

**GH-BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY AND REASSEMBLY**

**FOR MODELS**

**STR102XX**

**DOUBLE ACTING SERIES**

**PNEUMATIC ACTUATORS**

PART NUMBER: 074962

REVISION: "A"

RELEASE DATE: November, 1991

## 1.0 INTRODUCTION

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis STR102XX Double Acting Series Pneumatic Actuators. When the model number has a "-S" as a suffix then the actuator is special and may have some differences that are not included in this procedure.
- 1.2 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.
- 1.3 This procedure is written with the understanding that the actuator has been removed from the valve, the air or power gas has been removed from the power cylinders and all piping and accessories mounted on the actuator have been removed.

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

## 2.0 SUPPORT ITEMS AND TOOLS

- 2.1 Support Items - Service Kit, razor sharp cutting instrument, commercial leak testing solution and non-hardening thread sealant.
- 2.2 Tools: All tools are American Standard inch. Large adjustable wrench, two (2) large screwdrivers, allen wrench set, set of open/box-end wrenches, rubber or leather mallet, torque wrench (up to 5,000 in.lbs.), breaker bar, 1/2" drive socket set.

## 3.0 REFERENCE GH-BETTIS MATERIALS

- 3.1 Assembly Drawing 104913 for STR102XX double acting actuators.

## 4.0 GENERAL

- 4.1 Numbers in parentheses ( ), indicate the bubble number (reference number) used on the GH-Bettis Assembly Drawing and actuator Parts List.
- 4.2 As referenced in this procedure the front of the actuator is: Yoke bore nearest workman. The top of the actuator will be the housing cover.
- 4.3 When removing seals from seal groove, use a small standard screwdriver with the sharp edges rounded off or use a commercial seal removing tool.
- 4.4 Use a non-hardening thread sealant on all pipe threads.
- 4.5 Disassembly should be done in a clean area near a work bench.

4.6 Some components of this actuator are very heavy and will require a means of assistance.

#### 4.7 LUBRICATION REQUIREMENTS

4.7.1 Standard and high temperature service (-20°F to 350°F) use Kronaplate 100 lubricant. This lubricant is furnished in the GH-Bettis Service Kit.

4.7.2 Low temperature service (-50°F to +150°F) use Kronaplate 50. This lubricant is not furnished in the Service Kit.

### 5.0 GENERAL DISASSEMBLY

5.1 Remove stop screw nuts (2-140). Measure and record the exposed length of the stop screws (2-130).

5.2 Remove the snubber valve (1-230) from the housing cover (1-130).

### 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 6.13 may be performed simultaneously on both cylinders.

6.2 Remove tie bar hex nuts (2-100).

6.3 Remove outer end cap (2-30) 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. NOTE: Stop screw (2-130) may remain in outer end cap.

6.4 Pry inner end cap (2-40) from housing, using a breaker bar. Pry cylinder (2-10) from inner end cap (2-40).

6.5 Remove cylinder (2-10) from the inner end cap (2-40). When sliding the cylinder off, tilt the cylinder 15° to 30° degrees with respect to actuator centerline to help facilitate removal.

6.6 Remove split ring (2-80) and split ring retainer (2-90) from the outboard end of piston rod (2-70).

6.7 Slide piston (2-20) off piston rod (2-70) and tie bars (2-60). Refer to step 6.13 for 24" piston bushing (2-220) disassembly.

6.8 Remove second set of split rings (2-80) and split ring retainer (2-90).

6.9 Remove o-ring seal (5-20) and slide inner end cap (2-40) off piston rod (2-70) and tie bars (2-60).

6.10 Remove tie bars (2-60) from housing (1-10). Flats on outboard end are provided for wrench placement. Using flats will prevent damage to surfaces of tie bars. (DO NOT USE PIPE WRENCH).

6.11 Remove rod bushing (2-50) and rod seal (5-50) from inner end cap (2-40).

- 6.12 Remove piston rod (2-70) from yoke pin nut (1-110). Again, note wrench flats on outboard end. Using flats will prevent damage to surfaces to piston rod. (DO NOT USE PIPE WRENCH).
- 6.13 Fabricated 24" piston disassembly (refer to assembly drawing sheet 2 of 2 detail "B").
  - 6.13.1 Remove the retaining rings (2-230) from the piston.
  - 6.13.2 Remove the piston bushing (2-220) from the piston.

