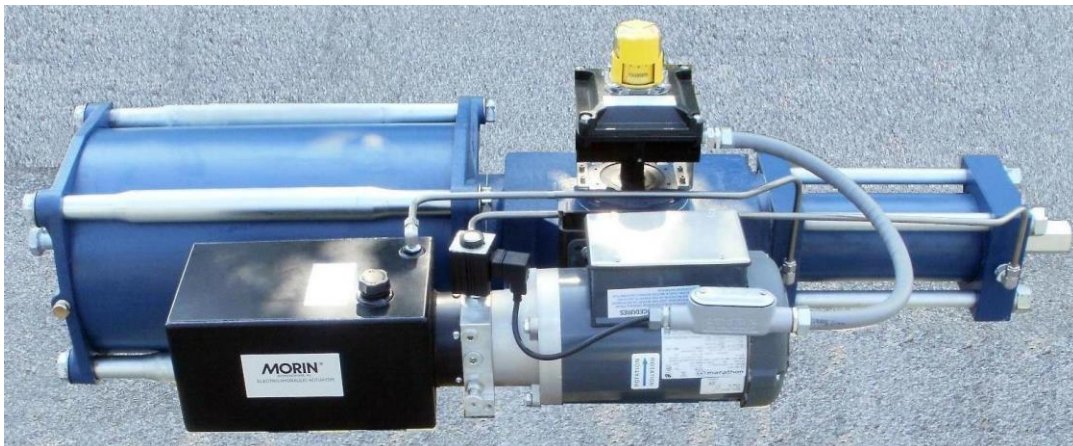




110 COMMERCE DRIVE
VALLEY COMMERCIAL CENTER
PELHAM, AL 35124

PHONE (205) 663-0533
FAX (205) 663-0703

Operation And Maintenance Instructions For Models EHP and EHPX Electro-Hydraulic Actuators



General Application

Morin Electro-Hydraulic Actuators are designed for “on-off” control of any quarter-turn ball, butterfly, rotary plug or damper style valve application.

Technical Data

Supply Voltage: 115 or 230 VAC Single Phase, 15 Amp max or as specified by nameplate.
Duty Cycle: One minute on, and three minutes off.

Temperature rating: Standard Range: -20°F to 130°F
Optional Range: -65°F to 130°F

Service Conditions: All components are suitable for indoor or outdoor installation and are weather resistant. Model EHP is a weather resistant unit (IP54). Model EHPX is weather resistant (IP54) and suitable for explosive atmospheres: NEC Class 1, Division 2, Group D

Angular rotation: 90 degrees \pm 8 degrees

Mounting: Horizontal, beacon up or vertical, motor up.

1. Description

The Morin electro-hydraulic actuator is a self-contained unit consisting of an electric hydraulic power unit with integral oil reservoir, control limit switches, terminal block, open/closed position beacon and a hydraulic actuator. The standard product is offered as spring fail closed (clockwise rotation) and electric motor powered open (counterclockwise rotation). Optional spring return, fail open or double acting are available. (Closing and opening rotation as viewed from the beacon side of the actuator.)

This manual covers primarily the installation and operation of the electro-hydraulic actuator.

Overview of Operation:

The hydraulic power unit (HPU) operates on Single Phase 115 or 230 VAC depending on customer order. Power is applied to the actuator closing the solenoid valve and starting the HPU motor. The fail closed actuator begins to open. The motor shuts off when the actuator reaches the fully open position but the hydraulic control solenoid remains energized with its solenoid valve closed. The actuator closes by spring energy when the electricity is shut off (either by remote control or by a power failure). The rotating beacon shows valve position. (See Figure 1)

If over a long period of time the actuator drifts a few degrees closed, the motor will automatically switch on and reestablish the fully open position. If electric power is lost, spring return actuators automatically move to the fail position. Double acting units fail in last position.

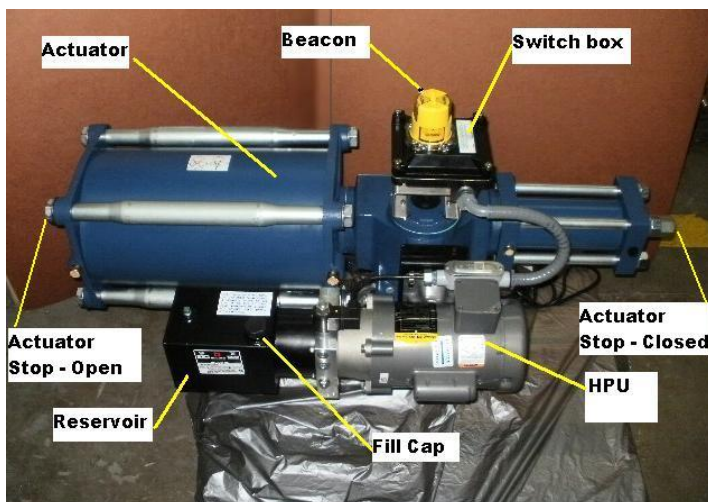


Figure 1

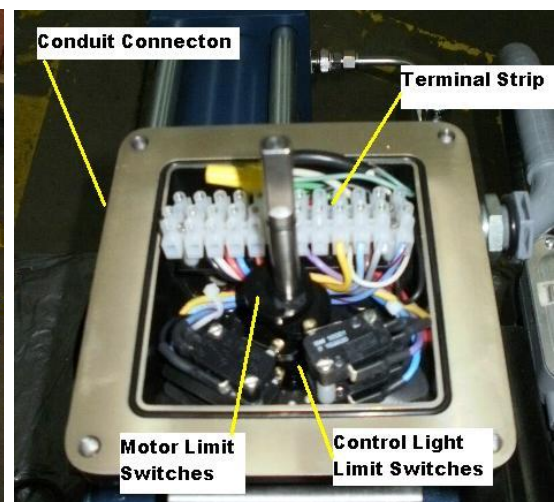


Figure 2

2. Installation

The actuator can be mounted parallel or perpendicular to pipeline provided the fill port of the reservoir is oriented up. The following instructions are for a spring return fail closed actuator. For a fail open actuator the method is similar.

