

BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

FOR

CB-S SERIES SPRING RETURN

ACTUATORS MODIFIED WITH A

LOCKING YOKE MECHANISM

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1.0 INTRODUCTION

This service procedure is offered as a guide to enable general maintenance to be performed on Bettis CB Series Spring Return actuators modified to include a locked yoke mechanism.

2.0 BASIC TOOLS

All tools are American Standard inch. Two adjustable wrenches, Allen wrench set, small screwdriver with sharp edges rounded off, medium size standard slot screwdriver, external snap ring pliers, flat file, 1/2" drive ratchet, 1/2" socket set, torque wrench (up to 2,000 in. lbs.), and commercial leak testing soap solution.

3.0 REFERENCE BETTIS MATERIALS

CB415/520/725-SR-S Assembly Drawing 065885
Base I Standard Dimensional Drawing 041878
General Operating & Maintenance Instructions (P/N 074650).

4.0 GENERAL DISASSEMBLY

NOTE: Numbers in parentheses, indicate the bubble number (reference number) used on the Bettis Assembly Drawing and Actuator parts list.

- 4.1 Remove all operating pressure from actuator, allowing the spring to stroke. The spring will rotate the yoke to fail position.
- 4.2 Remove all piping and accessories mounted on the actuator.
- 4.3 Remove actuator from valve and valve mounting bracket.
- 4.4 Disassembly should be done in a clean area on a work bench.
- 4.5 Loosen and remove hex nut (2-90) and stop screw (2-80) assembly. Stop screw (2-80) and hex nut (2-90) are pinned together making an assembly that is removed as one piece. Remove seal washer (3-80) and screw thread seal (3-70) from housing stop screw.

5.0 SPRING CYLINDER DISASSEMBLY

NOTE: The spring in CB Series Spring Return Units is preloaded. Unit must be disassembled in the following manner.

- 5.1 Remove acorn nut (2-110) from end cap (2-20) of center bar assembly (2-50).
- 5.2 Using a (1/2" drive) ratchet and socket on the welded nut, located on the housing end of the center bar (2-50), rotate the center bar counter-clockwise (CCW). This will cause the spring cylinder end cap (2-20) to gradually unscrew from the center bar (2-50).

- 5.3 Continue to rotate the center bar (2-50) counter-clockwise (CCW) until the spring preload is eliminated. As the preload is reduced it may be necessary to keep the spring cylinder end cap (2-20) from turning by holding the end cap stop screw nut (2-90) with an adjustable wrench.
- 5.4 After the spring preload is eliminated, unscrew the spring cylinder end cap (2-20) from the center bar (2-50). It is not necessary to remove the end cap stop screw (2-70) to service the actuator. If the end cap stop screw must be removed, the setting of the stop screw should be checked and recorded before removal.
- 5.5 Remove the spring (4) from within spring cylinder (2-10).
- 5.6 Hold housing torque shaft (1-30) with an adjustable wrench and pull cylinder (2-10) away from housing (1-10); slide cylinder over piston (2-30) and remove.
- 5.7 Pull piston (2-30) out of housing (1-10) and carefully slide piston off of center bar (2-50).
- 5.8 Using a small screwdriver with sharp edges rounded off, remove piston cylinder seal (3-60) and piston center bar seal (3-50).

6.0 HOUSING DISASSEMBLY

- 6.1 On actuators equipped with a cylinder adapter (2-140) CB415-SR, CB520-SR, and CB725-SR, remove cylinder gasket (3-20) from cylinder adapter (2-140) and remove cylinder adapter (2-140) from housing (1-10).
- 6.2 Remove cylinder gasket (3-30) from housing (1-10).
- 6.3 Slide the center bar (2-50) out of housing (1-10) and remove center bar thread seal (3-90) and washer seal (3-15) from center bar assembly (2-50).
- 6.4 Remove both snap rings (1-80) from torque shaft (1-30).
- 6.5 The following steps may need to be taken before disassembly can continue.
 - 6.5.1 If the torque shaft has any raised burrs or sharp edges they should be filed off, removing as little metal as possible.
 - 6.5.2 If there is excessive paint build-up on torque shaft it should be removed.
- 6.6 Push the torque shaft (1-30) out one side of housing (1-10) until torque shaft o-ring seal (3-40) is clear of housing. Remove o-ring seal (3-40) from torque shaft using small screw driver with sharp edges rounded off.
- 6.7 Push torque shaft (1-30) back thru housing and pull torque shaft completely out of housing while holding yoke key (1-50) in with your fingers.
- 6.8 Remove yoke key (1-50) and yoke key spring (1-70) from torque shaft (1-30).

