BETTIS

FIELD CONVERSION

SPRING CARTRIDGE

SPRING FAIL DIRECTION

FOR MODELS

T3XX-SRX-M7 AND T4XX-SRX-M7

SPRING RETURN SERIES

PNEUMATIC ACTUATORS

PROCEDURE NUMBER: SE - 089

REVISION: "A"

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1.0 INTRODUCTION

1.1 This service procedure is offered as a guide to enable field conversion, Spring Cartridge "spring to close" to "spring to open" or the inverse, to be performed on Bettis models T3XX-SRX-M7 and T4XX-SRX-M7 spring return pneumatic series 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.

1.2 **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 well trained, equipped, prepared and competent personnel.

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 customers representative and a authorized Bettis representative.

1.3 **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.

1.4 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.

2.0 REFERENCE MATERIALS

2.1 Assembly Drawings part number 036144 for T3XX-SR(CW)-M7.

2.2 Assembly Drawings part number 048102 for T3XX-SR(CCW)-M7.

2.3 Assembly Drawings part number 035994 for T4XX-SR(CW)-M7.

2.4 Assembly Drawings part number 048103 for T4XX-SR(CCW)-M7.

2.5 M7 Operating Instructions part number 074951.

3.0 GENERAL DETAILS

3.1 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.

3.2 Numbers in parentheses, ( ) indicate the bubble number (reference number) used on the GH Bettis Assembly Drawing and Actuator Parts Lists.

3.3 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 of the actuator. The housing cover (1-20) will be the top of the actuator.

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

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

3.5 Some components of this actuator are very heavy and will require a means of assistance.

3.6 HOUSING LUBRICATION REQUIREMENTS: Lubricants, other than those listed in steps 3.6.1 and 3.6.2, should not be used without prior written approval of Bettis Product Engineering.

3.6.1 Standard and high temperature service (-20°F to +350°F) use Bettis ESL-5, Kronaplate 100 lubricant. ESL-5 is contained in the Bettis Service/Seal Kit.

3.6.2 Low temperature service (-50°F to +150°F) use Kronaplate 50 lubricant. This lubricant is not contained in the Low Temperature Service/Seal Kit.

3.7 FLUID REQUIREMENTS: For use in the M7 Hydraulic Control Package (8) and the hydraulic control package cylinder. The following listed fluids are recommended fluids only and does not limit the use of other hydraulic fluids compatible with supplied seals and coatings.

3.7.1 Standard and high temperature service (35°F to 350°F) use Dexron II Automatic Transmission Fluid.

3.7.2 Low temperature service (-65°F to 180°F) use Exxon Univis J13 Hydraulic Fluid.

4.0 SPRING CARTRIDGE REMOVAL

4.1 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 "preload" removed.

4.2 Under no circumstances should the spring cartridge be cut open, as the spring is preloaded and the spring cartridge welded around it.

4.3 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.

4.4 Spring cartridge 'preload'. Locate the stop adjust 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. NOTE: DO NOT PROCEED TO NEXT STEP UNTIL YOU ARE SURE THERE IS NO SPRING "PRE-LOAD".

4.5 Open bleed valves (2-240) on cylinder (2-40).

CAUTION: Bleed valves (2-240) are 1/8 npt and may be manufactured out of brass. Use only the correct size wrench (13/32" inch open or box end wrench). Do not use pliers or other style adjustable wrench for bleed valve removal or adjustment.

4.6 Remove socket cap screw (4-60) and lockwasher (4-50).

4.7 Remove nut retainer (4-40).

4.8 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 actuator housing (1-10).

WARNING: The SR Cartridge is not field repairable. Under no circumstances should the spring cartridge be cut open as the spring is pre-loaded with the end caps and cylinder welded around the loaded spring.

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

4.9 Unscrew the spring return cartridge tie bars, alternately, approximately one turn per tie bar until the cartridge has become disengaged from the housing (1-10).

NOTE: Care must be taken not to remove the tie bars from the SR cartridge in as much as it would probably be impossible to replace them if they are removed.

4.10 Install two tie bar nuts onto the threaded portion of the tie bars that are extending from the spring cartridge after it has been removed from the housing. The purpose of this is to prevent an accidental removal of the tie bars from the spring cartridge.

4.11 Place the spring cartridge to one side.

5.0 PNEUMATIC (POWER) AND HYDRAULIC OVERRIDE CYLINDER REMOVAL

5.1 Stroke actuator to the mid position.

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

5.2 Remove cover bolts (1-90).

5.4 Remove cover (1-20). NOTE: This Piece will have a very tight fit.

5.5 Unscrew push rod (4-20) from yoke pin nut (1-30) and remove.

5.6 Unscrew piston rod (2-170) from yoke pin nut (1-30) by using a wrench (pipe, strap or vice grip wrench) that will allow you to grip piston rod (2-170) as close to yoke pin nut (1-30) as possible.

