

**BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY & REASSEMBLY**

**FOR MODELS**

**STRQ104XX-2SR**

**SPRING RETURN SERIES**

**PNEUMATIC ACTUATORS**

PART NUMBER: 114555

REVISION: "A"

RELEASE DATE: May, 1994



## 1.0 **INTRODUCTION**

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis STRQ104XX-SRX Spring Return Series pneumatic actuators. When the model number has a "-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 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.

### 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.

**SR:** Spring Cartridge

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

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

1.6 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 - Seal/Service Kit, Rail Alignment tool, razor sharp cutting instrument, commercial leak testing solution 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, 1/2" drive socket set. For itemized wrench size list and recommended wrench style refer to Chart No. 2 on page 15.

### **3.0 REFERENCE BETTIS MATERIALS**

- 3.1 Assembly Drawing 103803 for STRQ104XX-SR(CW) fail close actuators.
- 3.2 Assembly Drawing XXXXXX \* for STRQ104XX-SR(CCW) fail open actuators.
- 3.3 Rail alignment tool drawing part number B-064899.
- \* Part number not assigned at time of release of this procedure.

### **4.0 GENERAL INFORMATION**

- 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 and actuator Parts List.
- 4.3 As referenced in this procedure the front view of the actuator is: Cylinders perpendicular to the technician, side plate with accessory pads facing the technician. The top of the actuator will be the housing cover (1-130).
- 4.4 Due to the extreme size and weight of this actuator and it's parts it is recommended that the actuator be removed from it service location and be taken to a location where a heavy duty lift crane or block and tackle is available. For actuator approximate weight refer to Chart No. 1 on page 15.
- 4.5 Lift the actuator by the lifting lugs (1-160) on the sides of the housing only.

**WARNING: Lift the actuator only by the lifting lugs (1-160). Do not attempt to lift the actuator/valve assembly by lifting lugs (1-160).**

- 4.6 To help at re-assembly mark or tag all mating surfaces.
- 4.7 When removing seals from seal grooves, use a small standard screwdriver with the sharp edges rounded off or use a commercial seal removing tool.
- 4.8 Use a non-hardening thread sealant on all pipe threads.

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

- 4.9 LUBRICATION REQUIREMENTS: For use in all areas of the actuator. Lubricants, other than those listed in steps 4.9.1 and 4.9.2, should not be used without prior written approval of Bettis Product Engineering.
  - 4.9.1 Standard and high temperature service (20°F to +350°F) use Bettis ESL-5, Kronaplate 100 lubricant. This lubricant is furnished in the Bettis Service/Seal Kit.
  - 4.9.2 Low temperature service (-50°F to +150°F) use Kronaplate 50 lubricant. This lubricant is not furnished in the Service/Seal Kit.

**CAUTION: Actuator operating pressure is not to exceed the maximum operating pressure rating listed on it's 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. Also note if the actuator's spring rotates the actuator back to its' full fail position.

## **5.0 GENERAL DISASSEMBLY**

- 5.1 Remove stop screw nut pipe plugs (2-200) and SR cartridge stop screw nut pipe plugs.

NOTE: The stop screws (2-180) and SR stop screws have a 1/2" Square X 7/8" deep hole in their outboard end.

- 5.2 Hold the stop screw (2-180) in place by accessing the stop screw through the pipe plug hole in the end of the stop nut. Using a 1/2 inch square male drive extension hold the stop screw in place, remove stop nut (2-190). Repeat this procedure on the second set of power cylinders.

- 5.3 Repeat the stop nut removal procedure used in step 5.2 on both spring cartridge SR stop screws and stop nuts.

- 5.4 Measure and record the exposed length of both power cylinder stop screws (2-180) and both SR cartridge stop screw.

- 5.5 Remove four in number breathers (2-210). One breather is located in each outer end cap (2-30) and the other two breathers are located in each cylinder adapter (2-120).

- 5.6 Remove the snubber valve (1-230) from the housing cover (1-130).

## **6.0 SPRING CARTRIDGE REMOVAL**

- 6.1 The spring cartridge "pre-load" must be removed before the actuator is disassembled. Remove the spring cartridge "pre-load" as follows: Apply 50 psig pneumatic pressure four in number cylinder pressure inlet ports. Unscrew and remove both spring cartridge stop screws located in each spring cartridge (3-10). Remove the pressure from the pressure inlet ports.