- A. Bolt a mounting bracket to the actuator.
- B. Install a coupling on the valve. The rotary stops on valve must be removed or adjusted to allow actuator stops to do the stopping.
- C. Install the actuator and bracket assembly to the valve and tighten all fasteners.
- D. Remove the switch box cover and conduit plug. Install the hot, neutral, and ground wires from the power conduit at terminals 1 and 3 or 1,3 and 24 on the terminal strip depending on supply voltage. (See figures 2 and 3).
- E. Follow the appropriate NEC and local codes for your electrical wiring. If the explosion-proof NEC class 1 Division 2 actuator is being installed, be sure to install a conduit seal at the conduit inlet of the switch box. See NEC section 501 for proper procedure. A conduit seal is required at the inlet and outlet conduit connections because the switch box is actually rated NEC class 1 division 1 and both conduit seals are required to isolate the internal switch contacts.
- F. Apply power keeping hands clear of wires and the terminal strip. Allow the valve to open fully and verify that the motor shuts off just before the actuator reaches its position stop.
- G. Remove power and verify the actuator closes.

- H. If the actuator did not open or close fully, adjust the actuator stops and repeat step “F”. (See Figure 1).
- I. If the motor does not shut off just before the actuator reaches fully open, turn off the power, wait for the valve to close, and adjust the motor limit switch cam by pressing the cam down slightly and turning it in the appropriate direction. The uppermost cam controls the closed limit switch. Repeat step “F” and verify the motor shuts off. (See figure 2).
- J. Reinstall switch cover.

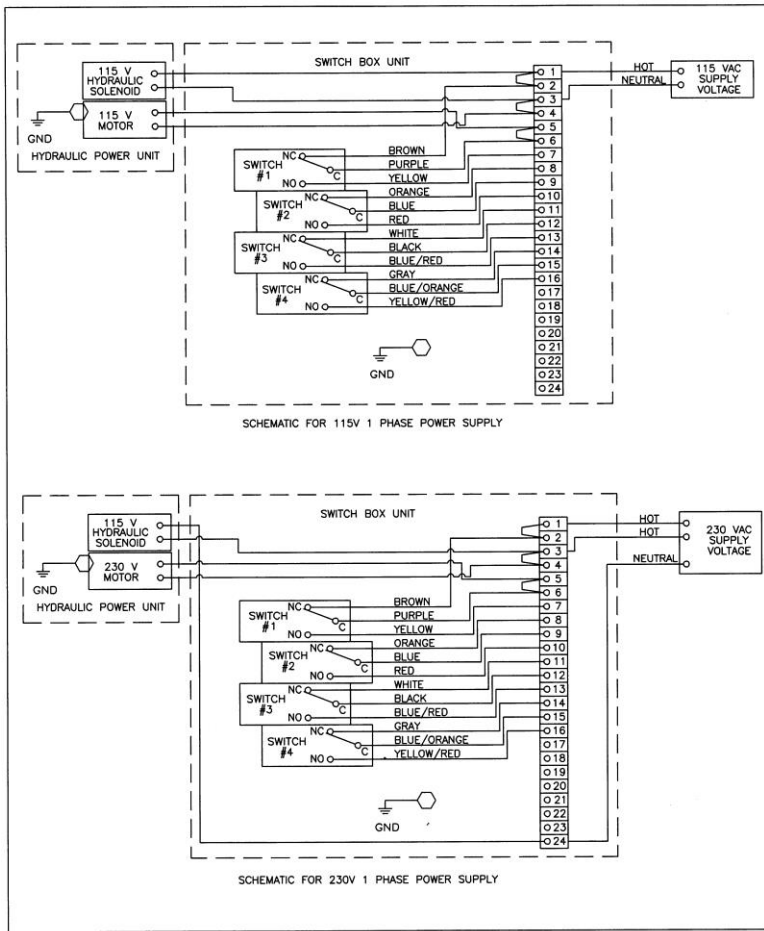


Figure 3

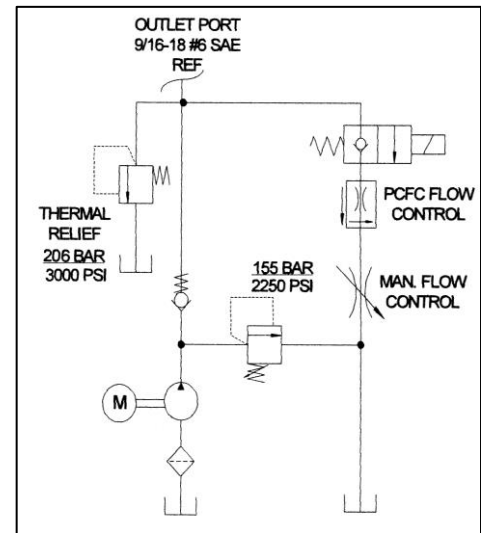


Figure 4

The models EHP15 and EHPX15 actuators use a square male output shaft drive. After the actuator is set up in steps A-H above, the actuator should be centered precisely in its coupling on the valve. Reposition the motor limit switch cam to stop the motor with the actuator in the half open position. Then loosen all the mounting bracket bolts. Grasp the actuator and shift it back and forth to center the actuator, coupling, and valve shafts along a common centerline. Then tighten all the mounting bracket bolts, turn the power off to close the actuator, and then reposition the motor stop cam to shut the motor off slightly before the actuator contacts the open position stop.

Open and Closed position switches:

The switch box has 4 adjustable limit switches (see figure 2). The Two upper switches control the HPU motor. (Only one of the two switches is used for spring return actuators). The two lower switches can be used by the customer to provide actuator position feedback for control panel lights or other instruments. Refer to the schematic in Figure 3 for wiring information.

