

**BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY AND REASSEMBLY**

**CB735-SR AND CB735A-SR**

**SPRING RETURN SERIES**

**PNEUMATIC ACTUATORS**

PART NUMBER: 074957

REVISION: "A"

DATE: January 4, 1995

## 1.0 INTRODUCTION

1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis CB735-SR and CB735A-SR Spring Return Series Actuators. When the actuator model number has "X" included in its description then the actuator is special and may have some differences that are not included in this procedure.

1.2 **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 well trained, equipped, prepared and competent 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 customers plant safety or work procedures. If a conflict arises between this procedure and the customers procedures the differences should be resolved in writing between an authorized customers representative and a authorized Bettis representative.

### 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 **BASIC SERVICE INFORMATION:** Complete actuator refurbishment requires the actuator be dismantled from the valve or device it is operating.

1.5 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.

1.6 This procedure is applicable with the understanding that all electrical power and pneumatic 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.

## 2.0 SUPPORT ITEMS AND TOOLS

2.1 Support Items - Service/Seal Kit, seal removal tool, commercial leak testing solution, and non-hardening thread sealant.

2.2 Tools - All tools are American Standard inch. Two adjustable wrenches, allen wrench set, medium size standard screwdriver, external snap ring pliers, flat file, 1/2" inch drive ratchet and deepwell socket set.

### **3.0 BETTIS REFERENCE MATERIALS**

- 3.1 Parts List for CB735-SR Figure No. 1, located on page 9.
- 3.2 Parts List for CB735A-SR Figure No. 2, located on page 10.
- 3.3 Assembly Drawing for CB735-SR use Figure No. 3 located on page 11.
- 3.4 Assembly Drawing for CB735A-SR use Figure No. 4 located on page 12.
- 3.5 Base I Standard Dimensional Drawing use Bettis sales print drawing SPD-5108.

### **4.0 GENERAL INFORMATION**

- 4.1 The CB735-SR actuator series went out of production in 1974. The Service/Seal Kit is a generic kit that fits all CB735 double acting and CB735-SR series actuators (models "Basic" and "A"). The Service Kit fits many different model actuators so there may be extra seals and gaskets in the kit.
- 4.2 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- 4.3 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on the attached drawing and Actuator Parts List (Figures 1 through 4).
- 4.4 When removing seals from seal grooves, use a small screwdriver with sharp edges rounded off or a commercial seal removing tool.
- 4.5 Use a non-hardening thread sealant on all pipe threads.

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

- 4.6 Disassembly should be done in a clean area on a work bench.
- 4.7 **LUBRICATION REQUIREMENTS:** For use in all areas of the actuator. Lubricants, other than those listed in steps 4.9.1 and 4.9.2, should not be used without prior written approval of Bettis Product Engineering.
  - 4.7.1 Standard and high temperature service (-20°F to +350°F) use Bettis ESL-5, Kronaplate 100 lubricant. ESL-5 is contained in the Bettis Service/Seal Kit.
  - 4.7.2 Low temperature service (-50°F to +150°F) use Kronaplate 50 lubricant. Kronaplate 50 is not contained in the Low Temperature Service/Seal Kit.

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

- 4.8 Before starting the general disassembly of the actuator, it is a good practice to operate the actuator with the nominal operating pressure (NOP), as listed on the actuator nametag or 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.

## 5.0 GENERAL DISASSEMBLY

- 5.1 The setting of stop screw (20) and (25) should be checked and setting recorded before stop screws are loosened or removed.
- 5.2 Loosen and remove hex nut (17) from housing stop screw (20).
- 5.3 Remove housing stop screw (20).

## 6.0 SPRING CYLINDER DISASSEMBLY

**CAUTION:** The center bar nut (12) located on the housing end of center bar (19) should never be removed before the spring is removed from the cylinder end of center bar (19). Refer to step 13.1.

