

CBB-Series Spring Return Pneumatic Actuators



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Section 1: Introduction

1.1 General service information

- 1.1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis CBB-SR double acting series actuators. The following is a list of general CBB-SR models numbers.

Table 1. CBB-SR Model numbers

| MODEL (1) | MODEL (1) | MODEL (1) |
|-----------|-----------|-----------|
| 315 | 315-M3 | 315-M3HW |
| 420 | 420-M3 | 420-M3HW |
| 520 | 520-M3 | 520-M3HW |
| 525 | 525-M3 | 525-M3HW |
| 725 | 725-M3 | 725-M3HW |

(1) Also includes actuator models with -10 and -11 as a suffix

NOTE:

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.

- 1.1.2 Normal recommended service interval for this actuator series is five years.

NOTE:

Storage time is counted as part of the service interval.

- 1.1.3 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.
- 1.1.4 Remove all piping and mounted accessories that will interfere with the module(s) that are to be worked on.
- 1.1.5 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- 1.1.6 Numbers in parentheses, () indicate the bubble number (reference number) used on the Bettis Assembly Drawing and Actuator Parts List.
- 1.1.7 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.
- 1.1.8 Use a non-hardening thread sealant on all pipe threads.

⚠ CAUTION: APPLICATION OF THREAD SEALANT

Apply the thread sealant per the manufacture’s instructions.

- 1.1.9 Bettis recommends that disassembly of the actuator should be done in a clean area on a workbench.

1.2 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.

NOTE:

This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).

M3:

Jackscrew or jackscrew assembly.

ES:

Extended Stop(s)

1.3 General safety information

- 1.3.1 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.

1.4 Bettis reference materials

- 1.4.1 CBBXXX Assembly Drawing use part number 152230.
- 1.4.2 CBBXXX-M3HW Assembly Drawing use part number 152608.

1.5 Service support items

- 1.5.1 Bettis Service Kit.
- 1.5.2 Commercial leak testing solution.
- 1.5.3 Non-hardening thread sealant.

1.6 Lubrication requirements

- 1.6.1 The actuator should be re-lubricated at the beginning of each service interval using the following recommended lubricants.

NOTE:

Lubricants other than those listed in steps 1.6.2 should not be used without prior written approval of Bettis Product Engineering. The lubricant item number on some assembly drawings is item (5) while the Bettis service kits lubricant item number is item number (500).

- 1.6.2 All temperature services (-50°F to +350°F)/(-45.5°C to 176.6°C) use Bettis ESL-5 lubricant. ESL-5 lubricant is contained in the Bettis Module Service Kit in tubes and the tubes are marked ESL-4,5 & 10 lubricant.

1.7 General tool information

- 1.7.1 All threads on CBB series actuators are Inch Unified and NPT.
- 1.7.2 All tools/Hexagons are American Standard inch. Two adjustable wrenches, Allen wrench set, small standard screwdriver with sharp edges rounded off, medium size standard screwdriver, diagonal cutting pliers, external snap ring pliers, flat file, drive ratchet / deepwell socket set and torque wrench (up to 2,000 inch pounds / 226 N-m).

1.8 Actuator weight

Table 2. Actuator weight

| Actuator Model | Approximate weight (3) | | Actuator Model | Approximate weight (3) | |
|----------------|------------------------|------|----------------|------------------------|------|
| | LB | KG | | LB | KG |
| 315-SR40 (1) | 22 | 10.0 | 520-SR40 (1) | 45 | 20.4 |
| 315-SR60 (1) | 23 | 10.4 | 520-SR60 (1) | 48 | 21.8 |
| 315-SR80 (1) | 26 | 11.8 | 520-SR80 (1) | 49 | 22.2 |
| 315-SR100 (1) | 25 | 11.4 | 520-SR100 (1) | 53 | 24.0 |
| 415-SR40 (1) | 27 | 12.2 | 525-SR40 (2) | 62 | 28.1 |
| 415-SR60 (1) | 29 | 13.2 | 525-SR60 (2) | 65 | 29.5 |
| 415-SR80 (1) | 30 | 13.6 | 525-SR80 (2) | 65 | 29.5 |
| 415-SR100 (1) | 31 | 14.1 | 525-SR100 (2) | 67 | 30.4 |
| 420-SR40 (1) | 37 | 16.8 | 725-SR40 (2) | 97 | 44.0 |
| 420-SR60 (1) | 39 | 17.7 | 725-SR60 (2) | 98 | 44.5 |
| 420-SR80 (1) | 40 | 18.1 | 725-SR80 (2) | 104 | 47.2 |
| 420-SR100 (1) | 41 | 18.6 | 725-SR100 (2) | 107 | 48.5 |

(1) When model has -M3HW add 2.0 pounds / 0.9 kilograms.