3. Operation

The actuator has been set up by the factory for correct operation and is ready to install and use. The reservoir is filled half full with hydraulic oil. The HPU has integral speed controls, an overpressure bypass control preset to 2250 psi, and a thermal relief valve to provide for fluid expansion with temperature changes. (See Figure 4) The speed controls are adjustable by the customer. They are set by the factory for maximum opening and closing speed. The opening speed is limited by how quickly the hydraulic pump can transfer fluid into the actuator cylinder, and this is relatively slow. The closing speed is controlled by the actuator spring and this speed is relatively fast. The factory sets the closing speed to 4 seconds and this is the maximum recommended closing speed. The hydraulic reservoir should be filled to half full.

4. Maintenance

The actuator is factory lubricated and does not normally require periodic lubrication while in service. Check the HPU reservoir periodically and maintain the fluid level half full with the actuator in the spring closed position. Use Chevron Hydraulic Oil AW or equal high quality petroleum based hydraulic fluid, ISO 22 viscosity. Do not over fill.

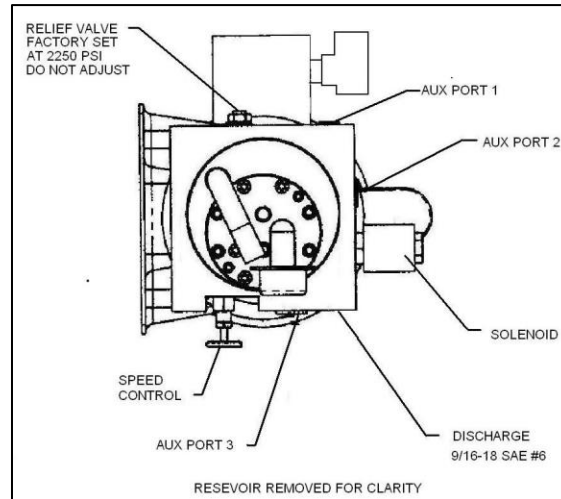


Figure 5

5. Removal of Actuator from Valve

CAUTION:

Do not attempt to remove mounting bolts between actuator and valve until supply voltage has been disconnected. If spring return, be sure that valve is completely in failed position. Caution: If valve is frozen in a position causing the spring to be compressed, removal of bracket bolts would allow spring to stroke, resulting in the actuator rotating over bracket causing possible injury or damage.

- A. Loosen bracket to actuator bolts to hand tight position.
- B. Physically shift actuator back and forth to be sure there is no strain (or shear stress) on the bracket bolts. Once it has been determined that there is no pressure or spring load remaining on the actuator, remove bolts and actuator from valve.
- C. In the event the valve is frozen or locked in place, resulting in spring energy remaining in the actuator, replace EHP adjustment screw (37a) on end of actuator opposite spring end with length of "all thread" rod of sufficient length and turn clockwise until it contacts the piston. **Caution:** Make sure the hydraulic pressure is vented before removing the travel stop. This procedure will safely secure the piston and spring assembly and allow actuator removal. Be sure to carefully remove "all thread" rod prior to actuator disassembly.

6. Operating instructions:

Operate the actuator in accordance with the pressure and temperature limits specified on the nameplate. See the appropriate Morin Catalog for technical information.

7. Troubleshooting:

The electrohydraulic actuator is shipped ready to install and use. If the unit does not operate correctly check the following:

- a. Motor won't start.
 - Check for power at terminals 1 and 3.
 - Check to see if the valve is already open
 - Check top microswitch cam adjustment.
- b. Motor won't stop.
 - Check to see if top microswitch cam is correctly adjusted.
 - Check to see that sufficient fluid is in the reservoir.
 - Check actuator stop bolt adjustment. The motor should power the actuator until the switch shuts it off. It should not hit the stop bolt first.
 - Check to see that all wires are seated correctly in terminal block
- c. Motor starts, actuator will not move.
 - Check to see if the reservoir has enough fluid. Fill reservoir half full.
 - The motor fan should rotate clockwise. Reverse motor leads to change direction.

For other questions contact the factory.

IMPORTANT SAFEGUARDS

Caution: To reduce the risk of injury:

- **Read the entire Operation and Maintenance Instruction manual before installing, operating, or servicing this actuator. Review the actuator specific operation, maintenance and installation manual for safety information.**
- **Warning: Danger of Electrical Shock. This unit operates on high voltage electricity; refer service and installation to a trained electrician.**
- Inspect the actuator regularly for signs of corrosion and repair immediately.
- Always remove pressure and disconnect power supply before servicing the actuator.
- Keep hands and feet clear of an actuator that is in service.
- Do not disassemble the actuator without reviewing the disassembly procedure in this manual first. This is particularly important that the proper procedure be followed to avoid injury from internal spring power.
- Before attempting to remove an actuator from the equipment it is assembled to, always be sure that spring is in the "failed" or extended position. Remove any accessory equipment that may cause the spring to remain compressed. If there is any doubt that the actuator is in the "failed" position, remove the hydraulic pressure from the actuator and install a long threaded bolt (a bolt that exceeds the length of the cylinder) in place of both travel stops. Once the actuator has been removed from the equipment the long bolts must be removed first before the actuator can be disassembled.
- Repair or replace a damaged actuator immediately.
- Operate the actuators within the pressure and temperature ranges specified on the nameplate. Otherwise the actuator life may be reduced or serious safety hazards may develop.

