

GH BETTIS
 OPERATING & MAINTENANCE INSTRUCTIONS
 INSTALLATION, DISASSEMBLY & ASSEMBLY
 FOR
 T20X.X-S SUBMERGED
 DOUBLE ACTING
 HYDRAULIC SERIES ACTUATORS

PART NUMBER: 74645

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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 T20X.X-S "Scotch-Yoke" type submerged hydraulic actuators.
- 1.2 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.

2.0 BASIC TOOLS

Large adjustable Wrench, Screwdriver, 1/2" Drive Socket Set, Torque Wrench (0-2,000 in. lbs.), Pipe Wrench, (1/4") Drift Punch, 24 oz. Ball Peen Hammer, Allen Wrench Set and Pry Bar.

3.0 REFERENCE GH BETTIS MATERIALS

- 3.1 Assembly Drawing Part Number 68386 for T201.5-S.
- 3.2 Assembly Drawing Part Number 68172 for T202.0-S.
- 3.3 Dimensional Base I Drawing Part Number 42382.
- 3.4 Operating, Storage & Maintenance Instruction (Op/Maint-002)

4.0 INSTALLATION INSTRUCTIONS

- 4.1 The following instructions describe the actuator preparation and mounting techniques for submerged service.
- 4.2 Actuators for submerged service must be protected from external pressure due to head pressure and ingress of sea water. Both of these conditions are accomplished by sealing the actuator housing, filling with oil, and providing a method of pressure equalization.
- 4.3 Pressure equalization is accomplished by piping a modified bladder type accumulator to the actuator housing.
- 4.4 Housing Filling Instructions:
 - 4.4.1 Remove snubber valve or relief valve (1-190).
 - 4.4.2 Remove housing drain plug (1-80).
 - 4.4.3 Apply low pressure to the external pressure inlet(s) on all the seapots (quantity will vary due to actuator housing).
 - 4.4.4 Hook one end of hydraulic hose to housing drain port and other end of hydraulic hose to a hand pump on a hydraulic.
 - 4.4.5 Pump hand pump to fill housing (1-10).

- 4.4.6 When oil starts to come out of snubber port, replace snubber (1-190).
- 4.4.7 Continue to pump oil to fill accumulator(s).
- 4.4.8 Remove hydraulic hose from housing drain port and replace drain plug (1-80), try not to lose any more oil than necessary.

4.5 Cylinder Filling Instructions

- 4.5.1 Actuators to be mounted on valves that are already submerged should have the housing and seapot filled as described above, before submergence. The actuator cylinder should also be filled with the hydraulic oil to be used for operation. The ideal method of connection to the power source would be to use flexible hose. This would allow the cylinder to be bled at the surface and eliminate the possibility of trapping any water in the cylinder.
- 4.5.2 If the piping must be connected sub-surface, the procedure for bleeding is as follows:
- 4.5.3 Connect the piping to the actuator. Open the bleed port on the top of cylinder and supply low pressure hydraulic fluid until no more air is seen to come from the bleed port. Close the bleed port and remove the drain plug from the bottom of the cylinder. Continue pumping low pressure oil until all the water is out of the cylinder and oil comes steadily from the drain port. Replace drain plug and stop flow of low pressure oil. Repeat for other end of cylinder.
- 4.5.4 Place the actuator and the valve in the same position (both open or closed) and remove any existing manual gearing from valve. At this point, check the valve and actuator mounting surfaces, stem adapter and valve stem for proper orientation and possible discrepancies. Install the actuator while the mounting bolts are still somewhat loose, as this will allow the actuator to center itself. The space between the valve and actuator and the yoke bore should be purged of water and filled with oil. Bettis has no specific recommendations for accomplishing this on an actual installation performed underwater.
- 4.5.5 Actuators are shipped from the factory with the stops set at approximately 90 degrees. Small adjustments of the stop screws are generally required once that actuator is installed on the valve. Refer to the valve manufacturers recommendations for specific requirements. On valves having internal stops, the actuator stops should be set at the same point, with the actuator doing the actual "stopping".

