

INSTRUCTION MANUAL

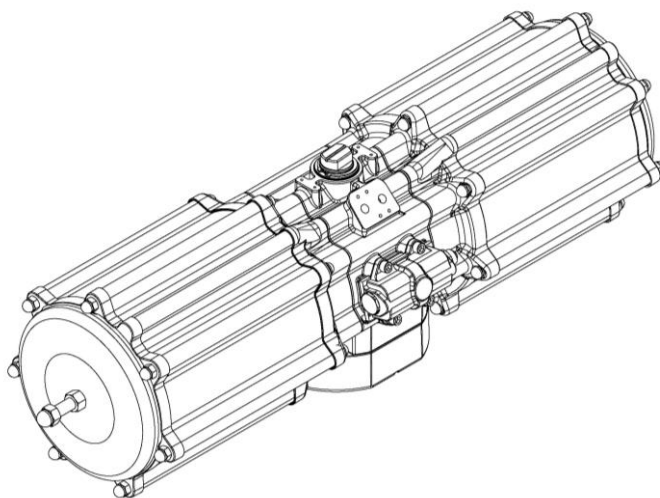
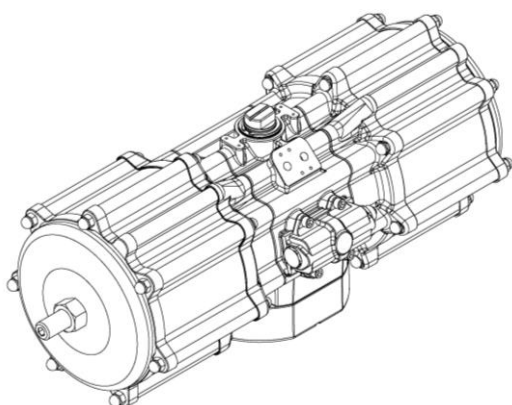
Scotch – Yoke

Part turn pneumatic actuator

GD2880 - GD8000 GS1440 – GS4000

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Actuatech reserves the right to change, at any time, the features and data of its own products, to better improve the quality and the duration of said products.

FOREWORD

The present User's Installation and Maintenance Manual has been edited in conformity with:

- 2006/42/EC Directive "Machinery";
- 2014/34/EU Directive "Equipment and protection systems designated to be used in potentially explosive atmospheres" (ATEX).

The following standards/technical specifications also apply:

- EN 15714-3:2009 Industrial valves: Actuators – Pneumatic part-turn actuators for industrial valves.
- IEC 61508:2010-1/7 Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 1 :7
- UNI CEN/TS 764-6:2005 Pressure equipment Part 6: Operating instructions structure and contents.

Below you will find the safety instructions, the minimum information for storage / warehousing, the installation, the commissioning, the maintenance and the instructions for disposal of products at the end of their life cycle for the pneumatic actuators:

Actuatech disclaims any liability for damage caused by improper use, even if partial, respect to the information contained in this manual.

1) GENERAL FEATURES

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Actuatech manufacture a wide range of part turn pneumatic actuators for valve remote control. The actuators are available on Double Acting "GD" and Spring Return "GS" versions.

- The principle of the actuator application is to open and close the connected valve, without the manual operation with lever or hand wheel, by means of an electric-pneumatic connection on remote control.

- Scotch – Yoke is a mechanical system that allows to transform the linear force into a rotary torque. Actuatech applies the scotch - yoke system for its actuator production to transfer the pistons linear force to a driving shaft torque.

This system provides a long working life and best performance with the minimum energy consumption.

- Actuatech Scotch-Yoke system with its oblique grooves produces a torque curve with the highest torque at the start opening operation in order to overcome the valve breakaway torque.

The maintenance should be done by Actuatech trained personnel only.

This instruction manual contains important information regarding the Actuatech Scotch-Yoke pneumatic actuator operation, installation, maintenance and storage.

Please read carefully before installation and keep it in a safe place for further reference.

2) WORKING CONDITIONS

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a) Construction.