NOTE: Care should be taken not to mar piston rod (2-170) in the area that passes through rod bushing (2-80) and rod seal (3-70).

5.7 Remove socket cap screw (2-160), lockwasher (2-150) and nut retainer (2-140).

5.8 Back off both tie bar hex nuts (2-130) until they are finger loose. Do not remove them from tie bars (2-100).

5.9 With tie bar nuts (2-130) hand tight against outer end cap (2-70), tie bars (2-100) will protrude through nuts (2-130) far enough to allow a wrench to be placed on the flats at the end of the tie bars. Back tie bars (2-100) out at approximately one turn per tie bar, alternately, making sure that the cylinder package follows the tie bars as they are unscrewed from the housing.

CAUTION: Due to the weight and size of the cylinder package, heavy duty support equipment will be required when removing the cylinder package from the actuator housing.

5.10 When tie bars (2-100) are completely unscrewed from the housing, grasp inner end cap (2-30) and pull the entire cylinder package away from housing (1-10).

NOTE: Place two (2) safety nuts on the exposed tie bar ends that were removed from the housing and tighten them hand tight against the inner end cap (2-30).

6.0 PNEUMATIC AND HYDRAULIC OVERRIDE CYLINDER RE-INSTALLATION

6.1 Loosen the remaining jam nut (1-120). Back out the stop screw (1-60), which had not been loosened previously, and screw it out until there is no possibility of the yoke coming into contact with the stop screw.

6.2 Remove and reverse the rod bushing (2-80) to the side of the housing that will be the new location of the pneumatic and hydraulic override cylinder.

6.3 Insert the push rod (4-20) into the housing on the new location of the spring cartridge (4-10) and thread it into the yoke nut, tightening it with either a strap wrench or a pipe wrench.

6.4 Align the pneumatic and hydraulic assembly by inserting the protruding piston rod (2-170) into the rod bushing (2-80) hole and threading the piston rod into the yoke pin nut. Tighten the piston rod (2-170).

6.5 Manually push the pneumatic and hydraulic cylinder assembly toward the housing (1-10) until there is just barely enough room left between the ends of the tie bars and the housing to remove the safety nuts.

6.6 By pressing on the ends of the tie bars, slide the cylinder assembly against the housing (1-10) until the tie bars engage the housing threads.

6.7 Tighten tie bars one (1) or two (2) turns per tie bar, alternately, until the cylinder assembly is made up with housing (1-10).

6.8 Slack off the tie bar nuts so that the tie bars can be seated with the flats at the outer ends of the tie bars.

6.9 Engage and tighten the tie bar nuts to 65 ±7 foot pounds lubricated. Install nut retainer (2-140), securing in place with retainer screw (2-110) and lockwasher (2-150). It is necessary that the flats on hex nuts (2-130) be aligned and parallel before the nut retainer can be installed.

7.0 SPRING CARTRIDGE RE-INSTALLATION

7.1 By pushing on the exposed spring return push rod (4-20) or tapping it with a soft mallet, stroke the unit until the yoke touches the housing at the end adjacent to the installed pressure cylinder.

7.2 Remove the safety nuts from the spring return cartridge.

7.3 Engage spring return cartridge onto the spring return push rod and engage the tie bars by screwing them into housing (1-10).

7.4 Torque tighten tie bars to 65 ±7 foot pounds lubricated. Install nut retainer (4-100), securing in place with screw (4-120) and lockwasher (4-110). It is necessary that the flats on hex nuts (4-90) be aligned and parallel before the nut retainer can be installed.

8.0 HOUSING COVER RE-INSTALLATION

8.1 Remove old yoke seal (3-50) in housing cover (1-20).

8.2 Coat new yoke seal (3-50) with grease and install into the cover.

8.3 Remove old cover gasket (3-20) and clean for new gasket.

8.4 Place new cover gasket (3-20) on top of the housing and align the holes in the gasket with the holes in the top of the housing.

8.5 Place cover (1-20) on housing (1-10) and align the holes in the cover with the holes in the housing and press the cover down against the housing.

8.6 Do this step only if you have pulled cover pins (1-130) or if you are replacing the cover pins. Insert cover pins (1-130) in the four holes in the cover. There are two holes located on either side of the housing cover. Drive these pins through the cover and into the housing.

8.7 Place cover screws (1-90) with gaskets (3-100) in the bolt holes in the cover and tighten.

8.8 Re-install the yoke cover (1-170) and position indicator (3-130) on the yoke with the pointer pointing to the new position as required for customer application.

9.0 RETURN TO SERVICE

9.1 Tighten two bleed valves (2-140) on hydraulic cylinder (2-40).

9.2 Re-install all tubing and accessories.

9.3 Thoroughly check all seal components for leaks.

9.4 Check actuator for smooth operation.