

**GH BETTIS**

**OPERATING & MAINTENANCE INSTRUCTIONS**

**FOR THE FOLLOWING MODELS:**

**NCB315, NCB420 AND NCB525**

**DOUBLE ACTING NUCLEAR SERIES ACTUATORS**

PART NUMBER: 68416

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## 1.0 INTRODUCTION

1.1 In order to assure and maintain the present level of qualification and traceability auditable to the Bettis Qualification Report Number 37274, 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 six hundred twenty-five cycles or five years whichever occurs first.

**COMPLETE ACTUATOR REFURBISHMENT  
REQUIRES THAT THE ACTUATOR BE  
DISMOUNTED FROM THE VALVE**

1.2 This service procedure is offered as a guide to enable general maintenance to be performed on GH Bettis NCB315, NCB420 and NCB525 Double Acting actuators. When the actuator model number has a "-S" as a suffix then the actuator is special and may have some differences that are not included in this procedure.

## 2.0 BASIC TOOLS

All tools are American Standard inch. Two adjustable wrenches, allen wrench set, small standard screwdriver, diagonal cutting pliers, external snap ring pliers, flat file, 1/2" drive ratchet and deepwell socket set, torque wrench (up to 2,000 inch pounds), commercial leak testing solution, and non-hardening thread sealant.

## 3.0 REFERENCE GH BETTIS MATERIALS

3.1 NCB315, NCB420, and NCB525 Assembly Drawing Part No. 49494.

3.2 NCB315, NCB420, and NCB525 Exploded Detail Part No. 68415.

## 4.0 GENERAL

4.1 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on GH Bettis Assembly Drawings, Exploded Detail Drawings, and Actuator Parts List.

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

4.3 Use a non-hardening thread sealant on all pipe threads.

4.4 Disassembly should be done in a clean area on a work bench.

4.5 LUBRICATION REQUIREMENTS: Dow Corning Molykote 44, medium grade.

## 5.0 GENERAL DISASSEMBLY

5.1 The setting of both stop screws (2-80) should be checked and setting recorded before stop screws are loosened or removed.

5.2 Remove all operating pressure from actuator power cylinder and disconnect all piping.

5.3 Remove all accessories.

5.4 Remove actuator from valve and valve mounting bracket.

5.5 Loosen and remove hex nut (2-90) from cylinder stop screw (2-80). Remove washer seal (3-80) and thread seal (3-70) from stop screw. Remove cylinder stop screw (2-80).

5.6 Loosen and remove hex nut (2-90) from housing stop screw (2-80). Remove washer seal (3-80) and thread seal (3-70) from stop screw.

5.7 Remove housing stop screw (2-80).

## **6.0 CYLINDER DISASSEMBLY**

6.1 Hold housing side acorn nut (2-110), loosen and remove cylinder side acorn nut (2-110) from center bar (2-50).

6.2 Remove seal gasket (3-10) from center bar. Diagonal cutters may be used to cut seal gasket.

6.3 Remove outer end cap (2-20) and cylinder gasket 3-30).

6.4 While holding housing torque shaft (1-30), pull cylinder (2-10) away from housing (1-10).

6.5 Slide cylinder (2-10) over piston (2-30) and remove.

6.6 Pull piston (2-30) out of housing (1-10) and carefully slide piston off center bar (2-50). Roll pin (1-60) and yoke pin (1-40) are removed as part of the piston assembly (2-30).

## **7.0 HOUSING DISASSEMBLY**

7.1 Slide center bar (2-50) out thru back of housing and remove acorn nut (2-110) and seal gasket (3-10) from center bar.

7.2 Remove both retaining rings (1-80) from torque shaft (1-30).

7.3 The following steps may need to be taken before disassembly can continue.

7.3.1 If torque shaft has any raised burrs or sharp edges they should be filed off, removing as little metal as possible.

7.3.2 If there is excessive paint build-up on torque shaft it should be removed.

7.4 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.

7.5 Push torque shaft (1-30) back thru housing. Pull torque shaft completely out of housing while holding yoke key (1-50) in with your fingers.

7.6 Remove yoke key (1-50) and yoke key spring (1-70) from torque shaft.

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

## **8.0 PRE-ASSEMBLY NOTES**

8.1 Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.

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 After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.

## **9.0 GENERAL RE-ASSEMBLY**

9.1 Apply a coating of 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 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 and insert the torque shaft (1-30) into and thru the housing and yoke. Rotate the torque shaft until the yoke key snaps into 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 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 torque shaft retaining rings (1-80) onto the torque shaft, making certain it is properly seated in the torque shaft groove.
- 9.10 Push the torque shaft back into the housing and install the remaining 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 Slip the gasket seal (3-10) on one end of the center bar (2-50) and screw the acorn nut (2-110) onto the end of the center bar.
- 9.14 Insert the center bar (2-50) into the center hole in back of housing (1-10) and slide center bar thru housing until gasket seal (3-10) and acorn nut (2-110) are flush against the housing. Care should be taken during installation of the center bar so as to not scratch it.
- 9.15 Install a cylinder gasket (3-30) on housing flange.

