

GH-BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

FOR

FQ10208-2SR060 SUB SEA HYDRAULIC ACTUATORS

REFERENCE SERIAL NUMBER 890775-1

PART NUMBER: 101553

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1.0 **INTRODUCTION**

This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis FQ10208-2SR060 Subsea hydraulic actuator.

2.0 **BASIC TOOLS**

Refer to fastener wrench size chart.

3.0 **REFERENCE GH-BETTIS MATERIALS**

1. Assembly drawing part number 100760.
2. Dimensional drawing part number 101368.

4.0 **GENERAL**

1. Numbers in parentheses (), indicate the bubble number, reference number, used on assembly drawing and actuator parts list.
2. Complete actuator refurbishment requires that the actuator be removed from the valve.
3. The actuator is symmetrical about the valve centerlines and it is understood that maintenance performed on one side of the housing is also to be done to the other side.
4. Some components of this actuator are very heavy and will require a means of assistance.
5. Remove all piping and accessories from the actuator.
6. Fluid Requirements: Castrol Hyspin AWH15.
7. Lubrication Requirements: Kronaplate 100 lubricant. This lubricant is furnished in the GH-Bettis Service Kit.

5.0 **GENERAL DISASSEMBLY**

1. Remove all four stop screw nuts (2-110). Measure the exposed length of the stop screws (2-100) and record each.
2. The spring cartridge "pre-load" must be removed before the actuator is disassembled. Remove the spring cartridge "pre-load" as follows: Apply 700 psig hydraulic pressure to both inner end cap pressure inlet ports. Unscrew and remove the two stop screws (2-100) located on the sub assembly spring cartridge. Remove the pressure from the pressure inlet ports.
3. Orient the actuator so that the drain plugs (2-140) on the actuator cylinder (2-10) are in the down position. Remove the cylinder drain plugs (2-140) and drain the hydraulic fluid.
4. Unscrew the spring cartridge pull rod from the guide block (1-50). The pull rod can be rotated for removal by going thru the spring cartridge stop screw hole with a 1/2 inch square drive extension.

6.0 **DISASSEMBLY**

1. Disconnect four spring cartridge brace rods as follows: Four of eight brace rods (3-20) are connected to anchor lugs on the housing cover (1-20) these anchor lugs are on the side

of the housing opposite from the actuator to valve mounting face. Remove one nut (3-30) from each of four rods at inner end. Loosen the inner nut (3-30) at the outer end of same four rods. Slide each rod outward to disconnect free from the housing cover (1-20).

2. Unscrew and remove the socket set screws (1-350) from the position indicator (1-340). Remove the position indicator (1-340) from the position indicator drive (1-320).
3. Unscrew and remove the hex cap screws (1-230) from the position indicator adapter (1-220). Remove position indicator adapter (1-220).
4. Unscrew and remove the 54 hex cap screws (1-40) from the cover (1-20).
5. Unscrew and remove the 12 hex cap screws (1-400). Remove the hex nuts (1-410) from the hex cap screws (1-400). Thread the 12 hex cap screws (1-400), less the hex nuts (1-410), back into the cover. When the hex cap screw comes into contact with the housing (1-10) then alternately turn each screw one full turn each until the cover is lifted off of the housing and the dowel pins (1-30) are clear of the cover. Now remove the cover from the housing.
6. Unscrew and remove socket cap screws (1-140) from then sliding block. Remove yoke pin retainer (1-130). Remove yoke pin retainer (1-130). Remove the yoke pin (1-110).
7. Using adjustable regulated pneumatic pressure on the cylinder inboard inlet port of one of the cylinders, apply minimum pressure that will move the guide block (1-50) to a position on the guide bar (1-60) that will allow access to the hole in the top of the guide block.
8. Using a punch or round tool that will fit into a .391 diameter hole. Insert this tool through the hole in guide block (1-50) and into the hole in the rod connector (1-270) and hold the rod connector in place while unscrewing the piston rod (2-50) from the rod connector.
9. Unscrew and remove the socket cap screws (2-180) from the outer end cap (2-30). Unscrew and remove the hex nut (2-120) from the outboard end of cylinder (2-10). Remove the outer end cap (2-30) from cylinder (2-10). Break the end cap free by tapping with a breaker bar on the end cap.
10. Unscrew and remove the tie bars (2-40) from the inner end cap (2-20). Flats on the outboard end are provided for wrench placement.
11. Remove the cylinder (2-10) from the inner end cap (2-20). When sliding the cylinder off of the piston (2-60) tilt the cylinder 15 to 30 degrees with respect to cylinder centerline.

