

GH BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY AND REASSEMBLY

FOR THE FOLLOWING MODELS

T3XX-SRX AND T4XX-SRX

SPRING RETURN SERIES

ACTUATORS

PART NUMBER: SE-004

DATE: October, 1992

REPLACES: SERVICE-004 dated April, 1992

1.0 **INTRODUCTION**

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on GH Bettis T3XX-SRX, T3XX-SRX-M3, T3XX-SRX-M3HW, T4XX-SRX, T4XX-SRX-M3, and T4XX-SRX-M3HW series actuators. When the actuator model number has "-S" as a suffix then the actuator is special and may have some differences that are not included in this procedure.
- 1.2 The maximum recommended service interval for this series of actuator is five years. Storage time is counted as part of the service interval.
- 1.3 This procedure is written with the understanding that the actuator has been removed from the valve, the air or power gas has been removed from the power cylinders and all piping and accessories mounted on the actuator have been removed.

**COMPLETE ACTUATOR REFURBISHMENT
REQUIRES THAT THE ACTUATOR BE
DISMOUNTED FROM THE VALVE**

2.0 **SUPPORT ITEMS AND TOOLS**

- 2.1 Support Items - Service/Seal Kit, razor sharp cutting instrument, commercial leak testing solution, and non-hardening thread sealant, two each 7/8-9 UNC hex nuts.
- 2.2 Tools - All tools are American Standard inch. Two each medium screwdriver, small standard screwdriver with corners rounded, putty knife, strap wrench, 3/16" in punch, rubber or leather mallet, and torque wrench (up to 5,000 in. lbs.). For recommended tool list refer to page 12 of 14.

3.0 **REFERENCE GH BETTIS MATERIALS**

- 3.1 Assembly Drawing 036040 for T3XX-SRX(CW)-M3/HW failing close actuators.
- 3.2 Assembly Drawing 048025 for T3XX-SRX(CCW)-M3/HW failing open actuators.
- 3.3 Exploded Detail Drawing 063406 for T3XX-SRX actuators.
- 3.4 Exploded Detail Drawing 065598 for T3XX-SRX-M3/HW actuators.
- 3.5 Assembly Drawing 035730 for T4XX-SRX(CW)-M3/HW failing close actuators.
- 3.6 Assembly Drawing 048027 for T4XX-SRX(CCW)-M3/HW failing open actuators.
- 3.7 Exploded Detail Drawing 063409 for T4XX-SRX actuators.
- 3.8 Exploded Detail Drawing 065599 for T4XX-SRX-M3/HW actuators.

4.0 **GENERAL**

- 4.1 Numbers in parentheses, () indicate the bubble number (reference number) used on the GH Bettis Assembly Drawing, Exploded Detail Drawing, and Actuator Parts Lists.
- 4.2 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.
- 4.3 Refer to Chart 1 of this instruction for approximate actuator weights.
- 4.4 To ensure correct re-assembly; that is, with spring on same end of housing as was, mark or tag right or left and mark 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 manufactures instructions.**
- 4.7 Disassembly of actuator should be done in a clean area on a work bench.
- 4.8 LUBRICATION REQUIREMENTS:
- 4.8.1 Standard and high temperature service (20°F to 350°F) use GH Bettis ESL-5 (Kronaplate 100). ESL-5 is contained in the GH Bettis Service/Seal Kit.
- 4.8.2 Low temperature service (50°F to 150°F) use Kronaplate 50. This lubricant is not in the Service/Seal Kit. For distributors of Kronaplate 50 lubricant in your area, call 800-428-7802.
- 4.9 It is a good practice to operate the actuator with the nominal operating pressure (NOP), as listed on the actuator nametag or the pressure used by the customer to operate the actuator during normal operation, before starting the general disassembly of the actuator. Notate and record any abnormal symptoms such as jerky or erratic operation. **NOTE: Pressure is not to exceed the maximum operating pressure rating listed on the name tag.**

