4112 | Protector |
| 64B | 64-416 | 64-416 | Closure |
| 65 | 65-401 | 65-401 | Grease Seal |
| 66A | 66-404 | 66-404 | Ball Bearing |
| 66B | 66-452 | 66-452 | Ball Bearing |
| 66C | 66-454 | 66-454 | Tapered Bearing Cone |
| 66D | 66-463 | 66-463 | Tapered Bearing Cup |
| 69 | 69-414 | 69-414 | Spinner Handle |
| 71A | 71-47 | 71-47 | Stud |
| 71B | 71-22 | — | Stud |
| 72A | 72-5 | 72-5 | Capscrew |
| 72B | 72-8 | 72-8 | Capscrew |
| 72C | 72-26 | 72-26 | Capscrew |
| 72D | 72-64 | 72-64 | Capscrew |
| 73A | 73-248 | 73-248 | Capscrew |
| 73B | 73-131 | 73-131 | Capscrew |
| 73C | — | 73-111 | Capscrew |
| 74 | 74-6 | 74-6 | Set Screw |
| 75A | 75-406 | 75-406 | Hex Nut |
| 75B | 75-408 | — | Hex Nut |
| 76 | 76-412 | 76-412 | Lube Fitting |
| 77A | 77-454 | 77-454 | Dowel Pin |
| 77B | 77-481 | 77-481 | Rollpin |
| 78 | 78-410 | 78-407 | Retainer Ring |

1277 4-WAY OPERATOR

REMOVING OPERATOR FROM THE VALVE

1. Seat the plug and remove the two plastic closures (64B).
2. Remove the retaining rings (78) and knock out the trunnion pin (41B). **CAUTION: DO NOT PEEN OR BURR OVER THE EDGES.**
3. Remove nuts (75B) attaching operator to valve bonnet.
4. Lift operator off valve by pulling up vertically until it clears the plug trunnion.

OPERATOR DISASSEMBLY

1. Remove set screw (74) and indicator (27A).
2. Remove the stem protector (64A).
3. Unbolt and remove the gear housing cover (26A).
4. Remove the upper stem nut (42).
5. Remove upper bearing (66A).
6. Remove the capscrew (72B), washer (44), handwheel (28), and key (45B).
7. Unbolt and remove the bearing cap (26C).
8. Screw out the worm shaft (24). Front bearing cone (66C) and cup (66D) and rear bearing cone (66C) will come out with the worm shaft.
9. Remove the worm gear (23) and key (45A).
10. Remove the retaining ring (78).
11. Unbolt and remove the gear housing (21A).
12. Unbolt and remove the guide pin (41A).
13. Pull the upper stem (22A) with middle stem lower stem, roller (48), lower bearing and indicator shaft (27B) out through the top of the housing (21C). If the bearings are tight in the housing, place the worm gear with its key on the upper stem upside down (hub up). Turn the gear to raise the lower stem as far as possible. Insert a 1/2" diameter bar through the two holes in the bottom of the housing (21B). Using a pipe wrench on the gear hub, turn the gear to lower the lower stem and jack the bearings clear of the housing (21C).
14. Remove the set screw (74) and push the indicator shaft out through the bottom of the lower stem.
15. Separate the three stems.
16. Remove the bearings (66B) from the upper stem.

OPERATOR ASSEMBLY

Stem Assembly

1. Apply a liberal coat of grease to all surfaces of the middle stem and lower stem. Thread the middle stem into the lower stem such that when the stop shoulders on each stem come together, the roller opening in the lower stem is exactly in line with the detent recess in the middle stem. This may require several attempts as the threads are multiple start and do not always assemble correctly with the first try.
2. Apply a coat of grease to the upper stem (22A) and thread it into the middle stem such that the drive pin in the upper stem is against the shoulder at the top of the middle stem and the detent recess in the upper stem is exactly in line with the roller opening in the middle stem. This operation may also require several attempts due to the multiple start threads.
3. Place the two bearings (66B) on the upper stem (22A).
CAUTION: THESE ARE RADIAL THRUST BEARINGS AND MUST BE INSTALLED SUCH THAT THE WIDEST SURFACES OF THE INNER RACEWAYS ARE BACK TO BACK. INCORRECT INSTALLATION WILL RESULT IN SERIOUS DAMAGE. INSTALL THE RETAINING RING (78) TO LOCK THE BEARINGS IN PLACE.