**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. For the approximate weight of the spring cartridge, refer to the following list:**

SR1 = 2404 lbs.                      SR2 = 2307 lbs.                      SR3 = 2087 lbs.

NOTE: Repeat steps 6.2 through 6.6 on one spring cartridge (3-10) and then repeated on the other spring cartridge (3-10).

- 6.2 Unscrew the spring cartridge pull rod from the yoke pin nut (1-110). The pull rod can be rotated for removal by going through the spring cartridge stop screw hole with a 1/2 inch square male drive extension.

6.3 Remove hex head screws (3-40) from adapter plate (3-20).

- 6.4 Loosen spring cartridge tie bar hex head nuts one turn.
- 6.5 NOTE: Flats are provided on the outboard end of the SR tie bars for wrench placement. Unscrew the spring cartridge tie bars from the housing (1-10). Pull the cartridge (3-10) away from and off of the housing (1-10).
- 6.6 To keep from inadvertently pulling the tie bars back into the spring cartridge use 1-3/8 inch 12 UNF hex nuts and screw them on to the spring cartridge tie bars. Place the spring cartridge to one side.

**WARNING: Under no circumstances should the spring cartridge be cut apart, as the spring is pre-loaded and the spring cartridge welded together.**

## **7.0 PRESSURE CYLINDERS DISASSEMBLY**

NOTE: The actuator is symmetrical about it's centerline. The following steps will be preformed and repeated on one set of power cylinders and then repeated on the second set of power cylinders.

- 7.1 Remove two in number tie bar hex nuts (2-100) from the outboard side of outer end cap (2-30).

**CAUTION: Do not damage o-ring groove when removing end cap.**

- 7.2 The fit between the cylinder and the outer end cap is very tight. Break the end cap free by tapping with a breaker bar on lip provided on the end cap. Remove outer end cap (2-30) from tandem cylinder (2-110).
- 7.3 Remove tandem cylinder (2-110) from cylinder adapter (2-120). When removing the cylinder off of the piston, tilt the cylinder 15° to 30° degrees with respect to actuator centerline to help facilitate removal.
- 7.4 NOTE: Flats on outboard end of tie bars are provided for wrench placement. Unscrew and remove outer tie bars (2-130) from the cylinder adapter (2-120).
- 7.5 NOTE: Keep the split rings in matched sets. Refer to assembly drawing page 2 of 2 Detail "B". Remove split ring set (2-80) and split ring retainer (2-90) from the outboard end of piston rod (2-70).
- 7.6 Remove the outboard piston (2-20) from piston rod (2-70).
- 7.7 NOTE: Keep the split rings in matched sets. Remove second set of split rings (2-80) and split ring retainer (2-90).
- 7.8 Refer to assembly drawing page 2 of 2 Detail "B". Remove o-ring seal (5-20) from outboard end of piston rod (2-70).
- 7.9 Unscrew and remove two in number tie bar nuts (2-140) from the outboard side of cylinder adapter (2-120).
- 7.10 Remove cylinder adapter (2-120) from piston rod (2-70).

- 7.11 Refer to assembly drawing page 2 of 2 Detail "D". Remove retaining ring (2-150) and rod bushing (2-50) from cylinder adapter (2-120).
- 7.12 NOTE: When removing the cylinder, tilt the cylinder 15° to 30° degrees with respect to actuator centerline. Remove cylinder (2-10) from inner end cap (2-40).

**CAUTION: Do not use pipe wrench to remove tie bars.**

- 7.13 Remove tie bars (2-60) from housing (1-10). NOTE: A 1/2 inch hexagonal recess is provided in the outboard end of the tie bars (2-60) to facilitate removal.
- 7.14 NOTE: Keep the split rings in matched sets. Remove split ring set (2-80) and split ring retainer (2-90) from the outboard side of inner piston (2-20).
- 7.15 Remove the inner piston (2-20) from the piston rod (2-70).
- 7.16 NOTE: Keep the split rings in matched sets. Remove the final set of split rings (2-80) and split ring retainer (2-90) from piston rod (2-70).