OPERATION And MAINTENANCE INSTRUCTIONS For HP Model High Pressure Actuators

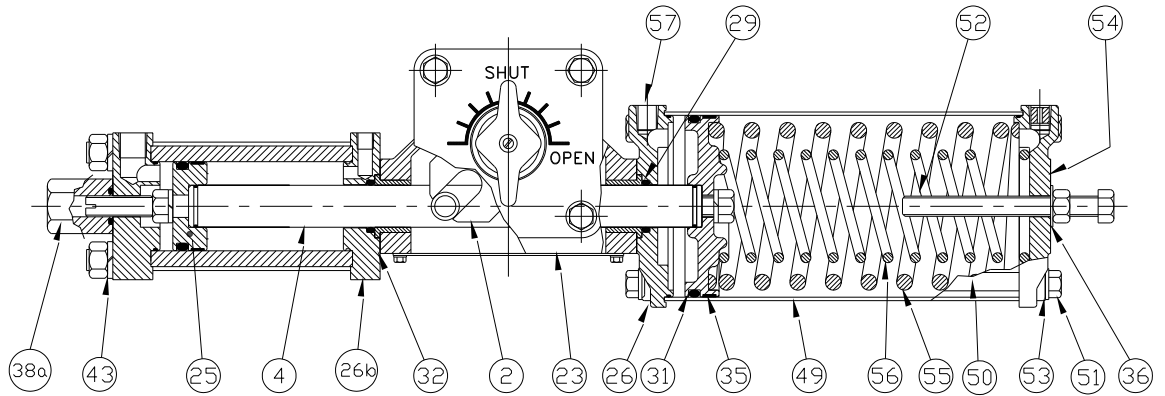
1. Installation

The actuator is factory lubricated and does not normally require periodic lubrication while in service. The actuator can be mounted parallel or perpendicular to pipeline

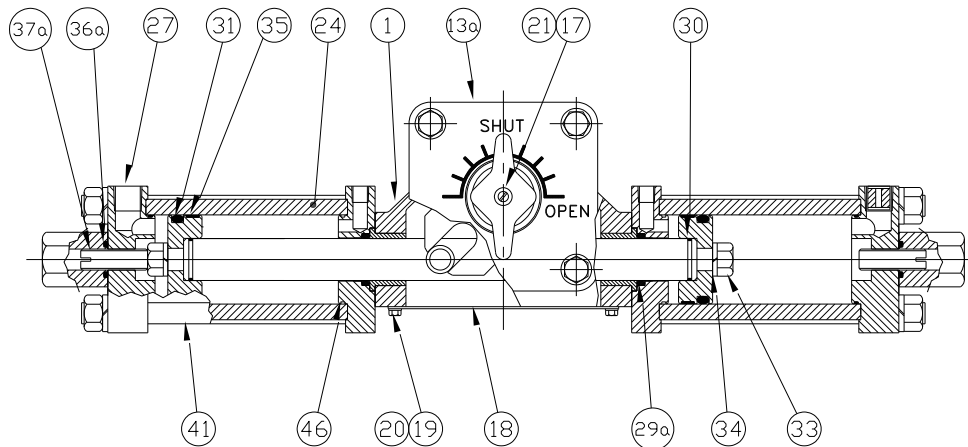
Bolt mounting bracket to actuator hand tight. DO NOT tighten yet.

- A. Install coupling on valve. Be sure rotary stops on valve are removed or adjusted to allow actuator stops to do the stopping.
- B. Install actuator and bracket to valve being sure to leave all fastener connections hand tight. If possible, stroke valve and actuator to a half open position 45° and physically shift actuator back and forth until coupling and all fasteners are relaxed then tighten all bolts and nuts. This procedure will accurately align valve stem to actuator output shaft and prolong valve stem seal life.
- C. Cycle valve / actuator assembly and observe for smooth operation.
- D. Adjust travel stops and motor switch cam stop as noted above.

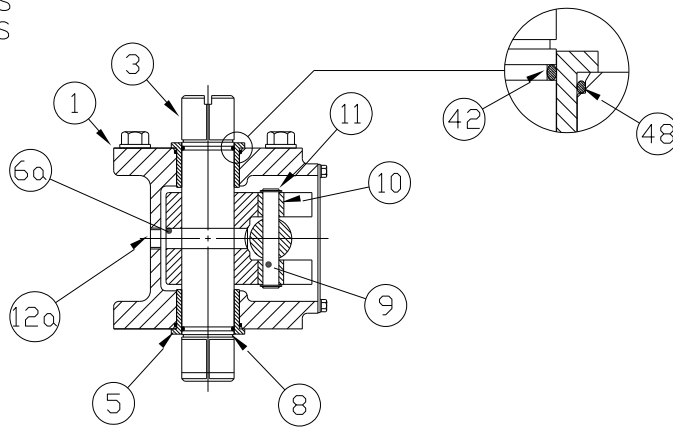
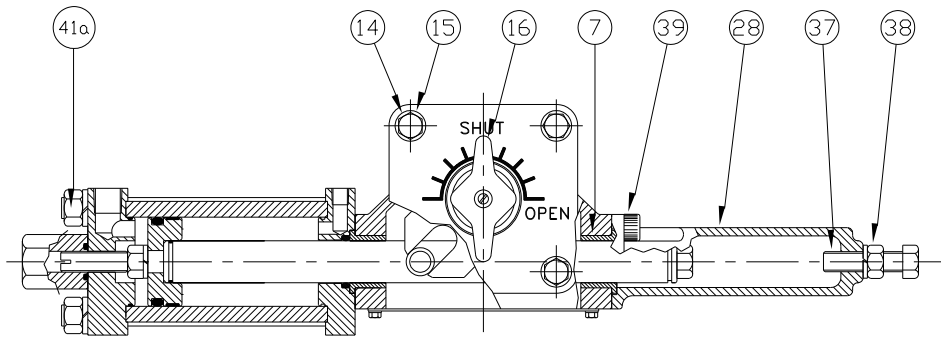
SINGLE ACTING
 SPRING RETURN
 ONE PISTON
 ALL MODELS
 EXCEPT
 HP 60 SERIES
 HP 65 SERIES
 HP 80 SERIES



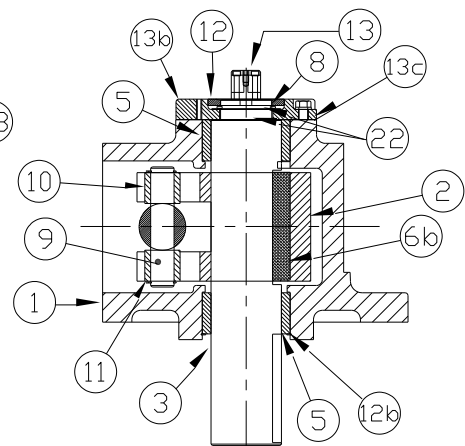
DOUBLE ACTING
 AIR TO AIR
 TWO PISTON
 ALL MODELS
 EXCEPT
 HP 60 SERIES
 HP 65 SERIES
 HP 80 SERIES



DOUBLE ACTING
 AIR TO AIR
 ONE PISTON
 ALL MODELS
 EXCEPT
 HP 60 SERIES
 HP 65 SERIES
 HP 80 SERIES



SECTION A-A Models HP15
 YOKE SHOWN AT MID-STROKE POINTER OMITTED FOR CLARITY



SECTION A-A, MODELS HP25-HP30
 YOKE SHOWN AT MID-STROKE, POINTER OMITTED FOR CLARITY.

