

BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY & REASSEMBLY

FOR MODELS

STR100X-SR

SPRING RETURN SERIES

HYDRAULIC ACTUATORS

PART NUMBER: 115484

REVISION: "A"

DATE: July, 1994

1.0 **INTRODUCTION**

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis STR100X-SR Spring Return Hydraulic series 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 hydraulic pressure has been removed from the actuator. 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 and non-hardening thread sealant.

2.2 Tools - All tools are American Standard inch. Two each medium screwdrivers, small standard screwdriver with corners rounded, putty knife, rubber or leather mallet and torque wrench (up to 5,000 in.lbs.). For recommended tool list refer to Chart No. 1 on page 13.

3.0 **BETTIS REFERENCE MATERIALS**

3.1 Assembly Drawing 111779 for STR100X-SR(CW) fail clockwise actuators.

3.2 Assembly Drawing XXXXXX* for STR100X-SR(CCW) fail counter clockwise actuators.

* Part number not assigned at release date of this procedure.

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 and Actuator Parts Lists.

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. NOTE: Disassembly of actuator should be done in a clean area. For actuator approximate weight refer to Chart No. 2 on page 14.

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. Make reference marks at the Spring Cartridge/Housing interface and the Hydraulic Cylinder/Housing interface to ensure that the assemblies are correctly returned to their original places.

4.7 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.

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 - HOUSING AND SPRING CARTRIDGE: 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. ESL-5 is contained 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 contained in the Low Temperature Service/Seal Kit.

4.10 FLUID REQUIREMENTS: For use in the hydraulic power cylinder (2-10). The following listed fluids are recommended fluids only and does not limit the use of other hydraulic fluids compatible with supplied seals and coatings.

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

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

5.0 GENERAL DISASSEMBLY

5.1 Remove stop screw nut pipe plugs (2-130) and SR cartridge stop screw nut pipe plugs.

NOTE: The stop screw (2-90) and SR stop screw have a 1/2" Square X 7/8" deep hole in their outboard end for wrenching purposes.

5.2 Hold stop screw (2-90) in place by accessing stop screw (2-90) through pipe plug hole in the end of stop screw nut (2-100). Using a 1/2 inch square drive extension hold stop screw (2-90) in place, remove stop nut (2-100).

5.3 Hold spring cartridge stop screw in place by accessing SR stop screw through the pipe plug hole in end of SR stop nut. Using a 1/2 inch square drive extension hold SR stop screw in place, remove SR stop nut.

5.4 Measure and record the exposed length of power cylinder stop screw (2-90) and spring cartridge stop screw.

5.5 Using the minimum hydraulic pressure, pressurize the actuator sufficient to move the pull rod away from the stop screw mounted in the end of the spring cartridge assembly.

5.6 Remove the spring cartridge "pre-load" as follows: Unscrew and remove spring cartridge stop screw located in spring cartridge (3-10).

5.7 Slowly release the hydraulic pressure and allow the actuator to return to the fail position.

WARNING: Ensure that all operating pressure is removed from the hydraulic cylinder.

5.8 Drain hydraulic fluid from cylinder assembly (2-10) by opening bleed valves (2-120) and then removing cylinder drain pipe plugs (2-110). One drain plug is located on outboard end of cylinder and the other on the inboard end of cylinder.

5.9 Record the orientation and location of bleed valves (2-120), pipe plugs (2-110), and pressure ports in cylinder assembly (2-10).

5.10 Remove stop screw (2-90) from cylinder (2-10).

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

6.0 SPRING CARTRIDGE REMOVAL

CAUTION: The spring cartridge "pre-load" must be removed before the actuator is disassembled. The spring cartridge "pre-load" is removed when steps 5.5 through 5.7 are completed.

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.

- 6.1 Unscrew the spring cartridge pull rod from yoke pin nut (1-110). NOTE: 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.
- 6.2 Remove hex head screws (3-40) from adapter plate (3-20).
- 6.3 Loosen spring cartridge tie bar nuts one turn.
- 6.4 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 housing (1-10).

NOTE: 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 open as the spring is pre-loaded with the end caps and cylinder welded around the loaded spring.