- 6.1 The spring in CB Series Spring Return Units is preloaded. Actuator must be disassembled in the following manner.
- 6.2 Remove center bar (12) from spring cylinder end cap (27) of center bar (19).
- 6.3 The end cap (27) has a 1-7/8 cast flat for wrench placement. Using this cast flat to hold end cap break the center bar nut (12) loose and remove.
- 6.4 Using a (1/2" inch drive) ratchet and socket on the center bar nut, located on the housing end of the center bar, rotate center bar counter-clockwise (CCW). This will cause end cap (27) to gradually unscrew from center bar (19). Continue to rotate center bar (19) counter-clockwise (CCW) until the spring preload is eliminated.

NOTE: Center bar nut (12) that is on the housing end of center bar (19) is affixed on the center bar.

- 6.5 After the spring preload is eliminated, unscrew end cap (27) from center bar (19).
- 6.6 Remove spring (22) from with in spring cylinder (18).
- 6.7 Holding housing (1) in place, pull cylinder (18) away from housing (1); slide cylinder over piston (2) and remove.
- 6.8 Pull piston (2) out of housing (1) and carefully slide piston off of center bar (19).

NOTE: Yoke pin roller (4), Yoke pin retainer (10) and yoke pin (6) are removed as part of piston (2).

- 6.9 Remove both yoke pin retainers (10) from yoke pin (6). This will allow the removal of yoke pin (6) and yoke pin rollers (4) from piston (2).

## 7.0 HOUSING DISASSEMBLY

- 7.1 Remove center bar assembly (19) from housing (1).
- 7.2 Remove both retaining rings (13) from torque shaft (5).
- 7.3 The following steps may need to be taken before disassembly can continue.

NOTE: If the torque shaft has any raised burrs or sharp edges they should be filed off, removing as little metal as possible. If there is excessive paint build-up on torque shaft it should be removed.

- 7.4 Push torque shaft (5) out one side of housing (1) until o-ring seal (15) is clear of housing. Remove o-ring seal (15) from torque shaft. Note: Torque shaft will only come out of housing (1) in one direction.
- 7.5 Push torque shaft (5) back through housing and pull torque shaft completely out of housing while holding yoke key (7) in with your fingers.
- 7.6 Remove yoke key (7) and yoke key spring (8) from torque shaft (5).
- 7.7 Remove yoke (3) from housing (1).
- 7.8 Remove breather (26) from end cap (27).

NOTE: Most CB735-SR Series Actuators used a snubber valve instead of a breather for items (4-20). It is recommended that the snubber valve for items (26) be replaced with a Bettis part number 029198.

## 8.0 PRE-ASSEMBLY NOTES

**CAUTION: Only new seals, that are still within the seals expectant shelf life, should be install back into actuator being refurbished.**

- 8.1 Remove and discard all seals and gaskets.
- 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, tie bars and piston rod must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

**CAUTION: Actuator parts that reflect any of the above listed characteristics must be replaced with new parts.**

- 8.4 Before installation coat all moving parts with a complete film of lubricant. Coat all seals with a complete film of lubricant, before installing into seal grooves.

## 9.0 GENERAL REASSEMBLY

- 9.1 Apply a coating of lubricant to housing (1) torque shaft holes.
- 9.2 Coat yoke (3) with lubricant and insert into housing (1).
- 9.3 Insert yoke key spring (8), with the ends pointing down, into the slot in torque shaft (5) and place yoke key (8) on top of yoke key (7) with the tapered side outward (Refer to Figure 3 or 4 for correct yoke key position).
- 9.4 Hold yoke key (8) down with your thumb, insert torque shaft (5) into and through housing (1) and yoke (3). Rotate torque shaft (5) until yoke key (8) snaps into the keyway in yoke (3).