Operator Body Assembly

4. Install the indicator shaft assembly (27B) into the bottom of the lower stem and up through all three stems. Align the detent hole in the indicator disc at the bottom of the indicator shaft with the hole in the lower stem and fasten with roll pin (77B).
5. Install O-ring (62A) in housing (21B).

6. Place the upper roller (48) and the lower roller (48) in their respective openings in the lower and middle stems. A liberal application of grease will hold them in position.
7. Place the stem assembly into the top of the housing such that the upper roller is in the vertical groove in the housing. Push the entire assembly down until the bearings rest on the shoulder in the housing.
8. Apply a coating of Form-A-Gasket to the surface of the guide pin boss of the housing. Insert the guide pin (41A) to fully engage the U-shaped groove in the lower stem and secure with capscrews (72A).
9. Place the gear key (45A) in the key way of the upper stem.

Bearing Assembly

10. Install tapered roller bearing cup (66D) in the rear bearing recess of the gear housing (21A) with large diameter of taper facing out.
11. Install tapered roller bearing cup (66D) and cone (66C) on handwheel end of worm shaft (24). Place bearing cone (66C) on the opposite end with large diameter of taper against shaft shoulder.
12. Install worm shaft with bearings in gear housing. Make certain the rear bearing cone has properly entered rear bearing cup.
13. Install O-ring (62B) in bearing cap (26C).
14. Apply a coating of Form-A-Gasket to the bearing cap boss on the gear housing (21A). Fasten bearing cap (26C) in place with capscrews (72D). Be sure to install the plastic shims (49) between gear housing and bearing cap. Select shims so no more than 5-10 lb/ft force is required to rotate worm shaft with no apparent end play.

Gear Assembly

15. Install worm gear (23) in gear housing with hub down (toward smaller opening).
16. Apply Form-A-Gasket to top flange of operator housing (21C). Place gear housing (21A) with assembled parts on top of operator housing guiding worm gear keyway over key (45A) in upper stem. Position the gear housing so that the handwheel end of the worm shaft is on the same side of the operator as the guide pin.
17. Fasten the gear housing to the operator housing with 12 pt capscrews (73B).
18. Fill gear housing with grease up to the top of the worm gear.
19. Install bearing (66A).
20. Install hex nut (42) and tighten snug with wrench.
21. Apply a smooth even coat of Form-A-Gasket over top surface of the gear housing.
22. Install the grease seal (65) in the gear housing cover (26A). Slide the cover over the indicator shaft and secure to top of gear housing with capscrews (72C).