7.0 HYDRAULIC POWER CYLINDER ASSEMBLY REMOVAL

- 7.1 Using a 1/2 inch square drive extension through the outer end of cylinder assembly (2-10), unscrew the piston rod (2-40) from the yoke pin nut (1-110).
 - 7.2 Use suitable lifting equipment to support the cylinder assembly.
 - 7.3 Around the large flange of the cylinder assembly (2-10) are eight socket cap screws. Four socket cap screws are item numbered (2-160) and four are item numbered (2-170). To identify four socket cap screws (2-160), use the top of the cylinder flange as a starting point, go clockwise around the cylinder flange to one o'clock, four o'clock, seven o'clock and ten o'clock these screws will be item (2-160).
- NOTE: Ensure that lifting equipment is taking the full weight of hydraulic cylinder assembly as it will be free once four socket cap screws (2-160) have been removed.
- 7.4 Remove the four socket cap screws (2-160). Refer to step 7.3 for (2-160) item identification.
 - 7.5 Move the hydraulic cylinder assembly away from housing (1-10) and place in a safe place ensuring that piston rod (2-40) is not damaged.
 - 7.6 Remove two guide Screws (2-140) and remove the Adapter (2-30).

- 7.7 Remove the cylinder assembly to a clean area for disassembly. See section 8.0 for hydraulic cylinder assembly dismantling procedure.

8.0 HYDRAULIC POWER CYLINDER ASSEMBLY DISASSEMBLY

- 8.1 Remove four socket cap screws (2-170). Remove inner end cap (2-20) from the cylinder (2-10)
- 8.2 Carefully withdraw piston rod (2-40) and piston (2-50) from cylinder (2-10).
- 8.3 NOTE: Keep the split rings in matched sets. Remove the split ring retainer (2-80) and the split rings (2-70) from the outboard side of piston (2-50).
- 8.4 Remove piston (2-50) from piston rod (2-40).
- 8.5 NOTE: Keep the split rings in matched sets. Remove inboard split ring retainer (2-80) and split rings (2-70).
- 8.6 Refer to assembly drawing page 2 of 2 detail "A". Remove retaining ring (2-150) from inner end cap (2-20).
- 8.7 Refer to assembly drawing page 2 of 2 detail "A". Remove piston rod bushing (2-60) from inner end cap (2-20).

9.0 HOUSING GROUP DISASSEMBLY

- 9.1 Remove two socket cap screws (3-30) from adapter plate (3-20). NOTE: These items are located on spring cartridge side of actuator.
 - 9.2 Remove adapter plate (3-20) from housing (1-10).
- NOTE: As a reference for steps 9.3, 9.4, and 9.5 refer to assembly drawing page 2 of 2 section A-A.
- 9.3 Remove position indicator pin (1-290) from position indicator drive assembly (1-260).
 - 9.4 Unscrew and remove eight hex cap screws (1-280) with gasket seals (4-100) from position indicator cover (1-270).
 - 9.5 Remove position indicator cover (1-270) from cover (1-130).
 - 9.6 Refer to assembly drawing page 2 of 2 detail "E". NOTE: Mark the hole, on yoke (1-30), that socket set screw (1-250) is removed from. Unscrew and remove set screw (1-250) from position indicator drive assembly (1-260).
 - 9.7 Refer to assembly drawing page 2 of 2 section AA. Remove position indicator drive assembly (1-260) from the top of yoke (1-30).
 - 9.8 Refer to assembly drawing page 2 of 2 detail "E". Unscrew and remove sixteen socket cap screws (1-60) from four upper yoke/segmented retaining rings (1-50).
 - 9.9 Refer to assembly drawing page 2 of 2 detail "E". Remove upper segmented retaining rings (1-50).
 - 9.10 NOTE: The eight cover screws (1-150), that have hex nut (1-240) on them, are not to be removed. Remove the remaining forty four cover screws (1-150) and gasket seals (4-50).

