

BETTIS

SERVICE PROCEDURE

DISASSEMBLY AND REASSEMBLY

FOR THE FOLLOWING MODEL

T3XXM *

DOUBLE ACTING SERIES

PNEUMATIC ACTUATORS

WITH INTERNAL MANUAL

*** Manufactured after February 1980**

PART NUMBER: 074890

REVISION: "A"

DATE: August, 1998

REPLACES: SERVICE-012 (Dated 8/85)

1.0 **INTRODUCTION**

- 1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis T3XXM pneumatic actuators manufactured after February, 1980 (includes actuator models that have a -10 or -11 suffix at the end of the model number). 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 **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.

- 1.3 **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.

WARNING: This procedure should not supersede or replace any customer's plant safety or work procedures. If a conflict arises between this procedure and the customer's procedures the differences should be resolved in writing between an authorized customers representative and an authorized Bettis representative.

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

- 1.5 Normal recommended service interval for this actuator series is five years to maximum total life cycle.

NOTE: 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. 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 - Bettis Service Kit, razor sharp cutting instrument, commercial leak testing solution, and non-hardening thread sealant.

2.2 Tools - All tools are American Standard inch. The following list of tools are general in nature.

NOTE: For recommended tool list by item number refer to the last page of this procedure.

QTY	DESCRIPTION	QTY	DESCRIPTION
2	Medium Screwdriver	1	1/2" Drive Socket Wrench Set
1	Small Standard Screwdriver with corners rounded	1	Torque Wrench (up to 5,000 inch pounds)
1	Putty Knife	1	Rubber or Leather Mallet
1	Allen Wrench Set	1	3/16" Pin Punch

3.0 **BETTIS REFERENCE MATERIALS**

3.1 Assembly Draws 039414 for T3XXM series actuators.

3.2 Exploded Detail Drawing 065547 for T3XXM series actuators.

NOTE: Exploded Detail drawings are contained in the Bettis Service Kit.

4.0 **GENERAL DETAILS FOR DISASSEMBLY**

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 attached drawing and actuator parts lists.

4.3 This procedure is written using the following Actuator references:

4.3.1 Stop screw side of housing (1-10) will be considered the front of the actuator.

4.3.2 Housing cover (1-20) will be the top of the actuator.

4.4 Mating parts should be marked for ease of reassembly, i.e. left and right stop screws and cylinder to housing.

4.5 When removing seals from seal groove, use a commercial seal-removing tool or use a small standard screwdriver with the sharp edges rounded off.

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

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

4.7 Disassembly should be done in a clean area on a workbench.

- 4.8 LUBRICATION REQUIREMENTS: Lubricants, other than those listed in steps 4.8.1, 4.8.2 and 4.8.3, should not be used without prior written approval of Bettis Product Engineering.
- 4.8.1 Standard Temperature Service (-20° F to +200° F) uses Bettis ESL-5 lubricant. ESL-5 is contained in the Standard Temperature Bettis Service Kit.
- 4.8.2 High Temperature Service (0° F to +350° F) use Bettis ESL-5 lubricant. ESL-5 is contained in the High Temperature Bettis Service Kit.
- 4.8.3 Low Temperature Service (-50° F to +150° F) use Bettis ESL-4 lubricant. ESL-4 is contained in the Low Temperature Bettis Service Kit.
- 4.9 Some of the actuator models are very heavy and will require a means of assistance. For actuator approximate weight refer to following chart (includes actuator models that have a -10 or -11 suffix at the end of the model number).

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS) **
T310M	197
T312M	222
T316M	264
** Weights listed for each model is for a bare actuator without valve mounting bracket or mounted accessories.	

CAUTION: Pressure applied to the actuator is not to exceed the maximum operating pressure rating listed on the actuator name tag.

- 4.10 Before starting the general disassembly of the actuator, it is a good practice to operate the actuator with the pressure used by the customer to operate the actuator during normal operation. Notate and record any abnormal symptoms such as jerky or erratic operation.
- 4.11 Mark the stop screws (1-60) left and right. The setting of the stop screws (1-60) should be checked and setting recorded before stop screws are loosened or removed. NOTE: Stop screws will be removed later in this procedure.