5.0 GENERAL DISASSEMBLY

- 5.1 If an M3 Jackscrew is mounted in the power cylinder (2-10), the M3 (2-210) should not contact the end of the piston rod (2-170).
- 5.2 For actuator equipped with M3HW jackscrew override with handwheel option, remove hex nut (8-30), lockwasher (8-20), and handwheel (8-10).
- 5.3 Measure the exposed length of right and left stop screws (1-60) and record each before loosening for removal.
- 5.4 Remove the socket cap screws (1-180) from position indicator (1-170) yoke weather cover (3-130) and remove position indicator/yoke weather cover.

6.0 SPRING CARTRIDGE REMOVAL

- 6.1 **WARNING:** Under no circumstances should the spring cartridge be cut apart, as the spring is pre-loaded and the spring cartridge welded together.
- 6.2 When the spring cartridge is installed on the actuator the spring is under compression. **DO NOT** remove the spring cartridge until the actuator has the stop screw "pre-load" removed.
- 6.3 Remove spring cartridge stop screw "pre-load" as follows: Apply nominal operating pressure to the pressure inlet port located in the outer end cap (2-30). Locate the stop screw (1-60) that is on the opposite side of the housing from the spring cartridge (4-10). Loosen jam nut (1-120). Unscrew and remove stop screw (1-60). Remove pressure from the pressure inlet port.
- 6.4 Remove socket head screw (4-60), lockwasher (4-50) and nut retainer (4-40) from the end of the spring cartridge assembly (4-10).
- 6.5 Alternately loosen the two large hex nuts on the outboard end of the spring cartridge (4-10). These nuts are welded to the tie bars that extend through the spring cartridge and screw into the actuator housing (1-10). Unscrew the tie bars until the spring cartridge is free from the housing. Care should be taken so that the tie bars are not pulled back into the spring cartridge.

- 6.6 To keep from inadvertently pulling the tie bars back into the spring cartridge use 7/8 inch 9 UNC hex nuts and screw them on to the spring cartridge tie bars. Place the spring cartridge to one side.

7.0 PRESSURE CYLINDER DISASSEMBLY

- 7.1 Remove breather (4-30) from inner end cap (2-40).
- 7.2 **OUTER END CAP REMOVAL** Outer end cap with M3 use steps 7.3 thru 7.5. Outer end cap without M3 use steps 7.6.
- 7.3 Loosen and thread jam nut (2-130) all the way back to the welded nut.
- 7.4 Loosen and remove socket cap screws (2-200) from jackscrew adapter (2-190).
- 7.5 Thread the M3 adapter (2-190) out until clear of hex nuts (2-90), now go to step 7.7.
- 7.6 Outer end cap (2-30) without M3 or M3HW jackscrew override will be disassembled as follows: Unscrew and remove socket head cap screw (2-120), lockwasher (2-110), and nut retainer (2-100).
- 7.7 Remove heavy hex nuts (2-90) from tie bars (2-60).
- 7.8 Remove outer end cap (2-30). The fit between the cylinder (2-10) and the outer end cap is very tight. Break the outer end cap free by tapping with a breaker bar on the lip provided on the end cap.
- 7.9 Pry inner end cap (2-40) away from the housing (1-10). Break the inner end cap free from the cylinder (2-10) by tapping with a breaker bar on the lip provided on the end cap.
- 7.10 Remove the cylinder (2-10). **NOTE: When sliding the cylinder off of the piston, tilt the cylinder to the piston rod, approximately 15 to 30 degrees.**
- 7.11 Unscrew the tie bars (2-60) from the housing (1-10). Flats are provided on the outboard end of the tie bars for wrench placement. Pull the tie bars out of the housing and inner end cap far enough to expose the o-ring seals (2-30). **CAUTION: DO NOT use a pipe wrench on the tie bars as it will mark the bar and cause seal leakage.**
- 7.12 Remove the o-ring seals from the inboard end of tie bars (2-60). Then remove the tie bars (2-20) by pulling the tie bars out and thru the piston (2-20).
- 7.13 Remove the split ring retainer (2-80) and the split ring (2-70) from the outboard side of the piston (2-20). **CAUTION: Keep the split rings in matched sets.**
- 7.14 Remove the piston (2-20) from the piston rod (2-170). The piston will slide off of the piston rod.
- 7.15 Remove the inboard split ring retainer (2-80) and the split ring (2-70) from the piston rod (2-170). **CAUTION: Keep the split rings in matched sets.**
- 7.16 Remove the inner end cap (2-40) by sliding it off over the piston rod (2-170).