**CAUTION: Do not use pipe wrench to remove the piston rod.**

- 7.17 NOTE: Flats on outboard end of tie bars are provided for wrench placement. Remove piston rod (2-70) from yoke pin nut (1-110).
- 7.18 Remove socket cap screws (2-160) and stat-o-seal (5-100) from inner end cap (2-40).
- 7.19 Remove inner end cap (2-40) from housing (1-10).
- 7.20 Refer to assembly drawing page 2 of 2 Detail "E". NOTE: Record the location of the rod bushing before removal. Remove rod bushing (2-50) and rod seal (5-60) from inner end cap (2-40).

## **8.0 HOUSING GROUP DISASSEMBLY**

- 8.1 Remove two in number socket cap screws (3-30) from both adapter plates (3-20).
- 8.2 Remove both adapter plates (3-20) from housing (1-10).
- 8.3 Remove position indicator pin (1-290) from position indicator drive assembly (1-260).
- 8.4 Unscrew and remove eight in number hex cap screws (1-280) with gasket seals (4-100) from position indicator cover (1-270).
- 8.5 Remove position indicator cover (1-270).
- 8.6 Refer to assembly drawing page 2 of 2 detail "H". NOTE: Mark the hole, on the yoke, that the socket set screw (1-250) is removed from. Unscrew and remove set screw (1-250) from position indicator drive assembly (1-260).
- 8.7 Remove position indicator drive assembly (1-260) from the top of yoke (1-30).



- 8.8 Refer to assembly drawing page 2 of 2 detail "H". Unscrew and remove sixteen in number socket cap screws (1-60) from four in number upper yoke/segmented retaining rings (1-50).

- 8.9 Remove upper segmented retaining rings (1-50).
- 8.10 Refer to assembly drawing page 2 of 2 housing section on right side of drawing. NOTE: The eight in number cover screws (1-150), that stick up and have hex nut (1-240) on them, are not to be removed. Remove forty four in number cover screws (1-150) and gasket seals (4-50).
- 8.11 To help in removing the housing cover (1-130) loosen the eight hex nuts (1-240). Alternately rotate the eight raised cover screws (1-150) clockwise until the cover is clear of the cover pins (1-140).
- 8.12 Remove cover (1-130) from housing (1-10).
- 8.13 Cover pins (1-140) should not be removed unless damaged.
- 8.14 Refer to assembly drawing page 2 of 2 detail "H". Remove upper yoke bushing (1-40).
- 8.15 Refer to assembly drawing page 2 of 2 detail "J". Position the housing in such a manner so as to give access to the lower yoke bushing (1-20).
- 8.16 Refer to assembly drawing page 2 of 2 detail "J". Unscrew and remove sixteen in number socket cap screws (1-60) from four in number lower yoke/segmented retaining rings (1-50).
- 8.17 Refer to assembly drawing page 2 of 2 detail "J". Remove the lower segmented retaining rings (1-50).
- 8.18 Refer to assembly drawing page 2 of 2 detail "J". Remove lower yoke bushing (1-20).
- NOTE: Because of the "quad-body" construction, the housing group is symmetrical about horizontal centerline. Steps 8.19 through 8.22 will be performed on one side of the housing centerline and then repeated on the other side of the housing centerline.
- 8.19 Remove the yoke pin (1-120). NOTE: Use the 1/2-13UNC X 1/2 inch deep tapped hole in top of the yoke pin for removal.
- 8.20 Remove two in number short yoke rollers (1-90) and one long yoke roller (1-100).
- 8.21 Remove the four in number shoulder bolts (1-80), two bolts from each of two rails (1-70). Remove rails (1-70) from housing (1-10).
- 8.22 Remove yoke pin nut (1-110) from yoke (1-30).
- 8.23 Return to step 8.19 and repeat steps 8.19 thru 8.22 on other side of the housing centerline.
- NOTE: Yoke needs to be rotated to full clockwise or counter clockwise position before yoke removal.
- 8.24 Remove the yoke (1-30) from the housing (1-10).

- 8.25 The following items need not be removed for standard actuator refurbishment: Lifting lug (1-160), lock-washer (1-180), hex head screw (1-170), thread insert (2-170), stop screws (2-180), four in number pipe plugs (1-190) and four in number pipe plugs (1-220).

## 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.

**CAUTION:** Actuator parts that reflect any of the characteristics listed in step 9.3 may require replacement with new parts.

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.

