

GH BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

CB315-SRXX-12, CB415-SRXX-12, CB420-SRXX-12,
CB520-SRXX-12, CB525-SRXX-12, AND CB725-SRXX-12

SPRING RETURN

-12 TRIM SERIES ACTUATORS

PART NUMBER 72005

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1.0 INTRODUCTION

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH Bettis CB -12 Trim Spring Return Series Actuators.
- 1.2 The maximum recommended service interval for this actuator series is six hundred twenty-five cycles or five years which ever occurs first.

**COMPLETE ACTUATOR REFURBISHMENT
REQUIRES THAT THE ACTUATOR BE
DISMOUNTED FROM THE VALVE**

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 screwdriver, diagonal cutting pliers, external snap ring pliers, flat file, 1/2" drive ratchet and deepwell socket set, torque wrench (up to 2,000 in.lbs.), commercial leak testing solution, and non-hardening thread sealant.

3.0 REFERENCE GH BETTIS MATERIALS

- 3.1 CB315-SR-12, CB420-SR-12, CB525-SR-12 Assembly Drawing Part No. 72406.
- 3.2 CB315-SR-12, CB420-SR-12, CB525-SR-12 Exploded Detail Part No. 72405.
- 3.3 CB415-SR-12, CB520-SR-12, CB725-SR-12 Assembly Drawing Part No. 72407.
- 3.4 CB415-SR-12, CB520-SR-12, CB725-SR-12 Exploded Detail Part No. 72404.
- 3.5 General Operating & Maintenance Instructions Part Number 71584.

4.0 GENERAL

- 4.1 Numbers in parentheses, () indicate the bubble number (reference number) used on the GH Bettis Assembly Drawings, Exploded Detail, and Actuator Parts List.
- 4.2 When removing or installing seals, use a small screwdriver with sharp edges rounded off or use a commercial seal removing tool.
- 4.3 Use a non-hardening thread sealant on all pipe threads.
- 4.4 Disassembly must be done in a clean area on a work bench.
- 4.5 LUBRICATION REQUIREMENTS. Dow Corning Molykote 44 (medium grade).

5.0 GENERAL DISASSEMBLY

- 5.1 The setting of the stop screws (2-70 & 2-80) should be checked and setting recorded before stop screws are loosened or removed.

- 5.2 Remove all operating pressure from actuator, allowing the spring to stroke. The spring will rotate to the fail position.
- 5.3 Remove all piping and accessories mounted on the actuator.
- 5.4 Remove actuator from valve and valve mounting bracket.
- 5.5 Loosen and remove hex nut (2-90) from housing stop screw (2-80). Remove seal washer (3-80) and screw thread seal (3-70) from housing stop screw.
- 5.6 Remove stop screw (2-80).

6.0 SPRING CYLINDER DISASSEMBLY

- 6.1 The spring in CB Series Spring Return Units is preloaded. Unit must be disassembled in the following manner.
- 6.2 Remove acorn nut (2-110) from spring cylinder end cap (2-20) of center bar assembly (2-50).
- 6.3 Using a (1/2" drive) ratchet and socket on the welded nut, located on the housing end of the center bar assembly (2-50), rotate the center bar assembly counter-clockwise (CCW). This will cause the spring cylinder end cap (2-20) to gradually unscrew from the center bar assembly (2-50).
- 6.4 Continue to rotate the center bar assembly (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.
- 6.5 After the spring preload is eliminated, unscrew the spring cylinder end cap (2-20) from the center bar assembly (2-50). It is not necessary to remove the end cap stop screw (2-70) to service the actuator.
- 6.6 Remove the spring (4) from within spring cylinder (2-10).
- 6.7 Hold housing torque shaft (1-30) with a wrench and pull cylinder (2-10) away from housing (1-10); slide cylinder over piston (2-30) and remove.
- 6.8 Pull piston (2-30) out of housing (1-10) and carefully slide piston off of center bar assembly (2-50). All -12 Trim Actuators were manufactured with a double lip seal piston. The double lip seal is no longer available and is replaced by a T-seal. This will require a new T-seal style piston.
 - 6.8.1 Roll pin(1-60) and yoke pin (1-40) are removed as part of the piston (2-30).
- 6.9 Remove piston cylinder seal (3-60) and piston center bar seal (3-50).

