OPERATING & MAINTENANCE INSTRUCTIONS
SPRING CARTRIDGE FIELD REMOVAL & REINSTALLATION

FOR

NT-3XX-SRX & NT4XX-SRX SERIES ACTUATORS

INTRODUCTION

In order to assure and maintain the present level of qualification and trace ability (Bettis Qualification Report # 037274), Bettis requires that any maintenance or service work be performed by a certified technician.

This service procedure is offered as a guide to enable the spring cartridge to be removed and reinstalled in the field on Bettis models NT3XX-SRX and NT4XX-SRX series nuclear actuators.

BASIC TOOLS

All tools are American Standard inch. Large adjustable wrench, screwdriver, 1/2 inch drive socket set, Allen wrench set, and torque wrench (up to 2000 in. lbs.).

REFERENCE BETTIS MATERIALS

NT3XX-SRX & NT3XX-SRX-M3 Fail Clockwise (CW) Assembly Drawing 036828
NT3XX-SRX & NT3XX-SRX-M3 Fail Counterclockwise (CCW) Assembly Dwg 042972
NT4XX-SRX & NT4XX-SRX-M3 Fail Clockwise (CW) Assembly Drawing 040059
NT4XX-SRX & NT4XX-SRX-M3 Fail Counterclockwise (CCW) Assembly Dwg 043011
NT3XX-SRX Exploded View Drawing D-060029
Operating & Maintenance Instructions (Op/Maint-003)

GENERAL DISASSEMBLY

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

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.

2. Spring cartridge "preload". Locate the stop adjustment screw (1-60) that is on the opposite side of the center housing from the spring cylinder (4-10). Loosen the jam nut (1-120) and unscrew the stop adjusting screw (1-60) until there isn't any more "preload" on the actuator. **CAUTION: DO NOT PROCEED TO NEXT STEP UNTIL YOU ARE SURE THERE IS NO SPRING "PRELOAD".**

3. Check again for spring 'preload'. Check the location of the position indicator. If the "preload" is off the spring, the indicator will face the front (clockwise units). On counter-clockwise units, indicator will point to right. **NOTE:** Stop screw side of housing is "front" side.

SPRING CARTRIDGE REM0VAL

NOTICE: When the spring cartridge is installed on the actuator the spring is under compression. DO NOT remove the spring cartridge until the act actuator has the "Pre-load" removed (refer to step 2 under General Disassembly). **WARNING: Under no circumstances should the spring cartridge be cut open as the spring is preloaded and the spring cartridge welded around it.**

1. Remove socket head screw (4-60), washer (4-50) and nut retainer (4-40).

   NOTE: "N" Series actuator spring cartridges are 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 #2.

2. Alternately loosen the two large tie bar 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. **NOTE:** To keep from inadvertently pulling the tie bars back into the spring cartridge use 7/8'1-9 UNC hex nuts and screw them on to the spring cartridge tie bars. Place the spring cartridge to one side.

GENERAL RE-ASSEMBLY

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

Before starting the assembly of an actuator, all parts should be thoroughly cleaned, inspected and de-burred. Particular attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding motion. After inspection, the parts should be carefully cleaned to remove all dirt, gaskets and other foreign material.

LUBRICATION REQUIREMENTS

1. Nuclear service use Dow Corning - Molykote 44 (medium grade). Reference Bettis Engineering Standard ESL 6.

SPRING CYLINDER RE-ASSEMBLY

NOTE: Make sure that the stop screws (1-60) have not been screwed in to the point that "Preload" will be created on the spring cartridge.

1. Remove the safety nuts from the spring return cartridge.

2. Engage the spring return cartridge 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).

3. Screw the tie bars into the brace plate (4-80). Alternately tighten the two welded tie bar nuts until the spring cartridge is firmly against the brace plate (4-80).

4. Tighten the tie bars to 350 foot pounds. 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.

5. Install the four hex nuts (4-100) on the inboard side of the brace plate (4-80).

NOTE: When tightening the brace bolts, insure that the spring cartridge is straight or else binding of the push rod (4-20) will occur.

TESTING PNEUMATIC ACTUATORS:

A. Leakage Test

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

Procedure.

1. Cycle the actuator five (5) times at the nominal operating pressure as per actuator name tag. This will allow the seals to seek their proper working attitude.

2. Apply air pressure (chart I column 'B' for the model being tested) to stroke the actuator and allow the unit to stabilize.

3. The above leakage test is now to be performed. If any leakage to atmosphere is noted, the actuator must be disassembled and the cause of leakage must be determined and corrected.

4. If excessive leakage across the piston is noted (generally a bubble which breaks three (3) seconds or less after starting to form), the unit must be disassembled and the cause of leakage must be determined and corrected.

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

B. Operational (Functional) Test

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

Procedure:

1. Adjust the pressure regulator to the pressure rating indicated in column 'B' of Chart 1, on the following page, for the model actuator being tested.

2. Cycle the actuator five (5) times at the above pressure. This will allow the seals to seek their proper working attitude.

   NOTE: Check the spring cartridge to insure that the vent is not plugged and is venting properly to the atmosphere.

3. Apply the above pressure to the actuator and allow the unit to stabilize. The actuator should stroke a full (90 degrees) travel with the stops properly set.
4. Decrease the cylinder pressure slowly until the actuator strokes approximately (5° degrees) off the opposite stop. The pressure reading attained must be greater than or equal to that listed in Column "A" of Chart 1 for the model actuator being tested.

5. Any jumpy or jerky operation, not attributed to seal drag or limited flow capacity, must be corrected and the above test performed again.

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

RETURN TO SERVICE

Refer to "Operating & Maintenance Instructions for Bettis Nuclear Rotary Valve Actuators" (OP/MAINT-003) for actuator start-up procedures.

CHART 1

FINAL QUALITY TESTING OF ACTUATORS

MODEL NUMBER	COLUMN A	COLUMN B	MODEL NUMBER	COLUMN A	COLUMN B
NT410-SRI	95	190	NT310-SRI	77	145
NT410-SR2	67	156	NT310-SR2	55	96
NT410-SR3	51	101	NT310-SR3	38	81
NT410-SR4	31	87	NT310-SR4	27	65
NT410-SR5	19	71	NT310-SR5	16	50
NT412-SRI	67	134	NT312-SRI	53	105
NT412-SR2	48	110	NT312-SR2	38	68
NT412-SR3	36	72	NT312-SR3	25	57
NT412-SR4	23	62	NT312-SR4	19	46
NT412-SR5	14	50	NT312-SR5	11	36
NT416-SRI	42	84	NT316-SRI	33	63
NT416-SR2	30	70	NT316-SR2	23	42
NT416-SR3	23	45	NT316-SR3	15	35
NT416-SR4	13	38	NT316-SR4	11	29
NT416-SR5	8	32	NT316-SR5	6	20
NT420-SRI	27	54			
NT420-SR2	18	44			
NT420-SR3	13	29			
NT420-SR4	8	25			
NT420-SR5	6	21			

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