BIFFI MORIN HP MODEL HIGH PRESSURE ACTUATORS

OPERATION AND MAINTENANCE INSTRUCTIONS

INTRODUCTION

General application

Biffi actuators are designed for 'on-off' or modulating control of any quarter-turn ball, butterfly, rotary plug or damper style valve application.

Technical data

Supply pressure:	Max operating pressure 27.6 to 155 bar (400 to 2250 psig) or as specified by nameplate. Max shell pressure 2250 psig or as specified by nameplate.
Supply medium:	Any gas or hydraulic fluid compatible with materials of construction.
Temperature rating:	standard range: -28°C to +98°C (-20°F to 210°F) optional range: -54°C to +149°C (-65°F to 300°F)
Angular rotation:	90 degrees ± 8 degrees

FIGURE 1 - SINGLE ACTING, TWO CYLINDERS

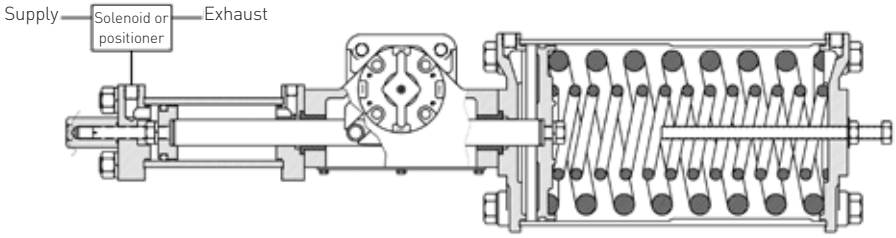


FIGURE 2 - DOUBLE ACTING, TWO CYLINDERS

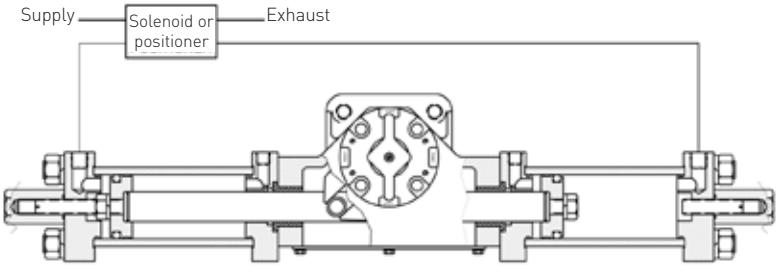
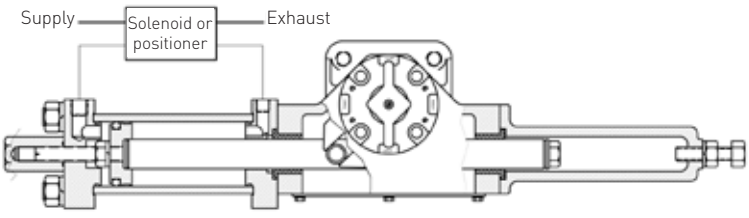


FIGURE 3 - DOUBLE ACTING, SINGLE CYLINDER



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. The actuator can be installed in any convenient position including vertical, horizontal or upside down.

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

B. Install coupling on valve. Be sure rotary stops on valve are removed or adjusted to allow actuator stops to do the stopping.

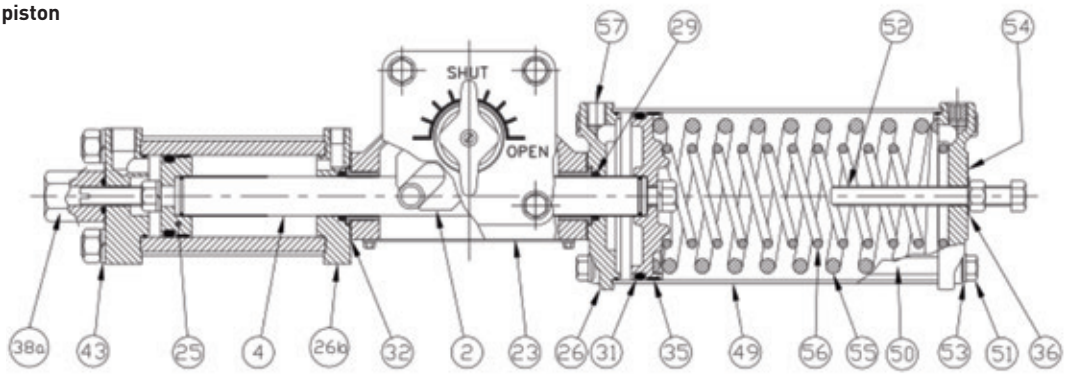
C. Install actuator and bracket to valve being sure to leave all fastener connections hand tight. If possible, stroke valve and actuator to a half open position 45° and physically shift actuator back and forth until coupling and all fasteners are relaxed then tighten all bolts and nuts. This procedure will accurately align valve stem to actuator output shaft and prolong valve stem seal life.

D. Cycle valve / actuator assembly and observe for smooth operation.

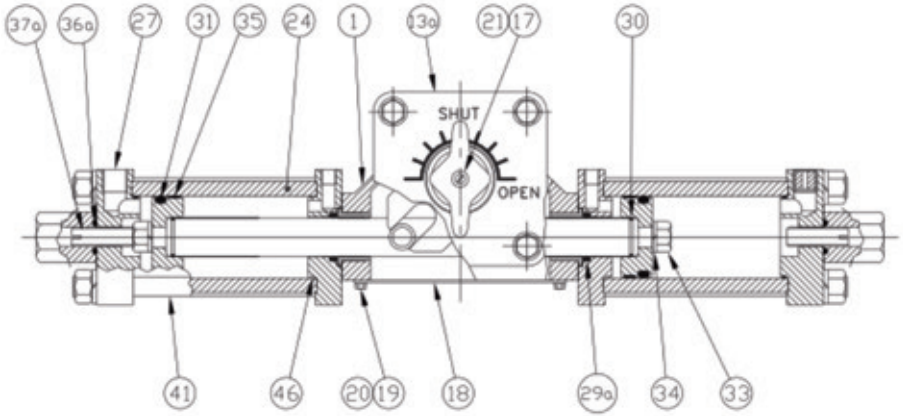
E. Adjust travel stops for perfect alignment in both open and closed positions.

