BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

INSTALLATION, DISASSEMBLY & ASSEMBLY

T42OX.X-S

DOUBLE ACTING SERIES

SUBMERGED HYDRAULIC ACTUATOR

PART NUMBER: 068165

REVISION: "A"

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1.0 INSTALLATION INSTRUCTIONS

The following instructions describe the actuator preparation and mounting techniques for submerged service.

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, other non-pressurized areas, filling with oil, and providing a method of pressure equalization.

Pressure equalization is accomplished by piping a modified bladder type accumulator (seapot) to the actuator housing and other non-pressurized areas such as the backside of the piston.

1.1 Filling Instructions

1.1.1 Use Schematic BSK-2367 as reference for the filling instructions.

1.1.2 Actuator must be in the full clockwise position as shown on Schematic BSK-2367.

1.1.3 If possible, roll actuator so that the seapot is on top of the actuator and then remove the housing drain plug.

1.1.4 Open bleed valve number 2.

1.1.5 Apply low pressure to the external pressure inlet(s) on all the seapots (quantity will vary due to actuator housing).

1.1.6 Hook one end of hydraulic hose to housing drain and other end of hydraulic hose to a hand pump on a hydraulic oil barrel.

1.1.7 Pump hand pump to fill housing and cylinder.

1.1.8 When oil starts to come out of bleed valve number 2, close bleed valve number 2.

1.1.9 Continue to pump oil to fill accumulator(s).

1.1.10 Remove hydraulic hose from housing drain and replace drain plug (try not to lose any more oil then necessary).

1.2 Power Cylinder(s) Filling Instructions

1.2.1 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.

1.2.2 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.

1.3 Sub-Surface Actuator Connection & mounting

1.3.1 If the piping must be connected sub-surface, the procedure for bleeding is as follows:

1.3.1.1 Connect the piping to the actuator per Schematic BSK-2367. Open the bleed valve number 1 on the top of cylinder number 1 and supply low pressure hydraulic fluid until no more air is seen to come from the bleed valve number 1. Close bleed valve number I and remove the drain plug from the bottom of cylinder number 1. Continue pumping low pressure oil until all the water is out of cylinder number 1 and oil comes steadily from the drain port. Replace drain plug and stop flow of low pressure oil.

1.3.1.2 Repeat for cylinder number 2 bleed valves number 3 and number 4.

1.3.1.3 Place the actuator and the valve in the same position (both open or closed) and remove any existing manual gearing from valve.

1.3.1.4 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.

1.4 Actuator Stop Adjustments

1.4.1 Actuators are shipped from the factory with the stops set at approximately 90º degrees. Small adjustments of the stop screws are generally required once that actuator is installed on the valve.

1.4.2 Refer to the valve manufacturers recommendations for specific requirements.

1.4.3 On valves having internal stops, the actuator stops should be set at the same point, with the actuator doing the actual "stopping".

2.0 SERVICE INSTRUCTIONS

2.1 Basic Tools

All tools are American Standard inch. Large adjustable wrench, screwdriver, pipe wrench, (1/4") drift punch, 24 oz. ball peen hammer, Allen wrench set, pry bar, 1/2" drive socket set, torque wrench (up to 3000 in. lbs.), Master Gasket Sealant with Master Gasket Primer. Non-hardening thread sealant such as Rector Seal No. 5.

2.2 Reference Bettis Materials

2.2.1 T4202.7 Assembly Drawing part number 068161.

2.2.2 General Operating & Maintenance Instructions for Hydraulic Rotary Valve Actuators part number 074651.

3.0 DISASSEMBLY - HYDRAULIC CYLINDER

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

3.1 Remove all operating pressure from actuator power cylinders (2-10) and cylinder adapter (2-40).

3.2 Remove all piping and plug all port holes.

3.3 Remove actuator from valve and valve mounting bracket.

3.4 Remove any remaining piping and all accessories mounted on actuator.

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

3.6 Drain the hydraulic fluid from hydraulic cylinders (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.

3.7 Both cylinder assemblies are identical. Use the same disassembly procedure for both cylinders.

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

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

3.10 Remove hex nut (2-100) and lockwasher (2-1 10) from piston rod (2-170).

3.11 Slide piston (2-20) off the piston rod (2-170).

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

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

3.14 Bleed valves (2-90) do not need to be removed for routine maintenance.

3.15 Repeat this same procedure (steps 3.8 thru 3.14) for the second cylinder assembly (2-10).

4.0 GENERAL DISASSEMBLY

4.1 Remove four socket cap screws (1-180) and gaskets (3-160) from position indicator (1-170), yoke weather cover (3-130) and remove position indicator/yoke weather cover.

