

GH BETTIS
OPERATING & MAINTENANCE INSTRUCTIONS
DISASSEMBLY & ASSEMBLY
FOR THE FOLLOWING MODEL
522C-H-12
DOUBLE ACTING SERIES ACTUATOR

PART NUMBER: 72610

REVISION "A"

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1.0 INTRODUCTION

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH Bettis 522C-H-12 "Scotch-Yoke" type actuators.
- 1.2 The maximum recommended service interval for this actuator series is six hundred twenty-five cycles or five years, which ever occurs first.

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, two each medium standard screwdriver, small standard screwdriver with edges removed, chain wrench, putty knife, allen wrench set, 3/16" pin punch, 1/2" drive socket set, rubber or leather mallet, torque wrench (up to 2,000 in.lbs.), non-corrosive leak testing solution, and non-hardening thread sealant.

3.0 REFERENCE GH BETTIS MATERIALS

- 3.1 Assembly Drawing Part Number 72606
- 3.2 Exploded Detail Drawing Part 72607
- 3.3 General Operating & Maintenance Instruction Part Number 71584

4.0 GENERAL

- 4.1 Numbers in parentheses, () indicate the bubble number (reference number) used on the GH Bettis Assembly Drawing, Exploded Detail Drawing, and actuator Parts List.
- 4.2 This procedure is written using the stop screw side of the housing (1-10) as a reference and this side will be considered the front side of the actuator.
- 4.3 The weight of the 522C-H-12 actuator, without accessories, is 135 pounds.
- 4.4 Mating parts should be marked for ease of reassembly, i.e. cylinder to cylinder adapter, cylinder adapter to housing, right and left stop screws, etc.
- 4.5 When removing seals from seal grooves, use a small screwdriver with the sharp edges rounded off or use a commercial seal removing tool.
- 4.6 Use a non-hardening thread sealant on all pipe threads.
- 4.7 Disassembly of actuator should be done in a clean area on a work bench.

- 4.8 LUBRICATION REQUIREMENTS: Use Dow Corning Molykote 44, medium grade.
- 4.9 The M4 hydraulic control assembly does not require periodic maintenance.

5.0 GENERAL DISASSEMBLY

- 5.1 Remove all operating pressure from actuator cylinders (3).
- 5.2 Remove all piping and accessories mounted on actuator.
- 5.3 The setting of stop screws (1-60) should be checked and settings recorded before stop screws are loosened or removed.
- 5.4 Remove the socket cap screws(1-120) from the position indicator (1-110) yoke weather cover (6-110) and remove position indicator/yoke weather cover.
- 5.5 Remove actuator from valve and valve mounting bracket.
- 5.6 Remove snubber (1-130) from the housing (1-10).
- 5.7 Drain the hydraulic fluid from the inboard side of both cylinders by removing drain plugs from the cylinder adapter.
- 5.8 Plug all ports in the M4 assembly as foreign material may enter the system and cause the unit to malfunction.
- 5.9 Remove M4 from actuator by loosening nuts/lockwashers on u-bolts and sliding M4/bracket assembly off the cylinder.

6.0 PRESSURE CYLINDER DISASSEMBLY

- 6.1 The following steps may be performed on one cylinder and then on the other cylinder or simultaneously on both cylinders.
- 6.2 Secure the chain wrench around the cylinder (3) as close to the welded end cap as possible. Using the mallet, break the cylinder loose sufficiently so it can be removed.
- 6.3 Remove the cylinder and when setting the cylinder aside, care should be taken to protect the chamfered edge and cylinder threads.
- 6.4 Remove the piston cup seals (6-10).
- 6.5 Unscrew and remove piston standard hex nut (2-70) and lockwasher (2-80).
- 6.6 Remove the piston (2-20).
- 6.7 Remove piston o-ring seal (6-50).
- 6.8 Remove the o-ring seal (6-40) from the cylinder adapter (2-30).

- 6.9 Unscrew and remove the four cylinder adapter screws (2-90) and gasket seals (6-80) from the cylinder adapter (2-30).
- 6.10 Remove the cylinder adapter (2-30), taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-40).
- 6.11 Remove rod seal (6-30) from housing side of cylinder adapter (2-30).

