

**GH-BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY & REASSEMBLY**

**FOR KCBM FIREFOXX II**

**K-MASS SERIES**

**DOUBLE ACTING ACTUATORS**

**WITH SINGLE DIRECTION**

**INTERNAL MANUAL CONTROL**

PART NUMBER: 074965

REVISION: "A"

DATE: July, 1993



## 1.0 INTRODUCTION

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis KCB415M, KCB420M, KCB520M, KCB525M and KCB725M Double Acting K-Series Actuators with internal single direction manual control.
- 1.2 **SAFETY STATEMENT:** Products supplied by GH-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 GH-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.**

### 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 DISMOUNTED 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 - Assembly tool CBM-SR part number 074113, Service/Seal Kit, latex window caulking, commercial leak testing solution, and non-hardening thread sealant.
- 2.2 Tools - All tools are American Standard inch. Two adjustable wrenches, 1/8" punch, 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 with deepwell socket set and torque wrench (up to 2,000 in-lbs).

## 3.0 GH-BETTIS MATERIALS

- 3.1 CB415M, CB520M, CB725M Assembly Drawing Part Number 102070\*
- 3.2 CB420M, CB525M Assembly Drawing Part Number 102071\*
- 3.3 Assembly tool drawing D-074113
- 3.4 CBM BASE I Dimensional Drawing 102076\* (Manual to close)
- 3.5 CBM BASE I Dimensional Drawing 102077\* (Manual to open)

\* **These drawings will not show the K-Mass coating and related covers and hardware.**

#### 4.0 GENERAL DETAILS

- 4.1 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- 4.2 Number in parentheses, ( ) indicate the bubble number (reference number) used on the GH-Bettis Assembly Drawings and Actuator Parts List.
- 4.3 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.
- 4.4 Use a non-hardening thread sealant on all pipe threads. **CAUTION: Apply the thread sealant per the manufacture's instructions.**
- 4.5 Disassembly must be done in a clean area on a work bench.
- 4.6 Lubrication Requirements - GH-Bettis ESL-5 (Kronaplate 100). ESL-5 is contained in the GH-Bettis Service Kit.
- 4.7 It is a good practice to operate the actuator with 65 psi operating pressure 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. **NOTE: Pressure is not to exceed the maximum operating pressure rating listed on the name tag.**

#### 5.0 GENERAL DISASSEMBLY

- 5.1 Cut through the latex caulking that seals the cover cap on the outer end of the cylinder (2-10) and the cover cap that covers the housing stop screw (2-80).
- 5.2 Remove a hex nut from the pipe extensions located on both ends of the actuator.
- 5.3 Remove both of the cover caps from the actuator.
- 5.4 The setting of the stop screws (2-80) should be checked and setting recorded before the stop screw is loosened or removed.
- 5.5 Rotate the handwheel clockwise until the actuator is at the end of its stroke.
- 5.6 Loosen and remove hex nut (2-90) from housing stop screw (2-80) and end cap stop screw (2-80).
- 5.7 Remove seal washer (3-80) and screw thread seal (3-70) from housing stop screw (2-80) and end cap stop screw (2-80).
- 5.7 Remove stop screws (2-80) from the housing (1-10) and the end cap (2-20).

#### 6.0 CYLINDER ASSEMBLY

- 6.1 Remove the grooved pin (6-20) from the handwheel (6-10).
- 6.2 Remove the handwheel (6-10) from the lead screw assembly (2-40).
- 6.3 Remove the grooved pin (2-100) from the lead screw assembly. This will allow the removal of the torque nut from the lead screw assembly.

- 6.4 Remove both of the thrust washers (2-180) and the thrust bearing (2-190) from the end cap (2-20).
- 6.5 Unscrew and remove acorn nut (2-110) and seal washer (3-10) from center bar assembly (2-50).
- 6.6 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 cylinder end cap (2-20) to gradually unscrew from the center bar assembly (2-50). Unscrew and remove the cylinder end cap (2-20) from the center bar assembly (2-50).
- 6.7 Hold 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 remove by carefully sliding piston off of center bar assembly (2-50). The lead screw assembly (2-40) and tie bars (2-140) will stay assembled with the piston.
- 6.9 Roll pin (1-60) and yoke pin (1-40) are removed as part of the piston (2-30) and they do not need to be removed from the piston.