- 9.11 To help in removing housing cover (1-130) loosen eight hex nuts (1-240). Alternately rotate eight raised cover screws (1-150) clockwise until the cover is clear of cover pins (1-140).
- 9.12 Remove cover (1-130) from housing (1-10).
- 9.13 Cover pins (1-140) should not be removed unless damaged.
- 9.14 Refer to assembly drawing page 2 of 2 detail "E". Remove upper yoke bushing (1-40).
- NOTE: As a reference for steps 9.15, 9.16, 9.17, and 9.18 refer to assembly drawing page 2 of 2 detail "F".
- 9.15 Position housing (1-10) in such a manner so as to give access to the lower yoke bushing (1-20).
- 9.16 Unscrew and remove sixteen socket cap screws (1-60) from four lower yoke/segmented retaining rings (1-50).
- 9.17 Remove lower segmented retaining rings (1-50).
- 9.18 Remove lower yoke bushing (1-20).
- 9.19 Refer to assembly drawing page 2 of 2 section A-A. Remove the yoke pin (1-120). NOTE: Use the 1/2-13UNC X 1/2 inch deep tapped hole on top of the yoke pin for removal.
- 9.20 Refer to assembly drawing page 2 of 2 section A-A. Remove one short yoke roller (1-90) and one long yoke roller (1-100).
- 9.21 Refer to assembly drawing page 2 of 2 detail "C". Remove four shoulder bolts (1-80), two bolts from each of two rails (1-70).
- 9.22 Remove rails (1-70) from housing (1-10).
- 9.23 Remove yoke pin nut (1-110) from yoke (1-30).
- NOTE: Yoke needs to be rotated to full clockwise or counter clockwise position before yoke removal.
- 9.24 Remove the yoke (1-30) from the housing (1-10).
- 9.25 The following items need not be removed for standard actuator refurbishment: Lifting lug (1-160), lock-washer (1-180), hex head screw (1-170), four pipe plugs (1-190) and four pipe plugs (1-220).

10.0 GENERAL RE-ASSEMBLY

CAUTION: Only new seals, that are still within the seals expectant shelf life, should be install back into actuator being refurbished.

- 10.1 Remove and discard all seals and gaskets.
- 10.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.

- 10.3 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 and piston rod must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

CAUTION: Actuator parts that reflect any of the characteristics listed in step 10.3 may require replacement with new parts.

- 10.4 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.

NOTE: The parts and seals used in the actuator housing assembly will be assembled using lubricant as identified in step 4.9. The parts and seals used in the cylinder assembly (2-10) will be assembled using the hydraulic fluid identified in step 4.10.

- 10.5 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.

11.0 CENTER HOUSING GROUP RE-ASSEMBLY

- 11.1 If removed, install four pipe plugs (1-190) and four pipe plugs (1-220).

NOTE: As a reference for steps 11.2, 11.3, and 11.4 refer to assembly drawing page 2 of 2 detail "F".

- 11.2 Apply lubricant to lower yoke bushing (1-20) and the yoke bore area in the housing.
- 11.3 Install o-ring seals (4-10) and (4-20) into the lower yoke bushing (1-20).
- 11.4 Install lower yoke bushing (1-20) into housing (1-10). Install four segment retaining rings (1-50) into the lower yoke bushing and retain with sixteen socket cap screws (1-60).
- 11.5 Apply lubricant to yoke (1-30) trunion and in the lower yoke arm slots.
- 11.6 Install yoke (1-30) into lower yoke bushing, the yoke hub with four tapped holes faces up. Rotate yoke to mid-stroke position.
- 11.7 Apply lubricant to one rail (1-70). Install lubricated rail (1-70) by inserting rail into the housing between yoke arms and toward the center area of housing (1-10). Align the inner rail (1-70) by installing a guide screw (2-140) through each side of housing (1-10) and into ends of rail (1-70). Retain inner rail with two shoulder bolts (1-80).
- 11.8 Apply lubricant to all surfaces of two short yoke rollers (1-90) and one long yoke roller (1-100). Install one short roller (1-90) into slot of bottom yoke arm.
- 11.9 Apply lubricant to the upper and lower surfaces of yoke pin nut (1-110). Install yoke pin nut (1-110) between the yoke arms and parallel to rail inside housing (1-10).

