

Valtek Auxiliary Handwheels and Limit Stops

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GENERAL INFORMATION

The following instructions are designed to assist in installing, operating, performing maintenance and disassembling handwheels and limit stops mounted on Valtek spring cylinder actuators. Product users and maintenance personnel should thoroughly review this bulletin in conjunction with the Valtek Installation, Operation, Maintenance Instructions for Cylinder Actuators (IOM 2), prior to working on the handwheels and limit stops.

To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly adhered to. Modifying this product, substituting non-factory parts, or using maintenance procedures other than outlined could drastically affect performance, be hazardous to personnel and equipment, and may void existing warranties.

WARNING: Standard industry safety practices must be adhered to when working on this, or any other, process control product. Specifically, personal protective and lifting devices must be used as warranted.

Valtek control valves are often equipped with auxiliary handwheels of the continuously connected or push-only type, allowing for manual operation of the valve in case of air failure. Continuously connected handwheels can also be used as a limit stop to limit valve travel in either the open or closed position. Push-only handwheels are designed to close the valve or limit opening. Limit stops limit the actuator stroke in one direction or the other.

INSTALLATION

Valtek control valves, equipped with auxiliary handwheels and limit stops, are installed as outlined in the maintenance bulletin for each type of valve. Refer to the sales catalog or certified dimensional drawing for estimated overhead clearance requirements. To allow for manual operation and maintenance, adequate access to the handwheel or limit stop must be provided.

SIDE-MOUNTED, CONTINUOUSLY CONNECTED HANDWHEELS, SIZE 25 AND 50 (Linear Actuators)

Operation

If air failure should occur, or if manual control of the valve is desired, the side-mounted, continuously connected handwheel can be operated as follows:

1. Set the three-way bypass valve (located on the supply line to the positioner) to 'manual' to vent the air pressure from the actuator.

NOTE: Three-way valves are installed in the supply line only when there is no lock-up system or volume tank. On volume tank or lock-in-place systems, the

bypass valve is located between the top and bottom cylinder ports.

2. To open the valve, turn the handwheel counter-clockwise to retract the plug.
3. To close the valve, turn the handwheel clockwise to extend the plug.
4. To return the valve to automatic control, return the handwheel nut to 'neutral' as shown by the handwheel position indicator and set the three-way bypass valve to 'auto.'
5. Adjusting the handwheel nut to a position other than neutral provides a limit stop function, either limiting opening or closing.

Maintenance

For proper operation of the handwheel, maintain a coat of multi-purpose lubricant on the bearings at all times. To do this:

1. Locate the two zerk fittings on the handwheel housing. One fitting lubricates both bearings simultaneously.
NOTE: The screw and nut threads are permanently lubricated with a solid film lubricant, requiring no additional lubrication.
2. Check all pivot points for wear and replace worn or damaged parts as necessary. Lubricate all pivot points.
3. Keep screw, nut and bearings free from dirt at all times. If dirt or grease builds up so that handwheel operation is impaired, disassemble handwheel and clean thoroughly.

Disassembly

To disassemble the side-mounted handwheel assembly on size 25 and 50 linear actuators, refer to Figure 1.

NOTE: Because of the handwheel's modular design, the handwheel assembly can be removed from the actuator without affecting the valve's operation (unless the handwheel is being used as a limit stop).

CAUTION: Prior to removing the handwheel unit, ensure that the handwheel is not functioning as a limit stop before removing the housing bolts. Failure to do so could cause serious personal injury. If the actuator remains in service during handwheel disassembly, keep hands and clothes away from moving parts to avoid injury.

1. Remove four housing bolts and lift handwheel assembly off the yoke.
2. Loosen the crank levers by removing two sets of spacers, bolts and nuts fastening the levers together. Remove one retaining ring from the pivot pin and push the pin out.
3. Remove the lock nut, handwheel and Woodruff key from the handwheel screw shaft.

4. Remove the internal retaining ring with a pair of internal snap-ring pliers.
5. Remove the handwheel screw shaft from the handwheel nut by turning shaft clockwise (the screw has left-hand threads). After the shaft is free from the nut, pull the shaft and bearings straight out and remove nut and crank levers from the housing.
6. After removing the support spacer, slide the two bearings and support washer (sandwiched between the bearings) off the handwheel screw shaft.

Reassembly

To reassemble the side-mounted handwheel on size 25 and 50 linear actuators:

1. Inspect all parts, especially the bearings, for damage or wear; clean all parts and lubricate each bearing.
2. Replace the bearings on the shaft in the following order: bearing, support washer, bearing, support spacer.