F. TUBING CONNECTIONS – Tubing connections for the hydraulic supply are to be attached as shown in Figures 1, 2, and 3. Note that on a two cylinder actuator the inboard endcap (adaptor) is vented and must not be connected to the hydraulic or high pressure gas supply.

Single acting spring return one piston
All models except:
HP60 series
HP65 series
HP80 series



Double acting air to air two pistons
All models except:
HP60 series
HP65 series
HP80 series



Double acting air to air one piston
All models except:
HP60 series
HP65 series
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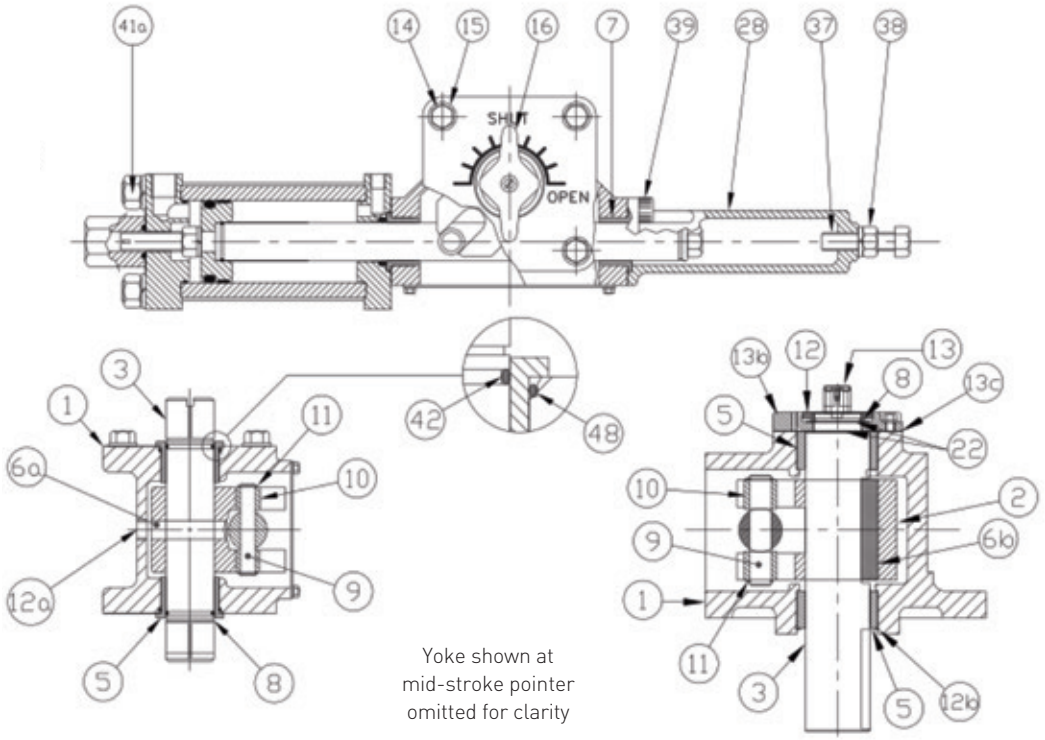
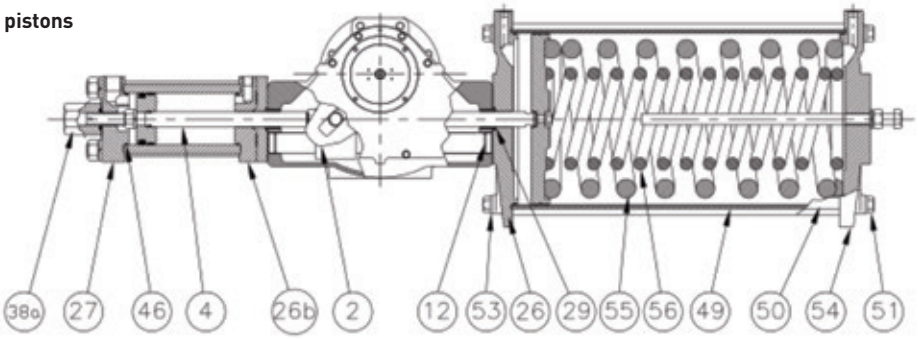


