SERVICE INSTRUCTIONS
ASSEMBLY & DISASSEMBLY
731-M3 DOUBLE ACTING
PNEUMATIC SERIFS ACTUATORS

INTRODUCTION

This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis H.D. 731-M3 "Scotch-Yokel' type pneumatic actuators.

BASIC TOOLS

Large adjustable wrench, screwdriver, chain wrench, torque wrench (up to 2,000 in. lbs.), 1/2" drive socket set, allen wrench set and rubber or leather mallet.

REFERENCE GH-BETTIS MATERIALS

GH-Bettis Assembly Drawing D36223 GH-Bettis Operating, Storage & Maintenance Instruction (Op/Maint-001)
GH-Bettis Service Instructions, HD Series.
Dimensional (Base 1) Drawing D40914.

GENERAL DISASSEMBLY

Note: Numbers in parentheses, indicate the bubble number (reference number) used on the GH-Bettis Assembly Drawing and actuator Bill of Material.

1. Remove all operating pressure from actuator power cylinder (3-10).

2. Remove all plumbing and accessories on actuator.

PRESSURE CYLINDER DISASSEMBLY

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.

2. To disassemble M3 (jackscrew):

   a. Back-off seal nut (3-30) and turn jackscrew until M3 protrudes from cylinder assembly.

   b. Remove pin (3-50) and washer (3-60).

   C. "Back-out" M3 (3-20) from cylinder assembly.

d. Remove seal nut and replace if wear is excessive.
NOTE: It may not be necessary to remove M3.

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

4. Unscrew piston nut (2-70) and remove the piston (2-20) and piston o-ring seal (6-50).

5. Unscrew and remove the four cylinder adapter ferry screws (2-90) and gasket seals (6-80).

6. Remove the cylinder adapter (2-30), taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-40). Remove rod seal (6-30).

ROD COVER DIS-ASSEMBLY

1. Unscrew four rod cover ferry head screws (2-100) and seal gaskets (6-80).

2. Remove rod cover (2-60) taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-50).

3. To disassemble M3 (jackscrew):

   a. Back-off seal nut (2-130) and turn jackscrew until M3 protrudes from rod cover.

   b. Remove pin (2-150) and washer (2-160).

   c. "Back-out" M3 (2-120) from cylinder assembly.

   d. Remove and replace seal nut if wear is excessive.

HOUSING GROUP DISASSEMBLY

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

2. Remove cover screws (1-30) and gasket seals (6-80).

3. Remove the housing cover (1-20).

4. Remove the upper yoke roller (1-50) and lift out the yoke pin (1-40).

5. Pull the piston rod (2-10) out through the rod bushing (2-40) - right side of housing.

6. Remove rod bushing (2-40) from housing (1-10).

7. Lift the yoke (1-140) from housing cavity.

8. Remove the lower yoke roller (1-50).

LUBRICATION REQUIREMENTS

1. Standard and high temperature service (-20º F to 350º F) use Kronaplate 100. Reference GH-Bettis Engineering Standard ESL-5.

2. Low temperature service (-100º F to 300º F)use Aeroshell 17. Reference GH-Bettis Engineering Standard ESL-4.

FLUID REQUIREMENTS

1. Standard and high temperature service (35º F to 350º F) use Exxon Dexron II Automatic Transmission Fluid. Identification #D-20106. Reference GH-Bettis Engineering Standard ESF-1.

2. Low temperature service (65º F to 180º F) use Exxon Univis Jl3 Hydraulic Fluid. Reference GH-Bettis Engineering Standard ESF-2.

GENERAL RE-ASSEMBLY

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. After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign matter.

The torque requirement for critical fasteners is specified at the appropriate step of the assembly procedure.

Remove all old seals and gaskets, taking care not to scratch or damage seal grooves.

CENTER HOUSING GROUP RE-ASSEMBLY

Orientation: Stop screw side of housing facing worker will be considered front view.

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

2. Coat one of the yoke o-ring seals (6-20) with grease and install into the housing (1-10) lower yoke bore.

3. Apply grease to the lower yoke bore in the body and orient the body with the yoke bore nearest you.

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

5. Coat the piston rod bushing (2-40) with grease and install into right side of the housing.

6. Apply a generous amount of grease to the slots in both yoke arms.

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

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

   NOTE: Threaded end of piston rod will be on side. Care should be taken not to scratch or damage piston rod.

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

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

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

12. Coat the yoke bore in the cover and upper yoke trunion with grease.

13. Place the cover gasket (6-60) onto the housing - both sides lightly greased.

14. Install the housing cover (1-20) and the four cover screws (1-30) with gasket seals (6-100).

15. If removed, install stop screw (1-60) with jam nut (1-70) and gasket seal (6-90). - 2 places.

16. If removed, install snubber valve assembly (1-130) into housing.

PRESSURE CYLINDER RE-ASSEMBLY

1. Install a cylinder adapter gasket (6-70), lightly greased - both sides, over the piston rod bushing on the right side of the housing.

