

**GH-BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY & REASSEMBLY**

**FOR MODELS**

**HD521-M4, HD721-M4 AND HD731-M4**

**DOUBLE ACTING SERIES**

**PNEUMATIC ACTUATORS**

**WITH HYDRAULIC**

**CONTROL PACKAGE**

PART NUMBER: SE-023

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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 HD521-M4, HD721-M4 and HD731-M4 Double Acting Pneumatic series actuators with M4 Hydraulic Control Package. 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 **SAFETY STATEMENT:** Products supplied by GH-Bettis, in its "as shipped" condition, are intrinsically safe if the instructions contained within this Service Instruction are strictly adhered to and executed by a well trained, equipped, prepared and competent technician.

**WARNING: FOR THE PROTECTION OF PERSONNEL WORKING ON GH-BETTIS ACTUATORS, THIS PROCEDURE SHOULD BE REVIEWED AND IMPLEMENTED FOR SAFE DISASSEMBLY AND REASSEMBLY. CLOSE ATTENTION SHOULD BE NOTED TO THE WARNINGS, CAUTIONS AND NOTES CONTAINED IN THIS PROCEDURE.**

### 1.3 DEFINITIONS:

**WARNING:** If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.

**CAUTION:** If not observed, user may incur damage to actuator and/or injury to personnel.

**NOTE:** Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.

### 1.4 **BASIC SERVICE INFORMATION: COMPLETE ACTUATOR REFURBISHMENT REQUIRES THE ACTUATOR BE DISMOUNTED FROM THE VALVE OR DEVICE IT IS OPERATING.**

- 1.5 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.
- 1.6 This procedure does not include M4 Disassembly and Reassembly Instructions. GH-Bettis does not recommend periodic maintenance for the M4 itself. The M4 needs only to be serviced when it malfunctions. Complete M4 refurbishment should be done by GH-Bettis.
- 1.7 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator. Also, it is understood that the actuator has been removed from the valve as well as all piping and accessories that are mounted on the actuator have been removed.

## 2.0 SUPPORT ITEMS AND TOOLS

- 2.1 Support Items - Service/Seal Kit, commercial leak testing solution, and non-hardening thread sealant.
- 2.2 Tools - All tools are American Standard inch. Two each medium screwdrivers, small standard screwdriver with corners rounded, putty knife, rubber or leather mallet and torque wrench (up to 2,000 inch pounds). Refer to back of procedure for item by item recommended tool list.

**3.0 REFERENCE GH-BETTIS MATERIALS**

- 3.1 Assembly Drawing part number 049679.
- 3.2 HD521-M4 and HD721-M4 Exploded Detail Drawing part number 063359.
- 3.3 HD731-M4 Exploded Detail Drawing part number 063357.

**4.0 GENERAL DETAILS**

- 4.1 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- 4.2 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on the GH-Bettis Assembly Drawing and Actuator Parts Lists.
- 4.3 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 of the actuator. The housing cover (1-20) will be the top of the actuator.
- 4.4 To help at re-assembly mark or tag all mating surfaces.
- 4.5 When removing seals from seal grooves, use a small screwdriver with sharp corners rounded off or a commercial seal removing tool.
- 4.6 Use a non-hardening thread sealant on all pipe threads.

**CAUTION: Apply the thread sealant per the manufacture's instructions.**

- 4.7 Disassembly of actuator should be done in a clean area on a work bench.
- 4.8 The actuator is heavy and will require a means of assistance. For actuator approximate weight refer to the following chart.

<u>ACTUATOR MODEL</u>	<u>APPROXIMATE ** WEIGHT (LBS)</u>
HD521-M4	135
HD721-M4	179
HD731-M4	230

\*\* Weights listed for each model are for bare actuators without valve mounting brackets and accessories.

- 4.9 **LUBRICATION REQUIREMENTS:** Lubricants, other than those listed in steps 4.9.1 and 4.9.2, should not be used without prior written approval of GH-Bettis Product Engineering.
  - 4.9.1 Standard and high temperature service (-20°F to +350°F) use GH-Bettis ESL-5, Kronaplate 100 lubricant. ESL-5 is contained in the GH-Bettis Service/Seal Kit.
  - 4.9.2 Low temperature service (-50°F to +150°F) use Kronaplate 50 lubricant. This lubricant is not contained in the Low Temperature Service/Seal Kit.