## **10.0 CYLINDER RE-ASSEMBLY**

- 10.1 Lightly coat the center bar (2-50) with lubricant, being sure to coat the exposed threads.
- 10.2 Install coat the piston center bar o-ring (3-50) in the internal groove in the head of piston (2-30).
- 10.3 Install the piston cylinder T-seal (3-60) onto the piston. T-seal (3-60) is composed of rubber (EP) seal and two back-up rings.
- 10.4 Coat the head of the piston along with the exposed ends of yoke pin (1-40) with lubricant.
- 10.5 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 (2-50).
- 10.6 Slide the piston (2-30) along the center bar (2-50) until the yoke pin (1-40) engages the yoke slots. Push the piston into the housing as far it will go, while holding the center bar flush against the housing.
- 10.7 Apply a very thin coating of lubricant to the cylinder bore of cylinder (2-10).
  - 10.7.1 CAUTION: EXCESS LUBRICANT IN THE CYLINDER BORE MAY CAUSE ERRATIC OR JUMPY/JERKY OPERATION.
- 10.8 Slip the lubricated cylinder (2-10) over the piston and onto the cylinder flange of housing (1-10).

- 10.9 Install gasket (3-30) onto the flange of outer end cap (2-20).
- 10.10 Slip the outer end cap (2-20) over the center bar (2-50) and into the cylinder (2-10).
- 10.11 Position the outer end cap (2-20) so that the pressure inlet port is at the bottom and the stop screw hole is at the top.
- 10.12 Place the remaining seal gasket (3-10) on the exposed end of the center bar (2-50) and screw the acorn nut (2-110) on the center bar hand tight.
- 10.13 Hold the cylinder side acorn nut (2-110) with a wrench and tighten the housing side acorn nut (2-110) to the proper torque as specified in Chart 2.
- 10.14 Insert the stop screw (2-80) into end cap (2-20) and screw approximately half way.
- 10.15 Thread the stop screw thread seal (3-70) onto the stop screw until it is flush with the end (2-20).
- 10.16 Slip the seal washer (3-80) onto the stop screw with the chamfer facing the thread seal (3-70).
- 10.17 Thread the stop screw nut (2-90) onto the cylinder stop screw (2-80) until hand tight.
- 10.18 Repeat steps 10.14 thru 10.17 for the housing stop screw.
- 10.19 Adjust both stop screws back to settings recorded in Step 5.1 under General Disassembly. Tighten both stop screw hex nuts (2-90) securely, while holding stop screws (2-80). 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 NCB Series Double Acting Actuators", part number 74942.

## **11.0 ACTUATOR TESTING**

- 11.1 All areas where leakage to atmosphere may occur are to be checked using a commercial leak testing solution.
- 11.2 Cycle the actuator five times at 65 psig air pressure. This will allow the seals to seek their proper working attitude.
- 11.3 Apply 65 psig air pressure to the housing pressure inlet port.
- 11.4 Apply a leak testing solution to the following areas:
  - 11.4.1 Cylinder to housing joint.
  - 11.4.2 Center bar gasket seal and acorn nut to housing.
  - 11.4.3 Housing stop screw and stop screw thread seal.
  - 11.4.4 Torque shaft seals.
  - 11.4.5 End Cap inlet pressure port.
- 11.5 Apply 65 psig pressure to the cylinder pressure inlet port.
- 11.6 Apply a leak testing solution to the following areas:
  - 11.6.1 Cylinder to end cap joint.
  - 11.6.2 Center bar gasket seal and acorn nut to end cap.

- 11.6.3 End cap stop screw and stop screw thread seal.
- 11.6.4 Body pressure inlet port.
- 11.7 If excessive leakage across the piston is noted, generally a bubble which breaks three seconds or less starting to form, the unit 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.

**12.0 RETURN TO SERVICE**

- 12.1 Re-install actuator to valve mounting bracket and valve.
- 12.2 Re-install any piping and accessories that were removed.
- 12.3 All accessories, including solenoid valves, positioners, pressure switches, etc., should be hooked up at this point and tested for proper operations and replaced if found defective.

CHART 1

NAME TAG PRESSURES

NCB-SERIES DOUBLE ACTING

| <u>ACTUATOR<br/>MODEL<br/>NUMBER</u> | <u>NOMINAL<br/>OPERATING<br/>PRESSURE</u> | <u>MAXIMUM<br/>OPERATING<br/>PRESSURE</u> | <u>MAXIMUM<br/>HYDROSTATIC<br/>TEST PRESSURE</u> |
|--------------------------------------|---|---|--|
| NCB315                               | (1)                                       | 120                                       | 240  |
| NCB420                               | (1)                                       | 120                                       | 240  |
| NCB525                               | (1)                                       | 120                                       | 240  |

(1) Per customer specification or not applicable

CHART 2

TORQUE REQUIREMENTS

FOR NCB-SERIES DOUBLE ACTING CENTER BAR

| ACTUATOR MODEL | MAXIMUM TORQUE |          |
|----------------|----------------|----------|
|                | IN. LBS.       | FT. LBS. |
| NCB315         | 600            | (55)     |
| NCB420         | 1,200          | (100)    |
| NCB525         | 1,560          | (130)    |

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