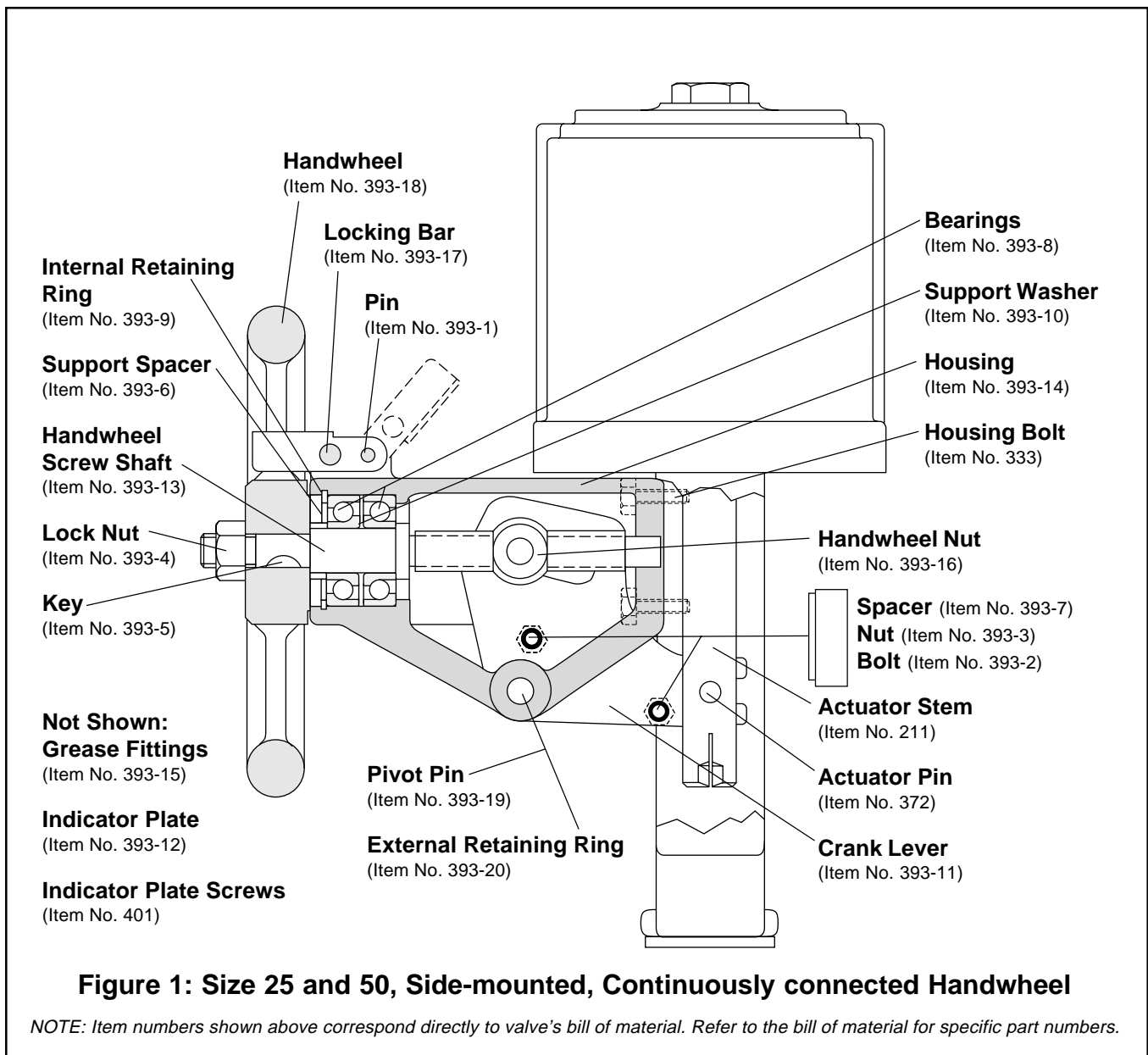
NOTE: The bearings must be oriented with the largest inside races (thrust supporting) facing each other, with a support washer between them (refer to Figure 1).

CAUTION: If the bearing orientation is incorrect, the bearings will be damaged.

3. Position the handwheel nut between the two lever cranks and reinstall the handwheel nut into the housing. Make sure the position indicator pin on the nut is inserted in the position indicator slot.
4. Lubricate the small tip on the handwheel shaft and mating hole in the housing. Reinsert the handwheel shaft into the housing and begin turning the screw counter-clockwise into the handwheel nut. Continue to turn until the bearings are seated in the housing and the nut is in the neutral position.
5. Install the internal retaining ring to hold the bearings in the housing.
6. Replace the handwheel on the shaft, making sure the Woodruff key is properly inserted in key slot.
7. Fasten the handwheel securely in position with the lock nut.

NOTE: If there is excessive movement ($\frac{1}{8}$ -inch or more) when pulling on the handwheel screw, the bearings are positioned backwards and must be reversed (refer to Step 2) before bearing damage occurs.

8. Lubricate and reinsert pivot pin and fasten with retaining ring. Bolt the two sides of the crank levers together, using two sets of spacers, bolts and nuts.
9. Reattach the handwheel assembly to the yoke using four housing bolts. Make sure the slotted ends of the lever cranks mate with the actuator stem pin.



CAUTION: Avoid reattaching the handwheel assembly to the yoke while the actuator remains in service. If the actuator remains in service during handwheel reassembly, ensure that the handwheel is in the neutral position and that hands and clothes are kept away from moving parts to avoid injury.

SIDE-MOUNTED, CONTINUOUSLY CONNECTED HANDWHEELS, SIZE 100 AND 200 (Linear Actuators only)

Operation

See 'Operation' under Size 25 and 50 Side-mounted Handwheels section.

Maintenance

Because the screw threads are permanently lubricated with a solid film lubricant, periodical lubrication is not

necessary; however, periodically examine the handwheel assembly:

1. Check bearing wear by pulling on the handwheel. If movement more than 1/8-inch in any one direction is present disassemble and inspect bearings.
2. Keep the handwheel mechanism free from dirt. If dirt begins to impair handwheel operation, disassemble and clean thoroughly.

Disassembly

To disassemble the side-mounted handwheel on size 100 and 200 linear actuators, refer to Figure 2:

1. Depressurize the process line and actuator to atmospheric pressure. Remove the actuator from valve (see valve's maintenance bulletin for instructions). Disassemble cylinder by following steps 1-6 under 'Disassembling Actuator' instructions found in IOM 2 (Cylinder Actuators).

WARNING: Failure to repressurize process line and actuator to atmospheric pressure could result in serious personal injury.

2. Slide the stem clamp and bellows off the actuator stem.
3. Remove the bolt holding the handwheel to the pinion shaft. Slide handwheel off pinion shaft.
4. Remove the housing set screw at the base of the handwheel housing and the retaining ring lock screw which releases the compression on the handwheel housing retaining ring.
5. Using two screwdrivers, remove the handwheel housing retaining ring.
6. Pull the handwheel assembly off the yoke, taking care not to gall the actuator stem O-ring as it is pulled from yoke.
7. With the cylinder and piston removed (Step 1), pull actuator stem straight out of the housing.
8. Remove the bearing spacer, lower bearing and handwheel nut from the actuator stem.
9. To remove the pinion gear and shaft, remove the pin retaining ring, rotate the pinion shaft so the pin will not hit the indicator gear bearing, and push the pin out. Slide the pinion shaft out of the pinion gear and housing.
10. Remove the bevel gear, wave spring and the upper thrust bearing.
11. If the pinion shaft bearings are worn or damaged, push them out with a suitable press and a dowel the same size as the bearing's outside diameter.
12. Remove the upper actuator stem O-ring. (It is not necessary to remove the O-ring retaining ring and O-ring retaining washer).
13. The indicator cover plate is attached to the housing with an adhesive gasket. Gently pry it off.
14. With a screwdriver, remove the two carriage screws holding the position indicator assembly to the housing. Remove assembly from housing.
15. Normally the position indicator assembly does not require disassembly. If disassembly is required, remove the inside stem retaining ring located on the lower end on the indicator stem. Screw the stem out of the indicator nut.
2. Insert upper actuator stem O-ring and replace O-ring retaining washer and retaining ring.
3. If the pinion shaft bearings have been removed, press in two new bearings with a dowel of the same diameter, using a suitable press.
4. To install the bevel gear and bearings, place the handwheel housing upside down. Lubricate the upper ball thrust bearing and place it in the housing, squarely on the machined shoulder.
5. Lubricate the bevel gear thoroughly on the teeth and the outer surface where it makes contact with the housing. Lubricate the inside of the square drive tube. Position the bevel gear assembly into the housing.
6. Lubricate the pinion gear, shaft and thrust bearings. Reposition the pinion gear and thrust bearings. Slide the pinion shaft through the outside of the housing until it mates with the pinion gear. Rotate the shaft until the hole in the pinion gear aligns with the shaft. Insert pin and replace pin retaining ring.
7. Screw the handwheel nut midway onto the actuator stem and insert the stem through the center of the bevel gear. Be careful not to score the polished surfaces of the actuator stem.
8. Position the wave spring on the shoulder of the bevel gear. Lubricate the lower ball thrust bearing and place it on the wave spring. Make sure the bearing fits into the step in the bevel gear with the wave spring sandwiched in between. Replace the bearing spacer with the bearing fitting inside the spacer's lip.
9. After replacing the lower actuator stem O-ring in the yoke, insert the yoke into the housing, taking care not to gall the actuator stem on the stem bushings or damage the O-ring.
10. Using two screwdrivers, replace the housing retaining ring.
11. Rotate the housing to the desired orientation and screw-in the retaining ring lockscrew and reinstall the housing setscrew until the retaining ring and housing are locked securely in place.
12. Reinstall the handwheel and handwheel bolt onto the pinion shaft. Fasten securely with nut.
13. Reassemble the position indicator assembly by inserting the indicator stem onto the carriage. Screw the indicator nut into the stem. Replace the stem retaining ring. Turn the stem until the indicator nut is centered between the two neutral marks stamped on the carriage.
14. Turn the handwheel counter-clockwise until the actuator stem begins to retract. Turn the handwheel clockwise for two complete turns, so that the handwheel nut is in the neutral position.