4.10 FLUID REQUIREMENTS: For use in the M4 Hydraulic Control Package (8) and the hydraulic control package cylinder assembly M4 (3-20). The following listed fluids are recommended fluids only and does not limit the use of other hydraulic fluids compatible with supplied seals and coatings.

4.10.1 Standard and high temperature service (35°F to +350°F) use Dexron II Automatic Transmission Fluid.

4.10.2 Low temperature service (-65°F to +180°F) use Exxon Unimis J13 Hydraulic Fluid.

## 5.0 **GENERAL DISASSEMBLY**

5.1 Mark or tag stop screw (1-60) left and right. Measure the exposed length of right and left stop screws (1-60) and record each before loosening for removal.

5.2 If not already removed disconnect all operating pressure from actuator pneumatic cylinder (3-10).

5.3 Record the locations of the pressure ports in the cylinder adapters (2-30) and (2-150).

5.4 Remove snubber valve (1-120) from top of the housing (1-10).

5.5 Remove socket cap screws (1-120) from position indicator (1-110), yoke weather cover (6-110) and remove position indicator/yoke weather cover.

5.5 Drain the hydraulic fluid from the hydraulic control cylinder (3-20) by opening the bleed valves (2-120) and then removing the cylinder drain pipe plugs (2-130). One is located on outboard end of cylinder assembly M4 (3-20) and the other on the cylinder adapter (2-150).

5.6 If the M4 package is remote mounted then disregard the rest of this step. If the M4 is mounted on the actuator then remove the M4 control package (8) from cylinder assembly M4 (3-20) as follows. Remove M4 from actuator cylinder (3-20) by loosening the nuts/lockwashers on the u-bolts and then slid the M4/bracket assembly off cylinder assembly -M4 (3-20).

Note: Plug 3/8" NPT ports as foreign material may enter the system and cause unit to malfunction.

## 6.0 **PNEUMATIC CYLINDER DISASSEMBLY**

6.1 Secure the chain wrench around the cylinder (3-10) as close to the welded end cap as possible. Using the mallet, break the cylinder loose sufficiently so it can be removed. Remove the cylinder (3-10) by rotating the cylinder counter clockwise.

NOTE: When setting the cylinder aside, care should be taken to protect the chamfered edge and cylinder threads.

6.2 Unscrew piston lock nut (2-70) and remove the piston (2-20).

6.3 Unscrew and remove the four cylinder adapter ferry screws (2-90).

- 6.4 Remove the cylinder adapter (2-30), taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-40).

## **7.0 HYDRAULIC CONTROL CYLINDER DISASSEMBLY**

- 7.1 Secure the chain wrench around the cylinder (3-20) as close to the welded end cap as possible. Using the mallet, break the cylinder loose sufficiently so it can be removed.

NOTE: When setting the cylinder aside, care should be taken to protect the chamfered edge and cylinder threads.

- 7.2 Unscrew piston lock nut (2-70) and remove the piston (2-20).
- 7.3 Unscrew the four cylinder adapter ferry screws (2-90).
- 7.4 Remove the cylinder adapter (2-150), taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-40).

## **8.0 HOUSING GROUP DISASSEMBLY**

- 8.1 Remove cover screws (1-30) and seal gaskets.
- 8.2 Remove the housing cover (1-20).
- 8.3 Rotate the yoke arms (1-140) to the center position.
- 8.4 Remove the upper yoke roller (1-50).
- 8.5 Lift out and remove the yoke pin (1-40).
- 8.6 Holding rod bushings (2-40) in place, pull the piston rod (2-10) out through the rod bushings (2-40).
- 8.7 Remove both rod bushings (2-40) from housing (1-10).
- 8.8 Lift out the yoke (1-140) from the housing cavity.
- 8.9 Remove the lower yoke roller (1-50).
- 8.10 Unscrew and remove the stop screws (1-60), jam nuts (1-70), and gasket seals (6-90). Be sure to identify this stop screw.
- 8.11 It is not necessary to remove housing pipe plug (1-100) or cylinder adapter pipe plug (2-110).
- 8.12 Using putty knife, remove cover gasket (6-60) and cylinder adapter gaskets (6-70).

## 9.0 GENERAL RE-ASSEMBLY

**CAUTION:** Only new seals, that are still within the seals expectant shelf life, should be install back into actuator being refurbished.

