GH BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

FOR THE

NT5XX

DOUBLE ACTING NUCLEAR

SERIES PNEUMATIC ACTUATORS

PART NUMBER: 68396

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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 performed 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 NT5XX-SRX 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 includes in this procedure.

2.0 BASIC TOOLS

All tools are American Standard inch. Large adjustable wrench, two each large standard screwdriver, small standard screwdriver with sharp edges removed, strap wrench, putty knife, 1-3/8" crowfoot wrench, pipe wrench, 1/4" drift punch, 24 oz. ball peen hammer, allen wrench set, pry bar, 1/2" drive socket set, torque wrench (up to 5000 inch pounds), razor sharp cutting instrument, commercial leak testing solution, and non-hardening thread sealant.

3.0 REFERENCE GH BETTIS MATERIALS

3.1 Exploded Detail Drawing Part Number 68394 (included in the GH Bettis Service Kit).

4.0 GENERAL

4.1 Numbers in parenthesis, ( ), 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 and the housing cover as the top of the actuator.

4.3 Refer to Chart number 1 for actuator weights.

4.4 Mating parts should be marked for ease of reassembly, i.e. left and right stop screws and cylinder to housing.

4.5 When removing seals from seal groove, use a small standard screwdriver with the sharp edges rounded off or use a commercial seal removing tool.

4.6 Use a non-hardening thread sealant on all pipe threads.

4.7 Disassembly should be done in a clean area on a work bench.

4.8 LUBRICATION REQUIREMENTS: Dow Corning Molycote 44, medium grade.

5.0 GENERAL DISASSEMBLY

5.1 Remove all operating pressure from actuator power cylinder (2-10).

5.2 Remove all piping and accessories mounted on the actuator.

5.3 Mark the stop screws (1-60) left and right. The setting of the stop screws (1-60) should be checked and setting recorded before stop screws are loosened or removed.

5.4 Remove actuator from valve and valve mounting bracket.

5.5 Remove socket cap screws (1-180) from position indicator (1-170) yoke weather cover (3-130) and remove position indicator/yoke weather cover.

6.0 PRESSURE CYLINDER DISASSEMBLY

6.1 Remove socket cap screw (2-120), washer (2-110) and nut retainer (2-100) from the end of the outer end cap (2-30).

6.2 Remove hex nuts (2-90) from tie bars (2-60).

6.3 Remove outer end cap (2-30). The fit between the cylinder (2-10) and the outer end cap is very tight. Break the outer end cap free by tapping with a breaker bar on the lip provided on the end cap. Do not damage o-ring groove on end cap.

6.4 Pry inner end cap (2-40) away from the housing (1-10). Break the inner end cap free from the cylinder (2-10) by tapping with a breaker bar on the lip provided on the end cap.

6.5 Remove the cylinder (2-10). When sliding the cylinder off of the piston, cant the cylinder 15 degrees to 30 degrees to the piston rod.

6.6 Remove the split ring retainer (2-80) and the split ring (2-70) from the outboard side of the piston (2-20). Early model actuators used a threaded piston rod and nut to retain the piston.

6.7 Remove the piston (2-20) from the piston rod (2-170). The piston will slide off of the piston rod and tie bars (2-60).

6.8 Remove the split ring retainer (2-80) and the split ring (2-70) from the inboard side of the piston.

6.9 Slide the inner end cap (2-40) off the tie bars (2-60) and piston rod (2-170).

6.10 Remove rod bushing (2-50). The bushing will slide off of the end of the piston rod.

6.11 Unscrew the tie bars (2-60) from the housing (1-10). Flats are provided on the outboard end of the tie bars for wrench placement. DO NOT use a pipe wrench on the tie bars as it will mark the bar and cause seal leakage. This step is optional as the tie bars can be left in the housing.

7.0 HOUSING GROUP DISASSEMBLY

7.1 Unscrew and remove the snubber valve (1-190) from the housing cover.

7.2 Unscrew piston rod (2-170) from yoke pin nut (1-30) and remove. Flats are provided on the outboard end of the piston rod for wrench placement. DO NOT use a pipe wrench on the piston rods as it will mark the rod and cause seal leakage.

