

# Operation and Maintenance Instructions for Bettis GVO-C Series GVO-CLP-T Pneumatic Actuators



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# Section 1: Introduction

Bettis GVO-C Linear valve actuator has been designed to meet a wide variety of applications. It has been manufactured to close tolerances and specifications and has been factory inspected and tested prior to shipment. Each actuator is identified with a unique serial number for reference when ordering replacement parts.

The following guidelines are designed to help you with your maintenance procedures.

## Section 2: Operation

1. Use only filtered, pressure regulated and lubricated air to operate the actuator. The air must be filtered to remove **all contaminants in excess of 30 microns** particle size. Lubrication is recommended to reduce component friction and maximize seal life. Use ESSO-NUTO H-32 oil (or equivalent, compatible with seal materials).
2. Care must be exercised to ensure that operating pressure does not exceed the **maximum rating of 150 psi**.
3. Unless equipped with optional metallic rod-scraper and rod boot, the cylinder should be operated in an environment free of excessive dust and abrasive particles.
4. Standard **operating temperature is between –30°C and +120°C (–25°F and +250°F)** unless specially equipped with high or low temperature seals.

## Section 3: Maintenance

Bettis GVO-C Linear actuator has been designed to give you trouble free performance with a minimum of maintenance. Periodic inspection and replacement of seals, when required, is recommended in order to ensure continued product safety and reliability. Inspection and seal replacement intervals depend on your specific operating conditions.

### 3.1 Inspection of Gland and Barrel Seals

1. Connect pressure line to rod-end port.
2. Apply Leak-Tek or similar solution to the gland bushing and piston rod juncture and inspect for signs of leakage.
3. Apply solution to the barrel and rod-end cap juncture and inspect for signs of leakage.
4. Connect pressure line at the cap-end port.
5. Apply solution to barrel and rear-end cap juncture and inspect for leakage.

### 3.2 Inspection of Piston Seals

1. Connect pressure line at rear-end cap port to allow actuator rod fully extend.
2. Install a pressure gauge at rod-end cap port and monitor reading for approximately 30 seconds. If the pressure reading remains at zero, piston seals performed properly. If a pressure rise is observed, seals should be replaced immediately.
3. Connect pressure line to rod-end cap port and pressure gauge to rear-end cap port and proceed to Step 2 above; repeat the same steps to verify seal performance in opposite direction.

## Section 4: Seal Replacement

### **⚠ WARNING:**

**Stop if your actuator is equipped with an internally installed compression spring. Proceed to Section 4.1.1, Dismantling Spring Loaded Actuators.**

### 4.1 Dismantling the Actuator, Non-Spring Loaded

1. **Make sure line pressure is shut off before disconnecting actuator.**
2. Remove the actuator to a clean working area.
3. Remove transducer flange assembly.  
See Section 6, "Transducer Replacement Instructions".
4. Unscrew tie rod nuts and remove tie rods. Always use appropriate tools.
5. Remove the rod-end and rear-end caps from barrel. Use a rubber mallet to loosen components if necessary.
6. Pull the piston and piston rod assembly from barrel. Take care not to damage the rod and the barrel. **Do not disassemble the rod from the piston.**
7. Unscrew gland bushing from rod-end cap.
8. Remove seals from both piston and gland bushing, noting orientation of seal edges (Vees). Edges must face into pressure direction. Remove seals (O-rings) from rod-end and rear-end caps grooves.
9. Verify barrel bore, gland bushing and rod surface for scratches or scoring, damage or excessive wear.
10. Replace piston rod assembly and/or gland bushing if damaged. Contact factory for replacement parts

#### 4.1.1 Dismantling Spring Loaded Actuators

(Spring loaded actuators are shipped with extended tie-rods at the rear-end cap)