9.4 NOTE: The parts and seals used in the actuator housing assembly, power cylinder and spring cartridge will be assembled using lubricant as identified in step 4.9. 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 INSTALLATION INSTRUCTIONS - The T-seal is a set 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.

9.6 Prime and apply master gasket (510) to all surfaces as indicated on the assembly drawing. Master Gasket should be applied per the manufactures instructions. In general a small continuous bead of sealant should be applied to one of the jointing surfaces. This sealant bead should be applied as close to the edge of jointing surfaces. This sealant bead should also be applied around any unsealed passages that passes through either surfaces to the atmosphere.

## 10.0 HOUSING GROUP RE-ASSEMBLY

10.1 If removed, install four in number pipe plugs (1-190) and four in number pipe plugs (1-220).

10.2 Refer to assembly drawing sheet 2 of 2 Detail "J". Apply lubricant to lower yoke bushing (1-20) and the yoke bore area in the housing.

10.3 Install o-ring seals (4-10) and (4-40) into lower yoke bushing (1-20).

- 10.4 Install lower yoke bushing (1-20) into housing (1-10). Install four in number segment retaining rings (1-50) into the lower yoke bushing and retain with sixteen in number socket cap screws (1-60).

- 10.5 Apply lubricant to the yoke (1-30) trunion in the lower yoke arm area slots.
- 10.6 Install yoke (1-30) into lower yoke bushing, the yoke hub with four tapped holes faces up. Rotate yoke to mid-stroke position.
- NOTE: Because of the "quad-body" construction, the housing group is symmetrical about horizontal centerline. Steps 10.7 through 10.12 will be performed on one side of the housing centerline and then repeated on the other side of the housing centerline.
- 10.7 Apply lubricant to all surfaces of two in number short yoke rollers (1-90) and one each long yoke roller (1-100). Install one short roller (1-90) into the slot of bottom yoke arm.
- 10.8 Apply lubricant to two in number rails (1-70). NOTE: Do not tighten the shoulder bolts at this point. Tie bars with "tipped" ends will be added later to support rail. Until that time, an adapter piece (see Drawing B64899) may be used as temporary replacements. Install inner rail (1-70) by inserting rail into the housing between yoke arms. Retain the inner rail with two in number shoulder bolts (1-80).
- 10.9 Apply lubricant to the upper and lower surfaces of yoke pin nut (1-110) and install between the yoke arms and parallel to rail inside housing.
- 10.10 Install long yoke roller (1-100) into slot of the yoke pin nut (1-110). Align hole of long roller with hole in short roller (1-90).
- 10.11 Apply lubricant to yoke pin (1-120) and install into the long yoke roller and the short yoke rollers.
- 10.12 Install final short yoke roller (1-90).
- 10.13 NOTE: Do not tighten the shoulder bolts. Use rail alignment tool to support rail until tie bars are installed. Install outer rail (1-70) with two in number shoulder bolts (1-80).
- 10.14 Return to step 10.7 and repeat steps 10.7 through 10.13.
- 10.15 Refer to assembly drawing sheet 2 of 2 Detail "E". Apply lubricant to two in number rod bushings (2-50) and install each rod bushing into same side of housing as was removed in step 7.20.
- 10.16 Install two in number piston rods (2-70), through the rod bushing installed in step 10.15, into yoke pin nuts (1-110).
- 10.17 Remove temporary adapter pieces one at a time and install tie bars (2-60) into the side of the housing with the tipped end of the tie bar inserted into the rail (1-70).
- CAUTION: Using the wrench flats on the outboard end, tighten the tie bars until threads bottom out, then back out one half turn.**
- 10.18 After four in number tie bars are installed then tighten eight in number shoulder bolts (1-80).
- 10.19 Rotate yoke (1-30) so that a minimum of piston rods (2-70) are exposed (clockwise for fail close actuators and counter clockwise for fail open actuators).

- 10.20 NOTE: Do not use pipe wrench on this step. Remove any burrs from the flats after tightening. Tighten two in number piston rods (2-70) to a torque of approximately 166 foot pound. Flats are provided on the outer end for wrenching purposes.
- 10.21 Refer to assembly drawing sheet 2 of 2 Detail "H". Position the position indicator drive assembly (1-260) onto the top of the yoke (1-30) with the slot positioned over the hole that was marked in step 8.6. Secure with the socket set screw (1-250).
- 10.22 Refer to assembly drawing sheet 2 of 2 Detail "H". Install the o-ring seal (4-80) over the position indicator drive assembly shaft and down against the flat cover plate.

