

**GH-BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY & REASSEMBLY**

**FOR THE FOLLOWING MODELS**

**T30X.X AND T40X.X**

**DOUBLE ACTING SERIES**

**HYDRAULIC ACTUATORS**

PART NUMBER: SE-010

REVISION: "A"

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## 1.0 INTRODUCTION

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis T30X.X and T40X.X double acting hydraulic series actuators. When the actuator model number has "-S" as a suffix then the actuator is special and may have some differences that are not included in this procedure.

NOTE: This does not include those actuators (5000 psi) that use the 5000 PSI cylinder modification as a hydraulic cylinder.

- 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 well trained, equipped, prepared and competent personnel.

**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 hydraulic 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, commercial leak testing solution, and non-hardening thread sealant.

- 2.2 Tools - All tools are American Standard inch. Two each medium standard screwdriver, small standard screwdriver with corners rounded, large adjustable wrench, putty knife, (1/4") drift punch, 24 oz. ball peen hammer, allen wrench set, pry bar, 1/2" drive socket set, rubber or leather mallet and a torque wrench (up to 5,000 in. lbs.).

### 3.0 GH-BETTIS REFERENCE MATERIALS

- 3.1 Model T30X.X Assembly Drawing part number 038829.
- 3.2 Model T30X.X Exploded Detail Drawing part number 065789 \*.
- 3.3 Model T40X.X Assembly Drawing part number 038709.
- 3.4 Model T40X.X Exploded Detail Drawing part number 065863 \*.

\* The exploded detail drawing is included in the GH-Bettis Service/Seal Kit.

### 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 Numbers in parenthesis, ( ), indicate the bubble number (reference number) used on the GH-Bettis Assembly Drawing, Exploded Detail Drawing, and actuator parts list.
- 4.3 This procedure is written using the stop screw side of the housing (1-10) as a reference and this side will be considered the front side of the actuator and the housing cover as the top of the actuator.
- 4.4 Mating parts should be marked for ease of reassembly, i.e. left and right stop screws and cylinder to housing.
- 4.5 When removing seals from seal groove, use a commercial seal removing tool or use a small standard screwdriver with the sharp edges rounded off.
- 4.6 **CAUTION: Apply thread sealant per the manufacture's instructions.** Use a non-hardening thread sealant on all pipe threads.
- 4.7 Disassembly should be done in a clean area on a work bench.
- 4.8 Some components of this actuator are very heavy and will require a means of assistance.
- 4.9 HOUSING LUBRICATION REQUIREMENTS: Lubricants, other than those listed in steps 4.9.1 and 4.9.2, should not be used without prior written approval of GH-Bettis Product Engineering.
- 4.9.1 Standard and high temperature service (-20°F to 350°F) use ESL-5 lubricant. ESL-5 is contained in the GH-Bettis Service/Seal Kit.
- 4.9.2 Low temperature service (-50°F to +150°F) use Kronaplate 50. This lubricant is not contained in the Low Temperature Service/Seal Kit.

4.10 FLUID REQUIREMENTS: For use in the hydraulic power cylinder (2-10). The following listed fluids are recommended fluids only and does not limit the use of other hydraulic fluids compatible with supplied seals and coatings.

4.10.1 Standard and high temperature service (-35°F to +350°F) use Dexron II Automatic Transmission Fluid.

4.10.2 Low temperature service (-65°F to +180°F) use Exxon Univis J13 Hydraulic Fluid.

## 5.0 GENERAL DISASSEMBLY

**WARNING:** Ensure that all operating pressure is removed from the hydraulic power cylinder.

5.1 Mark or tag stop screw (1-60) left and right. Measure the exposed length of right and left stop screws (1-60) and record each before loosening for removal.

5.2 To ensure correct re-assembly; that is, with hydraulic cylinder on same end of housing as was, mark or tag and mark mating surfaces.