Reassembly

To reassemble the side-mounted handwheel on Size 100 and 200 linear actuators:

1. Replace and lubricate all O-rings with a silicone lubricant (Dow Corning® 55M or equivalent). Clean all internal parts thoroughly before beginning assembly.

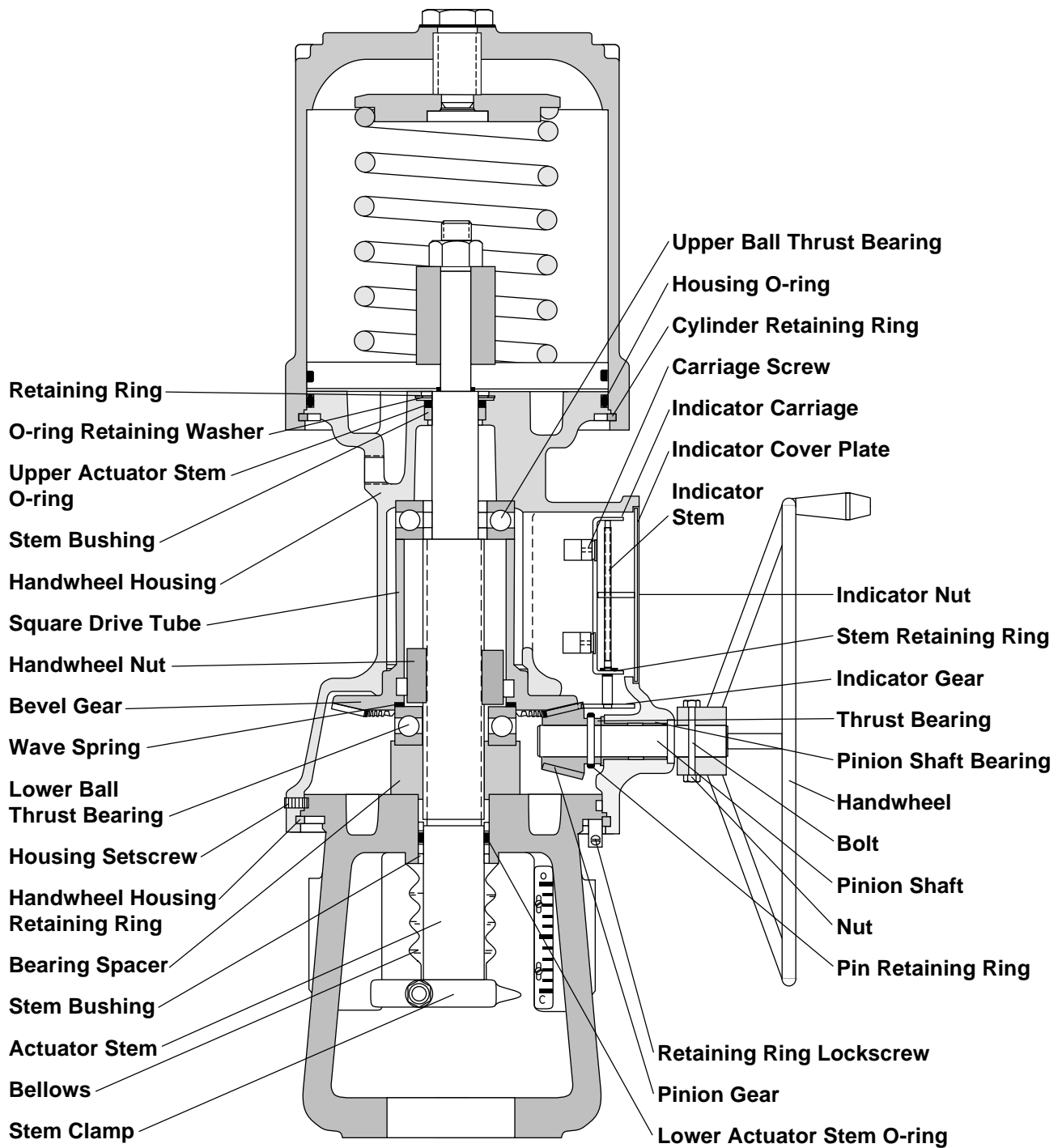


Figure 2: Size 100 and 200, Side-mounted, Continuously connected Handwheel

NOTE: Refer to factory for valve's bill of material item numbers.

NOTE: For correct neutral indication, it is important to have the handwheel assembly in the neutral position and the indicator nut between the neutral marks before installing the indicator assembly in the housing.

15. With two carriage screws, reinstall the position indicator assembly, making sure the indicator gear properly meshes with the pinion gear. Turn the handwheel to the full open or closed position and check for correct orientation; readjust if necessary. With the new adhesive gasket, reattach indicator cover plate.
16. Replace the housing O-ring.
17. Reattach the bellows and stem clamp to the yoke and actuator stem.
18. Reassemble the cylinder according to instructions found in IOM 2.