(2) When model has -M3HW add 4.0 pounds / 1.8 kilograms.

(3) Weight is for bare actuator without accessories or valve adaptation.

Section 2: Actuator disassembly

2.1 General disassembly

⚠ WARNING: DANGEROUS GAS AND/OR LIQUIDS

It is possible, that the actuator may contain a dangerous gas and/or liquids. Ensure that all proper measures have been taken to prevent exposure or release of these types of contaminants before commencing any work.

⚠ CAUTION: PRESSURE

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

NOTE:

Before starting the general disassembly of the actuator it is a good practice to operate actuator with the pressure used by the customer to operate the actuator during normal operation. Notate and record any abnormal symptoms such as jerky or erratic operation.

- 2.1.1 Remove all operating pressure from actuator, allowing the spring to stroke. The spring will rotate the yoke to its fail position.
- 2.1.2 Record the settings of stop screw / ES / M3 jackscrews (1-70) and stop screw / ES (4-30) before they are loosened or removed.

NOTE:

In place of stop screws the actuator may be equipped with one or two ES (ES = Extended Stops) or one M3/M3HW (1-70) located on outboard end of housing (1-10).

2.2 Spring cylinder disassembly

NOTE:

Review Section 2 steps 2.1.1 through 2.1.2 before proceeding with cylinder disassembly.

⚠ CAUTION: SPRINGS ARE PRELOADED

The spring in CBB Series Spring Return Actuators are preloaded.

⚠ WARNING: POTENTIALLY DANGEROUS DISASSEMBLY

Actuator must be disassembled in the following manner.

- 2.2.1 Remove hex nut (1-80) as follows: CBB315 through 725 standard housing stop screw or extended stop (ES) use step 2.2.1.1. CBB315-SR-M3/M3HW through CBB725-SR-M3/M3HW use step 2.2.1.2.
 - 2.2.1.1 **For CBB315 through 725 housing stop screw or extended stop screw (ES):**
 - 2.2.1.1.1 Loosen and remove hex nut (1-80) and washer (1-90) from stop screw (1-70) located in housing (1-10).
 - 2.2.1.1.2 Remove stop screw (1-70) located in housing (1-10).
 - 2.2.1.2 **For CBB315/420/520/525/725-SR-M3 or M3HW:**
 - 2.2.1.2.1 Remove retainer ring (12-30) and groove pin (12-20) from optional hex drive hub or from hand wheel (12-10).
 - 2.2.1.2.2 Remove optional hex drive hub or handwheel (12-10) from M3 jackscrew (1-70).
 - 2.2.1.2.3 Loosen and remove hex nut (1-80) from M3 jackscrew (1-70).

NOTE:

CBB420,520,525,725-SR-M3 or M3HW models: the M3 jackscrew (1-70) can not be removed now. The M3 jackscrew used in these models can be removed later in this procedure per step 2.3.7.

- 2.2.2 Loosen and remove hex nut (4-40) and washer (4-90) from end cap stop screw (4-30) or from end cap extended stop (4-30).
-

NOTE:

Extended stop or end cap stop screw (4-30) does not require removal from end cap (4-20) unless replacing with a new extended stop or stop screw.

- 2.2.3 Remove breather (30) from end cap (4-20).
- 2.2.4 Remove acorn nut (8-20) and gasket seal (5-50) from end cap (4-20).
- 2.2.5 Use a ratchet and socket on the welded nut, located on the housing end of center bar assembly (8-10), rotate center bar assembly (8-10) counter-clockwise (CCW). This will cause end cap (4-20) to gradually unscrew from center bar assembly (8-10).

NOTE:

The end cap (4-20) can be held in position by holding the end cap (4-20) with an adjustable wrench.

- 2.2.6 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 end cap (4-20) from turning.
 - 2.2.7 After the spring preload is eliminated, unscrew and remove end cap (4-20) from center bar assembly (8-10).
 - 2.2.8 Remove spring (4-70) from within spring cylinder (4-10).
 - 2.2.9 Hold torque shaft (1-30) and pull spring cylinder (4-10) away from housing (1-10); slide spring cylinder over piston (4-50) and remove.
 - 2.2.10 Remove spacer (1-110) from center bar assembly (8-10).
 - 2.2.11 Pull piston (4-50) out of housing (1-10) and carefully slide piston off of center bar assembly (8-10).
-

NOTE:

Piston (4-50) is an assembly made up of one roll pin and one yoke pin; do not attempt to disassemble the piston assembly.