5.0 PRESSURE CYLINDER DISASSEMBLY

- NOTE: 1 Disconnect all operating pressure from the actuator power cylinder (2-10).
2. Mark and record location of the pneumatic inlet ports on cylinder outer end cap (2-30) and inner end cap (2-40).
- 5.1 Unscrew and remove socket head cap screw (2-120), lockwasher (2-110), and nut retainer (2-100) from the end of outer end cap (2-30).
- 5.2 Remove heavy hex nuts (2-90) from tie bars (2-60).

CAUTION: When separating cylinder (2-10) from outer end cap (2-30) and inner end cap (2-40) do not damage o-ring groove.

5.3 Remove outer end cap (2-30). The fit between cylinder (2-10) and the outer end cap is very tight. NOTE: Break the outer end cap free by tapping with a breaker bar on the lip provided on the end cap.

5.4 Pry inner end cap (2-40) away from the housing (1-10). NOTE: Break the inner end cap free from cylinder (2-10) by tapping with a breaker bar on the lip provided on the end cap.

NOTE: When removing cylinder (2-10) off of piston (2-20), tilt cylinder (2-10) at an angle of approximately 15° to 30° degrees to the piston rod (2-170).

5.5 Remove cylinder (2-10) from the actuator.

NOTE: Move the piston so that there is at least four to six inches of distance between inner end cap (2-40) and piston (2-20).

CAUTION: Do not use a pipe wrench on the tie bars as it may mark the bars and cause seal leakage. Flats are provided on the outboard end of the tie bars for wrench placement.

5.6 Unscrew the tie bars (2-60) from the housing (1-10).

5.7 Pull the tie bars out of inner end cap (2-40) far enough to expose o-rings (3-30).

5.8 Remove o-rings (3-30) from inboard end of tie bars.

5.9 Remove tie bars (2-60) by pulling them out of piston (2-20).

WARNING: Keep split ring halves (2-70) in matched sets.

5.10 Remove split ring retainer (2-80) and split ring halves (2-70) from the outboard side of piston (2-20).

5.11 Remove piston (2-20) from piston rod (2-170).

5.12 Remove o-ring seal (3-40) from piston rod (2-170).

WARNING: Keep split ring halves (2-70) in matched sets.

5.13 Remove the remaining split ring retainer (2-80) and split ring halves (2-70) from piston rod (2-170).

5.14 Remove inner end cap (2-40) from piston rod (2-170).

6.0 HOUSING DISASSEMBLY

6.1 Remove snubber valve (1-190) from the housing cover (1-20).

- 6.2 Remove socket cap screws (1-180) from position indicator (1-170) and yoke weather cover (3-130).
- 6.3 Remove position indicator (1-170) and yoke weather cover (3-130) from the top of yoke (1-160).

CAUTION: Do not use a pipe wrench on the piston rod as it may mark the rod and may cause seal leakage. Flats are provided on the outboard end of the piston rod for wrench placement.

NOTE: Removal of piston rod may require extra amount of torque for break out due to the use of Loctite - 242 during assembly.

- 6.4 Unscrew piston rod (2-170) from yoke pin nut (1-30) and remove, including the rod bushing (2-50).
- 6.5 Remove rod bushing (2-50) from the end housing (1-10) or from piston rod (2-170).
- 6.6 Remove cover screws (1-90) with gasket seals (3-100) from housing cover (1-20).
- 6.7 Remove housing cover (1-20) from top of housing (1-10). **NOTE:** The cover will have a very tight fit. It is not necessary to remove cover pins (1-130) from the cover.
- 6.8 Drive roll pin (1-350) out of handle (1-360) and remove handle.
- 6.9 Unscrew and remove socket cap screws (1-210) with gaskets (6-40) from bearing cap assembly (1-200).
- 6.10 Remove bearing cap assembly (1-200) from lead screw (1-250). **NOTE:** When removing bearing cap, check for detent spring (1-340) and detent ball (1-330). These parts are small and can easily fall out and be displaced or lost.
- 6.11 Carefully, pry oil seal (6-30) from bearing cap assembly (1-200).
- 6.12 Remove lead screw (1-250).
- 6.13 Remove first set of race washer (1-260) and thrust bearing (1-270) from split ring (1-280).
- 6.14 Remove second set of race washer (1-260) and thrust bearing (1-270) from split ring (1-280) by sliding race washer and thrust bearing on to lead screw (1-250).
- 6.15 Remove split ring (1-280) and second set of race washer (1-260) and thrust bearing (1-270) from lead screw (1-250).
- 6.16 Remove camshaft assembly (1-310).
- 6.17 Remove top two yoke rollers (1-50) from the top of yoke pin (1-40).
- 6.18 Remove yoke pin (1-40) from yoke (1-160) and split nut (1-240).