7.3 Remove cover hex cap screws (1-90)/(10-90) and gasket seals (3-100).

7.4 Remove the housing cover (1-20). The cover will have a very tight fit. It is not necessary to remove cover pins (10-130)/(1-130).

7.5 Remove the top two rollers (1-50) and roller spacer (1-110) from the top of the yoke pin (1-40). Early model actuators did not use the roller spacer.

7.6 Remove the yoke pin (1-40).

7.7 Remove the yoke pin nut (1-30).

7.8 Remove the lower two yoke rollers (1-50) and roller spacers (1-110) from the bottom of the yoke and housing.

7.9 The yoke (1-160) can now be removed by lifting it from the housing.

7.10 Remove the stop screws (1-60), stop nuts (1-120), and gaskets (3-110).

7.11 Using putty knife, remove the end cap gasket (3-10) and the cover gasket (3-20).

7.12 It is not necessary to remove the pipe plug (1-80), the blind end cap (6-10), the hex head cap screws (6-20), the seal gaskets (6-30), the nut retainer (6-70), the lockwasher (6-80), the socket head cap screw (6-90), or the final end cap gasket (3-10), to service the actuator.

8.0 GENERAL RE-ASSEMBLY

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

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 or 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 seals with lubricant, before installing into seal grooves.

8.5 T-seal set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.

8.5.1 Install the T-seal into the seal grooves.

8.5.2 Install a back-up ring on each side of the T-seal.

8.5.3 When installing the back-up rings, do not align the skive-cuts.

8.5.4 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.

9.0 CENTER HOUSING GROUP RE-ASSEMBLY

9.1 If removed install drain plug (1-80) in actuator housing (1-10).

9.2 Take all the yoke pin rollers (1-50) and check to see if they will run (move) freely thru the tracks in the bottom of the housing and the housing cover.

9.3 Install one of the yoke o-ring seals (3-50) into the housing (1-10).

9.4 Inside the housing (1-10) apply lubricant to the tracks and yoke bore and position the housing with the yoke bore nearest you.

9.5 Apply lubricant to the slots in the upper/lower yoke arms and the lower bearing surface.

9.6 Install the yoke (1-160) into the housing (1-10) as follows: Arrange the yoke arm to approximately a 45 degree position in either direction and lower into the housing. The hub with tapped holes faces up. Rotate the yoke back to approximately the mid-stroke (center) position.

9.7 Apply lubricant to all surfaces of two of the yoke pin rollers (1-50) and two roller spacers (1-110). Place one yoke pin roller in the track in the bottom of the housing and position it under the slot in the yoke arms. Place a roller spacer (1-110) on top of the bottom yoke roller (1-50). Place a second yoke roller on top of the roller spacer in the slot in the lower yoke arm. Place another roller spacer (1-110) on top of the second yoke roller (1-50) and align the holes in the roller spacer and the yoke pin rollers.

9.8 Coat the upper and lower surfaces of the yoke pin nut (1-30) with lubricant and insert into position between the yoke arm, parallel to the track in the housing. Align the yoke pin hole with the yoke rollers and roller spacers.

9.9 Lubricate the yoke pin (1-40) and insert through the yoke pin nut (1-30), the two yoke rollers (1-50) and the two roller spacers (1-110).

9.10 Apply lubricant to all the surfaces of the two remaining yoke rollers (1-50) and two remaining roller spacers (1-110). Place one roller spacer on top of the yoke pin nut (1-30) then install the third yoke roller (1-50). Place the last roller spacer on top of the third yoke roller (1-50). Place the fourth and final yoke roller on to the yoke pin. The top roller will remain above the yoke arm and will engage the cover track when cover is installed.

9.11 Lubricate the piston rod (2-170) and slide into the right side of the housing. Screw the piston rod into the yoke pin nut (1-30). (DO NOT TIGHTEN) Flats are provided on the outboard end of the piston rod. These flats should be used to put a wrench on to tighten the piston rod. DO NOT use a pipe wrench on the piston rod, as it will cause seal leakage.

