

BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY & REASSEMBLY

FOR MODELS

NT8XX-SR SPRING RETURN

NUCLEAR SERIES

PNEUMATIC ACTUATORS

PART NUMBER: 065040

REVISION: "D"

RELEASE DATE: March, 1995

1.0. INTRODUCTION

- 1.1 In order to assure and maintain the present level of qualification, and auditable to the Bettis Qualification Report Part Number 037274, the following is required:
- 1.1.1 All maintenance or service work must be performed by a certified technician. A Certified Technician is a person who has successfully completed the manufacture's prescribed course and demonstrated the ability to supervise and/or perform applicable specified product related procedures.
- 1.1.2 Maintain a service interval of six hundred twenty-five cycles or five years which ever occurs first.
- 1.2 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis NT8XX-SR spring return nuclear series pneumatic 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.
- 1.3 SAFETY STATEMENT: Products supplied by 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 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.

WARNING: This procedure should not supersede or replace any customers plant safety or work procedures. If a conflict arises between this procedure and the customers procedures the differences should be resolved in writing between an authorized customer representative and a authorized Bettis representative.

1.4 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.

1.5 BASIC SERVICE INFORMATION: Complete actuator refurbishment requires the actuator be dismantled from the valve or device it is operating.

- 1.6 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.

- 1.7 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator, allowing the spring to stroke and rotate the actuator to its fail position. 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, razor sharp cutting instrument, seal removal tool, commercial leak testing solution, two each 1-8 UNC hex nuts and non-hardening thread sealant.
- 2.2 Tools - All tools are American Standard inch. Large adjustable wrench, two (2) large screwdrivers, allen wrench set, set of open/box-end wrenches, rubber or leather mallet, torque wrench (up to 5,000 in.lbs.), breaker bar, 1/4" drift punch and a 1/2" drive socket set. For recommended tool list refer to Chart 2 on page 14.

3.0 **BETTIS REFERENCE MATERIALS**

- 3.1 Assembly Drawing part number 038246 for fail clockwise (CW) actuators.
- 3.2 Assembly Drawing part number 063671 for fail counter clockwise (CCW) actuators.
- 3.3 Exploded Detail Drawing part number 068106 for NT8XX-SRX(CW), this drawing is provided in the Bettis Service/Seal Kit.

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 Bettis Assembly Drawing, Exploded Detail Drawing, and Actuator Parts Lists.
- 4.3 This procedure is written using the stop screw side of the housing (1-10-10) as a reference and this side will be considered the front of the actuator. The housing cover (1-10-20) will be the top of the actuator.
- 4.4 Refer to Chart 1 on page 14 of this instruction for approximate actuator weights.
- 4.5 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.
- 4.6 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.
- 4.7 Use a non-hardening thread sealant on all pipe threads.

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

- 4.8 Disassembly of actuator should be done in a clean area on a work bench.

- 4.9 LUBRICANT REQUIREMENTS: Dow Corning Molycote 44, medium grade. For use in all areas of the actuator. Lubricants , other than Dow Corning Molycote 44, cannot be used without prior written approval of Bettis Product Engineering.

WARNING: Pressure is not to exceed the maximum operating pressure rating listed on the name tag.

- 4.10 Before starting the general disassembly of the actuator, it is a good practice to operate the actuator with the pressure used by the customer to operate the actuator during normal operation. Notate and record any abnormal symptoms such as jerky or erratic operation.

5.0 GENERAL DISASSEMBLY

- 5.1 If not already removed, disconnect 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 Mark stop screws (1-50) left and right. The setting of stop screws (1-50) should be checked and setting recorded before stop screws are loosened or removed. NOTE: Stop screws will be removed later in this procedure.
- 5.3 Remove breather (4-30) from inner end cap (2-40).
- 5.4 Unscrew and remove snubber valve (1-190) from housing cover (1-10-20).
- 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.
- 5.6 Mark and record location of the pneumatic inlet ports on cylinder outer end cap (2-30) and inner end cap (2-40).