8.0 JACKSCREW DISASSEMBLY

- 8.1 For actuators equipped with M3 or M3HW jackscrew, use procedure starting at step 8.2, 8.8 or 8.13.

- 8.2 **1971 THRU 1980 M3/M3HW DISASSEMBLY** - This series of actuators may or may not have provision for retaining the M3 in the actuator end cap. If your actuator does not have a spirol pin (3-180) and flat washer (3-190) or a hex cap screw, then ignore steps 8.4 and 8.5 or any reference to these items in this procedure.
- 8.3 Using a 3/16 inch pin punch, drive out and remove pin (3-180).
- 8.4 Remove washer (3-190).
- 8.5 Remove jackscrew assembly (2-210) by pulling out of outer end cap (2-30).
- 8.6 Thread the jackscrew adapter (2-190) off of jackscrew assembly (2-210).
- 8.7 Thread the nut seal (2-130) off of jackscrew assembly (2-210).
- 8.8 **1981 thru 1990 M3/M3HW THRUST BEARING DISASSEMBLY** - Using a 1/4 inch pin punch, drive out and remove pin from bearing on end of jackscrew assembly (2-210).
- 8.9 Remove bearing assembly from jackscrew assembly (2-210).
- 8.10 Remove jackscrew assembly (2-210) by pulling it out of outer end cap (2-30).
- 8.11 Thread the jackscrew adapter (2-190) off of jackscrew assembly (2-210).
- 8.12 Thread the nut seal (2-130) off of jackscrew assembly (2-210).
- 8.13 **AFTER 1990 M3/M3HW THRUST BEARING DISASSEMBLY** - Using a pin punch, drive out and remove pin from jackscrew stud and slotted thrust nut.
- 8.14 Thread the slotted thrust nut against the timken bearing until the bearing retainer and the retaining ring are forced off of the end of the M3 stud. Then continue to thread the slotted thrust nut until the bearing and the nut are removed from the M3 stud.
- 8.15 Remove the M3 stud from the outer end cap (2-30).

9.0 HOUSING GROUP DISASSEMBLY

- 9.1 Unscrew push rod (4-20) from yoke pin nut (1-30) and remove from housing (1-10).
- 9.2 Unscrew piston rod (2-170) from yoke pin nut (1-30) and remove, including the rod bushing (2-50). Flats are provided on the outboard end of the piston rod for wrench placement. **DO NOT** use a pipe wrench on the piston rod as it will mark the rod and cause seal leakage.
- 9.3 Remove snubber (1-190) from housing cover (1-20).
- 9.4 Remove cover screws (1-90) and gasket seals (3-100).
- 9.5 Remove the housing cover (1-20). **NOTE: This piece will have a very tight fit.**
- 9.6 Remove the top two yoke rollers (1-50) from the top of the yoke pin (1-40).
- 9.7 Remove yoke pin (1-40).
- 9.8 Remove yoke pin nut (1-30).
- 9.9 Remove bottom two yoke rollers (1-50) from the housing.

- 9.10 Remove the yoke (1-160) by lifting it from the housing.
- 9.11 Remove the remaining stop screw (1-60), jam nut (1-120), and seal gasket (3-110). Be sure to mark or identify this stop screw.
- 9.12 It is not necessary to remove the drain pipe plug (1-80) or grease fittings (1-70) to service the actuator.