- 6.19 Remove split nut retainer (1-30) and split nut (1-240) from between the arms of yoke (1-160).
- 6.20 Remove lower two yoke rollers (1-50) from inside housing (1-10).
- 6.21 Remove yoke (1-160) by lifting it from housing (1-10).

CAUTION: The yoke/housing bearing area must be lubricated and inspected to extend service life and prevent degradation of torque output. This can only be accomplished by removing the yoke from the housing which requires removing the actuator from the valve.

- 6.22 Remove stop screws (1-60) with jam nuts (1-120) and seal gaskets (3-110).
- 6.23 Remove cam (1-220) from split nut (1-240).
- 6.24 Remove cam bushing (1-230) from split nut retainer (1-30).
- 6.25 It is not necessary to remove pipe plug (1-80) or grease fittings (1-70) to service the actuator. NOTE: Grease fittings (1-80) are optional as of March, 1983.

7.0 GENERAL REASSEMBLY

CAUTION: Only new seals that are still within the seal's expectant shelf life should be installed into actuator being refurbished.

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

CAUTION: Actuator parts that reflect any of the following listed characteristics must be replaced with new parts.

- 7.3 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.
- 7.4 INSTALLATION LUBRICATION INSTRUCTIONS: Use the correct lubrication as defined in Section 4.0 step 4.8.
 - 7.4.1 Before installation coat all moving parts with lubricant.
 - 7.4.2 Coat all seals with lubricant, before installing into groove.

8.0 HOUSING REASSEMBLY

- 8.1 If removed install drain plug (1-80) in actuator housing (1-10).
- 8.2 If removed, install grease fitting (1-70) in actuator housing (1-10) and cover (1-20) as follows:
- NOTE: Grease fittings are optional as of March, 1983.
- 8.2.1 The fitting in the housing is located on the bottom of the housing, next to the lower yoke bearing area.
- 8.2.2 The fitting in the cover is located on top of the cover in the upper yoke bearing area.
- 8.3 Inside housing (1-10) apply lubricant to the tracks and yoke bore.
- 8.4 Coat one yoke O-ring seal (3-50) with lubricant and install into seal groove located in bottom area of housing (1-10).
- 8.5 Apply lubricant to the slots in the upper/lower yoke arms and the lower bearing surface of yoke (1-160).
- 8.6 Install yoke (1-160) into housing (1-10) as follows:
- 8.6.1 Rotate yoke arms to approximately a 45° degree position in either direction and lower the yoke (1-160) down into the housing (1-10).
- NOTE: The hub of yoke (1-160) with tapped holes faces up.
- 8.6.2 Rotate the yoke arms back to approximately mid-stroke (center) position.
- 8.7 Apply lubricant to the surfaces of all four yoke rollers (1-50).
- 8.8 Place one yoke roller (1-50) in the track in the bottom of the housing and position it under the slot in the lower arm of yoke (1-160).
- 8.9 Place a second yoke roller (1-50) on top of the first yoke roller in the slot in the lower arm of yoke (1-160) and align the holes in both yoke rollers (1-50).
- 8.10 Install T3M cam (1-220), lobe section facing toward short end of split nut, into split nut (1-240) with the cam lobe section facing toward short end of split nut (1-240).
- NOTE: The installed T3M cam as installed in step 8.10 will put the split nut (2-240) into the "disengaged" position.
- 8.11 With the open side of split nut (1-240) facing up and threads facing front, insert split nut (1-240) into split nut retainer (1-30).

- 8.12 Coat the upper and lower surfaces of split nut retainer (1-30) with lubricant. With the threaded hole to the right install the split nut retainer into position between the arms of yoke (1-160) and parallel to the track in the bottom area housing (1-10).

NOTE: Align the hole in split nut retainer (1-30) with the holes in the two installed yoke rollers (1-50).

- 8.13 Lubricate the yoke pin (1-40) and insert through split nut retainer (1-30) and the two bottom yoke rollers (1-50).

- 8.14 Install the two remaining yoke rollers (1-50) as follows:

8.12.1 Install the third yoke roller (1-50) over the yoke pin (1-40) and into the slot in the upper arm of yoke (1-160).

8.12.2 Install the fourth and last remaining yoke roller (1-50) on top of the yoke pin roller installed in step 8.12.1.

NOTE: The top roller will remain partially above the arm of yoke (1-160). When the housing cover (1-20) is installed the top yoke pin roller will engage the track located in the housing cover (1-20).