- 9.1 Remove and discard all seals and gaskets.
- 9.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.
- 9.3 All parts should be thoroughly inspected for excessive wear, stress cracking, gauling and pitting. Attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding or rotating motion. Sealing surfaces of the cylinder, tie bars and piston rod must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

**CAUTION:** Actuator parts that reflect any of the above listed characteristics must be replaced with new parts.

- 9.4 Before installation coat all moving parts with a complete film of lubricant. Coat all seals with a complete film of lubricant, before installing into seal grooves.

NOTE: The parts and seals used in the actuator housing assembly (1-10) and the pneumatic cylinder assembly (3-10) will be assembled using lubricant as identified in step 4.9. The parts and seals used in the cylinder assembly M4 (3-20) and the hydraulic control package cylinder (8) will be assembled using the hydraulic fluid identified in step 4.10.

- 9.5 Low Temperature or trim -11 T Seal Set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.
  - 9.5.1 Install the T-seal into the seal groove.
  - 9.5.2 Install a back-up ring on each side of the T-seal.
  - 9.5.3 When installing the back-up rings, do not align the skive-cuts.
  - 9.5.4 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.
- 9.6 The torque requirements for critical fasteners are specified at the appropriate step of the assembly procedure.

## 10.0 CENTER HOUSING GROUP RE-ASSEMBLY

- 10.1 If removed, install a pipe plug (1-100) into the drain port of the housing (1-10).
- 10.2 Install one of the yoke o-ring seals (6-20) into the groove in the housing bore (1-10).
- 10.3 Apply lubricant to the yoke bore and the raised ribs in the bottom of the housing. Arrange the housing so that the yoke bore is nearest to you.
- 10.4 Apply a generous amount of lubricant to the slots in the upper and lower yoke arms and coat the bearing surfaces of the yoke (1-140).

- 10.5 Install the yoke (1-140) into the housing (1-10). The wide yoke arm should be installed toward the top of the housing.
- 10.6 Coat the piston rod bushings (2-40) with lubricant and install into both sides of the housing.
- 10.7 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.
- 10.8 Apply a light coat of lubricant to the piston rod (2-10) and install through the bushings in the housing.
- 10.9 Coat the yoke pin (1-40) with lubricant and install through the piston rod (2-10) into the lower yoke roller (1-50).
- 10.10 Coat the remaining yoke roller (1-50) with lubricant and install over the yoke pin and into the slot in the upper yoke arm.
- 10.11 Install the remaining yoke o-ring seal (6-20) into the housing cover (1-20).
- 10.12 Coat the yoke bore in the housing cover (1-20) with lubricant.
- 10.13 Install the cover gasket (6-60) onto the housing.
- 10.14 Install the housing cover (1-20) onto the housing (1-10) and retain with the four cover screws (1-30) with gasket seals (6-80). NOTE: For 521/721 actuators, gasket seals will be item number (6-100).

## 11.0 PNEUMATIC CYLINDER RE-ASSEMBLY

**CAUTION:** Use the lubricants as referenced in step 4.9 on all moving parts and seals in the Pneumatic cylinder assembly.

- 11.1 Install the remaining cylinder adapter gasket (6-70) over the exposed piston rod.
- 11.2 Install the remaining piston rod seal (6-30), lip first, into the cylinder adapter (2-30). NOTE: The energizer ring of rod seal must face the cylinder adapter (piston side).
- 11.3 Install the cylinder adapter (2-30) over the piston rod and retain with the cylinder adapter ferris head screws (2-90) and gasket seals (6-80). Arrange the cylinder adapter ports are in the same position as recorded in section 5. NOTE: Care should be taken at this point not to scratch the piston rod when installing the cylinder adapter.
- 11.4 If removed, install pipe plug (2-110) into the cylinder adapter (2-30) pressure port.
- 11.5 Install the remaining cylinder adapter oring seal (6-40) into the cylinder adapter in the groove at the inner end of the threads.
- 11.6 Install the remaining piston o-ring seal (6-50) onto the piston rod (2-10).