9.12 Place gaskets (3-110) and jam nuts (1-120) on the stop screws (1-60). Install both assemblies into the housing.

9.13 Place the housing cover gasket (3-20) on the housing (1-10).

9.14 Coat the remaining yoke o-ring seal (3-50) with lubricant and install into the cover.

9.15 Apply lubricant to the yoke bore and the track in the housing cover (1-20).

9.16 Apply lubricant to the yoke upper bearing surface.

9.17 Install the housing cover (1-20), being careful not to damage the gasket (3-20) or yoke o-ring seal (3-50). If the housing cover does not want to go down against the housing then the cover may be hanging on the top yoke roller.

9.18 Install the cover screws (1-90)/(10-90) and seal gaskets (3-100). LEAVE FINGER TIGHT - DO NOT TIGHTEN.

9.19 Do this step only if you have pulled the cover pins (1-130)/(10-130) or if you are replacing the cover pins. Drive the pins through the cover (1-20) and into the housing (1-10) until the pin is flush with the cover. The pins are deeply grooved at one end, tapering to a smooth diameter art the other end. The pin should be installed smooth end first.

9.20 Tighten the cover screws (1-90)/(10-90).

9.21 Apply lubricant to the rod bushing (2-50), install it over the piston rod and slide it up into the housing.

9.22 Tighten the piston rod (2-170) to a torque of approximately 150 foot pounds. Flats are provided on the outer end for wrenching purposes.

9.23 With the yoke rotated to the full clockwise (cw) position (as shown on the assembly drawing) position the yoke weather cover (3-130)/position indicator (1-170) on the yoke with the pointer facing to the front and perpendicular to the piston rod (2-170), secure with socket head cap screws (1-180).

9.24 Rotate the yoke to a position that will leave a minimum of the piston rod (2-170) protruding from the actuator housing.

10.0 PRESSURE CYLINDER RE-ASSEMBLY

10.1 Install the rod seal (3-70), lip first, into the recess provided in the inner end cap (2-40).

10.2 Install the end cap gasket (3-10) over the piston rod and rod bushing.

10.3 Install two tie bar o-ring seals (3-30) into the inner end cap (2-40).

10.4 Slide the inner end cap (2-40) over the piston rod (2-170) and the rod bushing (2-50), protruding from the housing. Install with the large raised boss toward the housing (flat side outward). The pressure inlet port should be toward the top of the actuator.

10.5 Install the end cap o-ring seal (3-60) onto the inner end cap (2-40).

10.6 Install two sets of piston tie bar T-seal components (3-80) into the piston internal seal grooves. Refer to step 8.4 and 8.5 for proper T-seal installation instructions.

10.7 Install the piston o-ring (3-40) onto the piston rod (2-170).

10.8 Coat the ends of the piston rod (2-170) with lubricant.

10.9 Install the two halves of the split ring (2-70) into the innermost groove in the piston rod. Retain with one of the split ring retainers (2-80), retaining ring groove away from piston.

10.10 Slide the piston (2-20) onto the piston rod against the split ring (2-70). Ribbed section of piston must face away from housing.

10.11 Install the two halves of the remaining split ring (2-70) onto the piston rod and retain with the split ring retainer (2-80).

10.12 Install the piston T seal set (3-90) into the piston external seal groove. Refer to steps 8.4 and 8.5 for proper T-seal installation instructions.

10.13 If removed, apply lubricant to the threads and end of the tie bars (2-60), (end without wrench flat), and install by carefully threading tie bars through the piston (2-20) and inserting through the inner end cap (2-40) and screwing into the housing (1-10). Lubricate all exposed surfaces of piston rod and tie bars.

10.14 Apply a very light coat of lubricant to the bore of the cylinder (2-10). CAUTION: Excess lubricant in the cylinder bore may cause erratic or jumpy/jerky operation.