TOP-MOUNTED, CONTINUOUSLY CONNECTED HANDWHEELS Size 100 and 200 (Linear Actuators)

Operation

If air failure occurs, or if manual control of the valve is desired, the top-mounted, continuously connected handwheel can be operated as follows:

1. Set the three-way bypass valve (located on the supply line to the positioner) to 'manual' to vent the air pressure from the actuator.

NOTE: three-way valves are installed in the supply line only when there is no lock-up system or volume tank. On volume tank or lock-in-place systems, the bypass valve is located between the top and bottom cylinder ports.

2. To open the valve, turn the handwheel counter-clockwise to retract the plug.
3. To close the valve, turn the handwheel clockwise to extend the plug.
4. To return the valve to automatic control, return the handwheel nut to 'neutral' as shown by the handwheel position indicator and set the three-way bypass valve to 'auto.' The neutral position is indicated when the top of the screw aligns with the red line on the cap liner.
5. Adjusting the handwheel nut to a position other than neutral provides a limit stop function, either limiting opening or closing.

Maintenance

Since the top-mounted, continuously connected handwheel is totally enclosed, there is generally no need for periodic maintenance; however, disassembly may be necessary if the mechanism fails. When reassembling the handwheel, be sure to thoroughly clean and lubricate the handwheel screw and drive nut with a multi-purpose lubricant.

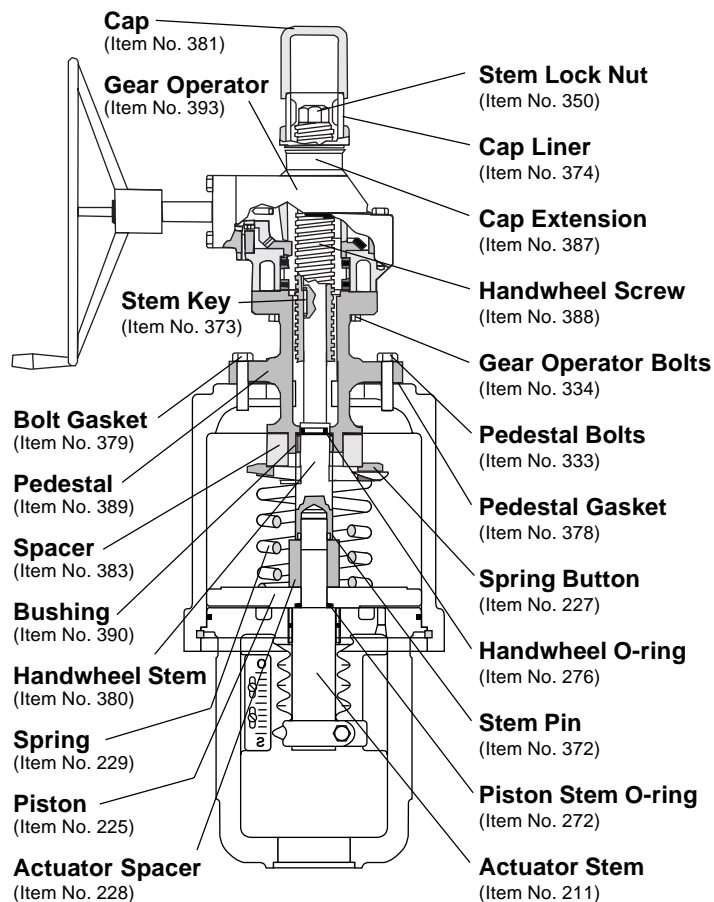


Figure 3: Top-mounted, Continuously connected Handwheel

NOTE: Item numbers shown above correspond directly to the valve's bill of material. Refer to the bill of material for specific part numbers.

Disassembly

Refer to Figure 3:

WARNING: Repressurize line and actuator to atmospheric pressure before disassembling the handwheel or removing the actuator from the valve. Also, make sure the handwheel screw is in the neutral position before disassembly. Failure to do so can cause serious personal injury to occur.

NOTE: These instructions are for air-to-open only. Instructions for the air-to-close design is the same with one exception: Pedestal bolts are not used to compress the spring for air-to-close action; therefore, no spring tension is released.

1. The handwheel may be disassembled while mounted on the valve, or the actuator can be removed and disassembled separately. If a change in the failure action is required, the entire actuator subassembly must be removed before proceeding (See 'Disassembling Actuator' in Maintenance Bulletin 1). The recommended procedure is to remove the actuator subassembly from the valve.

2. Remove the handwheel cap and the handwheel cap extension.
3. Loosen stem clamp and slide it off actuator stem.
4. Use a wrench on the actuator stem flats to secure the position of the stem so it cannot rotate. Remove the stem locknut.

CAUTION: Damage to the seating surfaces of the plug and seat can result if the plug is allowed to rotate during removal of the stem locknut.

5. Unbolt gear operator from pedestal.
NOTE: Bolts are located on the pedestal underneath the gear operator. They are not the bolts located at the top portion of the gear operator itself.
6. Lift off the gear operator, drive nut assembly and handwheel screw.
7. Unbolt pedestal from the cylinder actuator. This will relieve spring tension in the actuator (air-to-open only).

WARNING: Cylinder is spring loaded. Do not attempt to remove the handwheel pedestal bolts without following Step 8 exactly. Failure to do so can cause serious injury.

8. Remove the six pedestal bolts gradually to relieve spring tension. This can be done by loosening the first bolt approximately one-quarter turn, then loosening the bolt directly opposite one-quarter turn until all bolts have been loosened and the spring tension is relieved.

NOTE: The bolts are long enough to relieve all spring tension prior to removing the pedestal.

9. Remove the pedestal.
10. Lift out the spring button and spacer if provided (air-to-open only).
11. Remove cylinder retaining ring.
12. Disassemble cylinder from yoke.
13. Remove spring and spring button.
14. Lift out piston, actuator stem and handwheel stem assembly.

CAUTION: Unless the piston stem O-ring (sealing the two cylinder air chambers) is leaking, do not remove the handwheel stem from the actuator stem. It may be difficult to realign the stem pin hole while reassembling the handwheel stem.

15. Remove piston, yoke, and pedestal O-rings.

Reassembly

Refer to Figure 3:

1. Make sure all internal parts are thoroughly cleaned and lubricated before beginning assembly. Use new O-rings and gaskets. (O-rings should be lubricated with a silicone lubricant such as Dow Corning 55M or equivalent).
2. Reassemble the cylinder actuator using the appropriate actuator maintenance bulletin.