- 11.7 Install the remaining piston (2-20) onto the piston rod and retain with hex lock nut (2-70). One side of the piston has a raised boss in the center that is counter bored to accept an "O" ring. This side should be installed against the shoulder of the piston rod. Teflon insert of lock nut (2-70) should rest up against piston. Torque the piston rod hex nut (2-70) to approximately 146 foot pounds.
- 11.8 PISTON SEAL INSTALLATION:
- 11.8.1 Standard and High Temp Actuators: Coat the remaining piston U-cup seals (6-10) with lubricant and install into the piston seal grooves. The lip of the seals should point outward or away from each other.
- 11.8.2 Low Temp Actuators: The low temp piston seal is a T seal and is a bi-directional seal. Being a bi-directional seal only one is required and it can be installed in either piston seal groove. Install the T seal as instructed in step 9.5.
- 11.9 Push the piston in towards the housing as far as it will go.
- 11.10 Coat the cylinder threads and the entire cylinder (3-10) bore with lubricant.
- 11.11 Install the cylinder (3-10) over the piston and screw into the cylinder adapter (2-30). Tighten with a chain wrench.
- 11.12 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 pointing to the piston rod and perpendicular to the cylinder assemblies.
- 11.13 Install the stop screws (1-60), stop screw gasket seals (6-90) and stop screw jam nuts (1-70).
- 11.14 Adjust both stop screws (1-60) back to the settings recorded in section 5.
- 11.15 Tighten both stop screw jam nuts (1-70) securely, while holding the stop screws (1-60) in place.
- 11.16 Install and tighten yoke position indicator/yoke weather cover screws (1-120). These screws will need to be rechecked for tightness after the actuator has been cycled and tested.

## 12.0 HYDRAULIC CONTROL CYLINDER RE-ASSEMBLY

**CAUTION:** Use hydraulic fluid **ONLY**, as referenced in step 4.10, on all moving parts and seals in the Hydraulic Control cylinder.

- 12.1 Coat piston rod seal (6-30) with hydraulic fluid and install, lip first, into the cylinder adapter (2-30). NOTE: The energizer ring of rod seal (6-30) must face the cylinder adapter, piston side.
- 12.2 Install one cylinder adapter gasket (6-70) over the piston rod bushing on the left side of the housing (1-10).

- 12.3 Install the cylinder adapter (2-150) over the end of the piston rod and retain with the cylinder adapter ferris screws (2-90) and gasket seals (6-80). Arrange the cylinder adapter so that the ports are in the same position as recorded in section 5. Care should be taken at this point not to scratch the piston rod when installing the cylinder adapter.
- 12.4 If removed, install a pipe plug (2-110) into the cylinder adapter pressure port that it was removed from.
- 12.5 Install the cylinder adapter o-ring seal (6-40) into the cylinder adapter (2-150) in the groove at the inner end of the threads.
- 12.6 Install the piston o-ring seal (6-50) onto the piston rod (2-10).
- 12.7 PISTON SEAL INSTALLATION:
- 12.7.1 Standard and High Temp Actuators: Install the piston cup seals (6-10) into the piston (2-20) seal grooves. The lip of the seals should point outward or away from each other.
- 12.7.2 Low Temp Actuators: The low temp piston seal is a T seal and is a bi-directional seal. Being a bi-directional seal only one is required and it can be installed in either piston seal groove. Install the T seal as instructed in step 9.5.
- 12.8 Install the piston (2-20) onto the piston rod and retain with hex lock nut (2-70). One side of the piston has a raised boss in the center that has a counter-bore to accept an o-ring. This side should be installed against the shoulder of the piston rod. Teflon insert of hex lock nut (2-70) should rest up against piston. Torque hex nut (2-70) to 146 foot pounds.
- 12.9 Apply a coating of hydraulic fluid to the cylinder threads and the entire bore of the cylinder assembly -M4 (3-20).
- 12.11 Install the cylinder assembly -M4 (3-20) over the piston, screwing into the cylinder adapter (2-150). Tighten the cylinder assembly -M4 with a chain wrench. NOTE: 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.
- 12.12 Install the drain pipe plugs (2-130) into the cylinder adapter (2-150) and the cylinder assembly -M4 (2-150) drain ports.
- 12.13 Install the bleed valves (2-120) into the cylinder adapter (2-150) and the cylinder assembly -M4 (2-150) ports. NOTE: Make certain that the bleed valves are closed tight.

### **13.0 ACTUATOR TESTING**

- 13.1 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution. 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.
- 13.2 NOTE: Pressure applied to the actuator is not to exceed the maximum operating pressure rating listed on the actuator name tag. All leak testing will use 65 psig pneumatic pressure or the pressure used by the customer to operate the actuator during normal operation.

