BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY AND REASSEMBLY

FOR CBA-SR SPRING RETURN SERIES

MODELS CBA150.X, CBA201.X AND CBA251.X

HYDRAULIC ACTUATORS

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CONTENTS

1.0 INTRODUCTION

1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis CBA150.8-SR, CBA201.X-SR, and CBA251.X-SR spring return series hydraulic actuators.

1.2 When the actuator model number has "-S" as a suffix then the actuator is special and may have some differences that may not be included in this procedure.

2.0 DEFINITIONS

WARNING: If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.

CAUTION: If not observed, user may incur damage to actuator and/or injury to personnel.

NOTE: Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.

3.0 SAFETY

3.1 SAFETY STATEMENT: Products supplied by Bettis, in its "as shipped" condition, are intrinsically safe if the instructions contained within this Service Instruction are strictly adhered to and executed by well trained, equipped, prepared and competent personnel.

WARNING: For the protection of personnel working on Bettis actuators, this procedure should be reviewed and implemented for safe disassembly and reassembly. Close attention should be noted to the WARNINGS, CAUTIONS and NOTES contained in this procedure.

WARNING: This procedure should not supersede or replace any customer’s plant safety or work procedures. If a conflict arises between this procedure and the customer’s procedures the differences should be resolved in writing between an authorized customers representative and an authorized Bettis representative.

4.0 BASIC SERVICE INFORMATION

4.1 This procedure should only be implemented by technically competent technicians who should take care to observe good workmanship practices.

4.2 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on the Bettis Assembly Drawing and Actuator Parts List.

4.3 Complete actuator refurbishment requires the actuator be dismounted from the valve or device it is operating.

4.4 Normal recommended service interval for this actuator series is five years to maximum total life cycle.

NOTE: Storage time is counted as part of the service interval.

4.5 Use a non-hardening thread sealant on al pipe threads.

CAUTION: Apply thread sealant per the manufacture's instructions.

5.0 SUPPORT ITEMS AND TOOLS

5.1 **Support Items** - Service Kit and non-hardening thread sealant.

5.2 **Tools** - All tools are American Standard inch. Two adjustable wenches, Allen Wrench set, small standard screwdriver with sharp edges rounded off, medium size standard screwdriver, rubber or leather mallet, flat file, 1/2" inch drive ratchet/deep well socket set, torque wrench (up to 2,000 inch pound or 226 N-m).

6.0 BETTIS REFERENCE MATERIALS

6.1 CBAXXX.X-SR assembly drawing part number 129752.

7.0 LUBRICATION

7.1 LUBRICATION REQUIREMENTS HOUSING AND SPRING CYLINDER:

NOTE: The actuator should be re-lubricated at the beginning of each service interval using the following recommended lubricants. Lubricant other than those listed in step 4.6.1 should not be used without prior written approval of Bettis Product Engineering.

7.1.1 Standard, Low and High temperature service (-50°F to +350°F) (-45.5°C to +176.6°C) use Bettis ESL-5 lubricant. ESL-5 is contained in the Bettis Service Kit.

7.2 FLUID REQUIREMENTS HYDRAULIC RAM CYLINDER:

NOTE: Fluid to be used in the hydraulic power ram cylinder. The following listed fluids are recommended fluids only and should not limit the use of other hydraulic fluids compatible with supplied seals and coatings.

7.2.1 Standard and High temperature service (-35°F to +350°F) (-37.2°C to +176.6°C) use Dexron Automatic Transmission Fluid.

7.3.2 Low temperature service (-65°F to +180°F) (-53.8°C to +82.2°C) use Exxon Univis J13 Hydraulic Fluid.

8.0 GENERAL DISASSEMBLY

8.1 This procedure is applicable with the understanding that all electrical power and hydraulic pressure has been removed from the actuator. Also, it is understood that the actuator has been removed from the valve as well as all piping and accessories that are mounted on the actuator have been removed.

NOTE: In place of stop screws (4-30) and (6-30) the actuator may be equipped with one or two ETS (ETS = Extended Travel Stops).

8.2 Record the settings of stop screw (4-30) and (6-30) before stop screws are loosened or removed.

8.3 Loosen and remove hex nut (4-40) from stop screw (4-30).

8.4 Loosen and remove stop screw (4-30) from housing (1-10).

8.5 Loosen and remove hex nut (6-40) from stop screw (6-30).

8.6 Loosen and remove stop screw (6-30) from SR end cap (6-20).

8.7 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp edges rounded off.

8.8 Disassembly should be done in a clean area on a workbench.

9.0 SPRING CYLINDER DISASSEMBLY

NOTE: Review Sections 1 through 8 before proceeding with Spring Cylinder Disassembly.