3. Place the gasket on the cylinder. Place the pedestal on top of the cylinder. Pedestal should align with spring button or spring button spacer if used.

NOTE: Check bolting alignment for proper handwheel orientation.

4. Replace aluminum flat washers.
NOTE: To prevent air leaks, lightly coat the washers with a standard pipe sealant.
5. Reassemble pedestal bolts. Begin tightening the bolting in a manner that will keep the pedestal square with the cylinder.

WARNING: Failure to keep the pedestal square with the cylinder may result in damage to the pedestal O-ring and bushing.

6. Tighten the first bolt approximately one-quarter turn, then tighten the bolt directly opposite one-quarter turn. Continue tightening until sufficient gasket compression is applied to seal cylinder and pedestal tightly. This is necessary to prevent air leakage.
7. Before applying air to the cylinder, make sure the cylinder retaining ring is installed properly. Feed air to bottom of cylinder to raise handwheel stem (air-to-open only).
8. Insert round end key into slot in handwheel stem. Remove air. Handwheel stem will retract (air-to-open only).
9. Place gear operator on flat surface with top of the operator facing down. Insert key in gear operator drive nut. Install one set of roller thrust bearings in gear operator.
10. Align the key to the bevel gear key way and install drive nut. Install second set of roller thrust bearings.
11. Lubricate handwheel screw, and then screw (screw is left-hand threaded) into the drive nut until screw bottoms out.
CAUTION: Before completing the next step, be sure not to allow assembled portion of the handwheel to drop out of the gear operator. Failure to do so will cause the drive nut key to drop out of place. Steps 9 and 10 will then have to be repeated.

12. Install pedestal gasket.
13. Take the gear operator and handwheel screw assembly and insert it on handwheel stem while aligning stem key with slot in handwheel screw. Make sure gear operator is flush with pedestal top.
14. Once the gear operator is flush with the pedestal, replace bolts and tighten. Tighten the first bolt one-quarter turn, then tighten the bolt directly opposite one-quarter turn. Continue tightening all bolting until gear operator and pedestal are firmly seated.
15. Install lock nut on handwheel stem, and screw on handwheel cap extension.
16. Insert gaskets and cap liner (sight glass) into handwheel cap.

17. Screw on handwheel cap until no movement can be felt in the cap liner.
18. Tighten handwheel cap assembly.
CAUTION: Excessive tightening is not required. This is not a pressure retaining seal.

Reversing Spring Action

After following the disassembly of the actuator as outlined, the spring action can be reversed as follows:

1. Remove cylinder retaining ring, cylinder and spring.
2. Drive out the stem pin locking the handwheel stem to the actuator stem.
3. Screw the handwheel stem off the actuator stem. Make sure a wrench is used to prevent the actuator stem from rotating.

CAUTION: Damage to the seating surfaces of the plug and seat can result if the plug is allowed to rotate during removal of the handwheel stem.

4. Reinstall the actuator spacer on the opposite side of the piston. Replace the piston stem O-ring during this step.
5. Screw the handwheel stem back into the actuator stem. Realign stem pin hole and reinsert stem pin.
6. Reassemble actuator with spring under the piston for air-to-open (spring-to-retract). The spring should be installed over the piston for air-to-close (spring-to-extend). Make sure the actuator spacer is on the same side of the piston as the spring.
7. Reassemble by following the instructions in the 'Reassembly' section.

NOTE: The spring button and spring button guide are not used in the air-to-open configuration and should be removed and set aside. When changing to the air-to-close configuration, a spring button and spring button guide must be obtained from Flowserve or from existing supply.

TOP-MOUNTED, PUSH-ONLY HANDWHEELS (Rotary Actuators Only)

Operation

The push-only handwheel can be used to close the valve or as a limit stop to limit valve opening:

1. If provided, set the three-way bypass valve on 'manual' to vent air pressure to the actuator.
2. Turn handwheel in a clockwise direction to extend the actuator stem and to lower the valve plug.
3. To return the valve to automatic control, turn the handwheel counter-clockwise until the handwheel runs out of threads and stops (neutral position), and set the three-way valve on 'auto.'
4. To limit the opening of the valve, move the handwheel from neutral to the desired limiting position.

Maintenance

For proper operation of the handwheel, it is important to

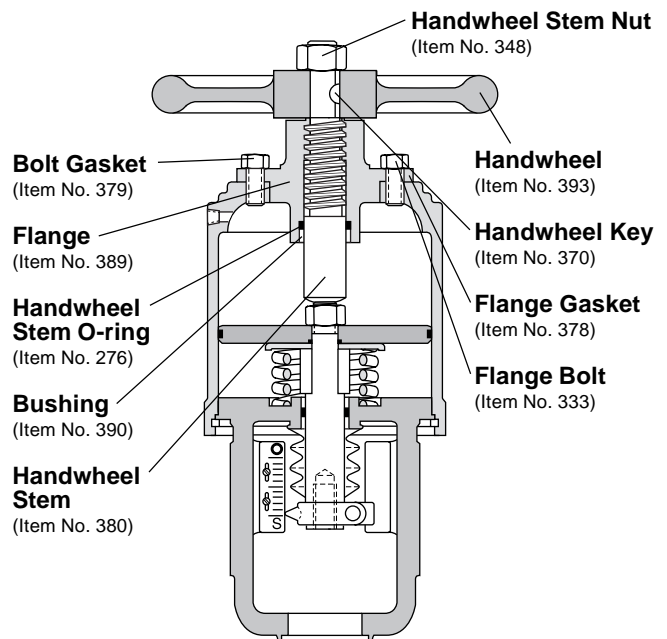


Figure 4: Top-mounted, Push-only Handwheel

NOTE: Item numbers shown above correspond directly to the valve's bill of material. Refer to the bill of material for specific part numbers.

maintain a coat of multi-purpose lubricant on the screw at all times. To do this:

1. Turn the handwheel counter-clockwise until the handwheel runs out of threads and stops, exposing the full length of the screw.
2. Clean and lubricate the exposed threads.

Disassembly

Refer to Figure 4:

1. The handwheel assembly can be disassembled while mounted on the valve, or the actuator can be removed and disassembled separately (see the valve's maintenance bulletins for instructions).

WARNING: Repressurize line and actuator to atmospheric pressure before removing the actuator from the valve, or serious personal injury could result.

2. Rotate the handwheel counter-clockwise until the handwheel runs out of threads and stops (neutral position). This releases some of the spring compression.

