

**GH-BETTIS**

**SERVICE INSTRUCTIONS**

**DISASSEMBLY & REASSEMBLY**

**FOR MODELS**

**STR102XX-SR**

**SPRING RETURN SERIES**

**PNEUMATIC ACTUATORS**

PART NUMBER: 074949

REVISION: "A"

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## 1.0 **INTRODUCTION**

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH-Bettis STR102XX-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 GH-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 GH-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. 1 on page 14.

### 3.0 REFERENCE GH-BETTIS MATERIALS

- 3.1 Assembly Drawing 104087 for STR10220-SR1/2/3(CW) fail close actuators.
- 3.2 Assembly Drawing 108420 for STR10220-SR1/2/3(CCW) fail open actuators.
- 3.3 Rail alignment tool drawing part number B-064899.

### 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 GH-Bettis Assembly Drawing and actuator Parts List.
- 4.3 As referenced in this procedure the front of the actuator is: Yoke bore nearest workman. The top of the actuator will be the housing cover (1-130).
- 4.4 When removing seals from seal grooves, use a small standard screwdriver with the sharp edges rounded off or use a commercial seal removing tool.
- 4.5 **CAUTION: Apply the thread sealant per the manufacture's instructions.** Use a non-hardening thread sealant on all pipe threads.
- 4.6 Disassembly should be done in a clean area near a work bench.
- 4.7 Some components of this actuator are very heavy and will require a means of assistance. For actuator approximate weight refer to Chart No. 2 on page 15.
- 4.8 LUBRICATION REQUIREMENTS: Lubricants, other than those listed in steps 4.8.1 and 4.8.2, should not be used without prior written approval of GH-Bettis Product Engineering.
  - 4.8.1 Standard and high temperature service (-20°F to +350°F) use GH-Bettis ESL-5, Kronaplate 100 lubricant. This lubricant is furnished in the GH-Bettis Service/Seal Kit.
  - 4.8.2 Low temperature service (-50°F to +150°F) use Kronaplate 50 lubricant. This lubricant is not furnished in the Service/Seal Kit.
- 4.9 **CAUTION: Actuator operating pressure is not to exceed the maximum operating pressure rating listed on it's name tag.** 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 plug (2-200) and SR cartridge stop screw nut pipe plug.

NOTE: The stop screw (2-180) and SR stop screw have a 1/2" Square X 7/8" deep female 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).
- 5.3 Repeat the stop nut removal procedure used in step 5.2 on the spring cartridge SR stop screw and stop nut.
- 5.4 Measure and record the exposed length of the power cylinder stop screw (2-180) and SR cartridge stop screw.
- 5.5 Remove two in number breathers (2-210). One breather is located in outer end cap (2-30) and the other in the 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 to both cylinder pressure inlet ports. Unscrew and remove the spring cartridge stop screw located on the 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.

- 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 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 UNC 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

- 7.1 Remove two in number tie bar hex nuts (2-100) from the outboard side of outer end cap (2-30).
- 7.2 **CAUTION: Do not damage o-ring groove when removing end cap.** 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). NOTE: Stop screw (2-180) may remain in outer end cap.
- 7.3 Remove tandem cylinder (2-110) from cylinder adapter (2-120). When sliding the cylinder off, 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. 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). Refer to step 7.7 for disassembly of 24" and larger fabricated pistons equipped with piston bushings (2-220).
- 7.7 24" inch and larger fabricated piston disassembly (refer to assembly drawing sheet 2 of 2 detail "K").
- 7.7.1 Remove the retaining rings (2-230) from the piston.
- 7.7.2 NOTE: The piston bushing should be replaced each time the actuator is refurbished (refer to section 1 for recommended service interval). Remove the piston bushing (2-220) from the piston. NOTE: The GH-Bettis Service Kit should contain new piston bushings.
- 7.8 NOTE: Keep the split rings in matched sets. Remove second set of split rings (2-80) and split ring retainer (2-90).
- 7.9 Remove o-ring seal (5-20) from outboard end of piston rod (2-70).
- 7.10 Unscrew and remove two in number tie bar nuts (2-140) from the outboard side of cylinder adapter (2-120).
- 7.11 Remove cylinder adapter (2-120) from piston rod (2-70).
- 7.12 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).
- 7.13 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).
- 7.14 **CAUTION: Do not use pipe wrench to remove tie bars.** Remove tie bars (2-60) from housing (1-10). 1/2 inch hex socket is on outboard end for wrench placement.