## **7.0 HOUSING GROUP DISASSEMBLY**

- 7.1 Remove position indicator pin (1-290).
- 7.2 Unscrew and remove hex cap screws (1-280) with gasket seals (4-100) from position indicator cover (1-270).
- 7.3 Remove position indicator cover (1-270).
- 7.4 Unscrew and remove set screw (1-250) from position indicator drive assembly (1-260). NOTE: Mark the hole that the set screw (1-250) is removed from.
- 7.5 Remove position indicator drive assembly (1-260) from the top of the yoke (1-30).
- 7.6 Remove cover screws (1-150) and gasket seals (4-50). NOTE: The eight cover screws (1-150), that stick up and have hex nut (1-240) on them, are not to be removed.
- 7.7 To help in removing the housing cover (1-130) loosen the eight hex nuts (1-240). Alternately rotate the eight raised cover screws (1-150) clockwise until the cover is clear of the cover pins (1-140).
- 7.8 Remove the cover (1-130).
- 7.9 Cover pins (1-140) should not be removed unless damaged.
- 7.10 Unscrew and remove socket cap screws (1-60) from upper yoke/segmented retaining rings (1-50).
- 7.11 Remove upper segmented retaining rings (1-50).
- 7.12 Remove upper yoke bushing (1-40).
- 7.13 Position the housing in such a manner so as to allow the lower yoke bushing (1-20) to be removed (refer to assembly drawing page 2 of 2 detail "G").
- 7.14 Unscrew and remove socket cap screws (1-60) from the lower yoke/segmented retaining rings (1-50).
- 7.15 Remove the lower segmented retaining rings (1-50).
- 7.16 Remove lower yoke bushing (1-20).

- 7.17 Remove the yoke pin (1-120).
- 7.18 Remove the short yoke rollers (1-90) and the long yoke roller (1-100).
- 7.19 Remove the yoke pin nut (1-110).
- 7.20 The following items need not be removed from the actuator housing for standard actuator refurbishment: yoke (1-30), rails (1-70) shoulder bolt (1-80), lifting lugs (1-160), lockwasher (1-180), hex head screw (1-170), and pipe plugs (1-190).

## **8.0 GENERAL RE-ASSEMBLY**

- 8.1 Remove all old seals and gaskets, taking care not to scratch or damage sealing surface areas.
- 8.2 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/flaking coating.
- 8.3 After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.
- 8.4 Coat all surfaces of actuators moving parts with lubricant, refer to step 4.7 for correct lubricant.
- 8.5 Coat all seals with lubricant, before installing into seal grooves.
- 8.6 T-seal set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.
  - 8.6.1 Install the T-seal into the seal grooves.
  - 8.6.2 Install a back-up ring on each side of the T-seal.
  - 8.6.3 When installing the back-up rings, do not align the skive-cuts.
  - 8.6.4 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.
- 8.7 Prime and apply master gasket (510) to all surfaces as indicated on the assembly drawing.

## **9.0 HOUSING GROUP RE-ASSEMBLY**

- 9.1 If removed, install pipe plugs (1-190).
- 9.2 Apply lubricant to lower yoke bushing (1-20) and yoke bore in housing.
- 9.3 Install o-ring seals (4-10) and (4-20) into the lower yoke bushing (1-20).
- 9.4 Install lower yoke bushing (1-20) into the housing (1-10).