Yoke shown at mid-stroke pointer omitted for clarity

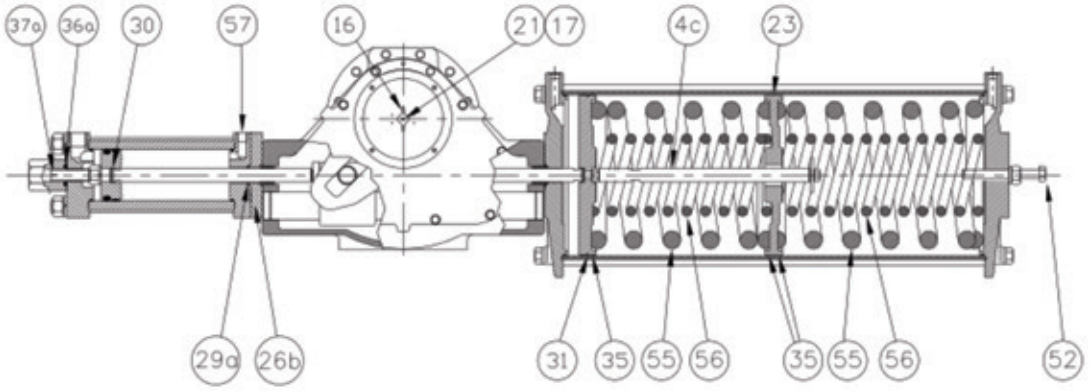
SECTION A - A, MODELS HP15

SECTION A - A, MODELS HP25 - HP30

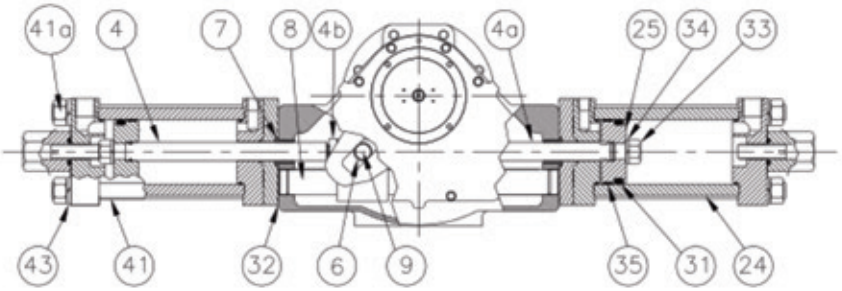
Single acting spring return two pistons
Model:
HP65 series



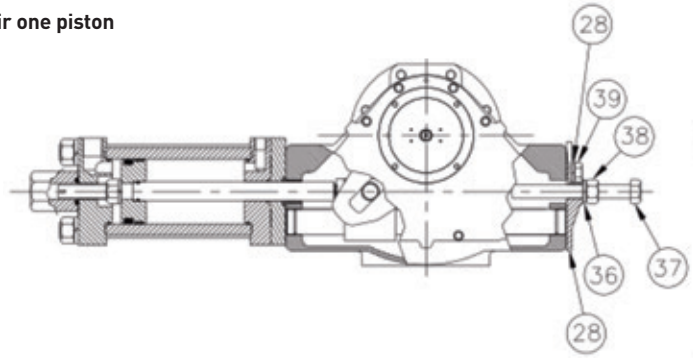
Single acting spring return two pistons
Model:
HP80 series

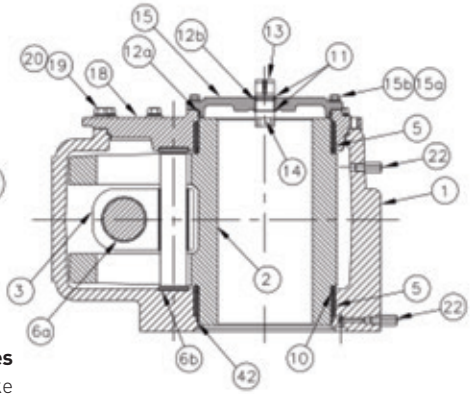


Double acting air to air two pistons
Models:
HP65 series
HP80 series



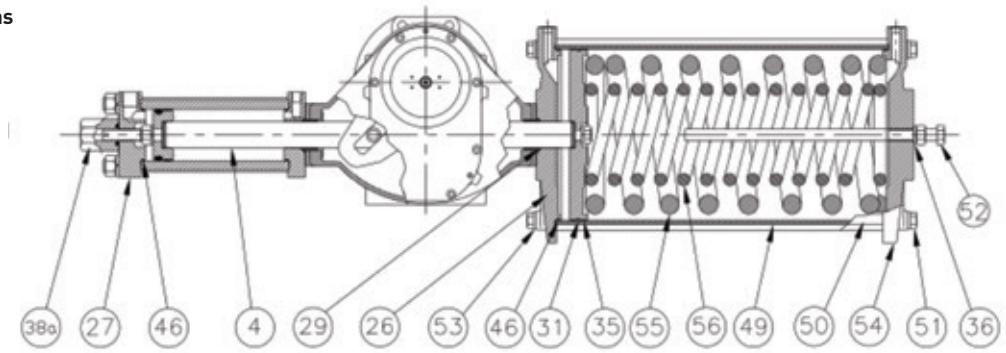
Double acting air to air one piston
Models:
HP65 series
HP80 series



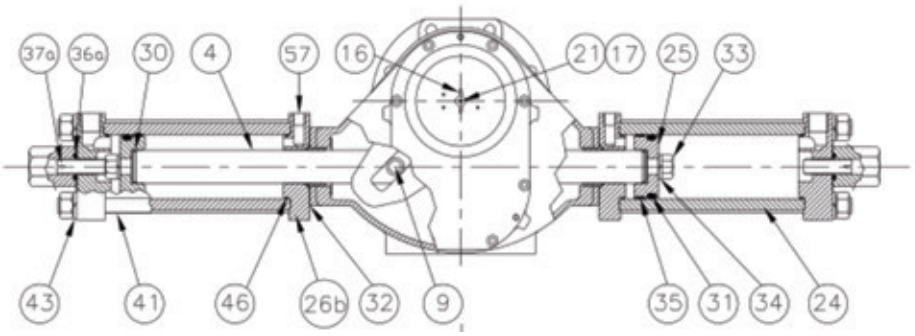


HP65 and HP80 series
Yoke shown at mid-stroke
pointer omitted for clarity

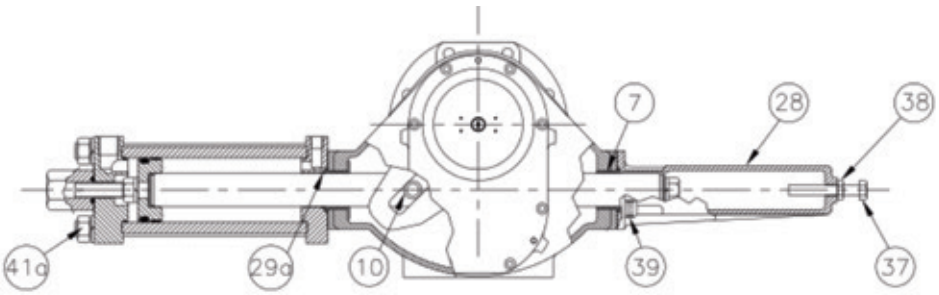
Single acting spring return two pistons
Model:
HP60 series

