

BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY AND REASSEMBLY

FOR CB-SR-S

SEISMIC SPRING RETURN

SERIES PNEUMATIC ACTUATORS

PART NUMBER: 102264

REVISION: "C"

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1.0 INTRODUCTION

- 1.1 In order to assure and maintain the present level of qualification and auditability to the seismic portions only of the Bettis Qualification Report number 037274 the following is required:
- 1.1.1 All maintenance or service work must be performed by a certified technician.
- 1.1.2 Maintain a service interval of five years.
- 1.2 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis CB315-SR-S, CB415-SR-S, CB420-SR-S, CB520-SR-S, CB525-SR-S and CB725-SR-S Seismic Series Pneumatic Actuators.
- 1.3 **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.
- 1.4 **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 a certified technician.
- 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 customer representative and an authorized Bettis representative.
- 1.5 **BASIC SERVICE INFORMATION:** Complete actuator refurbishment requires the actuator be dismantled from the valve or device it is operating.
- 1.6 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.

- 1.7 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator, allowing the spring to stroke and rotate the actuator to its fail position. 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.

2.0 SUPPORT ITEMS AND TOOLS

- 2.1 **Support Items** - Service/Seal Kit, commercial leak testing solution, and non-hardening thread sealant.
- 2.2 **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 Depew socket set, torque wrench (up to 2,000 inch pounds).

3.0 BETTIS REFERENCE MATERIALS

- 3.1 CB315-SR-S, CB420-SR-S, and CB525-SR-S Assembly Drawing Part Number 102225.
- 3.2 CB415-SR-S, CB520-SR-S, and CB725-SR-S Assembly Drawing Part Number 102221.
- 3.3 CB315-SR-S, CB420-SR-S, and CB525-SR-S Exploded Detail Drawing Part No. 102377*.
- 3.4 CB415-SR-S, CB520-SR-S, and CB725-SR-S Exploded Detail Drawing Part No. 102376*.

* Exploded Detail drawings are contained in Bettis Service Kits. The exploded detail drawings are generic drawings and may not show some items or details that are in the actuator being serviced by this procedure.

4.0 GENERAL

- 4.1 This procedure should only be implemented by a technically competent technician 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 Drawings, Exploded Detail, and Actuator Parts List.
- 4.3 When removing seals from seal groove, use a commercial seal removing tool or a small standard screwdriver with the sharp edges rounded off.
- 4.4 Use a non-hardening thread sealant on all pipe threads.

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

- 4.5 Disassembly of actuator should done in a clean area on a work bench when possible.

- 4.6 LUBRICATION REQUIREMENTS: For temperature service (-20°F to +350°F) use Bettis ESL-4, 5 & 10. Bettis Standard Service Kit contains ESL-4, 5 & 10 in tubes. Lubricants, other than Bettis ESL-4, 5 & 10 should not be used without prior written approval of Bettis Product Engineering.

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

- 4.7 It is a good practice to operate the actuator with the nominal operating pressure (NOP), as listed on the actuator name tag or the pressure used by the customer to operate the actuator during normal operation, before starting the general disassembly of the actuator. Notate and record any abnormal symptoms such as jerky or erratic operation.

5.0 GENERAL DISASSEMBLY

NOTE: In place of stop screws (2-70) and (2-80) the actuator may be equipped with Extended Travel Stops or special length stop screws.

- 5.1 The setting of stop screws (2-70) and (2-80) should be checked and setting recorded before stop screws are loosened or removed.
- 5.2 If not already removed, disconnect all operating pressure from actuator, allowing the spring to travel to its extended or relaxed position. The spring will rotate to the actuator to its fail position.
- 5.3 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.
- 5.4 Remove stop screw (2-80) from housing (1-10).
- 5.5 Loosen and remove hex nut (2-90) from end cap stop screw (2-70). Remove seal washer (3-80) and screw thread seal (3-70) from end cap stop screw.
- 5.6 Remove stop screw (2-70) from end cap (2-20).

6.0 SPRING CYLINDER DISASSEMBLY

- 6.1 The spring in CB-SR-S Seismic Series Actuators are preloaded. Actuator must be disassembled in the following manner.
- 6.2 Remove breather (2-130) from end cap (2-20), discard if the Bettis Service/Seal kit contains a new breather.

NOTE: Actuators piped for spring air assist will not be equipped with breather (2-130).

- 6.3 Unscrew and remove acorn nut (2-110) and seal gasket (3-10) from cylinder end of center bar assembly (2-50).