Indicator and Handwheel Assembly

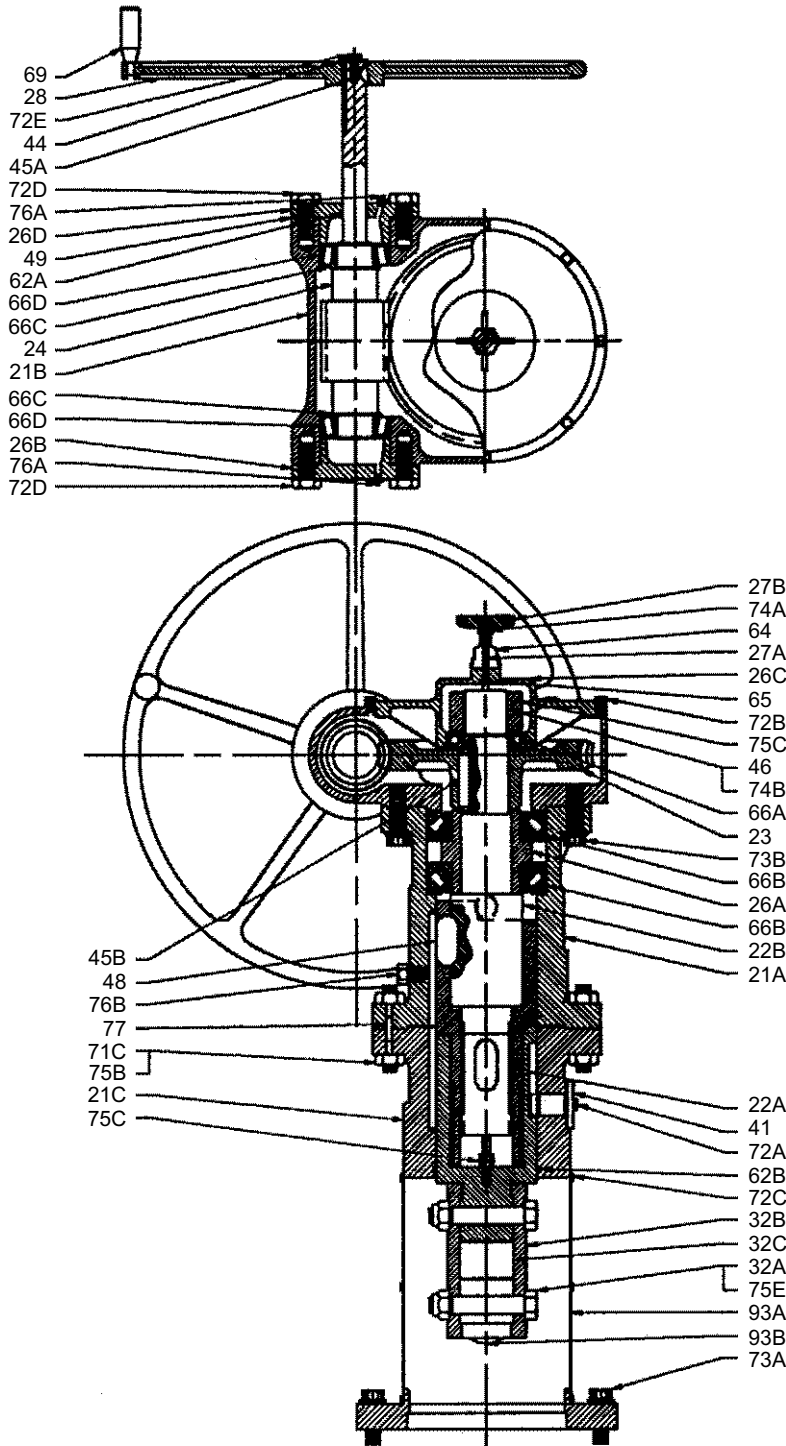
23. Install the stem protector (64A).
24. Install the indicator flag (27A) and secure with set screw (74).
25. Install handwheel (28) with key (45B), washer (44), and capscrew (72B).

INSTALLATION OF OPERATOR TO VALVE

1. Lift operator over plug trunnion and down on valve bonnet with recess at bottom of operator housing properly aligned to fit over packing gland.
 - For a Four-Way operator position the handwheel over "in" port of valve.
 - For a Seat & Reseat operator position the handwheel parallel to the valve flanges.
2. Install hex nuts (75B) hand tight.
3. Turn the worm shaft until lower stem comes down over plug trunnion and trunnion pin holes line up. It may be necessary to cycle operator completely right or left to line up holes. Drive in trunnion pin (41B) and install retaining rings (78) at each end.
4. Tighten hex nuts (75B) securely and install closures (64B).

1500 4-WAY OPERATOR

1500G 4-WAY AND SEAT & RESEAT



| 1500G is Used on Models | |
|-------------------------|-------|
| 16" | B4711 |
| 16" | B4721 |

