

GH BETTIS
OPERATING AND MAINTENANCE INSTRUCTIONS
DISASSEMBLY & REASSEMBLY
F10207 DOUBLE ACTING
HYDRAULIC ACTUATOR

PART NUMBER 71388

REVISION "A"

NEW RELEASE

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1.0 INTRODUCTION

- 1.1 This operating and maintenance procedure is offered as a guide to enable general maintenance to be performed on GH Bettis F10207 double acting hydraulic actuators.
- 1.2 The maximum recommended service interval for this actuator series is five years for normal service. Storage time is counted as part of the service interval.

COMPLETE ACTUATOR REFURBISHMENT REQUIRES THAT THE ACTUATOR BE DISMOUNTED FROM THE VALVE

2.0 BASIC TOOLS

All tools are American Standard inch. Extra large adjustable wrench, large standard slot screwdriver, 1/2" drive socket set, torque wrench (up to 600 foot pounds), 2-3/4" socket, 24 oz. ball peen hammer, pry bar, putty knife, razor sharp cutting instrument, non-corrosive leak testing solution, non-hardening thread sealant and Loctite 242.

3.0 REFERENCE GH BETTIS MATERIALS

- 3.1 F10207 Double Acting Assembly Drawing Part Number 71045.
- 3.2 Dimensional Drawing SPD 10216
- 3.3 General Operating & Maintenance Instructions (OP/MAINT-002).

4.0 GENERAL

- 4.1 Numbers in parentheses, () indicate the bubble number (reference number) used on the GH Bettis Assembly Drawing, Exploded Detail Drawings and actuator parts list.
- 4.2 Most components of this actuator are very heavy and will require a means of assistance.
- 4.3 Disassembly and assembly will require a minimum of three technicians.
- 4.4 When removing seals from seal grooves, use a small screwdriver with the sharp edges rounded off or use a commercial seal removing tool.

- 4.5 Use a non-hardening thread sealant on all pipe threads.
- 4.6 Disassembly of actuator should be done in a clean area.
- 4.7 Lubrication Requirements
 - 4.7.1 Standard service use Kronaplate 100.
 - 4.7.2 For distributors of Kronaplate in your area, call 800-428-7802.
- 4.8 Fluid Requirements
 - 4.8.1 Standard service use Exxon Dexron II Automatic Transmission Fluid.

5.0 GENERAL DISASSEMBLY

- 5.1 Make sure that actuator is in either the open or closed position.
- 5.2 Remove all operating pressure from both actuator power cylinders (2-10).
- 5.3 Drain hydraulic fluid from power cylinders by removing drain pipe plugs (2-190). This step may be done any time prior to pressure cylinder disassembly.
- 5.4 Remove actuator from valve and valve mounting bracket.

6.0 PRESSURE CYLINDERS DISASSEMBLY

- 6.1 Following steps will be performed on either power cylinder and then repeated on the other cylinder. However, steps 6.2 thru 6.19 may be performed simultaneously on both cylinders.
- 6.2 Remove the stop screw nut (2-150) and the o-ring seal (4-100).
- 6.3 Mark the stop screw (2-140). The setting should be checked and recorded before the stop screw is loosened or removed.
- 6.4 Stop screw (2-140) may remain in the outer end cap.
- 6.5 Remove the tie bar heavy hex nuts (2-130).
- 6.6 Remove the outer end cap (2-40) from the cylinder (2-10). The fit between the cylinder and the outer end cap is very tight. Break the end cap free by tapping with a breaker bar on lip provided on the end cap. DO NOT damage o-ring groove when removing end cap.
- 6.7 Remove the outer end cap o-ring seal (4-60).

