

SERVICE INSTRUCTIONS

ASSEMBLY & DISASSEMBLY

T50X DOUBLE ACTING HYDRAULIC SERIES ACTUATORS

INTRODUCTION

This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis T50X "Scotch-Yoke" type hydraulic actuators.

BASIC TOOLS

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

REFERENCE GH-BETTIS MATERIALS

T50X Assembly Drawing 036525
GH-Bettis Operating, Storage & Maintenance Instruction (OP/MAINT-002)
Dimensional (Base 1) Drawing 042305

GENERAL

NOTE: Numbers in parenthesis, indicate the bubble number (reference number) used on the GH-Bettis Assembly Drawing and actuator Bill of Material.

1. Remove all operating pressure from actuator power cylinder (2-10).
2. Remove all piping and accessories mounted on actuator.
3. Drain hydraulic cylinder (2-10) by removing pipe plugs (2-230) located on inboard and outboard ends of cylinder - bottom side.

DISASSEMBLY - PRESSURE HYDRAULIC CYLINDER

1. Remove socket cap screw (2-120), lockwasher (2-110) and nut retainer (2-100).
2. Remove hex nuts (2-90) from tie bars (2-60).
3. Remove outer end cap (2-30). The fit between the cylinder (2-10) and the outer end cap is very tight. Break the outer end cap free by tapping with a breaker bar on the lip provided on the end cap. **NOTE: DO NOT DAMAGE O-RING GROOVE ON END CAP.**
4. Pry inner end cap (2-40) away from the housing (1-10). Break the inner end cap free from the cylinder (2-10).
5. Remove the cylinder (2-10).

NOTE: When sliding the cylinder off of the piston (2-20), cant (angle) the cylinder to the piston rod 15° to 30° degrees.

6. Remove the ring retainer (2-80) and the split ring (2-70) from the outboard side of the piston (2-20).
7. Remove the piston (2-20) from the piston rod (2-170). The piston will slide off of the piston rod.
8. Remove o-ring seal (3-40).
9. Remove the ring retainer (2-80) and the split ring (2-70) from the inboard side of the piston.
10. Slide the inner end cap (2-40) off over the tie bars (2-60) and the piston rod (2-170).
11. Remove rod bushing (2-50) and rod seal (3-70). The bushing and rod seal will slide off of the end of the piston rod.
12. Unscrew the tie bars (2-60) from the housing (1-10). Flats are provided on the outboard end of the tie bars for wrench placement. DO NOT use a pipe wrench on the tie bars, as it will mark the bar and cause seal leakage.
13. Unscrew piston rod (2-170) from yoke pin nut (1-30) and remove. Flats are provided on the outboard end of the piston rod for wrench placement. DO NOT use a pipe wrench on the piston rod as it will mark the rod and cause seal leakage.

HOUSING GROUP DISASSEMBLY

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.
2. Remove cover screws (1-90)/(10-90) with gasket seals (3-100).
3. Remove the housing cover (1-20).

NOTF:-This piece will have a very tight fit.
4. Remove the yoke rollers (1-50) and roller spacer (1-110) from the top of the yoke pin (1-40). Remove the yoke pin (1-40).
5. Remove yoke pin nut (1-30).
6. Remove roller spacers (1-110) and bottom two yoke rollers (1-50) from housing.
7. The yoke (1-160) can now be removed by lifting it from the housing.
8. It is not necessary to remove the stop screws (1-60), drain plug (1-80), grease fittings (1-70) or blind end cap (6-10) to service the actuator.

NOTE: Grease fittings are optional as of 3/83.

GENERAL RE-ASSEMBLY

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

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

LUBRICATION REQUIREMENTS

1. Standard and high temperature service (-20°F to 350°F) use Kronaplate 100. Reference GH-Bettis Engineering Standard ESL-5.
2. Low temperature service (-100°F to 300°F) use Aeroshell 17. Reference GH-Bettis Engineering Standard ESL-4.

FLUID REQUIREMENTS

1. Standard and high temperature service (-35°F to 350°F) use Exxon Dexron II Automatic Transmission Fluid. Identification #D-20106. Reference GH-Bettis Engineering Standard ESF-1.
2. Low temperature service (-65°F to 180°F) use Exxon Univis J13 Hydraulic Fluid. Reference GH-Bettis Engineering Standard ESF-2.

CENTER HOUSING GROUP RE-ASSEMBLY

NOTE: Face stop screw side of housing. This will be considered the front side of the actuator.