- 11.10 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).
- 11.11 Apply lubricant to yoke pin (1-120) and install into the long yoke roller and the short yoke rollers.
- 11.12 Install short yoke roller (1-90) into slot of top yoke arm.
- 11.13 Apply lubricant to one rail (1-70). Install lubricated rail (1-70) by inserting rail into the housing between yoke arms and toward the outside area of housing (1-10). Align rail (1-70) by installing a guide screw (2-140) through each side of housing (1-10) and into ends of outer rail (1-70). Retain the rail with two shoulder bolts (1-80).
- 11.14 After rails (1-70) are installed then torque tighten four shoulder bolts (1-80) to 150 foot pounds lubricated.
- 11.15 Remove four guide screws (2-140).
- 11.16 Prepare the mounting surfaces of adapter plate (2-30) and adapter plate side of housing (1-10) per master gasket instructions (refer to step 10.5 under General Reassembly).
- 11.17 Install o-ring seal (4-40) to adapter plate (2-30).
- 11.18 Replace adapter plate (2-30) to housing (1-10) and retain in place with guide screws (2-140). Torque tighten guide screws (2-140) to 250 foot pounds lubricated.
- 11.19 Refer to assembly drawing page 2 of 2 section A-A. Install position indicator drive assembly (1-260) onto top of yoke (1-30) with the slot positioned over the hole that was marked in step 9.6.
- 11.20 Secure position indicator drive assembly (1-260) onto top of yoke (1-30) with socket set screw (1-250).
- 11.21 Refer to assembly drawing page 2 of 2 Detail "E". Install o-ring seal (4-80) over position indicator drive assembly shaft and down against the flat cover plate.

12.0 HYDRAULIC POWER CYLINDER ASSEMBLY RE-ASSEMBLY

NOTE: Where the procedure indicates to "coat or apply fluid", use hydraulic fluid for lubricating the part being installed.

- 12.1 Apply fluid to o-ring seal (5-40) and install on piston rod (2-40).
- 12.2 Install a set of matched split rings (2-70) into the inboard groove of piston rod (2-40) and retain with retaining ring (2-80).
- 12.3 Install piston (2-50) onto piston rod (2-40) and over the set of split rings.
- 12.4 Install a set of matched split rings (2-70) into the outboard groove and retain with retaining ring (2-80).

12.5 Refer to assembly drawing page 2 of 2 detail "B". Apply fluid and install two piston seals (5-10), ensuring that they are both facing outward and are back to back.

12.6 Refer to assembly drawing page 2 of 2 detail "B". For pistons with back-up rings, install two back-up rings (5-90).

NOTE: Model STR1008-SR does not use back-up rings (5-90) with the piston seals (5-10).

12.7 Refer to assembly drawing page 2 of 2 detail "B". Install two piston slide bushings (5-20).

12.8 Apply fluid to the entire cylinder bore of cylinder assembly (2-10).

12.9 Carefully insert the piston/piston rod assembly into the cylinder assembly (2-10).

NOTE: As a reference for steps 12.10, 12.11, 12.12 and 12.13 refer to assembly drawing page 2 of 2 detail "A".

12.10 Apply fluid and install two rod seals (5-50). Install one rod seal, lip first, into the recess provided in the inner end cap (2-20).

12.11 Install the second rod seal (5-50) into rod bushing (2-60), with the rod seal lip facing the rod bushing short side.

12.12 Apply fluid and install one o-ring seal (5-30) into inner end cap (2-20).

12.13 Install rod bushing (2-60) into inner end cap (2-20) and retain with retaining ring (2-150).

NOTE: Make sure that both rod seals (5-50) have their lips facing outward and are back to back.

12.14 Apply fluid and install one o-ring seal (5-70) onto inner end cap (2-20).

12.15 Prepare the mounting surface of the cylinder assembly flange and both mounting surfaces of inner end cap (2-20) per master gasket instructions (reference step 10.5 under General Reassembly).

12.16 Install four stat-o-seals (5-110) onto four socket cap screws (2-160).

12.17 Carefully install the inner end cap (2-20) over the piston rod (2-40) and into the open end of cylinder assembly (2-10). Install four socket cap screws (2-170) with gasket seals (5-110) and torque tighten to 240 foot pounds lubricated.

NOTE: Bettis does not require any special hydraulic fluid cleaning standard for this actuator. If required by customers facility, flush the hydraulic cylinder assembly to meet that facilities standard. Seal all openings after flushing.

13.0 HYDRAULIC POWER CYLINDER ASSEMBLY REPLACEMENT

NOTE: Ensure that the previously marked housing positions of the spring cartridge and hydraulic cylinder are observed when replacing the hydraulic cylinder assemblies.