- 13.3 Before testing for leaks, alternately apply and release 65 psig pneumatic 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.
- 13.4 Apply 65 psig pneumatic pressure to the pressure inlet port in the pneumatic cylinder adapter (2-30).
- 13.5 Apply leak testing solution to the following areas:
  - 13.5.1 The inlet port hole in the end of the pneumatic cylinder (3-10), checks the piston to cylinder wall and piston to piston rod seals.
  - 13.5.2 The threaded joint between the pneumatic cylinder (3-10) and cylinder adapter (2-30), checks the cylinder to cylinder adapter o-ring seal.
  - 13.5.3 The joint between the cylinder adapter and the housing (1-10).
  - 13.5.4 The snubber port hole located in the housing (1-10), checks the cylinder adapter to piston rod seal.
- 13.6 Remove pressure from the pressure inlet port on the pneumatic cylinder adapter (2-30).
- 13.7 Apply 65 psig pneumatic pressure to the inlet port in the end of pneumatic cylinder (3-10).
- 13.8 Apply leak testing solution to the inlet port in the cylinder adapter (2-30), checks piston to cylinder and piston to piston rod seals.
- 13.9 Remove pressure from the inlet port in the outboard end of pneumatic cylinder (3-10).
- 13.10 Apply 65 psig pneumatic pressure to the inlet port in the cylinder adapter (2-150).
- 13.11 Apply leak testing solution to the following areas:
  - 13.11.1 The inlet port in the outboard end of cylinder assembly -M4 (3-20), checks piston to cylinder and piston to piston rod seals.
  - 13.11.2 The threaded joint between the cylinder assembly -M4 (3-20) and cylinder adapter (2-150), checks the cylinder to cylinder adapter o-ring seal.
  - 13.11.3 The joint between the cylinder adapter (2-150) and the housing (1-10).
  - 13.11.4 The snubber port hole located in the housing (1-10), checks the cylinder adapter to piston rod seal.
- 13.12 Remove pressure from the pressure inlet port on cylinder adapter (2-150).
- 13.13 Apply 65 psig pneumatic pressure to the inlet port in the cylinder assembly -M4 (3-20).
- 13.14 Apply leak testing solution to the inlet port in the cylinder adapter (2-150), checks piston to cylinder and piston to piston rod seals.
- 13.15 Remove pressure from the inlet port in the outboard end of cylinder assembly -M4 (3-20).

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

#### 14.0 **M4 HYDRAULIC CONTROL PACKAGE INSTALLATION**

- NOTES:
1. The unit must be mounted with reservoir upright with the pump shaft horizontal.
  2. Recommend that a non hardening thread sealant, compatible with petroleum base hydraulic fluid be used in this system.

**CAUTION: Do not use teflon tape to seal hydraulic system threads.**

- 14.1 If the M4 (8) was mounted on the actuator then reinstall it on the hydraulic control cylinder assembly -M4 (3-20).
- 14.2 Hook up piping from the M4 hydraulic control block to cylinder ports.
- 14.3 M4 Refilling Instructions: Refilling of the M4 hydraulic control system and actuator cylinder is best accomplished using a pressure pump. If a pressure pump is not available go to step 14.4 for alternate refilling instructions. Put the actuator in the closed position (CW) and proceed using the following steps.
- 14.3.1 Remove the breather from the reservoir.
- 14.3.2 Attach the pump discharge line to reservoir breather port.
- 14.3.3 Open both speed control valves.
- 14.3.4 Open the two bleed valves (2-120), located at the end of the cylinder assembly -M4 (3-20) and on the inboard side of cylinder adapter (2-150).
- 14.3.5 Slowly pump hydraulic fluid into the reservoir. Approximately three to five PSI will be required. As the hydraulic fluid passes through the M4 control block into the cylinder, air will be displaced.
- 14.3.6 Close each bleed valve (2-120) when the air has been displaced and hydraulic fluid appears.
- 14.3.7 Remove pump discharge line from reservoir breather port.
- 14.3.8 Adjust fluid level to 1½" (40mm) from top of reservoir with actuator in open (CCW) position.
- 14.3.9 Re-install breather removed, in step 14.3.1.
- 14.4 Alternate Refilling Instructions: Refilling the M4 hydraulic control system, during field service, often must be done without the use of a pressure pump. Proceed as follows:
- 14.4.1 Put the actuator in the full clockwise (CW) position.
- 14.4.2 Remove the breather from the reservoir.