5.3 Record the locations of the pressure ports in the cylinder assemblies (2-10) mounting flanges.

5.4 Remove snubber valve (1-190) from the housing cover (1-10).

## 6.0 DISASSEMBLY - HYDRAULIC CYLINDER

6.1 Drain the hydraulic fluid from hydraulic cylinder (2-10) by removing the cylinder drain plugs (2-80). One is located on the outboard end of hydraulic cylinder and the other on the inboard end.

6.2 Remove socket cap screws (2-140) and lockwashers (2-130) from cylinder assembly (2-10).

6.3 Apply downward pressure on end of cylinder assembly (2-10). By tilting cylinder up and down, assembly should break free from adapter (2-40).

6.4 Remove hex nut (2-100) and lockwasher (2-110) from piston rod (2-170).

6.5 Remove piston (2-20) from the piston rod (2-170). NOTE: Early model actuators utilized a three piece piston with two piston seal retainers (2-70) and a piston (2-20). If any part of the three piece piston requires replacement they will be replaced with a one piece piston.

6.6 Remove piston seals (3-90) and piston head seal (3-40) from piston (2-20).

6.7 Remove o-ring seal (3-30) and back-up ring (3-120) from cylinder adapter (2-40).

## 7.0 HOUSING DISASSEMBLY

7.1 Remove four socket cap screws (1-180) from position indicator (1-170), yoke weather cover (3-130) and remove position indicator/yoke weather cover.

7.2 Remove cover screws (1-90) and gasket seals (3-100).

7.3 Remove housing cover (1-20). NOTE: This piece will have a very tight fit.

**CAUTION: Do not use a pipe wrench on the piston rods as it may mark the rod and cause seal leakage.**

7.4 NOTE: Removal of piston rod may require extra amount of torque for break out if Loctite - 242 was used during assembly. Unscrew piston rod (2-170) from yoke pin nut (1-30) and remove.

7.5 Remove the top two (2) yoke rollers (1-50) from the top of the yoke pin (1-40). Remove yoke pin and the bottom two (2) yoke rollers (1-50) from the housing. You may have to rotate the yoke (1-160) to one side in order to remove bottom rollers.

7.6 Remove yoke pin nut (1-30).

**CAUTION: The yoke/housing bearing area must be lubricated and inspected to extend service life and prevent degradation of torque output. This can only be accomplished by removing the yoke from the housing which requires removing the actuator from the valve.**

7.7. The yoke (1-160) can now be removed by lifting it from the housing.

7.8 Remove socket cap screws (2-120) and lockwashers (2-130) from inside housing (1-10). NOTE: T3 actuators will have a quantity of three socket cap screws (2-120) and T4's will have a quantity of four.

7.9 Remove the cylinder adapter (2-40) from housing.

7.10 Remove rod bushing (2-50) from housing.

7.11 Remove hex cap screw (6-20) and gasket seal (6-30) on blind end cap side.

7.12 Remove blind end cap (6-10) and gasket (3-10).

## **8.0 GENERAL RE-ASSEMBLY**

**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 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.

NOTE: The parts and seals used in the actuator housing assembly will be assembled using lubricant as identified in step 4.9. The parts and seals used in the cylinder assembly (2-10) will be assembled using the hydraulic fluid identified in step 4.10.