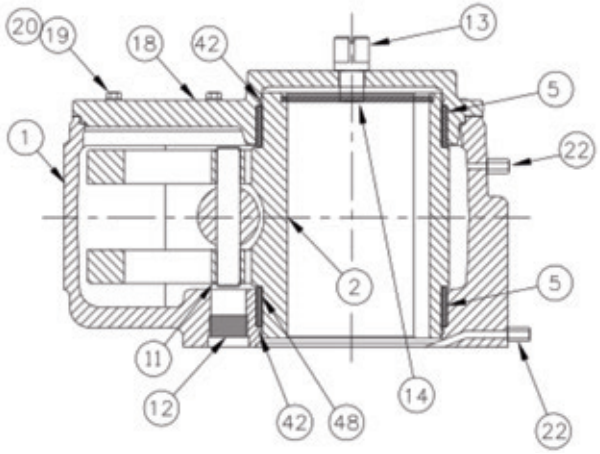


Double acting air to air two pistons
Model:
HP60 series



Double acting air to air one piston
Model:
HP60 series





NOTE
HP60 non-guide bar design only offered in stainless steel.

HP60 series
Yoke shown at mid-stroke
pointer omitted for clarity

MATERIALS OF CONSTRUCTION (continued next page)

		S material		B material		C material
	Item	**HP15**	**HP25 and HP30**	**HP15**	**HP25 and HP30**	**HP25 and HP30**
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	PTFE	PTFE composite	Bronze	PTFE composite	PTFE composite
6a	Yoke pin	18-8 SS	-	Steel	-	-
6b	Key - yoke	-	17-4 PH	-	Steel	Steel
7	Bushing - piston rod	PTFE	PTFE	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	-	NBR	-	NBR	NBR
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	-	-	-	-
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	NBR	NBR	NBR	NBR	NBR
29a	U cup seal - piston rod	Urethane	Urethane	Urethane	Urethane	Urethane
30	Seal - piston bolt	NBR	NBR	NBR	NBR	NBR
31	Seal- piston	NBR	NBR	NBR	NBR	NBR
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	PTFE	PTFE	PTFE	PTFE	PTFE
36	Thread seal	SS/EPDM	SS/EPDM	SS/EPDM	SS/EPDM	SS/EPDM
36a	Cap nut seal	NBR	NBR	NBR	NBR	NBR
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	-	-	NBR	-	-
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	NBR	NBR	NBR	NBR	NBR
46	Cylinder gasket or O-ring	NBR	NBR	NBR	NBR	NBR
47	Label - nameplate	MYLAR	MYLAR	MYLAR	MYLAR	MYLAR
48	Seal - output shaft bushing	-	-	NBR	-	-

MATERIALS OF CONSTRUCTION (continued)

		S material		B material		C material
	Item	**HP15**	**HP25 and HP30**	**HP15**	**HP25 and HP30**	**HP25 and HP30**
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

MATERIALS OF CONSTRUCTION (continued next page)

		S material			B material	C material
	Item	**HP60**		**Item**	**HP65 and HP80**	**HP65 and HP80**
1	Housing	316 SS	1	Housing	Ductile iron	Ductile iron
2	Yoke	17-4 PH	2	Yoke	Ductile iron	Ductile iron
			3	Guide block	Ductile iron	Ductile iron
			4	Piston rod - left	CPO	CPO
			4a	Piston rod - right	CPO	CPO
4	Piston rod	316 SS	4b	Jam nut - piston rod	Steel	Steel
			4c	Piston rod - extension	CPO	CPO
5	Bearing - yoke	PTFE composite	5	Bearing - yoke	PTFE composite	PTFE composite
			6	Bearing - thrust pin	Steel	Steel
			6a	Bearing - guide bar	Steel	Steel
			6b	Thrust bearing - thrust pin	Nylon	Nylon
7	Bushing - piston rod	Bronze	7	Bushing - piston rod	Bronze	Bronze
			8	Guide bar	CPO	CPO
9	Thrust pin	440C SS	9	Thrust pin	440C SS	440C SS
10	Slide block	Bronze	10	Seal, bearing	NBR	NBR
11	Retaining ring - pin	15-7 MO	11	Retaining ring - accessory drive	Steel	Steel
12	Plug - thrust pin access	18-8 SS	12	Seal - guide bar	NBR	NBR
			12a	Seal, cap	NBR	NBR
			12b	Seal, accessory drive	NBR	NBR
13	Pointer adaptor	Nylon	13	Accessory drive	Steel	Steel
14	Drive bar	Steel	14	Drive bar	Steel	Steel
			15	Cap	Ductile iron	Ductile iron
			15a	Washer, cap	Steel	Steel
			15b	Screw, cap	Steel	Steel
16	Pointer	Soft PVC	16	Pointer	Soft PVC	Soft PVC
17	Round head screw	18-8 SS	17	Round head screw	18-8 SS	Steel
18	Cover - housing	316 SS	18	Cover - housing	Ductile iron	Ductile iron
19	Hex head bolt - cover	18-8 SS	19	Hex head bolt - cover	Steel	Steel
20	Lock washer - cover	18-8 SS	20	Lock washer - cover	Steel	Steel
21	Pointer washer	18-8 SS	21	Pointer washer	Steel	Steel
22	Vent valve	Brass	22	Vent valve	Brass	Brass
			23	Cup, spring	Ductile iron	Ductile iron
24	Cylinder	316 SS	24	Cylinder	316 SS	Steel / XYLAN
25	Piston	316 SS	25	Piston	Ductile iron	Ductile iron
26	Adaptor	316 SS	26	Adaptor	Ductile iron	Ductile iron
			26a	Spacer plate (1485-2385 only)	Ductile iron	Ductile iron
26b	HP adaptor	316 SS	26b	HP adaptor	Ductile iron	Ductile iron
27	Endcap	316 SS	27	Endcap	Ductile iron	Ductile iron
28	Rod cover	316 SS	28	Rod cover	Ductile iron	Ductile iron
29	Seal - piston rod	NBR	29	Seal - piston rod	NBR	NBR
29a	Seal - piston rod	Urethane	29a	Seal - piston rod	Urethane	Urethane
30	Seal - piston bolt	NBR	30	Seal - piston bolt	NBR	NBR