6.0 SPRING CARTRIDGE REMOVAL

WARNING: Under no circumstances should spring cartridge be cut open as the spring is pre-loaded with end caps and cylinder welded around the loaded spring.

CAUTION: Due to weight and size of spring cartridge, support equipment will be required when removing spring cartridge from actuator housing.

WARNING: When spring cartridge is installed on the actuator the spring is under compression. Do not remove spring cartridge until actuator has "pre-load" removed.

- 6.1 Remove spring cartridge "pre-load" as follows: Apply sufficient operating pressure to the cylinder pressure inlet port, located in outer end cap (2-30), to move the actuator yoke (1-160) off of stop screw (1-50).
- 6.2 Locate stop screw (1-50) that is on the opposite side of the housing from spring cartridge (4-10). Loosen jam nut (1-100).
- 6.3 Unscrew stop screw (1-50) until it runs into inner end cap (2-40).
- 6.4 Remove pressure from pressure inlet port and allow spring to return actuator to the spring extended position (fail position).

- 6.5 Remove hex nuts (1-130) from back side of spring brace assembly (1-10-60). The remaining hex nuts (1-130) may be left on brace rods (4-80).

NOTE: Brace rods (4-80) will not be removed from spring cartridge (4-10).

- 6.6 Remove socket cap screw (4-60), lockwasher (4-50), and nut retainer (4-40) from between large hex nuts on outboard end of spring cartridge (4-10).

WARNING: Do not proceed to next step until spring cartridge "PRE-LOAD" has been removed (Refer to steps 6.1 through 6.3).

- 6.7 Alternately loosen two large hex nuts on outboard end of spring cartridge (4-10). NOTE: The spring cartridge tie bar nuts are welded to the tie bars that extend through spring cartridge and screw into spacer plate (1-10-70).

- 6.8 Unscrew tie bars until spring cartridge is free from spacer plate (1-10-70). Care should be taken so that tie bars are not pulled back into the spring cartridge. Place spring cartridge (4-10) to one side.

NOTE: To keep from inadvertently pulling tie bars back into spring cartridge use two each one inch -8 UNC hex nuts and screw them onto the spring cartridge tie bars.

- 6.9 Remove two ferry cap screws (1-10-90) and four socket screws (1-10-100) from spacer plate (1-10-70).

7.0 PRESSURE CYLINDER DISASSEMBLY

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

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

- 7.3 Remove outer end cap (2-30). The fit between cylinder (2-10) and the outer end cap is very tight. NOTE: Break the outer end cap free by tapping with a breaker bar on the lip provided on the end cap.

CAUTION: When separating cylinder (2-10) from outer end cap (2-30) do not damage o-ring groove.

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

CAUTION: When separating cylinder (2-10) from inner end cap (2-40) do not damage o-ring groove.

- 7.5 Remove cylinder (2-10). NOTE: When sliding cylinder (2-10) off of piston (2-20), tilt cylinder 15° to 30° degrees to piston rod (2-60).

- 7.6 Unscrew tie bars (2-60) from spacer plate (1-10-70). NOTE: Flats are provided on the outboard end of the tie bars for wrench placement. Remove tie bars (2-60) by pulling them out through housing (1-10-10), inner end cap (2-40) and piston (2-20).

7.7 Remove split ring retainer (2-80) and split rings (2-70) from outboard side of piston (2-20).

CAUTION: Keep the split rings (2-70) in matched sets.

7.8 Remove piston (2-20) from piston rod (2-170). Refer to step 7.12 for disassembling tie bar bushings (2-180) from fabricated piston with outer diameters of 24" inches and larger.

7.9 Remove o-ring seal (3-40) from piston rod (2-170).

7.10 Remove split ring retainer (2-80) and split rings (2-70) from piston rod (2-170).

CAUTION: Keep the split rings (2-70) in matched sets.

