BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY & REASSEMBLY

FOR MODELS

ST80X-SR2, ST80X-SR3

ST80X-SR4 AND ST80X-SR5

SERIES SPRING RETURN

HYDRAULIC ACTUATORS

PART NUMBER: 116077

REVISION: "A"

DATE: September, 1994

1.0 INTRODUCTION

1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis ST80X-SR2, ST80X-SR3, ST80X-SR4 and ST80X-SR5 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 dismounted 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, commercial leak testing solution, two each 1-8 UNC hex nuts, Loctite 242 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. 2 on page 12.

3.0 REFERENCE BETTIS MATERIALS

3.1 Assembly Drawing 104967 for ST80X-SR(CW) fail clockwise actuators.

4.0 GENERAL DETAILS

WARNING: This procedure is only to be used to disassemble the ST80X-SR2, -SR3, -SR4 and -SR5 series actuators. DO NOT USE THIS PROCEDURE FOR DISASSEMBLY OF ST80X-SR1 ACTUATORS. Refer to procedure part number 116076 for ST80X-SR1 actuators.

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 This procedure is written using the stop screw side of the housing (1-10) as a reference and this side will be considered the front of the actuator. The housing cover (1-20) will be the top of the actuator.

4.4 To help at re-assembly mark or tag all mating surfaces.

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

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

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

4.7 Disassembly of actuator should be done in a clean area on a work bench.

4.8 Some components of this actuator are very heavy and will require a means of assistance. For actuator approximate weight refer to Chart No. 1 on page 11.

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 (-20°F to +350°F) use Dexron II Automatic Transmission Fluid.

4.10.2 Low temperature service (-50°F to +150°F) use Exxon Univis J13 Hydraulic Fluid.

5.0 GENERAL DISASSEMBLY

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

5.1 Mark or tag stop screw (1-60) left and right. Measure the exposed length of right and left stop screws (1-60) and record each before loosening for removal. The stop screws will be removed later in this procedure.

5.2 To ensure correct re-assembly; that is, with hydraulic cylinder and spring cartridge in same location on housing as was, mark right or left and mark mating surfaces.

5.3 Record the orientation and location of bleed valves (2-100), pipe plugs (2-90), and pressure ports in cylinder assembly (2-10) mounting flange.

5.4 Remove snubber valves (1-190) from housing cover (1-20) and housing (1-10).

6.0 SPRING CARTRIDGE REMOVAL

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

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

SR2 = 722 lbs. SR3 = 667 lbs. SR4 = 686 lbs. SR5 = 478 lbs.

WARNING: Do not remove the spring cartridge (4-10) until the actuator has the spring "pre-load" removed.

6.1 When the spring cartridge is installed on the actuator the spring is under compression.

6.2 **Remove spring cartridge "pre-load" as follows:** Apply sufficient operating pressure to the pressure inlet port located in the cylinder assembly (2-10) outer end cap. Loosen both stop screw nuts (1-120). Unscrew and remove both stop screws (1-60). Remove the pressure from the pressure inlet port.

6.3 Remove socket cap screw (4-60), lockwasher (4-50), and nut retainer (4-40) between large hex nut on outboard end of spring cartridge (4-10).

6.4 Refer to assembly drawing page 2 of 2 Detail "A". Remove hex cap screws (4-100) from spring cartridge adapter plate (4-80).

6.5 Loosen the two large hex nuts on the outboard end of spring cartridge (4-10). Unscrew tie bars until the spring cartridge is free from spring cartridge adapter plate (4-80). Flats are provided on outboard end of the tie bars for wrench placement. Care should be taken so that the tie bars are not pulled back into the spring cartridge.

6.6 Remove spring cartridge assembly (4-10) clear of spring cartridge adapter plate (4-80) and push rod (4-20). To keep from inadvertently pulling the tie bars back into the spring cartridge use two each one inch -8 UNC hex nuts and install them on to the spring cartridge tie bars. Place spring cartridge (4-10) to one side.

7.0 HYDRAULIC POWER CYLINDER ASSEMBLY REMOVAL

7.1 Using a 1/2 inch square drive extension through outer end of cylinder assembly (2-10), unscrew piston rod (2-80) from yoke pin nut (1-30).