- 9.5 Install the segment retaining rings (1-50) into the lower yoke bushing and retain with the socket cap screws (1-60).
- 9.6 Apply lubricant to the yoke (1-30) trunion in the lower yoke arm area slots.
- 9.7 If removed install yoke (1-30) into lower yoke bushing the yoke hub with tapped holes faces up). Rotate yoke to mid-stroke position.
- 9.8 Apply lubricant to all surfaces of yoke rollers (1-90) and (1-100). Install one short roller (1-90) into slot of bottom yoke arm.
- 9.9 Apply lubricant to 'track-rails' (1-70). If removed install inner 'track-rail' (1-70). Slide rail into housing between yoke arms and fasten with shoulder bolts (1-80) DO NOT TIGHTEN. Tie bars with 'tipped' ends will be added later to support rail. Until that time, an adapter piece (see Drawing B-064899) may be used as temporary replacements.
- 9.10 Apply lubricant to the upper and lower surfaces of yoke pin nut (1-110) and install between the yoke arms and parallel to rail inside housing.
- 9.11 Install second yoke roller (1-100) into slot of the yoke pin nut (1-110). Align holes of both rollers.
- 9.12 Apply lubricant to yoke pin (1-120) and install into middle and bottom yoke rollers.
- 9.13 Install the final short yoke roller (1-90).
- 9.14 Install outer 'track-rail' (1-70) with shoulder bolts (1-80) DO NOT TIGHTEN. Again, use adapter piece to support rail until tie bars are installed.
- 9.15 Apply lubricant to one of the rod bushings (2-50) and install into housing.
- 9.16 Install piston rods (2-70) into yoke pin nut. DO NOT TIGHTEN. Use wrench flats on outboard end.
- 9.17 Remove temporary adapter pieces one at a time and install tie bars (2-60) into the side of the housing with the tipped end of the tie bars being inserted into the rails (1-70). Tighten until threads bottom out, then back out one half-turn.
- 9.18 After both tie bars sets are installed then tighten all four shoulder bolts (1-80).
- 9.19 Tighten piston rods (2-70) to a torque of approximately 2000 inch pounds (166 ft. lbs.). Flats are provided on the outer end cap for wrenching purposes. (DO NOT USE PIPE WRENCH). Remove any burrs from the flats after tightening.
- 9.23 Position the position indicator drive assembly (1-260) onto the top of the yoke (1-30) with the slot positioned over the hole that was marked in step 7.4. Secure with the set screw (1-250).
- 9.24 Install the øring seal (4-80) over the position indicator drive assembly shaft and down against the flat cover plate.

## **10.0 POWER CYLINDERS RE-ASSEMBLY**

- 10.1 Following steps will be performed on either power cylinder and then repeated on the other cylinder. However, steps 10.2 thru 10.13 may be performed simultaneously on both cylinders.
- 10.2 Install the end cap o-ring seal (4-40) into the inner end cap (2-40).
- 10.3 Install the rod seal (5-50) into recess (counter bore) provided in inner end cap (2-40). Install with energizer ring facing outboard side (away from housing).
- 10.4 Install the o-ring seals (5-10) into the inner end cap.
- 10.5 Install inner end cap (2-40) by sliding over piston rod , tie bar and rod bushing. Pressure port above actuator centerline. Exercise extreme care during installation in order to prevent damage to the rod seal (5-50). Refer to step 8.7 before installing the inner end cap.
- 10.6 Coat the grooves on the piston rod (2-70) with lubricant. Install the two (2) halves of the split ring (2-80) into the inner most groove in the piston rod and retain with the spiral retaining ring (2-90).
- 10.7 Install o-ring seal (5-20) onto the o-ring groove in the piston rod.
- 10.8 Install o-ring seal (5-30) on the O.D. of the inner end cap (2-40).
- 10.9 Install two o-ring seals (5-10) into the tie bar bores in a piston (2-20). Refer to step 10.10 for 24" piston bushing (2-220) reassembly.
- 10.10 Fabricated 24" piston reassembly (refer to assembly drawing sheet 2 of 2 detail "B").
  - 10.10.1 Install the o-ring seals (5-90) into the O.D. groove on piston bushings (2-220).
  - 10.10.2 Install the o-ring seals (5-10) into the I.D. groove in the piston bushing (2-220).
  - 10.10.3 Install the piston bushing (2-220) into the piston.
  - 10.10.4 Install the retaining rings (2-230) into the piston.
- 10.11 Install one of the pistons (2-20) onto piston rod (2-70) and up against the split ring installed in step 10.6.
- 10.12 Install second set of split ring (2-80) and ring retainer (2-90).
- 10.13 Install one of the piston T-seals (5-40) into the O.D. groove on the piston (2-20) that was installed in step 10.10.
- 10.14 Apply lubricant to the bore of the cylinder (2-10).

- 10.15 Slide cylinder (2-10) over piston and onto the inner end cap. Cylinder will have to be tilted approximately 15<sup>o</sup> to 30<sup>o</sup> across piston to facilitate installation. 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 the end of the cylinder.
- 10.16 If removed, install stop screw (2-130) into outer end cap. Back stop screw as far out as possible.
- 10.17 Install the o-ring seals (5-10) in the outer end cap tie bar holes.
- 10.18 Install the o-ring seal (5-30) onto outer end cap (2-30).
- 10.19 Install outer end cap (2-30) onto tie bars and into the cylinder (2-10).
- 10.20 Install the two tie bar nuts (2-100) with thread seals (5-60) and countersunk washer (5-70) onto the tie bars (2-60). NOTE: While the nuts are being tightened, do not allow the tie bars to turn.

