Service Instructions
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Bettis CBAX30 Spring-Return Series Pneumatic Actuators

Disassembly and Reassembly

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Section 1: Introduction

1.1 General Service Information

- This service procedure is offered as a guide to enable general maintenance to be performed on Bettis™ CBAX30-SR spring-return series actuators. The following is a list of general CBAX30 SR model numbers:

Table 1. CBAX30-SR Model Numbers

Model[1]		
CBA730-SR	CBA730-SR-M3	CBA730-SR-M3HW
CBA830-SR	CBA830-SR-M3	CBA830-SR-M3HW
CBA930-SR	CBA930-SR-M3	CBA930-SR-M3HW
CBA1030-SR	CBA1030-SR-M3	CBA1030-SR-M3HW

NOTE:
1. Also includes actuator models with -10 and -11 as a suffix.

NOTE:
When the actuator model number has "-S" as a suffix then the actuator is special and may have some differences that may not be included in this procedure.

- Normal recommended service interval for this actuator series is five years.

NOTE:
Storage time is counted as part of the service interval.

- This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.
- Remove all piping and mounted accessories that will interfere with the module(s) that are to be worked on.
- This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- Numbers in parentheses ( ), indicates the bubble number (reference number) used on the Bettis assembly drawing and Actuator Parts List.
- When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.
- Use a non-hardening thread sealant on all pipe threads.

⚠ CAUTION

Apply the thread sealant per the manufacturer's instructions.

- Bettis recommends that disassembly of the actuator components should be done in a clean area on a workbench.

1.2 Definitions

⚠ WARNING

If not observed, user may cause 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 are provided to assist maintenance personnel to carry out maintenance procedures.

NOTE:

This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).

M3: Jackscrew or jackscrew assembly

M3HW: Jackscrew assembly with handwheel

ES: Extended stop(s)

1.3 General Safety Information

Products supplied by Bettis, in its "as shipped" condition, are intrinsically safe if the instructions within this Service Instruction are strictly adhered to and executed by well-trained, equipped, prepared and competent personnel.

⚠ 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 given to the WARNINGS, CAUTIONS and NOTES from 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 customer's representative and an authorized Emerson Actuation Technologies representative.

⚠ WARNING

Electrostatic Charge - An electrostatic charge risk is present on the actuator surface; in case of cleaning, use only antistatic cloth; in case of maintenance, avoid all rubbing/frictions that could electrostatically charge the equipment.

1.4 Bettis Reference Materials

- CBAX30-SR assembly drawing use part number VA129743.
- CBBX30-SR-M3HW assembly drawing use part number 129745.

1.5 Service Support Items

- Bettis Service Kit
- Commercial leak testing solution
- Non-hardening thread sealant

1.6 Operating Media

- Recommended to use clean, dry air or inert gas.
- Other gases may be used with direction from Emerson Engineering to evaluate any possible restrictions or modifications which may need to be made for compatibility.

1.7 Lubrication Requirements

The actuator should be relubricated at the beginning of each service interval using the following recommended lubricants.

NOTE:

Lubricants other than those listed below should not be used without prior written approval of Bettis Product Engineering. The lubricant item number on some assembly drawings is item (5) while the Bettis service kits lubricant item number is (500).

All temperature services -45.5 to 176.6 °C / -50 to +350 °F use Bettis ESL-5 lubricant. ESL-5 lubricant is contained in the Bettis module service kit in tubes and the tubes are marked ESL-4, 5 and 10 lubricant.

1.8 General Tool Information

All threads on CBAX30-SR Series actuators are Inch Unified and NPT.

All tools/Hexagons are American Standard inch. Two adjustable wrenches, Allen wrench set, small standard screwdriver with sharp edges rounded off, medium size standard screwdriver, diagonal cutting pliers, external snap ring pliers, flat file, drive ratchet/deep well socket set and torque wrench (up to 226 Nm / 2,000 in-lb).

1.9 Actuator Weight

Table 2. Actuator Weight

Actuator Model	Approximate Weight[2]		Actuator Model	Approximate Weight[2]	
	kg	lb		kg	lb
CBA730-SR40[1]	71.7	158	CBA930-SR40[1]	88.5	195
CBA730-SR60[1]	72.8	160.5	CBA930-SR60[1]	91.6	202
CBA730-SR80[1]	73.9	163	CBA930-SR80[1]	93.7	206.5
CBA730-SR100[1]	74.4	164	CBA930-SR100[1]	93.0	205
CBA830-SR40[1]	81.6	180	CBA1030-SR40[1]	99.8	220
CBA830-SR60[1]	83.7	184.5	CBA1030-SR60[1]	102.3	225.5
CBA830-SR80[1]	85.3	188	CBA1030-SR80[1]	105.9	233.5
CBA830-SR100[1]	87.3	192.5	-	-	-

NOTES:
1. When model has -M3HW add 3.6 kg / 8 lb.
2. Weight is for bare actuator without accessories or valve adaption.

1.10 Actuator Storage

For applications where the actuator is not placed into immediate service, it is recommended that the actuator be cycled with regulated clean/dry pneumatic pressure at least once per month. Indoor storage, if available, is recommended for all actuators. Care should be taken to plug all open ports on actuator and controls to keep out foreign particles and moisture. Actuators should not be stored in an atmosphere that is harmful to resilient seals. Contact factory for extended storage period.

1.11 Actuator Installation

Since there are many valve and actuator combinations, it is not practical to include detailed instructions for each type. Mountings are designed to be as simple as possible to keep the guess work out of the installation.

Actuators are shipped from the factory with the travel stops adjusted for approximately 90° rotation. Generally, it is necessary to make slight travel stop adjustments once the actuator is installed onto the valve. Refer to the valve manufacturer's recommendations for specific requirements. When the valve has internal stops, the actuator should be adjusted at the same points.

NOTE:
The actual "stopping" should be done by the actuator. If the valve does not have internal stops, adjust the actuator to the full open position. Using this as a reference point, rotate the valve closed and adjust to the valve manufacturer's specifications for total rotation.