Standard Actuatech actuators are suitable for indoor and outdoor installation. The laser marking or a printed label on the actuator body gives the actuator technical characteristics: type, size, operating pressure, output torque, operating temperature, flange connection, product code and production date (see drawing pag.4).

b) Motive energy

The operating media should be dry and filtered compressed air not necessarily lubricated or inert gases compatible with internal actuator parts and lubricants.

The operating medium shall have a dew point equal to $-20\text{ }^{\circ}\text{C}$ or, to be at least, $10\text{ }^{\circ}\text{C}$ below the ambient temperature (ISO 8573-1, Class 3). The maximum particle size shall not exceed $40\text{ }\mu\text{m}$ (ISO 8573-1, Class 5).

c) Supply operating media pressure.

The maximum supply pressure is 8,4 bar (120 psi) (7 bar for GD8000)

Nominal supply pressure is 5,6 bar (80 psi), working pressure range from 2,5 bar (36 psi) up to 8,4 bar (120 psi).

d) Operating temperature.

Actuator standard working temperature range form $-20\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$) to $80\text{ }^{\circ}\text{C}$ ($176\text{ }^{\circ}\text{F}$)

For low and high temperature versions please contact Actuatch. For high humidity and low temperature application are recommended to use a supplementary protection (e.g. screens, sheds or integral painting)

e) Operating drive rotation.

Actuatch actuator provides a standard stroke of 100 ° rotation (-5 ° $+95\text{ }^{\circ}$), with stroke adjustment of 10 ° .

Some models are also available with stroke of 90 ° .

f) Cycle time.

The cycle time is dependent on different operating and installation factors such as the supply pressure, the flow capacity, the connection pipe size, the solenoid valve performance, the valve torque and characteristics, environmental temperature condition.

Actuator opening, closing and open/close cycle times (sec.).

Actuator size	0°-90° cycle time SEC	90°-0° cycle time SEC	Actuator size	0°-90° cycle time SEC	90°-0° cycle time SEC
GD2880	1,77	1,41	GS1440	1,37	1,4
GD3840	2,09	1,68	GS1920	1,62	2,03
GD5760	3,12	2,52	GS2880	2,17	2,42
GD8000	3,91	3,4	GS4000	3,83	3,97

The above time table is referred to a standard actuator working cycle at the following tests conditions:

Ambient temperature: $18\text{ }^{\circ}\text{C}$ – $25\text{ }^{\circ}\text{C}$
Motive energy operating medium: compressed air at 5,6 bar
Nominal cycle: 90 ° in both directions
Load: free

GD actuators operate with solenoid valve 5/2 ISO 1-2. While the GS actuators with solenoid valve 3/2.

Time tested with Electronic Timer device.

NOTE: different working condition such as air pressure, piping connection, filters or solenoid valves, could change the timing of the operations.

g) Lubrication.

The actuators are factory lubricated for the standard working condition life.

During maintenance and reassembling Actuatch recommends using TECNOLUBE SYNTHY POLYMER 402 or equivalents.

h) Internal wear protection

The cylinder is lapped to obtain a surface with fine roughness and is protected with $20\mu\text{m}$ technical oxidation. The pistons slide supports are in P.T.F.E. The use of steel bearings on the Scotch-Yoke system ensures no play and low friction during operation.

i) External protection

Actuatech standard actuators are suitable for indoor and outdoor installation. The aluminium body and the caps are external protected from corrosion and wear with 20 µm technical oxidation. Driving shaft and caps screws are in stainless steel. For aggressive atmosphere and severe environmental condition select the required protection from the external finishes showed in our catalogue or contact directly our technical department.

j) Functional Safety

The Actuatech S.p.A. pneumatic actuators are also suitable for installations which require high level of functional reliability, up to SIL3, in compliance with the IEC 61508 standard.