7.2 Use suitable lifting equipment to support cylinder assembly (2-10).

7.3 Around the large flange of cylinder assembly (2-10) are eight socket cap screws. To identify four socket cap screws (2-120), 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 (2-120). Remove four socket cap screws (2-120).

7.4 As socket cap screws (2-120) are removed, the cylinder assembly can be removed from cylinder adapter (2-130). Remove the cylinder assembly to a clean area for disassembly. See section 8.0 for hydraulic cylinder disassembly procedure.

8.0 HYDRAULIC POWER CYLINDER ASSEMBLY DISASSEMBLY

8.1 Drain any residual hydraulic fluid from cylinder assembly (2-10) by opening bleed valves (2-100) and then removing cylinder pipe plugs (2-90).

8.2 Remove four socket cap screws (2-110) from cylinder assembly (2-10).

8.3 Remove cylinder inner end cap (2-20) from cylinder assembly (2-10).

8.4 Carefully withdraw piston rod (2-80) and piston (2-30) from cylinder assembly (2-10).

8.5 Remove split ring retainer (2-70) and split rings (2-60) from the outboard side of piston (2-30). NOTE: Keep the split rings in matched sets.

8.6 Remove piston (2-30) from piston rod (2-80).

8.7 Remove inboard split ring retainer (2-70) and split rings (2-60). NOTE: Keep the split rings in matched sets.

8.8 Refer to assembly drawing page 2 of 2 Detail "B". Remove retaining ring (2-50) from inner end cap (2-20).

8.9 Refer to assembly drawing page 2 of 2 Detail "B". Remove rod bushing (2-40) from inner end cap (2-20).

9.0 HOUSING DISASSEMBLY

NOTE: Mark/record spring cartridge adapter plate (4-80) and adapter plate (2-130) locations before proceeding to steps 9.1 through 9.4.

9.1 Remove two socket cap screws (2-140) from adapter plate (2-130). NOTE: The two socket cap screws (2-140) extend from adapter plate (2-130), through housing (1-10) and screw into spring cartridge adapter plate (4-80).

9.2 Remove adapter plate (2-130) from housing (1-10).

9.3 Remove four socket cap screws (4-90) from spring cartridge adapter plate (4-80).

9.4 Remove spring cartridge adapter plate (4-80).

9.5 Unscrew and remove push rod (4-20) from yoke pin nut (1-30) and remove push rod from housing (1-10).

9.6 Refer to assembly drawing page 2 of 2 Section A-A. Remove position indicator pin (1-170) from position indicator drive (1-230).

NOTE: Mark and record the orientation of position indicator drive (1-230) relative to the top of yoke (1-160).

9.7 Unscrew and remove hex cap screws (1-240) with gasket seals (3-100) from position indicator cover (1-210).

9.8 Remove position indicator cover (1-210) from housing cover (1-20).

9.9 Refer to assembly drawing page 2 of 2 detail "D". NOTE: Mark the hole that set screw (1-180) is in. Unscrew and remove set screw (1-180) from position indicator drive (1-230)/yoke (1-160).

9.10 Remove position indicator drive (1-230) from top of yoke (1-160).

9.11 Remove fourteen hex cap screws (1-90) with gasket seals (3-100).

9.12 Remove housing cover (1-20) from housing (1-10). NOTE: The cover will have a very tight fit. It is not necessary to remove cover pins (1-130) from the housing cover (1-20).

9.13 Refer to assembly drawing page 2 of 2 detail "D". Remove two upper yoke rollers (1-50) and two upper roller spacers (1-110) from the top of yoke pin (1-40).

9.14 Remove yoke pin (1-40) from the yoke pin nut (1-30).

9.15 Remove yoke pin nut (1-30) from between the yoke arms.

9.16 Remove lower two yoke rollers (1-50) and lower two roller spacers (1-110) from the bottom of yoke (1-169) and housing (1-10).

9.17 The yoke (1-160) can now be removed by lifting it out from the housing cavity.

9.18 It is not necessary to remove yoke bushings (1-200) from housing cover (1-20) or housing (1-10) unless these items are being replaced due to damage or wear. It is not necessary to remove two pipe plugs (1-80), from the housing and position indicator cover (1-210), to service the actuator.

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 above listed characteristics must be replaced 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 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 pipe plugs (1-80) into housing (1-10) and position indicator cover (1-210).

