

GH BETTIS

OPERATING & MAINTENANCE INSTRUCTIONS

DISASSEMBLY & ASSEMBLY

FOR THE FOLLOWING MODELS

NT3XX-SRX, NT3XX-SRX-M3, NT3XX-SRX-M3HW

NT4XX-SRX, NT4XX-SRX-M3, & NT4XX-SRX-M3HW

NUCLEAR SERIES ACTUATORS

PART NUMBER 65038

REVISION "D"

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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 NT3XX-SRX, NT3-SRX-M3, NT3-SRXX-M3HW, NT4XX-SRX, NT4XX-SRX-M3, and NT4XX-SRX-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. Two each medium standard screwdriver, small standard screwdriver with corners rounded, putty knife, razor sharp cutting instrument, strap wrench, allen wrench set, 3/16" pin punch, 1/2" drive socket set, rubber or leather mallet, 1-7/16" deepwell socket, 1-1/4" crowfoot, 1-5/16 box end wrench, torque wrench (up to 5,000 in.lbs.), commercial leak testing solution and non-hardening thread sealant.

3.0 **REFERENCE GH BETTIS MATERIALS**

- 3.1 NT3XX-SRX & NT3XX-SRX-M3/M3HW (CW) Assembly Drawing 36828.
- 3.2 NT3XX-SRX & NT3XX-SRX-M3/M3HW (CCW) Assembly Drawing 42972.
- 3.3 NT3XX-SR (CW) Exploded View Drawing 65901.
- 3.4 NT3XX-SRX-M3 & -M3HW (CW) Exploded Detail Drawing 68043.
- 3.5 NT4XX-SRX & NT4XX-SRX-M3/M3HW (CW) Assembly Drawing 40059.
- 3.6 NT4XX-SRX & NT4XX-SRX-M3/M3HW (CCW) Assembly Drawing 43011.
- 3.7 NT4XX-SRX (CW) Exploded Detail Drawing 68049.
- 3.8 NT4XX-SRX-M3 & M3HW (CW) Exploded Detail Drawing 68069.

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 1 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 corners 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 power cylinder (2-10) 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 (2-210) should not contact the end of the piston rod (2-170).
- 5.5 For actuator equipped with M3HW jackscrew override with handwheel option, remove hex nut (8-30), lockwasher (8-20), and handwheel (8-10).
- 5.6 Measure the exposed length of right and left stop screws (1-60) and record each before loosening for removal.
- 5.7 Remove the socket cap screws (1-180) from position indicator (1-170) yoke weather cover (3-130) and remove position indicator/yoke weather cover.
- 5.8 Remove actuator from valve and valve mounting bracket.

6.0 SPRING CYLINDER REMOVAL

- 6.1 When the spring cartridge is installed on the actuator the spring is under compression. DO NOT remove the spring cartridge until the actuator has the "pre-load" removed.
- 6.2 Remove spring cartridge "pre-load" as follows: Apply nominal operating pressure to the pressure inlet port located in the outer end cap (2-30). Locate the stop screw (1-60) that is on the opposite side of the housing from the spring cartridge (4-10). Loosen jam nut (1-120). Unscrew and remove stop screw (1-60). Remove pressure from the pressure inlet port.
- 6.3 **WARNING:** Under no circumstances should the spring cartridge be cut apart, as the spring is pre-loaded and the spring cartridge welded together.
- 6.4 Remove socket head screw (4-60), lockwasher (4-50) and nut retainer (4-40) from the end of the spring cartridge assembly (4-10).
- 6.5 The actuator spring cartridge is equipped with a brace plate (4-80) that bolts to the actuator housing (1-10). There are four brace extension rods (4-90) that connect between the brace support lug (on the spring cartridge band) and the brace plate. The four hex nuts (4-100) located on the inboard side (next to housing) of the brace plate (4-80), must be removed before proceeding to step 6.6. The remaining hex nuts (4-100) will be left on the brace extension rods (4-90).
- 6.6 Alternately loosen the two large hex nuts on the outboard end of the spring cartridge (4-10). These nuts are welded to the tie bars that extend through the spring cartridge and screw into the brace plate (4-80). Unscrew the tie bars until the spring cartridge is free from the brace plate. Care should be taken so that the tie bars are not pulled back into the spring cartridge.
- 6.7 To keep from inadvertently pulling the tie bars back into the spring cartridge use 7/8 inch 9 UNC hex nuts and screw them on to the spring cartridge tie bars. Place the spring cartridge to one side.

