

BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY & REASSEMBLY

FOR MODELS

T82XX

DOUBLE ACTING SERIES

PNEUMATIC ACTUATORS

PART NUMBER: 074984

REVISION: "A"

RELEASE 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 T82XX double acting series pneumatic 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 **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.

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

1.5 The maximum recommended service interval for this actuator series is five years. Storage time is counted as part of the service interval.

1.6 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator. 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, razor sharp cutting instrument, seal removal tool, commercial leak testing solution, and non-hardening thread sealant.

2.2 Tools - All tools are American Standard inch. Large adjustable wrench, two (2) large screwdrivers, allen wrench set, set of open/box-end wrenches, rubber or leather mallet, torque wrench (up to 5,000 in. lbs.), breaker bar, 1/4" drift punch and a 1/2" drive socket set. For recommended tool list refer to Chart 2 on page 12.

3.0 **REFERENCE BETTIS MATERIALS**

3.1 Assembly Drawing part number 113410.

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 parenthesis, (), indicate the bubble number (reference number) used on the Bettis Assembly Drawing, Exploded Detail Drawing, and Actuator Parts List.
- 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 side of the actuator. The housing cover (1-20) will be the top of the actuator.
- 4.4 Refer to Chart number 1, on page 12, for actuator weights.
- 4.5 Mating parts should be marked for ease of reassembly, i.e. left and right stop screws and cylinder to housing.
- 4.6 When removing seals from seal groove, use a commercial seal removing tool or use a small standard screwdriver with the sharp edges rounded off.
- 4.7 Use a non-hardening thread sealant on all pipe threads.

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

- 4.8 Disassembly should be done in a clean area on a work bench.
- 4.9 LUBRICATION REQUIREMENTS: For use in all areas of the actuator. 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. Kronaplate 50 is not contained in the Low Temperature Service/Seal Kit.

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

5.0 GENERAL DISASSEMBLY

- 5.1 If not already removed disconnect all operating pressure from actuator power cylinders (2-10).
- 5.2 Mark stop screws (1-60) left and right. The setting of 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.

- 5.3 Remove socket cap screws (1-180) from position indicator (1-170) yoke weather cover (3-130) and remove position indicator/yoke weather cover.
- 5.4 Unscrew and remove snubber valve (1-190) from housing cover (1-20).
- 5.5 Mark and record location of the pneumatic inlet ports on cylinder outer end caps (2-30) and inner end caps (2-40).

6.0 PRESSURE CYLINDERS DISASSEMBLY

- 6.1 Refer to assembly drawing sheet 2 of 2 Detail "C". Remove socket cap screw (2-120), washer (2-110) and nut retainer (2-100) from end of both outer end caps (2-30).

NOTE: Because of the "double cylinder" construction, the housing group is symmetrical about vertical centerline. Steps 6.2 through 6.5 will be performed on one side of the housing centerline and then repeated on the other side of the housing centerline.

- 6.2 Remove hex nuts (2-90) from tie bars (2-60). NOTE: Flats are provided on the outboard end of the tie bars for wrench placement.
- 6.3 Remove outer end cap (2-30). The fit between the 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.

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

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

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

- 6.5 Remove cylinder (2-10). NOTE: When sliding cylinder off of piston, tilt cylinder 15° to 30° degrees to piston rod (2-170).
- 6.6 Repeat steps 6.2 through 6.5 on second cylinder assembly.
- 6.7 Remove tie bars (2-60) by pulling them out through housing (1-10), inner end caps (2-40) and pistons (2-20).

NOTE: Steps 6.8 through 6.12 will be performed on one side of the housing and then repeated on the other side of the housing.

CAUTION: Keep the split rings in matched sets.

- 6.8 Remove split ring retainer (2-80) and split rings (2-70) from outboard side of piston (2-20).
- 6.9 Remove piston (2-20) from piston rod (2-170). The piston will slide off of the piston rod. Refer to step 6.14 for 24" and larger diameter pistons for tie bar bushing (2-180) disassembly.

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

CAUTION: Keep the split rings in matched sets.

6.11 Remove split ring retainer (2-80) and split rings (2-70) from inboard side of the piston.

6.12 Remove inner end cap (2-40) off piston rod (2-170).

6.13 Repeat steps 6.8 through 6.12 on second cylinder assembly.

6.14 Fabricated 24" piston disassembly.

6.14.1 Remove retaining rings (2-190) from the piston.

6.14.2 Remove piston tie bar bushing (2-180) from the piston.

CAUTION: The piston tie bar bushing should be replaced each time actuator is refurbished (refer to section 1 for recommend service interval). NOTE: The Bettis Service/Seal Kit should contain a new piston tie bar bushing.