7.11 Remove inner end cap (2-40) off piston rod (2-170).

7.12 Disassembly of pistons with outer diameters of 24" inches and larger. Refer to assembly drawing detail "A".

7.12.1 Remove retainer rings (2-190) from piston (2-20).

7.12.2 Remove tie bar bushings (2-180) from piston (2-20).

8.0 HOUSING GROUP DISASSEMBLY

8.1 Unscrew push rod (4-20) from yoke pin nut (1-10-20) and remove from housing.

8.2 Unscrew piston rod (2-170) from yoke pin nut (1-20) and remove. Flats are provided on the outboard end of the piston rod for wrench placement.

CAUTION: Do not use a pipe wrench on the piston rod as it may mark the rod and cause seal leakage.

8.3 Remove rod bushing (2-50) from the housing or the piston rod.

8.4 Remove four cover/spring brace hex cap screws (1-10-80) with gasket seals (3-100).

8.5 Remove eight hex cap screws (1-80) with gasket seals (3-100) and two hex cap screws (1-10-40) with gasket seals (3-100).

NOTE: Spring brace assembly (1-10-60)/spacer plate (1-10-70), two cover pins (1-10-40), two cover pins (1-10-50), and cover (1-10-20) will come off together as one assembly.

8.6 Remove cover (1-10-20) from the housing (1-10-10).

NOTE: The cover will have a very tight fit due to cover pins (1-10-40) and (1-10-50). It is not necessary to remove cover pins (1-10-40) and (1-10-50) or separate cover (1-10-20) from spring brace assembly (1-10-60).

8.7 Remove top two yoke rollers (1-40) and two roller spacer plate (1-120) from top of yoke pin (1-30).

- 8.8 Remove yoke pin (1-30) from the slots of yoke (1-160).
- 8.9 Remove yoke pin nut (1-20) from between the arms of yoke (1-160).
- 8.10 Remove lower two yoke rollers (1-40) and two roller spacers (1-120) from the bottom of yoke and housing.

CAUTION: The yoke/housing bearing must be lubricated and inspected to extend service life and prevent degradation of torque output. This can only be accomplished by removing the yoke from the housing which requires removing the actuator from the valve or the device it is mounted on.

- 8.11 The yoke (1-160) can now be removed by lifting it from the housing.
- 8.12 Remove stop screws (1-50), stop nuts (1-100), and gaskets (3-110).
- 8.13 It is not necessary to remove pipe plug (1-70), grease fittings (1-60), or reducing bushing (102), to service the actuator.

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, galling 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 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.
- 9.5 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.

10.0 CENTER HOUSING GROUP RE-ASSEMBLY

- 10.1 If removed install drain plug (1-70) into actuator housing (1-10-10).

- 10.2 If removed, install grease fitting (1-60) in actuator housing (1-10-10) and cover (1-10-20). The fitting in the housing is located on the bottom of the housing, next to the lower yoke bearing area. The fitting in the cover is located on top of the cover in the upper yoke bearing area.
 - 10.3 Inside housing (1-10-10) apply lubricant to the track and yoke bore.
 - 10.4 Coat one of the o-ring seal (3-50) with lubricant and install into housing (1-10-10).
 - 10.5 Apply lubricant to the slots in the upper/lower yoke arms and the lower bearing surface.
 - 10.6 Install yoke (1-160) into housing (1-10-10) as follows: Arrange the yoke arms to approximately a 45° degree position in either direction and lower into the housing.
- NOTE: The yoke hub with tapped holes faces up. Rotate the yoke back to approximately mid-stroke (center) position.
- 10.7 Apply lubricant to all surfaces of two yoke rollers (1-40) and two roller spacers (1-120).
 - 10.8 Place one yoke roller in the track in bottom of housing and position it under the slot in the yoke arms.
 - 10.9 Place a roller spacer (1-120) on top of lower yoke roller (1-40).
 - 10.10 Place a second yoke roller (1-40) on top of roller spacer (1-120) in the slot in the lower yoke arm.
 - 10.11 Place a second roller spacer (1-120) on top of the second yoke roller (1-40) and align the holes in the roller spacer and the yoke rollers.
 - 10.12 Coat upper and lower surfaces of yoke pin nut (1-20) with lubricant and insert into position between the yoke arms, parallel to the track in the housing. Align the yoke pin hole with yoke rollers (1-40) and roller spacers (1-120).
 - 10.13 Lubricate yoke pin (1-30) and insert through yoke pin nut (1-20), two yoke rollers (1-40) and two roller spacers (1-120).
 - 10.14 Apply lubricant to all surfaces of the two remaining yoke rollers (1-40) and two remaining roller spacers (1-120).
 - 10.15 Place one roller spacer over yoke pin (1-30) and on top of yoke pin nut (1-20).
 - 10.16 Install third yoke roller (1-40) over yoke pin (1-30) and on top of roller spacer (1-120).
 - 10.17 Place the last roller spacer (1-120) over yoke pin (1-30) and on top of third yoke roller (1-40).
 - 10.18 Place the fourth and final yoke roller (1-40) over the yoke pin (1-30) and on top of roller spacer (1-120).
- NOTE: The top roller will remain above the yoke arm and will engage the cover track when cover (1-10-20) is installed.