10.15 Slide the lubricated cylinder (2-10) over the piston (2-20) and onto the inner end cap (2-40). When sliding the cylinder over the piston seal, cant cylinder 15 degrees to 30 degrees to piston rod, 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 ends of the cylinder.

10.16 Install two end cap tie bar o-ring seals (3-30) into the outer end cap (2-30).

10.17 Install the outer end cap cylinder o-ring seal (3-60) onto the outer end cap (2-30).

10.18 Install the outer end cap (2-30) onto the tie bars and into the end of cylinder (2-10). Make certain that the inlet port(s) are toward the top of the actuators.

10.19 Install the two tie bar nuts (2-90) on the tie bars (2-60), using them to draw all of the cylinder components into position. Torque alternately, in 50 ft. lb. increments until a final torque of 100 foot pounds has been achieved.

10.20 Install the nut retainer (2-100), securing in place with the retainer screw (2-120) and lockwasher (2-110). It is necessary that the flats on the hex nuts (2-90) be aligned and parallel before the nut retainer can be installed. It is permissible to exceed the 100 foot pound figure to align the hex nut flats.

11.0 BLIND END CAP RE-ASSEMBLY

11.1 Do this section only if the blind end cap and associated hardware were removed.

11.2 Install the blind end cap (6-10) onto the left end of the housing and retain using the hex cap screws (6-20).

11.3 Install the nut retainer (6-70), securing in place with the socket cap screw (6-90) and the washer (6-80).

12.0 ACTUATOR TESTING

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

12.2 Cycle the actuator five (5) times at 65 psig air pressure. This will allow the seals to seek their proper working attitude.

12.3 Apply 65 psig air pressure to the inlet port on the outer end cap (2-30).

12.4 Apply a leak testing solution to the following areas:

12.4.1 Joint between the outer end cap (2-30) and the cylinder (2-10). Checks cylinder to end cap seal.

12.4.2 Around the tie bar nuts on the cylinder end. Checks tie bar to end cap seals.

12.4.3 Pressure inlet port in the inner end cap (2-40). Checks piston to cylinder, piston to tie bar, and piston to piston rod seals.

12.5 Remove the pressure from the inlet port on the outer end cap.

12.6 Apply 65 psig air pressure to the inlet port on the inner end cap (2-40).

12.7 Apply a leak testing solution to the following areas:

12.7.1 Joint between the inner end cap (2-40) and the cylinder (2-10). Checks cylinder to end cap seal.

12.7.2 The snubber port hole located in the housing cover, checks the inner end cap to piston rod seal.

12.7.3 Pressure inlet port in the outer end cap (2-30). Checks piston to cylinder, piston to tie bar, and piston to push rod seals.

12.8 Remove the pressure from the inlet port on the inner end cap.

12.9 If excessive leakage across the piston is noted, generally a bubble which breaks three seconds or less after starting to form, the unit must be disassembled and the cause of leakage must be determined and corrected.

13.0 RETURN TO SERVICE

13.1 If supplied in service/seal kit, replace the software components of the snubber (1-190) and then install the snubber in the housing cover.

13.2 Re-install actuator to valve mounting bracket and valve.

13.3 Adjust both stop screws (1-60) back to settings recorded in step 5.3 under General Disassembly

13.4 Tighten both jam nuts (1-120) securely, while holding stop screws (1-60).

13.5 Re-install any piping and accessories that were removed.

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

CHART NO. 1

WEIGHTS FOR NT5XX

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS) **
NT516	543
NT520	659

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

CHART NO. 2

PRESSURE REQUIREMENTS & LIMITATIONS

NT5XX DOUBLE ACTING NUCLEAR SERIES

PNEUMATIC ACTUATOR

ACTUATOR MODEL	NOMINAL OPERATING PRESSURE (NOP)	MAXIMUM OPERATING PRESSURE (MOP)	MAXIMUM HYDRO-STATIC TEST PRESS
NT516	(1)	140	200
NT520	(1)	90	125

(1) Per customer specification or not applicable.

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