5.0 GENERAL

- 5.1 Numbers in parentheses, () indicate the bubble number (reference number) used on the GH Bettis Assembly Drawing, Exploded Detail Drawing, and actuator Parts Lists.
- 5.2 This procedure is written using the stop screw side of the housing (1-10) as the front side of the actuator and the housing cover (1-20) as the top of the actuator assembly.
- 5.3 Mating parts should be marked for ease of reassembly, i.e. cylinder to cylinder adapter, cylinder adapter to housing, right and left stop screws, etc.
- 5.4 When removing seals from seal grooves, use a small screwdriver with the sharp edges rounded off or use a commercial seal removing tool.
- 5.5 Disassembly of the actuator should be done in a clean area on a work bench.
- 5.6 Lubrication Requirements:
 - 5.6.1 Standard and high temperature service (-20°F to 200°F) use Kronaplate 100.
 - 5.6.2 Low temperature service (-50°F to +150°F) use Kronaplate 50.
 - 5.6.3 For distributors of Kronaplate lubricants in you area call 800-428-7802.
- 5.7 Fluid Requirements:
 - 5.7.1 Standard and high temperature service (-20°F to +350°F) use Dexron II Automatic Transmission Fluid.
 - 5.7.2 Low temperature service (-50°F to +150°F) use Exxon Unavis J13 Hydraulic Fluid.

6.0 GENERAL DISASSEMBLY

- 6.1 Remove all operating pressure from actuator power cylinder (2-10) and cylinder adapter (2-40).
- 6.2 Remove all piping and accessories mounted on actuators.
- 6.3 Drain the hydraulic fluid from hydraulic cylinder (2-10) by removing the cylinder drain plugs (2-90). They are located on the outboard and the inboard end of hydraulic cylinder (2-10).
- 6.4 Mark the stop screws (1-60) left and right. The setting of the stop screws (1-60) should be checked and setting recorded before stop screws are loosened or removed.
- 6.5 Remove actuator from valve and valve mounting bracket.

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

7.0 HYDRAULIC CYLINDER DISASSEMBLY

- 7.1 Remove socket cap screws (2-120) and lockwashers (2-110) from cylinder assembly (2-10).
- 7.2 Apply downward pressure on end of cylinder assembly (2-10). By canting cylinder up or down, assembly should break free from adapter (2-40).
- 7.3 Remove hex nut (2-100) from piston rod (2-170).
- 7.4 Piston (2-20) will slide off the piston rod (2-170).

8.0 HOUSING DISASSEMBLY

- 8.1 Remove snubber (1-190) and pipe plug (1-80) and drain oil from housing.
- 8.2 Remove cover screws (1-90) and gasket seals (3-100).
- 8.3 Remove housing cover (1-20). The cover will have a very tight fit. It is not necessary to remove the cover pins (1-130).
- 8.4 Remove the two (2) yoke rollers (1-50) from the top of yoke pin (1-40). Remove the yoke pin (1-40) from the yoke pin nut (4). Slide piston rod (2-170) and yoke pin nut (4) out of the way and remove bottom yoke rollers (1-50). You may have to swing yoke (1-160) to one side in order to remove bottom rollers.
- 8.5 Remove hex cap screw (6-20) and gasket seal (6-30) on blind end cap side.
- 8.6 Remove blind end cap (6-10).
- 8.7 Remove yoke pin nut (4), nut pin (2-180) and piston rod assembly (2-170) from housing by sliding it out of the housing - blind end cap side.
- 8.8 The yoke (1-160) can now be removed by lifting it from the housing.
- 8.9 Remove socket head cap screws (2-140) and lockwashers (2-130) from inside housing (1-10).
- 8.10 Remove cylinder adapter (2-40) from housing.
- 8.11 Remove rod bushing (2-50) from housing.
- 8.12 Remove stop screw nut (1-120), seal washer (1-200) and thread seal (3-170). Stop screw (1-60) does not have to be removed from housing (1-10).