7.0 PRESSURE CYLINDER DISASSEMBLY

- 7.1 Remove breather (4-30) from inner end cap (2-40).

7.2 OUTER END CAP REMOVAL

- 7.2.1 Outer end cap (2-30) with M3 or M3HW jackscrew override will be disassembled per the following steps:

- 7.2.1.1 Loosen and thread jam nut (2-130) all the way back to the welded nut.
- 7.2.1.2 Loosen and remove socket cap screws (2-200) from jackscrew adapter (2-190).
- 7.2.1.3 Back jackscrew adapter (2-190) out until clear of hex nuts (2-90). On newer model actuators the jackscrew assembly (2-190) will be retained in the outer end cap (2-30) by spiral pin (3-180) and washer (3-190). Proceed to step 7.2.3.
- 7.2.2 Outer end cap (2-30) without M3 or M3HW jackscrew override will be disassembled per the following step:
 - 7.2.2.1 Unscrew and remove socket head cap screw (2-120), lockwasher (2-110), and nut retainer (2-100).
- 7.2.3 Remove heavy hex nuts (2-90) from tie bars (2-60).
- 7.2.4 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.
- 7.3 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.
- 7.4 Remove the cylinder (2-10). NOTE: When sliding the cylinder off of the piston, tilt the cylinder to the piston rod, approximately 15 to 30 degrees.
- 7.5 Remove the split ring retainer (2-80) and the split ring (2-70) from the outboard side of the piston (2-20).
- 7.6 Remove the piston (2-20) from the piston rod (2-170). The piston will slide off of the piston rod.
- 7.7 Remove the split ring retainer (2-80) and the split ring (2-70) from the inboard side of the piston.
- 7.8 Slide the inner end cap (2-40) off over the tie bars (2-60) and piston rod (2-170).
- 7.9 Remove rod bushing (2-50). The bushing will slide off of the end of the piston rod.
- 7.10 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.)
- 7.11 For actuators equipped with M3 or M3HW jackscrew override, the following steps will be used for disassembly of the jackscrew assembly (2-210) from outer end cap (2-30).
 - 7.11.1 NOTE: Early model nuclear actuators may or may not have provision for spiral pin (3-180) and flat washer (3-190). If your actuator does not have these items, then ignore steps 7.11.2 and 7.11.3 or any other reference to these items in this procedure.
 - 7.11.2 Using a 3/16 inch pin punch, drive out and remove pin (3-180).
 - 7.11.3 Remove washer (3-190).
 - 7.11.4 Remove jackscrew assembly (2-210) by pulling out of outer end cap (2-30).
 - 7.11.5 Thread jackscrew adapter (2-190) off of jackscrew assembly (2-210).
 - 7.11.6 Remove o-ring seal (3-140) from jackscrew adapter (2-190).
 - 7.11.7 Remove thread screw seal (3-160) and washer seal (3-170).

8.0 HOUSING GROUP DISASSEMBLY

- 8.1 Unscrew push rod (4-20) from yoke pin nut (1-30) and remove from housing.
- 8.2 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 rod as it will mark the rod and cause seal leakage.
- 8.3 Remove snubber (1-190) from housing cover (1-20).
- 8.4 Remove cover screws (1-90) and gasket seals (3-100).
- 8.5 Remove the housing cover (1-20). **NOTE:** This piece will have a very tight fit.
- 8.6 Remove the top two yoke rollers (1-50) from the top of the yoke pin nut (1-40).
- 8.7 Remove yoke pin (1-40).
- 8.8 Remove yoke pin nut (1-30).
- 8.9 Remove bottom two yoke rollers (1-50) from the housing.
- 8.10 The yoke (1-160) can now be removed by lifting it from the housing.
- 8.11 Remove the remaining stop screw (1-60), jam nut (1-120), and seal gasket (3-110). Be sure to mark or identify this stop screw.
- 8.12 It is not necessary to remove the drain pipe plug (1-80) or grease fittings (1-70) to service the actuator.
- 8.13 Remove brace plate (4-80), socket cap screws (1-220) and two gaskets (3-10) from each side of the brace plate (4-80).