- 6.4 Using a (1/2" drive) ratchet and socket on the welded nut, located on the housing end of center bar assembly (2-50), rotate the center bar assembly counter-clockwise (CCW). This will cause end cap (2-20) to gradually unscrew from center bar assembly (2-50).
- 6.5 Continue to rotate center bar assembly (2-50) counter-clockwise (CCW) until the spring preload is eliminated. As the pre-load is reduced it may be necessary to prevent end cap (2-20) from turning by holding the end cap with a wrench.
- 6.6 After the spring preload is eliminated, unscrew and remove end cap (2-20) from center bar assembly (2-50).
- 6.7 If equipped with spacer (150) or stop collar (2-150) remove from center bar assembly (2-50).
- 6.8 Remove spring (4) from within cylinder (2-10).
- 6.9 Hold housing torque shaft (1-30) with a wrench, pull cylinder (2-10) away from housing (1-10); slide cylinder over piston (2-30) and remove.
- 6.10 Pull piston (2-30) out of housing (1-10) and carefully slide piston off center bar assembly (2-50).

NOTE: Roll pin (1-60) and yoke pin (1-40) are removed as part of piston (2-30) and they should not be removed from the piston. When replacing piston (2-30), roll pin (1-60) or yoke pin (1-40) they are replaced as an assembly.

7.0 HOUSING DISASSEMBLY

- 7.1 On actuators equipped with a cylinder adapter (2-140) CB415-SR, CB520-SR and CB725-SR, remove cylinder adapter (2-140) from housing (1-10).
- 7.2 Remove center bar assembly (2-50) from housing (1-10).
- 7.3 Cut and remove gasket seal (3-10) from center bar.
- 7.4 Remove and discard both retaining rings (1-80) from torque shaft (1-30).

CAUTION: Do not re-install old retaining rings, new ones are provided in the Bettis Service kit.

- 7.5 Record and mark the orientation of the flats on torque shaft (1-30) in relationship to the side of the housing each flat is exposed on.
- 7.6 The following steps may need to be taken before disassembly can continue.
 - 7.6.1 If outer ends of torque shaft (1-30) has any raised burrs or sharp edges they should be filled off, removing as little metal as possible.
 - 7.6.2 If there is excessive paint build-up on outer ends of torque shaft (1-30) the excess paint should be removed.

- 7.7 Push torque shaft (1-30) out one side of housing (1-10) until o-ring seal (3-40) is clear of housing (1-10).
- 7.8 Remove o-ring seal (3-40) from torque shaft (1-30).
- 7.9 Push torque shaft (1-30) back through housing (1-10) and pull torque shaft completely out the opposite side of housing (1-10) while holding yoke key (1-50) in place.
- 7.10 Remove yoke key (1-50) and yoke key spring (1-70) from torque shaft (1-30).
- 7.11 Remove yoke (1-20) from housing (1-10).

8.0 PRE-ASSEMBLY NOTES

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

- 8.1 Remove and discard all old seals and gaskets, taking care not to scratch or damage seal grooves.
- 8.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.
- 8.3 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 cylinder, 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 should be replaced with new parts.

- 8.4 Before installation coat all actuator moving parts with a complete film of lubricant. Coat all seals with a complete film of lubricant, before installing into seal grooves. NOTE: The parts and seals used in the actuator will be assembled using lubricant as identified in section 4 step 4.6.
- 8.5 The torque requirements for critical fasteners are specified at the appropriate step of the assembly procedure.

9.0 GENERAL RE-ASSEMBLY

- 9.1 Apply lubricant to the torque shafts holes located in housing (1-10).
- 9.2 Coat yoke (1-20) with lubricant and insert into housing (1-10).
- 9.3 Insert yoke key spring (1-70), with the ends pointing down, into the slot in torque shaft (1-30).

- 9.4 With the tapered side facing outward place yoke key (1-50) on top of spring (1-70). Refer to assembly drawing for correct key orientation.
- 9.5 Refer to step 7.4 for correct orientation of torque shaft flats. Hold yoke key (1-50) down and insert torque shaft (1-30) into the hole on one side of housing (1-10), then through yoke (1-20) and out the other side of housing (1-10).