Materials of Construction

	ITEM	S MATERIAL		B MATERIAL		C MATERIAL
		HP 15	HP 25 & HP 30	HP 15	HP 25 & HP 30	HP 25 & HP 30
1	Housing	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
2	Yoke	17-4 PH	17-4 PH	17-4 PH	17-4 PH	17-4 PH
3	Output shaft	17-4 SS	17-4 SS	4140	4140	4140
4	Piston rod	316 SS	316 SS	CPO	CPO	CPO
5	Bushing - Output Shaft	TEFLON	TEFLON COMPOSITE	BRONZE	TEFLON COMPOSITE	TEFLON COMPOSITE
6a	Yoke Pin	18-8 SS	-	STEEL	-	-
6b	Key - Yoke	-	17-4 PH	-	STEEL	STEEL
7	Bushing - Piston Rod	TEFLON	TEFLON	BRONZE	BRONZE	BRONZE
8	Retaining Ring - Output Shaft	15-7 MO	15-7 MO	STEEL	STEEL	STEEL
9	Thrust Pin	440C SS	440C SS	440C SS	440C SS	440C SS
10	Roller Bearing	440C SS	440C SS	440C SS	440C SS	440C SS
11	Retaining Ring - Pin	15-7 MO	15-7 MO	STEEL	STEEL	STEEL
12	Seal, Thrust Plate	-	BUNA-N	-	BUNA-N	BUNA-N
12a	Set Screw	18-8 SS	-	18-8 SS	-	-
12b	Retaining Ring - Lower Bearing	-	18-8 SS	-	STEEL	STEEL
13	Pointer Adaptor	-	NYLON	-	NYLON	NYLON
13a	Position Indicator	304 SS	-	DUCTILE IRON	-	-
13b	Thrust Plate	-	316 SS	-	DUCTILE IRON	DUCTILE IRON
13c	Gasket, Thrust Plate	-	FIBER	-	FIBER	FIBER
14	Hex Head Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
15	Lock Washer	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
16	Pointer	SOFT PVC	SOFT PVC	SOFT PVC	SOFT PVC	SOFT PVC
17	Round Head Screw	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
18	Cover- Housing	316 SS	316 SS	STEEL	STEEL	STEEL
19	Hex Head Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
20	Lock Washer	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
21	Pointer washer	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
22	Thrust Washer	-	18-8 SS	-	STEEL	STEEL
23	Gasket - Cover	FIBER	FIBER	FIBER	FIBER	FIBER
24	Cylinder	316 SS	316 SS	316 SS	316 SS	STEEL /XYLAN
25	Piston	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
26	Adaptor	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
26b	HP Adaptor	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
27	End cap	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
28	Rod Cover	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
29	Seal -Piston Rod	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
29a	U cup Seal - Piston Rod	URETHANE	URETHANE	URETHANE	URETHANE	URETHANE
30	Seal -Piston Bolt	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
31	Seal- Piston	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
32	Gasket - Housing	FIBER	FIBER	FIBER	FIBER	FIBER
33	Piston Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
34	Lock Washer	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
35	Bearing - Piston	TEFLON	TEFLON	TEFLON	TEFLON	TEFLON
36	Thread Seal	SS/EPDM	SS/EPDM	STEEL/EPDM	STEEL/EPDM	STEEL/EPDM
36a	Cap Nut Seal	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
37	Travel Stop Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
37a	HP Adjustment Screw	304 SS	304 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
38	Jam Nut	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
38a	Cap Nut	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
39	Socket Head Cap Screw	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
41	Tie Rod	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
41a	Nut - Tie Rod	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
42	Seal - Output Shaft	-	-	BUNA-N	-	-
43	Lock Washer	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
44	Hex Head Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
44a	Socket Head Cap Screw	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
45	Stato-seal	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
46	Cylinder Gasket or O-ring	BUNA-N	BUNA-N	BUNA-N	BUNA-N	BUNA-N
47	Label - Nameplate	MYLAR	MYLAR	MYLAR	MYLAR	MYLAR
48	Seal - Output Shaft Bushing	-	-	BUNA-N	-	-
49	Cylinder - Spring Side	316 SS	316 SS	316SS	316 SS	STEEL /XYLAN
50	Tie Rod - Spring Side	316 SS	316 SS	316 SS	STEEL	STEEL
51	Hex Head Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
52	Travel Stop Bolt	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
53	Flat Washer	18-8 SS	18-8 SS	18-8 SS	STEEL	STEEL
54	End cap - Spring Side	316 SS	316 SS	DUCTILE IRON	DUCTILE IRON	DUCTILE IRON
55	Spring - Outer	STEEL	STEEL	STEEL	STEEL	STEEL
56	Spring - Inner	STEEL	STEEL	STEEL	STEEL	STEEL
57	Breather	18-8 SS	18-8 SS	STEEL	STEEL	STEEL
58	Label - Spring	LEXAN	LEXAN	LEXAN	LEXAN	LEXAN

2. Spring Conversion

Consult factory for spring conversion. Some spring conversions can be done in the field and others will require a new spring cylinder.

3. Failure Mode Change

(Model HP15)

Conversion from “fail close” to “fail open” is accomplished by flipping the actuator over. The top and bottom of the center housing have identical mounting flanges and output shaft dimensions. Remove the vinyl pointer and indicator plate and mount them on opposite side of actuator.