## 11.0 POWER CYLINDERS RE-ASSEMBLY

NOTE: The actuator is symmetrical about it's centerline. The following steps will be preformed and repeated on one set of power cylinders and then repeated on the second set of power cylinders.

- 11.1 Prepare the mounting surfaces of the inner end cap (2-40) and end cap side of the housing (1-10) per master gasket instructions (reference step 9.6 under General Reassembly).
- 11.2 Refer to assembly drawing sheet 2 of 2 Detail "E". Install the end cap o-ring seal (4-20) into the inner end cap (2-40).

**CAUTION: Install rod seal (5-60) with energizer ring facing outboard side (away from housing).**

- 11.3 Install the rod seal (5-60) into recess (counter bore) provided in inner end cap (2-40).
- 11.4 Install two in number o-ring seals (5-10) into inner end cap (2-40).
- 11.5 Install inner end cap (2-40) by sliding over piston rod , tie bar and rod bushing. NOTE: The pressure port should be above the actuator centerline.

**CAUTION: Exercise extreme care during inner end cap installation in order to prevent damage to the rod seal (5-60).**

NOTE: Perform step 11.6 on 20" cylinders only.

- 11.6 Install two in number socket cap screws (2-160) with stat-o-seal (5-100) through inner end cap and into the thread insert (2-170).
- 11.7 Coat the seal grooves on the piston rod (2-70) with lubricant. Refer to assembly drawing page 2 of 2 Detail "B". Install a matched set of split rings (2-80) into the inner most groove on the piston rod and retain with a retaining ring (2-90).
- 11.8 Refer to assembly drawing page 2 of 2 Detail "B". Install o-ring seal (5-20) onto the innermost o-ring groove in the piston rod.
- 11.9 Refer to assembly drawing page 2 of 2 Detail "C". Install o-ring seal (5-30) into the O.D. seal groove on inner end cap (2-40).

- 11.10 Refer to assembly drawing page 2 of 2 Detail "B". Install two in number o-ring seals (5-10) into tie bar bores in a piston (2-20).



- 11.11 NOTE: When installing cast pistons install with ribbed section of piston is facing away from the housing (1-10). Install piston (2-20) onto piston rod (2-70) and up against the split ring installed in step 11.7.
- 11.12 Refer to assembly drawing page 2 of 2 Detail "B". Install second set of matched split rings (2-80) and ring retainer (2-90).
- 11.13 Refer to assembly drawing page 2 of 2 Detail "C". Install one of the piston T-seals (5-50) into the O.D. groove on the piston (2-20) that was installed in step 11.11.
- 11.14 Apply lubricant to the bore of the cylinder (2-10).

**CAUTION:** Make certain the back-up rings (components of the rod T-seal) are seated into the seal groove. Should the back-up rings or seal member be pinched between the piston and tie bar, the components could be damaged, becoming a potential source of leakage.

**CAUTION:** If needed, when installing the cylinder, hammer on the end of the cylinder only with a non metallic object.

- 11.15 Install cylinder (2-10) over piston and onto the inner end cap (2-40). The cylinder will have to be tilted approximately 15° to 30° degrees across piston to facilitate installation.
- 11.16 Install the o-ring seal (5-10) into cylinder adapter (2-120).
- 11.17 Install two in number oring seals (5-30) onto the O.D. seal groove of cylinder adapter (2-120).
- 11.18 Install rod seal (5-60) into recess (counter-bore) provided in the cylinder adapter (2-120). Install with energizer ring facing the rod bushing (reference to Detail "D").
- 11.19 Install the rod bushing (2-50) into the counter bore in the cylinder adapter (2-120) and retain by installing the retaining ring (2-150).
- 11.20 Install the cylinder adapter (2-120) by sliding over the piston rod and tie bars and into short cylinder (2-10). The cylinder adapter should be install with the rod bushing recess facing out away from the housing.