## **9.0 CENTER HOUSING GROUP RE-ASSEMBLY**

- 9.1 If removed, install drain plug (1-80) in actuator housing (1-10).
- 9.2 Coat the yoke o-ring seal (3-50) with lubricate and install into the housing (1-10).
- 9.3 Inside the housing (1-10) apply lubricant to the tracks and yoke bore and arrange the housing with the yoke bore nearest you and top of housing (gasket surface) facing up.
- 9.4 Apply lubricant to the yoke (1-160) lower bearing surface and install into the housing (1-10) as follows: arrange the yoke arm to approximately a 45° degree position in either direction and lower into the housing. The hub with tapped holes faces up. Rotate the yoke back to approximately the mid-stroke (center) position.
- 9.5 Apply lubricant to the slots in the upper and lower yoke arm.
- 9.6 Apply lubricant to all surfaces of all four (4) yoke rollers (1-50). Place one yoke roller (1-50) in the bottom track of the housing and position it under the slot in the yoke arms. Place a second yoke roller on top of the first yoke roller in the slot in the lower yoke arm and align the holes in the yoke rollers.
- 9.7 Coat the upper and lower surfaces of the yoke pin nut (1-30) with lubricant and insert into position between the yoke arm, parallel to the track in the housing. Align the yoke pin hole with the yoke rollers.
- 9.8 Lubricate the yoke pin (1-40) and insert through the yoke pin nut (1-30) and the two (2) yoke rollers (1-50).
- 9.9 Apply lubricant to all the surfaces of the two remaining yoke rollers (1-50).
- 9.10 Install the third yoke pin roller over the yoke pin in the slot in the upper yoke arm and now install the fourth and last remaining yoke roller on top of the yoke roller you just installed in the upper yoke arm slot. The top roller will remain above the yoke arm and will engage the cover track when cover is installed.

**CAUTION:** If the cycle speed of the actuator is two seconds or faster, apply Loctite 242 to the external threads of the piston rod (2-170). **NOTE:** Loctite cure time is 10 - 30 minutes.

**NOTE:** The GH-Bettis Service/Seal Kit should contain a new rod bushing. Apply lubricant to the rod bushing (2-50).

- 9.11 **NOTE:** Do not tighten the piston rod until the housing cover (1-20) is installed. Install the rod bushing (2-50) on to the piston rod (2-170) then insert the piston rod/rod bushing combination through the right hand side of the housing. Make certain that the rod bushing is installed into the side of the housing and then screw the piston rod into the yoke pin nut (1-30).
- 9.12 Install the end cap gasket (3-10) over the piston rod bushing.
- 9.13 **CAUTION: Install rod seal (3-70) with the energizer ring facing outboard side (away from housing).** Coat the rod seal (3-70) with lubricant and install, lip first, into the recess provided in the inner end cap (2-40).
- 9.14 Install cylinder adapter (2-40) over piston rod and slide adapter up against housing. As adapter is installed, be sure to align bolt holes in housing.
- 9.15 **NOTE:** T3 actuators will have a quantity of three socket cap screws (2-120) and T4's will have a quantity of four. Fasten cylinder adapter (2-40) to housing (1-10) with socket cap screws (1-120) and lockwashers (2-130) from inside housing. Yoke (1-160) will have to be rotated to the full counter-clockwise position.
- 9.16 Do this step only if you have removed the housing stop screws (1-60). Place gasket (3-110) and jam nut (1-120) on the stop screw (1-60). Install stop screws in the housing. Screw the jam nut down against the actuator housing finger tight.
- 9.17 Apply a thin coating of lubricant to the housing cover gasket (3-20) surface.
- 9.18 Place the housing cover gasket (3-20) on the housing (1-10).
- 9.19 Coat the yoke o-ring seal (3-50) with lubricant and install in cover (1-20).
- 9.20 Apply lubricant to the cover yoke bore and the track in the housing cover (1-20). Apply a thin coat of lubricant to the gasket surface.
- 9.21 Apply lubricant to the yoke upper bearing surface.
- 9.22 Install the housing cover (1-20), being careful not to damage the gasket (3-20) or yoke o-ring (3-50).
- 9.23 Install the cover screws (1-90) and seal gasket (3-100). LEAVE FINGER TIGHT - DO NOT TIGHTEN.
- 9.24 Do this step only if you have pulled the cover pins (1-130) or if you are replacing the cover pins. Drive the four pins (1-130) through the cover (1-20) and into the housing (1-10) until the pin is flush with the cover. The pins are deeply grooved at one end, tapering to a smooth diameter at the other end. The pin should be installed smooth end first.