Good instrument practices are also recommended. Clean/dry regulated pneumatic pressure is essential for long service life and satisfactory operation. It should be noted that new pneumatic lines often have scale and other debris in them and these lines should be purged of all foreign material.

NOTE:
Scale and debris can damage control valves, solenoids and seals.

1.12 Actuator Start-up

1.12.1 Prestart-up checks

1. Inspect to ensure the unit has been mounted onto valve properly. Gear flange mounting bolts, stem key, set screw(s) are installed and secured.
2. No tubing damaged or accessories dislodged during the shipping or the installation.
3. Indicated position confirms valve position.
4. All switching valves in normal operating position as per schematic/instructions.

1.12.2 Check connections

1. Pneumatic/hydraulic components connected as per schematic enclosed or in service manual supplied.
2. Pneumatic supply connected to the identified ports.
3. Electrical connection terminals are secured.
4. Wiring as per enclosed diagram or service manual supplied.

NOTE:
When actuator is first placed into service, it should be cycled with regulated pneumatic pressure. This is necessary because the seals have been stationary, causing them to take a "set". Therefore, the actuator should be operated through several cycles to exercise the seals so as to achieve a service ready condition.

1.12.3 Speed of operation
The actuator speed of operation is determined by a number of factors including:

1. Power supply line length
2. Power supply line size
3. Power supply line pressure
4. Control valve and fitting orifice size
5. Torque requirements of the valve
6. Size of the actuator
7. Setting of speed controls
8. Hydraulic manual override (where available)

Due to the interaction of these variables, it is difficult to specify a "normal" operating time. Faster operating time may be obtained by using one or more of the following:

1. Larger supply lines
2. Larger control valve
3. Higher supply pressure *
4. Quick exhaust valves

NOTE: * Not to exceed maximum operating pressure of actuator or control components.

Slower operating time may be obtained by using flow control valves to meter the exhaust. Excessive exhaust flow metering may cause erratic operation.

1.13 Actuator Operation

1.13.1 Controlled operation
Controlled operation is accomplished by pressurizing and/or depressurizing the appropriate cylinder inlet(s) of a double-acting. Do not exceed pressures indicated on actuator nameplate.

1.13.2 Manual operation
All pressure must be vented or equalized on both sides of the pneumatic piston prior to manual operation.

Section 2: Actuator Disassembly

2.1 General Disassembly

⚠ WARNING

It is possible that the actuator may contain a dangerous gas and/or liquids. Ensure that all proper measures have been taken to prevent exposure or release of these types of contaminants before commencing any work.

⚠ CAUTION

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

NOTE:

Before starting the general disassembly of the actuator it is a good practice to operate actuator with the pressure used by the customer during normal operation. Notate and record any abnormal symptoms such as jerky or erratic operation.

2.1.1 Remove all operating pressure from actuator, allowing the spring to stroke. The spring will rotate the yoke to its fail position.

NOTE:

In place of stop screws, the actuator may be equipped with one or two.
ES (Extended Stops) or one M3/M3HW (6-30) located on outboard end of housing (1-10).

2.1.2 Record the settings of stop screw (6-30)/ES (6-30)/M3 jackscrew (6-30) and stop screw (4-30)/ES (4-30) before they are loosened or removed.

2.1.3 CBAX30-SR-M3/M3HW:

- **2.1.3.1** Remove retainer ring (12-30) from M3 jackscrew (6-30).
- **2.1.3.2** Remove groove pin (12-20) from optional hex drive hub or from handwheel (12-10).
- **2.1.3.3** Remove optional hex drive hub or handwheel (12-10) from M3 jackscrew (6-30).
- **2.1.3.4** Remove caution tag (12-40) from M3 jackscrew (6-30).

2.1.4 Loosen and remove hex nut (6-40) from stop screw (6-30), ES (6-30) or M3 jackscrew (6-30).

2.1.5 Remove stop screw (6-30) or ES (6-30) from housing adapter (6-10).

NOTE:

CBAX30-SR-M3 or M3HW models the M3 cannot be removed now. The M3 used in these models can be removed later in this procedure using step 2.3.8.

2.2 Spring Cylinder Disassembly

NOTE:
Review Section 2, steps 2.1.1 through 2.1.5 before proceeding with spring cylinder disassembly.

The spring in CBAX30 Series spring-return actuators are preloaded.

Actuator must be disassembled in the following manner:

2.2.1 Loosen and remove hex nut (4-40) from stop screw (4-30) or from ES (4-30).

NOTE:
Stop screw (4-30) or ES (4-30) does not require removal from end cap (4-20) unless replacing with a new part.

2.2.2 Remove breather (30) from end cap (4-20).

2.2.3 Remove acorn nut (8-20) and gasket seal (5-60) from center bar assembly (8-10).

2.2.4 Use a ratchet and socket on the welded nut, located on the housing end of center bar assembly (8-10), rotate center bar assembly (8-10) counterclockwise (CCW). This will cause end cap (4-20) to gradually unscrew from center bar assembly (8-10).

2.2.5 Continue to rotate center bar assembly (8-10) counterclockwise (CCW) until the spring preload is eliminated. As preload is reduced it may be necessary to keep end cap (4-20) from turning.

NOTE:
Hold end cap (4-20) in position with an adjustable wrench.

2.2.6 After the spring preload is eliminated, unscrew and remove end cap (4-20) from center bar assembly (8-10).

2.2.7 Remove spring (4-70) from within spring cylinder (4-10).

2.2.8 Hold torque shaft (1-30) and pull spring cylinder (4-10) away from housing (1-10); slide spring cylinder over piston (4-50) and remove.

2.2.9 Pull piston (4-50) out of housing (1-10) and carefully slide piston off of center bar assembly (8-10).

NOTE:
Piston (4-50) is an assembly made up of one roll pin and one yoke pin; do not attempt to disassemble the piston assembly.