- 14.4.3 Fill the reservoir approximately three-fourths (3/4) full.
  - 14.4.4 Open both speed control valves.
  - 14.4.5 Open the bleed valve (2-120) on the outboard end of the cylinder assembly -M4 (3-20) only.
  - 14.4.6 Rotate the handle slowly, clockwise, until all air has escaped from the system.
  - 14.4.7 Close the bleed valve opened in step 14.4.5. During the fill procedure, it is important that the lowest level be not less than approximately one-fourth (¼) of the reservoir volume at any time.
  - 14.4.8 Open the bleed valve (2-120) on the inboard end of the cylinder adapter (2-150).
  - 14.4.9 Rotate the handle slowly, counterclockwise, until all air has escaped from the system.
  - 14.4.10 Close the bleed valve opened in step 14.4.8. During the fill procedure, the piston will not move. This may be determined by observing the position indicator (1-110) on the actuator.
  - 14.4.11 Adjust fluid level to 1-1/2" (40mm) from top of reservoir with actuator in open (CCW) positions.
  - 14.4.12 Re-install breather removed in step 14.4.2.
- 14.5 Additional M4 Instructions These steps are to be performed to insure air is removed from the system (most likely air in pump) and to test the operation of M4 hydraulic control system.
- 14.5.1 Turn M4 crank arm CW. The actuator should move clockwise as well. Adjust outboard bleed valve (2-120) to remove air from system.
  - 14.5.2 Turn M4 crank arm CCW. The actuator will move counterclockwise. Adjust inboard bleed valve (2-120) to remove air from system.
  - 14.5.3 With bleed valves closed, stroke actuator full 90°, CW and CCW, using M4 override.

## 15.0 ACTUATOR OPERATIONAL (FUNCTIONAL) TEST

Note: This test is used to verify proper function of the actuator and its related system (accessories).

- 15.1 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.

NOTE: The following step can be done when reinstalled on the valve.

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

**16.0 RETURN TO SERVICE**

- 16.1 Replace the software components of the snubber (1-120) and then install into the housing (1-10).
- 16.2 The actuator should now be ready to return to service.

**17.0 INFORMATION NOTES:**

- 17.1 HD521-M4, HD721-M4 and HD731-M4 actuators use a Polypak rod seal to seal the cylinders from the center housing (1-10). The dimensional stack of the rod seal and the rod bushing is less than the rod seal cavity. This dimensional difference does not affect the ability of the current polypak seal to provide sealing in this application.
- 17.2 All asbestos has been eliminated from the gasket material used in GH-Bettis Actuators. The current gasket material used is Non Asbestos Synthetic Fiber.

**HD521-M4 AND HD721-M4 TOOL STYLE AND WRENCH SIZES**

ITEM NO.	WRENCH SIZE	QTY	DESCRIPTION	RECOMMENDED WRENCH STYLE
1-30	9/16"	4	Cover Screws	Socket
1-60	1/2"	2	Stop Screw	Open End or Adjustable
1-70	15/16"	2	Stop Screw Nut	Open End or Adjustable
1-100	7/16"	1	Pipe Plug	Open End
1-120	3/16"	4	Weather Cover Screws	Allen
1-130	7/8"	1	Snubber	Deep Socket
2-70	1-1/4"	2	Piston Rod Lok Nut	Socket
2-90	7/16"	8	Cylinder Adapter Screws	12 Point Socket (1)
2-110	7/16"	2	Pipe Plugs	Open End
3-10	(1)	1	Pneumatic Cylinder	Chain (2)
3-10	(1)	1	Cylinder Assembly -M4	Chain (2)

**731-M4 TOOL STYLE AND WRENCH SIZES**

ITEM NO.	WRENCH SIZE	QTY	DESCRIPTION	RECOMMENDED WRENCH STYLE
1-30	3/4"	4	Cover Screws	Socket
1-60	7/8"	2	Stop Screw	Open End or Adjustable
1-70	1-5/16"	2	Stop Screw Nut	Open End or Adjustable
1-100	7/16"	1	Pipe Plug	Open End
1-120	3/16"	4	Weather Cover Screws	Allen
1-130	7/8"	1	Snubber	Deep Socket
2-70	1-5/8"	2	Piston Rod Lok Nut	Socket
2-90	1/2"	8	Cylinder Adapter Screws	12 Point Socket (1)
2-110	7/16"	2	Pipe Plugs	Open End
3-10	(1)	1	Pneumatic Cylinder	Chain (2)
3-20	(1)	1	Cylinder Assembly -M4	Chain (2)

(1) No alternate style recommended

(2) GH-Bettis recommends a short handled chain wrench with a 40" chain (an example is a #11 Titan Chain wrench with a 40 inch chain).