9.25 Tighten the cover screws (1-90).

## **10.0 HYDRAULIC CYLINDER RE-ASSEMBLY**

10.1 Coat o-ring seal (3-30) and back-up ring (3-130) with hydraulic fluid and install in cylinder adapter (2-40).

NOTE: Back-up ring will be installed in the groove between the o-ring and the 'housing-side' of the groove.

10.2 Coat o-ring seal (3-40) with hydraulic fluid and install in piston (2-20).

10.3 Coat piston seals (3-90) with hydraulic fluid and install on piston (2-20).

10.4 Coat piston rod (2-170) with hydraulic fluid (threaded end) and slide piston (2-20) into place.  
NOTE: Three piece piston installation will require a piston seal retainer (2-70) to be installed over the piston rod (2-170), then install the center piston piece (with piston seals installed) over the piston rod and then install the second piston seal retainer (2-70).

10.5 Install lockwasher (2-110) and heavy hex nut (2-100) onto piston rod. Torque to 150 foot pounds maximum. NOTE: Piston rod will be tightened as well.

10.6 If removed, install drain plugs (2-80) into cylinder assembly (2-10).

10.7 Coat cylinder adapter (2-40) and cylinder assembly cylinder bore (2-10) with hydraulic fluid. Install cylinder assembly over adapter.

10.8 Fasten cylinder assembly (2-10) with socket cap screws (2-140) and lockwasher.

10.9 Coat end cap gasket (3-10) with lubricant.

10.10 Install end cap gasket (3-10) and blind end cap (6-10) with hex cap screws (6-20) and gasket seals (6-30).

10.11 Fill hydraulic cylinder (both inboard and outboard) with fluid until full; if removed, install bleed valves (2-90).

10.12 Install yoke weather cover (3-130) and position indicator (1-170) on yoke with socket cap screws (1-180). Pointer on indicator will face front and perpendicular to centerline of actuator.

## **11.0 ACTUATOR TESTING**

11.1 LEAKAGE TEST: All sources of leakage to atmosphere and across the piston are to be checked using hydraulic pressure.

11.1.1 Cycle the actuator five times at 100% of the normal operating pressure (NOP), as marked on actuator name tag. This allows the new seals to seek their proper service condition.

- 11.1.2 Apply 100% of the maximum operating pressure (MOP), as marked on actuator name tag, and allow the unit to stabilize.
- 11.1.3 If there is any notable leakage, the actuator must be disassembled and the cause of leakage must be determined and corrected.
- 11.1.4 If an actuator was disassembled and repaired, the above leakage test must be performed again.
- 11.2 **OPTIONAL SHELL TEST:** This test should be performed if any one of the following items are replaced: tie bar, piston, piston rod, end cap, or cylinder.
  - 11.2.1 All air should be bled from the cylinder before shell testing.
  - 11.2.2 Shell tests the actuator by applying 1.5 times the maximum test pressure, as marked on actuator name tag, to both sides of the piston simultaneously for a period of two (2) minutes.
  - 11.2.3 If any leakage occurs, the unit must be disassembled and the cause of leakage must be determined and corrected.
- 11.3 **OPERATIONAL (FUNCTIONAL TEST):** This test is used to verify proper function of the actuator and is to be done off of the valve or when the valve stem is not coupled to the actuator yoke.
  - 11.3.1 Cycle the actuator at 10% of the maximum operating pressure (MOP) per actuator name tag.
  - 11.3.2 Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity, must be corrected.

## **12.0 RETURN TO SERVICE**

- 12.1 Replace the software components of the snubber valve (1-190) and then install the snubber in the housing cover port.
- 12.2 Adjust both stop screws (1-60) back to settings recorded in section 5 under General Disassembly.
- 12.3 Tighten both stop nuts (1-120) securely, while holding stop screw (1-60).
- 12.4 After the actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.