- 2.2.12 On models CBB415-SR, CBB520-SR, and CBB725-SR remove cylinder adapter (4-15).

2.3 Housing disassembly

- 2.3.1 Remove center bar assembly (8-10) from housing (1-10).
- 2.3.2 Remove both retaining rings (1-60) from torque shaft (1-30). On the CBB, remove washers (1-65) from housing.
- 2.3.3 The following steps may be required before disassembly can continue.
 - 2.3.3.1 If torque shaft (1-30) has any raised burrs or sharp edges they should be removed.

NOTE:

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

- 2.3.3.2 If there is excessive paint build-up on torque shaft (1-30) it should be removed.
- 2.3.4 Remove the torque shaft (1-30) by pushing it out one side of housing (1-10).
- 2.3.5 Remove yoke key (1-40) and yoke key spring (1-50) from torque shaft (1-30).
- 2.3.6 Remove yoke (1-20) from housing (1-10).
- 2.3.7 Actuator models CBB315-SR with a M3 or M3HW mounted in the outboard end of housing (1-10) remove M3 jackscrew (1-70) from housing (1-10).

NOTE:

The M3 jackscrew (1-70) will be removed from the inside of housing (1-10).

- 2.3.8 Actuator models CBB420, 520, 525, 725 with a M3 or M3HW mounted in the outboard end of housing (1-10) complete steps 2.3.8.1 and 2.3.8.2.
 - 2.3.8.1 Remove retainer ring (2-40) from M3 adapter (1-90).
 - 2.3.8.2 Remove M3 adapter (1-90) from housing (1-10).

NOTE:

The M3 adapter will be removed from the inside of housing (1-10) with the M3 jackscrew.

Section 3: Actuator reassembly

3.1 General reassembly

⚠ CAUTION: CHECK SHELF LIFE OF SEALS

Only new seals that are still within the seals expectant shelf life should be installed into the actuator being refurbished.

- 3.1.1 Remove and discard all old seals and gaskets.
- 3.1.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.
- 3.1.3 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 must be free of deep scratches, pitting, corrosion and blistering or flaking coating. On the CBB models, there are two O-Rings on the torque shaft and two extra O-Rings beneath the washers on the housing. These items **MUST** be replaced upon re-assembly

NOTE:

Prior to installing new seals: Fit the torque shaft snap ring groove with installation rings that come with the CBB service kits. These rings help guide the torque-shaft through the housing and seals which will prevent seal damage. First, take out both old seals, then install the rings onto the shaft, and then install seals in housing. Once this is done, remove install rings and proceed. See LCD PAK installation instructions, Part Number 153955, for details.

Coat torque shaft LCD PAK seals (2-20) with lubricant and install in one of the grooves located in the torque shaft bore of the housing (1-10).

The cup/lip of torque shaft seal will be installed facing inward into the housing. For the CBB, coat the torque-shaft O-Ring (2-25) with grease upon installation.

The following steps used to reassemble the following models: CBB315, 420, 520, 525 and 725. Use assembly drawing part numbers 129738 and 152230 for this section.

⚠ CAUTION: REPLACE WITH NEW PARTS.

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

- 3.1.4 **INSTALLATION LUBRICATION INSTRUCTIONS:** Use the correct lubrication as defined in Section 1 step 1.6.
 - 3.1.4.1 Before installation coat all moving parts with lubricant.
 - 3.1.4.2 Coat all seals with lubricant, before installing into seal grooves.

3.2 Housing reassembly

NOTE:

In section 3.2 where the step indicates to "lubricate, coat or apply lubricant", use lubricant as identified in Section 1 step 1.6 for lubricating the part being installed.

Review Section 3 steps 3.1.1 through 3.1.4 before proceeding with housing reassembly.

Housing M3 jackscrew (1-70) installation: Use steps 3.2.1 for CBB315/415-SR-M3 and steps 3.2.2 for CBB420/520/525/725-SR-M3 includes M3HW models.

3.2.1 M3 JACKSCREW INSTALLATION FOR CBB315/415-SR-M3.

3.2.1.1 Apply a light coating of lubricant to the threads of M3 jackscrew (1-70).

NOTE:

M3 jackscrew (1-70) will be installed from the inside of housing (1-10).

3.2.1.2 Insert and rotate M3 jackscrew (1-70) into housing (1-10). NOTE: Rotate the M3 jackscrew into the housing until the inboard end of the M3 jackscrew is up against the inside of housing (1-10).