## **7.0 HOUSING DISASSEMBLY**

- 7.1 On actuators equipped with a cylinder adapter (2-120) CB415M, CB520M and CB725M, remove cylinder adapter (2-120) from housing (1-10).
- 7.2 Slide center bar assembly (2-50) out of housing (1-10).
- 7.3 Remove both retaining rings (1-80) from torque shaft (1-30). Do not re-use retaining rings when new retaining rings are provided in the Service/Seal Kit.
- 7.4 The following steps may need to be taken before disassembly can continue.
  - 7.4.1 If the torque shaft has any raised burrs or sharp edges they should be filed off, removing as little metal as possible.
  - 7.4.2 If there is excessive paint build-up on torque shaft it should be removed.
- 7.5 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.
- 7.6 Push torque shaft (1-30) back through housing and pull torque shaft completely out of housing while holding yoke key (1-50) in place with your fingers.
- 7.7 Remove yoke key (1-50) and yoke key spring (1-70) from torque shaft (1-30).
- 7.8 Remove yoke (1-20) from housing (1-10).

## **8.0 PRE-ASSEMBLY NOTES**

- 8.1 Remove and discard all old seals and gaskets. All parts should be cleaned to remove all dirt and other foreign material prior to inspection.
- 8.2 All parts should be thoroughly inspected. Particular attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding motion. Sealing surfaces must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

- 8.3 All K-Mass coated parts should be inspected for damage to the coating. Replace or repair all K-Mass parts that are damaged.
- 8.4 Coat all surfaces contacting moving parts with lubricant.
- 8.5 Coat all seals with lubricant, before installing into grooves, also both sides of gaskets.

## **9.0 ACTUATOR RE-ASSEMBLY**

- 9.1 Apply 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 through the housing and yoke. **CAUTION: 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 Install one of the torque shaft o-ring seals (3-40) in 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 Install the remaining torque shaft o-ring seal (3-40) in the o-ring groove of the torque shaft (1-30).
- 9.9 Install one of the new 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 new 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 Coat the center bar assembly (2-50) with lubricant, being sure to coat the exposed threads.
- 9.14 Slide the washer seal (3-15) on to the center bar assembly (2-50) with the chamfered side facing away from the welded nut. Install the thread seal (3-90) next to the washer seal and both flush up 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 washer seal (3-15), thread seal (3-90) and the welded nut are flush against the housing.
- 9.16 Install cylinder gasket (3-30) on housing flange.

- 9.17 On actuators equipped with a cylinder adapter (2-120), CB415M, CB520M and CB725M, install the cylinder adapter (2-120) onto the housing flange, with the stepped outer diameter facing away from the housing, and place a cylinder gasket (3-20) onto the stepped diameter on the cylinder adapter.

## 10.0 CYLINDER RE-ASSEMBLY

- 10.1 If the leadscrew assembly (2-40) was not removed from the piston then start re-assembly at step 10.5. If the leadscrew assembly (2-40) and tie bars (2-140) were removed from the piston (2-30) then start re-assembly at step 10.2.
- 10.2 Install the tie bars (2-140) into the threaded holes in the face of the piston (2-30). Torque the tie bars per Chart Number 2. **NOTE: There are flats provided on the tie bars for wrenching.**
- 10.3 Install the leadscrew assembly (2-40) on the tie bars (2-140) by inserting the tie bars through the bronze half nut and then through the guide flange.
- 10.4 Retain the guide flange with hex nuts (2-150) and lock-washers (2-160).
- 10.5 Install the piston o-ring seal (3-50) in the internal groove in the head of piston (2-30).
- 10.6 Install the piston seal (3-60) onto the O.D. of the piston.
- 10.7 Coat the heal of the piston along with the exposed ends of yoke pin (1-40) with lubricant. Also lubricate the lead screw assembly (2-40) and the tie bars (2-140).
- 10.8 Re-coat the center bar assembly (2-50) with lubricant.
- 10.9 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). 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.
- 10.10 Apply a light coating of lubricant to the cylinder bore of cylinder (2-10).
- 10.11 Slip the lubricated cylinder (2-10) over the piston/lead screw assembly (2-40)/tie bars (2-140) and onto the flange of housing (1-10). **NOTE: Cylinder (2-10) will slip onto the flange of cylinder adapter (2-140) on CB415M, CB520M, and CB725M models.**
- 10.12 Screw the cylinder end cap (2-20) onto the center bar assembly (2-50).
- 10.13 Position the cylinder end cap (2-20) so that the lead screw assembly shaft is lined up with the hole in the end cap. Insert assembly tool part number 074113, through the end cap hole and screw the tool into the lead screw assembly (2-40).
- 10.14 Using a (1/2" drive) ratchet (or an impact wrench) and socket on the welded nut rotate the center bar assembly clockwise (CW). This will cause the cylinder end cap (2-20) to gradually screw further onto the center bar assembly (2-50). Continue to rotate the center bar (2-50) clockwise until the cylinder is seated against the housing flange or adapter (2-140) and the end cap (2-20) is properly seated against the cylinder (2-10).
- 10.15 Tighten the center bar assembly (2-50) to the proper torque as specified in Chart number 1.
- 10.16 Place the acorn nut (2-110) and seal washer (3-10) on the exposed end of the center bar assembly (2-50) and tighten securely.
- 10.17 Remove assembly tool part number 074113 from end cap (2-20).