| Item No. | 4-WAY Part No. | S & RG Part No. | Description |
|----------|----------------|-----------------|--------------------------|
| 21A | 21-571 | 21-571 | Upper Housing |
| 21B | 21-573 | 21-573 | Gear Housing |
| 21C | 21-593 | 21-593 | Lower Housing |
| 22A | 22-540 | 22-557 | Stem Sub Assembly |
| 22B | 22-509 | 22-509 | Upper Stem |
| 23 | 23-477 | 23-411 | Worm Gear |
| 24 | 24-430 | 24-425 | Worm Shaft |
| 26A | 26-426 | 26-426 | Bearing Retainer |
| 26B | 26-488 | 26-488 | Bearing Cap |
| 26C | 26-515 | 26-515 | Gear Housing Cover |
| 26D | 26-489 | 26-489 | Bearing Cap |
| 27A | 27-450 | 27-450 | Indicator Shaft |
| 27B | 27-575 | 27-406 | Indicator |
| 28 | 28-432 | 28-432 | Handwheel |
| 32A | 32-410 | 32-410 | Coupling Bolt |
| 32B | 32-478 | 32-409 | Operator Coupling |
| 32C | 32-479 | 32-452 | Coupling Spacer |
| 41 | 41-474 | 41-474 | Guide Pin |
| 44 | 44-401 | 44-401 | Washer |
| 45A | 45-402 | 45-402 | Key |
| 45B | 45-414 | 45-414 | Key |
| 46 | 46-449 | 46-449 | Insert |
| 48 | 48-408 | 48-408 | Roller |
| 49 | 49-649 | 49-649 | Shim |
| 62A | 62-20-V | 62-20-V | O-Ring |
| 62B | 62-86-V | 62-89-V | O-Ring |
| 64 | 64-412 | 64-412 | Protector |
| 65 | 65-40 | 65-401 | Grease Seal |
| 66A | 66-424 | 66-424 | Ball Bearing |
| 66B | 66-425 | 66-425 | Spherical Roller Bearing |
| 66C | 66-454 | 66-454 | Taper Bearing Cone |
| 66D | 66-463 | 66-463 | Taper Bearing Cup |
| 69 | 69-414 | 69-414 | Spinner Handle |
| 71 | 71-109 | 71-109 | Stud |
| 72A | 72-5 | 72-5 | Capscrew |
| 72B | 72-26 | 72-26 | Capscrew |
| 72C | 72-21 | 72-21 | Capscrew |
| 72D | 72-64 | 72-64 | Capscrew |
| 72E | 72-8 | 72-8 | Capscrew |
| 73A | 73-87 | 73-87 | Capscrew |
| 73B | 73-124 | 73-124 | Capscrew |
| 74A | 74-6 | 74-6 | Set Screw |
| 74B | 74-10 | 74-10 | Set Screw |
| 75A | 75-408 | 75-408 | Hex Nut |
| 75B | 75-414 | 75-414 | Jam Nut |
| 75C | 75-441 | 75-441 | Round Nut |
| 75D | 75-442 | 75-442 | Stop Nut |
| 76A | 76-412 | 76-412 | Lube Fitting |
| 76B | 76-470 | 76-470 | Plug |
| 77 | 77-478 | 77-478 | Dowel Pin |
| 93A | 93-424 | 93-424 | Shield |
| 93B | 93-497 | 93-497 | Shield |

1500 4-WAY OPERATOR

REMOVING OPERATOR FROM THE VALVE

1. Seat the plug and remove the two plastic closures (64).
2. Remove coupling halves (32B) by removing nuts (75E) and coupling bolts (32A).
3. Remove capscrews (73A) attaching operator to valve bonnet.
4. Lift operator off valve by pulling up vertically until it clears the plug trunnion.

OPERATOR DISASSEMBLY

1. Remove set screw (74A) and indicator (27B).
2. Remove the stem protector (64).
3. Unbolt and remove the gear housing cover (26C).
4. Remove the upper stem nut (75D).
5. Remove upper bearing (66A).
6. Remove the capscrew (72E), washer (44), handwheel (28), and key (45A).
7. Unbolt and remove the bearing cap (26D).
8. Screw out the worm shaft (24). Front bearing cone (66C) and cup (66D) and rear bearing cone (66C) will come out with the worm shaft.
9. Remove the worm gear (23) and key (45B).
10. Unbolt and remove the gear housing (21B).
11. Unbolt and remove the guide pin (41).
12. Pull the upper stem (22A) with middle stem, lower stem, roller (48), lower bearing and indicator shaft (27A) out through the top of the housing (21A). If the bearings are tight in the housing, place the worm gear with its key on the upper stem upside down (hub up). Turn the gear to raise the lower stem as far as possible. Insert a 1/2" diameter bar through the two holes in the bottom of the housing (21C). Using a pipe wrench on the gear hub, turn the gear to lower the lower stem and jack the bearings clear of the housing (21A).
13. Remove the set screw (74A) and push the indicator shaft out through the bottom of the lower stem.
14. Separate the three stems.
15. Remove the bearings (66B) from the upper stem.