3.2.1.3 Install O-ring seal (2-30) onto M3 jackscrew (1-70) until it is flush with the housing.

3.2.1.4 Install hex nut (1-80) onto M3 jackscrew (1-70) until hand tight.

3.2.2 M3 JACKSCREW INSTALLATION FOR CBB420/520/525/725-SR-M3.

3.2.2.1 Apply a coating of lubricant to outer diameter and inner diameter threads of M3 adapter (1-90).

3.2.2.2 Coat O-ring seal (2-45) with lubricant and install into outer diameter seal groove located in the M3 adapter (1-90).

3.2.2.3 Apply a light coating of lubricant to the threads of M3 jackscrew (1-70).

3.2.2.4 Install and rotate the M3 jackscrew (1-70) into M3 adapter (1-90).

NOTE:

Rotate the M3 jackscrew into the adapter until the inboard end of the jackscrew is up against the adapter.

3.2.2.5 Install M3 adapter (1-90) into housing (1-10).

NOTE:

The M3 adapter will be installed from the inside of housing (1-10).

3.2.2.6 Install retainer ring (2-40) onto groove in M3 adapter (1-90).

3.2.2.7 Install o-ring seal (2-30) onto M3 jackscrew (1-70).

NOTE:

Move the o-ring seal (2-30) down the M3 jackscrew until it is next to the M3 adapter.

3.2.2.8 Install hex nut (1-80) onto M3 jackscrew (1-70).

NOTE:

Rotate the hex nut down the M3 jackscrew until it is next to the M3 adapter.

3.2.3 Apply a coating of lubricant to the torque shaft holes located on each side of housing (1-10).

3.2.4 Coat torque shaft wiper seals (2-20) with lubricant and install in one of the grooves located in the torque shaft bore of the housing (1-10).

NOTE:

The cup of torque shaft wiper seal will be installed facing down into the housing.

3.2.5 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).

3.2.6 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: YOKE KEY INSTALLATION

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.

3.2.7 Hold the yoke key (1-40) down with your thumb; insert the torque shaft (1-30) by gently rotating it into the housing (1-10) and yoke (1-20) on the opposite side of the installed torque shaft wiper seal (2-20)

NOTE:

Torque Shaft should be installed with key rotated 180 degrees opposite yoke key slot.

When the torque shaft (1-30) is flush with the housing (1-10) push the torque shaft (1-30) through until the empty seal groove is exposed. Install the other torque shaft wiper seal (2-20) into the groove

NOTE:

The cup of the torque shaft wiper seal again needs to be installed facing inward into the housing. Two new retaining rings (1-60) are contained in the Bettis CBB Service Kits

- 3.2.8 Install one of the new retaining rings (1-60) onto the exposed end of the torque shaft, making certain it is properly seated in the groove of the torque shaft (1-30). Gently push and rotate the torque shaft (1-30) until the retaining ring (1-60) is pressed against the housing (1-10). Install the other retaining ring (1-60) to the other side of the torque shaft (1-30).

⚠ CAUTION: TORQUE SHAFT INSTALLATION

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

- 3.2.9 Rotate the torque shaft (1-30) so that the arms of yoke (1-20) point outward.
- 3.2.10 Coat O-ring seal (5-20) with lubricant and install into inner diameter seal groove located in the center bar hole of housing (1-10).
- 3.2.11 Coat entire length of center bar (8-10) with lubricant including the threads.
- 3.2.12 Insert center bar assembly (8-10) into the center hole of housing (1-10). Slide center bar assembly through housing until center bar assembly nut is flush against the housing (1-10).

⚠ WARNING: CENTER BAR ASSEMBLY INSTALLATION

Care should be taken during installation of center bar assembly so as to not scratch it.

- 3.2.13 Re-coat center bar assembly (8-10) with lubricant.
- 3.2.14 Coat one o-ring seal (5-10) with lubricant and install onto outer diameter flange located on housing adapter end of housing (1-10).
- 3.2.15 Actuators equipped with cylinder adapter (4-15), models CBB415-SR, CBB520-SR and CBB725-SR, do steps 3.2.15.1 and 3.2.15.2.
 - 3.2.15.1 Install cylinder adapter (4-15) onto housing flange, with the stepped outer diameter, of cylinder adapter (4-15), facing away from housing (1-10).
 - 3.2.15.2 Install one o-seal (5-15) onto stepped diameter of cylinder adapter (4-15).