7.0 **HOUSING DISASSEMBLY**

- 7.1 On actuators equipped with a cylinder adapter (2-140) CB-415-SR-12, CB-520-SR-12 and CB-725-SR-12, remove cylinder gasket (3-20) from cylinder adapter (2-140) and remove cylinder adapter (2-140) from housing.
- 7.2 Remove cylinder gasket (3-30) from flange of housing (1-10).
- 7.3 Slide center bar assembly (2-50) out of housing (1-10).
- 7.4 Cut and remove gasket seal (3-10) from center bar.
- 7.5 Remove both retaining rings (1-80) from torque shaft (1-30). Do not reuse retaining rings if new ones are provided in the seal/service kit.
- 7.6 The following steps may need to be taken before disassembly can continue.
 - 7.6.1 If the torque shaft has any raised burrs or sharp edges they should be filed off, removing as little metal as possible.
 - 7.6.2 If there is excessive paint build-up on torque shaft it should be removed.
- 7.7 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.
- 7.8 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.
- 7.9 Remove yoke key (1-50) and yoke key spring (1-70) from torque shaft (1-30).
- 7.10 Remove second o-ring seal (3-40) from torque shaft (1-30).
- 7.11 Remove yoke (1-20) from housing (1-10).
- 7.12 Remove the breather (2-130) from the end cap (2-20), discard if the seal/service kit contains a new breather of like design.

8.0 **PRE-ASSEMBLY NOTES**

- 8.1 Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.
- 8.2 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.
- 8.3 After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.
- 8.4 Coat all seals with lubricant, before installing into the seal grooves.

9.0 **GENERAL RE-ASSEMBLY**

- 9.1 Apply a light coating of lubricant to the housing (1-10) torque shaft holes.
- 9.2 Coat the yoke (1-20) with lubricant and insert into housing (1-10).
- 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 for correct key orientation.
- 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 Lightly coat one of the torque shaft o-ring seals (3-40) with lubricant and install on 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 Lightly coat the remaining torque shaft o-ring seal (3-40) with lubricant and install on 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 lubricant to the slots in the yoke arms.
- 9.13 Lightly coat the center bar assembly (2-50) with lubricant, being sure to coat the exposed threads.
- 9.14 Lightly coat the gasket seal (3-10) with lubricant and carefully slide onto the center bar (2-50) until it rests against the welded nut.
- 9.15 Insert the center bar assembly (2-50) into the center hole of housing (1-10) and slide center bar assembly through housing until seal gasket (3-10) and welded nut are flush against the housing.
 - 9.15.1 Care should be taken during installation of the center bar so as to not scratch it.
- 9.16 Install cylinder gasket (3-30) on housing flange.

- 9.16.1 On actuators equipped with a cylinder adapter (1-140), CB-415-SR-12, CB-520-SR-12 AND CB-725-SR-12, install the cylinder adapter (2-140) onto the housing flange, with the stepped outer diameter facing away from the housing flange, and place a cylinder gasket (3-20) onto the stepped diameter on the cylinder adapter.

10.0 SPRING CYLINDER RE-ASSEMBLY

- 10.1 Lightly reacoat the center bar assembly(2-50) with lubricant.
- 10.2 Lightly coat the piston center bar o-ring seal (3-50) with lubricant and install in the internal groove in the head of piston (2-30).
- 10.3 Lightly coat the piston cylinder T-seal (3-60) with lubricant and install onto the piston.
- 10.3.1 T-Seal is composed of rubber (EP) seal and two back-up rings. The rings serve as anti-extrusion back-ups.
- 10.4 Lightly coat the head of the piston along with the exposed ends of yoke pin (1-40) with lubricant.
- 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 assembly (2-50).
- 10.6 Slide the piston (2-30) along the center bar assembly (2-50) until the yoke pin (1-40) engages the yoke slots. Push the piston into the housing as far as it will go, while holding the center bar assembly flush against the housing.
- 10.7 Apply a very thin coating of lubricant to the cylinder bore of cylinder (2-10).
- 10.7.1 **CAUTION:** EXCESS LUBRICANT IN THE CYLINDER BORE MAY CAUSE ERRATIC OR JUMPY/JERKY OPERATION.
- 10.8 Slip the lubricated cylinder (2-10) over the piston and onto the flange of housing (1-10).
- 10.8.1 Cylinder (2-10) will slip onto the flange of cylinder adapter (2-140) on CB415-SR-12, CB520-SR-12, and CB725-SR-12 models.
- 10.9 Apply a coat of lubricant on the spring and carefully slide the spring (4) into the open cylinder until it contacts the piston head.
- 10.10 Screw the spring cylinder end cap (2-20) onto the center bar assembly (2-50) until it just touches the spring (4).
- 10.11 Position 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 (2-90) with a wrench.