- 10.19 Apply lubricant to piston rod (2-170) and rod bushing (2-50). Install rod bushing (2-50) onto piston rod (2-170).

NOTE: Rod bushing (2-50) should be replaced each time actuator is refurbished (refer to section 1 for recommend service interval). The Bettis Service/Seal Kit should contain a new rod bushing (2-50).

- 10.20 Install lubricated piston rod (2-170) with rod bushing (2-50) into the right side of the housing for fail clockwise (CW) actuators or into the left side of the housing for fail counter clockwise (CCW) actuators.

CAUTION: Do not tighten piston rod until the housing cover is installed later in this procedure.

- 10.21 Slide rod bushing along the piston rod and into the housing counter bore. Screw the piston rod into yoke pin nut (1-20).
- 10.22 Lubricate push rod (4-20) and install into the other side of housing (1-10-10) and screw into yoke pin nut (1-20).
- 10.23 Place seal gaskets (3-110) and jam nuts (1-100) on stop screws (1-50). Install both assemblies into the housing.
- 10.24 Place housing cover gasket (3-20) on housing (1-10-10).
- 10.25 Coat o-ring seal (3-50) with lubricant and install into cover (1-10-20).
- 10.26 Apply lubricant to yoke bore and the track in cover (1-10-20).
- 10.27 Apply lubricant to the yoke upper bearing surface.
- 10.28 Install housing cover (1-10-20) and spring brace assembly/spacer plate (1-10-60)/(1-10-70) being careful not to damage the gasket (3-20) or yoke o-ring seal (3-50).
- 10.29 Install seal gaskets (3-100) on to cover screws (1-10-30), (1-10-80), and (1-80).
- 10.30 Install eight cover screws (1-80), two cover screws (1-10-30) and four cover screws (1-10-80).

NOTE: Leave all cover screws finger tight - do not tighten.

- 10.31 Install and tighten two ferry cap screws (1-10-90) through spacer plate (1-10-70) and into housing (1-10-10).
- 10.32 Install and tighten four socket cap screws (1-10-100) through spacer plate (1-10-70) and into housing (1-10-10).
- 10.33 Do this step only if you have pulled cover pins (1-10-40) or if you are replacing the cover pins. Drive the two pins (1-10-40) through cover (1-10-20) and into housing (1-10-10) until the pins are flush with the cover. NOTE: Cover pins are deeply grooved at one end, tapering to a smooth diameter at other end. The cover pin should be installed smooth end first.

- 10.34 Do this step only if you have pulled spring brace/cover pins (1-10-50) and separated the cover (1-10-20) and spring brace assembly (1-10-60). Place spring brace assembly (1-10-60) into position and drive two cover pins (1-10-50) through the spring brace assembly, cover (1-10-20), and into housing (1-10-10).
- 10.35 Tighten cover screws (1-80) (1-10-30), and (1-10-80), torque to 16 ± 1 foot pounds lubricated.
- 10.36 Tighten piston rod (2-170) to a torque of approximately 150 ± 7 foot pounds. NOTE: 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.

CAUTION: Do not use a pipe wrench or similar tool to tighten piston rod.