2.2.10 On models CBA830-SR, CBA930-SR and CBA1030-SR, remove cylinder adapter (4-15).

2.3 Housing Disassembly

2.3.1 Remove center bar assembly (8-10) housing adapter (6-10).

2.3.2 Remove housing adapter (6-10) from housing (1-10).

2.3.3 Remove the position indicator (1-50) from torque shaft (1-30).

2.3.4 Remove retaining ring (2-90) from torque shaft (1-30).

2.3.5 Remove thrust washer (2-80) and thrust bearing (2-70) from torque shaft (1-30).

2.3.6 Remove the torque shaft (1-30) by pushing it out one side of housing (1-10).

2.3.7 Remove yoke key (1-40) from torque shaft (1-30).

2.3.8 Remove yoke (1-20) from housing (1-10).

2.3.9 Actuator equipped with a M3 or M3HW mounted in the housing adapter (6-10) complete steps 2.3.9.1 and 2.3.9.2.

- **2.3.9.1** Remove retainer ring (7-60) from M3 adapter (6-55).
- **2.3.9.2** Remove M3 adapter (6-55) with M3 jackscrew (6-30) from housing adapter (6-10).

2.3.10 Torque shaft upper bearing (2-30) and lower torque shaft bearing (2-50) are pressed into the housing and should not be removed during routine actuator maintenance.

Section 3: Actuator Reassembly

3.1 General Reassembly

⚠ CAUTION

Only new seals that are still within the seals expectant shelf life should be installed into the actuator being refurbished.

3.1.1 Remove and discard all old seals and gaskets.

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

3.1.3 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, torque shaft and center bar assembly must be free of deep scratches, pitting, corrosion and blistering or flaking coating.

⚠ CAUTION

Actuator parts that reflect any of the above listed characteristics may need replacement with new parts.

3.1.4 Installation lubrication instructions
Use the correct lubrication as defined in Section 1.7.

3.1.4.1 Before installation, coat all moving parts and the thrust washer (8-30) with lubricant.

3.1.4.2 Coat all seals with lubricant, before installing into seal grooves.

3.1.5 Torque shaft upper bearing (2-20) and lower bearing (2-50) are not recommended as parts that require field replacement. Consult Houston, Texas Bettis Service Coordinator for "torque shaft upper or lower bearing" replacement information.

3.2 Housing Reassembly

NOTE:

Review Section 3, steps 3.1.1 through 3.1.5 before proceeding with housing reassembly.

In Section 3.2 where the step indicates to "lubricate, coat or apply lubricant", use lubricant as identified in Section 1.7 for lubricating the part being installed.

Actuators equipped with M3 jackscrew, install M3 per step 3.2.1. Actuators equipped with housing adapter ES or stop screw (6-30), skip step 3.2.1 and continue assembly at step 3.2.2.

3.2.1 M3 jackscrew installation:

3.2.1.1 Apply a coating of lubricant to outer diameter and inner diameter threads of M3 jackscrew adapter (6-55).

3.2.1.2 Coat O-ring seal (7-65) with lubricant and install into outer diameter seal groove located in the M3 jackscrew adapter (6-55).

3.2.1.3 Apply a light coating of lubricant to the threads of M3 jackscrew (6-30).

3.2.1.4 Install and rotate the M3 jackscrew (6-30) into M3 jackscrew adapter (6-55).

NOTE:

Rotate the M3 jackscrew into the adapter until the inboard end of the jackscrew is up against the adapter.

3.2.1.5 Install M3 jackscrew adapter (6-55) with M3 jackscrew (6-30) into housing adapter (6-10).

3.2.1.6 Install retainer ring (7-60) onto groove in M3 jackscrew adapter (6-55).

3.2.1.7 Install O-ring seal (7-30) onto M3 jackscrew (6-30).

NOTE:

Move the O-ring seal (7-30) down the M3 jackscrew until it is next to the M3 jackscrew adapter.

3.2.1.8 Install hex nut (6-40) onto M3 jackscrew (6-30).

NOTE:

Rotate the hex nut down the M3 jackscrew until it is next to the M3 jackscrew adapter.

3.2.2 Lubricate ES or stop screw (6-30) and install into housing adapter (6-10).

3.2.3 Apply a coating of lubricant to the torque shaft holes located on each side of housing (1-10).

3.2.4 Coat rod wiper seal (2-20) with lubricant and install in the grooves located in the upper torque shaft through hole of housing (1-10).

NOTE:

The cup of wiper seal will be installed facing down into the housing.

3.2.5 Coat U-cup seal (2-40) with lubricant and install into the groove located in the lower torque shaft through hole of housing (1-10) — the inner most groove nearest the yoke (1-20).

NOTE:

The cup of rod wiper seal will be installed facing into the housing.

3.2.6 Coat rod wiper (2-60) with lubricant and install into the outer most groove located in the lower torque shaft through hole of housing (1-10).

NOTE:

The cup of rod wiper will be installed facing to the outside of housing (1-10).

3.2.7 Coat yoke (1-20) with lubricant and install into housing (1-10). Apply a generous amount of lubricant to the slots in the arms of yoke (1-20).

3.2.8 Insert the yoke key (1-40) into the slot in the torque shaft (1-30).

3.2.9 Hold the yoke key (1-40) in position and insert the torque shaft (1-30) into and through housing (1-10) and yoke (1-20).

3.2.10 Install thrust bearing (2-70) onto the upper area of torque shaft (1-30).

3.2.11 Install thrust washer (2-80) onto the upper area of torque shaft (1-30) on top of thrust bearing (2-70).

NOTE:

A new retaining ring (2-90) is provided in the Bettis CBA Service Kit.

3.2.12 Install the new retaining ring (2-90) into the groove located on the upper area of torque shaft (1-30).

⚠ CAUTION

Verify that retaining ring (2-90) is properly seated in the groove of torque shaft (1-30).

3.2.13 Rotate the torque shaft (1-30) so that the arms of yoke (1-20) point outward.

3.2.14 Coat O-ring seal (5-20) with lubricant and install into inner diameter seal groove located in the center bar hole of housing adapter (6-10).

3.2.15 Coat thrust washer (8-30) with lubricant and install onto center bar assembly (8-10).

NOTE:

Position thrust washer (8-30) up against the center bar assembly weld nut.

⚠ CAUTION

Verify that the thrust washer (8-30) is well lubricated between the thrust washer (8-30) and the center bar assembly weld nut (8-10).