- 7.15 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).
- 7.16 Remove the inner piston (2-20) from the piston rod (2-70). Refer to step 7.7 for disassembly of 24" inch and larger pistons equipped with piston bushings (2-220).
- 7.17 NOTE: Keep the split rings in matched sets. Remove the final set of split rings (2-80) and split ring retainer (2-90).
- 7.18 **CAUTION: Do not use pipe wrench to remove the piston rod.** NOTE: Flats on outboard end of tie bars are provided for wrench placement. Remove piston rod (2-70) from yoke pin nut (1-110).
- 7.19 Remove socket cap screws (2-160) and stat-o-seal (5-100) from inner end cap (2-40) and remove inner end cap (2-40).
- 7.20 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 the spring cartridge side of actuator.
- 8.2 Remove adapter plate (3-20).
- 8.3 Remove position indicator pin (1-290) from the 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 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 the yoke (1-30).
- 8.8 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 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).
- 8.13 Cover pins (1-140) should not be removed unless damaged.

- 8.14 Remove upper yoke bushing (1-40).
- 8.15 Position the housing in such a manner so as to give access to the lower yoke bushing (1-20) (refer to assembly drawing page 2 of 2 detail "J").
- 8.16 Unscrew and remove sixteen in number socket cap screws (1-60) from four in number lower yoke/segmented retaining rings (1-50).
- 8.17 Remove the lower segmented retaining rings (1-50).
- 8.18 Remove lower yoke bushing (1-20).
- 8.19 Remove the yoke pin (1-120).
- 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 the rails (1-70) from the housing (1-10).
- 8.22 Remove the yoke pin nut (1-110) from the yoke (1-30).
- 8.23 Remove the yoke (1-30) from the housing (1-10).
- 8.24 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 4.8. 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 or this procedure.

## **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 the lower yoke bushing (1-20).
- 10.4 Install lower yoke bushing (1-20) into the 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.
- 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 Apply lubricant to one in number rod bushing (2-50) and install into the same side of housing as was removed in step 7.20.
- 10.15 NOTE: Do not tighten. Use wrench flats on outboard end. Install piston rod (2-70) into yoke pin nut.
- 10.16 **CAUTION: Tighten the tie bars until threads bottom out, then back out one half-turn.** 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 being inserted into the rail (1-70).
- 10.17 After both tie bars are installed then tighten all four shoulder bolts (1-80).
- 10.18 Rotate the yoke (1-30) so that a minimum of the piston rod (2-70) is exposed (clockwise for fail close actuators and counterclockwise for fail open actuators).
- 10.19 NOTE: Do not use pipe wrench on this step. Remove any burrs from the flats after tightening. Tighten piston rod (2-70) to a torque of approximately 2000 inch pounds (166 ft. lbs.). Flats are provided on the outer end for wrenching purposes.
- 10.20 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).
- 10.21 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**

- 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 Install the end cap o-ring seal (4-20) into the inner end cap (2-40).
- 11.3 **CAUTION: Install with energizer ring facing outboard side (away from housing).** 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 the inner end cap.
- 11.5 NOTE: The pressure port should be above the actuator centerline. **CAUTION: Exercise extreme care during installation in order to prevent damage to the rod seal (5-60).** Install inner end cap (2-40) by sliding over piston rod , tie bar and rod bushing.
- 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. 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 Install o-ring seal (5-20) onto the innermost o-ring groove in the piston rod.
- 11.9 Install o-ring seal (5-30) into the O.D. seal groove on inner end cap (2-40).