10.0 GENERAL RE-ASSEMBLY

- 10.1 Remove and discard all old seals and gaskets. All parts should be cleaned to remove all dirt and other foreign material prior to inspection.
- 10.2 All parts should be thoroughly inspected. Particular attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding motion. Sealing surfaces must be free of deep scratches, pitting, corrosion and blistering or flaking coating.
- 10.3 Coat all surfaces of actuators moving parts with lubricant.
- 10.4 Coat all seals with lubricant, before installing into grooves, also both sides of gaskets.
- 10.5 T Seal Set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.
 - 10.5.1 Install the T-seal into the seal groove.
 - 10.5.2 Install a back-up ring on each side of the T-seal.
 - 10.5.3 When installing the back-up rings, do not align the skive-cuts.
 - 10.5.4 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.

11.0 CENTER HOUSING GROUP RE-ASSEMBLY

- 11.1 Inside the housing (1-10) apply lubricant to the tracks and yoke bore and arrange the housing with the yoke bore nearest you.
- 11.2 Install one yoke o-ring seal (3-50) into the housing (1-10).
- 11.3 Apply lubricant to the yoke (1-160) lower bearing surface and install into the housing (1-10) as follows: Position the yoke arm to approximately at 45° position in either direction and lower into the housing. The hub with tapped holes faces up. Rotate the yoke back to approximately the mid-stroke (center) position.
- 11.4 Apply lubricant to the slots in the upper and lower yoke arms.
- 11.5 Apply lubricant to all surfaces of all four yoke rollers (1-50). Place one yoke roller (1-50) in the track in the bottom of the housing and position it under the slot in the yoke arms. Place a second yoke roller on top of the first yoke roller in the slot in the lower yoke arm and align the holes in the yoke rollers.
- 11.6 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 rollers.

- 11.7 Lubricate the yoke pin (1-40) and insert through the yoke pin nut (1-30) and the two yoke rollers (1-50).
- 11.8 Install the third yoke pin roller over the yoke pin in the slot in the upper yoke arm and now install the fourth and last remaining yoke roller on top of the yoke roller you just installed in the upper yoke arm slot. The top roller will remain partially above the yoke and will engage the cover track when cover is installed.
- 11.9 Slide piston rod (2-170) into the side of body and screw into the yoke pin nut (1-30). **DO NOT TIGHTEN.** For spring to open actuators, install the piston rod on the left side of the housing. For spring to close actuators, install the piston rod on the right hand side of the housing.
- 11.10 Install the rod bushing (2-50) over the piston rod and slide it into the housing. **DO NOT** tighten the piston rod until the housing cover is installed.
- 11.11 Slide push rod (4-20) into side of body and screw into the yoke pin nut (1-30). Tighten the push rod with a strap wrench or a pipe wrench.
- 11.12 Place gaskets (3-110) and jam nut (1-120) onto the stop screws (1-60). Install the stop screws into the housing, making sure the stop screw marked "left" is installed into the left stop screw hole.
- 11.13 Place the housing cover gasket (3-20) onto the housing (1-10).
- 11.14 Install the remaining yoke o-ring seal (3-50) into cover (1-20).
- 11.15 Apply lubricant to the yoke bore and the track in the housing cover (1-20).
- 11.16 Apply lubricant to the upper bearing surface of the yoke (1-160).
- 11.17 Install the housing cover (1-10), being careful not to damage the gasket (3-20) or yoke o-ring (3-50).
- 11.18 Install the cover screws (1-90) and seal gaskets (3-100). **LEAVE FINGER TIGHT-DO NOT TIGHTEN.**
- 11.19 Do this step **only** if you have pulled the cover pins (1-130) or if you are replacing the cover pins. Drive the four pins (1-130) thru the cover (1-20) and into the housing (1-10) until the pin is flush with the cover. The pins are deeply grooved at one end, tapering to a smooth diameter at the other end. The pin should be installed smooth end first.
- 11.20 Tighten the cover screws (1-90).
- 11.21 Tighten the piston rod (2-170) (installed in step 11.10) to a torque of approximately 1800 in. lbs. (150 ft. lbs.). Flats are provided on the outer end for wrenching purposes.
- 11.22 **POSITION INDICATOR INSTALLATION** - See step 11.23 for spring to close actuators (CW) or step 11.24 for spring to open (CCW) actuators.
- 11.23 For spring to close actuators (clockwise) rotate the yoke to the full clockwise (CW) position (as shown on the clockwise assembly drawings) position the yoke weather cover (3-130) /position indicator (1-170) on the yoke with the pointer facing the front and perpendicular to the piston rod (2-170). Secure with the socket head cap screws (1-180).
- 11.24 For spring to open actuators (counterclockwise), rotate the yoke to the full counterclockwise (CCW) position (as shown on the counterclockwise assembly drawings), position the yoke weather cover (3-130) position indicator (1-170) on the yoke with the pointer facing the right and parallel with the piston rod (2-170). Secure with the socket head cap screws (1-180).