7.0 HOUSING GROUP DISASSEMBLY

- 7.1 Remove cover screws (1-30) and gasket seals (6-100).
- 7.2 Remove the housing cover (1-20).
- 7.3 Remove o-ring seal (6-20) from the cover.
- 7.4 Move the yoke arms to the center position.
- 7.5 Remove the upper yoke roller (1-50).
- 7.6 Lift out the yoke pin (1-40).
- 7.7 Holding rod bushing (2-40) in place, pull the piston rod(2-10) out through the rod bushings (2-40).
- 7.8 Remove both rod bushings (2-40) from housing (1-10).
- 7.9 Lift the yoke (1-140) from the housing cavity.
- 7.10 Remove the lower yoke roller (1-50).
- 7.11 Remove o-ring seal (6-20) from the housing.
- 7.12 Remove the stop screws (1-60), jam nuts (1-70), and gasket seals (6-90). Be sure to identify the stop screws.
- 7.13 It is not necessary to remove housing pipe plug (1-100) or cylinder adapter pipe plugs (2-110).
- 7.14 Using a putty knife, remove the cover gasket (6-60) and cylinder adapter gaskets (6-70).

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 an 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 groove.

9.0 CENTER HOUSING GROUP RE-ASSEMBLY

9.1 If removed, install a pipe plug (1-100) into the drain port of the housing (1-10).

9.2 Coat one of the yoke o-ring seals (6-20) with lubricant and install into the housing (1-10).

9.3 Apply lubricant to the yoke bore in the body and position the body with the yoke bore nearest you. Lubricate the raised ribs in the bottom of the housing.

9.4 Apply a generous amount of lubricant to the slots in the upper and lower yoke arms of yoke (1-140).

9.5 Coat the bearing surfaces of the yoke (1-140) with lubrication and install into the body. The wide yoke arm should be installed toward the top of the housing.

9.6 Coat the piston rod bushings (2-40) with lubricant and install into both sides of the housing (1-10).

9.7 Coat one of the yoke rollers (1-50) with lubricant and place into the lower yoke arm slot nearest the cylindrical portion of the yoke.

9.8 Apply a light coat of lubricant to the piston rod (2-10) and install thru the bushings in the housing.

9.9 Coat the yoke pin (1-40) with lubricant and install thru the piston rod (2-10) into the lower yoke roller (1-50).

9.10 Coat the remaining yoke roller (1-50) with lubricant and install over the yoke pin and into the slot in the upper yoke arm.

9.11 Install the stop screws (1-60), stop screw gasket seals (6-90), and stop screw jam nuts (1-70).

9.12 Coat the remaining yoke o-ring seal (6-20) with lubricant and install into the housing cover (1-20).

9.13 Coat the yoke bore in the cover (1-20) with lubricant.

9.14 Lightly coat the cover gasket (6-60) with lubricant and place onto the housing.

9.15 Install the housing cover (1-20) and the four cover screws (1-30) with gasket seals (6-80) onto the housing (1-10).

10.0 PRESSURE CYLINDER RE-ASSEMBLY

10.1 The following steps may be performed on one cylinder and then on the other cylinder or simultaneously on both cylinders.