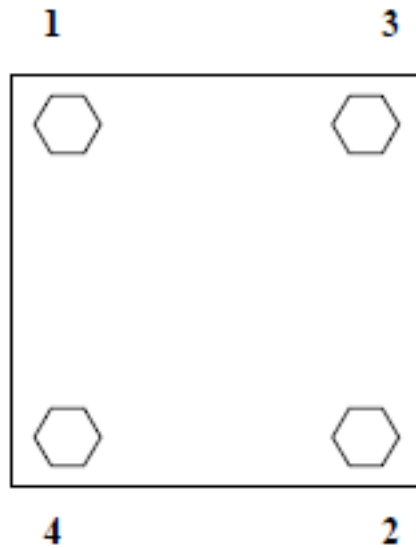
1. **Make sure line pressure is shut off before disconnecting actuator.**
2. Remove the actuator to a clean working area.
3. Before loosening tie-rod nuts, clamp the tie-rod being worked on with a “Vise-Grip” or similar locking device, to prevent unthreading from the rod-end cap. Loosen each tie-rod nut one to two turns at a time, in the sequence shown on Figure 1, until the spring is completely decompressed.
4. Remove rod-end cap together with tie-rods.
5. Pull the piston and piston rod assembly from barrel. Take care not to damage the rod and the barrel. **Do not disassemble the rod from the piston.**
6. Unscrew gland bushing from rod-end cap.
7. Remove seals from both piston and gland bushing, noting orientation of seal edges (Vees). Edges must face into pressure direction. Remove seals (O-rings) from rod-end and rear-end cap grooves.
8. Verify barrel bore, gland bushing and rod surface for scratches or scoring, damage or excessive wear.
9. Replace piston rod assembly and/or gland bushing if damaged. Contact factory for replacement parts.

## 4.2 Reassembling the Actuator

1. Carefully clean all components, grooves and surfaces prior to reassembly. Use compressed air to remove all solid particles.
2. Apply a light coat of grease (ESSO LIDOK EP2 or equivalent) to all packing and seal grooves.
3. Place O-rings in appropriate head and cap grooves.
4. Install piston seals. Vees must face pressure direction.
5. Install wear-band(s) on piston.
6. Slide piston and piston rod assembly into barrel. Take care not to damage seals.
7. Install gland seals, back-up rings and rod wiper in gland bushing.
8. Push gland bushing pilot diameter into actuator head. Tap with a rubber mallet, if necessary, to overcome resistance caused by O-ring.
9. Thread the bushing flange flush with actuator head. Tighten until snug.
10. Install cap on barrel. Ensure that barrel seal (O-ring) is properly seated in groove.
11. Slide actuator head over the piston rod and seat against barrel end. Make sure that bushing and barrel seals remain properly seated.
12. Install tie rods and hand tighten nuts. Make sure that head and cap are properly aligned.
13. Tighten tie rod nuts in sequence shown in Figure 1. Torque to values shown in Table 1.
14. Install Transducer Flange assembly.  
See Section 6, "Transducer Replacement Instructions".



**Figure 1 Tie Rod Nut Torquing Sequence**



**Table 1. Torque Values**

Cylinder Bore (Inches)	Number of Tie Rods	Diameter of Tie Rods (Inches)	Torque (lb-ft) (No Lubrication)
4	4	3/8	15
5	4	1/2	25
6	4	1/2	30
7	4	5/8	35
8	4	5/8	60
10	4	3/4	90
12	4	3/4	125
14	4	7/8	150
16	4	1	190
18	4	1-1/8	260
20	4	1-1/4	320
22	4	1-1/2	360
24	4	1-1/2	400
26	4	1-1/2	450
28	4	2	485

## Section 5: Seal-Kit Selection

Use genuine parts only to ensure proper fit and function for continuous trouble free operation.

In order to supply you with the appropriate seal-kit for your actuator, we require the **part number and the serial number** shown on the identification tag located on the barrel of the actuator.

## Section 6: Transducer Replacement Instructions

### (Only Applies to Replacement of Transducer/Flange Assembly)

1. Fully retract cylinder piston rod.
2. Ensure pressure is released from both ports of cylinder (fully depressurizing cylinder).
3. Remove cable from receptacle in rear of transducer flange.
4. Remove 4x bolts (5/16-18UNC) from transducer flange.
5. Remove transducer flange from cap. Take notice that there is a threaded hole, 1/4-28UNF, in center of flange to assist with removal. Removal tool is available.