- 10.13 Using a (1/2" drive) ratchet (or an impact wrench) and socket on the welded nut, located on the housing end of the center bar assembly (2-50), rotate the center bar assembly 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 assembly (2-50) clockwise until the spring (4) is fully compressed, the cylinder is seated against the housing flange 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 assembly 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 assembly (2-50) and tighten securely.
- 10.17 Lightly coat stop screw (2-80) with lubricant and insert into the housing (1-10) and screw in until stop screw contacts the piston.
- 10.18 Lightly coat stop screw thread seal (3-70) with lubricant and thread onto the stop screw (2-80) until it is flush with the housing.
- 10.19 Slip the washer seal (3-80) onto the stop screw with the chamfer facing the thread seal (3-70).
- 10.20 Thread the stop screw nut (2-90) onto the stop screw (2-80) until hand tight.
- 10.21 If removed, thread stop screw (2-70) into end cap (2-20).
- 10.22 If removed, thread the remaining stop screw hex nut (2-90) onto SR stop screw (2-70).
- 10.23 Adjust both stop screws (2-70 & 2-80) back to setting recorded in Step 5.1 under General Disassembly. Tighten both stop screw hex nuts (2-90) securely, while holding stop screw (2-70 & 2-80).
 - 10.23.1 If the stop screw settings were not recorded and cannot be determined, then refer to Operating & Maintenance Instructions For Initially Setting Travel Stop Screws on CB-Series Spring Return Actuators', procedure number Service-043.

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 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 Nominal Operating Pressure and allow the unit to stabilize.
- 11.2.3 Apply a leak testing solution to the following areas:
 - 11.2.3.1 Cylinder to housing joint on CB315-SR-12, CB420-SR-12, and CB525-SR-12 or cylinder to cylinder adapter to housing joints on CB415-SR-12, CB520-SR-12, and CB725-SR-12 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. **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° travel with the stops properly set.

12.0 RETURN TO SERVICE

- 12.1 If removed, replace or re-install breather (2-130) into end cap (2-20).
- 12.2 Re-install actuator to valve mounting bracket and valve.
- 12.3 Re-install any piping and accessories that were removed.
- 12.4 All accessories, including solenoid valves, positioners, pressure switches, etc., should be hooked up at this point and tested for proper operations and replaced if found defective.
- 12.5 Refer to General Operating & Maintenance Instructions for -12 Trim Series Actuators Part Number 71548 for actuator start-up procedures.

CHART 1

TORQUE REQUIREMENTS

FOR CB SERIES CENTER BARS

<u>ACTUATOR MODEL</u>	MAXIMUM TORQUE	
	<u>IN.LBS.</u>	<u>FT.LBS.</u>
CB315-SRXX-12	660	55
CB415-SRXX-12	660	55
CB420-SRXX-12	1,200	100
CB520-SRXX-12	1,200	100
CB525-SRXX-12	1,560	130
CB725-SRXX-12	1,560	130

CHART 2

**PRESSURE REQUIREMENTS & LIMITATIONS
FOR CB SERIES
SPRING RETURN ACTUATORS**

<u>ACTUATOR MODEL</u>	<u>NOMINAL OPERATING PRESSURE</u>	<u>MAXIMUM OPERATING PRESSURE</u>	<u>MAXIMUM HYDROSTATIC TEST PRESSURE</u>	<u>MAXIMUM AIR ASSIST PRESSURE</u>	<u>COLUMN B SPRING SELECTION PRESSURE</u>
CB315-SR40-12	40	145	240	98	28
CB315-SR60-12	60	160	240	86	42
CB315-SR80-12	80	170	240	74	56
CB415-SR40-12	40	90	160	56	30
CB415-SR60-12	60	100	160	48	44
CB415-SR80-12	80	115	160	33	57
CB420-SR40-12	40	140	240	96	29
CB420-SR60-12	60	155	240	83	45
CB420-SR80-12	80	165	240	71	58
CB520-SR40-12	40	100	160	55	30
CB520-SR60-12	60	110	160	43	44
CB520-SR80-12	80	125	160	31	59
CB525-SR40-12	40	160	240	97	28
CB525-SR60-12	60	175	240	84	42
CB525-SR80-12	80	190	240	71	57
CB725-SR40-12	40	95	160	56	28
CB725-SR60-12	60	105	160	43	44
CB725-SR80-12	80	120	160	30	58

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