- 6.8 Unscrew and remove the tie bars (2-30). Flats on outboard end are provided for wrench placement.
- 6.9 Pry the inner end cap (2-20) from housing, again using a breaker bar. Pry the cylinder (2-10) from the inner end cap.
- 6.10 Remove the cylinder (2-10) from actuator. When sliding the cylinder off, cant cylinder 15 to 30 degrees with respect to cylinder centerline to help facilitate removal.
- 6.11 Remove the hex nut (2-100) from the piston rod (2-50).
- 6.12 Remove the piston spacer (2-80).
- 6.13 Remove the piston (2-60) by sliding it off of the end of the piston rod (2-50).
- 6.14 Remove the o-ring seal (4-40) from the piston rod (2-50).
- 6.15 Remove the piston T-seal set (4-30).
- 6.16 Remove the inner end cap o-ring seal (4-60).
- 6.17 Slide the inner end cap (2-20) off of the piston rod.
- 6.18 Remove the end cap gasket (4-110).
- 6.19 Remove the rod seal (4-50) from the inner end cap (2-20)

7.0 HOUSING GROUP DISASSEMBLY

- 7.1 Remove hex head cap screw (1-180) and lockwashers (1-190) from the position indicator (1-170).
- 7.2 Remove position indicator (1-170) and yoke weather cover (4-20).
- 7.3 Remove cover hex head cap screw (1-40) and the seal gaskets (4-70).
- 7.4 Remove the housing cover (1-20). This piece will have a very tight fit.
- 7.5 Remove the cover gasket (4-10).
- 7.6 Remove upper yoke bushing (1-110) from the cover (1-20).
- 7.7 Remove two hex head cap screws (1-160) from the top of the slide block (1-130).

- 7.8 Remove yoke pin retainer (1-150).
- 7.9 Remove top slide block (1-130).
- 7.10 Remove yoke pin (1-120). Remove yoke pin by inserting 1/4"-20 UNC screw into top of yoke pin and pull straight up and out.
- 7.11 Rotate the yoke 90 degrees or to the other end of travel.
- 7.12 Using a strap wrench unscrew and remove both piston rods (2-50).
- 7.13 Remove both of the rod bushings (2-90) from the housing.
- 7.14 Remove coupling block (1-140) by inserting 3/8"-16 UNC screw into top of coupling block and pull straight up and out.
- 7.15 Remove the hex head cap screws (2-110) and the lockwashers (2-120) from the cover plate (2-70) on both sides of the housing.
- 7.16 Remove the cover plate (2-70).
- 7.17 Remove the cover plate gasket (4-90)
- 7.18 Remove guide bar (1-90) by sliding out of housing.
- 7.19 Remove guide block (1-80).
- 7.20 Remove lower sliding block (1-130).
- 7.21 Remove the yoke (1-100) by lifting the yoke out of the housing (1-10).
- 7.22 Remove the lower yoke bushing (1-110).
- 7.23 Remove both of the o-ring seals (4-120) and (4-130) from the upper and lower yoke bushings (1-110).
- 7.24 The snubber (1-220), the bleed valves (2-180) and the cover pins (1-30) do not need removing.

8.0 GENERAL RE-ASSEMBLY

- 8.1 Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.
- 8.2 Before starting the assembly of the 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.

- 8.3 After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.
- 8.4 Coat all seals with lubricant, before installing into seal grooves.
- 8.5 T-seal set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.
 - 8.5.1 Install the T-seal into the seal groove.
 - 8.5.2 Install a back-up ring on each side of the T-Seal.
 - 8.5.3 When installing the back-up rings, do not align the skive-cuts.
 - 8.5.4 If the back-up rings are too long and the rings overlap beyond the skive-cuts, then the rings must be trimmed with a razor sharp instrument.

9.0 HOUSING GROUP RE-ASSEMBLY

- 9.1 Lubricate the o-ring seals (4-120) and (4-130) install into the upper and lower yoke bushings (1-110).
- 9.2 Lubricate the lower yoke bushing and install into the housing (1-10).
- 9.3 Apply lubricant to the yoke (1-100) lower bearing surface and install into the housing (1-10) as follows: Rotate the yoke arm to approximately a 90 degree position in either direction and lower into the housing. The hub with tapped holes faces up.
- 9.4 Apply lubricant to the slots in the upper and lower yoke arm.
- 9.5 Apply lubricant to slide blocks (1-130) and install one slide block down into the lower yoke arm with the two tapped holes facing down.
- 9.6 Apply lubricant to the guide block (1-80).
- 9.7 Install the second slide block (1-130) into the upper yoke arm by placing the slide block between the yoke arm and up into the upper yoke arm.
- 9.8 While holding the second slide block in the upper yoke arm, place guide block (1-80) in between the yoke arms with the rectangle coupling block holes closest to the center of the yoke.