CAUTION: If cycle speed of the actuator is two seconds or faster, apply Loctite 242 to external threads of piston rod (2-170). NOTE: Loctite cure time is 10 to 30 minutes.

NOTE: A new rod bushing is provided in the standard Bettis Service Kit.

- 8.15 Apply lubricant to piston rod (2-170) and rod bushing (2-50). Install rod bushing over the piston rod.

- 8.16 Install piston rod (2-170) with rod bushing (2-50) into the right side of housing (1-10). Slide rod bushing (2-50) along the piston rod and into the counter bore located in the end of housing (1-10).

- 8.17 Screw piston rod (2-170) into split nut retainer (1-30). NOTE: Do not torque tighten piston rod until housing cover (1-20) is installed later in this procedure.

- 8.18 Place jam nuts (1-110) and new gaskets (3-110) on stop screws (1-60).

- 8.19 Install the pre-assembled stop screws into the front of housing (1-10).

- 8.20 Install cam bushing (1-230) into split nut retainer (1-30).

- 8.21 Coat o-ring seal (6-20) with lubricant and install on lever hub (1-290).

- 8.22 Install cam shaft/lever hub assembly into housing (left side). Insert camshaft assembly far enough into housing until camshaft is inserted into the first cam bushing (1-230).

NOTE: When handle shaft (1-300) and (1-320) is installed, make certain that handle is placed in the down position.

- 8.23 Insert camshaft assembly (1-130), with lever facing down, through cam (1-220) and second cam bushing (1-230). Install far enough until lever knob rests snugly in cavity inside of housing.
 - 8.24 Install lead screw pin (1-400) into lead screw (1-250).
 - 8.25 Install race (1-260), thrust bearing (2-270) and a second race (2-270) onto lead screw (1-250), the non-threaded end. Install the set far enough onto lead screw until it has slipped past the relief area.
 - 8.26 Install split rings (1-280) into lead screw relief area.
 - 8.27 Slide the race, bearing, race, previously install in step 8.23, over split ring (1-280).
 - 8.28 Install second set of race, thrust bearing and race onto lead screw and over split ring.
 - 8.29 Install lead screw (1-250) into housing (1-10). Insert lead screw through split nut retainer, lead screw pin (1-400), and is installed into hole on far side of housing (1-10).
 - 8.30 Coat bearing cap gasket (6-10) with lubricant and install to housing (1-10).
 - 8.31 Move camshaft handle to mid-stroke position. (Handle facing away).
 - 8.32 Insert detent spring (1-340) and detent ball (1-330) into bearing cap assembly (1-200).
- NOTE: Bearing cap assembly may be first installed onto lead screw but not far enough to prevent inserting detent ball and spring.
- 8.33 Assemble bearing cap assembly to actuator. Slide bearing cap toward housing, be sure detent ball and spring are still firmly held in place until up against lever hub (1-300).
 - 8.34 Install bearing cap assembly to housing with socket cap screws (1-210) and seal gaskets (6-40).
 - 8.35 Install oil seal (6-30) into bearing cap assembly (1-200).
 - 8.36 Install handle (1-360) onto lead screw and retain with roll pin (1-350).
 - 8.37 Move camshaft handle (1-300) assembly to vertical position (up); split nut should be fully engaged into lead screw.
 - 8.38 Rotate actuator, using handle (1-360) to full clockwise (CW) position.
 - 8.39 Place cover gasket (3-20) onto the top of housing (1-10).
 - 8.40 Coat remaining o-ring seal (3-50) with lubricant and install into the seal groove located in the yoke bore of housing cover (1-20).
 - 8.41 Apply lubricant to the yoke bore and track in housing cover (1-20).

- 8.42 Apply lubricant to upper bearing surface of yoke (1-160).
- 8.43 Install housing cover (1-20), being careful not to damage gasket (3-20) or o-ring seal (3-50).
- 8.44 Install new seal gaskets (3-100) onto cover screws (1-90).
- 8.45 Install cover screws (1-90) with new seal gaskets (3-100). NOTE: Leave cover screws loose, do not tighten.
- 8.46 Do this step only if you have pulled cover pins (1-130) or if you are replacing the cover pins.
- NOTE: The cover pins (1-130) are grooved at one end, tapering to a smooth diameter at the other end.
- 8.46.1 Install four cover pins smooth end first into housing cover (1-20).
- 8.46.2 Drive four cover pins (1-130) through cover (1-20) and into housing (1-10) until each pin is flush with the cover.
- 8.47 Tighten cover screws (1-90).