CAUTION: The spring in CBA Series Spring Return Actuators are preloaded.

WARNING: Actuator must be disassembled in the following manner.

9.1 Remove acorn nut (8-20) and gasket seal (7-50) from SR end cap (6-20).

9.2 Use a ratchet and socket on the welded nut, located on the hydraulic ram cylinder end of center bar assembly (8-10), rotate center bar assembly (8-10) counter-clockwise (CCW). This will cause SR end cap (6-20) to gradually unscrew from center bar assembly (8-10).

NOTE: The SR end cap (6-20) can be held in position by holding the SR end cap (6-20) with an adjustable wrench.

9.3 Continue to rotate center bar assembly (8-10) counter-clockwise (CCW) until the spring preload is eliminated. As preload is reduced it may be necessary to keep SR end cap (6-20) from turning.

9.4 After the spring preload is eliminated, unscrew and remove SR end cap (6-20) from center bar assembly (8-10).

9.5 Remove spring (6-70) from within spring cylinder (6-10).

9.6 Hold the torque shaft (1-30) and pull spring cylinder (6-10) away from housing (1-10); slide spring cylinder over spring guide assembly (6-50) and remove.

NOTE: The Spring guide assembly (6-50) is an assembly made up of the spring guide assembly (3), roll pin, and yoke pin. Do not attempt to disassemble the spring guide assembly.

9.7 Remove spacer (6-25) from center bar assembly (8-10).

9.8 Pull spring guide assembly (6-50) out of housing (1-10) and carefully slide spring guide assembly off of center bar assembly (8-10).

9.9 CBA models with cylinder adapter (6-15) remove cylinder adapter.

9.10 It is not necessary to remove pipe plug (31) from the SR end cap (6-20).

10.0 HYDRAULIC POWER RAM CYLINDER DISASSEMBLY

10.1 Remove center bar assembly (8-10) from end cap (4-20).

10.2 When center bar assembly (8-10) is removed the following items will come apart: Housing adapter (4-15), ram cylinder (4-10), ram (4-50) and end cap (4-20).

11.0 HOUSING DISASSEMBLY

118.1 Remove the setscrew (1-60) from yoke (1-20) and torque shaft (1-30).

11.2 The following steps may be required before disassembly can continue.

11.2.1 When the torque shaft (1-30) has raised burrs or sharp edges they should be removed.

NOTE: When removing burrs and sharp edges, remove as little metal as possible.

11.2.2 When there is excessive paint build-up on torque shaft it should be removed.

11.3 Remove the torque shaft (1-30) by pushing it out one side of housing (1-10).

11.4 Remove yoke key (1-40) and yoke key spring (1-50) from torque shaft (1-30).

11.5 Remove yoke (1-20) from housing (1-10).

11.6 Remove bushing (2-10) from between the arms of yoke (1-20).

11.7 Remove vent check (30) from housing (1-10).

12.0 PREASSEMBLY NOTES

CAUTION: Only new seals that are still within the seal's expectant shelf life should be install into actuator being refurbished.

12.1 Remove and discard all old seals and gasket seals.

12.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.

12.3 All parts should be thoroughly inspected for excessive wear, stress cracking, galling and pitting. Attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding or rotating motion. Sealing surfaces of the ram, torque shaft and center bar assembly must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

CAUTION: Actuator parts that reflect any of the above listed characteristics may need replacement with new parts.

12.4 INSTALLATION LUBRICATION INSTRUCTIONS: Use the correct lubrication as defined in section 7.0 steps 7.1 and 7.2.

12.4.1 Before installation coat all moving parts with the correct lubricant.

12.4.2 Coat all seals with the correct lubricant, before installing into seal grooves.

13.0 HOUSING REASSEMBLY

NOTE: In section 13.0 where the step indicates to "lubricate, coat or apply lubricant", use lubricant as identified in Section 7.0 for lubricating the part being installed.

13.1 Apply a coating of lubricant to housing (1-10) in the area of torque shaft holes.

13.2 Coat rod wiper seals (2-20) with lubricant and install in the grooves located in the torque shaft through holes located on each side of housing (1-10).

13.3 Coat yoke (1-20) with lubricant and install into housing (1-10). Apply a generous amount of lubricant to the slots in the arms of yoke (1-20).

13.4 Insert the yoke key spring (1-50), with the ends pointing down, into the slot in the torque shaft (1-30) and place the yoke key (1-40) on top of the spring with the tapered side outward.

WARNING: If the yoke key (1-40) is installed incorrectly the housing may be damaged when next disassembly occurs. Refer to assembly drawing for correct yoke key spring and yoke key orientation.

13.5 Hold the yoke key (1-40) down with your thumb, insert the torque shaft (1-30) into and through housing (1-10) and yoke (1-20).