3.2.16 Coat entire length of center bar assembly (8-10) with lubricant including the threads.

3.2.17 Insert center bar assembly (8-10) into the center hole of housing adapter (6-10). Slide center bar assembly through housing adapter until center bar assembly nut is flush against the housing adapter (6-10).

⚠ WARNING

Care should be taken during installation of center bar assembly so as to not scratch it or damage the housing adapter O-ring seal (5-20).

NOTE:

Rotate the hex nut down the M3 jackscrew until it is next to the M3 adapter.

3.2.18 Recoat center bar assembly (8-10) with lubricant.

3.2.19 Coat O-ring seal (7-10) with lubricant and install onto outer diameter flange located on housing adapter end of housing (1-10).

3.2.20 Install housing adapter (6-10), with installed center bar assembly (8-10), on to the cylinder adapter end of housing (1-10).

3.2.21 Coat one O-ring seal (5-10) with lubricant and install onto outer diameter flange located on cylinder adapter end of housing (1-10).

3.2.22 Actuators equipped with cylinder adapter (4-15), models CBA830-SR, CBA930-SR and CBA1030-SR, do steps 3.2.22.1 and 3.2.22.2.

3.2.22.1 Install cylinder adapter (4-15) onto housing flange, with the stepped outer diameter, of cylinder adapter (4-15), facing away from housing (1-10).

3.2.22.2 Install one O-ring seal (5-15) onto stepped diameter of cylinder adapter (4-15).

3.3 Spring Cylinder Reassembly

NOTE:

Review Section 3, steps 3.1.1 through 3.1.4 before proceeding with spring cylinder reassembly.

In Section 3.3 where the step indicates to “lubricate, coat or apply lubricant”, use lubricant as identified in Section 1.7 for lubricating the part being installed.

3.3.1 Coat all areas of piston (4-50) with lubricant.

3.3.2 If removed coat rod bushing (5-50) with lubricant and install into the internal rod bushing groove located in the head of piston (4-50).

3.3.3 Coat rod T-seal (5-25) with lubricant and install in the internal seal groove in the head of piston (4-50).

3.3.4 Coat piston seal (5-40) with lubricant and install into outer diameter seal groove of piston (4-50).

3.3.5 Coat piston bearing (5-45) with lubricant and install into outer diameter bearing groove of piston (4-50).

3.3.6 Install bushing (1-60) between the two arms of yoke (1-20).

3.3.7 With the piston head facing away from housing (1-10) install piston assembly (4-50) onto center bar assembly (8-10).

3.3.8 Carefully slide piston assembly (4-50) along center bar assembly (8-10) until the yoke pin engages the slots of yoke (1-20).

NOTE:
While holding the center bar assembly flush against the housing adapter (6-10), push piston assembly (4-50) into housing (1-10) as far as the piston will go.

3.3.9 Apply a coating of lubricant to entire bore of spring cylinder (4-10).

3.3.10 Spring cylinder (4-10) installation:

3.3.10.1 For CBA830-SR, CBA930-SR and CBA1030-SR models, install the lubricated spring cylinder (4-10) over the piston and up-against the O-ring seal on the stepped diameter flange of cylinder adapter (4-15).

3.3.10.2 For CBA730-SR models, install the lubricated spring cylinder (4-10) over the piston and up-against the O-ring seal on the flange of housing (1-10).

3.3.11 Apply a coat of lubricant to the spring (4-70). Insert the spring into the spring cylinder by carefully sliding the spring into the open spring cylinder until the spring contacts the head of piston (4-50).

3.3.12 End cap seal installation:

3.3.12.1 For CBA830 SR, CBA930 SR and CBA1030 SR models, install o ring seal (5-15) onto end cap (4-20).

3.3.12.2 For CBA730 SR models, install O-ring seal (5-10) onto end cap (4-20).

3.3.13 If removed, install stop screw (4-30) or ES (4-30) into end cap (4-20).

NOTE:
Position spring cylinder (4-10) so that spring tag (4-60) will be adjacent to accessory mounting pads located on the actuator housing.

3.3.14 Install end cap (4-20) onto center bar assembly (8-10) by rotating the end cap in a clockwise direction.

3.3.15 Position the end cap (4-20) so that the breather port is at the bottom and the stop screw/ES (4-30) is at the top.

⚠ WARNING

Do not allow end cap (4-20) to rotate during center bar assembly tightening. The end cap must maintain the position as described in step 3.3.15.

3.3.16 Keep end cap (4-20) from turning by holding end cap in position.

3.3.17 Using a ratchet and socket on the center bar assembly nut, rotate center bar assembly clockwise (CW). This will cause end cap (4-20) to gradually screw further onto center bar assembly (8-10).

3.3.18 Continue to rotate center bar assembly (8-10) clockwise until spring (4-70) is fully compressed, the spring cylinder is seated against the flange of housing (1-10) or adapter (4-15) and end cap (4-20) is properly seated in spring cylinder (4-10).

3.3.19 Torque tighten center bar assembly (8-10) to 233 lbf-ft / 316 Nm.

3.3.20 Place seal gasket (5-60) on the exposed end of the center bar assembly (8-10).

3.3.21 Place acorn nut (8-20) on the exposed end of center bar assembly (8-10) and tighten securely.

3.3.22 Install O-ring seal (5-30) onto ES or stop screw (4-30) until it is flush with the end cap (4-20).

3.3.23 Install hex nut (4-40) and washer (4-90) onto ES or stop screw (4-30) do not tighten.

NOTE:

Washer (4-90) is not applicable to the M3HW assembly.

3.3.24 Adjust all ES, stop screws or M3 jackscrew back to setting recorded in Section 2, step 2.1.2 under General Disassembly. Tighten both stop screw hex nuts (4-40) and (6-40) securely, while holding ES, stop screws or M3 jackscrews in position.

3.3.25 M3 hex drive hub or handwheel installation as follows:

3.3.25.1 Install caution tag (12-40) onto M3 jackscrew (6-30).

3.3.25.2 Install hex drive hub (12-10) or handwheel (12-10) onto M3 jackscrew (6-30) and align the “hole” of the drive hub with the “hole” located in the M3 jackscrew.

