

GH BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

FOR THE FOLLOWING MODELS

N722-SRXX,N722-SRXX-M3,N722-SRXX-M3HW,

N732-SRXX,N732-SRXX-M3,AND N732-SRXX-M3HW

NUCLEAR SERIES ACTUATORS

PART NUMBER 65037

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1.0 **INTRODUCTION**

- 1.1 In order to assure and maintain the present level of qualification and auditable to the Bettis Qualification Report Number 37274 the following is required:
 - 1.1.1 All maintenance or service work must be preformed by a certified technician.
 - 1.1.2 Maintain a service interval of six hundred twenty-five cycles or five years which ever occurs first.

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

- 1.2 This service procedure is offered as a guide to enable general maintenance to be performed on GH Bettis N722-SRXX, N722-SRXX-M3, N722-SRXX-M3HW, N732-SRXX, N732-SRXX-M3, and N732-SRXX-M3HW nuclear actuators. When the actuator model number has "-S" as a suffix then the actuator is special and may have some differences that are not included in this procedure.

2.0 **BASIC TOOLS**

All tools are American Standard inch. Large adjustable wrench, two each medium standard screwdriver, small standard screwdriver with corners rounded, chain wrench, allen wrench set, putty knife, 3/16" pin punch, 1/2" drive socket set, rubber or leather mallet, torque wrench (up to 2,000 in.lbs.), commercial leak testing solution and non-hardening thread sealant.

3.0 **REFERENCE GH BETTIS MATERIALS**

- 3.1 Assembly Drawing Part Number 36664 fail close (CW).
- 3.2 Assembly Drawing Part Number 72546 fail open (CCW).
- 3.3 Exploded Detail Part Number 65940 for N722-SR.
- 3.4 Exploded Detail Part Number 65978 of N732-SR.
- 3.5 Exploded Detail Part Number 68073 for N722-SR-M3/M3HW.
- 3.6 Exploded Detail Part Number 68088 for N732-SR-M3/M3HW.
- 3.7 General Operating & Maintenance Instruction Part Number 65043.

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 lists.
- 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 and the housing cover as the top of the actuator.
- 4.3 Refer to Chart 2 (Page 8) for approximate actuator weights.
- 4.4 To ensure correct re-assembly; that is, with spring on same end of housing as was, mark or tag right (or left) and mark mating surfaces (see 4.2).
- 4.5 When removing seals from seal grooves, use a small screwdriver with sharp edges rounded off or a commercial seal removing tool.
- 4.6 Use a non-hardening thread sealant on all pipe threads.
- 4.7 Disassembly of actuator must be done in a clean area on a work bench.

4.8 LUBRICATION REQUIREMENTS: Dow Corning Molykote 44.

5.0 GENERAL DISASSEMBLY

- 5.1 Remove all operating pressure from actuator cylinder (3-10) and spring cylinder (4-10), allowing the spring to stroke. The spring will rotate the yoke to the fail position.
- 5.2 Remove brace rods to brace support if applicable.
- 5.3 Remove all piping and any accessories mounted on actuator.
- 5.4 If an M3 is mounted, the M3 jackscrew (3-20) should not contact the end of the piston rod (2-10).
- 5.5 Remove two breathers (4-20). One is located in the end of spring cylinder (4-10) and the other is located in the port of cylinder adapter (2-30).
- 5.6 Actuators equipped with M3HW jackscrew override with handwheel option, remove hex nut (8-30), lockwasher (8-20), and handwheel (8-10).
- 5.7 Measure the exposed length of right and left stop screws (1-60) and record each before loosening for removal.
- 5.8 Remove the socket cap screws (1-120) from position indicator (1-110) yoke weather cover (6-110) and remove position indicator/yoke weather cover.
- 5.9 Remove snubber (1-130) from top of housing (1-10).
- 5.10 Remove actuator from valve and valve mounting bracket.

6.0 SPRING CYLINDER REMOVAL

- 6.1 When the spring cylinder is installed on the actuator the spring is under compression. DO NOT remove the spring cylinder until the actuator has the "pre-load" removed.
- 6.2 Remove spring cylinder "pre-load" as follows: Apply nominal operating pressure to the pressure inlet port located in the cylinder adapter (2-30) and cylinder (3-10). Locate the stop screw (1-60) that is on the opposite side of the housing from the spring cylinder (4-10). Loosen jam nut (1-70). Unscrew and remove stop screw (1-60). Remove pressure from the pressure inlet port.
- 6.3 **WARNING:** Under no circumstances should the spring cartridge (5) be cut apart, as the spring is pre-loaded and the spring cartridge welded together.
- 6.4 Secure the chain wrench around the spring cylinder (4-10) as close to the welded end cap as possible. Using a mallet, break the cylinder loose and then remove the cylinder by rotating in a counter clockwise direction. When setting the spring cylinder (4-10) aside, care should be taken to protect the chamfered edge and cylinder threads.
- 6.5 Due to the weight and the nature of a preloaded assembly, caution should be exercised when handling the spring cartridge (5). The spring cartridge (5) is unattached and is only contained by the spring cylinder (4-10).
- 6.6 Unscrew and remove standard hex nut (2-70) and lockwasher (2-80) from piston rod (2-10). Some actuators will not have a lockwasher (2-80) but will use a self-locking jam nut (2-70).
- 6.7 Remove the piston (2-20).