- 6.9 Remove second o-ring seal (3-40) from torque shaft (1-30) using the small screwdriver with sharp edges rounded off
- 6.10 Remove yoke (1-20) from housing (1-10).

7.0 PREASSEMBLY NOTES

- 7.1 Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.
- 7.2 Before starting the assembly of an actuator, all parts should be thoroughly cleaned, inspected and de-burred as necessary. Particular attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding motion. After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.

8.0 LUBRICATION REQUIREMENTS

- 8.1 Standard and high temperature service (-20 degrees F to +350 degrees F) use Kronaplate 100 grease. Kronaplate 100 is a petroleum base Grade NLGI No. 2 with molybdenum disulfide EP additive or equivalent.

9.0 GENERAL REASSEMBLY

- 9.1 Apply a light coating of grease to the housing (1-10) torque shaft holes.
- 9.2 Coat the yoke (1-20) with grease and insert into housing (1-10) with yoke arms pointing outward. The notched yoke arms must be laced in the housing so that the notches are located closest to the stop screw (2-80).
- 9.3 Insert the yoke key spring (1-70), with the ends pointing down, into the slot in the torque shaft (1-30) and place the yoke key (1-50) on top of the spring with the tapered side outward. (Refer to assembly drawing 065885.)
- 9.4 Hold the yoke key (1-50) down with your thumb, insert the torque shaft (1-30) into and thru the housing and yoke. Rotate the torque shaft until the yoke key snaps into the keyway in the yoke.
- 9.5 Push the torque shaft out of one side of the housing until the o-ring groove is clear of the housing.
- 9.6 Coat one of the torque shaft seals (3-40) with grease and install in the o-ring groove of the torque shaft (1-30).
- 9.7 Carefully push the torque shaft back into the housing until the o-ring groove on the opposite end of the torque shaft is just clear of the housing.
- 9.8 Coat the remaining torque shaft o-ring seal (3-40) with grease and install in the o-ring groove of the torque shaft (1-30).

- 9.9 Install one of the torque shaft retaining rings (1-80) onto the torque shaft, making certain it is properly seated in the shaft groove.
- 9.10 Push the torque shaft back into the housing and install the remaining retaining ring (1-80) on the torque shaft.
- 9.11 Rotate the torque shaft so that the yoke arms point outward.
- 9.12 Apply a generous amount of grease to the slots in the yoke arms.
- 9.13 Carefully slide the washer seal (3-15) (chamfered side away from welded nut) and then the center bar thread seal (3-90) onto the center bar assembly (2-50) until they rest against the welded nut.
- 9.14 Insert the center bar assembly (2-50) into the center hole of housing (1-10) and slide center bar assembly thru housing until thread seal (3-90), washer seal (3-15), and welded nut are flush against the housing.
 - 9.14.1 Care should be taken during installation of the center bar so as to not scratch it.
- 9.15 Coat the cylinder gasket (3-30) with grease and install on housing flange.
 - 9.15.1 On actuators equipped with a cylinder adapter (2-140) CB415-SR, CB520-SR, and CB725-SR, install the cylinder adapter (2-140) onto the housing flange, with the stepped outer diameter facing away from the housing, and place a greased cylinder gasket (3-20) onto the stepped diameter on the cylinder adapter (2-140).