3.3.25.3 Install groove pin (12-20) into the hex drive hub (12-10) or handwheel (12-10).

3.3.25.4 Install retainer ring (12-30) onto the outboard end of M3 jackscrew (6-30).

Section 4: Actuator Testing

4.1 Actuator Testing

4.1.1 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.

4.1.2 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 serial number tag (20).

4.1.3 All leak testing will use the customer normal operating pressure or the actuator name tag Normal Operating Pressure (NOP).

NOTE:

When testing the actuator use a proper adjusted regulator to apply pressure to the actuator.

4.1.4 Before testing for leaks, apply and release the pressure listed in step 4.1.3 to the housing side of the piston. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.

4.1.5 Apply the pressure listed in step 4.1.3 to the housing side of the piston and allow the actuator to stabilize.

4.1.6 Apply a leak testing solution to the following areas:

- **4.1.6.1** Spring cylinder to housing joint on CBA730-SR or spring cylinder to cylinder adapter to housing joints on CBA830-SR, CBA930-SR and CBA1030-SR actuators.
- **4.1.6.2** On the out board end of housing (6-10) at the center bar assembly nut. Checks the center bar to housing O-ring seal (5-20).
- **4.1.6.3** On the out board end of housing (1-10) at the joint of the housing (1-10) and the housing adapter (6-10). Checks the O-ring seal sealing the housing flange to the housing adapter.
- **4.1.6.4** At the joint between housing adapter (6-10), M3 jackscrew/ES/ stop screw (6-30) and hex nut (6-40). Checks M3 jackscrew/ES/ stop screw O-ring seal (7-30) and O-ring seal (7-65) when actuator has a housing adapter M3 jackscrew.
- **4.1.6.5** Both torque shaft (1-30) to housing (1-10) interfaces. Checks wiper seal (2-20), O-ring seal (2-40) and rod wiper (2-60).
- **4.1.6.6** End cap (4-20) breather (30) port hole. Checks the piston to cylinder seal (5-40) and piston to center bar seal (5-25).
- **4.1.6.7** Remove pressure from pressure inlet port in the housing (1-10).

4.1.7 If an actuator was disassembled and repaired as a result of this procedure, the above leakage test must be performed again.

4.1.8 Operational (Functional) Test: This test is used to verify proper function of the actuator.

NOTE:

This test is to be done off of the valve or when valve stem is not coupled to the actuator torque shaft.

4.1.8.1 Adjust the pressure regulator to the pressure rating that the customer uses to operate the actuator during normal service.

4.1.8.2 Apply the above pressure to the actuator and allow the actuator to stabilize. The actuator should stroke a full 90° travel with the stops properly set.

4.1.9 Shell Pressure Test: Optional pressure test can be performed on a PED certified actuator by applying pressure to both sides of the piston simultaneously for a period of two (2) minutes. If any leakage occurs across a static seal, the unit must be disassembled and the cause of leakage must be determined and corrected.

⚠ WARNING

The actuators main pressure bearing parts will be tested in controlled conditions in accordance with the requirement of PED by pressuring both sides of the piston to avoid damage and over torquing of the actuator components. If further future testing in the field is necessary, Emerson should be contacted for guidance.

4.2 Return to Service

4.2.1 Install breather (30) into end cap (4-20).

4.2.2 Install position indicator (1-50) onto the top of torque shaft (1-30).

4.2.3 After the actuator is installed back on the valve or the device it is operating all accessories should be hooked up and tested for proper operation and replaced, if found defective.

Section 5: Field Conversions

5.1 Fail Mode Reversal (CW to CCW or CCW to CW)

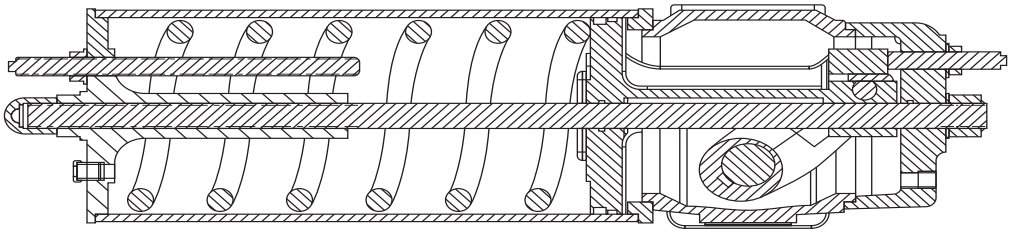
5.1.1 Disassemble actuator, refer to Section 2.

5.1.2 Converting to CCW:
Assemble actuator with spring cylinder assembly on the right side of housing and housing adapter assembly on left side using the orientation below, refer to Section 3.

5.1.3 Converting to CW:
Assemble actuator with cylinder assembly on the left side of housing and housing adapter assembly on right side using the orientation below, refer to Section 3.

Figure 1. Fail Modes

CCW FAIL MODE



CW FAIL MODE

Section 6: Troubleshooting

6.1 Fault Insertion

In the unlikely event of a fault developing, the following Fault Location Table is provided to assist the service engineer to perform troubleshooting. This table is designed to cover as wide a range of Emerson's Bettis actuators as possible. Reference to equipment not supplied should be ignored.

Table 3. Fault Location Table

Symptom	Potential Causes	Remedy
Erratic movement	Irregular supply of operating medium	Check operating medium for consistent supply pressure and correct as necessary.
	Inadequate lubrication	Dismantle, relubricate and reassemble.
	Worn parts	Dismantle. Visually inspect for significant wear. Actuator replacement may be required.
	Defective valve	Consult the valve OEM's documentation.
Short stroke	Incorrectly set stops (valve and/or actuator)	Check the position of the travel stops and readjust as necessary.
	Hardened grease	Dismantle, remove any hard grease, relubricate and reassemble.
	Debris left in the cylinder or housing during maintenance	Disassemble cylinder assembly to remove debris. Reassemble cylinder assemble as necessary.
	Defective valve	Consult the valve manufacturer's documentation.
Apparent lack of torque	Inadequate supply pressure	Ensure supply pressure is above the minimum operating pressure of the actuator and that output torque produced at supply pressure exceeds valve torque demand.
	Incorrect speed control settings	Adjust speed controls to increase flow.
	Exhaust port blocked	Remove and clean the exhaust port silencers and replace.
	Pipe work blocked, crushed or leaking	Examine the pipe work for blockages, crushed pipe or leakage. Clear or replace as necessary.
	Defective controls	Examine the controls, refurbish or renew as necessary. Refer to component manufacturer's documentation.
	Defective piston seal	Dismantle the cylinder assembly, remove the defective piston seal. Fit new seal and reassemble.
	Defective rod seal	Dismantle the cylinder assembly, remove the defective rod seal. Fit new seal and reassemble.
	Defective housing seal	Dismantle the housing assembly, remove the defective seal. Fit new seal and reassemble.
	High valve torque or valve seized	Consult the valve OEM documentation.