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 gaskets material.
- 9.4 Coat all moving parts with lubricant.
- 9.5 Coat all seals with lubricant, before installing into grooves.
- 9.6 T-Seal Set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.
 - 9.6.1 Install the T-seal into the seal groove.
 - 9.6.2 Install a back-up ring on each side of the T-seal.
 - 9.6.3 When installing the back-up rings, do not align the skive-cuts.
 - 9.6.4 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.

10.0 CENTER HOUSING GROUP RE-ASSEMBLY

- 10.1 Take all the yoke 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.
- 10.2 Install one yoke o-ring seal (3-50) into the housing (1-10).

- 10.3 Inside the housing (1-10) apply lubricant to the tracks and yoke bore and arrange the housing with the yoke bore nearest you.
- 10.4 Apply lubricant to the yoke (1-160) lower bearing surface and install into the housing (1-10) as follows: Position the yoke arm to approximately a 45^o 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.
- 10.5 Apply lubricant to the slots in the upper and lower yoke arms.
- 10.6 Apply lubricant to all surfaces of all four yoke rollers (1-50). Place one yoke roller (1-50) in the track in the bottom of the housing and position it under the slot in the yoke arms. Place a second yoke roller on top of the first yoke roller in the slot in the lower yoke arm and align the holes in the yoke rollers.
- 10.7 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.
- 10.8 Lubricate the yoke pin (1-40) and insert through the yoke pin nut (1-30) and the two yoke rollers (1-50).
- 10.9 Apply lubricant to all the surfaces of the two remaining yoke rollers (1-50).
- 10.10 Install the third yoke pin roller over the yoke pin in the slot in the upper yoke arm and now install the fourth and last remaining yoke roller on top of the yoke roller you just installed in the upper yoke arm slot. The top roller will remain above the yoke arm and will engage the cover track when cover is installed.
- 10.11 Slide piston rod (2-170) into the side of body and screw into the yoke pin nut (1-30). **DO NOT TIGHTEN.** (For spring to open actuators, install the piston rod on the left side of the housing.) For spring to close actuators, install the piston rod on the right hand side of the housing. When installing per step 10.22, apply a wrench to the flats on the outer end. To prevent seal leakage, **DO NOT** use a pipe wrench on the piston rod.
- 10.12 Slide push rod (4-20) into side of body and screw into the yoke pin nut (1-30). Tighten the push rod with a strap wrench or a pipe wrench.
- 10.13 Place gaskets (3-110) and jam nuts (1-120) onto the stop screws (1-60). Install the stop screws into the housing, making sure the stop screw marked "left" is installed into the left stop screw hole.
- 10.14 Place the housing cover gasket (3-20) on the housing (1-10).
- 10.15 Install the remaining yoke o-ring seal (3-50) into cover (1-20).
- 10.16 Apply lubricant to the yoke bore and the track in the housing cover (1-20).
- 10.17 Apply lubricant to the yoke upper bearing surface.
- 10.18 Install the housing cover (1-20), being careful not to damage the gasket (3-20) or yoke o-ring (3-50).
- 10.19 Install the cover screws (1-90) and seal gasket (3-100). LEAVE FINGER TIGHT - DO NOT TIGHTEN.
- 10.20 Do this step only if you have pulled the cover pins (1-130) or if you are replacing the cover pins. Drive the four pins (1-130) thru 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 at the other end. The pin should be installed smooth end first.
- 10.21 Tighten the cover screws (1-90).
- 10.22 Tighten the piston rod (2-170) (installed in step 10.11) to a torque of approximately 1800 in.lbs. (150 ft.lbs.). Flats are provided on the outer end for wrenching purposes. DO NOT USE A PIPE WRENCH OR SIMILAR TOOL TO TIGHTEN PISTON ROD.

10.23 POSITION INDICATOR INSTALLATION

10.23.1 For spring to close actuators (clockwise) rotate the yoke to the full clockwise (CW) position (as shown on the clockwise assembly drawings) position the yoke weather cover (3-130)/position indicator (1-170) on the yoke with the pointer facing the front and perpendicular to the piston rod (2-170). Secure with the socket head cap screws (1-180).