10.0 SPRING CYLINDER REASSEMBLY

- 10.1 Coat the center bar assembly (2-50) with grease, being sure to coat the exposed threads.
- 10.2 Coat the piston center bar o-ring seal (3-50) with grease and install in the internal groove in the piston head (2-30).
- 10.3 Coat the piston cylinder seal (3-60) with grease and install onto the piston.
- 10.4 Coat the heel of the piston along with the yoke pin (1-40) with grease.
- 10.5 With the piston head facing away from the housing (1-10) and with the yoke pin (1-40) up, carefully slide the piston (2-30) onto the center bar (2-50).
- 10.6 Slide the piston (2-30) along the center bar (2-50) until the yoke pin (1-40) engages the yoke slots (1-20). Push the piston into the housing as far as it will go, while holding the center bar flush against the housing.
- 10.7 Apply a thin coating of grease to the cylinder (2-10) bore.

- 10.8 Slip the end of the cylinder (2-10) over the piston and onto the housing (1-10) cylinder flange.
 - 10.8.1 Cylinder will slip onto cylinder adapter on CB415/520/725 units.
- 10.9 Apply a coat of grease on the spring and carefully slide the spring (4) into the open cylinder until it contacts the piston.
- 10.10 Screw the spring cylinder end cap (2-20) onto the center bar (2-50) until it just touches the spring (4).
- 10.11 Orientate the spring cylinder end cap (2-20) so that the breather port is at the bottom and the stop screw (2-70) is at the top.
- 10.12 Keep the spring cylinder end cap (2-20) from turning by holding the end cap stop screw nut (2-90) with a wrench.
- 10.13 Using a (1/2" drive) ratchet and socket on the welded nut, located on the housing end of the center bar (2-50), rotate the center bar clockwise (CW) This will cause the spring cylinder end cap (2-20) to gradually screw further onto the center bar assembly (2-50).
- 10.14 Continue to rotate the center bar (2-50) clockwise until the spring (4) is fully compressed, the cylinder is seated against the housing flange (1-10) or adapter (2-140) and the spring cylinder end cap (2-20) is properly seated against the cylinder (2-10).
- 10.15 Tighten the center bar to the proper torque as specified in Chart 1.
- 10.16 Place the acorn nut (2-110) on the exposed end of the center bar and tighten securely.
- 10.17 Slip the washer seal (3-80) onto the stop screw with the chamfer facing away from the pinned hex nut (2-90).
- 10.18 Thread the stop screw thread seal (3-70) onto the stop screw (2-80) until it is flush with the washer seal (3-80).
- 10.19 Insert the stop-screw (2-80) into the housing (1-10) and screw in until hex nut (2-90), washer seal (3-80), and thread seal (3-80) contact the housing (1-10).
- 10.20 If removed, adjust stop screw (2-70) back to setting recorded in Section 5, Step 5.4. Tighten stop screw hex nut (2-90) securely, while holding stop screw (2-70).

11.0 ACTUATOR TESTING

11.1 ~~Leakage Test~~

All areas where leakage to atmosphere may occur are to be checked using a soapy solution.

11.2 ~~Procedure:~~

11.2.1 Cycle the actuator five times at the Nominal Operating Pressure (NOP) as per Chart 2 (for the model being tested). This will allow the seals to seek their proper working attitude.

11.2.2 Stroke the actuator with the Nominal Operating Pressure (NOP) and allow the unit to stabilize.

11.2.3 Apply a leak testing soap solution to the following areas:

11.2.3.1 Cylinder to housing joint on CB315-SR, CB420-SR, and CB525-SR or cylinder to cylinder adapter to housing joints on CB415-SR, and CB725-SR actuators.

11.2.3.2 Center bar seal and nut to housing.

11.2.3.3 Housing stop-screw and stop screw thread seal.

11.2.3.4 Torque shaft seals.

11.2.3.5 Cylinder breather.

11.2.4 If excessive leakage across the piston is noted (generally a bubble which breaks three seconds or less after starting to form), the unit must be disassembled and the cause of leakage must be determined and corrected.

11.2.5 If an actuator was disassembled and repaired as a result of this procedure, the above leakage test must be performed again.