- 11.10 24" inch and larger Fabricated piston pre-assembly (refer to the assembly drawing sheet 2 of 2 detail "K"). Pre-assemble two in number Pistons (2-20).
- 11.10.1 Install o-ring seal (5-90) into O.D. seal groove on piston bushing (2-220).
- 11.10.2 Install piston bushings (2-220) into pistons (2-20) and retain with retaining rings (2-230).
- 11.11 Install two o-ring seals (5-10) into tie bar bores in a piston (2-20).
- 11.12 NOTE: When installing cast pistons install with ribbed section of piston is facing away from the housing (1-10). When installing fabricated pistons, 24" inch diameter and larger, make certain that the smaller diameter piston plate is facing away from housing (1-10). Install piston (2-20) onto piston rod (2-70) and up against the split ring installed in step 11.7.
- 11.13 Install second set of matched split rings (2-80) and ring retainer (2-90).
- 11.14 Install one of the piston T-seals (5-50) into the O.D. groove on the piston (2-20) that was installed in step 11.12.
- 11.15 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.

- 11.16 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.
- 11.17 Install the o-ring seal (5-10) into cylinder adapter (2-120).
- 11.18 Install two in number o-ring seals (5-30) onto the O.D. seal groove of cylinder adapter (2-120).
- 11.19 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").
- 11.20 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).
- 11.21 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.

- 11.22 Install the 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.

- 11.23 Install the outer tie bars (2-130) into the cylinder adapter (2-120). Tighten until threads bottom out, then back out one half-turn.
- 11.24 Coat the grooves on the piston rod (2-70) with lubricant. Install a matched set of split rings (2-80) into the remaining inner most groove of the piston rod and retain with the retaining ring (2-90).
- 11.25 Install o-ring seal (5-20) into the seal groove on piston rod (2-70).
- 11.26 Install o-ring seals (5-10) into tie bar bores in the remaining piston (2-20).
- 11.27 NOTE: When installing cast pistons install with ribbed section of piston is facing away from the housing (1-10). When installing fabricated pistons, 24" inch diameter and larger, make certain that the smaller diameter piston plate is facing away from housing (1-10). Install the remaining piston (2-20) onto piston rod (2-70).
- 11.28 Install a matched set of split rings (2-80) and ring retainer (2-90).
- 11.29 Install a piston T-seal (5-50) into the O.D. groove on the outboard piston (2-20).
- 11.30 Apply lubricant to 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.

- 11.31 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.
- 11.32 If removed, install stop screw (2-180) into outer end cap.
- 11.33 Install two in number o-ring seals (5-10) in the outer end cap.
- 11.34 Install o-ring seal (5-30) onto the O.D. seal groove on outer end cap (2-30).
- 11.35 Install the 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.

- 11.36 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

- 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 Install o-ring seal (4-20) into the housing side of adapter plate (3-20).
- 12.3 Install the 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 the spring cartridge (3-10).
- 12.5 Install the o-ring seal (6-30) over the SR tie bars and onto the 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 Insert the tie bars into the tapped holes in the housing (1-10). Screw the SR tie bars into the housing (1-10). Tighten each tie bar until the threads bottom out, then back out one quarter-turn.
- 12.8 **CAUTION: While the nuts are being tightened, do not allow the tie bars to turn.** Use the spring cartridge tie bar nuts to draw the spring cartridge firmly against the adapter plate (3-20).
- 12.9 Install the hex head screws (3-40) through the adapter plate (3-20) and into the spring cartridge end plate. Torque tighten to 130 foot pounds lubricated.
- 12.10 Remove the SR tie bar nuts on outboard end of the 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.** Re-install the SR tie bar nuts onto the SR tie bars. Torque, the SR tie bar nuts, alternately in 50 ft. lb increments, until a final torque of 150 ±15 foot pounds has been achieved.
- 12.11 Install the SR stop screw into the outboard end of the spring cartridge (3-10).