- 10.37 Tighten push rod (4-20) securely with a strap wrench.
- 10.38 Rotate the yoke to a position that will leave a minimum of the piston rod (2-170) protruding from the actuator housing.

11.0 PRESSURE CYLINDER RE-ASSEMBLY

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

CAUTION: Install rod seal with energizer ring facing outboard side (away from housing).

- 11.2 Install end cap gasket (3-10) over piston rod (2-170) and rod bushing (2-50).

- 11.3 Coat two o-ring seals (3-30) with lubricant and install into inner end cap (2-40).

NOTE: Some tie bar o-rings are held in place by "staked" washers. Check end cap to ensure washers are secured. If needed re-stake washers.

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

CAUTION: Exercise extreme care during end cap installation, in order to prevent damage to rod seal (3-70).

- 11.5 Apply lubricant to o-ring seal (3-60) and install into outer diameter seal groove of inner end cap (2-40).

NOTE: Step 11.6 is done only if actuator has a fabricated piston with greater than 20" inch diameter, i.e. 24", 28" 32" ect. If 20" inch diameter or smaller disregard step 11.6 and proceed to step 11.7.

- 11.6 Fabricated piston, 24" and larger, reassembly (refer to assembly drawing detail "A").

CAUTION: Tie bar bushings (2-180) should be replaced each time actuator is refurbished.

NOTE: The Bettis Service/Seal Kit should contain a new tie bar bushings.

- 11.6.1 Install o-ring seals (3-140) into outer diameter seal groove on tie bar bushings (2-180).
- 11.6.2 Apply lubricant to two sets of T-seal components (3-80) and install into inner diameter seal groove in tie bar bushings (2-180).
- 11.6.3 Install tie bar bushings (2-180) into fabricated piston (2-20).
- 11.6.4 Install retaining rings (2-190) into fabricated piston (2-20).
- 11.7 Apply lubricant to two sets of piston tie bar T-seal components (3-80) and install into piston internal seal groove. NOTE: refer to step 9.5 for proper installation instructions.
- 11.8 Coat outer end of piston rod (2-170) with lubricant.
- 11.9 Apply lubricant to o-ring (3-40) and place onto piston rod (2-170).
- 11.10 Install a matched set of split rings (2-70) into the inner most groove in the piston rod and retain with one split ring retainer (2-80), retaining ring groove away from piston.
- 11.11 Install piston (2-20) onto the piston rod against split rings (2-70). NOTE: When installing cast pistons install with ribbed section of piston facing away from housing.

CAUTION: When installing 24" inch diameter, or larger, pistons make certain that smaller diameter plate faces outer end cap (2-30).

- 11.12 Install a matched set of split rings (2-70) into the inner most groove in the piston rod and retain with one of the split ring retainers (2-80), retaining ring groove away from piston.
- 11.13 Apply lubricant to the threads and end of tie bars (2-60), end without wrench flat.
- 11.14 Install by carefully inserting the tie bars through piston (2-20), inner end cap (2-40), housing (1-10-10) and screw tie bars into spacer plate (1-10-70).

CAUTION: Tighten the tie bars until the threads bottom out, then back out each tie bar one half-turn.

- 11.15 Lubricate all exposed surfaces of piston rod (2-170) and tie bars (2-60).
- 11.16 Apply a light coat of lubricant to bore of cylinder (2-10).
- 11.17 Coat piston T seal components (3-90) with lubricant and install into the piston external seal groove. Refer to section 9 for proper "T" seal installation.
- 11.18 Install lubricated cylinder (2-10) over piston (2-20) and onto inner end cap (2-40). When sliding cylinder over the piston seal tilt cylinder 15° to 30° degrees to piston rod.

CAUTION: If needed when installing cylinder (2-10), hammer on the end of cylinder only with a non metallic object.

CAUTION: Make certain back-up rings, components of piston T-seal (3-90), are seated into piston external 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.

11.19 Apply lubricant to two o-ring seals (3-30) and install into outer end cap (2-30).

NOTE: Some tie bar o-rings are held in place by "staked" washers. Check end cap to ensure washers are secured. If needed re-stake washers.