## **11.0 HOUSING COVER INSTALLATION**

- 11.1 Apply lubricant to the upper yoke bushing (1-40).
- 11.2 Install the remaining o-ring seals (4-10) and (4-20) into the upper yoke bushing (1-40).
- 11.3 Install the upper yoke bushing (1-40) into the housing cover (1-130).
- 11.4 Install the remaining segmented retaining rings (1-50) into the upper yoke bushing and retain with socket cap screws (1-60).
- 11.5 Remove all housing cover screws (1-150) and replace the gasket seals (4-50) with new seals.
- 11.6 Install the housing cover gasket (4-30) onto the housing (1-10).
- 11.7 Install the housing cover (1-130) onto the housing (1-10).
- 11.8 Install the housing cover screws (1-150), with the new gasket seals (4-50), back into the housing cover. Tighten all cover screws but the eight cover screws that have hex nuts (1-240).
- 11.9 Tighten the eight hex nuts (1-240).
- 11.10 Install the o-ring seal (4-70) into the bottom seal groove inside the position indicator cover (1-270).
- 11.11 Install the wiper ring (4-60) into the top seal groove inside the position indicator cover (1-270).

- 11.12 Install the o-ring seal (4-90) into the bottom seal groove on the bottom of the position indicator cover (1-270).
- 11.13 Install the position indicator cover (1-270), being careful not to damage the o-ring seals (4-90), (4-70) and wiper ring (4-60).
- 11.14 Install new gasket seals (4-100) on to hex head screws (1-280).
- 11.15 Install and tighten the position indicator cover screws (1-280).
- 11.16 Install the position indicator pointer (1-290) into the taped hole in the position indicator drive assembly (1-260).

## **12.0 ACTUATOR TESTING**

- 12.1 Leakage Test - All areas where leakage to atmosphere may occur are to be checked, using a commercial leak testing solution.
- 12.2 Apply air pressure (65 psig) to one side of the piston and allow the unit to stabilize. If any leakage to atmosphere is noted, the actuator must be disassembled and the cause of leakage must be determined and corrected.
- 12.3 If excessive leakage across the piston is noted, generally a bubble which breaks three seconds or less after starting to form, cycle the actuator five times to allow the seals to seek their proper working attitude and retest. If excessive leakage across the piston remains, the unit must be disassembled and the cause of leakage must be determined and corrected.
- 12.4 Repeat the above procedure for the opposite side of the piston.
- 12.5 If an actuator was disassembled and repaired, the above leakage test must be performed again.
- 12.6 Operational Test - This test is used to verify proper function of the actuator and its' related system (accessories).
  - 12.6.1 Cycle the actuator at 10% of the maximum operating pressure.
  - 12.6.2 All accessories, including solenoid valves, positioner, pressure switches, etc., should hooked up and tested for proper operations and replaced if found defective.

## **13.0 RETURN TO SERVICE**

- 13.1 If supplied in the service kit, replace the software components of the snubber valve (1-230). If removed, install the snubber valve (1-230) in the housing cover.
- 13.2 Adjust stop screws (2-130) back to settings recorded in step 5.1.
- 13.3 Install o-ring seals (5-20) into the stop nuts (2-140). Tighten both stop nuts securely.

- 13.4 All accessories, including solenoid valves, positioners, pressure switches, etc., should be hooked up and tested for proper operations and replaced, if found defective.
- 13.5 The actuator is ready to return to service.

**CHART NO. 1**

**PRESSURE REQUIREMENTS & LIMITATIONS FOR**

**STR102XX DOUBLE ACTING ACTUATORS**

<u>ACTUATOR MODEL</u>	<u>NOMINAL OPERATING PRESSURE (NOP)</u>	<u>MAXIMUM OPERATING PRESSURE (MOP)</u>	<u>MAXIMUM ALLOWABLE WORKING PRESSURE (MAWP)</u>
STR10212	(1)	266	501
STR10216	(1)	164	315
STR10220	(1)	103	197
STR10224	(1)	74	141

(1) Per customer specifications or not applicable.

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