(Models HP25, HP30, HP65, HP80)

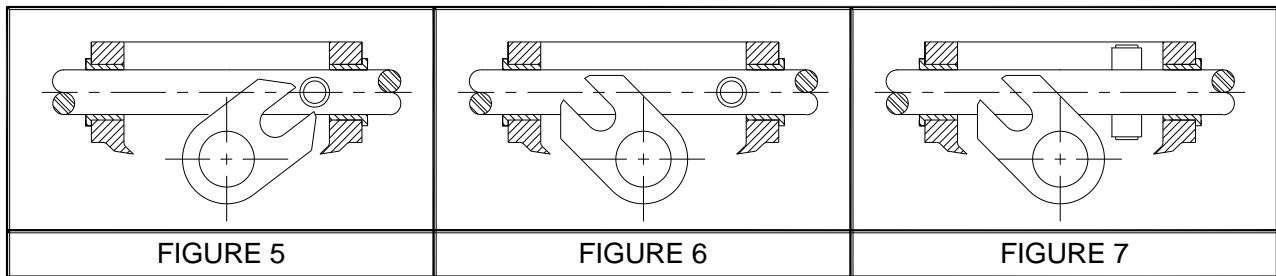
Fail open and fail closed must be specified at time of order.

4. Removal of Actuator from Valve

CAUTION

Do not attempt to remove mounting bolts between actuator and valve until supply pressure has been disconnected and vented. If spring return, be sure that valve is completely in failed position. If valve is frozen in a position causing the spring to be compressed, removal of bracket bolts would allow spring to stroke, resulting in the actuator rotating over bracket causing possible injury or damage.

- D. Loosen bracket to actuator bolts to hand tight position.
- E. Physically shift actuator back and forth to be sure there is no strain (or shear stress) on the bracket bolts. Once it has been determined that there is no pressure or spring load remaining on the actuator, remove bolts and actuator from valve.
- F. In the event the valve is frozen or locked in place, resulting in spring energy remaining in the actuator, replace HP adjustment screw (37a) on end of actuator opposite spring end with length of “all thread” rod of sufficient length and turn clockwise until it contacts the piston. This procedure will safely secure the piston and spring assembly and allow



actuator removal. Be sure to carefully remove “all thread” rod prior to actuator disassembly.

5. Disassembly-Symmetric Yoke Actuators

- A. Remove endcap(s) (27 & 54); tie rods (41 & 50) and cylinder (24 & 49). Remove rod cover (28) if applicable.
- B. Remove piston bolts (33) and pistons (25) and springs if applicable (55 and 56).
- C. Remove adaptor (26) and piston rod seals (29).
- D. Remove housing cover (18), pointer (16) and position indicator (13) (where applicable).

(Model HP15)

- E. Disengage yoke (2) from roller bearing assembly by pulling piston rod to extreme right, as in FIGURE 5, and swing yoke mechanism clear of roller bearing as in FIGURE 6.
- F. Rotate piston rod 90° to allow access to retaining ring (11) as shown in FIGURE 7.
- G. Remove retaining ring (11) and bearing (10). Then rotate piston rod (4) 180° and remove the bearing (10) and thrust pin (9) assembly.
- H. Remove piston rod (4) and piston rod bushings (7).
- I. Remove plug (12a) from back of housing.
- J. Using a punch or suitable dowel pin, insert through clearance hole and press yoke pin (6a) out.
- K. Remove retaining ring (8) from output shaft (3). Remove output shaft (3) and yoke (2).
- L. Remove bushings (5) from housing.

(Models HP25 & HP30)

- E. Disengage yoke (2) from roller bearing assembly by pulling piston rod (4) to extreme right, as in FIGURE 5, and swing yoke (2) clear of roller bearing (10) assembly. See FIGURE 6.
- B. Rotate piston rod (4) 90° to allow access to retaining ring (11) as shown in FIGURE 7.
- C. Remove retaining ring (11) and bearing (10). Then rotate piston rod (4) 180° and remove the bearing and thrust pin assembly.
- D. Remove piston rod (4) and piston rod bushings (7).
- I. Remove retaining rings (8) and (12b) on both ends of output shaft.
- J. Remove thrust plate (13b) and thrust washers (22) from the output shaft (3).
- K. Position the yoke (2) in the fully clockwise position (viewed from the thrust plate (13b) side).
- L. Using a soft hammer, drive output shaft (3) out through top of housing (1).
- M. Withdraw yoke (2) from housing (1).
- N. Remove the output shaft bushings (5) from the housing (1).

Disassembly – Canted Yoke Actuators

Canted yoke actuators are disassembled the same way as the symmetric yoke actuators except for the following additional instructions for specific models:

(Models HP15)

These actuators are disassembled using the same procedure as the symmetric actuators. However, the thrust pin (9) is removed from the housing (1) via access plugs on the upper and lower housing mounting flanges.

(Models HP25 & HP30)

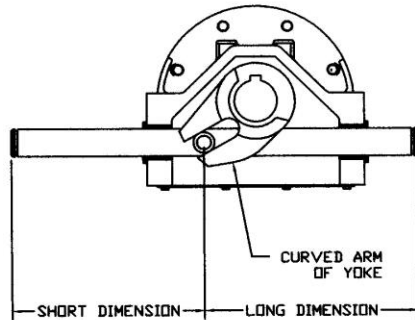
- G. Remove the pointer (16), pointer adaptor (13) and pry out the thrust plate seal (12) (if fitted).
- H. Remove the thrust plate (13b) and thrust washers (22) from the output shaft (3).
- I. Position the yoke (2) in the fully clockwise position (viewed from the thrust plate (13b) side).
- J. Using a soft hammer, drive output shaft (3) out through the thrust plate side of the housing (1). This will drive out the upper output shaft bushing (5) and yoke key (6b).
- K. Remove the piston rod bushings (7) from the housing (1).
- L. Shift the yoke (2) around in the housing (1) so that the thrust pin (9) and roller bearing (10) assembly can be moved out of the yoke slot. Remove the thrust pin retaining rings (11) and withdraw the roller bearings (10), thrust pin (9), piston rod (4) and yoke (2).
- M. Remove the lower output shaft bushing retaining ring (12b) and lower output shaft bushing (5).