11.2 Coat one o-ring seal (3-50) with lubricant and install into bottom of housing (1-10).

11.3 If yoke bushings (1-200) were removed then install one in the housing yoke bore and one in the housing cover yoke bore.

11.4 Inside the housing (1-10) apply lubricant to the track and yoke bore. Arrange or position housing (1-10) with yoke bore nearest the worker.

11.5 Apply lubricant to slots in the upper and lower arms of yoke (1-160).

11.6 Apply lubricant to yoke (1-160) lower bearing surface and install into housing (1-10) as follows: Position the yoke arms to approximately 45° degree position in either direction and install yoke (1-160) into housing (1-10). NOTE: The hub with tapped holes faces up. Rotate the yoke arms back to approximately mid-stroke (center) position.

11.7 Apply lubricant to all surfaces of all four yoke pin rollers (1-50) and four roller spacers (1-110). Place one yoke pin roller in the track in bottom of housing (1-10) and position it under yoke arm slot in the lower yoke arm. Place one roller spacer (1-110) on top of lower yoke roller (1-50). Place a second yoke pin roller on top of the roller spacer in the yoke arm slot in lower yoke arm. Place a second roller spacer (1-110) on to of second yoke pin roller (1-50) and align holes in roller spacer and yoke pin rollers.

11.8 Coat the upper and lower surfaces of the yoke pin nut (1-30) with lubricant and insert into position between the yoke arms, parallel to the track in the housing. Align the yoke pin hole with the yoke pin rollers.

11.9 Lubricate yoke pin (1-40) and insert through the yoke pin nut (1-30) and the two yoke pin rollers (1-50).

CAUTION: Verify that yoke pin (1-40) passed through or engaged two lower yoke pin rollers (1-50) and two lower roller spacers (1-110).

11.10 Install one roller spacer on top of yoke pin nut (1-30) then install the third yoke pin roller (1-50). Place the last roller spacer on top of the third yoke roller (1-50). Place the fourth and final yoke pin roller on to the yoke pin. NOTE: The top yoke pin roller will remain above the upper yoke arm and will engage the track in the cover when cover (1-20) is installed.

11.11 Lubricate push rod (4-20) and install into the left side of housing (1-10) for fail clockwise (CW) actuators or into right side of housing for fail counter clockwise (CCW) actuators.

CAUTION: Do not tighten push rod (4-20) until the housing cover is installed later in the procedure.

11.12 Prepare both mounting surfaces of the cylinder adapter (2-130), spring cartridge adapter plate (4-80) and both ends of housing (1-10) per master gasket instructions (reference note 5 on assembly drawing).

11.13 Install one o-ring seal (3-10) into the housing side of spring cartridge adapter plate (4-80).

11.14 Install one o-ring seal (3-10) into the housing side of cylinder adapter (2-130).

11.15 Install spring cartridge adapter plate (4-80) on to the end of housing (1-10) as recorded in steps 9.1 through 9.4.

11.16 Retain spring cartridge adapter plate (4-80) with four socket cap screws (4-90).

11.17 Install cylinder adapter (2-130) on to the end of housing (1-10) as recorded in steps 9.1 through 9.4.

11.18 Retain with two socket cap screws (2-140). NOTE: The two socket cap screws (2-140) extend from adapter plate (2-130) through housing (1-10) and screw into spring cartridge adapter plate (4-80).

11.19 Torque tighten two socket cap screws (2-140) to 368 ±5 foot pounds lubricated.

11.20 Position the position indicator drive (1-230) onto the top of the yoke (1-160) with the slot positioned over the hole that was marked in note after step 9.6. Secure with the set screw (1-180).

11.21 Refer to assembly drawing page 2 of 2 detail "E". Install o-ring seal (3-150) over the position indicator drive shaft and down against the flat of the position indicator drive (1-230).

11.22 Prepare the mounting surfaces of housing cover (1-20) and housing (1-10) per master gasket instructions (reference note 5 on the assembly drawing).

11.23 Place housing cover gasket (3-20) onto master gasket prepared housing (1-10).

11.24 Apply lubricant to the upper bearing surface of yoke (1-160).

11.25 Apply lubricant to the yoke bore and track in housing cover (1-20).

11.26 Install the remaining o-ring seal (3-50) into cover (1-20).

11.27 Install housing cover (1-20), being careful not to damage gasket (3-20) or o-ring (3-50).

11.28 Install seal gaskets (3-100) on fourteen hex cap screws (1-90).

11.29 Install fourteen cover screws (1-90) with seal gaskets (3-100). NOTE: Leave hex cap screws finger tight, do not tighten.