7.0 HOUSING GROUP DISASSEMBLY

7.1 Unscrew both piston rods (2-170) from yoke pin nut (1-30) and remove. 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.

CAUTION: Do not use a pipe wrench on the piston rods as it will mark the rod and cause seal leakage.

7.2 Remove both rod bushings (2-50) from the housing or the piston rods.

7.3 Remove fourteen hex cap screws (1-90) with gasket seals (3-100) from housing cover (1-20).

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

7.5 Remove top two yoke rollers (1-50) and roller spacers (1-110) from top of yoke pin (1-40).

NOTE: Early model actuators did not use the roller spacer. When replacing rollers refer to information notes step 13.1 and it's **CAUTION**.

7.6 Remove yoke pin (1-40).

7.7 Remove yoke pin nut (1-30).

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

CAUTION: The yoke/housing bearing 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.

NOTE: Step 7.9 is done if housing cover is equipped with a upper yoke bushing (1-140). The addition of upper yoke bushing (1-140) was implemented during the year 1989. All replacement housing covers will be machined to accept a upper yoke bushing (1-140) and will automatically come fitted with a upper yoke bushing (1-140).

7.9 Remove yoke bushing (1-140) from the top of yoke (1-160).

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

NOTE: Step 7.11 is done if housing is equipped with a lower yoke bushing (1-140). The addition of lower yoke bushing (1-140) was implemented during the year 1989. All replacement housings will be machined to accept a lower yoke bushing (1-140) and will automatically come fitted with a lower yoke bushing (1-140).

7.11 Remove yoke bushing (1-140) from the lower housing area.

7.12 Remove stop screws (1-60), stop nuts (1-120), and gaskets (3-110).

7.13 It is not necessary to remove the pipe plug (1-80) or grease fittings (1-70) to service the actuator. NOTE: Grease fittings are optional as of March, 1983.

8.0 GENERAL RE-ASSEMBLY

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

8.1 Remove and discard all seals and gaskets.

8.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.

8.3 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.

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

8.4 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.

8.5 T-seal set installation - The T-seal is composed of one rubber seal and two split skive-cut back-up rings.

8.5.1 Install the T-seal into the seal grooves.

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

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

8.5.4 If the back-up rings are too long and the rings overlap beyond the skive-cuts, then the rings must be trimmed with a razor sharp instrument.

9.0 CENTER HOUSING GROUP RE-ASSEMBLY

9.1 If removed install drain plug (1-80) in actuator housing (1-10).

9.2 If removed, install grease fitting (1-70) in actuator housing (1-10) and cover (1-20). The fitting in the housing is located on the bottom of the housing, next to the lower yoke bearing area. The fitting in the cover is located on top of the cover in the upper yoke bearing area. NOTE: Grease fittings are optional as of March, 1983.

9.3 Inside housing (1-10) apply lubricant to the track and yoke bore.

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

NOTE: Step 9.5 is done if housing is equipped with a lower yoke bushing (1-140). The addition of lower yoke bushing (1-140) was implemented during the year 1989. All replacement housings will be machined to accept a lower yoke bushing (1-140) and will automatically come fitted with a lower yoke bushing (1-140).

9.5 Coat lower yoke bushing (1-140) with lubricant and install into lower area of housing (1-10)

9.6 Apply lubricant to the slots in the upper/lower yoke arms and the lower bearing surface.

9.7 Install yoke (1-160) into housing (1-10) as follows: Arrange the yoke arms to approximately a 45° degree position in either direction and lower into the housing. NOTE: The yoke hub with tapped holes faces up. Rotate the yoke back to approximately mid-stroke (center) position.

9.8 Apply lubricant to all surfaces of two yoke rollers (1-50) and two roller spacers (1-110). Place one yoke roller in the track in bottom of housing and position it under the slot in the yoke arms. Place a roller spacer (1-110) on top of the lower yoke roller (1-50). Place a second yoke roller on top of the roller spacer in the slot in the lower yoke arm. Place a second roller spacer (1-110) on top of the second yoke roller (1-50) and align the holes in the roller spacer and the yoke rollers. T82XX actuators manufactured before 1978 did not use roller spacers (1-110) with yoke rollers (1-50), refer to information note step 13.1 when replacing rollers or roller spacers.

9.9 Coat upper and lower surfaces of 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 yoke rollers (1-50) and roller spacers (1-110).

9.10 Lubricate yoke pin (1-40) and insert through yoke pin nut (1-30), two yoke rollers (1-50) and two roller spacers (1-110).