13.1 Install o-ring seal (5-80) into the outboard side of inner end cap (2-30).

- 13.2 Attach suitable lifting equipment to the hydraulic cylinder assembly so that it is evenly balanced when lifted.
- 13.3 Guide the piston rod (2-40) through the adapter plate (2-30) bore and locate into the yoke pin nut (1-110). Screw the piston rod (2-40) into the yoke pin nut (1-110).

NOTE: A 1/2" square drive socket is provided in the end of the piston rod (2-90).

- 13.4 Torque tighten piston rod (2-40) to 200 foot pounds lubricated.
- 13.5 Align the hydraulic cylinder assembly parts to the correct orientation as marked in step 4.6, section 4.0.
- 13.6 Replace four socket cap screws (2-160) complete with gasket seals (5-110), torque tighten to 240 foot pounds lubricated.
- 13.7 Insert a suitable instrument or metal rod into stop screw (2-90) aperture, hole, in the cylinder (2-10). Carefully push yoke pin nut (1-110) until it rests against housing (1-10), adjacent to the location where spring cartridge assemblies (3-10) will be installed.
- 13.8 Replace stop screw (2-90) into the outer end of cylinder (2-10).
- 13.9 Re-set stop screw (2-90) back to the setting recorded in step 5.4.
- 13.10 Install o-ring seal (5-100) into stop screw nut (2-100). Replace stop screw nut (2-100) to stop screw (2-90).
- 13.11 Go through the pipe plug hole, and using a 1/2 inch square drive extension to hold stop screws (2-90) in place, tighten stop screw nuts (2-100).
- 13.12 Install pipe plug (2-130) into cylinder (2-10) stop screw nut.

14.0 SPRING CARTRIDGE INSTALLATION

- 14.1 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 10.5 under General Reassembly).
- 14.2 Install o-ring seal (4-40) into housing side of adapter plate (3-20).
- 14.3 Install adapter plate (3-20) and retain with two socket cap screws (3-30).
- 14.4 Remove the safety nuts from the inboard end of spring cartridge (3-10).
- 14.5 Install o-ring seal (6-30) over the spring cartridge 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.

- 14.6 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. Torque tighten SR pull rod to 166 ±8 foot pounds lubricated.
- 14.7 Screw the spring cartridge tie bars into housing (1-10). Tighten tie bars until the threads bottom out, then back out one half-turn.
- 14.8 Use the spring cartridge tie bar nuts to draw spring cartridge firmly against adapter plate (3-20).
- 14.9 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.
- 14.10 Refer to assembly drawing page 2 of 2 Detail "D". Remove the spring cartridge tie bar nuts on outboard end of spring cartridge (3-10). 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.

- 14.11 Re-install spring cartridge tie bar nuts onto the spring cartridge tie bars. Torque tighten, spring cartridge tie bar nuts, alternately in 50 foot pound increments, until a final torque of 150 ±15 foot pounds lubricated has been achieved.

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

- 14.12 Install spring cartridge stop screw into outboard end of spring cartridge (3-10).
- 14.13 After spring cartridge is installed set spring cartridge stop screw back to the setting recorded in step 5.4.
- 14.14 Refer to assembly drawing page 2 of 2 Detail "D". Install O-ring Seal (6-40) into spring cartridge stop screw nut. Replace spring cartridge stop screw nut to the spring cartridge stop screws.
- 14.15 Go through SR stop nut pipe plug hole, and using a 1/2 inch square drive extension to hold the SR stop screws in place, tighten the SR stop screw nuts.
- 14.16 Install spring cartridge pipe plug into spring cartridge stop screw nut.

15.0 HOUSING COVER INSTALLATION

- 15.1 Refer to assembly drawing page 2 of 2 Detail "E". Apply lubricant to upper yoke bushing (1-40). Install o-ring seals (4-10) and (4-20) into upper yoke bushing (1-40).
- 15.2 Refer to assembly drawing page 2 of 2 Detail "E". Install upper yoke bushing (1-40) into housing cover (1-130). Install four segment retaining rings (1-50) into the upper yoke bushing and retain in the housing cover with sixteen socket cap screws (1-60).