MATERIALS OF CONSTRUCTION (continued)

		S material			B material	C material
	Item	**HP60**		**Item**	**HP65 and HP80**	**HP65 and HP80**
31	Seal - piston	NBR	31	Seal - piston	NBR	NBR
32	Gasket - housing	Fiber	32	Gasket - housing	Fiber	Fiber
33	Hex head bolt - piston	18-8 SS	33	Hex head bolt - piston	Steel	Steel
34	Lock washer - piston	18-8 SS	34	Lock washer - piston	Steel	Steel
35	Bearing - piston	PTFE	35	Bearing - piston	PTFE	PTFE
36	Thread seal	SS/EPDM	36	Thread seal	Steel/EPDM	Steel/EPDM
36a	Cap nut seal	NBR	36a	Cap nut seal	NBR	NBR
37a	HP adjusment screw	304 SS	37a	Seal - piston rod	Ductile iron	Ductile iron
38	Jam nut	18-8 SS	38	Jam nut	Steel	Steel
38a	Cap nut	316 SS	38a	Cap nut	Ductile iron	Ductile iron
39	Socket head cap screw	18-8 SS	39	Socket head cap screw	Steel	Steel
41	Tie rod	18-8 SS	41	Tie rod	Steel	Steel
41a	Nut - tie rod	18-8 SS	41a	Nut - tie rod	Steel	Steel
42	Seal - yoke	NBR	42	Seal - yoke	NBR	NBR
43	Lock washer	18-8 SS	43	Lock washer	Steel	Steel
44	Hex head bolt	18-8 SS	44	Hex head bolt	Steel	Steel
44a	Socket head cap screw	18-8 SS	44a	Socket head cap screw	Steel	Steel
45	Stato-seal	NBR	45	Stato-seal	NBR	NBR
46	Cylinder O-ring	NBR	46	Cylinder O-ring	NBR	NBR
47	Label - nameplate	MYLAR	47	Label - nameplate	MYLAR	MYLAR
48	Seal - output shaft bushing	NBR				
49	Cylinder - spring side	316 SS	49	Cylinder - spring side	316 SS	Steel / XYLAN
50	Tie rod - spring side	316 SS	50	Tie rod - spring side	Steel	Steel
51	Hex head bolt	18-8 SS	51	Hex head bolt	Steel	Steel
52	Travel stop bolt	18-8 SS	52	Travel stop bolt	Steel	Steel
53	Flat washer	18-8 SS	53	Flat washer	Steel	Steel
54	Endcap - spring side	316 SS	54	Endcap - spring side	Ductile iron	Ductile iron
55	Spring - outer	Steel	55	Spring - outer	Steel	Steel
56	Spring - inner	Steel	56	Spring - inner	Steel	Steel
57	Breather	18-8 SS	57	Breather	Steel	Steel
58	Label - spring	LEXAN	58	Label - spring	LEXAN	LEXAN

2. MANUAL HANDPUMP OVERRIDE

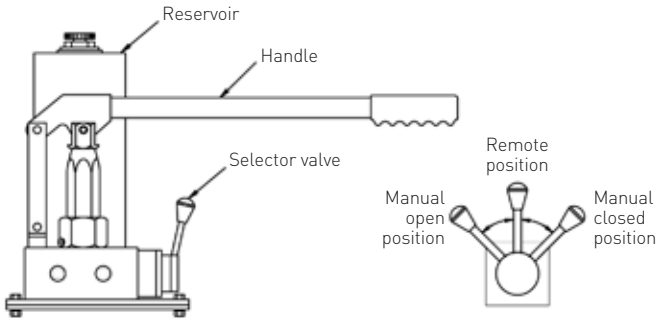
(see Figure 4)

A. ALWAYS VENT THE HYDRAULIC FLUID SUPPLY TO THE ACTUATOR BEFORE USING THE OVERRIDE. Failure to do so may damage the actuator or hydraulic power supply.
B. Maintain fluid level to 25.4 mm (1") high with piston rod extended line using ISO-22 hydraulic fluid. Use Chevron Hydraulic Oil AW or equal.
C. Open reservoir air vent when operating pump.
D. The selector control valve is set in center position for remote operation. Select left or right positions for manual open or manual close as shown on pump label.
E. Store and lock handle to keep pump plunger closed. Do not remotely operate actuator with handle on plunger.

MANUAL HAND PUMP SPECIFICATIONS

1. Reservoir fill volume = 0.20 dm^3 (12.20 in^3)
2. Pump volume/stroke = 0.01 dm^3 (0.66 in^3)
3. Handle length = 610 mm (24 in)

FIGURE 4 - HYDRAULIC OVERRIDE



3. PROXIMITY SWITCH MOUNTING

Morin actuators are available with drilled and tapped ports to accept any proximity switches with 5/8-18 UNF, 12-1 mm and 18-1 mm threads. Mounting brackets are not required.