9.11 Apply lubricant to all surfaces of the two remaining yoke rollers (1-50) and two remaining roller spacers (1-110). Place one roller spacer on top of yoke pin nut (1-30) then install the third yoke roller (1-50). Place the last roller spacer on top of the third yoke roller (1-50). Place the fourth and final yoke roller on top of the yoke pin. The top roller will remain above the yoke arm and will engage the cover track when the cover is installed.

- 9.12 Apply lubricant to two piston rods (2-170) and two rod bushings (2-50). Install one rod bushing over each piston rod.

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

- 9.13 Install one lubricated piston rod (2-170) with rod bushing (2-50) into the right side of housing (1-10). Slide rod bushing along the piston rod and into the housing counter bore. Screw the piston rod into yoke pin nut (1-30). NOTE: Do not tighten piston rod until the housing cover is installed later in this procedure.
- 9.14 Install a second lubricated piston rod (2-170) with rod bushing (2-50) into the left side of housing (1-10). Slide rod bushing along the piston rod and into the housing counter bore. Screw the piston rod into yoke pin nut (1-30). NOTE: Do not tighten piston rod until the housing cover is installed later in this procedure.
- 9.15 Place gaskets (3-110) and jam nuts (1-120) on stop screws (1-60). Install both assemblies into the housing.
- 9.16 Place housing cover gasket (3-20) on housing (1-10).
- 9.17 Coat o-ring seal (3-50) with lubricant and install into housing cover (1-20).
- 9.18 Apply lubricant to yoke bore and the track in housing cover (1-20).
- 9.19 Apply lubricant to the yoke upper bearing surface.

NOTE: Step 9.20 is done if housing cover is equipped with a upper yoke bushing (1-140). The addition of upper yoke bushing (1-140) was implemented during the year 1989. All replacement housing covers will be machined to accept a upper yoke bushing (1-140) and will automatically come fitted with a upper yoke bushing (1-140).

- 9.20 Coat upper yoke bushing (1-140) with lubricant and install onto yoke (1-160).
- 9.21 Install housing cover (1-20), being careful not to damage gasket (3-20) or o-ring seal (3-50).
- 9.22 Install fourteen cover screws (1-90) with seal gaskets (3-100). NOTE: Leave finger tight - do not tighten.
- 9.23 Do this step only if you have pulled cover pins (1-130) or if you are replacing the cover pins. Drive the pins through cover (1-20) and into housing (1-10) until the pins are flush with the cover. NOTE: 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.
- 9.24 Torque tighten cover screws (1-90) to 16 ± 1 foot pounds lubricated.
- 9.25 Tighten both piston rods (2-170) to a torque of approximately 150 ± 7 foot pounds. NOTE: Flats are provided on the outboard end of the piston rod. These flats should be used to put a wrench on to tighten the piston rod.

CAUTION: Do not use a pipe wrench or similar tool to tighten piston rod.

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

10.0 PRESSURE CYLINDER RE-ASSEMBLY

NOTE: Because of the "double cylinder" construction, the housing group is symmetrical about vertical centerline. Steps 10.1 through 10.12 will be performed on one side of the housing centerline and then repeated on the other side of the housing centerline.

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

CAUTION: Install with energizer ring facing outboard side (away from housing).

- 10.2 Install end cap gasket (3-10) over piston rod (2-170) and rod bushing (2-50).

- 10.3 Coat two o-ring seals (3-30) with lubricant and install into inner end cap (2-40).

NOTE: Some tie bar o-rings are held in place by "staked" washers. Check end cap to ensure washers are secured. If needed re-stake washers.

- 10.4 Install inner end cap (2-40) over piston rod (2-170) and rod bushing (2-50). Install with the large raised boss toward the housing (flat side outward). NOTE: The pressure inlet port should be toward the top of the actuator.

CAUTION: Exercise extreme care during end cap installation, in order to prevent damage to rod seal (3-70).

- 10.5 Apply lubricant to o-ring seal (3-60) and install onto inner end cap (2-40).

NOTE: Step 10.6 is done only if actuator has a piston with greater than 20" inch diameter, i.e. 24", 28" 32" ect. If 20" inch diameter or smaller disregard step 10.6 and proceed to step 10.7.

- 10.6 Fabricated piston, 24" and larger, reassembly (refer to assembly drawing detail "A").

10.6.1 Install o-ring seals (3-140) into O.D. groove on piston bushings (2-180).

10.6.2 Apply lubricant to two sets of T-seal components (3-80) and install into I.D. groove in piston tie bar bushing (2-180).