2. Coat the piston rod seal (6-30) with grease and install, lip first, into the cylinder adapter (2-30).

3. Install the cylinder adapter (2-30) over the right end of the piston rod and retain with the cylinder adapter ferry head screws (2-90) and gasket seals (6-80). Orient the cylinder adapter with the single cast stiffening rib on the stop screw side and pointing up at 45º degrees.

4. If removed, install a pipe plug (2-110) into both cylinder adapter pressure port on back side that is pointing away from the yoke bore and down at 45º. Use Rectorseal #5 or equivalent (refer to GH-Bettis Engineering Specification ESMA 4601).

5. Coat the cylinder adapter o-ring seal (6-40) with grease and install into the cylinder adapter in the groove at the inner end of the threads.

6. Coat the piston head o-ring seal (6-50) with grease and install onto the piston rod.

7. Install the piston (2-20) onto the piston rod and retain with hex nut (2-70). One side of the piston has a raised boss in the center that is counterbored to accept and o-ring ring. This side should be installed against the shoulder of the piston rod. Torque piston rod hex nut 1,750 in. lbs. (146 ft. lbs.).

   NOTE: Teflon seal inside hex nut will rest against piston.

8a. Standard and High Temp Actuators:

   Coat the piston U-cup seals (6-10) with grease and install onto the piston. The lips of the seals should point outward toward the sides of the piston.

8b. Low Temp Actuators:

   1.) Apply grease to piston T-seal (6-10).

      NOTE: Seal is composed of rubber seal and two back-up rings. The rings serve as anti-extrusion back-ups.

   2.) Install T-seal (6-10) into piston seal groove - outboard end of piston.

9. Pre-assemble the M3 jackscrew override (3-20) into cylinder (3-10) using the following procedure:

   a. Install nut seal (3-30) onto jackscrew assembly (3-20). Thread nut seal until it is against the welded nut.

   b. Apply a generous coating of grease to the M3 threads (3-20).

c. Thread the jackscrew assembly (3-20) into the cylinder end cap (3-10). Turn the jackscrew until the end of the assembly protrudes out of the threaded end of the cylinder (3-10).

d. Install Washer (3-60) and pin (3-50) as shown on assembly drawing. NOTE: Washer (3-60) must be installed in this assembly. If the washer is not used, then the pin (3-50) may shear when it comes in contact with the cylinder end cap.

e. Turn the jackscrew counter-clockwise until the washer (3-60) just comes into contact with the cylinder end cap.

f. If desirable, wipe away excess grease on jackscrew after operation. If preferred, grease may be left on jackscrew to provide additional corrosion protection.

9. Turn nut seal clockwise until fully tight against end cap.

10. Apply a thin coating of grease to the bore of the cylinder (3-10) for a distance of approximately three inches (75mm).

11. Install the cylinder assembly (3-10) over the piston and 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.

ROD COVER RE-ASSEMBLY

1. Install the remaining cylinder gasket (6-70), lightly greased both sides, onto the left side of housing.

2. Pre-assemble the M3 jackscrew override (2-120) into rod cover (2-60) using the following procedure:

a. Install nut seal (2-130) onto jackscrew assembly (2-120). Thread nut seal until it is against the welded nut.
b. Apply a generous coating of grease to the M3 threads (2-120).

c. Thread the jackscrew assembly (2-120) into the rod cover (2-60). Turn the jackscrew until the end of the assembly protrudes from the end of the rod cover.

d. Install washer (2-160) and pin (2-150) as shown on assembly drawing. Note: Washer (2-160) must be installed in this assembly. If the washer is not used, then the pin (2-150) may shear when it comes in contact with the rod cover.

e. Turn the jackscrew counter-clockwise until the washer (2-160) comes into contact with the cylinder end cap.

3. Install rod cover (2-60) over left end of piston rod and fasten with ferry cap screws (2-100) and gasket seals (6-80).

4. If desirable, wipe away excess grease on jackscrew after operation. If preferred, grease may be left on jackscrew to provide additional corrosion protection.

5. Turn nut seal clockwise until fully tight.

6. Install yoke weather cover (6-110) and position indicator (1-110) with socket cap screws (1-120). When yoke is in full clockwise position, pointer (on indicator) will be facing away and perpendicular to piston rod.

TESTING ACTUATORS

A. Leakage Test

NOTE: All areas, where leakage to atmosphere may occur, are to be checked using a soapy solution.

Procedure:

1. 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.

2. If excessive leakage across the piston is noted, generally a bubble which breaks three (3) seconds or less after starting to form, cycle the actuator five (5) 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.

3. Repeat the above procedure for the opposite side of the piston.

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

B. Operational (Functional) Test

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

Procedure:

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.

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

PRESSURE REQUIREMENTS & LIMITATIONS
FOR
731-M3 ACTUATORS

MODEL	NOMINAL OPERATING PRESSURE (NOP)	MAXIMUM OPERATING PRESSURE (MOP)	MAXIMUM ALLOWABLE WORKING PRESSURE (MAWP)
731-M3	Customer Spec. or N.A.	250	300

RETURN TO SERVICE

1. Pneumatic rotary valve actuators - Refer to "Operating, Storage & Maintenance Instruction for GH-Bettis Pneumatic Rotary Valve Actuators" (OP/MAINT-001) for actuator start-up procedures.