10.23.2 For spring to open actuators (counterclockwise), rotate the yoke to the full counterclockwise (CCW) position (as shown on the counterclockwise assembly drawings), position the yoke weather cover (3-130)/position indicator (1-170) on the yoke with the pointer facing the right and parallel with the piston rod (2-170). Secure with the socket head cap screws (1-180).

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

11.0 JACKSCREW OUTER END CAP PRE-ASSEMBLY

11.1 Do this section for those actuators equipped with M3 or M3HW jackscrew overrides.

11.2 Apply a light coating of lubricant to the threads of jackscrew assembly (2-210).

11.3 If removed, thread on hex jam nut (2-130) onto jackscrew assembly (2-210).

11.4 Install countersunk washer seal (3-170) then follow with thread screw seal (3-160) onto jackscrew assembly (2-210). The countersink of washer seal (3-170) should face the thread screw seal (3-160). Thread these items until they are up against the hex jam nut (2-130).

11.5 Lightly lubricate the o-ring groove area on the jackscrew adapter (2-190).

11.6 Install the o-ring seal (3-140) into o-ring groove on jackscrew adapter (2-190).

11.7 Thread jackscrew adapter (2-190) onto jackscrew assembly (2-210).

11.8 Insert jackscrew assembly (2-210) through outer end cap (2-30) and retain with socket-head cap screws (2-200). Leave socket head cap screws (2-200) finger tight.

11.9 Install flat washer (3-190) onto end of jackscrew assembly (2-210).

11.10 Insert spiral pin (3-180) into end of jackscrew assembly (2-210) making sure that equal amounts of pin is exposed on both sides of jackscrew assembly (2-210).

11.1 Rotate jackscrew assembly (2-210) counterclockwise until washer (3-190) is up against the outer end cap.

12.0 PRESSURE CYLINDER RE-ASSEMBLY

12.1 Apply lubricant to rod bushing (2-50), install it over the piston rod and slide it up into the housing. For clockwise actuators, install on right side of housing (1-10), and counterclockwise actuators install on the left side of housing (1-10).

12.2 Coat the rod seal (3-70) with lubricant and install, lip first, into the recess provided in the inner end cap (2-40).

12.3 Install one of the gaskets (3-10) over the piston rod and rod bushing.

12.4 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.

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

- 12.6 Install two sets of piston tie bar T-seal components (3-80) into the piston internal seal groove. Refer to step 9.5 for proper installation instructions.

- 12.7 Install the piston o-ring seal (3-40) onto the piston rod (2-170).
- 12.8 Coat the ends of the piston rod (2-170) with lubricant.
- 12.9 Install the two halves of the split ring (2-70) into the inner most groove in the piston rod and retain with one of the spiral retaining rings (2-80).
- 12.10 Slide the piston (2-20) onto the piston rod against the split ring (2-70).
- 12.11 Install the two halves of the remaining split ring (2-70) onto the piston rod and retain with the spiral retaining ring (2-80).
- 12.12 Install the piston T-seal components (3-90) into the piston external seal groove. Refer to step 9.5 for proper installation instructions.
- 12.13 Apply lubricant to the threads and end of the tie bars (2-60), end without wrench flat, and install by carefully pushing tie bars through the piston (2-20).
- 12.14 Install two tie bar o-ring seals (3-30) onto the inboard end of the tie bars (2-60) into the o-ring grooves provided.
- 12.15 Insert the tie bars through the inner end cap (2-40) and screw into the housing (1-10). If the tie bars were not removed, then disregard this step.
- 12.16 Apply lubricant to the entire bore of the cylinder (2-10). **CAUTION:** Excess lubricant in the cylinder bore may cause erratic or jumpy/jerky operation.
- 12.17 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 tilt cylinder 15° to 30° too 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 component could be damaged, becoming a potential source of leakage. **DO NOT** hammer on ends of cylinder.
- 12.18 Install two end cap tie bar o-ring seals (3-30) onto the outboard end of the tie bars (2-60) into the o-ring grooves provided.
- 12.19 Install the outer end cap cylinder o-ring seal (3-60) onto the outer end cap (2-30).
- 12.20 Install the outer end cap (2-30) onto the tie bars (2-60) and into the end of the cylinder (2-10).
- 12.21 Outer End Cap With M3
 - 12.21.1 Remove socket head cap screws (2-200) from jackscrew adapter and pull out jackscrew assembly until enough clearance is available to install tie bar nuts (2-90).
 - 12.21.2 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 85 foot pound plus or minus 10% has been achieved. It is necessary that the flats on the hex nuts (2-90) be aligned and parallel before the jackscrew adapter can be installed.
 - 12.21.3 Rotate the jackscrew assembly counterclockwise until end of CCW travel.
 - 12.21.4 Insert jackscrew adapter and jackscrew assembly back into the outer end cap.
 - 12.21.5 Retain jackscrew adapter with socket head cap screws (2-200).
 - 12.21.6 Tighten jam nut (2-130).