- 10.2 Coat the piston rod seal (6-30) with lubricant and install, lip first, into the cylinder adapter (2-30). The energizer ring of the rod seal (6-30) must face the cylinder adapter (piston side).
- 10.3 Lightly coat one cylinder adapter gasket (6-70) with lubricant. Install the adapter gasket over the piston rod bushing and up against the housing.
- 10.4 Install the cylinder adapter (2-30) over the end of the piston rod and retain with the cylinder adapter ferry screws (2-90) and gasket seals (6-80). Arrange the cylinder adapter with the single cast stiffening rib on the housing side pointing toward the yoke bore and up at 45 degrees. The location of the ports may be different on your actuator, depending on plumbing and accessory requirements. Care should be taken at this point to not scratch the piston rod when installing the cylinder adapter.
- 10.5 If removed, install a pipe plug (2-110) into the cylinder adapter pressure port that is pointing away from the yoke bore and down at 45 degrees.
- 10.6 Coat the cylinder adapter o-ring seal (6-40) with lubricant and install into the cylinder adapter (2-30) in the groove at the inner end of the threads.
- 10.7 Coat the o-ring seal (6-50) with lubricant and install onto the piston rod (2-10).
- 10.8 Coat one piston u-cup seal (6-10) with lubricant and install into piston seal groove with the lip of the seal pointing outward toward the side of the piston.
- 10.9 Coat the second u-cup seal (6-10) with lubricant and install into remaining piston seal groove with lip of the seal pointing outward toward the side of the piston.
- 10.10 Install the piston (2-20) onto the piston rod and retain with standard hex nut (2-70) and lockwasher (2-80). One side of the piston has a raised boss in the center that is counterbored to accept an "O" ring. This side should be installed against the shoulder of the piston rod. Torque the piston rod hex nut (2-40) to approximately 1,750 in.lbs. or 146 foot pounds.
- 10.11 Apply a thin coating of lubricant to the bore of the cylinders (3).
- 10.12 Install the cylinder (3) over the piston, screwing into the cylinder adapter. Tighten with a chain wrench. Exercise caution to prevent pinching of the piston cup seal lip during installation. It is necessary to depress the seal lip while working the cylinder over it. The chain wrench should be secured as close to the welded end cap as possible.

11.0 ACTUATOR TESTING

11.1 Leakage Test - General

11.1.1 All areas, where leakage to atmosphere may occur, are to be checked using a leak testing solution.

11.1.2 Before leak testing may be accomplished, it will be necessary to provide a piping system whereby pressure may be applied simultaneously to all common pressure ports.

11.1.3 All leak testing will use 65 psig pneumatic pressure.

11.2 Before testing for leaks, alternately apply and release the 65 psig pressure to each side of the pistons to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their proper working attitude.

11.3 Leakage Test - Procedure

11.3.1 Simultaneously apply 65 psig pressure to the pressure ports in the end of one cylinder (3) and in the other cylinder adapter (2-30).

11.3.2 Apply leak testing solution to the following areas:

11.3.2.1 The pressure inlet port in the cylinder adapter (2-30), checks piston to cylinder and piston to piston rod seal.

11.3.2.2 The pressure inlet port hole in the end of the other cylinder checks the piston to cylinder wall and piston to piston rod seals.

11.3.2.3 The threaded joint between the cylinder and cylinder adapters (2-30), checks the cylinder to cylinder adapter o-ring seal.

11.3.2.4 The joint between the cylinder adapter and the housing.

11.3.2.5 The snubber port hole located in the housing, checks the cylinder adapter to piston rod seal.

11.3.3 Repeat steps 11.3.1 thru 11.3.2.5 for the other cylinder and cylinder adapter.

11.3.4 If excessive leakage 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.

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

11.4 OPERATIONAL (FUNCTIONAL) TEST

- 11.4.1 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.
- 11.4.2 Cycle the actuator at 10% of the maximum operating pressure. Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity, must be corrected.
- 11.4.3 All accessories, including solenoid valves, positioners, pressure switches, etc., must be hooked up and tested for proper operations and replaced, if found defective.

12.0 M4 HYDRAULIC CONTROL INSTALLATION

- 12.1 Re-install the M4 control package (8) on the cylinder (3) with u-bolts. DO NOT over-tighten u-bolts or damage to the cylinder may result. NOTE: The unit must be mounted with reservoir upright with the pump shaft horizontal.
- 12.2 Hook-up piping from the M4 hydraulic control block to the cylinder adapter ports.
NOTE: Recommend that a non-hardening thread sealant, compatible with petroleum base hydraulic fluid (example; Rectorseal #5 be used in this system). DO NOT USE TEFLON TAPE TO SEAL HYDRAULIC SYSTEM THREADS.