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

- 9.6 Push the torque shaft out one side of housing (1-10) until the o-ring seal groove is clear of housing (1-10).
 - 9.7 Install one o-ring seal (3-40) into the o-ring groove of torque shaft (1-30).
 - 9.8 Carefully push the torque shaft back into housing (1-10) until the o-ring groove on the opposite end of torque shaft (1-30) is just visible and clear of housing (1-10).
 - 9.9 Install remaining o-ring seal (3-40) into the o-ring groove of torque shaft (1-30).
 - 9.10 Install one of the new retaining rings (1-80) onto the torque shaft; making certain it is properly seated in the torque shaft groove.
 - 9.11 Push the torque shaft back into the housing and install the remaining new retaining ring (1-80) onto the torque shaft.
 - 9.12 Rotate torque shaft (1-30) so that the yoke arms point toward the cylinder end of housing (1-10).
 - 9.13 Apply a generous amount of lubricant to the slots in the yoke arms.
 - 9.14 Install gasket seal (3-10) onto center bar assembly (2-50) slide it down the center bar until it rests against the welded nut.
 - 9.15 Coat entire length of center bar assembly (2-50) with lubricant.
 - 9.16 Insert lubricated center bar assembly into the center hole of housing (1-10) and slide center bar assembly through housing until gasket seal (3-10) and welded nut are flush against the housing.
- NOTE: Care should be taken during installation of center bar assembly (2-50) so as to not scratch or mar its finish.
- 9.17 Install cylinder gasket (3-30) on housing flange.
 - 9.18 On Actuator models CB415-SR-S, CB520-SR-S and CB725-SR-S (equipped with a cylinder adapter), perform the following two steps.

NOTE: Cylinder adapter (2-140) is to have its stepped outer diameter facing away from housing (1-10).

9.18.1 Install cylinder adapter (2-140) onto the flange of housing (1-10) and up against cylinder gasket (3-30).

9.18.2 Install cylinder gasket (3-20) onto stepped diameter of cylinder adapter (2-140).

10.0 SPRING CYLINDER RE-ASSEMBLY

10.1 Re-coat exposed areas of center bar assembly (2-50) with lubricant.

10.2 Coat o-ring seal (3-50) with lubricant and install into the internal seal groove in the head of piston (2-30).

10.3 Coat T-seal (3-60) with lubricant and install into outer diameter seal groove of piston (2-30) using steps 10.3.1 through 10.3.4.

NOTE: T-seal set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.

10.3.1 Install the T-seal into the seal grooves.

10.3.2 Install a back-up ring on each side of the T-seal.

10.3.3 When installing the back-up rings do not align the skive-cuts.

10.3.4 If the back-up rings are too long and the rings overlap beyond the skive-cuts, and then the rings must be trimmed with a razor sharp instrument.

10.4 Coat the heel of piston (2-30) and the exposed ends of yoke pin (1-40) with lubricant.

10.5 With the piston head facing away from housing (1-10) and with the yoke pin (1-40) up, carefully install piston (2-30) onto center bar assembly (2-50).

10.6 Slide piston (2-30) along center bar assembly (2-50) until yoke pin (1-40) engages the slots in the arms of yoke (1-20). While holding the nut of center bar assembly (2-50) flush against housing (1-10) push piston (2-30) into housing (1-10) as far as it will go.

10.7 If the actuator is equipped with spacer (150) complete step 10.7.1 or if equipped with stop collar (2-150) do steps 10.7.2 and 10.7.3.

10.7.1 Install spacer (150) onto center bar assembly (2-50).

10.7.2 Install o-ring seal (3-50) into the internal o-ring seal groove of stop collar (2-150).

10.7.3 Install stop collar (2-150) onto center bar assembly (2-50). NOTE: Install o-ring seal end of stop collar onto center bar assembly (2-50) first.

10.8 CYLINDER (2-10) INSTALLATION:

10.8.1 Coat the entire bore of cylinder (2-10) with a coating of lubricant.

10.8.2 On models CB315-SR-S, CB420-SR-S and CB525-SR-S install lubricated cylinder (2-10) over the piston and onto the flange of housing (1-10) and up against cylinder gasket (3-30).

10.8.3 On models CB415-SR-S, CB520-SR-S, and CB725-SR-S install lubricated cylinder (2-10) onto the flange of cylinder adapter (2-140) and up against cylinder gasket (3-20).

10.9 Apply a coat of lubricant on spring (4) and carefully slide the spring into the open cylinder until the spring contacts the head of piston (2-30).

10.10 CYLINDER GASKET (3-20) OR (3-30) TO END CAP INSTALLATION:

10.10.1 On models CB315-SR-S, CB420-SR-S and CB525-SR-S install cylinder gasket (3-30) onto end cap (2-20).

10.10.2 On models CB415-SR-S, CB520-SR-S, and CB725-SR-S install cylinder gasket (3-20) onto end cap (2-20).

10.11 Screw end cap (2-20) onto center bar assembly (2-50) until end cap (2-20) just touches spring (4).

NOTE: Refer to exploded detail drawing or assembly drawing for correct position of the breather porthole and the stop screw porthole.