6.2 Operational Test

6.2.1 Full Stroke Test
The "Full Stroke Test" ("On-line") must be performed to satisfy the PFD_{AVG} (average probability of failure on demand) value. The full stroke test frequencies will be defined by the final installer to achieve the defined SIL level.

6.2.1.1 Procedure

6.2.1.1.1 Stroke the actuator/valve assembly two complete open/close cycles with complete closing of the valve.

6.2.1.1.2 Verify the open/close cycles functioned correctly (e.g., check locally, or automatically via Logic solver, the correct movement of the actuator/valve).

Upon successful completion of the above described Full Stroke Test procedure, the "Test Coverage" can be considered 99%.

6.2.2 Partial Stroke Test (when requested)
The "Partial Stroke Test" ("On-line") can be performed to improve the PFD_{AVG} value and to satisfy PFD_{AVG} value. A typical partial stroke value is 15% of the stroke and the recommended test interval is about every one to three months.

6.2.2.1 Procedure

6.2.2.1.1 Operate the actuator/valve assembly for No° 1 open/close cycles 15% of the stroke.

6.2.2.1.2 Verify the partial stroke test functioned correctly (e.g., check locally, or automatically via Logic solver, or via the PST system the correct movement of the actuator/valve was 15% of the stroke).

NOTE:
The above test is only applicable on systems equipped with a partial stroke feature.

Section 7: Removal and Decommissioning

⚠ WARNING

Always follow safe work practices to remove and disassemble CBA and CBB-Series actuator.

The below basic 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 a customer's authorized representative and an authorized Emerson Actuation Technologies representative.

⚠ CAUTION

Make sure actuator is isolated before removing from valve. Turn OFF the power medium and bleed off all pressure first, including storage tank (if present). Next, bleed off pilot pressure, disconnect: pneumatic pressure supply, pilot tubing and electrical wiring (if equipped).

Before starting the disassembly, a large area should be created around the actuator so to allow any kind of movement.

Separate the parts composing the actuator according to their nature (e.g., metallic and plastic materials, fluids, etc.) and send them to differentiate waste collection sites, as provided for by the laws and provisions in force.

1. Drain tanks and remove tubing from actuator. Remove accessories (if equipped) and controls from actuator.
2. Remove all equipment mounted on top of actuator (limit switches, end of stroke valve, relevant pneumatic/electric connection, etc.).
3. Remove mounting bolts, and actuator is ready to be removed from valve.
   For complete actuator tear down, refer to Section 2 of the manual.

Section 8: Document Revision

Table 4. Revision Overview

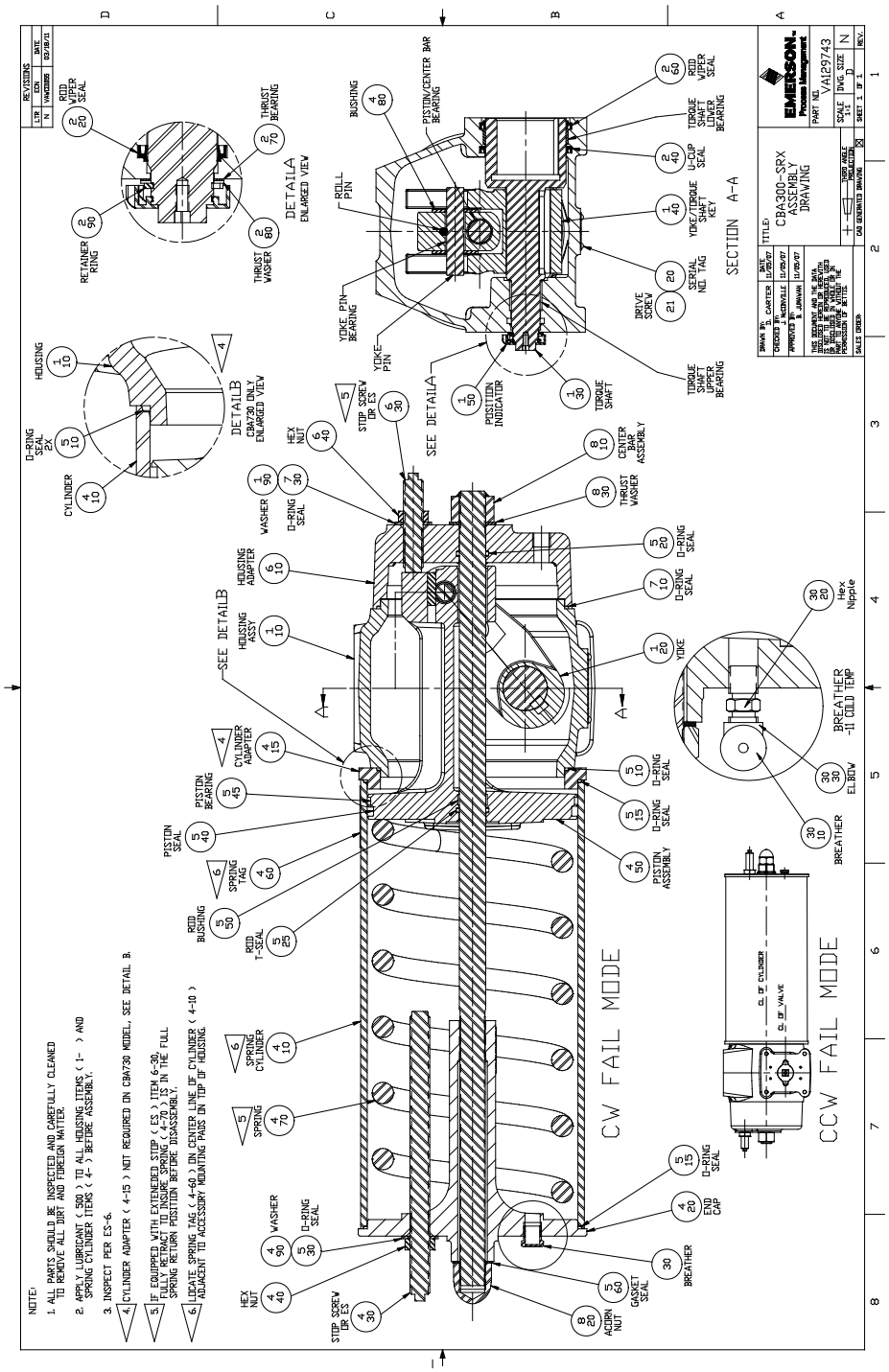
Rev	Date	ECN	Description	By *
A	May 2002	Released	N/A	B. Cornelius
B	April 2007	19527	Updated	L. Ramirez
C	January 2012	VAWCO2292	Updated	N. Mundy
D	August 2015	VAWCO2746	Updated	C. Rico
E	February 2022	N/A	Product Photo Update	N/A
0	April 2022	N/A	Added Warning for Electrostatic Charge	N/A
1	June 2024	SY1214	Added Appendix C	Sanket Yewale