6. Assembly-Symmetric Yoke Actuators

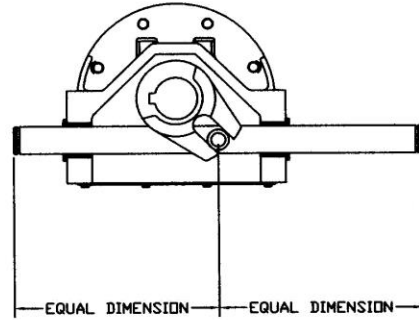
(Model HP15)

- A. Insert piston rod bushings (7) and output shaft bushings (5) in housing. Lube output shaft bushings o-rings (48) with "Dow Corning #55" lubricant. Push one o-ring halfway on each bushing and install bushings in housing.
- B. Place yoke (2) in position in housing. Lubricate with "WD40" or similar lubricant and install output shaft (3). Lube output shaft o-rings (42) with "Dow Corning #55" lubricant. Install one o-ring on one end of output shaft and insert through housing and yoke. Install second o-ring on opposite end of output shaft and push output shaft back into housing.) Secure output shaft with retaining rings (8).
- C. Lubricate and press yoke pin (6) into yoke and output shaft assembly from open side of housing. Be sure pin is pressed flush in yoke to prevent interference with piston rod (4).

THE CANTED YOKE PISTON ROD IS NOT SYMMETRICAL. IT MUST BE POSITIONED AS SHOWN. THE SYMMETRICAL YOKE PISTON ROD CAN BE INSTALLED EITHER WAY.



CANTED YOKE ACTUATOR
CLOSED POSITION - TOP VIEW



SYMMETRIC YOKE ACTUATOR
OPEN POSITION - TOP VIEW

FIGURE 7

(Models HP25 & HP30)

- A. Insert yoke key (6b) into output shaft (3).
- B. Install yoke (2) in housing (1). Slide output shaft (3) through top of housing (1) into the yoke (2). Install lubricated upper and lower bearings (5a).
- C. Install lower thrust washer (22), thrust plate (13), upper thrust washer (22) retaining ring (8) and thrust plate seal (12) (if fitted). Install lower bearing retaining ring (12b).

(Models HP15, HP25, HP30)

- D. Lubricate with "WD40" and install piston rod (4) being careful not to scratch sealing surfaces when sliding through yoke assembly.
- E. Swing yoke clear toward left side of housing as shown in FIGURE 7.
- F. Sub-assemble thrust pin (9) with one roller bearing (10) and one retaining ring (11). Pre-lubricate sub-assembly with high temperature grease such as "Whitmore's Omnitemp II".
- G. Install roller bearing sub-assembly per FIGURE 7. Rotate piston rod 180° and assemble second roller bearing and retaining ring. Place ample amount of high temperature grease on roller bearing and inside wear area of yoke.
- H. Engage roller bearing in yoke assembly as shown in FIGURE 7, 6, & 5.
- I. Install plug (12a) in back of housing if applicable. Use "Loctite 222 Thread Locker".

(Cylinder and Rod Cover Assembly-All Models)

- J. Assemble bolt (33) on end of piston rod before installing rod cover when rod cover is required.
- K. Install rod cover (28) if applicable. Actuators utilizing one piston only require a rod cover. Bolt rod cover and gasket in place with socket head screws (39). Use "Loctite 222 Thread Locker."
- L. Install piston rod lip seal (29a), by lubricate o-ring with "Dow Corning #55" lubricant, and then inserting cup end into deeper recess of HP adaptor (26b). **The open lips of the cup must face the cylinder so that the lip seal expands under operating pressure** (shown in Figure 8). If spring return lubricate piston rod o-ring (29) with "Dow Corning #55" lubricant and install on piston rod (4, 4a).

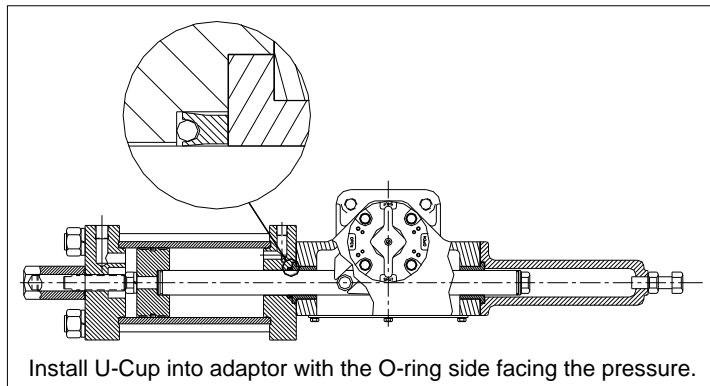


FIGURE 8

- M. Lubricate piston bolt o-ring (30) with "Dow Corning #55" lubricate and put on piston rod (4).
- N. Assemble adaptor (26, 26b) to housing. The seal must slide over the lubricated piston o-ring (30) on the piston rod (4) to avoid damage to the seal lips. A gasket (32) must be used between adaptor and housing. If actuator is spring return model be sure to insert long tie rod bolts (51) with washer into adaptor prior to bolting adaptor to housing. Insert socket head cap screws (44) from housing into HP adaptor (26b) using Loctite. If spring return, insert hex head bolts (44) with stato-seals (45) through spring side adaptor (26) into housing (1). Use "Loctite 262 Permanent Thread Locker". Uniformly tighten bolts. Refer to Assembly Torque Requirement (FIGURE 10) for proper bolt torque.
- O. Assemble piston (25) to piston rod with bolt (33) and lock washer (34). Use "Loctite 262 Permanent Thread Locker" on bolt threads. Rotate piston before tightening piston bolt to ensure proper seating of o-ring. Refer to Assembly Torque Requirement (FIGURE 10) for proper bolt torque.
- P. Install lubricated o-ring (46) in HP adaptor (26b) groove.
- Q. Lubricate piston o-ring (31) with "Dow Corning #55" lubricant and install on piston (25).
- R. Lubricate piston bearing (35) with "Dow Corning #55" lubricant and install on piston (25). Assemble bottom two tie rods (41) on HP adaptor (26b). Lubricate cylinder (24) with "Dow Corning #55" lubricant and slide cylinder over piston (25) until cylinder is in contact with o-ring (46) in HP adaptor (26b) groove. Assemble top two tie rods (41) on HP adaptor (26b).
- S. Insert cylinder o-ring (46) in endcap (27) groove and place endcap over tie rods (41) and on cylinder (24).
- T. Assemble lock washers (43) and nuts (#?) on tie rods (41) and uniformly tighten. Do not exceed torque values shown in Assembly Torque Requirement Table (FIGURE 10).
- U. Install position indicator (13) and pointer (16), where applicable. Assemble HP adjusting screws (37a), cap nuts (38), and cap nut seals (36a). For rod cover assemble adjusting screw (37) with jam nut (38) and install on rod cover (28).
- V. Stroke actuator with rated supply air and check for leaks.