1. If removed, install drain plug (1-80) in actuator housing (1-10).
2. If removed, install the grease fittings (1-70) in the actuator housing (1-10) and cover (1-20). The fitting in the housing is located on the bottom of the housing, next to the lower yoke bearing area. The fitting in the cover is located on top of the cover in the upper yoke bearing area.

NOTE: Grease fitting (1-70) is optional, as of 3/1/83.

3. 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.
4. Coat the yoke o-ring seal (3-50) with grease and install into the housing (1-10).
5. Inside the housing (1-10) apply grease to the tracks and yoke bore and orientate the housing with the yoke bore nearest you.
6. Apply grease to the yoke (1-160) lower bearing surface and install into the housing (1-10) as follows: Orientate the yoke arm to approximately a 45° 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.
7. Apply grease to the slots in the upper and lower yoke arm.

8. Apply grease to all surfaces on two of the yoke rollers (1-50) and two roller spacers (1-110). Place one yoke roller in the track in the bottom of the housing and position it under the slot in the yoke arms. Place a roller spacer (1-110) on top of the bottom yoke roller (1-50). Place a second yoke roller on top of the roller spacer in the slot in the lower yoke arm. Place another roller spacer (1-110) on top of the second yoke roller (1-50) and align the holes in the roller spacer and the yoke rollers.
9. Coat the upper and lower surfaces of the yoke pin nut (1-30) with grease and insert into position between the yoke arm, parallel to the track in the housing. Align the yoke pin hole with the yoke rollers and roller spacers.
10. Grease the yoke pin (1-40) and insert through the yoke pin nut (1-30), the two yoke rollers (1-50) and the two roller spacers (1-110).
11. Apply grease to all the surfaces of the two remaining yoke rollers (1-50) and two remaining roller spacers (1-110). Place one roller spacer on top of the yoke pin nut (1-30) then install the third yoke roller (1-50). Place the last roller spacer on top of the third yoke roller (1-50). Place the fourth and final yoke roller on to the yoke pin.

NOTE: The top roller will remain above the yoke arm and will engage the cover track when cover is installed.

12. Slide piston rod (2-170) into right side of body and screw into the yoke pin nut (1-30). (DO NOT TIGHTEN)
13. 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 screws. Install assembly into housing - two places.
14. Apply a thin coating of grease to the housing cover gasket (3-20) surface.
15. Place the housing cover gasket (3-20) on the housing (1-10).
16. Coat the remaining yoke o-ring seal (3-50) with grease and install in cover (1-20).
17. Apply grease to the yoke bore and the track in the housing cover (1-20).
18. Apply grease to the yoke (1-160) upper bearing surface.
19. Install the housing cover (1-20), being careful not to damage the gasket (3-20) or yoke o-ring seal (3-50).
20. Install the cover screws (1-90)/(10-90) and seal gasket (3-100). **LEAVE FINGER TIGHT DO NOT TIGHTEN.**
21. 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.

NOTE: 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.

22. Tighten the cover screws (1-90)/(10-90).

23. Tighten the piston rod (2-170) (installed in step 12) to a torque of approximately 150 ft. lbs. (1800 in. lbs.). Flats are provided on the outer end for wrenching purposes. **DO NOT USE A PIPE WRENCH OR SIMILAR TOOL TO TIGHTEN PISTON ROD.**
24. With the yoke rotated to the full clockwise (CW) position (as shown on the assembly drawing) position the yoke weather cover (3-130)/position indicator (1-170) on the yoke with the pointer facing to the front and perpendicular to the piston rod (2-170). Secure with socket head cap screws (1-180).
25. Rotate the yoke to the full counter-clockwise position, leaving a minimum of the piston rod (2-170) protruding from the actuator housing (1-10).
26. If removed, install blind end cap (6-10) and associated hardware.