#### ⚠ CAUTION:

Do not use receptacle to pull out flange.

#### ⚠ CAUTION:

Do not move transducer flange far from cap as transducer cable is limited length and can be damaged/torn.

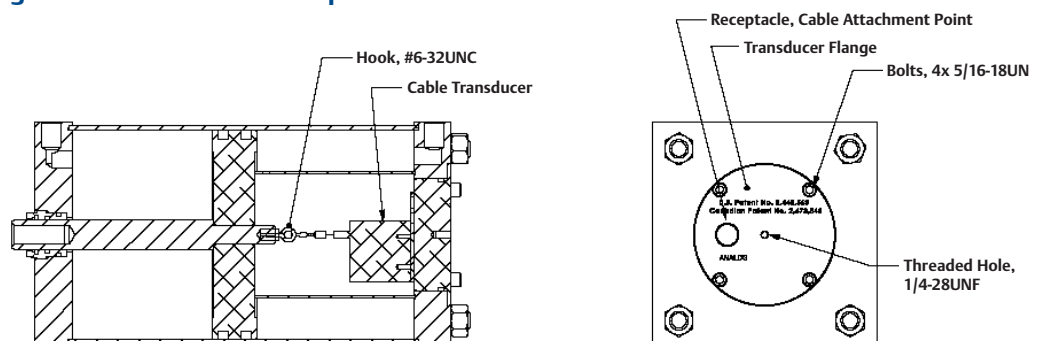
6. Insert hand into flange opening (cap) and unhook the end of cable, from hook #6-32 which is installed in end of piston rod.

#### ⚠ CAUTION:

If hook #6-32 is not opened, it must be modified. Using a high speed cutoff wheel (Dremel tool), cut the eyebolt on its open side, increasing the opening, allowing the cable to be removed. Clean inside of cylinder from cutting operation.

7. Using new transducer assembly, hook the end of the cable onto the hook #6-32 in the end of piston rod.
8. Place transducer flange into cap end and align bolt holes.
9. Insert 4x bolts (5/16-18UN) into cap and tighten. Torque = 8 ft-lbs.
10. Re-attach cable to receptacle in rear of flange.
11. Run auto-tune program on positioner (if required).

Figure 2 Transducer Replacement



## Section 7: Storage Condition

Bettis GVO-C Linear pneumatic actuators are shipped pre-lubricated, with exposed machined parts protected against corrosion. Piston rods and extended tie rods are protected against physical damage with polyurethane mesh sleeving. Air supply ports are protected with plastic cap plugs. All actuators are ready to use when they are shipped from factory. If the actuators must be stored before installation for a period of time, following storage conditions are required:

1. Actuators must be stored indoors.
2. Actuators must be stored in vertical position to prevent packing deformation.
3. Ambient storage temperature:  $-20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  ( $-4^{\circ}\text{F}$  to  $+104^{\circ}\text{F}$ ).
4. Humidity: maximum 60%.
5. Do not remove protective cap plugs or protective covers.
6. Apply every 6 months a thin layer of metal protective coating on all machined exposed parts (threads).

Before installation and start-up, following steps must be taken:

1. Remove all protective plastic plugs from air supply ports.
2. Spray a small amount (approximately 10 ml) of clean mineral petroleum based oil into the air supply ports.
3. Run the actuator for 8 to 10 dry cycles (piston rod free, without being connected to any device).

If cylinders are stored horizontally, there may be a chance that the piston and gland seals will become deformed and lose their sealing effectiveness.

1. Repeat Steps 1 and 2 as above.
2. Pressurize the cylinder and then cycle the cylinder **Without Any Load** and at slow speed for at least **Twenty Full Cycles**.
3. Observe if there is any leakage across the piston or at the gland bushing. If so, replace the seals.

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