- 15.3 Remove fifty two housing cover screws (1-150) and replace gasket seals (4-50) with new gasket seals.
- 15.4 Prepare the mounting surfaces of housing (1-10) and housing cover (1-130) per master gasket instructions (reference step 10.5 under General Reassembly).
- 15.5 Install housing cover gasket (4-30) onto housing (1-10).
- 15.6 Install housing cover (1-130) onto housing (1-10).
- 15.7 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).
- 15.8 Make sure that eight cover screws with hex nuts (1-240) are not in contact with housing (1-10). Tighten eight hex nuts (1-240).
- 15.9 Refer to assembly drawing page 2 of 2 Detail "E". Install o-ring seal (4-70) into the bottom seal groove inside position indicator cover (1-270).
- 15.10 Refer to assembly drawing page 2 of 2 Detail "E". Install wiper ring (4-60) into the top groove inside position indicator cover (1-270).
- 15.11 Prepare the mounting surfaces of the position indicator cover (1-270) and the housing cover (1-130) per master gasket instructions (reference step 10.5 under General Reassembly).
- 15.12 Refer to assembly drawing page 2 of 2 Detail "E". Install o-ring seal (4-90) into the bottom seal groove on the bottom of position indicator cover (1-270).
- 15.13 Refer to assembly drawing page 2 of 2 section A-A. Install position indicator cover (1-270), being careful not to damage o-ring seals (4-90), (4-70) and wiper ring (4-60).
- 15.14 Install gasket seals (4-100) onto hex head screws (1-280).
- 15.15 Refer to assembly drawing page 2 of 2 section A-A. Install and tighten hex head screws (1-280) with gasket seals (4-100).
- 15.16 Refer to assembly drawing page 2 of 2 section A-A. Install position indicator pin (1-290) into the taped hole in position indicator drive assembly (1-260).

16.0 RETURN TO SERVICE

- 16.1 Replace the software components of the snubber valve (1-230). Install the snubber valve (1-230) in the housing cover.
- 16.2 After the actuator is mounted on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.
- 16.3 The actuator is ready to return to service.

CHART NO. 1 - TOOL STYLE AND WRENCH SIZES

ITEM NO.	WRENCH SIZE	ITEM QTY	LOCATION OR DESCRIPTION	RECOMMENDED WRENCH STYLE
1-60	3/16"	32	Socket cap screws	Hex socket or allen
1-80	5/8"	4	Shoulder bolts	Hex socket
1-150	3/4"	52	Hex cap screws	Socket
1-170	1-1/8"	16	Hex cap screws	Socket
1-190	7/16" Sq.	4	Pipe plug, 3/8" NPT	Open end or adjustable
1-220	9/16" Sq.	4	Pipe plug, 1/2" NPT	Open end or adjustable
1-230	7/8"	1	Snubber Assembly	Deep socket
1-240	3/4"	8	Standard hex nut	Open end
1-250	3/8"	1	Socket set screw	Allen
1-280	9/16"	8	Hex cap screw	Socket
2-40	1/2" Sq.	1	Piston rod	Square drive (1)
2-90	1-1/4"	1	Stop screw	Open end or adjustable
2-100	2-3/4"	1	Stop screw nut	Open end or adjustable
2-110	9/32" Sq.	2	Pipe plug, 1/8" NPT	Open end or adjustable
2-120	13/32"	2	Bleed valve	Open end or box
2-130	9/16" Sq.	1	Pipe plug, 1/2" NPT	Open end or adjustable
2-140	1"	2	Guide screw	Allen
2-160	3/4"	4	Socket cap screw	Hex socket
2-170	3/4"	4	Socket cap screw	Hex socket
3-30	1"	2	Socket cap screw	Hex socket
3-40	1-1/8"	4	Hex cap screw	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	SR pipe plug, 1/2" NPT	Open end or adjustable
(1) No alternate recommended or wrench placement not provided.				

CHART NO. 2 - ACTUATOR WEIGHTS

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS) **		
	SR1	SR2	SR3
STR1005-SRX	-----	4250	4030
STR1006-SRX	4380	4283	4063
STR1007-SRX	4461	4364	4144
STR1008-SRX	4500	4403	4183
STR1010-SRX	4695	4598	4378
** Weights listed for each model are for bare actuators without valve mounting accessories.			

ECN	DATE	REV	BY *	DATE
Released	July, 1994	A	COMPILED	19 July 1994
			CHECKED	19 July 1994
			APPROVED	19 July 1994

* Signatures on file Bettis Actuator & Controls, Waller, Texas