- 10.18 Lubricate the thrust bearing (2-190) and both thrust washers (2-180). Install one thrust washer into the end cap then install the thrust bearing and then install the last thrust washer.

- 10.19 Install the o-ring seal (3-100) onto the groove in the torque nut.
- 10.20 Install the torque nut over the lead screw assembly shaft, aligning the hole in torque nut with the hole in the lead screw shaft.
- 10.21 Apply Master Gasket to the groove pin (2-100) per the manufactures instructions. Insert the grooved pin (2-100) in the torque nut and drive it into lead screw shaft.
- 10.22 Install the O-ring seal (3-110) into the handwheel (6-10) seal groove.
- 10.23 Install the handwheel (6-10) into the torque nut and retain with the grooved pin (6-20)
- 10.24 Coat the stop screws (2-80) with lubricant and insert into the housing (1-10) and end cap (2-20).
- 10.25 Screw Thread the stop screw thread seals (3-70) onto the stop screws (2-80) until they are flush with the housing (1-10) or end cap (2-20).
- 10.26 Slip the countersunk washers (3-80) onto the stop screws (2-80) with the chamfer facing the thread seals (3-70).
- 10.27 Screw the stop screw nuts (2-90) onto the stop screws (2-80) until hand tight.
- 10.28 Adjust both stop screws (2-80) back to setting recorded in section 5 under General Disassembly. Tighten both stop screw hex nuts (2-90) securely, while holding stop screws (2-80).
- 10.29 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 & NCB Actuators", part number 074943.

## 11.0 **ACTUATOR TESTING**

- 11.1 Leakage Test - All areas where leakage to atmosphere may occur are to be checked using a leak testing solution.
- 11.2 Procedure - Cycle the actuator five times at 65 PSI operating pressure. This will allow the seals to seek their proper service condition. 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.
- 11.3 Apply 65 psi operating pressure to the actuator housing inlet port and allow the actuator to move against the cylinder stop screw and stabilize.
- 11.4 Apply leak testing solution to the following areas:
  - 11.4.1 Cylinder (2-10) to housing (1-10) joint on CB420M and CB525M or cylinder (2-10) to cylinder adapter (2-120) to housing (1-10) joints on CB415M, CB520M and CB725M.
  - 11.4.2 The center bar thread seal (3-90) at the housing (1-10).
  - 11.4.3 The housing stop screw and stop screw thread seal.
  - 11.4.4 The torque shaft seals.
  - 11.4.5 The cylinder end cap inlet port.

- 11.5 Apply 65 psi operating pressure to the actuator cylinder inlet port and allow the actuator to move against the housing stop screw and stabilize.
- 11.6 Apply leak testing solution to the following areas:
  - 11.6.1 The cylinder (2-10) to end cap (2-20) joint.
  - 11.6.2 The cylinder end cap stop screw (2-80) and stop screw thread seal (3-70).
  - 11.6.3 The center bar seal (3-10) at the acorn nut (2-110) and end cap (2-20).
  - 11.6.4 The grooved pin (2-100) and the torque nut.
  - 11.6.5 The housing inlet port.
- 11.7 Remove all pressure from the actuator.
- 11.8 If an actuator was disassembled and repaired as a result of this procedure, the above leakage test must be performed again.

**12.0 RETURN TO SERVICE**

- 12.1 Install any K-Mass covers and hardware remove during this procedure.
- 12.2 Using a tube of latex window caulk seal all joints that where removed or cut through during disassembly.
- 12.3 After the actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.

**CHART NUMBER 1**

**TORQUE REQUIREMENTS - CENTER BARS**

<b>ACTUATOR MODEL</b>	<b>MAXIMUM TORQUE</b>	
	<b>IN. LBS.</b>	<b>FT. LBS.</b>
KCB415M	660	55
KCB420M	1,200	100
KCB520M	1,200	100
KCB525M	1,560	130
KCB725M	1,560	130

**CHART NUMBER 2**

**TORQUE REQUIREMENTS - TIE BARS**

<b>ACTUATOR MODEL</b>	<b>FT. LBS.</b>
KCB415M	12 ± 5%
KCB420M	12 ± 5%
KCB520M	20 ± 5%
KCB525M	20 ± 5%
KCB725M	30 ± 5%

<b>ECN</b>	<b>DATE</b>	<b>REV</b>	<b>BY *</b>	<b>DATE</b>
Released	July 1, 1993	A	COMPILED BC	1 July 1993
			CHECKED BJ	1 July 1993
			APPROVED RMM	1 July 1993

\* Signatures on file Waller, Texas