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

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

4.3.1 Cover pins (1-20) will come off with the cover (1-20) and they need not be removed from the cover.

4.4 Unscrew and remove both piston rods (2-170) from yoke pin nut (1-30). Flats are provided on the outboard end of the piston rods for wrench placement. DO NOT use a pipe wrench on the piston rod, as it will mark the rod and may cause seal leakage.

4.5 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 swing yoke (1-160) to one side in order to remove bottom rollers.

4.6 Remove yoke pin nut (1-30).

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

4.8 It is not necessary to remove the drain pipe plug (1-80) to service the actuator.

4.9 The setting of the stop screws (1-60) should be checked and settings recorded before stop screws are loosened or removed.

4.10 Unscrew and remove the two stop screws (1-60), jam nut (1-110), washer seal (3-140), and thread seal (3-110).

4.11 Remove four socket cap screws (2-120) and lockwashers (2-130) from one side of housing (1-10).

4.12 Slide cylinder adapter (2-40) away from housing. Remove rod seal (3-70) from adapter.

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

4.14 Remove gasket (3-10).

4.15 Repeat steps 4.11 thru 4.14 for other side of housing (1-10).

5.0 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, the parts should be thoroughly inspected and deburred. 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 and other foreign material.

6.0 LUBRICATION REQUIREMENTS

6.1 Standard and high temperature service (-20º F to +200º F)use Bettis ESL-5.

6.2 Low temperature service (-50º F to +150º F) use Kronaplate 50.

7.0 FLUID REQUIREMENTS

7.1 Standard and high temperature service (-20º F to +200º F) use Exxon Dexron Automatic Transmission Fluid.

7.2 Low temperature service (-50º F to +150º F) use Exxon Univis J13 Hydraulic Fluid.

8.0 CENTER HOUSING GROUP REASSEMBLY

8.1 If removed install drain plug (1-80) in actuator housing (1-10).

8.2 Take all the yoke rollers (I -50) and check to see if they will run (move) freely thru the tracks in the bottom of the housing and the housing cover.

8.3 Coat the yoke oring seal (3-50) with grease and install into the housing (1-10).

8.4 Inside the housing (1-10) apply grease to the tracks and yoke bore and orient the housing with the yoke bore nearest you and top of - housing (gasket surface) facing up.

8.5 Apply grease to the yoke (1-160) lower bearing surface and install into the housing (1-10) as follows: Orient the yoke arm to approximately a 45º degree position in either direction and lower into the housing. The hub with tapped holes f aces up. Rotate the yoke back to approximately the mid-stroke (center) position.

8.6 Apply grease to the slots in the upper and lower yoke arm.

8.7 Apply grease 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.

8.8 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.

8.9 Grease the yoke pin (1-40) and insert through the yoke pin nut (1-30) and the two (2) yoke rollers (1-50).

8.10 Apply grease to all the surfaces of the two (2) remaining yoke rollers (1-50).

8.11 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.

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

8.12 Install one piston rod (2-170) into housing (1-10). Slide into the right side of housing and screw into the yoke pin nut (1-30). (DO NOT TIGHTEN) Flats are provided on the outboard end of the piston rod. These flats should be used to put a wrench on to tighten the piston rod. DO NOT use a pipe wrench on the piston rod, as it will cause seal leakage.

8.13 Apply grease to one rod bushing (2-50), install it over the piston rod and slide it up into the housing.

8.14 Clean mounting flanges of both the right side cylinder adapter (2-40) and the cylinder adapter mounting flange on the right end of housing (1-10).

8.15 Spray Master Gasket Primer to both flanges. Allow one to two minutes to dry.

8.16 Smear Master Gasket Flange Sealant (3-170) on both sides of gasket (3-10).

8.17 Install coated gasket (3-10) over the piston rod end and over rod bushing (2-50).

8.18 Coat the rod seal (3-70) with grease and install into the recess provided in the cylinder adapter. Be sure that the seal lips are installed first, with heel of seal facing housing.

8.19 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.

8.20 Fasten cylinder adapter (2-40) to housing (1-10) with socket cap screws (2-120) and lockwashers (2-130) from inside housing.