10.12 Position end cap (2-20) so that the breather port is at the bottom and the stop screw (2-70) is at the top.

10.13 Keep the spring cylinder end cap (2-20) from turning by holding the end cap stop screw (2-90) with a wrench.

10.14 Using a 1/2" drive ratchet (or a impact wrench) 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 end cap (2-20) to gradually screw further onto center bar assembly (2-50).

10.15 Continue to rotate center bar assembly (2-50) clockwise until spring (4) is fully compressed, cylinder (2-10) is seated against the flange of housing (1-10) or seated against the flange of adapter (2-140) and end cap (2-20) is properly seated against cylinder (2-10).

- 10.16 Torque tighten center bar assembly (2-50) to the torque as specified in the following Chart.

TORQUE REQUIREMENTS FOR CB-SR-S CENTER BARS		
ACTUATOR MODEL	MAXIMUM TORQUE	
	INCH POUNDS	FOOT POUNDS
CB315-SRXX-S	660	55
CB415-SRXX-S	660	55
CB420-SRXX-S	1,200	100
CB520-SRXX-S	1,200	100
CB525-SRXX-S	1,560	100
CB725-SRXX-S	1,560	130

- 10.17 Install gasket seal (3-10) onto outboard end of center bar assembly (2-50).
- 10.18 Install acorn nut (2-110) on the exposed end of center bar assembly (2-50) and tighten securely.
- 10.19 Lightly coat stop screw (2-80) with lubricant and install into housing (1-10). Turn the stop screw until it contacts piston (2-30).
- 10.20 Lightly coat thread seal (3-70) with lubricant and install onto stop screw (2-80) until it is flush with housing (1-10).
- 10.21 Install seal washer (3-80) onto the stop screw with the chamfer side facing thread seal (3-70).
- 10.22 Install hex nut (2-90) onto stop screw (2-80), turn until hand tight.
- 10.23 Lightly coat stop screw (2-70) with lubricant and install into end cap (2-20).
- 10.24 Lightly coat thread seal (3-70) with lubricant and install onto stop screw (2-70) until it is flush with end cap (2-20).
- 10.25 Install seal washer (3-80) onto the stop screw with the chamfer side facing thread seal (3-70).
- 10.26 Install the remaining hex nut (2-90) onto stop screw (2-70), turn until hand tight.
- 10.27 Adjust both stop screws (2-70) and (2-80) back to setting recorded in section 5, step 5.1 under General Disassembly.
- 10.28 Tighten both hex nuts (2-90) securely, while holding stop screw (2-70) and (2-80) in position.

11.0 ACTUATOR TESTING

11.1 In general all areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution. Generally, a small bubble, which breaks about three seconds after starting to form, is considered acceptable. If excessive leakage is noted, the formed bubble breaks before three seconds, the actuator must be disassembled and the cause of leakage must be determined and corrected.

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

11.2 All leak testing will use the nominal operating pressure (NOP) as listed on the actuator name tag or the pressure used by the customer to operate the actuator during normal operation.

CAUTION: Test the actuator using a properly adjusted self relieving regulator, with gauge.

11.3 Before testing for leaks, alternately apply and release operating pressure, as described in step 11.2, to the pressure side of the pistons to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their proper service condition.

11.4 Apply operating pressure, as described in step 11.2 to the pressure inlet port in actuator housing (1-10).

11.5 Apply a leak testing solution to the following areas:

11.5.1 Cylinder to housing joint on CB315-SR, CB420-SR, and CB525-SR or cylinder to cylinder adapter to housing joints on CB415-SR, CB520-SR, and CB725-SR actuator. Checks gaskets (3-20) or (3-30).

11.5.2 Center bar assembly nut to housing. Checks gasket seal (3-10).

11.5.3 Housing stop screw (2-80), hex nut (2-90), washer seal (3-80) and thread seal (3-70).

11.5.4 Two locations for torque shaft (1-30) to housing (1-10) interfaces. Checks the two o-ring seals (3-40).

11.5.5 Form a leak testing solution bubble over the breather port hole in end cap (2-20). Checks the piston to cylinder wall and piston to center bar seals (3-60) and (3-50).

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

11.7 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.

11.7.1 Adjust the pressure regulator to the pressure as described in step 11.2.

11.7.2 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.

12.0 RETURN TO SERVICE

12.1 Install new breather (2-130) into end cap (2-20). Actuators that are piped for spring air assist will not use breather (2-130).

12.2 After actuator is reinstalled on the device it is to operate all pneumatic accessories are to be hooked up, leak tested, and then each accessory checked for proper operation.

WARNING: Any defective or malfunctioning accessory is to be replaced before actuator is placed into service.

12.3 The actuator should now be ready to return to service.

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Released	December 1994	A	COMPILED	
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* Signatures on file Bettis Actuator & Controls, Waller, Texas