- 9.5 Push torque shaft (5) out one side of housing (1) until the o-ring groove is clear of housing (1).
- 9.6 Coat one o-ring seal (15) with lubricant and install in the o-ring groove of torque shaft (5).
- 9.7 Carefully push torque shaft (5) back into housing (1) until o-ring groove on opposite end of torque shaft (5) is just clear of housing (1).
- 9.8 Coat remaining o-ring seal (15) with lubricant and install into o-ring groove of torque shaft (5).
- 9.9 Install one retaining rings (13) onto torque shaft (5), making certain it is properly seated in torque shaft groove.
- 9.10 Push torque shaft (5) back into housing (1) and install remaining retaining ring (13) on torque shaft (5).
- 9.11 Rotate torque shaft (5) so that the arms of yoke (3) point outward.
- 9.12 Apply a generous amount of lubricant to slots in the yoke arms.
- 9.13 Coat center bar (19) with lubricant, being sure to coat the exposed threads.
- 9.14 Install o-ring seal (28) into o-ring groove located on housing end of center bar (19).
- 9.15 Insert the center bar (19) into the center hole of housing (1) and slide center bar through housing until center bar nut (12) is flush against housing (1).

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

- 9.16 Install o-ring seal (24) on flange of housing (1).

## **10.0 SPRING CYLINDER REASSEMBLY**

- 10.1 Install one of the yoke pin retainers (10) onto the yoke pin (6).
- 10.2 Apply lubricant to the yoke pin (6) and the two yoke pin rollers (4).
- 10.3 Slide one lubricated yoke pin roller (4) onto yoke pin (6) and up against yoke pin retainer (10).
- 10.4 Insert this partially assembled yoke pin (6) with yoke pin roller (4) through the hole in the piston shank. Hold this assembly in place while second lubricated yoke pin roller (4) is placed on yoke pin (6). Retain yoke pin (6) and rollers (4) in piston (2) with second yoke pin retainer (10).
- 10.5 Re-coat center bar (19) with lubricant.
- 10.6 Coat rod T-seal (11) with lubricant and install into the internal seal groove in the head of piston (2).

- 10.7 Coat piston seal (14) with lubricant and install into outer diameter seal groove of piston (2). This seal will have a very loose fit.
- NOTE: The actuator was shipped with a piston cup seal (14) to seal the piston to the cylinder (18). The piston cup seal is replaced with a o-ring and the piston cup seal is no longer available.
- 10.8 Coat the head of the piston along with the exposed ends of yoke pin (6) with lubricant.
  - 10.9 With the piston head facing away from housing (1) and with yoke pin (6) up, carefully slide piston (2) onto center bar (19).
  - 10.10 Slide piston (2) along center bar (19) until yoke pin (6) engages the slots of yoke (3). While holding center bar nut (12) flush against the housing (1) push piston (2) into housing (1) as far as it will go.
  - 10.11 Apply a coating of lubricant to entire bore of cylinder (2).
  - 10.12 Slip lubricant cylinder (2) over piston (2) and onto the flange of housing (1).
  - 10.13 Apply a coat of lubricant on spring (22) and carefully slide spring (22) into the open cylinder until it contacts the head of piston (2).
  - 10.14 Screw end cap (27) onto center bar (19) until end cap (27) touches spring (22).
  - 10.15 Position end cap (27) so that the breather port is at the bottom and stop screw (25) is at the top.
  - 10.16 Keep end cap (27) from turning by holding nut (17) with an adjustable wrench.
  - 10.17 Using a (1/2" inch drive) ratchet and socket on nut (12), located on the housing end of center bar (19), rotate center bar clockwise (CW). This will cause end cap (27) to gradually screw further onto center bar (19).
  - 10.18 Continue to rotate the center bar (19) clockwise until the spring (22) is fully compressed, the cylinder is seated against the housing flange and the spring cylinder end cap (27) is properly seated against the cylinder (18).
  - 10.19 Tighten center bar (19).
  - 10.20 Place second center bar nut (12) on the exposed end of center bar (19) and tighten securely.
  - 10.21 Screw one thread seal (23) onto stop screw (20).
  - 10.22 Slip washer (21) onto the stop screw with the chamfer facing thread seal (23).
  - 10.23 Screw one nut (17) onto stop screw (25).
  - 10.24 Insert stop screw (20) into housing (1) and screw until stop screw (20) contacts piston (2).
  - 10.25 If removed, screw stop screw (25) into end cap (27).
  - 10.26 Repeat steps 10.21, 10.22 and 10.23 for stop screw (25).