A. Remove plastic plugs from proximity ports located on the back of the actuator housing.
B. Insert switch and turn clockwise until switch touches ferrous activator on yoke, then back off approximately 1.6 mm (1/16").
C. Test switch by stroking actuator and verifying make and break of switch.
D. Repeat procedure for second switch if required.

4. SPRING CONVERSION

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

5. 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.

6. 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.

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 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 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.

7. DISASSEMBLY - SYMMETRIC YOKE ACTUATORS

A. Remove endcap(s) (27 and 54); tie rods (41 and 50) and cylinder (24 and 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 and 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).

FIGURE 5

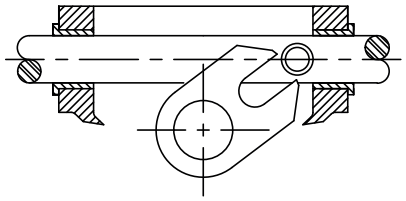


FIGURE 6

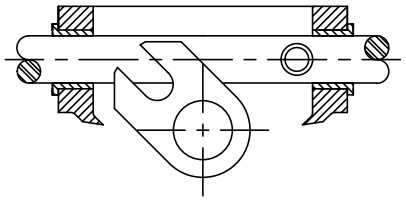
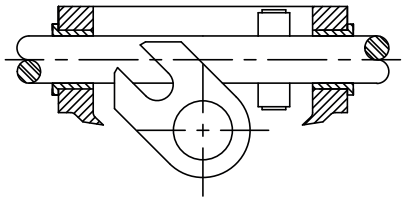


FIGURE 7



(Models HP60)

F. Remove all cover bolts (19). Three of these bolts occupy 'jack bolt' holes and are threaded into the cover (18). Screw three long cover bolts into these 'jack bolt' holes and turn them sequentially ½ turn at a time to pry the cover off. See Figure 6A.
G. Remove the thrust pin access plug (12). (Figure 5A)
H. Push the yoke (2) using the piston rod (4) until the thrust pin (9) is centered over the thrust pin access hole (See Figure 5A). Remove the upper thrust pin retaining ring (11) from the thrust pin (9) (Figure 7A).
I. Push the thrust pin (9) and lower retaining ring (11) out through the thrust pin access hole allowing the slide blocks (10) to fall free. Remove the slide blocks (10).
J. Remove the piston rod (4), piston rod bushings (7), yoke (2). Remove yoke bearings (5), and yoke seals (42) from the housing (1) and cover (18). Remove the upper and lower vent valves (22) from the back of the housing.

(Models HP65 and HP80)

D. Remove adaptor spacer (26a) (installed on models HP65 only, see Figure 7B).
E. Remove cap (15) by removing the cap bolts (15a).
F. Remove all cover bolts (19) and cover (18). Three of these bolts occupy 'jack bolt' holes and are threaded into the cover (18). Screw three long cover bolts into these 'jack bolt' holes and turn them sequentially ½ turn at a time to pry the cover off. See Figure 6B.
K. Swing the yoke (2) to one side to expose the guide block (3).
L. Unscrew the piston rod jam nuts (4b) and remove the piston rods (4 and 4a).
M. Remove the guide bar (8), thrust pin (9), guide block (3) and yoke (2).
N. Remove the yoke bearings (5).

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 and HP30)

F. Remove the pointer (16), pointer adaptor (13) and pry out the thrust plate seal (12) (if fitted).
G. Remove the thrust plate (13b) and thrust washers (22) from the output shaft (3).
H. Position the yoke (2) in the fully clockwise position (viewed from the thrust plate (13b) side).
I. 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).
J. Remove the piston rod bushings (7) from the housing (1).
K. 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).
L. Remove the lower output shaft bushing retaining ring (12b) and lower output shaft bushing (5).

FIGURE 5A

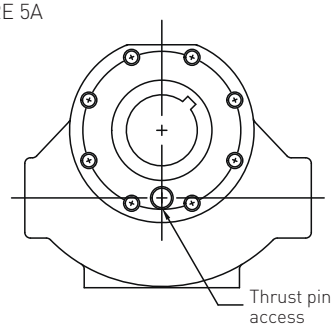


FIGURE 6A

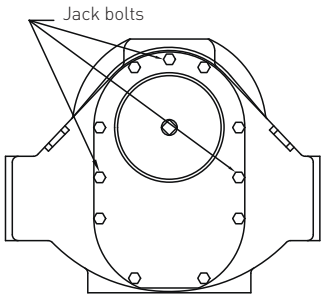


FIGURE 7A

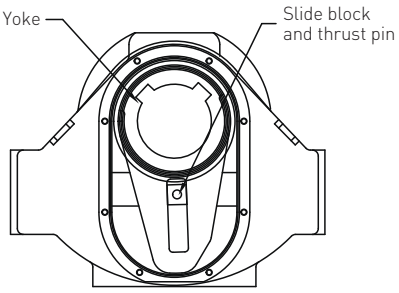
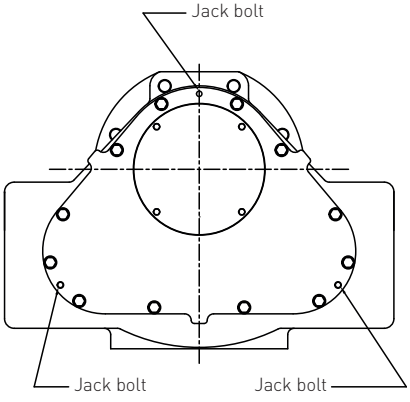


FIGURE 6B



8. 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).

(Models HP25 and 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).

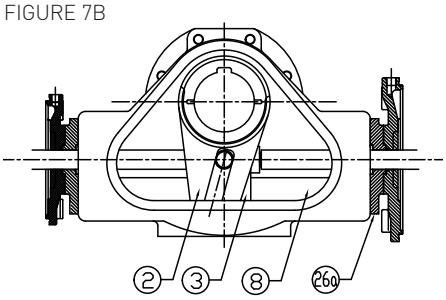
(Models HP15, HP25, HP30)

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, and 5.
I. Install plug (12a) in back of housing if applicable. Use 'Loctite 222 Thread Locker'.