PRESSURE CYLINDER RE-ASSEMBLY

1. Apply grease to the rod bushing (2-50), install it over the piston rod and slide it up into the housing.
2. Coat the rod seal (3-70) with fluid and install, lip first, into the recess provided in the inner end cap.
NOTE: Rod seal is a bi-directional seal and will seal in both directions.
3. Coat the end cap gasket (3-10) with grease on both sides and install over the piston rod and rod bushing.
4. Coat two tie bar o-ring seals (3-30) with fluid and install into the inner end cap (2-40).
NOTE: O-ring seals are retained with "staked" washers. Be sure that washers are secured in counterbores.
5. Slide the inner end cap (2-40) over the piston rod (2-170) and the rod bushing (2-50), protruding from the housing. Install with the large raised boss toward the housing. The pressure inlet port should be toward the top of the actuator.
NOTE: Exercise extreme care during installation, in order to prevent damage to the rod seal (3-70).
6. Apply fluid to the end cap o-ring seal (3-60) and install on the inner end cap (2-40).
7. Apply fluid to two sets of piston tie bar T-seal components (3-80) and install into the piston (2-20).
8. Apply fluid to the piston o-ring (3-40) and place onto the piston rod (2-170).
9. Coat the end of the piston rod (2-170) with fluid.
10. Install the two halves of the split ring (2-70) into the inner most groove in the piston rod and retain with one of the spiral retaining rings (2-80).
11. Slide the piston (2-20) onto the piston rod against the split ring (2-70).
NOTE: Piston seal groove will face toward housing.

12. Install the two halves of the remaining split ring (2-70) onto the piston rod and retain with the remaining retaining ring (2-80).
13. Coat the piston T seal components (3-90) with fluid and install on the piston (4-20).
14. Install tie bars (2-60), end without wrench flat first, by carefully threading tie bars through the piston (2-20) and inserting through the inner end cap (2-40) and screwing into the housing (1-10).
15. Apply fluid to the bore of the cylinder (2-10) for a distance of approximately four inches (100 mm).
16. Slide the lubricated end of the cylinder (2-10) over the piston (2-20) and onto the inner end cap (2-40).
NOTE: When sliding the cylinder over the piston sealant cylinder 15° to 30° degrees to piston rod, make certain the back-up rings (components of the piston seal) are seated into the seal groove. Should the back-up rings or seal member be pinched between the piston and cylinder, the components could be damaged, becoming a potential source of leakage. **DO NOT** hammer on ends of cylinder. Port holes for plugs and bleed valves must be aligned vertically.
17. Apply fluid to two end cap tie bar o-ring seals (3-30) and install into the outer end cap (2-30).
18. Apply fluid to the outer end cap cylinder o-ring seal (3-60) and install onto the outer end cap (2-30).
19. Install the outer end cap (2-30) onto the tie bars and into the end of the cylinder (2-10). The pressure inlet port should be toward the top of the actuator.
20. Install the two tie bar nuts (2-90) on the tie bars (2-60), using them to draw all of the cylinder components into position. Torque alternately, in 50 ft. lb. increments, until a final torque of 125 ft. lbs. (1,500 in. lbs.) has been achieved.
21. Install the nut retainer (2-100), securing in place with the retainer screw (2-120) and lockwasher (2-110). It is necessary that the flats on the hex nuts (2-90) be aligned and parallel before the nut retainer can be installed.
22. Install pipe plugs (2-230) and bleed valves (2-240).

NOTE: Bleed valves (2-240) should be orientated at the cylinders' highest point when actuator is mounted in its' final operational position.

TESTING HYDRAULIC ACTUATORS

A. Leakage Test

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

Procedure:

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

2. Apply 100% of the maximum operating pressure (MOP), as marked on actuator name tag, and allow the unit to stabilize.
3. If there is any notable leakage, the actuator must be disassembled and the cause of leakage must be determined and corrected.
4. 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 minutes. If any leakage occurs, the unit must be disassembled and the cause of leakage must be determined and corrected.
5. If an actuator was disassembled and repaired, the above leakage test must be performed again.

B. Operational (Functional) Test

NOTE: This test is used to verify proper function of the actuator and its' related system (accessories).

1. Cycle the actuator at 100 PSI operating pressure. Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity, must be corrected.
2. All accessories, including solenoid valves, positioners, pressure switches, etc., must be hooked up and tested for proper operations and replaced if found defective.

FINAL QUALITY TESTING OF ACTUATORS

MODEL	NOMINAL OPERATING PRESSURE (NOP)	MAXIMUM OPERATING PRESSURE (MOP)	MAXIMUM ALLOWABLE WORKING PRESSURE (MAWP)
T505	Customer spec or N.A.	1700	1800
T507	"	725	850
T508	"	550	650

RETURN TO SERVICE

1. If removed, install the snubber valve (1-190) in the cover (1-20) of the housing (1-10).
2. Re-install all piping and accessories that were removed.
3. Refer to GH-Bettis "Operating, Storage and Maintenance Instructions for GH-Bettis Rotary Valve Actuators" (OP/MAINT-002) for actuator start-up procedures.