13.0 M4 REFILLING INSTRUCTIONS

- 13.1 Refilling of the M4 hydraulic control system and actuator cylinder is best accomplished by using a pressure pump. Put the actuator in the closed position (cw) and proceed using the following steps.
 - 13.1.1 Remove the breather from the reservoir.
 - 13.1.2 Be sure drain plugs (2-130) are installed in the cylinder adapter.
 - 13.1.3 Attach the pump discharge line to reservoir breather port.
 - 13.1.4 Open both speed control valves on the M4 control block.
 - 13.1.5 Open the two bleed valves (2-120), located at top of the cylinder adapters (2-30).
 - 13.1.6 Slowly pump hydraulic fluid into the M4 reservoir. Approximately three (3) to five (5) PSI will be required. As the hydraulic fluid passes through the M4 control block into the cylinder, air will be displaced.
 - 13.1.7 Close each bleed valve (2-120) when the air has been displaced and hydraulic fluid appears.

- 13.1.8 Remove pump discharge line from reservoir breather port.
Adjust fluid level to 1-1/2" (40 mm) from top of reservoir.
- 13.1.9 Re-install breather removed in step 13.1.1.

14.0 ALTERNATE REFILLING INSTRUCTIONS

- 14.1 Refilling the M4 hydraulic control system during field service, often must be done without the use of a pressure pump. Proceed as follows:
 - 14.1.1 Put the actuator in the closed position (cw).
 - 14.1.2 Remove the breather from the reservoir.
 - 14.1.3 Fill the reservoir approximately three-fourths (3/4) full.
 - 14.1.4 Open both speed control valves on the M4 control block.
 - 14.1.5 Open the bleed valve (2-120) on the left side cylinder adapter only.
 - 14.1.6 Rotate the handle slowly, clockwise, until all air has escaped from the system.
 - 14.1.7 During the fill procedure, it is important that the lowest fluid level be not less than approximately one-fourth (1/4) of the reservoir volume at any time.
 - 14.1.8 Close the bleed valve, opened in step 14.1.5.
 - 14.1.9 Open the bleed valve (2-120) on the right side cylinder adapter only.
 - 14.1.10 Rotate the handle slowly, counter clockwise, until all air has escaped from the system.
 - 14.1.11 During the fill procedure, the piston will not move. This may be determined by observing the position indicator (1-110) on the actuator.
 - 14.1.12 Close the bleed valve opened in step 14.1.9.
 - 14.1.13 Adjust fluid level to 1-1/2" (40 mm) from top of reservoir.
 - 14.1.14 Re-install breather removed in step 14.1.2.

15.0 RETURN TO SERVICE

- 15.1 Install the snubber (1-130) in the housing next to the housing cover.
- 15.2 Re-install actuator to valve mounting bracket and valve.
- 15.3 Adjust both stop screws (1-60) back to settings recorded in step 5.3 under General Disassembly.

- 15.4 Tighten both jam nuts (1-70) securely, while holding stop screws (1-60).
- 15.5 Rotate the yoke to the full clockwise (CW) position. Position the yoke weather cover (6-110) and position indicator (1-110) on the yoke (1-140) with the pointer facing the piston rod and perpendicular to the cylinder assemblies.
- 15.6 Install and tighten yoke position indicator/yoke weather cover screw (1-120). These screws will need to be rechecked for tightness after the actuator has been cycled.
- 15.7 Reinstall any piping and accessories that were removed.
- 15.8 All accessories, including solenoid valves, positioners, pressure switched, etc., should be hooked up and tested for proper operations and replaced, if found defective.
- 15.9 Refer to General Operating & Maintenance Instructions, part number 71584 for actuator start-up procedures.

CHART 1

PRESSURE REQUIREMENTS & LIMITATIONS

FOR MODEL

522 PNEUMATIC ACTUATOR

<u>ACTUATOR MODEL</u>	<u>NOMINAL OPERATING PRESSURE (NOP)</u>	<u>MAXIMUM OPERATING PRESSURE (MOP)</u>	<u>MAXIMUM HYDROSTATIC TEST PRESSURE</u>
522	(1)	300	325

(1) Per customer specification or not applicable.

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