12.22 Outer End Cap Without M3

- 12.22.1 Install the two tie bar nuts (2-90) onto 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 85 foot pounds plus or minus 10% has been achieved.
- 12.22.2 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.

13.0 **SPRING CARTRIDGE INSTALLATION**

- 13.1 Make sure that the stop screws (1-60) have not been screwed in to the point that "pre-load" will be created on the spring cartridge.
- 13.2 Install the end cap gasket (3-10) over push rod (4-20).
- 13.3 Install brace plate (4-80) with socket cap screws (1-220) to housing (1-10). Torque socket cap screws to 100 to 120 foot pounds.
- 13.4 Install the SR end cap gasket (3-10) over push rod (4-20) and up against brace plate (4-80).
- 13.5 Apply 10 psig pneumatic pressure to the breather port in the inner end cap (2-40) and stroke the actuator. Remove the pressure from the breather port.
- 13.6 Remove the safety nuts from the spring return cartridge.
- 13.7 Engage the spring return cartridge (4-10) onto the spring return push rod (4-20) and align the spring cartridge tie bars with the holes in the brace plate (4-80) and also align the brace extension rods with the holes in the brace plate (4-80).
- 13.8 Screw the tie bars into the brace plate (4-80). Alternately tighten the tie bar nuts until the spring cartridge is firmly against the brace plate (4-80).
- 13.9 Tighten the tie bars to 85 foot pounds plus or minus 10%. Install the nut retainer (4-40), securing in place with the socket cap screw (4-60) and washer (4-50). It is necessary that the flats on the hex nuts be aligned and parallel before the nut retainer can be installed.
- 13.10 Install the four hex nuts (4-100) onto the brace extension rods (4-90) on the inboard side of the brace plate (4-80).

14.0 **ACTUATOR TESTING**

- 14.1 All areas, where leakage to atmosphere may occur, are to be checked using a leak testing solution.
- 14.2 Cycle the actuator five times at the nominal operating pressure (NOP) as per actuator name tag or per Chart 2 (page 11) for model being tested. This will allow the seals to seek their proper working attitude.
- 14.3 Stroke the actuator with the Nominal Operating Pressure and allow the unit to stabilize.
- 14.4 Apply a leak testing solution to the followings areas:
 - 14.4.1 Joint between the outer end cap (2-30) and the cylinder (2-10). Checks cylinder to end cap seal.
 - 14.4.2 Around the tie bar nuts on the cylinder end and on M3 equipped actuators around jackscrew adapter, thread screw seal, washer seal and jam nut. Checks tie bar to end cap seals.
 - 14.4.3 Breather port in the inner end cap (2-40). Checks piston to cylinder, piston to tie bar, and piston to push rod seals.

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

- 14.6 If an actuator was disassembled and repaired, the above leakage test must be performed again.
- 14.7 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.
- 14.8 Before the operational testing may be accomplished, it will be necessary to provide a piping system whereby pressure may be applied simultaneously to all common pressure ports.
- 14.9 Adjust the pressure regulator to the pressure rating indicated in column "B" of Chart 2 (page 11) for the model actuator being tested.
- 14.10 Apply the above pressure to the actuator pressure inlet ports and allow the actuator to stabilize. The actuator should stroke a full 90⁰ travel.
- 14.11 Remove pressure from the pressure inlet ports.

