

GH BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

FOR

FS DOUBLE ACTING-SERIES

FIRESAFE ACTUATORS

PART NUMBER: 74876

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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 FS double acting-series firesafe pneumatic actuators.
- 1.2 The maximum recommended service interval for this actuator series is five years.

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

2.0 **BASIC TOOLS**

All tools are American Standard inch. Large adjustable wrench, standard slot screwdriver, 1/4" drift punch, 1/2" drive socket set, 24 oz. ball peen hammer, Allen wrench set, pry bar, and commercial leak testing solution.

3.0 **REFERENCE GH-BETTIS MATERIALS**

- 3.1 FS Double Acting Assembly Drawing Part Number 67499.
- 3.2 Pneumatic test assembly schematic number BSK-2369.

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 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.
- 4.3 When removing seals from seal grooves, use a small screwdriver with the sharp edges rounded off or use a commercial seal removing tool.
- 4.4 Disassembly of actuator should be done in a clean area on a work bench.
- 4.5 Lubrication Requirements - use only the lubricant that is recommended by GH-Bettis.

5.0 **GENERAL DISASSEMBLY**

- 5.1 Remove all operating pressure from actuator power cylinder assembly (2-10).
- 5.2 Remove all piping and accessories mounted on actuator.
- 5.3 The setting of stop screws (1-200) should be checked and settings recorded before stop screws are loosened or removed.
- 5.4 Remove actuator from valve and valve mounting bracket.

6.0 **PRESSURE CYLINDER DISASSEMBLY**

- 6.1 Remove socket cap screw (2-110) and lockwasher (2-120) from cylinder assembly (2-10).

- 6.2 Remove cylinder assembly (2-10).
- 6.3 Remove piston seal set (4-30).
- 6.4 Unscrew and remove lock nut (2-100) and spacer washer (2-80) from piston rod (2-50).
- 6.5 Remove piston (2-60).
- 6.6 Remove piston internal o-ring seal (4-40).
- 6.7 Remove thrust washer (2-70) from piston rod (2-50).
- 6.8 Remove gasket (4-110) and cylinder o-ring seal (4-60) from inner end cap (2-20).
- 6.9 Unscrew and remove the inner end cap socket screws (2-30), seal (4-70), and washer (4-80).
- 6.10 Remove inner end cap (2-20), taking care not to scratch the piston rod (2-50) or disengage the rod bushing (2-90) from the housing (1-10). Scratching the piston rod can be prevented by carefully removing the inner end cap, thus averting disengagement of the rod bushing from the housing.
- 6.11 Remove rod seal (4-50) from inner end cap (2-20).
- 6.12 Unscrew piston rod (2-50) from guide block (1-80). Flats are provided on the piston rod for wrench placement. DO NOT use a pipe wrench on the piston rod as it will mar the rod and may cause seal leakage.
- 6.13 Hold rod bushing (2-90) in place and remove and piston rod (2-50).
- 6.14 Remove rod bushing (2-90) from housing (1-10).
- 6.15 Remove gasket (4-90). (Only shown on blind end cap.)

7.0 **HOUSING GROUP DISASSEMBLY**

- 7.1 Remove socket cap screws (1-180) and lockwashers (1-190) from position indicator.
- 7.2 Remove position indicator (1-170) and yoke weather cover (4-20).
- 7.3 Remove cover hex cap screws (1-40) and lockwashers (1-50).
- 7.4 Remove the housing cover (1-20). NOTE: This piece will have a very tight fit.
- 7.5 Remove the cover gasket (4-10).
- 7.6 Remove upper trunion bushing (1-110) from top of yoke (1-100).
- 7.7 Remove two round head screws (1-160) from top 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 1/2"-20 UNC screw into top of yoke pin and pull straight up and out.
- 7.11 Remove coupling block (1-140). Remove coupling block by inserting 1/2"-20 UNC screw into top of coupling block and pull straight up and out.