3.3 Spring cylinder reassembly

- 3.3.1 Coat piston (4-50) outer diameter seal groove, inner diameter seal groove, head of piston and exposed ends of yoke pin with lubricant.
- 3.3.2 Coat o-ring seal (5-20) with lubricant and install in the internal seal groove in the head of piston (4-50).
- 3.3.3 Coat seal (5-40) with lubricant and install into outer diameter seal groove of piston (4-50). The piston seal will fit very loosely in the outer diameter seal groove.
- 3.3.4 Install bushing (1-100) between the two arms of yoke (1-20).
- 3.3.5 With the piston head facing away from housing (1-10) and with yoke pin up, install piston (4-50) onto center bar assembly (8-10).
- 3.3.6 Carefully slide piston (4-50) along center bar (8-10) until yoke pin engages the yoke slots.

NOTE:

While holding the center bar assembly flush against the housing, push piston (4-50) into housing (1-10) as far as the piston will go.

- 3.3.7 Apply a coating of lubricant to entire bore of spring cylinder (4-10).
- 3.3.8 Spring cylinder installation:
 - 3.3.8.1 For CBB415-SR, CBB520-SR and CBB725-SR models install the lubricated spring cylinder (4-10) over the piston and up-against the o-ring seal on the stepped diameter flange of cylinder adapter (4-15).
 - 3.3.8.2 For CBB315-SR, CBB420-SR and CBB525-SR models install the lubricated spring cylinder (4-10) over the piston and up-against the o-ring seal on the flange of housing (1-10).
- 3.3.9 Install spacer (1-110) onto center bar assembly (8-10).
- 3.3.10 Apply a coat of lubricant to the spring (4-70). Install the spring into the spring cylinder by carefully sliding the spring into the open spring cylinder end until the spring contacts the head of piston (4-50).
- 3.3.11 End cap seal installation.
 - 3.3.11.1 For CBB415-SR, CBB520-SR and CBB725-SR models install O-ring seal (5-15) onto end cap (4-20).
 - 3.3.11.2 For CBB315-SR, CBB420-SR and CBB525-SR models install O-ring seal (5-10) onto end cap (4-20).
- 3.3.12 If removed install stop screw / ES (4-30) into end cap (4-20) and set stop screw to the approximated setting recorded in Section 2 step 2.1.2.

NOTE:

Position spring cylinder (4-10) so that spring tag (4-60) will be adjacent to accessory mounting pads located on the actuator housing.

- 3.3.13 Install end cap (4-20) onto center bar assembly (8-10) by rotating the end cap in a clockwise direction.
- 3.3.14 Position the end cap (4-20) so that the breather port is at the bottom and the stop screw / ES (4-30) is at the top.

⚠ WARNING: END CAP INSTALLATION

Do not allow end cap (4-20) to rotate during center bar assembly tightening. The end cap must maintain the position as described in step 3.3.14.

- 3.3.15 Keep end cap (4-20) from turning by holding end cap with an adjustable wrench.
- 3.3.16 Using a ratchet and socket on the center bar assembly nut, rotate center bar assembly clockwise (CW). This will cause end cap (4-20) to gradually screw further onto center bar assembly (8-10).

- 3.3.17 Continue to rotate center bar assembly (8-10) clockwise until spring (4-70) is fully compressed, the spring cylinder is seated against the flange of housing (1-10) or adapter (4-15) and end cap (4-20) is properly seated in spring cylinder (4-10).
- 3.3.18 Tighten center bar assembly (8-10) to the proper torque as specified in the following chart.

Table 3. Tightening torque center bar

| Actuator Model | Maximum Torque | |
|-------------------|----------------|-----|
| | FT. LBS. | N-m |
| 315-SR and 415-SR | 55 | 75 |
| 420-SR and 520-SR | 100 | 136 |
| 525-SR and 725-SR | 130 | 176 |

- 3.3.19 Place seal gasket (5-50) on the exposed end of the center bar assembly (8-10).
- 3.3.20 Place acorn nut (8-20) on the exposed outboard end of center bar assembly (8-10) and tighten securely.
- 3.3.21 Install the stop screw / ES / M3 jackscrew (1-70) for CBB315/415-SR-M3 and non M3 model actuators as follows:
 - 3.3.21.1 Install stop screw / ES / M3 jackscrew (1-70) into housing (1-10) and screw in until stop screw contacts the piston.
 - 3.3.21.2 Install o-ring seal (2-30) onto stop screw / ES / M3 jackscrew (1-70) until it is flush with the housing.
 - 3.3.21.3 Install hex nut (1-80) onto stop screw (1-70) until hand tight.
- 3.3.22 Install o-ring seal (5-30) onto the stop screw / ES (4-30) until it is flush with the end cap.
- 3.3.23 Install new washer (4-90) onto the stop screw / ES (4-30) until it is close to the end cap
- 3.3.24 Install hex nut (4-40) onto stop screw / ES (4-30) until hand tight.
- 3.3.25 Adjust stop screw / ES / M3 jackscrew (1-70) and stop screw / ES (4-30) back to setting recorded in Section 2 step 2.1.2 under General Disassembly. Tighten both stop screw hex nuts (4-40) and (1-80) securely, while holding stop screw (1-70) and (4-30).
- 3.3.26 M3 hex drive hub or handwheel installation as follows:
 - 3.3.26.1 Install hex drive hub (12-10) or handwheel (12-10) onto M3 jackscrew (1-70) and align the “hole” of the drive hub with the “hole” located in the M3 jackscrew.
 - 3.3.26.2 Install retainer ring (12-30) and groove pin (12-20) into the hex drive hub (12-10) or handwheel (12-10).