7.0 PRESSURE CYLINDER DISASSEMBLY

- 7.1 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 and then remove the cylinder by rotating in a counter clockwise direction. When setting the cylinder aside, care should be taken to protect the chamfered edge and cylinder threads.

- 7.2 Unscrew and remove standard hex nut (2-70) and lockwasher (2-80).
- 7.3 Remove the piston (2-20).
- 7.4 On the power cylinder (3-10) side of the actuator, unscrew and remove the four cylinder adapter ferry screws (2-90) and gasket seals (6-80) from the cylinder adapter (2-30).
- 7.5 Remove the cylinder adapter (2-30), taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-40).
- 7.6 On the spring cylinder (4-10) side of the actuator, unscrew and remove the four cylinder adapter ferry screws (2-90) and gasket seals (6-80) from the remaining cylinder adapter (2-30).
- 7.7 Remove the cylinder adapter (2-30), taking care not to scratch the piston rod (2-10) or disengage the rod bushing (2-40).
- 7.8 For actuators equipped with M3 or M3HW jackscrew override, the following steps will be used for disassembly of the M3 from cylinder (3-10).
 - 7.8.1 With the cylinder (3-10) on a work bench, lubricate jackscrew assembly (3-20) threads with lubricant.
 - 7.8.2 Loosen and thread jam nut (3-30) all the way back to the welded nut.
 - 7.8.3 Thread the jackscrew assembly (3-20) into the cylinder (3-10) until the pin (6-160) and washer (6-170) are exposed.
 - 7.8.4 Using a 3/16 inch pin punch, drive out and remove pin (6-160).
 - 7.8.5 Remove washer (6-170).
 - 7.8.6 Thread the jackscrew assembly (3-20) out and remove.
 - 7.8.7 Remove thread seal (6-130) and countersunk washer (6-120).

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 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 bushing (2-40) in place, pull the piston rod (2-10) out through the rod bushings (2-40).
- 8.7 Lift out the yoke (1-140) from the housing cavity.
- 8.8 Remove the lower yoke roller (1-50).
- 8.9 Remove both rod bushings (2-40) from housing (1-10).
- 8.10 Unscrew and remove the remaining stop screw (1-60), jam nut (1-70), and gasket seal (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

- 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 and gasket material.
- 9.4 Coat all seals with lubricant, before installing into grooves.

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 in the body and arrange the body so that the yoke bore is nearest to you. Lubricate the raised ribs in the bottom of the housing.
- 10.4 Apply a generous amount of lubricant to the slots in the upper and lower yoke arms of yoke (1-140).
- 10.5 Coat the bearing surfaces of the yoke (1-140) with lubricant and install into the body. 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 thru the bushings in the housing.
- 10.9 Coat the yoke pin (1-40) with lubricant and install thru the piston rod (2-10) into the lower yoke roller (1-50).
- 10.10 Install the remaining yoke o-ring seal (6-20) into the housing cover (1-20).
- 10.11 Coat the remaining yoke roller (1-50) with lubricant and install over the yoke pin and into the slot in the upper yoke arm.
- 10.12 Coat the yoke bore in the cover (1-20) with lubricant.
- 10.13 Install the cover gasket (6-60) onto the housing.
- 10.14 Install the housing cover (1-20) and the four cover screws (1-30) with gasket seals (6-80) onto the housing (1-10). NOTE: For N722 actuators, gasket seals will be item number (6-100).

11.0 PRESSURE CYLINDER RE-ASSEMBLY

- 11.1 Coat the piston rod seal (6-30) with lubricant and install, lip first, into the cylinder adapter (2-30). The energizer ring of rod seal (6-30) must face the cylinder adapter, piston side.
- 11.2 Install one cylinder adapter gasket (6-70) over the piston rod bushing on the right side of the housing for clockwise actuators or on the left side of the housing for counterclockwise actuators.
- 11.3 Install the cylinder adapter (2-30) 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 with the single cast stiffening rib on the

housing side pointing toward the yoke bore and up at 45 degrees. Care should be taken at this point not to scratch the piston rod when installing the cylinder adapter.