- 7.12 Remove guide bar (1-90) by sliding out of housing.
- 7.13 Remove guide block (1-80).
- 7.14 Remove lower sliding block (1-130).
- 7.15 Before removing the yoke (1-100), mark the top of the yoke and record the keyway locations.
- 7.16 Remove yoke (1-100) by lifting yoke out of housing (1-10).
- 7.17 Remove lower trunnion bushing (1-110).
- 7.18 Remove stop screws (1-200), jam nuts (1-210), and gasket washers (4-100). This step need only be done if gasket washers are being replaced.
- 7.19 The snubber (1-220) and the cover pins (1-30) do not need removing.

8.0 **BLIND END CAP DISASSEMBLY**

- 8.1 Remove the blind end cap socket cap screws (5-20) and lockwashers (5-30).
- 8.2 Remove blind end cap (5-10).
- 8.3 Remove gasket (4-90).

9.0 **GENERAL RE-ASSEMBLY**

- 9.1 Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.
- 9.2 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.
- 9.3 After inspection, the parts should be carefully cleaned to remove all dirt, gaskets, and other foreign material.
- 9.4 The cylinder assembly (2-10) is not field repairable.
- 9.5 When installing gaskets **DO NOT** use lubricant on the gasket or on the mating surfaces. The gaskets used in this actuator are thermal barriers. If lubricant is used on the gaskets, the lubricant will act as a thermal transmitter and help defeat the firesafe characteristics of the actuator.
- 9.6 All o-ring seals and the groove they fit in are to be lubricated prior to installation.

10.0 **YOKE PREASSEMBLY**

- 10.1 Place the yoke (1-100) on a clean work surface and arrange the yoke so that the yoke arm is pointing towards you with one keyway in the opposite direction from the yoke arm is pointing towards you with one keyway in the opposite direction from the yoke arm and the second keyway pointing to your right. NOTE: Only on standard bore and key units.
- 10.2 Apply lubricant to the slot in the top and bottom yoke arms.
- 10.3 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.
- 10.4 Apply lubricant to the guide block (1-80).

- 10.5 Install the second slide block (1-130) into the upper yoke arm by placing the slide block between the yoke arms and up into the upper yoke arm.

- 10.6 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 hole closest to the center of the yoke and to your left.
- 10.7 Apply lubricant to the coupling block (1-140).
- 10.8 Move the guide block (1-80) to your left until the coupling block hole is exposed from under the upper yoke arm.
- 10.9 Insert the coupling block (1-140) into the guide block with the tapped hole facing up.
- 10.10 Move the guide block back into the center of the yoke arms until the yoke pin hole is completely exposed in the yoke arm slot and is in alignment with the hole in both blocks (1-130).
- 10.11 Lubricate the yoke pin (1-120) and insert into the hole in the top slide block (1-130), with the tapped hole up.
- 10.12 Slide the yoke pin retainer (1-150) into the yoke pin groove and attach to the slide block (1-130) using cap screws (1-160).

11.0 **BLIND END CAP ASSEMBLY**

- 11.1 Install one gasket (4-90) onto the left side of housing (1-10). Refer to Section 9, step 9.4 for gasket information.
- 11.2 Install blind end cap (5-10) using socket cap screw (5-20) and lockwasher (5-30).

12.0 **HOUSING GROUP REASSEMBLY**

- 12.1 Apply lubricant to the yoke bore in the housing (1-10) and arrange the housing with the yoke bore nearest you.
- 12.2 Coat one of the trunnion bushings with lubricant and install into the bottom of the housing.
- 12.3 Coat the bearing surfaces of the preassembled yoke (1-100) with lubricant and install into the lower trunnion bushing.
- 12.4 Coat the remaining trunnion bushing with lubricant and install onto the upper bearing surface of yoke (1-100).
- 12.5 Lubricate guide bar (1-90) and install into right side of housing through guide block (1-80).
- 12.6 If removed, lubricate stop screws (1-20) and thread on jam nuts (1-210) with washer (4-100).
- 12.7 Install the assembled stop screw assemblies into housing (1-10) at their previously marked settings, recorded in step 5.3 under General Disassembly.

13.0 **PRESSURE CYLINDER REASSEMBLY**

- 13.1 Coat rod seal (4-50) with lubricant and install, lip first, into the inner end cap (2-20).
- 13.2 Lubricate rod bushing (2-90) and install into inner end cap (2-20).
- 13.3 Position the remaining gasket (4-90) and inner end cap (2-20) to the right side of housing (1-10). Align and retain the inner end cap with cap screws (2-30), washer (4-80), and screw thread seal (4-70).
- 13.4 Install o-ring seal (4-60) into the o-ring groove on the inner end cap (2-20).