- 11.25 Rotate the yoke to a position that will leave a minimum of the piston rod (2-170) protruding from the actuator housing.

13.0 PRESSURE CYLINDER RE-ASSEMBLY

- 13.1 Install the rod seal (3-70), lip first, into the recess provided in the inner end cap (2-40).
- 13.2 Install one of the end cap gaskets (3-10) over the piston rod and rod bushing.
- 13.3 Slide the inner end cap (2-40) over the piston rod (2-170) and the rod bushing (2-50), protruding from the housing. Install with the large raised boss toward the housing (flat side outward). The inlet port should be toward the top of the actuator.
- 13.4 Install the o-ring seal (3-60) onto the inner end cap (2-40).
- 13.5 Install two sets of piston tie bar T-seal components (3-80) into the piston internal seal groove. Refer to steps 10.5 for proper T-seal installation instructions.
- 13.6 Install the piston o-ring seal (3-40) onto the piston rod (2-170).
- 13.7 Coat the ends of the piston rod (2-170) with lubricant.
- 13.8 Install a matched set of split rings (2-70) into the inner most groove in the piston rod and retain with one of the retaining rings (2-80).
- 13.9 Slide the piston (2-20) onto the piston rod against the split ring (2-70).
- 13.10 Install a matched set of split rings (2-70) onto the piston rod and retain with the retaining ring (2-80).
- 13.11 Install the piston T-seal components (3-90) into the piston external seal groove.
- 13.12 Apply lubricant to the threads and end of the tie bars (2-60), end without wrench flat, and install by carefully pushing tie bars through the piston (2-20).
- 13.13 Install two tie bar o-ring seals (3-30) onto the inboard end of the tie bars (2-60) into the o-ring grooves provided.
- 13.14 Insert the tie bars through the inner end cap (2-40) and screw into the housing (1-10). Tighten until threads bottom out, then back out a half-turn.
- 13.15 Apply lubricant to the entire bore of the cylinder (2-10).
- 13.16 Slide the lubricated cylinder (2-10) over the piston (2-20) and onto the inner end cap (2-40). **NOTE: When sliding the cylinder over the piston seal, tilt cylinder 15° to 30° to the piston rod. CAUTION: hammer on the ends of cylinder (2-10) only with a non metallic object.**
- CAUTION: Make certain the back-up rings (components of the piston seal) are seated into the seal groove. Should the back-up rings or seal member be pinched between the piston and cylinder, the component could be damaged, becoming a potential source of leakage.**
- 13.17 Install two end cap tie bar o-ring seals (3-30) onto the outboard end of the tie bars (2-60) into the o-ring groove provided.
- 13.18 Install the outer end cap cylinder o-ring seal (3-60) onto the outer end cap (2-30).
- 13.19 Install the outer end cap (2-30) onto the tie bars (2-60) and into the end of the cylinder (2-10).