WARNING: Cylinder is spring loaded. Do not attempt to remove flange bolts without following Steps 3 and 4 exactly or serious injury can occur.

3. Remove four of the six handwheel flange bolts, leaving two opposing bolts.
4. Remove two remaining handwheel flange bolts

slowly and simultaneously, relieving the remaining spring compression. The bolts are long enough to relieve all spring compression prior to removing the flange (as long as the handwheel is in the full counter-clockwise position).

WARNING: Make sure handwheel is in full counter-clockwise position. Otherwise, serious injury may result when removing the flange bolts.

5. Lift the handwheel/flange assembly from the actuator. Remove the flange gasket.
6. The actuator may now be disassembled according to the valve's or actuator's maintenance bulletin.
7. If it is necessary to replace the handwheel stem O-ring, remove handwheel nut and handwheel.
8. Screw the handwheel stem off flange and replace O-ring. There is no need to replace the bushing.

Reassembly

Refer to Figure 4:

1. Make sure all internal parts are thoroughly cleaned and lubricated before beginning reassembly. Use new O-rings and gaskets (O-rings should be lubricated with a silicone lubricant, such as Dow Corning 55 M).
2. Insert new handwheel stem O-ring. Reassemble handwheel assembly (if disassembled) by screwing the handwheel stem into the flange. Replace the handwheel, handwheel key and lock nut.
3. Reassemble the actuator using the valve's or actuator's maintenance bulletin.
4. Install a new flange gasket.
5. Position the handwheel/flange assembly on the actuator.
6. Using new bolt gaskets, install two opposing flange bolts and tighten evenly to compress spring.
7. Remount and tighten four remaining flange bolts.

DECLUTCHABLE HANDWHEELS (Rotary Actuators Only)

Operation

The declutchable handwheel used on rotary actuators can be operated as follows:

1. Set the three-way bypass valve to 'manual' to vent the air pressure from the actuator.
2. Engage the handwheel mechanism by rotating the clutch handle 90° and allowing it to be fully seated in the clutch indicator's deep slot.
3. Rotate the handwheel until the spring loaded clutch key engages the handwheel gear. At this point the handwheel mechanism is fully engaged.

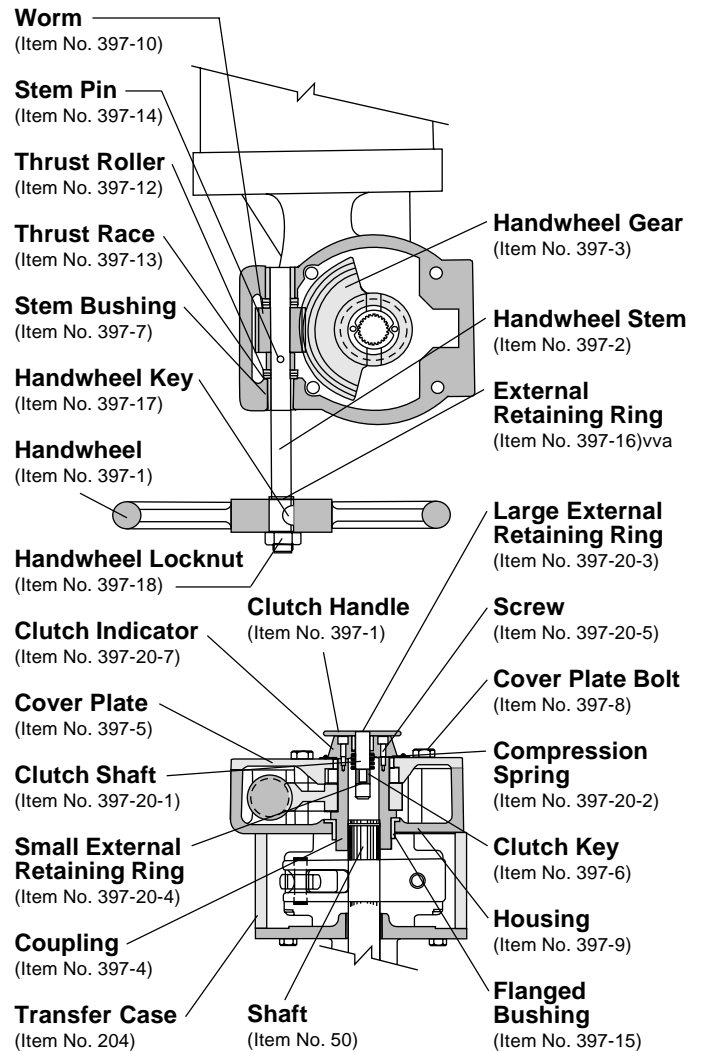


Figure 5: Declutchable Handwheel

NOTE: Item numbers shown above correspond directly to the valve's bill of material. Refer to the bill of material for specific part numbers.

4. To open, turn the handwheel counter-clockwise.
5. To close, turn the handwheel clockwise.
6. To declutch the handwheel, rotate the handwheel until there is little or no load on it. Pull the clutch handle out and index it 90° until it seats in the clutch indicator's shallow slot.

NOTE: *It will be difficult to pull out the clutch handle if the handwheel mechanism is transmitting torque.*

Maintenance

Because the handwheel gearbox is packed with grease, periodic maintenance is not required; however, periodically examine the handwheel:

1. Check for bearing and gear wear by pulling on the handwheel. If it gives more than 1/8-inch in any one direction, disassemble and inspect the bearings and gears.

2. Keep the handwheel mechanism free from dirt. If dirt begins to impair handwheel operation, disassemble and clean thoroughly.

Disassembly

To disassemble the declutchable handwheel on rotary actuators, refer to Figure 5:

1. It is not necessary to remove the valve from line to disassemble handwheel, although it is important to repressurize the line to atmospheric pressure.

WARNING: Failure to repressurize the line and actuator to atmospheric pressure could result in serious personal injury.

2. Remove the four cover-plate bolts and slide the handwheel assembly off the transfer case and shaft.
3. Remove the two sockethead screws holding the clutch indicator to the coupling and remove the cover plate from the assembly.
4. If disassembly of clutch assembly is necessary, remove large external retaining ring (use snap-ring pliers) located on the clutch shaft by the clutch handle. Slide the clutch handle and clutch indicator off the shaft. Remove clutch shaft from the cover plate and slide compression spring off of the shaft. Remove the small external retaining ring and the clutch key from the shaft.
5. If it is necessary to remove the handwheel from the handwheel stem, remove the handwheel lock nut and slide the handwheel and handwheel key off the handwheel stem.