NOTE: Yoke (1-160) will have to be orientated to full counterclockwise position, opposite cylinder adapter.

8.21 Repeat steps 8.12 thru 8.20 for the left side of housing (1-10).

8.22 Place the thread seal (3-110), washer seal (3-140), and jam nut (1-110) onto the stop screws (1-60). Install the stop screws into the housing, returning them to the setting recorded in Section 4, Step 4.9. Tighten the jam nut down against the actuator housing.

8.23 Coat the yoke oring seal (3-50) with grease and install in cover (1-20).

8.24 Apply grease to the cover yoke bore and the track in the housing cover (1-20).

8.25 Apply grease to the yoke upper bearing surface.

8.26 Clean mounting flanges of both the housing cover (1-20) and housing (1-10).

8.27 Spray Master Gasket Primer to both flanges. Allow one to two minutes to dry.

8.28 Smear Master Gasket Flange Sealant (3-170) on both sides of housing cover gasket (3-20).

8.29 Place the housing cover gasket (3-20) onto the housing cover flange.

8.30 Install the housing cover (1-20), being careful not to damage the gasket (3-20) or yoke oring (3-50).

8.31 Install the cover screws (1-90) and seal gasket (3-100). LEAVE FINGER TIGHT - DO NOT TIGHTEN.

8.32 Do this step only if you have pulled the cover pins (1-120) or if you are replacing the cover pins. Drive the four pins (1-120) 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.

8.33 Tighten the cover screws (1-90).

9.0 HYDRAULIC CYLINDERS REASSEMBLY

9.1 Coat two sets oring seals (3-30) and back-up rings (3-130) with hydraulic fluid and install in both cylinder adapters (2-40). NOTE: Back-up ring will be installed in the groove between the oring and the 'housing-side' of the groove.

9.2 Coat two sets oring seals (3-40) with hydraulic fluid and install into piston (2-20).

9.3 Coat two sets piston seals (3-90) with hydraulic fluid and install on pistons (2-20).

9.4 Coat both piston rods (2-170) with hydraulic fluid (threaded end) and slide both pistons (2-20) into place.

9.5 Install lockwasher (2-110) and heavy hex nut (2-100) onto both piston rods. Torque to 200 foot pounds maximum (2400 in. lbs.). Piston rod will be tightened as well.

9.6 If removed, install drain plugs (2-80) into cylinder assembly (2-10). Use a non-hardening thread sealant, compatible with petroleum base hydraulic fluid on threaded connections (example: Rector Seal #5).

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

9.8 Install both cylinder assemblies (2-10) over adapters (2-40).

9.9 Fasten both cylinder assemblies (2-10) with socket cap screws (2-140) and lockwashers (2-130).

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

9.11 Install yoke weather cover (3-130), well greased, and position indicator (1-170) on yoke with socket cap screws (1-180) and gaskets (3-160). Pointer on indicator will face front and perpendicular to centerline of actuator.

10.0 HYDRAULIC ACTUATOR TESTING

10.1 Leakage Test

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

10.2 Procedure:

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

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

10.2.3 If there is any notable leakage, the actuator must be disassembled and the cause of leakage must be determined and corrected.

10.2.4 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 (2) minutes. If any leakage occurs, the unit must be disassembled and the cause of leakage must be determined and corrected.

10.2.5 If an actuator was disassembled and repaired, the above leakage test must be performed again.

10.3 Operational (Functional) Test

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

10.4 Procedure:

10.4.1 Cycle the actuator at 10% of the maximum operating pressure per actuator name tag. Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity, must be corrected.

10.4.2 All accessories, including solenoid valves, positioners, pressure switches, etc., must be hooked up and tested for proper operations, and replaced if found defective.

11.0 RETURN TO SERVICE

11.1 Re-install any piping and accessories removed.

11.2 Re-install actuator to valve and valve mounting bracket.

11.3 Refer to Section 1.0 for actuator installation instructions.

11.4 Refer to General Operating & Maintenance Instructions for Bettis Hydraulic Rotary Valve Actuators (part number 074651) for actuator start-up procedures.

PRESSURE REQUIREMENTS & LIMITATIONS

FOR

T42OX.X HYD. ACTUATORS

ACTUATOR MODEL	NOMINAL OPERATING PRESSURE	MAXIMUM OPERATING PRESSURE	MAXIMUM HYDROSTATIC TEST PRESSURE
T4202.7	Customer Spec. or N.A.	3750	3750

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