Section 4: Actuator Testing

4.1 Actuator testing

- 4.1.1 **Leak Test - General** - A small amount of leakage may be tolerated. Generally, a small bubble which breaks about three seconds after starting to form is considered acceptable.
- 4.1.2 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution.

⚠ WARNING: MAXIMUM OPERATING PRESSURE

Pressure is not to exceed the maximum operating pressure rating listed on the serial number tag (20).

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

NOTE:

When testing the actuator use a proper adjusted regulator to apply pressure to the actuator.

- 4.1.4 Before testing for leaks, apply and release the pressure listed in step 4.1.3 to the housing side of the piston. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.
- 4.1.5 Apply the pressure listed in step 4.1.3 to the housing side of the piston and allow the actuator to stabilize.
- 4.1.6 Apply a leak testing solution to the following areas:
 - 4.1.6.1 Spring cylinder to housing joint on CBB315-SR, CBB420-SR, and CBB525-SR or spring cylinder to cylinder adapter to housing joints on CBB415-SR, CBB520-SR, and CBB725-SR actuators.
 - 4.1.6.2 On the out board end of housing (1-10) at the center bar assembly nut. Checks the center bar to housing o-ring seal (5-20).
 - 4.1.6.3 Housing stop screw O-ring seal (2-30).
 - 4.1.6.4 Torque shaft (1-30) to housing (1-10) interface. Check rod wiper seals (2-20).
 - 4.1.6.5 End cap (4-20) port hole. Check the piston to cylinder seal (5-40) and piston to center bar seal (5-20).
 - 4.1.6.6 Remove pressure from pressure inlet port in the housing (1-10).
- 4.1.7 If an actuator was disassembled and repaired as a result of this procedure, the above leakage test must be performed again.
- 4.1.8 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 shaft.

- 4.1.8.1 Adjust the pressure regulator to the pressure rating that the customer uses to operate the actuator during normal service.
- 4.1.8.2 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.

4.2 Return to service

- 4.2.1 Install breather (30) into end cap (4-20).
- 4.2.2 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.

4.3 Pressure requirement & limitations for CBB-SR actuators

Table 4. Pressure requirement and limitations

| Actuator Model | Nominal Operating Pressure | | Maximum Operating Pressure | | Actuator Model | Nominal Operating Pressure | | Maximum Operating Pressure | |
|----------------|----------------------------|------|----------------------------|-------|----------------|----------------------------|------|----------------------------|-------|
| | Psig | Barg | Psig | Barg | | Psig | Barg | Psig | Barg |
| 315-SR40 | 40 | 2.76 | 155 | 10.69 | 520-SR40 | 40 | 2.76 | 110 | 7.59 |
| 315-SR60 | 60 | 4.14 | 152 | 10.48 | 520-SR60 | 60 | 4.14 | 116 | 8.00 |
| 315-SR80 | 80 | 5.52 | 150 | 10.34 | 520-SR80 | 80 | 5.52 | 120 | 8.27 |
| 315-SR100 | 100 | 6.89 | 164 | 11.31 | 520-SR100 | 100 | 6.89 | 132 | 9.10 |
| 415-SR40 | 40 | 2.76 | 100 | 6.89 | 525-SR40 | 40 | 2.76 | 146 | 10.07 |
| 415-SR60 | 60 | 4.14 | 112 | 7.72 | 525-SR60 | 60 | 4.14 | 151 | 10.41 |
| 415-SR80 | 80 | 5.52 | 117 | 8.07 | 525-SR80 | 80 | 5.52 | 159 | 10.96 |
| 415-SR100 | 100 | 6.89 | 114 | 7.86 | 525-SR100 | 100 | 6.89 | 163 | 11.24 |
| 420-SR40 | 40 | 2.76 | 157 | 10.83 | 725-SR40 | 40 | 2.76 | 102 | 7.03 |
| 420-SR60 | 60 | 4.14 | 156 | 10.76 | 725-SR60 | 60 | 4.14 | 115 | 7.95 |
| 420-SR80 | 80 | 5.52 | 161 | 11.10 | 725-SR80 | 80 | 5.52 | 124 | 8.55 |
| 420-SR100 | 100 | 6.89 | 166 | 11.45 | 725-SR100 | 100 | 6.89 | 124 | 8.55 |