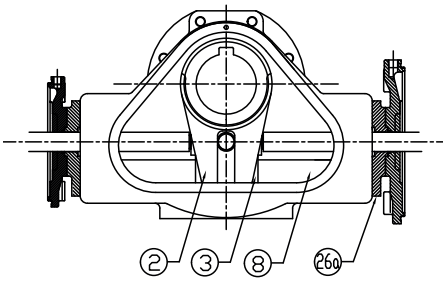
(Models HP60)

A. Install yoke seals (42) using O-ring lube and yoke bearings (5) using WD-40 into the cover (18) and housing (1).
B. Inspect the housing upper and lower vent passages and clear any blockage. Install new vent valves (22).
C. Lubricate the bearing surfaces of the yoke (2) with WD-40 and install the yoke (2) in the housing (1). Install the yoke with the marking and the pointer drive bar visible through the cover hole.
D. Install the piston rod bushings (7) and the piston rod (4).
E. Install the lower retaining ring (11) on the thrust pin (9) and lubricate the pin with Whitmore grease. Lubricate the slide blocks (10) with Whitmore grease inside and out and position them in the yoke (2) slots. Insert the thrust pin (9) through the thrust pin access hole (Figure 6A) and slide it through the lower slide block (10), piston rod (4), and upper slide block (10). Install the upper retaining ring (11) on the thrust pin (9).
F. Place joint compound on the sealing surface of the cover (18), install the cover on the housing (1), and torque the cover bolts (19) to 41 Nm (30 ft-lb). Install the short cover bolts (19) into the jack bolt holes of the cover (18).

FIGURE 7B



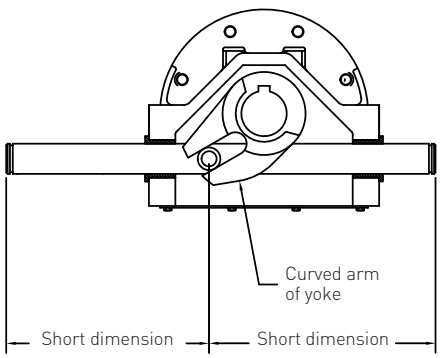
CANTED YOKE ACTUATOR



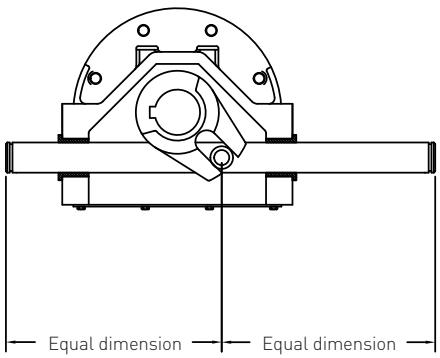
SYMMETRIC YOKE ACTUATOR

FIGURE 7C

The canted yoke piston rod is not symmetrical. It must be positioned as shown. The symmetrical yoke piston rod can be installed either way.

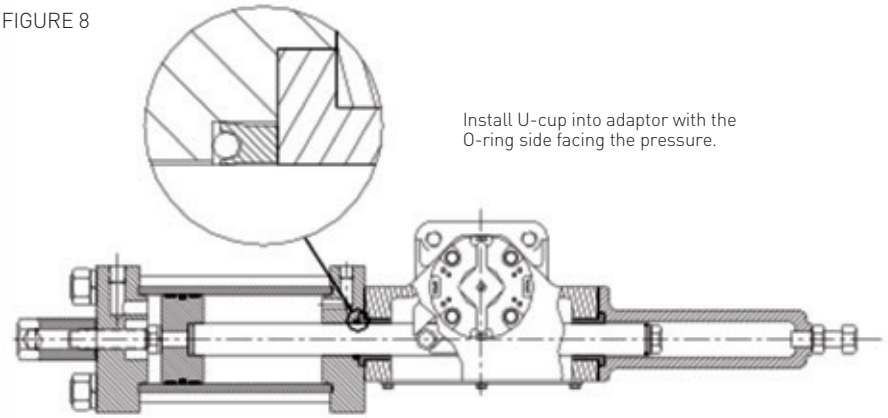


CANTED YOKE ACTUATOR
Closed position - top view



SYMMETRIC YOKE ACTUATOR
Open position - top view

FIGURE 8



(Models HP65 and HP80)

A. Install new guide bar bearing (6a) and thrust pin bearings (6b) in the guide block (3).
B. Install new yoke bearings (5) and thrust bearings (6) in housing (1) and cover (18). Position the bearing seal (10) in the yoke bearings (5) toward the inside of the housing (1).
C. Use Valvoline multi-purpose grease /GM (or equal) to lubricate all bearings including a generous amount on the thrust bearings (6).
D. Insert the yoke (2) into the housing (1).
E. Insert the guide block (3) into the housing (1) and slide the guide bar (8) through the housing (1) and through the guide block. Install the guide bar seals (12), lubricate the seals with grease, and then finish sliding the guide bar into the housing.
F. Install the piston rod bearings (7) in the housing (1).
G. Install the jam nuts (4b) on the piston rods (4) and (4a) and install the piston rods. Symmetric yoke piston rods are equal length and can be installed on either side. See Figure 7C.
H. Swing the yoke (2) over the guide block (3) and install the thrust pin (9).
I. Insert a bead of Dow Corning 732 silicone sealant on the cover (18) sealing surface and install the cover (18) on the housing (1) torquing the bolts to 8 Nm (6 ft-lb).
J. Install the cap seal (12a) and cap (15).