11.20 Apply lubricant to o-ring seal (3-60) and install into outer diameter seal groove of outer end cap (2-30).

11.21 Install outer end cap (2-30) onto tie bars and into open end of cylinder (2-10). NOTE: The pressure inlet port should be toward the top of the actuator.

11.22 Install two hex nuts (2-90) on tie bars (2-60), using them to draw all of the cylinder components into position. For all pistons with 20" inch diameter and smaller torque alternately, in 50 foot pound increments until a final torque of 110 ±11 foot pounds, lubricated, has been achieved. Fabricated piston, 24" diameter and larger torque alternately, in 50 ft.lb. increments until a final torque of 125 +10/-0 foot pounds, lubricated, has been achieved.

CAUTION: While the tie bar nuts are being tightened, do not allow the tie bars to turn.

11.23 Install nut retainer (2-100), securing in place with retainer screw (2-120) and lockwasher (2-110). It is necessary that the flats on hex nuts (2-90) be aligned and parallel before nut retainer (2-100) can be installed.

11.24 Apply sufficient pneumatic pressure to the breather port in inner end cap (2-40) and stroke the actuator. Remove the pneumatic pressure from the breather port. If pneumatic pressure is not available then by pushing on the exposed push rod (4-20) or tapping it with a soft mallet, stroke the actuator until the yoke touches the housing at the end of its stroke.

12.0 SPRING CARTRIDGE INSTALLATION

NOTE: Make sure that the stop screws (1-50) have not been screwed into the point that "pre-load" will be created on the spring cartridge.

12.1 Remove the nuts, installed at step 6.8, from the spring cartridge tie bars.

12.2 Place spring cartridge (4-10) on to push rod (4-20) and align the spring cartridge tie bars with the holes in the spacer plate (1-10-70). Also align brace rods (4-80) with holes in spring brace assembly (1-10-60).

12.3 Screw the tie bars into spacer plate (1-10-70). Alternately tighten tie bar nuts in 50 foot pounds increments until the spring cartridge is firmly against the spacer plate and torque to 100 ±11 foot pounds lubricated.

12.4 Install nut retainer (4-40), lockwasher (4-50), and socket cap screw (4-60). NOTE: It is necessary that the flats on the hex nuts be aligned and parallel before the nut retainer can be installed.

- 12.5 Install hex nuts (1-130) onto brace rods (4-80) and tighten.
- 12.6 POSITION INDICATOR INSTALLATION - Spring to close actuators (clockwise) use steps 12.6.1 through 12.6.3. Spring to open actuators (counter clockwise) use steps 12.6.4 through 12.6.6.
- 12.6.1 For spring to close actuators (clockwise) rotate yoke to the full clockwise (CW) position (as shown on the clockwise assembly drawings).
- 12.6.2 Install weather cover (3-130) and position indicator (1-170) on yoke (1-160). Arrange the position indicator's pointer perpendicular with the piston rod (2-170) and facing front of the actuator (stop screw side of the housing).
- 12.6.3 Secure weather cover (3-130) and position indicator (1-170) to yoke (1-160) with four socket cap screws (1-180).
- 12.6.4 For spring to open actuators (counter clockwise) rotate yoke to the full counterclockwise (CCW) position (as shown on the counter clockwise assembly drawing).
- 12.6.5 Install weather cover (3-130) and position indicator (1-170) on yoke (1-160). Arrange the position indicator's pointer facing the right and parallel with piston rod (2-170).
- 12.6.6 Secure weather cover (3-130) and position indicator (1-170) to yoke (1-160) with four socket cap screws (1-180).

13.0 ACTUATOR TESTING

- 13.1 General Leak Testing: A small amount of leakage may be tolerated. Generally, a small bubble which breaks about three seconds after starting to form is considered acceptable.
- 13.2 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution.

WARNING: Pressure is not to exceed the maximum operating pressure rating listed on the name tag.