15.0 RETURN TO SERVICE

- 15.1 Install breather (4-30) in the inner end cap of the cylinder (2-10). A new breather is provided in the service kit. Use this breather if it is the same size or larger NPT than the original.
- 15.2 If supplied in the service kit, replace the software components of the snubber (1-190) and then install the snubber in the housing cover.
- 15.3 Re-install actuator to valve mounting bracket and valve.
- 15.4 Adjust both stop screws (1-60) back to settings recorded in step 5.6 under General Disassembly.
- 15.5 Tighten both jam nuts (1-120) securely, while holding stop screws (1-60).
- 15.6 Re-install any piping and accessories that were removed.
- 15.7 For actuators equipped with a M3 jackscrew override and require an optional handwheel, M3HW, install the handwheel using the following procedure:
 - 15.7.1 Place the handwheel (8-10) onto the welded nut (the handwheel hub has a cast hexagon hole that fits over the welded nut).
 - 15.7.2 Place lockwasher (8-20) onto M3 up against handwheel hub.
 - 15.7.3 Place hex nut (8-30) onto M3 and thread up against lockwasher, torque to 250 foot pounds.
- 15.8 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

WEIGHTS FOR MODELS
NT-3XX-SRXX & NT4XX-SRX

ACTUATOR MODEL	APPROXIMATE WEIGHT (LBS) **				
	<u>SR1</u>	<u>SR2</u>	<u>SR3</u>	<u>SR4</u>	<u>SR5</u>
NT310-SRX	546	468	374	380	385
NT310-SRX-M3	555	477	383	389	394
NT310-SRX-M3HW	561	483	389	395	400
NT312-SRX	572	494	399	406	411
NT312-SRX-M3	581	503	408	415	420
NT312-SRX-M3HW	587	509	414	421	426
NT316-SRX	620	542	447	454	-
NT316-SRX-M3	629	551	456	463	-
NT316-SRX-M3HW	635	557	462	469	-
NT410-SRX	593	598	520	420	425
NT410-SRX-M3	602	607	529	429	434
NT410-SRX-M3HW	608	613	535	435	440
NT412-SRX	625	630	551	452	457
NT412-SRX-M3	634	639	560	461	466
NT412-SRX-M3HW	640	645	566	467	472
NT416-SRX	672	678	599	500	505
NT416-SRX-M3	681	687	608	509	514
NT416-SRX-M3HW	687	693	614	515	520
NT420-SRX	745	750	672	573	-
NT420-SRX-M3	754	759	681	582	-
NT420-SRX-M3HW	760	765	687	588	-

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

CHART 2
PRESSURE REQUIREMENTS & LIMITATIONS
FOR
NT3XX-SRX & NT4XX-SRX
NUCLEAR SERIES ACTUATORS

ACTUATOR MODEL *	NOMINAL OPERATING PRESSURE (NOP)	MAXIMUM OPERATING PRESSURE (MOP)	MAXIMUM HYDROSTATIC TEST PRESSURE	MAXIMUM AIR ASSIST PRESSURE (MAAP)	COLUMN B SPRING SELECTION PRESSURE
NT310-SR1	217	300	325	23	145
NT310-SR2	146	250	300	68	96
NT310-SR3	112	235	300	82	81
NT310-SR4	85	220	250	98	65
NT310-SR5	61	210	250	110	50
NT312-SR1	152	200	225	16	105
NT312-SR2	102	175	225	47	68
NT312-SR3	78	165	225	57	57
NT312-SR4	60	155	225	68	46
NT312-SR5	43	150	225	77	36
NT316-SR1	95	130	130	10	63
NT316-SR2	64	110	130	29	42
NT316-SR3	49	105	130	35	35
NT316-SR4	37	95	130	42	29
NT410-SR1	275	315	325	48	190
NT410-SR2	247	315	325	80	156
NT410-SR3	163	315	325	118	101
NT410-SR4	130	315	325	142	87
NT410-SR5	102	290	325	157	71
NT412-SR1	217	220	225	34	134
NT412-SR2	173	220	225	55	110
NT412-SR3	114	220	225	82	72
NT412-SR4	91	220	225	99	62
NT412-SR5	71	200	225	109	50
NT416-SR1	135	135	150	21	84
NT416-SR2	108	135	150	34	70
NT416-SR3	71	135	150	51	45
NT416-SR4	57	135	150	61	38
NT416-SR5	44	125	150	67	32
NT420-SR1	85	85	90	13	54
NT420-SR2	68	85	90	21	44
NT420-SR3	45	85	90	32	29
NT420-SR4	36	85	90	38	25

* Includes actuator models that have -M3 and -M3HW included in their model numbers, i.e., NT312-SR2-M3 OR NT416-SR3-M3HW.

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