- 11.4 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.
- 11.5 Install the cylinder adapter o-ring seal (6-40) into the cylinder adapter (2-30) in the groove at the inner end of the threads.
- 11.6 Install the piston o-ring seal (6-50) onto the piston rod (2-10).
- 11.7 Install the piston (2-20) onto the piston rod and retain with lockwasher (2-80) and hex nut (2-70). 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 hex nut (2-70) to 146 foot pounds.
- 11.8 Install one of the piston cup seals (6-10) into the piston outermost groove. The lips of the seal should point outward toward the welded end of the cylinder.
- 11.9 For actuators equipped with M3 jackscrew overrides, pre-assemble the M3 into cylinder (3-10) using the following procedure.
 - 11.9.1 Apply a light coating of lubricant to the threads of jackscrew assembly (3-20).
 - 11.9.2 Install jam nut (3-30), countersunk washer (6-120) and thread screw seal (6-130), onto jackscrew assembly (3-20). The countersink of washer (6-120) should face the thread screw seal (6-130). Thread these items until they are up against the welded nut,
 - 11.9.3 Thread the jackscrew assembly (3-20) into the end cap of cylinder (3-10). Turn the jackscrew until the end of the assembly protrudes out of the threaded end of the cylinder.
 - 11.9.4 Install washer (6-170) and pin (6-160) as shown on assembly drawing.
 - 11.9.5 Turn the jackscrew until the washer (6-170) comes into contact with the cylinder end cap.
 - 11.9.6 If desirable, wipe away excess lubricant on jackscrew after operation. If preferred, lubricant may be left on jackscrew to provide additional corrosion protection.
 - 11.9.7 Tighten jam nut (3-30) against countersunk washer (6-120) and thread screw seal (6-130) until fully tight against end cap.
- 11.10 Apply a very light coating of lubricant to the cylinder threads and the entire bore of the cylinder (3-10).
 - 11.10.1 CAUTION: Excess lubricant in the cylinder bore may cause erratic or jumpy/jerky operation.
- 11.11 Install the cylinder (3-10) 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.

12.0 SPRING CYLINDER RE-ASSEMBLY

- 12.1 Install the remaining cylinder adapter gasket (6-70) over the piston rod.
- 12.2 Install the remaining piston rod seal (6-30), lip first, into the cylinder adapter (2-30). The energizer ring of rod seal must face the cylinder adapter (piston side).
- 12.3 Install the cylinder adapter (2-30) over the piston rod and retain with the cylinder adapter ferry head 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 port may be different on your actuator depending on plumbing and accessory requirements.

- 12.4 If removed, install pipe plug (2-110) into the cylinder adapter pressure port that is pointing away from the yoke bore and down at 45 degrees.

- 12.5 Install the remaining cylinder adapter o-ring seal (6-40) into the cylinder adapter in the groove at the inner end of the threads.
- 12.6 Install the remaining piston o-ring seal (6-50) onto the piston rod (2-10).
- 12.7 Install the remaining piston (2-20) onto the piston rod and retain with lockwasher (2-80) and hex 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.
- 12.8 Install the remaining piston cup seal (6-10) into the innermost piston groove, which is on the side of the piston with the raised boss and counter bore. The seal lip should point toward the side of the piston and housing.
- 12.9 Push the piston in towards the housing as far as it will go, to ease the installation of the cylinder/spring assembly.
- 12.10 Very lightly coat the cylinder threads and the entire cylinder bore with lubricant. **CAUTION:** Excess lubricant in the cylinder bore may cause erratic or jumpy/jerky operation.
- 12.11 Coat the outside of the spring with lubricant and insert the spring cartridge assembly (5) into the spring cylinder (4-10). One end of the spring cartridge assembly has a flat face with a deep hole in it, this end should be inserted into the cylinder first.
- 12.12 Install the spring cylinder, containing the spring cartridge, over the piston and screw into the cylinder adapter (2-30). Tighten with a chain wrench.
- 12.13 **POSITION INDICATOR INSTALLATION**
 - 12.13.1 For spring to close actuators (clockwise), 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.
 - 12.13.2 For spring to open actuators (counterclockwise), rotate the yoke to full counterclockwise (CCW) position. Position the yoke weather cover (6-110) and position indicator (1-110) on the yoke with the pointer to the air cylinder (3-10) and parallel to the piston rod (2-10).
 - 12.13.3 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.
- 12.14 Install the stop screws (1-60), stop screw gasket seals (6-90) and stop screw jam nuts (1-70).