- 9.9 Lubricate the guide bar (1-90) and install into one side of housing through guide block (1-80) and into the other side of the housing until the ends of the guide bar is flush with the sides of the housing (1-10).
- 9.10 Using the hex head cap screws (2-110) and the lockwashers (2-120) install the cover plate (2-70). Place the cover plate gasket (4-90) in between the side of the housing and the cover plate.
- 9.11 Torque the hex head cap screws (2-110) to 50 foot pounds.
- 9.12 Lubricate both of the rod bushings (2-90) and install into each side of the cover plate/housing.
- 9.13 Lubricate one of the piston rods (2-50) and install through the rod bushing located on the side of the housing that is 90 degrees from the direction that the yoke arms are pointing.
- 9.14 Apply lubricant to one of the coupling blocks (1-140).
- 9.15 Insert the coupling block (1-140) into the guide block on the same side of the guide block/housing that the piston rod was installed in step 9.13. The tapped hole will be facing up.
- 9.16 Apply Loctite Removable Threadlocker 242 to the piston rod threads, coupling block end only, and thread into the coupling block installed in step 9.15.
- 9.17 Lubricate the remaining piston rod (2-50) and install through the remaining rod bushing that was installed in step 9.12.
- 9.18 Apply lubricant to the remaining coupling block (1-140).
- 9.19 Insert the coupling block (1-140) into the guide block. The tapped hole will be facing up.
- 9.20 Using Loctite 242 as explained in step 9.16 thread the piston rod, installed in step 9.17, into the coupling block installed in step 9.19.
- 9.21 Rotate the yoke (1-100) until the yoke pin hole located in the guide block is completely exposed in the yoke arm slot and is aligned with the holes in both of the slide blocks. (1-130)
- 9.22 Lubricate the yoke pin (1-120) and insert into the hole in the top slide block (1-130), with the tapped hole up.

- 9.23 Slide the yoke pin retainer (1-150) into the yoke groove and attach to the slide block (1-130) using hex head cap screw (1-160).
- 9.24 Lubricate the upper yoke brushing (1-110) and install into the cover (1-20).
- 9.25 Apply lubricant to the yoke (1-100) upper bearing surface.
- 9.26 Re-lubricate the guide bar (1-90), yoke slots and exposed areas of the piston rod (2-50).
- 9.27 Apply lubricant to the yoke bore in the housing cover (1-20).
- 9.28 Place the housing cover gasket (4-10) on the housing (1-10).
- 9.29 Install the housing cover (1-20), being careful not to damage the cover gasket (4-10).
- 9.30 Install the cover screws (1-40) and seal gaskets (4-70). Leave finger tight - do not tighten.
- 9.31 Do this step only if the cover pins (1-30) have been pulled or if the pins are being replaced. Drive the pins (1-30) through the cover (1-20) and into the housing (1-10). The pins should be flush with the cover. The pins are deeply grooved at one end and taper to a smooth diameter at the other end. The pins should be installed smooth end first.
- 9.32 Tighten the cover screws (1-40). Torque to 20 foot pounds.

10.0 PRESSURE CYLINDER RE-ASSEMBLY

- 10.1 The following steps will be performed on either power cylinder and then repeated on the other cylinder. However, steps 10.2 thru 10.21 may be performed simultaneously on both cylinders.
- 10.2 Coat the rod seal (4-50) with lubricant and install, lip first, into the recess provided in the inner end cap (2-20). The energizer ring of the rod seal must face the inner end cap.
- 10.3 Install the end cap gasket (4-110) over the piston rod and rod bushing.
- 10.4 Slide the inner end cap (2-20) over the piston rod (2-50) and the rod bushing (2-90). The pressure inlet port is positioned to the short side of the actuator away from the valve stem.