- 13.20 **OUTER END CAP INSTALLATION WITH M3** Pre-assemble M3 outer end cap per section 17.0 then use steps 13.22 thru 13.28. **OUTER END CAP WITHOUT M3** use steps 13.28 and 13.29.
- 13.21 Install the outer end cap (2-30) onto the tie bars (2-60) and into the end of the cylinder (2-10).
- 13.22 Remove socket head cap screws (2-200) from jackscrew adapter and pull out jackscrew assembly until enough clearance is available to install tie bar nuts (2-90).
- 13.23 Install the two tie bar nuts (2-90) onto the tie bars (2-60), using them to draw all of the cylinder components into position. **CAUTION: While the nuts are being tightened, do not allow the tie bars to turn.** Torque alternately until a final torque of 65 foot pounds plus or minus 10% has been achieved. It is necessary that the flats on the hex nuts (2-90) be aligned and parallel before the jackscrew adapter can be installed.
- 13.24 Rotate the jackscrew assembly counterclockwise until end of CCW travel.
- 13.25 Insert jackscrew adapter (2-190) and jackscrew assembly (2-210) back into the outer end cap.
- 13.26 Retain jackscrew adapter (2-190) with socket head cap screws (2-200).
- 13.27 Tighten seal nut (2-130).
- 13.28 Install the two tie bar nuts (2-90) onto the tie bars (2-60), using them to draw all of the cylinder components into position. NOTE: While the nuts are being tightened, do not allow the tie bars to turn. Torque alternately until a final torque of 65 foot pounds plus or minus 10% has been achieved.
- 13.29 Install the nut retainer (2-100), securing in place with the retainer screw (2-120) and lockwasher (2-110). It is necessary that the flats on the hex nuts (2-90) be aligned and parallel before the nut retainer can be installed.

14.0 **SPRING CARTRIDGE INSTALLATION**

- 14.1 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.
- 14.2 Install the end cap gasket (3-10) over push rod (4-20).
- 14.3 Prepare the SR cartridge (4-10) to be installed as follows: Remove the safety nuts, loose spacer plate, and gasket (4-70). Install replacement gasket over the tie bars, then install loose spacer plate over the tie bars.
- 14.4 Install the SR cartridge (4-10) onto the push rod (4-20). Do not allow the tie bars to be pushed back into the SR cartridge. Insert the tie bars thru the gasket (3-10) into the mating holes in the housing (1-10).
- 14.5 Screw the tie bars into the housing (1-10). Alternately tighten each until the SR cartridge is firmly attached to the housing.
- 14.6 Tighten each tie bar to 65 foot pounds plus or minus ten percent. Install the nut retainer (4-40) between the hex heads of tie bars. Retain by tightening screw (4-60) with lockwasher (4-50).

15.0 **ACTUATOR TESTING**

- 15.1 All areas, where leakage to atmosphere may occur, are to be checked using a leak testing solution. If excessive leakage is noted, generally a bubble which breaks three seconds or less after starting to form, the unit must be disassembled and the cause of leakage must be determined and corrected.

- 15.2 Cycle the actuator five time at the nominal operating pressure (NOP) as per actuator name tag. This will allow the seals to seek their proper service attitude.
- 15.3 Stroke the actuator with the Nominal Operating Pressure and allow the unit to stabilize.
- 15.4 Apply a leak testing solution to the following areas:
 - 15.5 Joint between the outer end cap (2-30) and the cylinder (2-10). This will check the cylinder to end cap seal.
 - 15.6 Around the tie bar nuts on the cylinder end cap and on M3 equipped actuators around jackscrew adapter and seal nut. This will check tie bar to end cap seals.
 - 15.7 Form a bubble over the breather port in the inner end cap (2-40). This will check the piston to cylinder, piston to tie bar, and piston to piston rod seals.
 - 15.8 If an actuator was disassembled and repaired, the above leakage test must be performed again.
 - 15.9 Remove pressure from the pressure inlet ports.