9.0 GENERAL RE-ASSEMBLY

- 9.1 Remove master gasket (3-160), taking care not to scratch or damage seal grooves.
- 9.2 Remove all old seals, taking care not to damage seal grooves.
- 9.3 Before starting the assembly of an actuator, all parts should be thoroughly cleaned, inspected and de-burred. Particular attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding motion.
- 9.4 After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.
- 9.5 Coat all seals with lubricant before installing into seal grooves.

10.0 CENTER HOUSING GROUP RE-ASSEMBLY

- 10.1 Apply fluid to rod seal (3-70) and install inside cylinder adapter (2-40). Lips or energizer ring of rod seal must face away from housing.
- 10.2 Apply fluid to rod bushing (2-50) and install into cylinder adapter.
- 10.3 Apply master gasket (3-160) between housing and cylinder adapter.
- 10.4 Bolt cylinder adapter to housing from inside, using socket head screws (2-140) and lockwashers (2-130).
- 10.5 If removed, install drain plug (1-80) in actuator housing (1-10).
- 10.6 Take all the yoke rollers (1-50) and check to see if they will run (move) freely thru the tracks in the bottom of the housing and the housing cover.
- 10.7 Coat the yoke o-ring seal (3-50) with lubricant and install into the housing (1-10).
- 10.8 Inside the housing (1-10) apply lubricant to the tracks and yoke bore and arrange the housing with the yoke bore nearest you.
- 10.9 Apply lubricant to the slots in the upper and lower yoke arm.
- 10.10 Apply lubricant to the yoke (1-160) lower bearing surface and install into the housing (1-10) as follows: rotate the yoke arm to approximately a 45° position in either direction and lower into the housing. The hub with tapped holes must face up. Rotate the yoke back to approximately the mid-stroke (center) position.
- 10.11 Apply lubricant to all surfaces of all four yoke rollers (1-50). Place one yoke roller (1-50) in the track in the bottom 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.

- 10.12 For T202.0 Actuators - Slide piston rod (2-170), into yoke pin nut (4) and line up the two thru holes. Drive nut pin (2-180) into small thru hole until end is flush with top of yoke pin nut (4). (This step necessary only if yoke nut pin (4) and piston rod (2-170) were disassembled by removing yoke nut pin (2-180).
- 10.13 For T201.5 Actuators - Screw piston rod (2-170) into threaded hole in yoke pin nut (4) until hand tight.
- 10.14 Slide the piston rod/split nut assembly through the left side of the housing (1-10) and align the yoke pin hole with the hole in the lower rollers (1-50).
- 10.15 Lubricate the yoke pin (1-40) and insert through the yoke pin nut (4) and the two bottom yoke rollers (1-50).
- 10.16 Apply lubricant to all the surfaces of the two remaining yoke rollers (1-50) and install on yoke pin (1-40).
- 10.17 Do this step only if you have removed the housing stop screws (1-60). Place thread seal (3-170) and countersunk washer (1-20) on the stop screw (1-60). Install stop screws in the housing. Thread the stop screw nut (1-120) down against the actuator housing.
- 10.18 Apply master gasket (3-160) to housing, blind end cap side.
- 10.19 Install blind end cap (6-10) with hex cap screws (6-20) and gasket seals (6-30).
- 10.20 Apply master gasket to the housing cover gasket surface.
- 10.21 Coat the yoke o-ring seal (3-50) with lubricant and install in cover (1-20).
- 10.22 Apply lubricant to the yoke bore and track in the housing cover (1-20).
- 10.23 Apply lubricant to the yoke upper bearing surface and install the housing cover (1-20), being careful not to damage yoke o-ring (3-50).
- 10.24 Install the cover screws (1-90) and seal gasket (3-100). LEAVE FINGER TIGHT - DO NO TIGHTEN.
- 10.25 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) thru 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.
- 10.26 Tighten the cover screws (1-90) to a torque of approximately 100 in. lbs. or 8.3 ft. lbs.

10.27 With yoke to the full clockwise (cw) position (as shown on the assembly drawings), position the yoke weather cover (3-130)/position indicator (1-170) on the yoke with the pointer facing toward the front and perpendicular to the piston rod (2-170) - secure with the four round head cap screws (1-180) and gaskets (3-180).