Note:
* Signatures on file at Emerson Actuation Technologies, Houston, Texas.

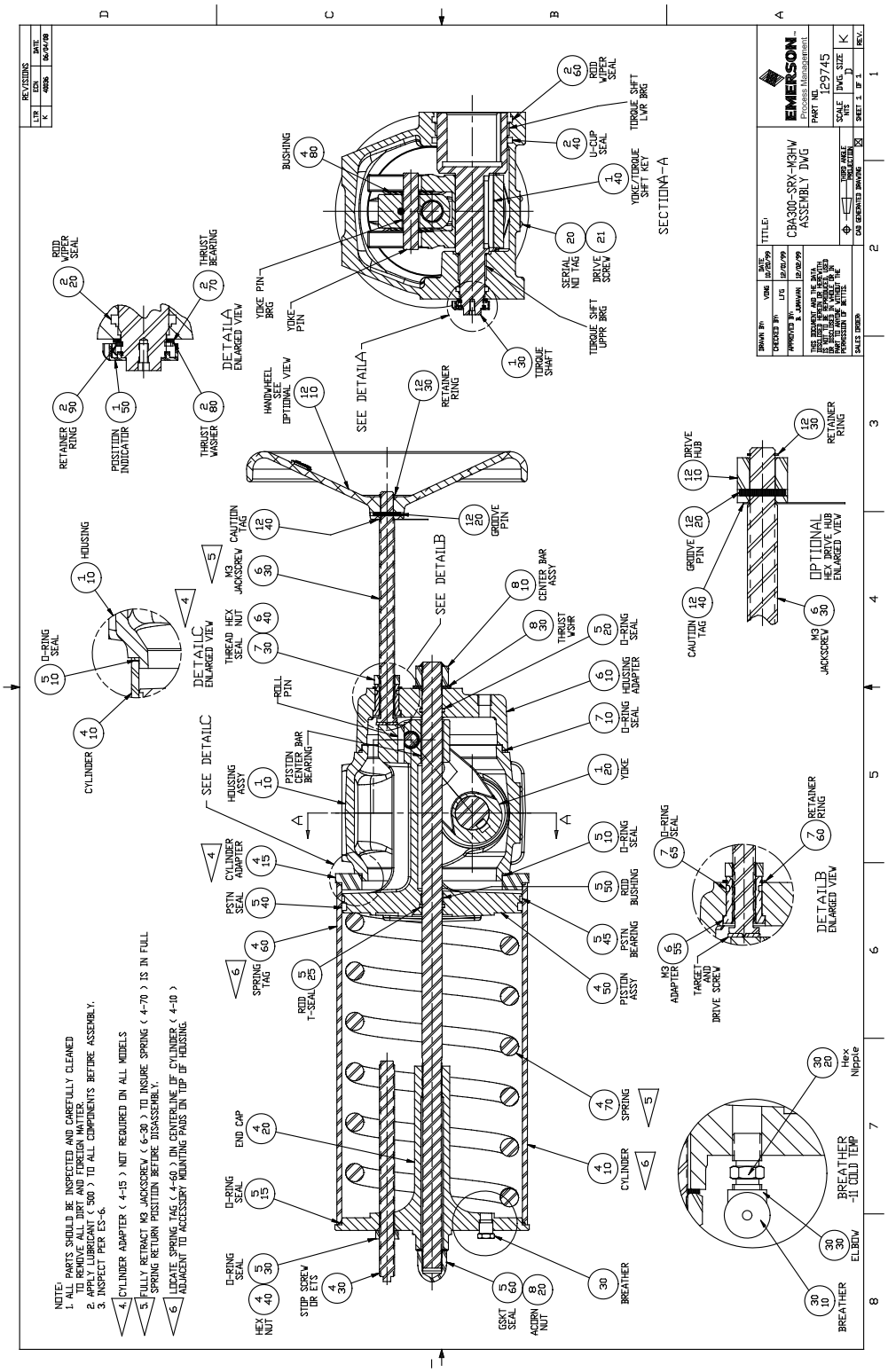
Appendix A: List of Tables

Appendix B: List of Drawings

A.1 Part Number VA129743, CBA300-SRX Assembly Drawing



A.2 Part Number 129745, CBA300-SRX-M3HW Assembly Drawing



Appendix C: Safety Instructions for Use in (Potential) Explosive Atmosphere

C.1 Intended Use

The actuator series have been designed to comply with the explosion safety requirements in the Ex-standards EN IEC 60079-0:2018, EN ISO 80079-36, EN ISO 80079-37:2016 and EN 1127-1:2019. These standards contain the requirements for non-electrical equipment in potentially explosive atmospheres.