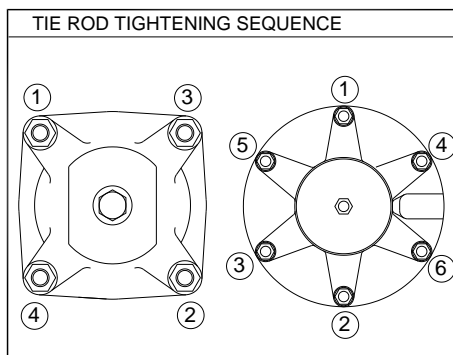


FIGURE 9

ASSEMBLY TORQUE REQUIREMENTS (FT./LBS.)				
Model No.	Adaptor Bolt (44)	Piston Bolt (33)	Tie Rod (41)	Tie Rod Bolt Spring side (51)
HP15-2	30	40	30	25
HP15-3	30	150	150	25
HP25-3	150	150	150	100
HP25-4	150	150	250	250
HP30-4	150	150	250	250
HP30-6, HP60-6	250	250	250	250
HP30-8, HP60-8	250	250	250	250
HP65-6, HP80-6	250	250	250	250
HP65-8, HP80-8	250	250	250	250

FIGURE 10

SPRING RETURN ONLY

All Models

- W. Lubricate piston bolt o-ring (30) with "Dow Corning #55" lubricant and put on piston rod. Assemble piston (25) to piston rod with bolt (33) and lock washer (34). Use "Loctite 262 Permanent Thread Locker" on bolt threads. Rotate piston before tightening piston bolt to ensure proper seating of o-ring. Refer to Assembly Torque Requirement (FIGURE 10) for proper bolt torque.
- X. Install lubricated cylinder o-ring (46) in adaptor (26) groove.
- Y. Lubricate piston seal (31) with "Dow Corning #55" lubricant and install on piston (25).

- Z. Lubricate piston bearing (35) and cylinder (24) with "Dow Corning #55" lubricant. Hold piston bearing (35) in place on piston (25) and slide cylinder (49) over piston and bearing until cylinder is in contact with o-ring (46) in adaptor (26) groove.
- AA. Place cylinder o-ring (46) in endcap (54). Insert long bolts (51) with flat washer (53) in endcap (54).
- AB. Place springs against piston, being sure to nest in contours.
- AC. Mount endcap over extended spring(s) and fasten to hollow tie rods (50) with bolts (51). To prevent galling, lubricate bolts (51) with "Whitmore's Omnitemp II" grease or equal. Alternately and uniformly tighten bolts (51) in hollow tie rods. Tighten each bolt approximately $\frac{1}{4}$ " – $\frac{1}{2}$ " following the sequence shown in Tie Rod Tightening Sequence (FIGURE 9) until spring is completely compressed. Be sure that each hollow tie rod slides into the counterbore in the endcap. Do not over tighten bolts. Refer to Assembly Torque Requirements Table (FIGURE 10).
- AD. Install position indicator (13) and pointer (16), where applicable. Assemble adjusting screws (52), thread seals (36) and jam nuts (38).
- AE. Stoke actuator with rated supply air and check for leaks.

Assembly – Canted Yoke Actuators

Canted yoke actuators are assembled the same way as the symmetric yoke actuators except for the following additional instructions for specific models.

Canted yoke actuators have a non-symmetrical piston rod as well as a non-symmetrical yoke. It is important to orient the piston rod with the longer dimension in relation to the yoke as shown in Figure 7c. Note that the finished housing assembly is used for both fail open and fail closed actuators.

(Models HP25 & HP30)

- A. Insert the yoke (2) into the housing (1) and position the yoke in the fully clockwise position (viewed from the thrust plate (13b) side).
- B. Insert the piston rod (4) correctly oriented with the longer dimension as shown in figure 7c.
- C. Install the thrust pin (9) and roller bearings (10) using generous amounts of Whitmore Omnitemp grease and install both pin retaining rings (11).
- D. Shift the yoke (2) and piston rod (4) so that the thrust pin (11) and roller bearing (10) assembly can be inserted into the yoke slot. The absence of the piston rod bushings (7) and output shaft bushings (5) allows just enough room for this process.
- E. Insert the lower output shaft bushing (5) and retaining ring (12b). This bushing must have a press fit. The integral seal o-ring must be oriented toward the yoke.
- F. Insert the yoke key (6b) into the output shaft (3), then insert the output shaft into the housing (1) and yoke (2) and lower output shaft bushing (5).
- G. Install the upper output shaft bushing (5) over the output shaft and into the housing (5). The bearing must have a press fit. The integral seal o-ring must be oriented toward the yoke.
- H. Install output shaft thrust washer (22), thrust plate gasket (13b) thrust plate (13b), thrust washer (22) and retaining ring (8).
- I. Install Pointer adaptor (13) using two socket head cap screws.
- J. Install the thrust plate seal (12), pointer (16) and pointer washer (21).