- 10.27 Adjust both stop screws (20) and (25) back to setting recorded in section 5 under General Disassembly. Tighten both stop screw hex nuts (17) securely, while holding stop screw (20) and (25).

## 11.0 ACTUATOR TESTING

- 11.1 **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.
- 11.2 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution.

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

- 11.3 All leak testing will use NOP pressure, as listed on the actuator name tag, or the pressure customer uses to normally operate actuator with.

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

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

- 11.5 Stroke the actuator with pressure, as described in step 11.3, and allow the actuator to stabilize.

- 11.6 Apply a leak testing solution to the following areas:

11.6.1 Cylinder to housing joint.

11.6.2 Center bar nut to housing.

11.6.3 Housing stop screw and stop screw thread seal.

11.6.4 Torque shaft seals.

11.6.5 Cylinder breather port hole.

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

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

- 11.9 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.

- 11.10 Adjust the pressure regulator to the NOP pressure.



- 11.11 Apply the above pressure to the actuator and allow the unit to stabilize. The actuator should stroke a full 90° degrees of travel with the stops properly adjusted.

## 12.0 RETURN TO SERVICE

- 12.1 Re-install breather (26) into end cap (27).

NOTE: Most CB735-SR Series Actuators used a snubber valve instead of a breather for items (26). It is recommended that the snubber valve for items (26) be replaced with a Bettis part number 029198.

- 12.2 After the actuator is re-installed on the item it is operating all accessories should be hooked up and tested for proper operation and replaced if found defective.

## 13.0 GENERAL NOTES

- 13.1 All asbestos has been eliminated from the gasket material used in Bettis Actuators. The current gasket material used is Non Asbestos Synthetic Fiber.

<u>ECN</u>	<u>DATE</u>	<u>REV</u>		<u>BY *</u>	<u>DATE</u>
Released	January, 1995	A	COMPILED	Bill Cornelius	5 January 1995
			CHECKED	Bill Cornelius	5 January 1995
			APPROVED	Robert McEver	5 January 1995

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

**FIGURE NO. 1 - CB735A-SR PARTS LIST**

ITEM	PART NO	DESCRIPTION	MATERIAL	MATERIAL SPEC.	QTY.
1	011543	Housing (1)	Ductile Iron	ASTM A-536 Grade 60-40-18	1
2	011535	Piston (1)	Ductile Iron	ASTM A-536 Grade 65-45-12	1
3	011544	Yoke (1)	Ductile Iron	ASTM A-536 Grade 80-55-06	1
4	011542	Yoke pin roller	Steel	AISI S7	2
5	022842	Torque shaft	Steel	Stressproof	1
6	011531	Yoke pin	Steel	AISI 4140/42	1
7	011532	Yoke key	Steel	ASTM A-108 Grade 1018/20	1
8	011533	Yoke key spring	Steel	AISI 1075	1
9	003727	Pressure port plug	Steel	Commercial	1
10	011545	Yoke pin retainer	Steel	Commercial	2
11	012789	Piston rod seal	Nitrile	Commercial	1 SET
12	011540	Center bar nut	Steel	Commercial	2
13	003110	Torque shaft retainer	Steel	Commercial	2
14	034117	Piston cup seal	Nitrile	Duro 70A	1
15	005224	Torque shaft seal	Nitrile	Commercial	2
16	003293	Serial number tag	Aluminum	ASTM B-209	1
17	011293	Stop screw nut	Steel	Commercial	2
18	013608	Cylinder	Steel	AISI C1018/20	1
19	013609	Center bar	Steel	Stressproof	1
20	016363	Stop screw	Steel	Commercial	1
21	011539	Stop screw washer	Steel	Commercial	1
22		Spring	Steel	AISI 5160	1
23	003040	Stop screw seal	Nitrile	Commercial	1
24	005167	Cylinder seal	Nitrile	Commercial	1
25	013607	Stop screw	Steel	ASTM A-108 Grade 1018/20	1
26	011967	Snubber valve (2)		Commercial	1
27	014961	End cap	Ductile Iron	ASTM A-536 Grade 65-45-12	1
28	005024	Center bar seal	Nitrile	Commercial	1

(1) Not for sale.