13.0 ACTUATOR TESTING

- 13.1 All areas, where leakage to atmosphere may occur, are to be checked using a leak testing solution.
- 13.2 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.
- 13.3 All leak testing will use the nominal operating pressure (NOP) as listed on the actuator nametag or from Chart 1 of this procedure (Page 8).
- 13.4 Before testing for leaks, alternately apply and release NOP pressure to the pressure 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.
- 13.5 Simultaneously apply NOP pressure to the pressure port in the end of cylinder (3-10) and to the SR cylinder adapter (2-30).

- 13.6 Apply leak testing solution to the following areas:
 - 13.6.1 The breather port in the cylinder adapter (2-30), checks piston to cylinder and piston to piston rod seals.
 - 13.6.2 The breather port hole in the end of the SR cylinder (4-10), checks the piston to cylinder wall and piston to piston rod seals.
 - 13.6.3 The threaded joint between the SR cylinder (4-10) and cylinder adapter (2-30), checks the cylinder to cylinder adapter o-ring seal.
 - 13.6.4 The joint between the cylinder adapter and the housing.
 - 13.6.5 The snubber port hole located in the housing, checks the cylinder adapter to piston rod seal.
- 13.7 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.
- 13.8 If an actuator was disassembled and repaired, the above leakage test must be performed again.
- 13.9 Operational Test the actuator to verify proper function of the actuator. This test is to be done off of the valve or when the valve stem is not coupled to the actuator yoke.
- 13.10 Adjust the pressure regulator to the pressure rating indicated in column "B" of chart 1 (Page 8) for the model actuator being tested.
- 13.11 Apply the above pressure to the actuator pressure inlet ports and allow the actuator to stabilize. The actuator should stroke a full 90 degrees travel.
- 13.12 Remove pressure from the pressure inlet ports.

14.0 RETURN TO SERVICE

- 14.1 Install one breather (4-20) in the end of the spring cylinder (4-10). New breathers are provided in the service kit. Use these new breathers if they are the same size or larger NPT than the original.
- 14.2 Install the remaining breather (4-20) into the cylinder adapter (2-30) of cylinder (3-10). New breathers are provided in the service kit. Use these new breathers if they are the same size of larger NPT than the original.
- 14.3 If supplied in the service kit, replace the software components of the snubber (1-190) and then install the snubber into the housing.
- 14.4 Re-install actuator to valve mounting bracket and valve.
- 14.5 Adjust both stop screws (1-60) back to settings recorded in step 5.7 under General Disassembly.
- 14.6 Tighten both jam nuts (1-70) securely, while holding stop screws (1-60).
- 14.7 Re-install any piping and accessories that were removed.
- 14.8 For actuators equipped with a M3 jackscrew override and require an optional handwheel, M3HW, install the handwheel using the following procedure:
 - 14.8.1 Place the handwheel (8-10) onto the welded nut (the handwheel hub has a cast hexagon hole that fits over the welded nut).
 - 14.8.2 Place lockwasher (8-20) onto M3 up against handwheel hub.

14.8.3 Place hex nut (8-30) onto M3 and thread up against lockwasher, torque to 250 foot pounds.

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

CHART 1

PRESSURE REQUIREMENTS & LIMITATIONS
FOR NUCLEAR MODELS
N722-SRXX & N732-SRXX

<u>ACTUATOR MODEL *</u>	<u>NOMINAL OPERATING PRESSURE (NOP)</u>	<u>MAXIMUM OPERATING PRESSURE (MOP)</u>	<u>MAXIMUM HYDROSTATIC TEST PRESSURE</u>	<u>MAXIMUM AIR ASSIST PRESSURE (MAAP)</u>	<u>COLUMN B SPRING SELECTION PRESSURE</u>
N722-SR40	40	105	125	44	33
N722-SR60	60	115	125	29	49
N722-SR80	80	130	150	17	64
N732-SR40	40	160	200	125	31
N732-SR60	60	175	200	108	50
N732-SR80	80	190	225	98	61

* Includes actuator models that have -M3 and -M3HW included in their model numbers, i.e., N732-SR60-M3.

CHART 2

WEIGHTS FOR NUCLEAR MODELS
N722-SRXX & N732-SRXX

<u>ACTUATOR MODEL</u>	<u>APPROXIMATE WEIGHT (LBS) **</u>		
	<u>SR40</u>	<u>SR60</u>	<u>SR80</u>
N722-SRXX	231	244	250
N722-SRXX-M3	236	249	255
N722-SRXX-M3HW	242	255	261
N732-SRXX	292	309	334
N732-SRXX-M3	297	314	339
N732-SRXX-M3HW	303	320	345

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

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