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

- 11.21 Install two in number tie bar nuts (2-140) on the tie bars (2-60). Torque tighten the tie bar nuts, alternately in 50 ft. lb. increments, until a final torque of 150 ±15 foot pounds lubricated has been achieved.
- 11.22 Install two in number outer tie bars (2-130) into cylinder adapter (2-120). Tighten until threads bottom out, then back out one half-turn.
- 11.23 Coat the grooves on the piston rod (2-70) with lubricant. Refer to assembly drawing page 2 of 2 Detail "B". Install a matched set of split rings (2-80) into the remaining inner most groove of the piston rod and retain with retaining ring (2-90).

- 11.24 Refer to assembly drawing page 2 of 2 Detail "B". Install o-ring seal (5-20) into the seal groove on piston rod (2-70).

- 11.25 Refer to assembly drawing page 2 of 2 Detail "B". Install o-ring seals (5-10) into tie bar bores in the remaining piston (2-20).
- 11.26 NOTE: When installing pistons install with ribbed section of piston is facing away from housing (1-10). Install the remaining piston (2-20) onto piston rod (2-70).
- 11.27 Refer to assembly drawing page 2 of 2 Detail "B". Install a matched set of split rings (2-80) and ring retainer (2-90).
- 11.28 Refer to assembly drawing page 2 of 2 Detail "C". Install a piston T-seal (5-50) into the O.D. groove on the outboard piston (2-20).
- 11.30 Apply lubricant to entire bore of cylinder (2-110).

**CAUTION:** Make certain the back-up rings (components of the rod T-seal) are seated into the seal groove. Should the back-up rings or seal member be pinched between the piston and tie bar, the components could be damaged, becoming a potential source of leakage.

**CAUTION:** If needed, when installing the cylinder, hammer on the end of the cylinder only with a non metallic object.

- 11.30 Install the tandem cylinder (2-110) over the piston and onto cylinder adapter (2-120). Cylinder will have to be tilted approximately 15° to 30° degrees across piston to facilitate installation.
- 11.31 If removed, install stop screw (2-180) into outer end cap (2-30).
- 11.32 Refer to assembly drawing page 2 of 2 Detail "A". Install two in number o-ring seals (5-10) into outer end cap (2-30).
- 11.33 Refer to assembly drawing page 2 of 2 Detail "A". Install o-ring seal (5-30) onto the O.D. seal groove on outer end cap (2-30).
- 11.34 Install outer end cap (2-30) onto tie bars (2-130) and into tandem cylinder (2-110).

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

- 11.35 Install two in number tie bar hex head nuts (2-100) onto outer tie bars (2-130). Torque tighten the tie bar nuts, alternately in 50 ft. lb. increments, until a final torque of 150 ±15 foot pounds lubricated has been achieved.

## 12.0 SPRING CARTRIDGE INSTALLATION

**NOTE:** The actuator is symmetrical about it's centerline. The following steps will be preformed and repeated on one in number spring cartridge and then repeated on the second spring cartridge.

- 12.1 Prepare both mounting surfaces of adapter plate (3-20), inboard end of spring cartridge (3-10) and adapter plate (3-20) side of the housing (1-10) per master gasket instructions (reference step 9.6 under General Reassembly).

- 12.2 Refer to assembly drawing page 2 of 2 Detail "F". Install o-ring seal (4-20) into housing side of adapter plate (3-20).
- 12.3 Install adapter plate (3-20) and retain with socket cap screws (3-30).
- 12.4 If installed remove the safety nuts from the inboard end of spring cartridge (3-10).
- 12.5 Refer to assembly drawing page 2 of 2 Detail "F". Install o-ring seal (6-30) over the SR tie bars and onto spring cartridge inner end.

**CAUTION: While installing the pull rod do not allow the spring cartridge tie bars to be pushed back into the spring cartridge.**

- 12.6 Bring the spring cartridge up to the housing and insert the pull rod through the adapter plate, housing and then screw pull rod into the yoke pin nut (1-110). The pull rod can be rotated by going through the spring cartridge stop screw hole (in the outboard end of the cartridge) with a 1/2 inch square drive extension. Do not tighten the pull rod.
- 12.7 Screw the SR tie bars into the housing (1-10). Tighten each tie bar until the threads bottom out, then back out one half-turn.

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

- 12.8 Use the spring cartridge tie bar nuts to draw spring cartridge firmly against adapter plate (3-20).
- 12.9 Install hex head screws (3-40) through adapter plate (3-20) and into the spring cartridge end plate. Torque tighten to 130 foot pounds lubricated.
- 12.10 Refer to assembly drawing page 2 of 2 Detail "G". Remove the SR tie bar nuts on outboard end of spring cartridge. Removed old thread seals (6-10) and countersunk washers (6-20). Install new thread seals (6-10) and countersunk washers (6-20).