10.6.3 Install piston tie bar bushings (2-180) into the piston.

10.6.4 Install retaining rings (2-190) into the piston.

- 10.7 Apply lubricant to two sets of piston tie bar T-seal components (3-80) and install into the piston internal seal groove. Refer to section 8 for proper T-seal installation instructions.

- 10.8 Coat ends of the piston rod (2-170) with lubricant.

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

- 10.10 Install a matched set of split rings (2-70) into the inner most groove in the piston rod and retain with one split ring retainer (2-80), retaining ring groove away from piston.

- 10.11 Install piston (2-20) onto the piston rod against split rings (2-70). NOTE: When installing cast pistons install with ribbed section of piston facing away from housing.

CAUTION: When installing 24" inch diameter, or larger, pistons make certain that the smaller diameter plate faces the outer end cap (2-30).

- 10.12 Install a matched set of split rings (2-70) into the inner most groove in the piston rod and retain with one of the split ring retainers (2-80), retaining ring groove away from piston.

- 10.13 Repeat steps 10.1 through 10.12 on second cylinder assembly.

- 10.14 Apply lubricant to the threads and both ends of tie bars (2-60).

- 10.15 Install by carefully inserting the tie bars through first piston (2-20), first inner end cap (2-40), housing (1-10), second inner end cap (2-40), and second piston (2-20). NOTE: The tie bars (2-60) must protrude through the pistons with equal length.

- 10.16 Lubricate all exposed surfaces of both piston rods (2-170) and both tie bars (2-60).

NOTE: Steps 10.17 through 10.22 will be performed on one cylinder assembly and then repeated on the other cylinder assembly.

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

- 10.18 Coat the piston T seal components (3-90) with lubricant and install into the piston external seal groove. Refer to section 8 for proper "T" seal installation.

- 10.19 Install lubricated cylinder (2-10) over piston (2-20) and onto inner end cap (2-40). When sliding the cylinder over the piston seal tilt cylinder 15° to 30° degrees to piston rod.

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

CAUTION: Make certain back-up rings, components of piston T-seal (3-90), are seated into piston external 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.

- 10.20 Apply lubricant to two o-ring seals (3-30) and install into outer end cap (2-30).

NOTE: Some tie bar o-rings are held in place by "staked" washers. Check end cap to ensure washers are secured. If needed re-stake washers.

- 10.21 Apply lubricant to o-ring seal (3-60) and install onto outer end cap (2-30).

- 10.22 Install outer end cap (2-30) onto tie bars and into open end of cylinder (2-10). NOTE: Make certain that the inlet port(s) are toward the top of the actuator.

- 10.23 Install two hex nuts (2-90) on to the end of tie bars (2-60) where outer end cap (2-30) was installed in step 10.22

- 10.24 Repeat steps 10.17 through 10.23 on second cylinder assembly.

- 10.25 Use hex nuts (2-90), on the ends of tie bars (2-60), to draw components of both cylinder into position. Torque alternately, in 50 foot pound increments, until a final torque of 110 ± 11 foot pounds has been achieved.
- 10.26 Install two nut retainer (2-100), securing in place with retainer screws (2-120) and lockwashers (2-110). NOTE: It is necessary that the flats on hex nuts (2-90) be aligned and parallel before nut retainers (2-100) can be installed.
- 10.27 Rotate yoke to the full clockwise (CW) position (as shown on the assembly drawing).
- 12.28 Install weather cover (3-130) and position indicator (1-170) on yoke (1-160). Arrange the position indicator's pointer perpendicular with piston rod (2-170) and facing the front of the actuator (stop screw side of the housing).
- 12.29 Secure weather cover (3-130) and position indicator (1-170) to yoke (1-160) with four socket cap screws (1-180).

11.0 ACTUATOR TESTING

- 11.1 **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.
- 11.2 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 name tag.

- 11.3 All leak testing will use 65 psig pressure. NOTE: When testing the actuator use a proper adjusted regulator to apply pressure to the actuator.
- 11.4 Before testing for leaks, alternately apply and release 65 psi pressure to each side of both pistons to stroke the actuator fully. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.

NOTE: Steps 11.5 through 11.8 will be performed on one cylinder assembly and then repeated on the other cylinder assembly.

- 11.5 Apply 65 psig pressure to the pressure port in the outer end cap (2-30).
- 11.6 Apply a leak testing solution to the following areas:
 - 11.6.1 Joint between outer end cap (2-30) and cylinder (2-10). Checks cylinder to end cap o-ring seal.
 - 11.6.2 Around tie bar nuts (2-90) on the cylinder outer end cap (2-30). Checks tie bars to outer end cap o-ring seals.
 - 11.6.3 The pressure inlet port in inner end cap (2-40). Checks piston to cylinder, piston to tie bar, and piston to piston rod seals.
 - 11.6.4 Remove pressure from pressure inlet port in the outer end cap.
- 11.7 Apply 65 psig pressure to the pressure port in inner end cap (2-40).