The actuators comply with the constructional safety type “c” requirements. The actuators are designed for gas group IIB or IIC and dust group IIIC applications and are applicable in temperature classes T6 to T3 depending on model. The Equipment Protection Level is Gb for gas and Db for dust, so the actuators can be used in Ex classified hazardous zones 1/21.

C.2 ATEX Marking

Complete ATEX Marking:

II 2 G Ex h IIB or IIC T6 to T3 Gb
II 2 D Ex h IIIC T85 °C to T200 °C Db

Ambient Temperature Ranges (T_{amb}):

- Standard Temperature: -20 to 200 °F / -29 to 93 °C
- Low Temperature: -40 to 150 °F / -40 to 65 °C
- High Temperature: 0 to 350 °F / -18 to 176 °C
- Special Low Temperature *: -76 to 212 °F/ -60 to 100 °C

NOTES:

1. The minimum and maximum temperatures can vary according to the project design (gaskets, O-rings and grease used), as well as other certifications within the given range. Please refer to the special conditions for safe use.
2. Hazardous area is likely to occur in normal operation occasionally in greater than 10 and less than 1000 hours/year.
3. * Not applicable for all products and available with Carbon Steel (CS) material.

C.3 Safety Instructions

1. Before the installation, please carefully read the service instructions. Emerson is not responsible for damages caused by operations not complying with the instruction manuals.
2. All the operations shall be done by a trained and qualified operator. All maintenance operations must be performed in accordance with the instructions detailed in the maintenance manual.
3. The assembly cannot be installed and used in classified areas as zone 0 to 20, mines (group I).
4. The equipment shall be installed in a place where the risk of lightning is covered by the relevant industrial code of practice.
5. Assembly, disassembly and maintenance is only allowed at the actuator, when at the time of the activity, there are no explosive mixtures.
6. During maintenance operations, the user must take all appropriate measures to prevent risks related to the toxicity of substances, using appropriate protective equipment (e.g., gloves, goggles, face mask), according to the extent provided the technical and organizational point of use and the recommendations provided in the specifications of the used substances.
7. All the mechanical components do not have ignition sources during the normal working process. The user shall check periodically the vibration presence and/or abnormal noises and it must stop the unit immediately, check the causes and contact the manufacturer.
8. Actuators do not have an inherent ignition source due to electro-static discharge, but explosion hazards may be present due to the discharge of static electricity from other valve assembly components.
    a. To avoid personal injury or property damage, make sure that the valve is grounded to the pipeline before placing the valve assembly into service.
    b. Use and maintain alternate shaft-to-valve body bonding, such as a shaft-to-body bonding strap assembly.
    c. The equipment must be earthed through an anti-loosening and anti-rotation device. The user must regularly check the effectiveness of the ground connection.
    d. A warning is present into the label: “Potential electrostatic charging hazard”.
9. When equipment is installed in a hazardous area location (potentially explosive atmosphere), prevent sparks by proper tool selection and avoiding other types of impact energy.
10. It is under end user responsibility to avoid the explosive mixture inside the actuator.
11. To avoid increasing dust explosion risk, periodically clean dust deposits from all equipment.
12. Proper care must be taken to avoid generation of static electricity on the non-conductive external surfaces of the equipment (e.g., rubbing of surfaces, etc.).
13. The paint protection must not exceed 200 µm if the actuator is used in a group IIC atmosphere. For group IIA or IIB atmospheres, the paint protection must not exceed a thickness of 0.08 in / 2 mm.
14. For single acting actuators, it is necessary to use safe air and to convey by a piping inlet/exhaust of the cylinder outside of the Ex-zone (Safe Area).

15. After maintenance operations carried out, perform a few actuator operations to check that its movement is regular and that there is no air/oil leakage through the seals/gaskets.
16. It is under end user responsibility to make sure the electrical equipment installed on the actuators have a separated ATEX evaluation and they are designed according to the ATEX Directive, and they are suitable for the installation zone, group of gas, temperature class, maximum surface temperature, EPL and range of temperature.
17. It is forbidden to use this equipment in a different way if it is not included in the instruction manual. Emerson is not responsible for damages caused by an improper and/or dangerous use.

C.4 Maximum Temperatures

⚠ WARNING

The actuator's surface temperature is dependent upon process operating conditions. Personal injury or property damage caused by fire or explosion, can result if the actuator's surface temperature exceeds the acceptable temperature for the hazardous area classification. To avoid an increase of instrumentation and/or accessory surface temperature due to process operating conditions, ensure adequate ventilation, shielding or insulation of these actuator components installed in a potentially hazardous or explosive atmosphere.

Table C-1. Ambient and ATEX Temperatures

Temperature			Valid Actuator Trim
Ambient Range	ATEX Class	TX (ATEX Surface Temperature)	
-20 to 167 °F / -29 to 75 °C	T6	T185 °F / T85 °C	Standard Temperature Trim
-20 to 194 °F / -29 to 90 °C	T5	T212 °F / T100 °C	
-20 to 200 °F / -29 to 93 °C	T4	T217 °F / T103 °C	
-40 to 150 °F / -40 to 65 °C	T6	T167 °F / T75 °C	Low Temperature Trim
0 to 257 °F / -18 to 125 °C	T4	T275 °F / T135 °C	High Temperature Trim
0 to 350 °F / -18 to 176 °C	T3	T367 °F / T186 °C	
-76 to 167 °F / -60 to 75 °C	T6	T185 °F / T85 °C	Special Low Temperature Trim *
-76 to 194 °F / -60 to 90 °C	T5	T212 °F / T100 °C	
-76 to 212 °F / -60 to 100 °C	T4	T230 °F / T110 °C	

Notes:
1. * Not applicable for all products and available with Carbon Steel (CS) material.
2. The specified values are valid with condition: Maximum cycle frequency of actuator is less than 1 Hz at a maximum of 50 cycles per hour and at maximum load.

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