CAUTION: Rotate the torque shaft until the yoke key snaps into the yoke keyway.

13.6 Install set screw (1-60) through yoke (1-20) and screw into torque shaft (1-30).

NOTE: Tighten set screw (1-60) until it is seated on the surface of the torque shaft (1-30). Setscrew (1-60) is self-locking.

13.7 Rotate torque shaft (1-30) so that the arms of yoke (1-20) point outward.

13.8 Coat one o-ring seal (5-10) with lubricant and install onto outer diameter flange located on housing adapter end of housing (1-10).

14.0 HYDRAULIC RAM CYLINDER REASSEMBLY

NOTE: In section 14.0 where the step indicates to "lubricate, coat or apply fluid", use hydraulic fluid as identified in Section 7.0 for lubricating the part being installed.

14.1 Coat o-ring seal (5-90) with fluid and install into inner diameter seal groove of end cap (4-20).

14.2 Coat two o-ring seals (5-50) with fluid and install onto outer diameter cylinder flange of end cap (4-20) and housing adapter (4-15).

14.3 Install gasket seal (7-50) onto the center bar assembly (8-10). Carefully slide the gasket seal until it is next to the center bar assembly nut.

14.4 Install outer end cap (4-20) onto the center bar assembly (8-10). Carefully slide the outer end cap down the center bar assembly until it is next to the center bar assembly nut.

14.5 Coat rod bearings (5-60) with fluid and install one into inner diameter groove located in the outboard end of ram (4-50).

14.6 Install second lubricated rod bearing (5-60) into inner diameter groove located in the inboard end of ram (4-50).

14.7 Coat Polypak seal (5-70) with fluid and install with lip facing outboard end of ram (4-50).

14.8 Coat the end of the center bar assembly (8-10) that has a weld hex nut with lubricant.

14.9 Install ram (4-50) onto the center bar assembly (8-10). Carefully slide the ram until it rest against the end cap (4-20).

14.10 Coat Polypak seal (5-40) with fluid and install with lip facing outboard end of housing adapter (4-15).

14.11 Coat rod wiper (5-20) with fluid and install into inner diameter groove located in the housing adapter (4-15).

14.12 Coat rod bearing (5-30) with fluid and install into inner diameter groove located in the housing adapter (4-15).

14.13 Install ram cylinder (4-10) onto the center bar assembly (8-10). Insert the ram cylinder onto end cap (4-20) and over o-ring seal (5-50).

14.14 Install housing adapter (4-15) onto the center bar assembly (8-10). Carefully slide the housing adapter down the center bar assembly and insert the ram housing adapter (4-15) into ram cylinder and over o-ring seal (5-50).

14.15 Insert pre-assembled center bar assembly (8-10) into the center hole of housing adapter (4-15). Slide center bar assembly through housing until housing adapter installs on the flange of housing (1-10) and over o-ring seal (5-10).

15.0 SPRING CYLINDER REASSEMBLY

NOTE: In section 15.0 where the step indicates to "lubricate, coat or apply lubricant", use lubricant as identified in Section 7.0 for lubricating the part being installed.

15.1 Coat exposed area of center bar assembly (8-10) with lubricant.

15.2 Install o-ring seal (7-10) onto the flange of housing (1-10).

15.3 On Actuator models equipped with a cylinder adapter (6-15), perform the following two steps.

NOTE: Cylinder adapter (6-15) is to have its stepped outer diameter facing away from housing (1-10).

15.3.1 Install cylinder adapter (6-15) onto the flange of housing (1-10) and over o-ring seal (7-10).

15.3.2 Install o-ring seal (7-15) onto stepped diameter of cylinder adapter (6-15).

15.4 Coat spring guide assembly (6-50) outer diameter, inner diameter hole, head of spring guide assembly and exposed ends of yoke pin with lubricant.

15.5 Install bushing (2-10) between the two arms of yoke (1-20).

15.6 With the spring guide head facing away from housing (1-10) and with yoke pin up, install spring guide assembly (6-50) onto center bar assembly (8-10).

15.7 Carefully slide spring guide assembly (6-50) along center bar assembly (8-10) until yoke pin engages the two slots of yoke (1-20).

NOTE: While holding the center bar assembly flush against the outer end cap (4-20), push spring guide assembly (6-50) into housing (1-10) as far as the spring guide assembly (6-50) will go.

15.8 Install spacer (6-25) onto center bar assembly (8-10).

15.9 Apply a coating of lubricant to entire bore of spring cylinder (6-10).

15.10 Spring cylinder installation:

15.10.1 For CBA150.8-SR4XX, CBA201.X-SR5XX and CBA25X.X-SR7XX models install the lubricated spring cylinder (6-10) over the spring guide assembly and onto the stepped diameter flange of cylinder adapter (6-15) and over o-ring seal (7-15).