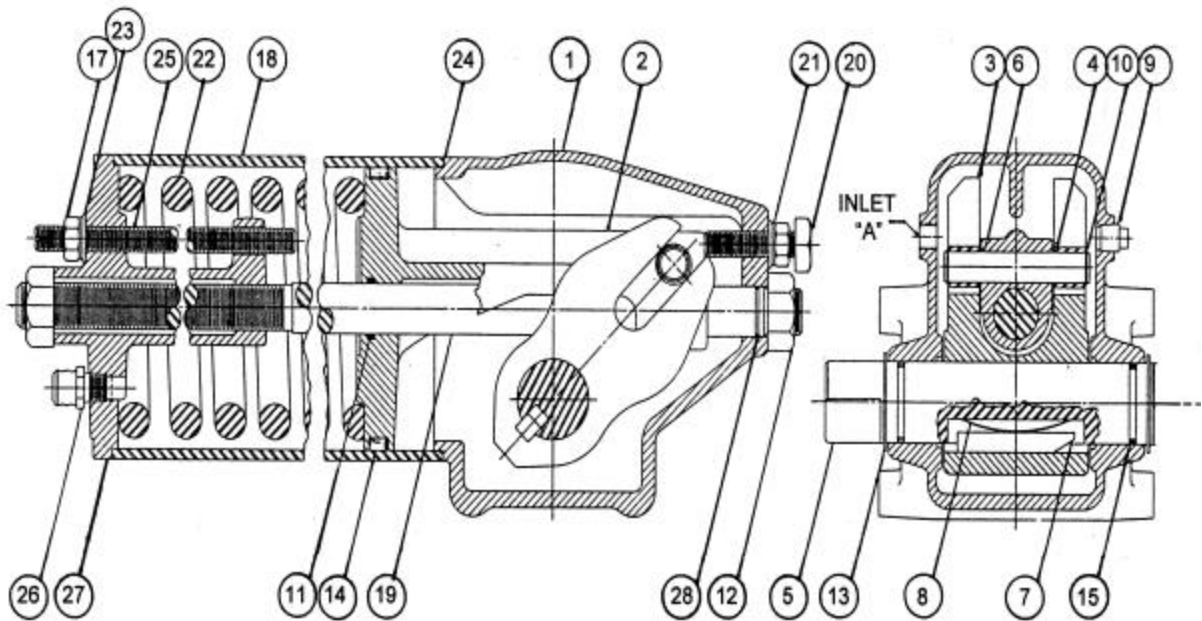
(2) Replace with Breather, Lenz model BF-6, Bettis Part Number 029198.