11.3 ~~Operational (Functional) Test~~

This test is used to verify proper function of the actuator and its' related system (accessories). THIS TEST IS TO BE DONE OFF OF THE VALVE OR WHEN VALVE STEM IS NOT COUPLED TO THE ACTUATOR TORQUE PLUG.

11.4 ~~Procedure:~~

11.4.1 Adjust the pressure regulator to the pressure rating indicated in column 'B' of Chart 2, on the following pages for the model actuator being tested.

- 11.4.2 Apply the above pressure to the actuator and allow the unit to stabilize. The actuator should stroke a full 90 degrees travel with the stops properly set.
- 11.4.3 Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity must be corrected and the above test performed again.
- 11.4.5 All accessories, including solenoid valves, positioners, pressure switches, etc., must be hooked up at this point and tested for proper operations and replaced if found defective.

12.0 RETURN TO SERVICE

- 12.1 Re-install actuator to valve mounting bracket and valve.
- 12.2 Re-install any piping and accessories that were removed.
- 12.3 Refer to General Operating & Maintenance Instructions for Pneumatic Rotary Valve Actuators (P/N 074650) for actuator start-up procedures.

CHART 1

TORQUE REQUIREMENTS

FOR CB-SERIES SPRING RETURN CENTER BARS

ACTUATOR MODEL	MAXIMUM TORQUE	
	INCH POUNDS	FOOT POUNDS
CB315-SR	660	55
CB415-SR	660	55
CB420-SR	1,200	100
CB520-SR	1,200	100
CB525-SR	1,560	130
CB725-SR	1,560	130

CHART 2
PRESSURE REQUIREMENTS AND LIMITATIONS FOR
CB SERIES - SPRING RETURN ACTUATORS

ACTUATOR MODEL	NOMINAL OPERATING PRESSURE	MAXIMUM OPERATING PRESSURE	MAXIMUM HYDROSTATIC TEST PRESS.	MAXIMUM AIR ASSIST PRESSURE	COLUMN "B" SPRING SELECTION PRESSURE
CB315-SR40	40	145	240	129	28
CB315-SR60	60	160	240	136	42
CB315-SR80	80	170	240	138	56
CB315-SR100	100	180	240	141	70
CB415-SR40	40	90	160	74	30
CB415-SR60	60	100	160	76	44
CB415-SR80	80	115	160	83	57
CB415-SR100	100	130	160	96	75
CB420-SR40	40	140	240	126	29
CB420-SR60	60	155	240	134	45
CB420-SR80	80	165	240	137	58
CB420-SR100	100	180	240	145	75
CB520-SR40	40	100	160	87	30
CB520-SR60	60	110	160	88	44
CB520-SR80	80	125	160	96	59
CB520-SR100	100	135	160	94	78
CB525-SR40	40	160	240	144	28
CB525-SR60	60	175	240	152	42
CB525-SR80	80	190	240	160	57
CB525-SR100	100	200	240	162	72
CB725-SR40	40	95	160	79	28
CB725-SR60	60	105	160	81	44
CB725-SR80	80	120	160	89	58
CB725-SR100	100	135	160	100	75

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SP 18087-105
Brazil
T +55 15 3238 3788
F +55 15 3228 3300

ASIA PACIFIC

No. 9 Gul Road
#01-02 Singapore 629361
T +65 6501 4600
F +65 6268 0028

No.1 Lai Yuan Road
Wuqing Development Area
Tianjin 301700
P.R.China
T +86 22 8212 3300
F +86 22 8212 3308

MIDDLE EAST & AFRICA

P. O. Box 17033
Dubai
United Arab Emirates
T +971 4 811 8100
F +971 4 886 5465

P. O. Box 10305
Jubail 31961
Saudi Arabia
T +966 3 340 8650
F +966 3 340 8790

24 Angus Crescent
Longmeadow Business Estate
East P.O. Box 6908; Greenstone
1616 Modderfontein, Extension 5
South Africa
T +27 11 451 3700
F +27 11 451 3800

EUROPE

Berenyi u. 72- 100
Videoton Industry Park,
Building #230
Székesfehérvár 8000
Hungary
T +36 22 530 950
F +36 22 543 700

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