11.30 NOTE: Do this step only if you have pulled cover pins (1-130) or if you are replacing the cover pins. Drive four pins (1-130) through cover (1-20) and into housing (1-10) until the pins are flush with cover (1-20). The pins (1-130) are deeply grooved at one end and tapering to a smooth diameter at the other end. The pins should be installed smooth end first.

11.31 Tighten cover screws (1-90).

11.32 Tighten push rod (4-20) securely with a strap wrench.

11.33 Place thread seals (3-110), countersunk washers (3-120) and jam nuts (1-120) on stop screws (1-60). Install the stop screws into the housing, making sure the stop screws marked in step 5.13 are installed into the same stop screw holes as they where removed from.

11.34 Prepare the mounting surface of position indicator cover (1-210) and housing cover (1-20) per master gasket instructions (reference step 10.5).

11.35 Install o-ring seal (3-140) into the bottom seal groove inside position indicator cover (1-210).

11.36 Install wiper ring (3-160) into the top groove inside position indicator cover (1-210).

11.37 Install o-ring seal (3-170) into bottom seal groove on the bottom of position indicator cover (1-210).

11.38 Install position indicator cover (1-210), being careful not to damage o-ring seals (3-140), (3-170) and wiper ring (3-160).

11.39 Install six new gasket seals (3-100) on to hex cap screws (1-240).

11.40 Install and tighten hex cap screws (1-240) with gasket seals (3-100).

11.41 Install position indicator pointer (1-170) into the taped hole in position indicator drive assembly (1-230).

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 (3-40) and install on piston rod (2-80).

12.2 Install a set of matched split rings (2-60) into the inboard groove of piston rod (2-80) and retain with retaining ring (2-70).

12.3 Install piston (2-30) onto piston rod (2-80) and over the set of split rings.

12.4 Install a set of matched split rings (2-60) into the outboard piston rod groove and retain with retaining ring (2-70).

12.5 Apply fluid and install two polypak seals (3-90) into piston (2-30) outer diameter seal grooves. NOTE: Ensuring that the polypak seals are both facing outward and are back to back.

12.6 Install two back-up rings (3-200) in to piston (2-30) outer diameter seal grooves. NOTE Install back up rings as shown on assembly drawing sheet 2 of 2 Detail "C".

12.7 Install two piston wear rings (3-80) into piston (2-30) outer diameter.

12.8 Apply fluid to the cylinder wall of cylinder assembly (2-10) and then carefully insert the piston assembly into the cylinder assembly.

12.9 Refer to assembly drawing page 2 of 2 Detail "B". Apply fluid and install two polypak seals (3-70). Install one polypak seal, lip first, into the recess provided in inner end cap (2-20). Install the second polypak, lip facing rod bushing short side, into rod bushing (2-40).

12.10 Refer to assembly drawing page 2 of 2 Detail "B". Apply fluid and install o-ring seals (3-60), (3-180) and (3-230) to inner end cap (2-20).

12.11 NOTE: Make sure that both polypaks (3-70) have their lips facing outward and are back to back. Install rod bushing (2-40) into inner end cap (2-20) and retain with retaining ring (2-50).

12.12 Prepare the mounting surface of the cylinder assembly flange and both mounting surfaces of inner end cap (2-20) per master gasket instructions (reference section 10 step 10.5).

12.13 Install four stat-o-seals (3-240) on to four socket cap screws (2-110).

12.14 Carefully install inner end cap (2-20) over piston rod (2-80) and into the open end of cylinder assembly (2-10). Install four socket cap screws (2-110) and torque tighten to 240 ft lbs 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

13.1 Apply loctite - 242 to external threads on the piston rod (2-80). NOTE: loctite cure time is ten to thirty minutes.

13.2 Install four stat-o-seals (3-240) on to four socket cap screws (2-120).

13.3 NOTE: Refer to step 5.3 for correct location for cylinder assembly flange. Carefully install piston rod (2-80) through cylinder adapter (2-130) and bring cylinder assembly (2-10), with inner end cap (2-20), up to cylinder adapter (2-130). Align the four cylinder assembly flange "through holes" with the tapped holes in cylinder adapter (2-130).