15.10.2 For CBA150.8-SR3XX, CBA201.X-SR4XXX and CBA25X.X-SR5XXX models install the lubricated spring cylinder (6-10) over the spring guide assembly and onto the flange of housing (1-10) and over o-ring seal (7-10).

15.11 Apply a coat of lubricant to the spring (6-70). Install the spring into the spring cylinder by carefully sliding the spring into the open spring cylinder end until the spring contacts the spring guide assembly.

15.12 SR End Cap outer diameter o-ring seal installation.

15.12.1 For CBA150.8-SR4XX, CBA201.X-SR5XX and CBA25X.X-SR7XX models install o-ring seal (7-15) onto SR end cap (6-20).

15.12.2 For CBA150.8-SR3XX, CBA201.X-SR4XXX and CBA25X.X-SR5XXX models install end cap o-ring seal (7-10) onto SR end cap (6-20).

15.13 Install the stop screw (6-30) into SR end cap (6-20).

15.14 Install o-ring seal (7-30) onto stop screw (6-30) until it is flush with SR end cap (6-20).

15.15 Install the stop screw hex nut (6-40) onto stop screw (6-30) until hand tight.

15.16 Screw SR end cap (6-20) onto center bar assembly (8-10).

15.17 Position the spring cylinder SR end cap (6-20) so that the SR stop screw (6-30) is at the top.

15.18 Keep SR end cap (6-20) from turning by holding end cap stop screw hex nut (6-40) with an adjustable wrench.

15.19 Using a ratchet and socket on the nut located of housing end of center bar assembly (8-10), rotate center bar assembly clockwise (CW). This will cause SR end cap (6-20) to gradually screw further onto center bar assembly (8-10).

15.20 Continue to rotate center bar assembly (8-10) clockwise until spring (6-70) is compressed, the spring cylinder is seated against the housing flange or adapter (6-15) and SR end cap (6-20) is properly seated against spring cylinder (6-10).

15.21 Tighten center bar assembly (8-10) to the proper torque as specified in the following chart.

ACTUATOR MODEL	MAXIMUM TORQUE		
	INCH POUNDS	FOOT POUNDS	N-m
CBA150.X-SR	480	40	54.2
CBA201.X-SR	1080	90	122
CBA251.X-SR	1884	157	212.9

15.22 Place the remaining seal gasket (7-50) on the exposed end of the center bar assembly (8-10).

15.23 Place acorn nut (8-20) on the exposed outboard end of center bar assembly (8-10) and tighten securely.

15.24 Install the stop screw (4-30) into housing (1-10) and screw in until stop screw contacts the spring guide assembly (6-50).

15.25 Install oring seal (5-80) onto stop screw (4-30) until it is flush with the housing adapter (4-15).

15.26 Install stop screw hex nut (4-40) onto stop screw (4-30) until hand tight.

15.27 Adjust both stop screws (4-30) and (6-30) back to setting recorded in Step 8.2 under General Disassembly. Tighten both stop screw hex nuts (4-40) and (6-40) securely, while holding stop screw (4-30) and (6-30).

16.0 ACTUATOR TESTING

16.1 Leakage Test: All sources of leakage to atmosphere are to be checked using hydraulic pressure. This includes cylinder/end cap interface and cylinder /housing adapter interface.

WARNING: Pressure is not to exceed the maximum operating pressure rating listed on the name tag.

16.2 All leak testing will use the customer normal operating pressure or the actuator name tag normal operating pressure (NOP).

16.3 Procedure:

16.3.1 Cycle the actuator five (5) times at the as listed in step 16.2. This allows the seals to seek their proper service condition.

16.3.2 Apply the pressure as listed in step 16.2 and allow the unit to stabilize.

16.3.3 If there is any notable leakage, the actuator must be disassembled and the cause of leakage must be determined and corrected.

16.3.4 If an actuator was disassembled and repaired, the above leakage test must be performed again.

16.4 Operational (Functional) Test This test is used to verify proper function of the actuator.

NOTE: This test is to be done off of the valve or when valve stem is not coupled to the actuator torque plug.

16.4.1 Adjust the pressure regulator to the pressure rating that the customer uses to operate the actuator during normal service.

16.4.2 Apply the above pressure to the actuator and allow the actuator to stabilize. The actuator should stroke a full 90° travel with the stops properly set.

17.0 RETURN TO SERVICE

17.1 Install vent check (30) into port of housing (1-10).

17.2 If Removed install pipe plug (31) into port of SR end cap (6-20).

17.3 After the actuator is installed back on the valve all accessories should be hooked up and tested for proper operation and replaced, if found defective.

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