16.0 RETURN TO SERVICE

- 16.1 Install breather (4-30) in the inner end cap of the cylinder (2-10).
- 16.2 If supplied in the service kit, replace the software components of the snubber (1-190) and then install the snubber into the housing cover.
- 16.3 Adjust both stop screws (1-60) back to settings recorded in step 5.3 under General Disassembly.
- 16.4 Tighten both jam nuts (1-120) securely, while holding stop screws (1-60).
- 16.5 Re-install any piping and accessories that were removed.
- 16.6 For actuators equipped with a M3 jackscrew override and require an optional handwheel, M3HW, install the handwheel using the following procedure:
 - 16.7 Place the handwheel (8-10) onto the M3 stud and over the nut (the handwheel hub has a cast hexagon hole that fits over the nut).
 - 16.8 Place lockwasher (8-20) onto M3 up against handwheel hub.
 - 16.9 Place hex nut (8-30) onto M3 and thread up against lockwasher, torque to 250 foot pounds.
 - 16.10 All accessories, including solenoid valves, positioners, pressure switches, etc., should be hooked up and tested for proper operations and replaced if found defective.

17.0 M3 JACKSCREW OUTER END CAP PRE-ASSEMBLY

- 17.1 **ACTUATORS MANUFACTURED PRIOR TO 1978**
 - 17.1.1 Apply a light coating of lubricant to the threads of jackscrew assembly (2-210).
 - 17.1.2 If removed, thread on the nut seal (2-130) onto jackscrew assembly (2-210).
 - 17.1.3 Lightly lubricate the o-ring groove area on the jackscrew adapter (2-190).

- 17.1.4 Lightly lubricate the o-ring seal (100) and install into o-ring groove on jackscrew adapter (2-190).
- 17.1.5 Thread jackscrew adapter (2-190) onto jackscrew assembly (2-210).
- 17.1.6 Insert jackscrew assembly (2-210) through outer end cap (2-30) and retain with socket-head cap screws (2-200). Leave socket head cap screws (2-200) finger tight.

17.2 ACTUATORS MANUFACTURED 1978 THRU 1981

- 17.2.1 Apply a light coating of lubricant to the threads of jackscrew assembly (2-210).
- 17.2.2 If removed, thread on the nut seal (2-130) onto jackscrew assembly (2-210).
- 17.2.3 Lightly lubricate the o-ring groove area on the jackscrew adapter (2-190).
- 17.2.4 Lightly lubricate the o-ring seal (100) and install into o-ring groove on jackscrew adapter (2-190).
- 17.2.5 Thread jackscrew adapter (2-190) onto jackscrew assembly (2-210).
- 17.2.6 Insert jackscrew assembly (2-210) through outer end cap (2-30) and retain with socket-head cap screws (2-200). Leave socket head cap screws (2-200) finger tight.
- 17.2.7 To retaining the M3 in the cylinder thread a hex head cap screw into the threaded hole in the turndown area of the M3 stud.
- 17.2.8 Turn the jackscrew until the retaining screw just comes into contact with the cylinder end cap.

17.3 ACTUATORS MANUFACTURED 1982 THRU 1990

- 17.3.1 Apply a light coating of lubricant to the threads of jackscrew assembly (2-210).
- 17.3.2 If removed, thread on the nut seal (2-130) onto jackscrew assembly (2-210).
- 17.3.3 Lubricate the o-ring groove area on the jackscrew adapter (2-190).
- 17.3.4 Lubricate the o-ring seal (100) and install into o-ring groove on jackscrew adapter (2-190).
- 17.3.5 Thread jackscrew adapter (2-190) onto jackscrew assembly (2-210).
- 17.3.6 Insert jackscrew assembly (2-210) through outer end cap (2-30) and retain with socket-head cap screws (2-200). Leave socket head cap screws (2-200) finger tight.
- 17.3.7 Install a flat washer onto the end of jackscrew assembly (2-210)
- 17.3.8 Insert a spirol pin into end of jackscrew assembly (2-210) making sure that equal amounts of pin is exposed on both sides of jackscrew assembly.
- 17.3.9 Rotate jackscrew assembly (2-210) counterclockwise until the washer is up against the outer end cap.
- 17.3.10 Slide bearing assembly onto the end of jackscrew assembly (2-210) and line up hole in bearing assembly with hole in jackscrew assembly.