- 13.3 Unless otherwise listed all leak testing will use the nominal operating pressure (NOP) as listed on the actuator name tag or the pressure used by the customer to operate actuator during normal operation. NOTE: When testing the actuator use a proper adjusted regulator to apply pressure to the actuator.
- 13.4 Before testing for leaks, alternately apply and release pressure, as defined in step 13.3, to the pressure side of the piston to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.
- 13.5 Apply pressure, as defined in step 13.3, to pressure inlet port in outer end cap (2-30).

- 13.6 Apply a leak testing solution to the following areas:
- 13.6.1 Joint between outer end cap (2-30) and cylinder (2-10). Checks cylinder to end cap o-ring seals.
 - 13.6.2 Around tie bar nuts (2-90) on outer end cap (2-30). Checks tie bars to end cap o-ring seals.
 - 13.6.3 Form a bubble over the breather port hole in inner end cap (2-40). Checks piston to cylinder, piston to tie bar, and piston to piston rod seals.
- 13.7 If an actuator was disassembled and repaired, the above leakage test must be performed again.
- 13.8 Operation test the actuator to verify proper function of the actuator. This test is to be done off of the valve.
- 13.8.1 Adjust the pressure regulator to the pressure as defined in step 13.3.
 - 13.8.2 Apply the above pressure to the actuator power cylinder pressure inlet port and allow the actuator to stabilize. The actuator should stroke a full 90° degree travel.
- 13.9 Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity, should be corrected and the above test performed again.
- 13.10 Remove pressure from pressure inlet port in the outer end cap.

14.0 RETURN TO SERVICE

- 14.1 Install breather (4-30) in inner end cap (2-40).
- 14.2 Replace software components of snubber (1-190) and then install snubber in housing cover port.
- 14.3 Adjust both stop screws (1-50) back to settings recorded in section 5 under General Disassembly.
- 14.4 Tighten both stop nuts (1-100) securely, while holding stop screw (1-50).
- 14.5 After the actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.

CHART 1 - ACTUATOR WEIGHTS

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS) (1)			
	SR2	SR3	SR4	SR5
NT816-SRX	1553	1326	1346	1175
NT820-SRX	1672	1575	1466	1295
NT824-SRX	2144	-----	-----	-----

NOTES: (1) Weights listed for each actuator model are for bare actuators without accessories or valve mounting brackets

CHART 2 - TOOL STYLE AND WRENCH SIZES

ITEM NO.	WRENCH SIZE	QTY	LOCATION	RECOMMENDED WRENCH STYLE
1-50	15/16"	2	Stop Screw	Open end or adjustable
1-60	7/16"	2	Grease fitting	Socket end or box end
1-70	7/16"	1	Pipe plug	Open end or adjustable
1-80	9/16"	8	Hex cap screw	Socket
1-100	1-7/8"	2	Stop Screw nut	Box end (1)
1-130	1-5/8"	8	Heavy hex nut	Open end
1-180	3/16"	4	Socket cap screw	Allen
1-190	7/8"	1	Snubber	Deep socket
1-10-30	9/16"	2	Hex cap screw	Socket
1-10-80	9/16"	4	Hex cap screw	Socket
1-10-90	1"	2	Ferry cap screw	12 point Socket
1-10-100	3/4"	4	Socket cap screw	Allen
2-60	5/8"	2	Tie bars flats	Open end or adjustable
2-90	1-5/8"	2	Heavy hex nut	Crows foot (1)
None	1-5/8"	2	SR Tie bar nut	Deep socket
2-120	3/16"	1	Socket cap screw	Allen
2-170	1-3/8"	1	Piston rod flat	Crows foot (1)
4-20	(1)	1	Push rod	Strap wrench
4-30	11/16"	1	Breather	Open end
4-60	3/16"	1	Socket cap screw	Allen

NOTE: (1) No alternate style recommended or wrench placement not provided.

ECN	DATE	REV		BY *	DATE
8609	10/28/85	A	COMPILED	Bill Cornelius	17 March 1995
C9126	04/23/87	B	CHECKED	Bill Cornelius	17 March 1995
10207	06/20/89	C	APPROVED	Robert McEver	17 March 1995
14832	03/17/95	D			

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