OPERATOR ASSEMBLY

Stem Assembly

1. Thread indicator shaft (27A) and jam nut (75C) in lower stem. Tighten nut.
2. Apply a liberal coat of grease to all surfaces of the middle and lower stem. Thread the middle stem into the lower stem such that when the stop shoulders on each stem come together, the roller opening in the lower stem is exactly in line with the detent recess in the middle stem. This may require several attempts as the threads are multiple start and do not always assemble correctly with the first try.
3. Apply a coat of grease to the upper stem (22B) and thread it into the middle stem such that the detent pin in the upper stem is against the shoulder at the top of the middle stem, and the detent recess in the upper stem is exactly in line with the roller opening in the middle stem. This operation may also require several attempts due to the multiple start threads.
4. Place the bearing (66B) on the upper stem. Install bearing retainer (26A) and second bearing (66B).

CAUTION: THESE ARE RADIAL THRUST BEARINGS AND MUST BE INSTALLED SUCH THAT THE WIDEST SURFACES OF THE INNER RACEWAYS ARE BACK TO BACK. INCORRECT INSTALLATION WILL RESULT IN SERIOUS DAMAGE.

Operator Body Assembly

5. Install O-ring (62B) in housing (21C).
6. Place the upper roller (48) and lower roller (48) in their respective openings in the lower and middle stems. A liberal application of grease will hold them in position.

7. Place the stem assembly into the top of the housing such that the upper roller is in the vertical groove in the housing. Push the entire assembly down until the bearings rest on the shoulder in the housing.
8. Apply a coating of Form-A-Gasket to the surface of the guide pin boss of the housing. Insert the guide pin (41) to fully engage the U-shaped groove in the lower stem and secure with capscrews (72A).
9. Place the gear key (45B) in the keyway of the upper stem.

Bearing Assembly

10. Install tapered roller bearing cup (66D) in the rear bearing recess of the gear housing (21B) with large diameter of taper facing out. Install bearing cone (66C) into bearing cup.
11. Install tapered roller bearing cup (66D) and cone (66C) on handwheel end of worm shaft (24). Place bearing cone (66C) on the opposite end with large diameter of taper against shaft shoulder.
12. Install worm shaft with bearings in gear housing. Make certain the rear bearing cone has properly entered rear bearing cup.
13. Install O-ring (62B) in bearing cap (26B).
14. Apply a coating of Form-A-Gasket to the bearing cap boss on the gear housing (21B). Fasten bearing cap (26B) in place with capscrews (72D). Be sure to install the plastic shims (49) between gear housing and bearing cap. Select shims so no more than 5-10 lb-ft force is required to rotate worm shaft with no apparent end play.

Gear Assembly

15. Install worm gear (23) in gear housing with hub down (toward smaller opening).
16. Apply Form-A-Gasket to top flange of operator housing (21A).
17. Apply Form-A-Gasket to top flange of operator housing (21C). Place gear housing (21A) with assembled parts on top of operator housing guiding worm gear keyway over key (45B) in upper stem. Position the gear housing so that the handwheel end of the worm shaft is on the same side of the operator as the guide pin.
18. Fasten the gear housing to the operator housing with capscrews (73B).
19. Fill gear housing with grease up to the top of the worm gear.
20. Install bearing (66A).
21. Install nut (75D) and tighten snug with a wrench. Install insert (46) and lock in set screw (74B).
22. Apply a smooth even coat of Form-A-Gasket over top surface of the gear housing.
23. Install the grease seal (65) in the gear housing cover (26C). Slide the cover over the indicator shaft and secure to top of gear housing with capscrews (72B).

Indicator and Handwheel Assembly

24. Install the stem protector (64).
25. Install the indicator flag (27B) and secure with set screw (74A).
26. Install handwheel (28) with key (45A), washer (44), and capscrew (72E).

INSTALLATION OF OPERATOR TO VALVE

1. Lift operator over plug trunnion and down on valve bonnet with recess at bottom of operator housing properly aligned to fit over packing gland.
 - For a Four-Way operator position the handwheel over "in" port of valve.
 - For a Seat & Reseat operator position the handwheel parallel to the valve flanges.
2. Install capscrews (73A) hand tight.
3. With stems in position as referred to in **Note 7 of OPERATOR ASSEMBLY**, plug coupling hole should be in line with pipeline and valve in the closed position. Turn worm shaft clockwise, lowering stem. Place spacer (32C) between plug trunnion and lower stem. Coupling holes in plug and lower stem should be in line. Install coupling halves (32B) and insert coupling bolts (32A) and nuts (75E).
4. Tighten capscrews (73A) securely and install closures (64B).

Contact your Cameron's Valves & Measurement group representative for a Repair Manual

GENERAL VALVE®



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