12. Remove split ring (2-70) and retaining ring set (2-90) from the piston rod (2-50). Slide the piston (2-60) off of the piston rod (2-50). Remove the second split ring set (2-70) from the piston rod.
13. Remove the piston rod (2-50) by pulling it out through the housing (1-10) and inner end cap (2-20).
14. Remove retainer ring (2-150) from the inner end cap (2-20).
15. Unscrew and remove the hex cap screws (1-170) from the housing, this will allow the inner end cap (2-20) to be removed.
16. Remove the rod bushing (2-80) from the inner end cap.
17. Unscrew and remove the socket cap screws (1-300) from the rod connector flange (1-290) and remove the rod connector flange from the guide block (1-50). Remove the rod connector (1-270) and spherical washer (1-330).
18. Unscrew and remove hex cap screws from the guide bar cover (1-260). Remove the guide bar cover (1-260). Remove the guide bar (1-60) by pulling it out through the side of the housing.
19. Remove the guide block (1-50). Remove the sliding blocks (1-120).
20. Remove the yoke (1-70) by lifting out of the housing.
21. Unscrew and remove hex cap screws (1-190). Remove yoke bushing retainer ring (1-180). Remove yoke bushings (1-100).
22. It is not necessary or recommended that the sub assembly spring cartridge (3-10) be removed during routine maintenance.

7.0 GENERAL REASSEMBLY

1. Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.
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.
3. After inspection, the parts should be carefully cleaned to remove all dirt and gasket material.
4. Coat all moving parts with lubricant. Coat all seals with lubricant, before installing into grooves. Use Kronaplate 100 lubricant in the housing and Castrol Hyspin AWH15 hydraulic fluid in the cylinder.
5. Apply SS pipe sealant, Loctite-567-7, to threads as marked on the assembly drawing 100760 as note 4.
6. Apply sealant, Loctite-242, to external threads as marked on the assembly drawing as note 5.

7. Apply Master Gasket to seal cover to housing and position indicator to cover.

8.0 HOUSING REASSEMBLY

1. Install oring seals (5-10) and (5-20) onto the yoke bushings (1-100). Install the yoke bushings into the housing (1-10) and the cover (1-20). Retain the yoke bushing (1-100) with the yoke bushing retainer ring (1-180), hex cap screw (1-190) and lockwasher (1-200).
2. Lubricate the yoke (1-70) and then install into the housing (1-10).
3. Install one of the sliding blocks (1-120) into the bottom yoke arm and one in the top yoke arm. Install the guide block (1-50) in between the yoke arms. Install the yoke pin (1-110) into and through the sliding blocks and the guide block. Retain the yoke pin with the yoke pin retainer (1-130), the lockwasher (1-420) and socket cap screw (1-140).
4. Install the guide bar (1-60) into the side of the housing and through the guide block and into the other side of the housing.
5. Install the guide bar cover gasket (5-130). Install the guide bar cover (1-260) and retainer with the hex cap screw (1-280), the countersunk washer (5-90) and the thread seal (5-100).
6. Thread the pull rod into the guide block (1-50) and torque to 300 foot pounds.
7. Install the o-ring seals (4-30) into the inner end cap (2-20). Install the rod seals (4-60) into the rod bushing (2-80). Install the rod bushing into the inner end cap (2-20) and retain with the retainer ring (2-150).
8. Install the end cap gasket (4-10). Install the inner end cap (2-20) and retain with hex cap screws (1-170).
9. Install the spherical washer (1-330) and the rod connector (1-270) into the guide block (1-50). Install the rod connector flange (1-290) and retain with the socket cap screws (1-300). Torque the socket cap screws (1-300) to 200 foot pounds.
10. Install the piston rod (2-50) through the inner end cap (2-20) and thread into the rod connector (1-270).
11. Remove the 12 hex cap screws (1-400) from the cover (1-20). Install the hex nuts (1-410) onto the hex cap screws (1-400) and install the 12 hex cap screws (1-400) with the hex nuts (1-410) back into the cover. The 12 hex cap screws should not be threaded in far enough to contact the housing.
12. Install the cover gasket (5-50), refer to note 6 on assembly drawing 100760 for master gasket instructions. Install the cover (1-20) onto the housing (1-10). Align the cover dowel pin holes with the dowel pins (1-30) in

the housing. Using a leather or rubber mallet tap the cover onto the housing.