- 11.8 Apply a leak testing solution to the following areas:
- 11.8.1 Joint between inner end cap (2-40) and cylinder (2-10). Checks cylinder to inner end cap o-ring seal.
 - 11.8.2 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).
 - 11.8.3 The snubber valve port hole in housing cover (1-20). Checks the rod seal and tie bars to end cap o-ring seals.
 - 11.8.4 Remove pressure from pressure inlet port in the inner end cap.
- 11.9 Repeat steps 11.5 through 11.8 on second cylinder assembly.
- 11.10 If an actuator was disassembled and repaired, the above leakage test must be performed again.

12.0 RETURN TO SERVICE

- 12.1 Replace the software components of snubber (1-190) and then install the snubber in housing cover port.
- 12.2 Adjust both stop screws (1-60) back to settings recorded in section 5 under General Disassembly.
- 12.3 Tighten both jam nuts (1-120) securely, while holding stop screws (1-60).
- 12.4 After actuator is installed on the valve all accessories should be hooked up and tested for proper operations and replaced, if found defective.

13.0 INFORMATION NOTES

- 13.1 Actuators manufactured before 1978 did not use roller spacers (1-110) with yoke rollers (1-50).

CAUTION: When replacing the rollers on pre 1978 actuators order a complete set of both rollers and roller spacers. A complete set consists of: four rollers (1-50) and two roller spacers (1-110). The original rollers are the same part number as model T82XX shipped after 1978 but they are shorter. Due to the difference in size the top or bottom yoke roller may not engage the actuator track sufficiently and may cause actuator failure.

- 13.2 On outer and inner end caps some tie bar o-rings are held in place by "staked" washers. NOTE: Check all end caps to ensure washers are secured. If needed re-stake washers.

CHART NO. 1 - ACTUATOR WEIGHTS

ACTUATOR MODEL	APPROXIMATE WEIGHT (POUNDS) **
T8210	827
T8212	861
T8216	975
T8220	1207
T8224	1865

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

CHART NO. 2 - TOOL STYLE AND WRENCH SIZES

ITEM NO.	WRENCH SIZE	QUANTITY	LOCATION	RECOMMENDED WRENCH STYLE
1-60	15/16"	2	Stop Screw	Open End or Adjustable
1-90	9/16"	14	Cover Screws	Socket
1-120	1-7/8"	2	Stop Screw Nut	Box End (1)
1-180	3/16"	4	Weather Cover Screws	Allen
1-190	7/8"	1	Snubber	Deep Socket
2-60	5/8"	2	Tie Bar Flats	Open End Or Adjustable
2-90	1-5/8"	2	Tie Bar Nuts	Socket
2-120	3/16"	1	Nut Retainer Screw	Allen
2-170	1-3/8"	1	Piston Rod Flat	Crows Foot (1)

(1) No alternate style recommended

ECN	DATE	REV	BY *	DATE	
Released	July, 1994	A	COMPILED	Bill Cornelius	7 July 1994
			CHECKED	Bobby Jumawan	7 July 1994
			APPROVED	Robert McEver	7 July 1994

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325, Iporanga Sorocaba
SP 18087-105
Brazil
T +55 15 3238 3788
F +55 15 3228 3300

ASIA PACIFIC

No. 9 Gul Road
#01-02 Singapore 629361
T +65 6501 4600
F +65 6268 0028

No.1 Lai Yuan Road
Wuqing Development Area
Tianjin 301700
P.R.China
T +86 22 8212 3300
F +86 22 8212 3308

MIDDLE EAST & AFRICA

P. O. Box 17033
Dubai
United Arab Emirates
T +971 4 811 8100
F +971 4 886 5465

P. O. Box 10305
Jubail 31961
Saudi Arabia
T +966 3 340 8650
F +966 3 340 8790

24 Angus Crescent
Longmeadow Business Estate
East P.O. Box 6908; Greenstone
1616 Modderfontein, Extension 5
South Africa
T +27 11 451 3700
F +27 11 451 3800

EUROPE

Berenyi u. 72- 100
Videoton Industry Park,
Building #230
Székesfehérvár 8000
Hungary
T +36 22 530 950
F +36 22 543 700

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www.emersonprocess.com/valveautomationlocations
Or contact us at info.valveautomation@emerson.com

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