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

- 12.11 Re-install SR tie bar nuts onto the SR tie bars. Torque tighten, SR tie bar nuts, alternately in 50 foot pound increments, until a final torque of 150 ±15 foot pounds lubricated has been achieved.
- 12.12 Install the SR stop screw into the outboard end of the spring cartridge (3-10).
- 12.13 Repeat steps 12.2 thru 12.12 on second spring cartridge.

### **13.0 HOUSING COVER INSTALLATION**

- 13.1 Refer to assembly drawing page 2 of 2 Detail "H". Apply lubricant to upper yoke bushing (1-40). Install o-ring seals (4-10) and (4-40) into upper yoke bushing (1-40).
- 13.2 Refer to assembly drawing page 2 of 2 Detail "H". Install upper yoke bushing (1-40) into housing cover (1-130). Install four in number segment retaining rings (1-50) into the upper

yoke bushing and retain in the housing cover with sixteen in number socket cap screws (1-60).

- 13.3 Remove fifty two in number housing cover screws (1-150) and replace gasket seals (4-50) with new gasket seals.
- 13.4 Prepare the mounting surfaces of housing (1-10) and housing cover (1-130) per master gasket instructions (reference step 9.6 under General Reassembly).
- 13.5 Install housing cover gasket (4-30) onto housing (1-10).
- 13.6 Install housing cover (1-130) onto housing (1-10).
- 13.7 Install housing cover screws (1-150), with new gasket seals, back into housing cover (1-130). Tighten all cover screws, with the exception of the eight cover screws that have hex nuts (1-240).
- 13.8 Make sure that eight cover screws with hex nuts (1-240) are not in contact with housing (1-10). Tighten eight in number hex nuts (1-240).
- 13.9 Refer to assembly drawing page 2 of 2 Detail "H". Install o-ring seal (4-70) into the bottom seal groove inside position indicator cover (1-270).
- 13.10 Refer to assembly drawing page 2 of 2 Detail "H". Install wiper ring (4-60) into the top groove inside position indicator cover (1-270).
- 13.11 Prepare the mounting surfaces of the position indicator cover (1-270) and the housing cover (1-130) per master gasket instructions (reference step 9.6 under General Reassembly).
- 13.12 Refer to assembly drawing page 2 of 2 Detail "H". Install o-ring seal (4-90) into the bottom seal groove on the bottom of position indicator cover (1-270).
- 13.13 Install position indicator cover (1-270), being careful not to damage o-ring seals (4-90), (4-70) and wiper ring (4-60).
- 13.14 Install and tighten position indicator cover screws (1-280) with gasket seals (4-100).
- 13.15 Install position indicator pointer (1-290) into the taped hole in position indicator drive assembly (1-260).

#### **14.0 ACTUATOR TESTING**

- 14.1 Leakage Test - All areas where leakage to atmosphere may occur are to be checked, using a commercial leak testing solution.
- 14.2 Cycle the actuator five time at the nominal operating pressure (NOP) as listed on the actuator name tag or the customers normal actuator supply pressure. If excessive leakage across the pistons is noted, generally a bubble which breaks three seconds or less after starting to form, cycle the actuator five times as this will allow the seals to seek their proper service condition. If excessive leakage across the piston remains, the actuator must be disassembled and the cause of leakage must be determined and corrected.
- 14.3 Simultaneous apply NOP pressure to the pressure port in the inner end cap (2-40) and to the cylinder adapter (2-120) and allow the actuator to stabilize.