13. Install the 54 hex cap screws (1-40) with the stat-o-seal (5-30) into the cover/housing.
14. Install the rod slide bushing (5-80) and the o-ring seal (5-60) into the position indicator adapter (1-220). Install the o-ring seal (5-70) into the position indicator adapter (1-220), refer to note 6 on the assembly drawing. Install the position indicator adapter (1-220) and retain with the hex cap screw (1-230), the flat washer (5-110) and the stat-o-seal (5-30).

9.0 **POWER CYLINDER REASSEMBLY**

1. Install the o-ring seal (4-40) onto the inner end cap (2-20).
2. Install the o-ring seal (4-20) onto the piston rod.
3. Install the two halves of the split ring (2-70) into the inner most groove in the piston rod.
4. Install the piston (2-60) onto the piston rod (2-50) and over the split rings (2-70). Install the second set of split rings (2-70) and retain with retaining ring (2-90).
5. Install the piston seal (4-50) and the piston slide bushing (4-80) onto the piston.
6. Slide cylinder (2-10) over piston and onto the inner end cap. Cylinder will have to be tilted approximately 15° to 30° across piston to facilitate installation. Make certain the piston slide bushing (4-80) is seated into the groove.
7. Install the tie bars (2-40) into the inner end cap (2-20).
8. Install the o-ring seal (4-40) onto the outer end cap (2-30).
9. Install the outer end cap (2-30) over the tie bars (2-40) and onto the cylinder (2-10). Install the hex nuts (2-120) and torque to 300 foot pounds.
10. Install the brace rods (3-20) back into the anchor rods on the housing cover (1-20).
11. Install the heavy hex nut (3-30) that where removed in paragraph 6.0 step 1. Tighten the inner nuts (3-30) at the outer end of the brace rods.
12. The brace rods (3-20) are for "bracing only", use the following sequence for tightening the out board end heavy hex nuts (3-30). Make sure that the nuts on cover anchor lugs are tightened up against the anchor lugs. Loosen the nuts on both sides of the spring cartridge end cap. Lock the end cap outboard side nuts up against the end cap. Using a cross pattern in two rounds of tightening, tighten each outboard nut 3/8 of a turn for a total turn on each nut of 3/4 of a turn. Tighten the inboard side nuts up against the end cap.
13. Install the stop screws (2-100) removed from the sub assembly spring cartridge. Adjust

the stop screw (2-100) back to the setting recorded in step 1 of paragraph 5.0.

14. Install the o-ring seal (4-70) into the stop screw nut (2-110). Install the stop screw nut (2-110) onto the stop screws (2-100).
15. Install the drain pipe plugs (2-190) into the bottom or lowest point of the cylinder (2-10).
16. If removed, install the bleed valves (2-180). For correct cylinder bleeding, the bleed valve must be located at the highest vertical point of the cylinder.

10.0 **ACTUATOR TESTING**

1. Leakage Test. All areas, where leakage to atmosphere may occur, are to be checked using hydraulic pressure.
2. Cycle the actuator five (5) times at 1625 psi. This will allow the seals to seek a service ready condition.
3. Apply 1700 psi and allow unit to stabilize.
4. If there is any notable leakage, the actuator 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.
6. Optional Shell Test. This test should be performed if any one of the following items are replaced: tie bar, piston, piston rod, end caps or cylinder.
7. All air should be bled from the cylinder before shell testing.
8. Shell test 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.
9. If any leakage occurs, the unit must be disassembled and the cause of leakage must be determined and corrected.
10. 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. Adjust the pressure regulator to 1120 psi.
12. Cycle the actuator ten (10) times at the above pressure. This will allow the seals to seek their proper working attitude.
13. Apply the above pressure to the actuator and allow the unit to stabilize. The actuator should stroke a full (90 degrees) travel, with the stops properly set.
14. 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

1. Replace the software components of the snubber (1-210). The snubbers are located as follows: one on the cover (1-20) and four on the valve mounting area of the actuator housing.
2. Install the position indicator (1-340) onto the position indicator drive (1-320) and retain with socket set screw (1-350).
3. Re-install any piping and accessories that were removed.

CHART 1
FASTENER WRENCH SIZE CHART

ITEM NO.	WRENCH SIZE (INCHES)
1-40	3/4
1-80	1/2
1-140	3/8 SOCKET (HEX)
1-160	1-1/2
1-170	2-1/16
1-190	9/16
1-230	3/4
1-280	15/16
1-300	1/2 SOCKET (HEX)
1-350	1/8 SOCKET (HEX)
1-370	2-3/8
1-400	3/4
1-410	3/4
2-40	7/8 FLATS
2-50	2-1/2 FLATS
2-100	1-1/4
2-110	2-3/4
2-120	2-1/16
2-180	3/16 SOCKET (HEX)
3-30	1-5/8