CAUTION: Do not use a pipe wrench or similar tool to tighten piston rod. Flats are provided on the outboard end of piston rods (2-170) for wrenching purposes.

- 8.48 Torque tighten piston rod (2-170) to a torque of 150 ±7 foot pounds lubricated.
- 8.49 Rotate yoke to a position that will leave a minimum of piston rod (2-170) protruding from the actuator housing.

9.0 PRESSURE CYLINDER REASSEMBLY

- 9.1 Apply lubricant to rod seal (3-70) and install, lip first, into the recess provided in inner end cap (2-40).

CAUTION: Install rod seal (3-70) with the energizer ring facing outboard side (away from housing).

- 9.2 Apply lubricant to end cap gasket (3-10) and install over piston rod (2-170) and rod bushing (2-50).
- 9.3 Install inner end cap (2-40) over piston rod (2-170) and rod bushing (2-50). NOTE: Install inner end cap with large raised boss toward the housing (flat side outward). End cap pressure inlet port should be toward the top of actuator.
- 9.4 Apply lubricant to o-ring seal (3-60) and install into outer diameter seal groove on inner end cap (2-40).

9.5 T-seal set (3-80) installation as follows:

NOTE: The T-seal is composed of one rubber seal and two split skive-cut back-up rings.

9.5.1 Apply lubricant to two sets of piston tie bar T-seal components (3-80).

9.5.2 Install the T-seals into piston (2-20) internal seal grooves.

9.5.3 Install a back-up ring on each side of the T-seal.

9.5.4 When installing the back-up rings, do not align the skive-cuts.

9.6 Apply lubricant to threads and outboard end of piston rod (2-170).

9.7 Apply lubricant to o-ring seal (3-40) and place onto piston rod (2-170).

9.8 Install matched set of split ring halves (2-70) into innermost groove on piston rod and retain with retaining ring (2-80).

9.9 Install piston (2-20) onto piston rod (2-170) and up against split ring set (2-70).

9.10 Install matched set of split ring halves (2-70) onto piston rod and retain with retaining ring (2-80).

9.11 Apply lubricant to threads and end of tie bars (2-60), end without wrench flat.

9.12 Install two tie bars (2-60) by carefully inserting through piston (2-20). NOTE: Install tie bars far enough through piston to expose inboard o-ring seal groove.

9.13 Apply lubricant to two o-ring seals (3-30) and install into exposed seal groove on inboard end of tie bars.

9.14 Insert tie bars (2-60) through inner end cap (2-40) and screw into the end of housing (1-10).

CAUTION: Tighten the tie bars until the threads bottom out, then back out each tie bar one-half (1/2) turn.

9.15 Apply a light coat of lubricant to the bore of the cylinder (2-10).

NOTE: The original seal used in the outer diameter seal groove of piston (2-20) was a piston T-seal with two back-up rings. The replacement seal for this location is a Bettis D-ring seal (no back-up rings are required). The D-ring seal is directly interchangeable with the T-seal.

9.16 Coat D-ring seal (3-90) with lubricant and install into the piston external seal groove with the flat side of the D-ring installed down into the seal groove.

CAUTION: If needed when installing cylinder (2-10), hammer on end of cylinder only with a non-metallic object.

- 9.17 Install end of cylinder (2-10) over piston (2-20) and onto inner end cap (2-40). When installing cylinder over the piston seal, tilt cylinder 15° to 30° degrees to piston rod (2-170).
- 9.18 Apply lubricant to two o-ring seals (3-30) and install into seal groove on outboard end of tie bars (2-60).
- 9.19 Apply lubricant to o-ring seal (3-60) and install into outer diameter seal groove on outer end cap (2-30).
- 9.20 Install outer end cap (2-30) onto tie bars and into end of cylinder (2-10). NOTE: Verify that outer end cap inlet port(s) are toward top of actuator.
- 9.21 Install two tie bar nuts (2-90) onto tie bars (2-60), using them to draw all of the cylinder components into position.

CAUTION: While tie bar nuts (2-90) are being tightened do not allow tie bars (2-60) to rotate.