NOTE: All stems use either an external retaining ring or a shoulder on the stem to hold the handwheel in place. The retaining ring does not require removal except for replacement.

6. Drive the stem pin through the stem and worm gear until it nearly touches the housing wall. Rotate the stem 180° and pull out the pin with a pair of vice grips or similar tool.
7. Slide the stem out of the assembly. Simultaneously slide the handwheel gear off the coupling and remove the worm. Remove the two sets of thrust rollers and races. The two stem bearings should be visually inspected for damage or wear. If removal of the stem bushings is necessary, push them out using a dowel of the same diameter and a suitable press.
8. Pull the coupling out of the housing. Inspect the flanged bushing for wear. If necessary, remove with an appropriate press and dowel.

Reassembly

To reassemble the declutchable handwheel on rotary actuators, refer to Figure 5:

1. Clean all parts thoroughly before reassembling the declutchable handwheel.
 2. To reassemble the clutch assembly (if disassembled), slide the clutch key onto the small end of the clutch shaft and secure with the small external retaining ring. Install the compression spring over the shaft. Position the clutch indicator on the outside of the cover plate. Slide the large end of the clutch shaft through the clutch indicator from the inside of the cover. Install the clutch handle and large external retaining ring.
 3. Using a press, install new stem bushings (if removed).
 4. Using a press, install a new flanged bushing (if removed). Lubricate and reinstall the coupling. Note that the coupling rotates inside the flanged bushing.
 5. Thoroughly lubricate the worm and handwheel gear. Holding the worm engaged in the gear (as shown in Figure 5), slide the handwheel gear onto the coupling.
 6. Install a thrust bearing at each end of worm, making sure roller is sandwiched between the two races.
 7. Slide the handwheel stem through the stem bearings and worm gear. Align pin holes in the worm gear and stem, and drive pin into place.
 8. If the handwheel was removed from the stem, insert the handwheel key into its slot in the handwheel stem. Slide the handwheel on and secure it with the handwheel locknut.
 9. Pack the entire inside volume of the handwheel housing with a multi-purpose grease.
 10. Rotate the coupling until its slot aligns with the slot in the handwheel gear. Replace the cover plate, making sure the clutch key slides into the slots. Rotate the clutch handle until it fits into the bottom of the deep slot in the indicator and allows the clutch key to engage the gear and coupling. If the key does not engage, rotate the handwheel back and forth until it does. Rotate the clutch indicator until the two screw holes line up and the pointer points to the stroke indicator scale. Fasten in place with the two screws.
- CAUTION: Since the gear has limited rotation, the splines on the shaft and coupling must be correctly oriented. Incorrect alignment will result in limited handwheel rotation.**
11. To correctly orient the splined shaft and coupling, check to see if the valve is open or closed. If closed, rotate the handwheel clockwise with the clutch engaged until the gear hits the stop. Next, slide the handwheel assembly onto the splined shaft, making sure the line on the end of the shaft lines up exactly with the closest line on the coupling. Reinstall the four cover plate bolts.
 12. If the handwheel does not stroke the valve fully, the splined shaft and coupling are not aligned correctly. Repeat Step 11.

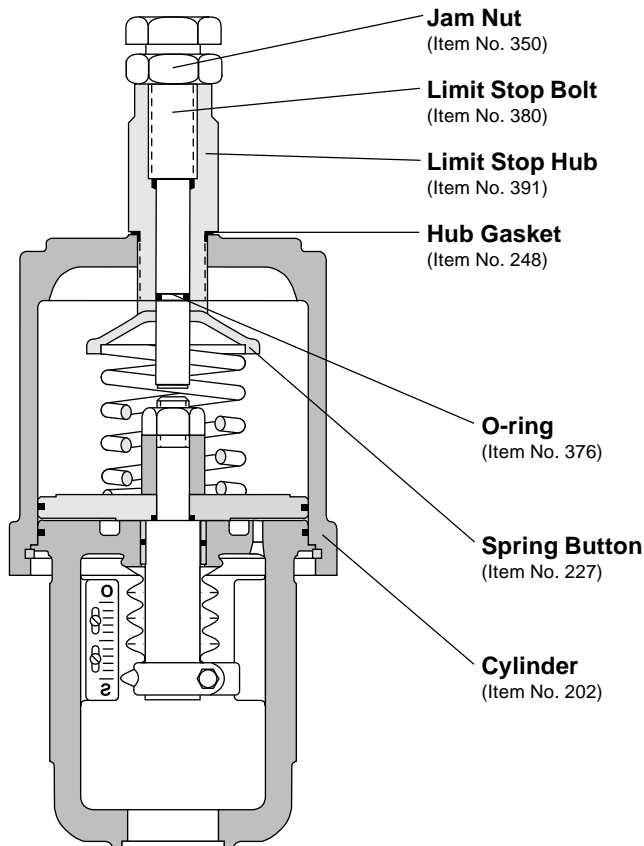


Figure 6: Push-only Limit stop

NOTE: Item numbers shown above correspond directly to the valve's bill of material. Refer to the bill of material for specific part numbers.

PUSH-ONLY LIMIT STOPS (Linear Actuators Only)

Operation

The push-only limit stop is used to limit valve opening. To set the limit stop:

1. Loosen the limit stop jam nut (see Figure 6).
2. To lengthen the stroke, screw the limit stop bolt counter-clockwise from the locking stop hub until the desired position is reached. To shorten the stroke, screw the limit stop bolt clockwise into the locking stop hub until the desired position is reached.
3. Tighten the limit stop jam nut firmly against the locking stop hub.

Maintenance

For proper maintenance of the limit stop, it is important to maintain a coat of multi-purpose lubricant on the limit stop bolt threads at all times. To do this:

1. Vent air pressure on both sides of piston.
2. Loosen the limit stop jam nut.
3. Extend the limit stop bolt until the entire length of the threaded portion is exposed.
4. Clean and lubricate the threads.
5. Return the limit stop bolt to desired position.

6. Tighten the limit stop jam nut firmly against the locking stop hub.

Disassembly

Refer to Figure 6:

WARNING: Repressurize line and actuator to atmospheric pressure before disassembling the hand-wheel or removing the actuator from the valve, or serious personal injury could result.

1. The limit stop may be disassembled while mounted on the valve, or the actuator can be removed and disassembled separately (see the valve's maintenance bulletins for instructions).
2. Vent air pressure on both sides of the piston. Loosen the limit stop jam nut and screw the limit stop bolt counter-clockwise until it can be removed from the limit stop hub. Remove the O-ring and jam nut from the limit stop bolt.
3. Screw the limit stop hub off the cylinder. Larger sizes are designed with an internal flanged hub. If this is the case, remove the flange bolts. Remove the gasket from the limit stop hub.
4. Actuator may now be disassembled according to Maintenance Bulletin 2.