- 14.4 Apply a commercial leak testing solution to the following areas:
- 14.4.1 Joint between the inner end cap (2-40) and the cylinder (2-10). This checks cylinder to inner end cap o-ring seal.
  - 14.4.2 The breather port hole in the cylinder adapter (2-120). This checks the inner piston to cylinder (2-10) "T" seal (5-50), the o-ring seal (5-10), (5-20) and rod seal (5-60).
  - 14.4.3 The snubber valve port hole in the housing cover. This checks the o-ring seals that seals the tie bars to the inner end cap. Also checks the rod seal (5-60) that seals the piston rod to the inner end cap.
  - 14.4.4 Joint between the cylinder adapter (2-120) and the tandem cylinder (2-110). This checks the tandem cylinder to cylinder adapter (2-120) o-ring seal.
  - 14.4.5 The breather port hole in the outer end cap (2-30). This checks the outer piston to tandem cylinder, piston to tie bars, and piston to piston rod o-ring seal.
  - 14.4.6 The breather port hole in the cylinder adapter (2-120). This checks the piston rod seal (5-60) and the o-ring seal (5-100) installed in the cylinder adapter (2-120).
  - 14.4.7 Remove pressure from the pressure inlet ports.
- 14.5 If an actuator was disassembled and repaired, the above leakage test must be performed again.

## 15.0 **RETURN TO SERVICE**

- 15.1 Install breathers (2-110) in the outer end cap (2-30) and the cylinder adapter (2-120).
- 15.2 Replace the software components of the snubber valve (1-230). Install the snubber valve (1-230) in the housing cover.
- 15.3 Adjust stop screw (2-180) and spring cartridge stop screw back to settings recorded in section 5.
- 15.4 Refer to assembly drawing page 2 of 2 Detail "A". Install o-ring seals (5-20) into stop nuts (2-190). Install both stop nuts on to stop screws (2-180).
- 15.5 Refer to assembly drawing page 2 of 2 Detail "G". Install o-ring seals (6-40) into SR stop nuts. Install both stop nuts on to SR stop screws.
- 15.6 Go through the pipe plug (2-200) holes, and using a 1/2 inch square drive extension to hold the stop screws (2-180) in place, tighten the stop screw nuts (2-190).
- 15.7 Go through the SR stop nut pipe plug holes, and using a 1/2 inch square drive extension to hold the SR stop screws in place, tighten the SR stop screw nuts.
- 15.8 After the actuator is mounted on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.
- 15.9 The actuator is ready to return to service.





## CHART NO. 1 - ACTUATOR WEIGHTS

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS)**		
	SR1	SR2	SR3
STRQ10412-SRX	8047	7853	7412
STRQ10416-SRX	8318	8124	7684
STRQ10420-SRX	8734	8540	8100

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

## CHART NO. 2 - TOOL STYLE AND WRENCH SIZES

ITEM NO.	WRENCH SIZE	ITEM QTY	LOCATION OR DESCRIPTION	RECOMMENDED WRENCH STYLE
1-60	3/16"	32	Segmented retainer	Hex socket or allen
1-80	5/8"	4	Rail shoulder bolts	Hex socket
1-150	3/4"	52	Cover Screws	Socket
1-170	1-1/8"	16	Lifting lugs hex screws	Socket
1-180	3/16"	1	Pos. Indicator Drive screw	Allen
1-230	7/8"	1	Snubber Valve	Deep socket
1-240	3/4"	8	Cover screws lifting nut	Open end
1-250	1/4"	1	Position Indicator drive	Allen
1-280	9/16"	8	Position Indicator cover	Socket
2-60	3/4"	2	Tie bar flats	Open end or adjustable
2-70	1/2" Sq.	1	Piston rod	Square drive (1)
2-100	2-3/16"	2	Tie bar nuts	Crows foot (1)
2-130	3/4"	2	Outer tie bar flats	Open end or adjustable
2-140	1-5/16"	2	Tandem tie bar nut	Hex socket
2-160	3/4"	1	Inner end cap to housing	Hex socket
2-180	1-1/4"	1	Stop Screw	Open end or adjustable
2-190	2-3/4"	1	Stop nut	Open end or adjustable
2-200	9/16" Sq.	1	1/2" NPT drain plug	Open end or adjustable
3-30	1"	2	Adapter plate to housing	Hex socket
3-40	1-1/8"	4	Adapter plate to SR	Open end or adjustable
None	3/4"	2	SR Tie bars	Open end or adjustable
None	2-3/16"	2	SR Tie bar nut	Deep socket
None	1/2" Sq.	1	SR pull rod	1/2" square drive (1)
None	9/16" Sq.	1	1/2" NPT drain plug	Open end or adjustable

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

ECN	DATE	REV	BY *	DATE
Released	May, 1994	A	COMPILED CHECKED	BC BJ
				31 May 1994 31 May 1994