13.4 Retain cylinder assembly (2-10) with four socket cap screws (2-120) with stat-o-seals (3-240).

13.5 Torque tighten socket cap screws (2-120) to 150 foot pounds lubricated.

13.6 Using a 1/2 inch square drive extension through the SAE port in the outer end of cylinder assembly (2-10), screw piston rod (2-80) into yoke pin nut (1-30).

13.7 Torque tighten piston rod (2-80) to 150 foot pounds.

14.0 SPRING CARTRIDGE INSTALLATION

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

14.1 Prepare interfacing surfaces of the spring cartridge inboard end and the outboard side of spring cartridge adapter plate (4-80) per master gasket instructions (reference section 10 step 10.5).

14.2 On the outboard side of spring cartridge adapter plate (4-80) install o-ring seal (3-190) into the seal groove.

14.3 Remove the two nuts, installed in section 6, from the inboard end of the spring cartridge tie bars.

14.4 Place spring cartridge (4-10) onto push rod (4-20) and align spring cartridge tie bars with the holes in spring cartridge adapter plate (4-80).

CAUTION: When installing the SR do not allow the spring cartridge tie bars to be pushed back into the cartridge.

14.6 Insert and screw the SR tie bars into the mating holes in the SR adapter plate (4-80). Tighten each tie bar until the threads bottom out, then back out one quarter-turn.

14.7 Install and screw four hex cap screws (4-100) through spring cartridge adapter plate (4-80) and into holes in spring cartridge (4-10) inboard end.

14.8 Use the spring cartridge tie bar nuts to draw the spring cartridge firmly against the adapter plate (4-80).

14.9 Remove the tie bar nuts on outboard end of spring cartridge (4-10) and install new thread seals (3-210) and countersunk washers (3-220). Torque alternately, in 50 foot pound increments, until a final torque of 110 ± 11 foot pounds lubricated has been achieved.

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

14.10 Install nut retainer (4-40), securing in place with retainer screw (4-60) and lockwasher (4-50). NOTE: It is necessary that the flats on the SR tie bar hex nuts be aligned and parallel before the nut retainer can be installed.

15.0 RETURN TO SERVICE

15.1 Replace the software components of the snubber valves (1-190) and then install the snubbers in the housing cover port and the housing port.

15.2 Adjust both stop screws (1-60) back to settings recorded in section 5 under General Disassembly.

15.3 Tighten both stop nuts (1-120) securely, while holding stop screw (1-60).

15.4 After the actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.

CHART NO. 1 - ACTUATOR WEIGHTS

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS)** SR2	SR3	SR4	SR5
ST804.0-SRX	1277	1222	1241	1032
ST805.0-SRX	1322	1267	1286	1077
ST806.0-SRX	1371	1316	1335	1126
ST807.0-SRX	1434	1379	1398	1189

** 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	QTY	LOCATION	RECOMMENDED WRENCH STYLE
1-60	15/16"	2	Stop Screw	Open end or adjustable
1-80	7/16"	2	Pipe plug	open end or adjustable
1-90	9/16"	14	Cover Screws	Socket
1-120	2"	2	Stop Screw nut	Box end (1)
1-180	1/8"	1	Socket set screw	Allen
1-190	7/8"	1	Snubber	Deep socket
1-240	9/16"	6	Hex cap screws	Socket
2-80	1/2"	1	Piston rod	male square socket
2-90	9/32"	2	Pipe plug	Open end or adjustable
2-100	13/32"	2	1/8 " bleed valve	Open or box end (1)
2-110	1/2"	4	Socket cap screws	Allen
2-120	1/2"	4	Socket cap screws	Allen
2-140	3/4"	2	Socket cap screws	Allen
2-150	5/8"	1	Pipe plug	Open end or adjustable
None	1-5/8"	2	SR Tie bar nut	Deep socket
4-20	(1)	1	Push rod	Strap wrench (1)
4-60	3/16"	1	Nut retainer screw	Allen
4-90	1/2"	4	SR adapter screws	Allen
4-100	15/16"	4	SR adapter screws	Socket

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

ECN	DATE	REV		BY *	DATE
Released	September, 1994	A	COMPILED	Bill Cornelius	23 September 1994
			CHECKED	Bill Cornelius	23 September 1994
			APPROVED	Robert McEver	23 September 1994

* **Signatures on file Waller, Texas**