17.3.11 Using a 1/4 inch pin punch, drive in the pin through the bearing assembly and jackscrew assembly.

17.3.12 Rotate jackscrew assembly (2-210) counterclockwise until bearing is up against the outer end cap.

17.4 **ACTUATORS MANUFACTURED 1982 THRU 1990**

17.4.1 Apply a light coating of lubricant to the threads of jackscrew assembly (2-210).

17.4.2 If removed, thread on the nut seal (2-130) onto jackscrew assembly (2-210).

17.4.3 Lightly lubricate the o-ring groove area on the jackscrew adapter (2-190).

17.4.4 Lightly lubricate the o-ring seal (100) and install into o-ring groove on jackscrew adapter (2-190).

17.4.5 Thread jackscrew adapter (2-190) onto jackscrew assembly (2-210).

17.4.6 Insert jackscrew assembly (2-210) through outer end cap (2-30) and retain with socket-head cap screws (2-200). Leave socket head cap screws (2-200) finger tight.

17.4.7 Install slotted thrust nut on to turned-down end of M3 stud with slotted face toward the outer end cap. Thread the nut past the pin hole in the M3 stud.

17.4.8 Assemble the bearing onto the bearing retainer with the inner race facing the retainer flange. Insert the wire "C" ring into the bearing side of the retainer assembly until the "C" ring opens up into its groove.

17.4.9 Press the retainer assembly onto the turned-down end of the stud, using a wood block and a hammer. **NOTE: The wire "C" ring needs to be forced onto the neck of the stud end.**

17.4.10 Begin to unthread the thrust nut. Continue till the nut mates with face of bearing. Then back off until nut slot lines up with pin hole. Insert spiral pin thru the M3 stud retaining the slotted nut in its position.

17.4.11 Rotate jackscrew assembly (2-210) counterclockwise until bearing is up against the outer end cap.

CHART 1**WEIGHTS FOR ACTUATORS MODELS****T3XX-SRX & T4XX-SRX SERIES (1)**

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS) (2)				
	SR1	SR2	SR3	SR4	SR5
T310-SRX	474	393	322	329	332
T310-SRX-M3	482	401	330	337	340
T310-SRX-M3HW	488	407	336	343	346
T312-SRX	499	419	348	355	358
T312-SRX-M3	507	427	356	363	366
T312-SRX-M3HW	513	433	362	369	372
T316-SRX	547	467	396	403	---
T316-SRX-M3	555	475	404	411	---
T316-SRX-M3HW	561	481	410	417	---
T410-SRX	519	525	445	369	372
T410-SRX-M3	527	533	453	377	380
T410-SRX-M3HW	533	539	459	393	386
T412-SRX	550	557	476	401	404
T412-SRX-M3	558	565	484	409	412
T412-SRX-M3HW	564	571	490	415	418
T416-SRX	598	605	524	449	452
T416-SRX-M3	606	613	532	457	460
T416-SRX-M3HW	612	619	538	463	466
T420-SRX	671	678	597	522	---
T420-SRX-M3	679	686	605	530	---
T420-SRX-M3HW	685	692	611	536	---

NOTES:

- (1) Includes both fail clockwise (CW) and fail counterclockwise (CCW) actuator models.
- (2) Weights listed for each actuator model are for bare actuators without accessories or valve mounting brackets.