- 9.22 Torque tighten tie bar nuts (2-90) to 65 ± 7 foot pounds lubricated. NOTE: It is necessary that the flats on the hex nuts (2-90) be aligned and parallel before the nut retainer can be installed.
- 9.23 Install lockwasher (2-110) onto screw (2-120).
- 9.24 Install nut retainer (2-100), securing in place with retainer screw (2-120) and lockwasher (2-110).
- 9.25 POSITION INDICATOR INSTALLATION:
 - 9.25.1 Rotate the yoke to full clockwise (CW) position (as shown on the assembly drawing).
 - 9.25.2 Install the yoke weather cover (3-130) and position indicator (1-170) on top of yoke (1-160). The pointer of position indicator (1-170) will be pointing or facing the front of the actuator and perpendicular to piston rod (2-170).
 - 9.25.3 Install socket cap screws (1-180) through position indicator (1-170), yoke weather cover (3-130) and screw into the top of yoke (1-160).

10.0 ACTUATOR TESTING

- 10.1 **Leak Test - General** - A small amount of leakage may be tolerated. Generally, a small bubble, which breaks about three seconds after starting to form, is considered acceptable.

- 10.2 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution.

WARNING: Pressure is not to exceed the maximum operating pressure rating listed on the nametag.

- 10.3 All leak testing will use 65 psig pressure. NOTE: When testing the actuator use a proper adjusted regulator to apply pressure to the actuator.
- 10.4 Before testing for leaks, alternately apply and release 65 psi pressure to the each side of the piston to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.
- 10.5 Apply 65 psig pressure to the pressure port in the outer end cap (2-30).
- 10.6 Apply a leak testing solution to the following areas:
- 10.6.1 Joint between outer end cap (2-30) and cylinder (2-10). Checks cylinder to end cap o-ring seal.
 - 10.6.2 Around tie bar nuts (2-90) on the cylinder outer end cap (2-30). Checks tie bars to outer end cap o-ring seals.
 - 10.6.3 The pressure inlet port in inner end cap (2-40). Checks piston to cylinder, piston to tie bar, and piston to piston rod seals.
 - 10.6.4 Remove pressure from pressure inlet port in the outer end cap.
- 10.7 Apply 65 psig pressure to the pressure port in inner end cap (2-40).
- 10.8 Apply a leak testing solution to the following areas:
- 10.8.1 Joint between inner end cap (2-40) and cylinder (2-10). Checks cylinder to inner end cap o-ring seal.
 - 10.8.2 Around the joint of inner end cap (2-40) and housing (1-10). Checks tie bars to inner end cap o-ring seals and the inner end cap to housing gasket seal (3-10).
 - 10.8.3 The snubber valve port hole in housing cover (1-20). Checks the rod seal and tie bars to end cap o-ring seals.
 - 10.8.4 Remove pressure from pressure inlet port in the inner end cap.
- 10.9 If an actuator was disassembled and repaired, the above leakage test must be performed again.

11.0 RETURN TO SERVICE

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

- 11.2 Adjust both stop screws (1-60) back to settings recorded in section 5 under General Disassembly.
- 11.3 Tighten both jam nuts (1-110) securely, while holding stop screws (1-60).
- 11.4 After the actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.

TOOL STYLE AND WRENCH SIZES			
ITEM NO.	WRENCH SIZE	LOCATION	RECOMMENDED WRENCH STYLE
1-60	1/2"	Stop Screw	Open End or Adjustable
1-80	9/16"	Housing Drain Plug	Open End or Adjustable
1-90	1/2"	Cover Screws	Socket
1-110	1-5/16"	Stop Screw Nut	Box End (1)
1-180	3/16"	Weather Cover Screws	Allen (1)
1-190	7/8"	Snubber Valve	Deep Socket
1-210	3/8"	Socket Cap Screw	Allen (1)
2-60	1/2"	Tie Bar Flats	Open End or Adjustable
2-90	1-7/16"	Tie Bar Nuts	Deep Socket
2-120	3/16"	Nut Retainer	Allen (1)
2-170	1-1/4"	Piston Rod Flats	Crows Foot (1)
(1) No alternate style tool recommended			

ECN	DATE	REV	BY *	DATE
Released	August, 1998	A	COMPILED	<u>Bill Cornelius</u> 14 August 98
			CHECKED	<u>Bill Cornelius</u> 14 August 98
			APPROVED	<u>Bob McEver</u> 14 August 98

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