Reassembly

Refer to Figure 6 and proceed as follows:

1. Make sure all internal parts are thoroughly cleaned and lubricated before beginning reassembly. Use only new O-rings and gaskets (O-rings should be lubricated with a silicone lubricant, such as Dow Corning 55 M). Reassemble the actuator according to Maintenance Bulletin 2.
2. Install a new O-ring on the limit stop bolt and a new gasket on the limit stop hub.
3. Screw the limit stop hub into the cylinder or on larger sizes, reinstall hub and flange bolts.
4. Make sure the end of the hub seats properly with the spring button. Tighten the limit stop hub (or flange bolts) only enough to make an adequate air seal with the gasket.
5. After installing the jam nut on the limit stop bolt, screw the limit stop bolt into the limit stop hub until the desired position is reached.
6. Tighten the jam nut against the limit stop hub.

PULL-ONLY LIMIT STOPS (Linear Actuators Only)

Operation

WARNING: The limit stop bolt and jam nuts are moving parts. Keep hands, hair or clothing clear during operation or serious injury can result.

The pull-only limit stop is used to limit valve closing. To set the limit stop:

1. Loosen the limit stop jam nuts (see Figure 7).
2. Apply air under the piston until the limit position is reached.

3. Readjust the jam nuts until they are seated next to the limit stop flange. Tighten jam nuts securely against each other.

Maintenance

For proper maintenance, maintain a coat of multi-purpose lubricant on the limit stop bolt threads at all times. To do this:

1. Apply air under the piston until the actuator is fully retracted, exposing the bolt threads.
2. Remove the limit stop jam nuts.
3. Clean and lubricate the threads.
4. Return limit stop jam nuts to the desired position.
5. Securely tighten the jam nuts against each other.

Disassembly

Refer to figure 7:

WARNING: Repressurize the line and actuator to atmospheric pressure before disassembling the limit stop or removing the actuator from the valve, or serious personal injury could result.

1. The limit stop may be disassembled while mounted on the valve, or the actuator can be removed and disassembled separately (see the valve's maintenance bulletin for instructions).
2. Vent air on both sides of the piston.
3. Loosen and remove the limit stop jam nuts.

WARNING: Cylinder is spring loaded. Do not attempt to remove the flange bolts without following Steps 4 and 5 exactly or serious injury could occur.

4. Remove all but two opposing flange bolts and bolt gaskets.
5. Remove the two remaining bolts slowly and simultaneously, relieving the remaining spring compression. The bolts are of sufficient length to relieve all spring compression prior to releasing the flange.
6. Lift the limit stop flange off the cylinder, taking care not to damage the limit stop bolt threads and bushing. Remove flange gasket from top of cylinder.
7. Remove the limit stop flange O-ring.
8. The actuator may now be disassembled according to Maintenance Bulletin 2.

9. Unless the limit stop bolt is to be replaced, do not remove the pin from the actuator stem, since realigning the pin hole in both pieces is difficult. However, if it is necessary to replace the piston stem O-ring, drive the stem pin out and screw the limit stop bolt off the actuator stem.

Reassembly

Refer to Figure 7:

1. Make sure all internal parts are thoroughly cleaned and lubricated before beginning reassembly. Use

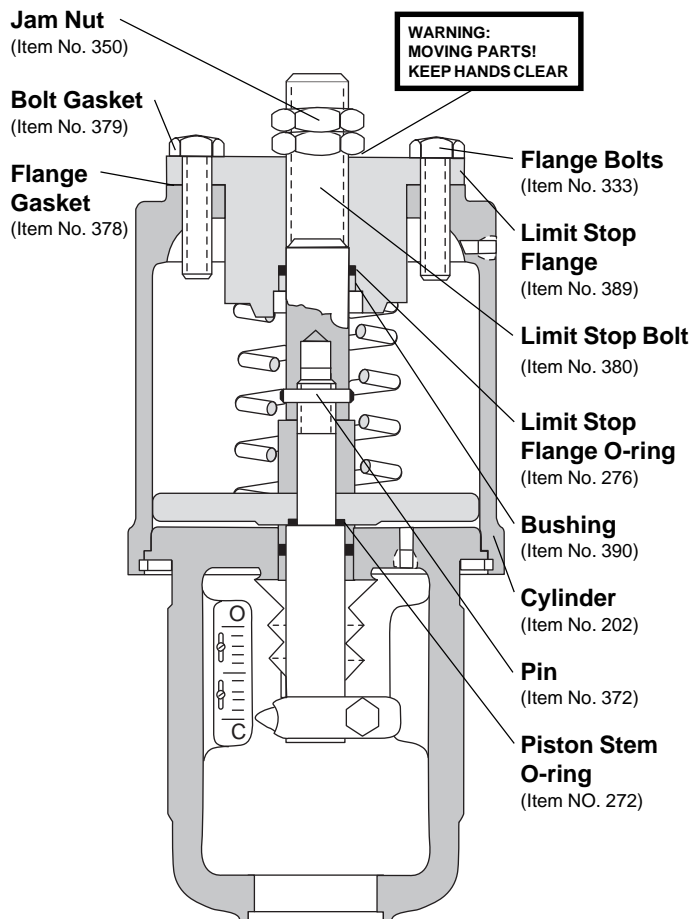


Figure 7: Pull-only Limit Stop

NOTE: Item numbers shown above correspond directly to the valve's bill of material. Refer to the bill of material or specific part numbers.

only new O-rings and gaskets (O-rings should be lubricated with a silicone lubricant such as Dow Corning 55 M).

2. Reassemble the actuator according to Maintenance Bulletin 2. If the limit stop bolt is being replaced, replace the piston stem O-ring and screw the limit stop bolt and the actuator stem together. Realign the pin hole and drive the stem pin firmly in place. Reassemble the cylinder and retaining ring according to Maintenance Bulletin 2.
3. Replace the limit stop flange O-ring. Install the flange and a new flange gasket on the cylinder.
4. Using new bolt gaskets, install two opposing bolts and tighten evenly to compress the spring.
5. Reassemble the four remaining bolts and bolt gaskets. Tighten sufficiently to form a proper seal with the flange gasket and bolt gasket.
6. Apply air under the piston until the desired limit position is reached.
7. Reinstall the limit stop jam nuts until they are seated against the limit stop flange. Tighten both jam nuts firmly against each other.