Section 5: Document Revision

Table 5. Revision overview

| ECN | DATE | REV | | BY * | DATE |
|----------|-------------|-----|----------|-----------|---------|
| 19527 | April 2007 | C | COMPILED | D.Blahnik | 6/30/09 |
| 40548 | 12 May 2009 | D | CHECKED | B.Jumawan | 6/30/09 |
| 40677 | 6/30/09 | E | APPROVED | K.Chin | 6/30/09 |
| 0526 001 | 5/08/2012 | F | COMPILED | C. Rico | 5/08/12 |

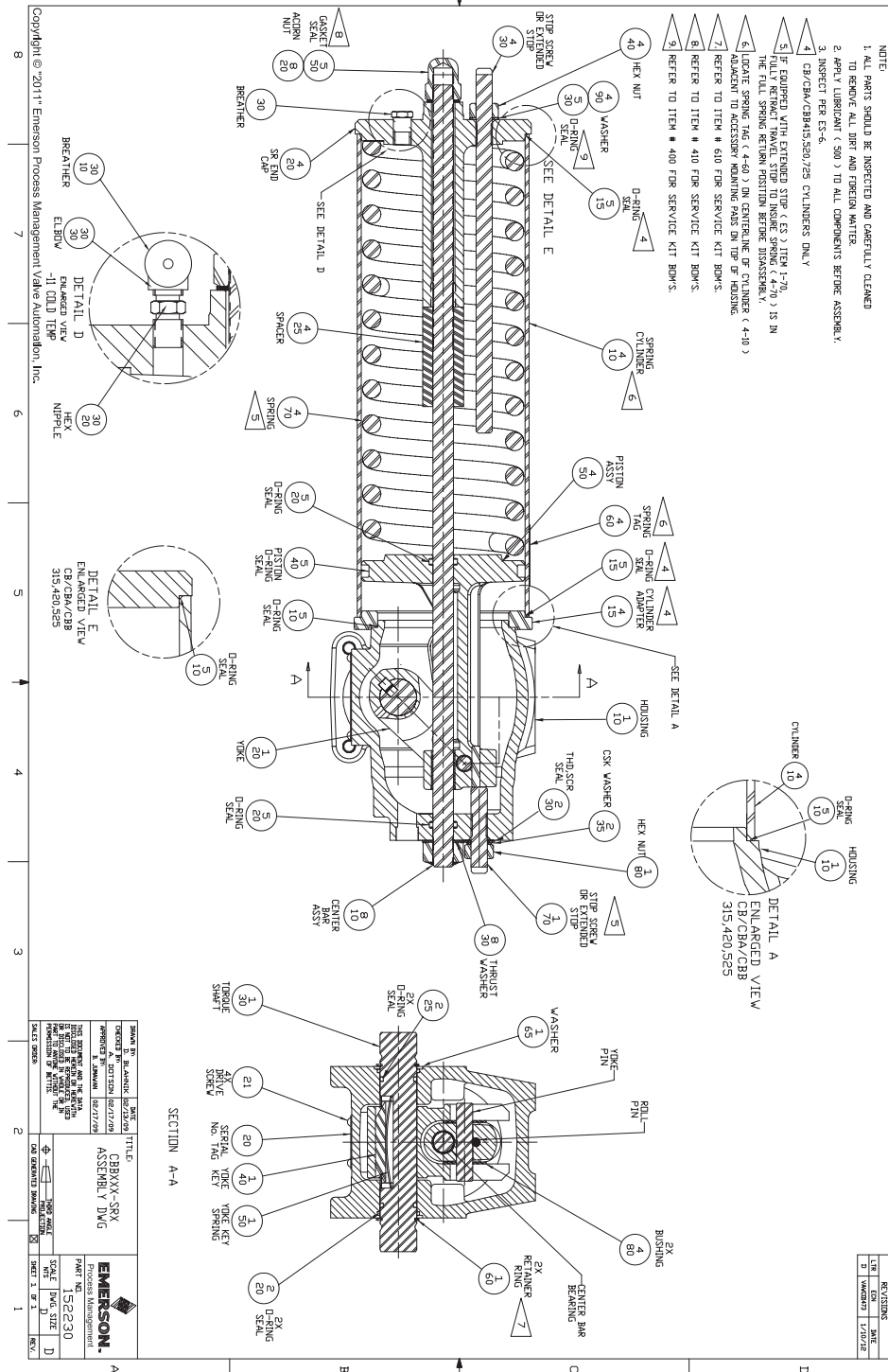
* Signatures on file Bettis Actuator & Controls, Waller, Texas