11.0 HYDRAULIC CYLINDER RE-ASSEMBLY

11.1 Coat o-ring seal (3-20) and back-up ring (3-30) with hydraulic fluid and install in cylinder adapter (2-40). Back-up ring will be installed in the groove between the o-ring and the 'housing side' of the groove.

11.2 Coat o-ring seal (3-40) with hydraulic fluid and install on piston rod (2-170).

11.3 Coat piston seals (3-90) with hydraulic fluid and install on piston (2-20). Piston seal will have to be installed over piston. Back-up/wear rings will fold over piston seal.

11.4 Coat end of piston rod (2-170) with hydraulic fluid and slide piston (2-20) into place. On T201.5, install piston split ring (2-60) on piston rod first, then slide piston over ring onto piston rod.

11.5 Install hex lock nut (2-100) onto piston rod and torque to 1,000 in. lbs. or 83.3 ft. lbs. maximum.

11.6 If removed, install o-ring plugs (2-80) into cylinder assembly (2-10).

11.7 Coat cylinder adapter (2-40) and cylinder assembly cylinder bore (2-10) with hydraulic fluid. Install cylinder assembly over adapter. Install the cylinder (2-10) so the bleed ports will be facing up when the actuator is mounted on the valve.

11.8 Fasten cylinder assembly (2-10) with socket cap screws (2-120) and lockwasher (2-130).

11.9 Install lower drain plugs (2-90), if removed, in bottom of cylinder (2-10).

11.10 Install bleed valves (2-90), if removed.

12.0 TESTING

12.1 All sources of leakage to atmosphere and across the piston are to be checked using hydraulic pressure.

12.2 Cycle the actuator five (5) time at 100% of the normal operating pressure (NOP), as marked on actuator name tag. This allows the seals to seek their proper working attitude.

12.3 Apply 100% of the maximum operating pressure (MOP), as marked on actuator name tag, and allow the unit to stabilize.

- 12.4 If there is any notable leakage, the actuator must be disassembled and the cause of leakage must be determined and corrected. If no leakage is noted, repeat step 2 for the opposite side of the piston.

PRESSURE REQUIREMENTS & LIMITATIONS
FOR
T20X.X-S HYD. ACTUATORS - SUBMERGED

MODEL	NOMINAL OPERATING PRESSURE (NOP)	MAXIMUM OPERATING PRESSURE (MOP)	MAXIMUM ALLOWABLE WORKING PRESSURE (MAWP)
T202.0	Customer Spec	3150	3500
T201.5	or N.A.	1550	2000

13.0 RETURN TO SERVICE

- 13.1 If removed, re-install any piping and accessories that were removed.
- 13.2 Replace software components of snubber (1-190) and install snubber into cover (1-20).

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NORTH & SOUTH AMERICA

19200 Northwest Freeway
Houston, TX 77065
USA
T +1 281 477 4100
F +1 281 477 2809

Av. Hollingsworth,
325, Iporanga Sorocaba
SP 18087-105
Brazil
T +55 15 3238 3788
F +55 15 3228 3300

ASIA PACIFIC

No. 9 Gul Road
#01-02 Singapore 629361
T +65 6501 4600
F +65 6268 0028

No.1 Lai Yuan Road
Wuqing Development Area
Tianjin 301700
P.R.China
T +86 22 8212 3300
F +86 22 8212 3308

MIDDLE EAST & AFRICA

P. O. Box 17033
Dubai
United Arab Emirates
T +971 4 811 8100
F +971 4 886 5465

P. O. Box 10305
Jubail 31961
Saudi Arabia
T +966 3 340 8650
F +966 3 340 8790

24 Angus Crescent
Longmeadow Business Estate
East P.O. Box 6908; Greenstone
1616 Modderfontein, Extension 5
South Africa
T +27 11 451 3700
F +27 11 451 3800

EUROPE

Berenyi u. 72- 100
Videoton Industry Park,
Building #230
Székesfehérvár 8000
Hungary
T +36 22 530 950
F +36 22 543 700

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