**FIGURE NO. 2 - CB735-SR PARTS LIST**

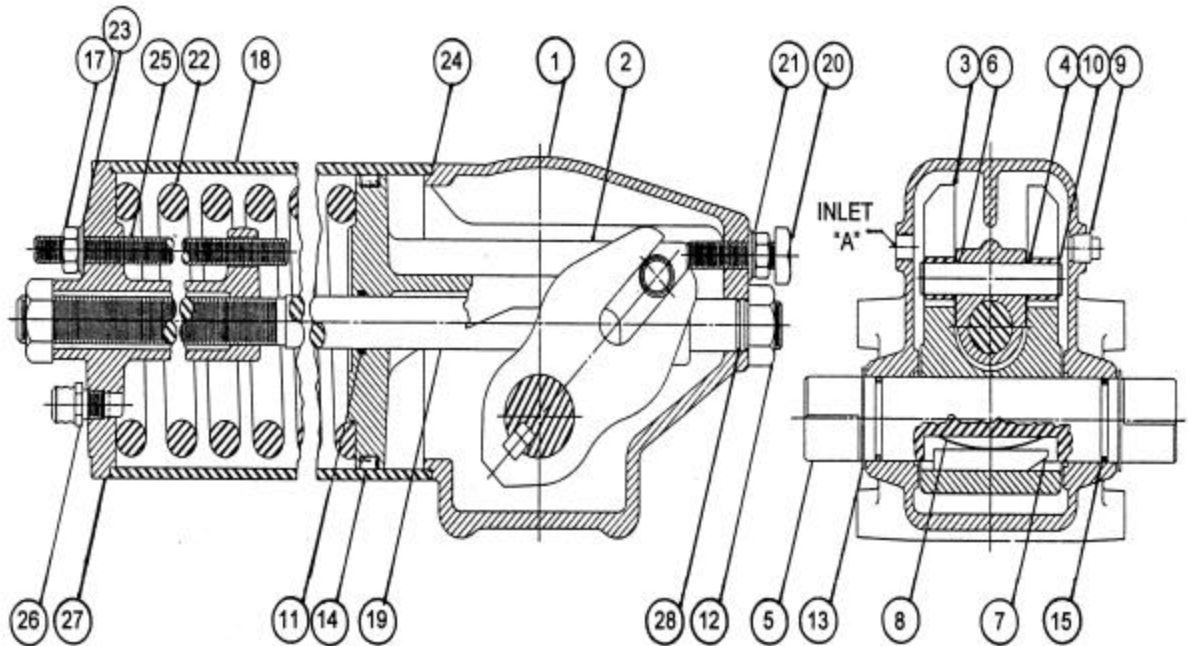
ITEM	PART NO	DESCRIPTION	MATERIAL	MATERIAL SPEC.	QTY.
1	011543	Housing (1)	Ductile Iron	ASTM A-536 Grade 60-40-18	1
2	011535	Piston (1)	Ductile Iron	ASTM A-536 Grade 65-45-12	1
3	011544	Yoke (1)	Ductile Iron	ASTM A-536 Grade 80-55-06	1
4	011542	Yoke pin roller	Steel	AISI S7	2
5	011536	Torque shaft	Steel	Stressproof	1
6	011531	Yoke pin	Steel	AISI 4140/42	1
7	011532	Yoke key	Steel	ASTM A-108 Grade C1018/20	1
8	011533	Yoke key spring	Steel	AISI 1075	1
9	003727	Pressure port plug	Steel	Commercial	1
10	011545	Yoke pin retainer	Steel	Commercial	2
11	012789	Piston rod seal	Nitrile	Commercial	1 SET
12	011540	Center bar nut	Steel	Commercial	2
13	003110	Torque shaft retainer	Steel	Commercial	2
14	034117	Piston cup seal	Nitrile	Duro 70A	1
15	005224	Torque shaft seal	Nitrile	Commercial	2
16	003293	Serial number tag	Aluminum	ASTM B-209	1
17	011293	Stop screw nut	Steel	Commercial	2
18	013608	Cylinder	Steel	AISI C1018/20	1
19	013609	Center bar	Steel	Stressproof	1
20	016363	Stop screw	Steel	Commercial	1
21	011539	Stop screw washer	Steel	Commercial	1
22		Spring	Steel	AISI 5160	1
23	003040	Stop screw seal	Nitrile	Commercial	1
24	005167	Cylinder seal	Nitrile	Commercial	1
25	013607	Stop screw	Steel	ASTM A-108 Grade C1018/20	1
26	011967	Snubber valve (2)		Commercial	1
27	013961	End cap	Ductile Iron	ASTM A-536 Grade 65-45-12	
28	005024	Center bar seal	Nitrile	Commercial	1

(1) Not for sale.

(2) Use Breather, Lenz model BF-6, Bettis Part Number 029198.



**CB735-SR - FIGURE NO. 3**



**CB735A-SR - FIGURE NO. 4**

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