Appendix A: List of Tables

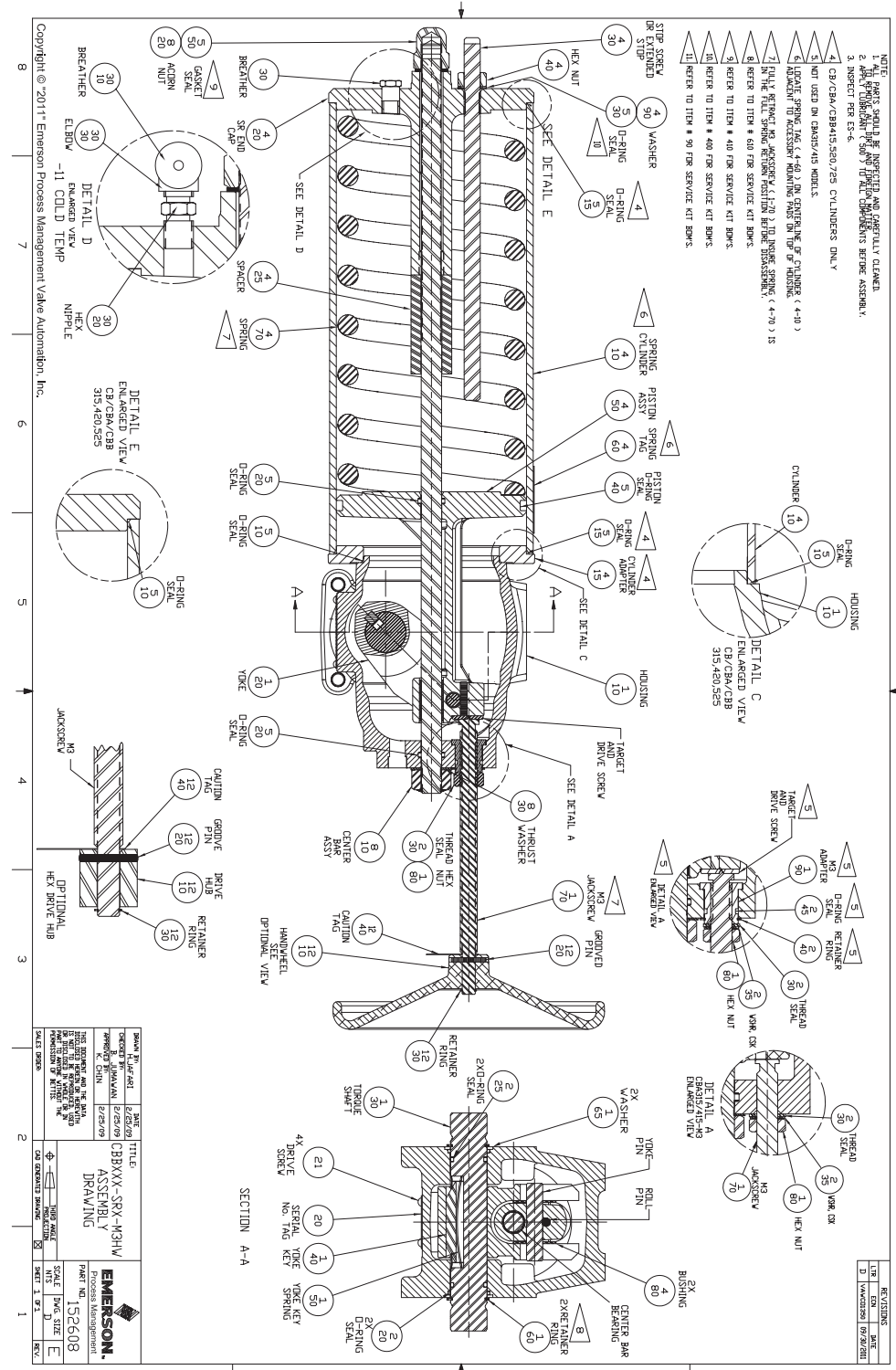
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Appendix B: List of Drawings

B.1 Part No. 152230, CBBXXX-SRX Assembly Dwg



B.2 Part No. 152608, CBBXXX-SRX-M3HW Assembly Dwg



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