- 13.5 Lubricate piston rod (2-50) and install through inner end cap (2-20).
- 13.6 Thread piston rod (2-50) into coupling block (1-140).
- 13.7 Install thrust washer (2-70) over end of piston rod (2-50).
- 13.8 Install o-ring seal (4-40) into the piston (2-60).
- 13.9 Install the piston (2-60) onto the piston rod (2-50) and retain with washer (2-80) and lock nut (2-100).
- 13.10 Coat the o-ring seal set (4-30) with lubricant and install into the piston seal groove. The seal set is composed of one o-ring seal and two back-up rings. Install one back-up ring on each side of o-ring. NOTE: The concave surface of the back-up ring must face the o-ring seal.
- 13.11 Move or push the piston (2-60) in until it is stroked towards the inner end cap as far as it will travel.
- 13.12 Lightly coat the cylinder bore of cylinder assembly (2-10) with lubricant.
- 13.13 Install gasket (4-110) onto inner end cap (2-20).
- 13.14 Install cylinder assembly (2-10) over piston (2-60) using methods as illustrated in Figures 1 and 2.
- 13.15 Install cap screws (2-110) and washers (2-120).

14.0 **ACTUATOR TESTING**

14.1 **Leakage Test - General**

- 14.1.1 All areas where leakage to atmosphere may occur, are to be checked using a leak testing solution.
 - 14.1.2 All leak testing will use the nominal operating pressure (NOP) as listed on the actuator nametag.
 - 14.1.3 Keep clear of housing area while operating actuator.
- 14.2 Before testing for leaks, alternately apply and release NOP pressure to each side of the piston to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their proper working attitude.

14.3 **Leakage Test - Procedure**

- 14.3.1 Apply NOP pressure to the pressure port in the inner end cap (2-20).
- 14.3.2 Apply a leak testing solution to the following areas:
 - 14.3.2.1 Inside of housing (1-10) to the area around the piston rod at the point where it comes through the housing. Checks the inner end cap to piston rod seal.
 - 14.3.2.2 Inside the housing around the area where the cap screws (2-30) come through the housing.
 - 14.3.2.3 To the joint between the inner end cap (2-20) and the cylinder (2-10).

14.3.2.4 The pressure port inlet hole in the outboard end of cylinder (2-10). Checks piston to cylinder and piston to piston rod seal.

14.3.2.5 Make sure that all of the leak testing solution is cleaned from inside of the housing.

14.3.2.6 Re-lubricate the piston rod inside the housing.

14.3.3 Remove pressure from the pressure port in the inner end cap (2-20).

14.3.4 If excessive leakage across the piston is noted, generally a bubble which breaks three seconds or less after starting to form, the actuator must be disassembled and the cause of leakage must be determined and corrected.

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

14.4 Apply lubricant to the yoke bore in the housing cover (1-20).

14.5 Place the housing cover gasket (4-10) on the housing (1-10).

14.6 Install the housing cover (1-20), being careful not to damage the cover gasket (4-10).

14.7 Install the cover screws (1-40) and washers (1-50). Leave finger tight - do not tighten.

14.8 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.

14.9 Tighten the cover screws (1-40).

14.10 OPERATION TEST

14.10.1 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.

14.10.2 Cycle the actuator at 10% of the maximum operating pressure as per actuator nametag (1-230). The actuator should stroke a full 90° travel with the stop screws properly set. Leave the actuator in the full clockwise position.

15.0 RETURN TO SERVICE

15.1 If removed, install the snubber (1-220) in the housing cover.

15.2 Re-install the actuator to the valve mounting bracket and valve.

15.3 With the yoke rotated to the full clockwise position, install the weather cover (4-20) and position indicator (1-170) on the yoke with the pointer facing front and perpendicular to the piston rod. Secure with the cap screws (1-180) and lockwashers (1-190).

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

FIGURE 2

FIGURE 1

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South Africa
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F +27 11 451 3800

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Videoton Industry Park,
Building #230
Székesfehérvár 8000
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