(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 'Locktite 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).
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 'Locktite 262 Permanent Thread Locker'. Uniformly tighten bolts. Refer to Assembly torque requirements chart (Table 1) 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 requirements chart (Table 1) 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 (41a) on tie rods (41) and uniformly tighten. Do not exceed torque values shown in Assembly torque requirements chart (Table 1).
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.

TABLE 1 - ASSEMBLY TORQUE REQUIREMENTS (Nm)

Model no.	Adaptor bolt (44)	Piston bolt (33)	Tie rod (33)	Tie rod bolt spring side (51)
HP15-2	40.7	54.2	40.7	33.9
HP15-3	40.7	203.4	203.4	33.9
HP25-3	203.4	203.4	203.4	135.6
HP25-4	203.4	203.4	339.0	339.0
HP30-4	203.4	203.4	339.0	339.0
HP30-6, HP60-6	339.0	339.0	339.0	339.0
HP30-8, HP60-8	339.0	339.0	339.0	339.0
HP65-6, HP80-6	339.0	339.0	339.0	339.0
HP65-8, HP80-8	339.0	339.0	339.0	339.0

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 requirements chart (Table 1) 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 6.4 - 12.7 mm (¼" - ½") 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 chart (Table 1).

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 and 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.

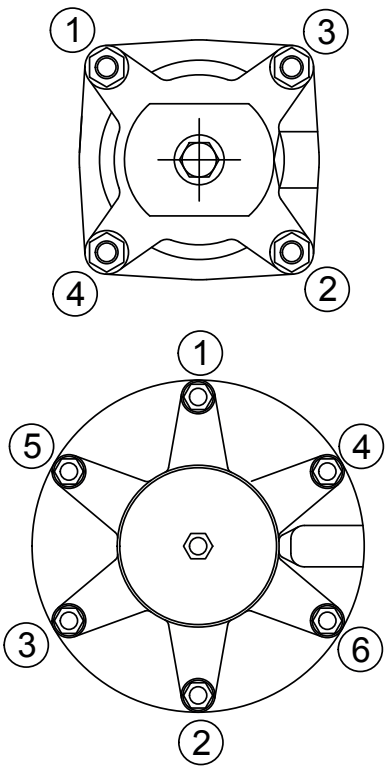
E. Insert the lower output shaft bushing (5) and retaining ring (12b). This bushing must have a press fit. The integral seal O-ring must be oriented toward the yoke.

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).

FIGURE 9 - TIE ROD TIGHTENING SEQUENCE



I. Install Pointer adaptor (13) using two socket head cap screws.

J. Install the thrust plate seal (12), pointer (16) and pointer washer (21).

(Models HP65 and HP80)

Assembly for these canted yoke actuator models is identical to the symmetric yoke models. However, the yoke (2) must be oriented as shown in Figure 7B. The left and right piston rods are different lengths. Refer to Figure 7C to assure the correct orientation.

9. 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.

10. IMPORTANT SAFEGUARDS

CAUTION: *To reduce the risk of injury:*

- Read the entire operation and maintenance instruction manual before installing, operating, or servicing this actuator.
- 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 be cocked. If there is any doubt that the actuator is in the 'failed' position, remove the air 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.
- Inspect the vent valves on models HP60-HP80 during regular maintenance periods. The valves should allow leaking fluids to escape but prevent contaminates from the surrounding atmosphere from entering the actuator. Fluid leaking from the lower valve indicates a valve stem seal leak. Fluid leaking from the upper valve indicates a leaking cylinder seal. If leakage is observed from either valve disassemble and repair the source immediately. Never replace the vent valves with plugs.
- 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.

11. ADDITIONAL SAFETY INSTRUCTIONS FOR ACTUATORS USED IN EMERGENCY SHUT-DOWN SERVICE OR IEC 61508 SAFETY INTEGRITY LEVEL (SIL) COMPLIANT INSTALLATIONS

1. The actuator will move a valve to the designated safe position per the actuator design within the specified safety time.
2. The actuator has met the systematic requirements for SIL-3.
3. The actuator is a Type A device with a hardware fault tolerance (HFT) = 0.
4. If the automated partial valve stroke test (PVST) diagnostics is used, the diagnostics time is the PVST test interval.
5. Customer is required to confirm the actuator is operated within the listed temperature limitations shown on page 1.
6. Customers may voluntarily register their actuator by contacting Morin Actuator sales department.
7. Actuators should be inspected for proper functioning and signs of deterioration every 100,000 cycles or annually (whichever comes first) under normal operating conditions. Inspect more frequently under severe operating conditions. Defects should be repaired promptly.
8. Normal operating conditions are: hydraulic oil compatible with actuator materials of construction and clean to ISO 4406 standards; operating temperature and pressures consistent with the actuator nameplate and catalog limits; environment free from excessive particulates; operating environment consistent with the actuator materials of construction. Under these conditions, actuator life can exceed a million cycles.
9. The recommended minimum operating interval is six months and a partial stroke is acceptable to confirm that the installation is functioning.
10. When an actuator has been repaired or any maintenance is performed, check the actuator for proper function (proof testing). Any failures effecting functional safety should be reported to the Pelham facility.
11. IEC 61508 (SIL) installations should consult the Morin factory to obtain the assessment and FMEDA report, which include failure data, PFDAVG, and other associated statistical data to establish or satisfy SIL level or requirements. This information is available in report MOR 12\04-064 R001 V1 R1 FMEDA.
12. Proof testing of the actuator shall be performed on the interval determined per IEC 61508 / IEC 61511 requirements. A suggested proof test is included in report MOR 12\04-064 R001 V1 R1 FMEDA. No special tools are needed. The report includes the achieved proof test coverage.
13. The technician performing a proof test should be trained in Safety Integrated Systems (SIS) operations including bypass procedures and actuator maintenance. No special tools are required.

Biffi reserves the the right to change product designs and specifications without notice.

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