## 13.0 HOUSING COVER INSTALLATION

- 13.1 Apply lubricant to the upper yoke bushing (1-40). Install o-ring seals (4-10) and (4-40) into the upper yoke bushing (1-40).
- 13.2 Install upper yoke bushing (1-40) into the 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 the gasket seals (4-50) with new gasket seals.
- 13.4 Prepare the mounting surfaces of the housing (1-10) and the housing cover (1-130) per master gasket instructions (reference step 9.6 under General Reassembly).
- 13.5 Install the housing cover gasket (4-30) onto the housing (1-10).
- 13.6 Install the housing cover (1-130) onto the housing (1-10).
- 13.7 Install the housing cover screws (1-150), with the new gasket seals, back into the housing cover. Tighten all cover screws, with the exception of the eight cover screws that have hex nuts (1-240).
- 13.8 Make sure that the eight cover screws with hex nuts (1-240) are not in contact with the housing. Tighten the eight hex nuts (1-240).
- 13.9 Install the o-ring seal (4-70) into the bottom seal groove inside the position indicator cover (1-270).
- 13.10 Install the wiper ring (4-60) into the top groove inside the 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 Install the o-ring seal (4-90) into the bottom seal groove on the bottom of the position indicator cover (1-270).
- 13.13 Install the position indicator cover (1-270), being careful not to damage the o-ring seals (4-90), (4-70) and wiper ring (4-60).
- 13.14 Install and tighten the position indicator cover screws (1-280) with gasket seals (4-100).
- 13.15 Install the position indicator pointer (1-290) into the taped hole in the 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 Install o-ring seals (5-20) into the stop nut (2-190) and spring cartridge stop nut. Install both stop nuts on to the stop screw (2-180) and SR stop screw.
- 15.5 Go through the pipe plug (2-200) hole, and using a 1/2 inch square drive extension to hold the stop screw (2-180) in place, tighten the stop screw nut (2-190). Go through the SR stop nut pipe plug hole, and using a 1/2 inch square drive extension to hold the SR stop screw in place, tighten the SR stop screw nut.
- 15.6 After the actuator is mounted on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.
- 15.7 The actuator is ready to return to service.

**CHART NO. 1 - TOOL STYLE AND WRENCH SIZE**

ITEM NO.	WRENCH SIZE	ITEM QTY.	DESCRIPTION OR LOCATION	RECOMMENDED WRENCH STYLE
1-60	3/16"	32	Socket Cap Screws (1/4-20UNC x 1/2")	Hex Socket or Allen
1-80	5/8"	4	Shoulder Bolts	Hex Socket
1-150	3/4"	52	Hex Cap Screws (1/2-13UNC x 1-1/4")	Socket
1-170	1-1/8"	16	Hex Cap Screws (3/4-10UNC x 1-3/4")	Socket
1-190	7/16"	4	Pipe Plug (3/8 NPT)	Allen
1-230	7/8"	1	Snubber Valve	Deep Socket
1-240	3/4"	8	Standard Hex Nut (1/2-13UNC)	Open End
1-250	1/4"	1	Socket Set Screw (1/2-13UNC x 1")	Allen
1-280	9/16"	8	Hex Cap Screws (3/8-16UNC x 3/4")	Socket
2-60	1/2"	2	Tie Bar	Allen
2-70	1-3/4"	1	Piston rod	Crows Foot (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 Nuts	Hex Socket
2-160	3/4"	2	Socket Cap Screws (1-8UNC x 2-1/2")	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	Pipe Plug (1/2 NPT)	Open End or Adjustable
2-210	1"	2	Breather Assembly	Adjustable
3-30	1"	2	Socket Cap Screws(1.375-12UNF x 2.25")	Hex Socket
3-40	1-1/8"	4	Socket Cap Screws (3/4-10UNC x 3-3/4")	Open End or Adjustable
None	3/4"	2	SR Tie Bars	Open End or Adjustable
None	2-3/16"	2	SR Tie Bar Nuts	Deep Socket
None	1/2" Sq.	1	SR Pull Rod	Square Male Drive (1)
None	9/16" Sq.	1	Pipe Plug	Open End or Adjustable

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

## CHART NO. 2 - ACTUATOR WEIGHTS

<b>ACTUATOR MODEL</b>	<b>APPROXIMATE WEIGHT (POUNDS) **</b>		
	<b><u>SR1</u></b>	<b><u>SR2</u></b>	<b><u>SR3</u></b>
STR10212-SRX	4562	4465	4245
STR10216-SRX	4698	4601	4381
STR10220-SRX	4906	4809	4589
STR10224-SRX	4953	4856	4636

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

<b>ECN</b>	<b>DATE</b>	<b>REV</b>	<b>BY *</b>	<b>DATE</b>	
Released	November 8, 1993	A	COMPILED	BC	11 November 1993
			CHECKED	BJ	11 November 1993
			APPROVED	RMM	11 November 1993

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