- 10.5 Install the o-ring seal (4-60) into the o-ring groove on the inner end cap (2-20).
- 10.6 Install the o-ring seal (4-40) into the o-ring groove located on the piston end of the piston rod (2-50).
- 10.7 Install the piston (2-60) onto the piston rod (2-50).
- 10.8 Install the piston spacer (2-80) onto the piston rod (2-50).
- 10.9 Retain the piston and piston spacer with the hex nut (2-100). Torque the hex nut to 200 foot pounds.
- 10.10 Coat the piston T-seal components (4-30) with hydraulic fluid and install into the piston external seal groove. Refer to step 8.5 for proper installation instructions.
- 10.11 Slide the end of the cylinder (2-10) over the piston (2-60) and onto the inner end cap (2-20). When sliding the cylinder over the piston seal cant 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.
- 10.12 Insert the tie bars (2-30) through the inner end cap (2-20) and screw them into the housing (1-10).
- 10.13 Install the o-ring seal (4-60) into the o-ring groove on the outer end cap (2-40).
- 10.14 Slide the outer end cap (2-40) over the end of the tie bars (2-30) and into the end of the cylinder (2-10).
- 10.15 Thread the heavy hex nuts (2-130) on to the tie bars (2-30). Torque to 500 foot pounds.
- 10.16 If removed, install the stop screw (2-140) into the outer end cap.
- 10.17 If the stop screws were removed or the setting disturbed, adjust back to the setting recorded in step 6.3.
- 10.18 Install the o-ring seal (4-100) into the stop screw nut (2-150).
- 10.19 Install the stop screw nut (2-150) on to the stop screw (2-140) and tighten.

10.20 Install the drain pipe plugs (2-190) into the bottom or lowest point of the cylinder (2-10).

10.21 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.

11.0 ACTUATOR TESTING

11.1 Leakage Test. All areas, where leakage to atmosphere may occur, are to be checked using hydraulic pressure.

11.2 Procedure:

11.2.1 Cycle the actuator five (5) times at 100% of the normal operating pressure (NOP), as per actuator name tag or per Chart 1 for model being tested. This will allow the seals to seek a service ready condition.

11.2.2 Apply 100% of the maximum operating pressure (MOP), as marked on actuator name tag or per Chart 1, and allow unit to stabilize.

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

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

11.3 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.

11.3.1 All air should be bled from the cylinder before shell testing.

11.3.2 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.

11.3.3 If any leakage occurs, the unit must be disassembled and the cause of leakage must be determined and corrected.

11.4 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.

11.5 Procedure:

- 11.5.1 Cycle the actuator at 10% of the maximum operating pressure (MOP) per actuator name tag. Any jumpy or jerky operation. not attributed to seal drag or limited flow capacity, must be corrected.
- 11.5.2 All accessories, including solenoid valves, positioners, pressure switches, etc., must be hooked up and tested for proper operations and replaced found defective.

CHART 1

**PRESSURE REQUIREMENTS AND LIMITATIONS
FOR
F10207 DOUBLE ACTING ACTUATORS**

ACTUATOR MODEL	NOMINAL OPERATING PRESSURE (NOP)	MAXIMUM OPERATING PRESSURE (MOP)	MAXIMUM HYDROSTATIC TEST PRESSURE
F10207	1500	3000	4500

12.0 RETURN TO SERVICE

- 12.1 If removed, install the snubber valve (1-220).
- 12.2 Install the position indicator (1-170) and the yoke weather cover ((4-20) with the hex head cap screws (1-180) and the lockwashers (1-190). With the actuator rotated clockwise the position indicator will be pointing to the closed position tag. (1-260).
- 12.3 Re-install the actuator to the valve.
- 12.4 Re-install all piping and accessories that were removed.
- 12.5 Refer to General Operating & Maintenance Instructions for GH Bettis Hydraulic Rotary Valve Actuators" (OP/MAINT-002) for actuator start-up procedure.

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