k) Marking and classification

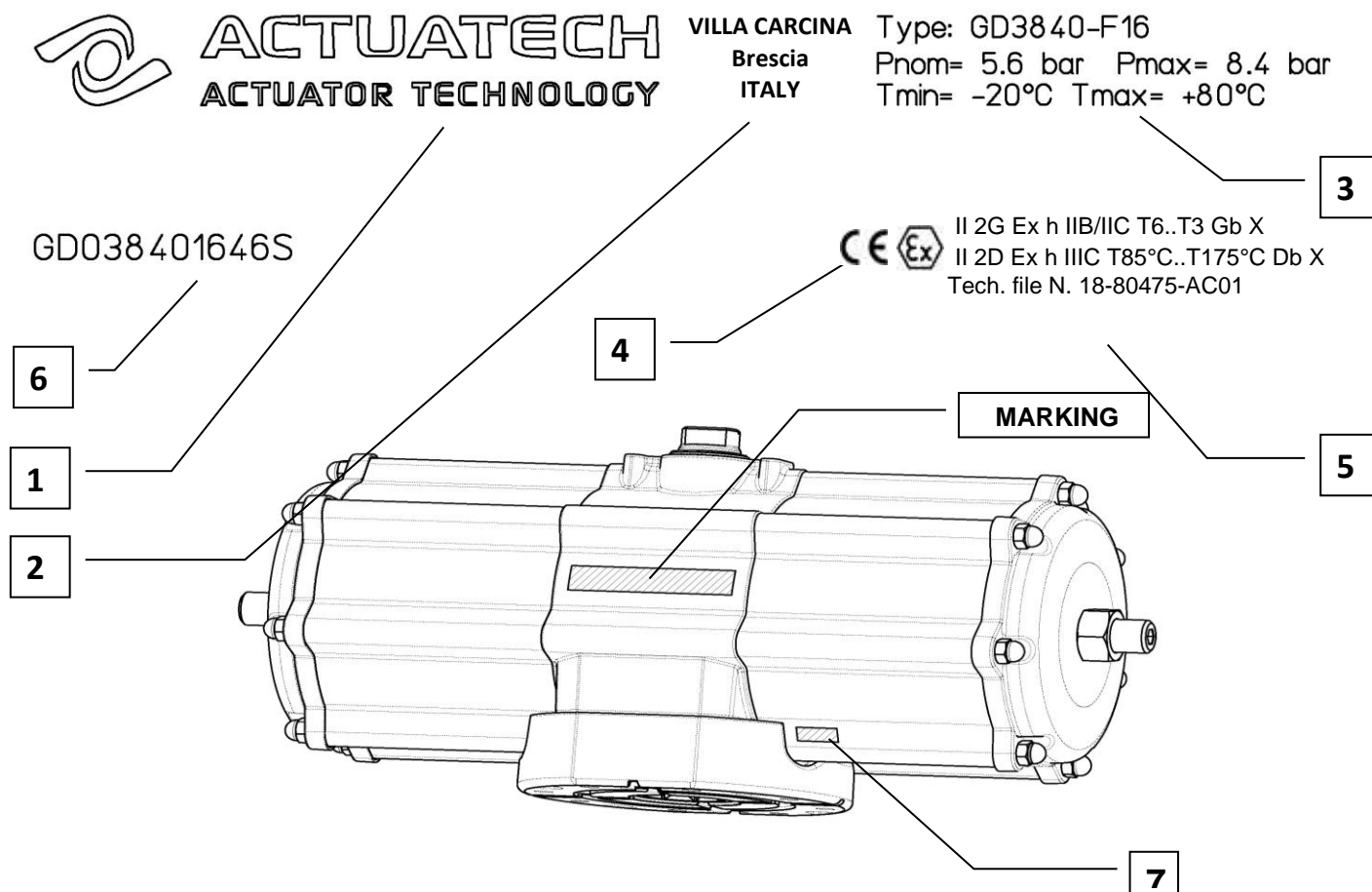
All Actuatech actuators bodies are marked with the Manufacturer name and address, the actuator Type code including the Series and Size, and its range of Pressure and Temperatures working conditions and limits.

1. Name of the company in charge of marketing the product in the E.U.
2. Address of the company in charge of marketing the product in the E.U.
3. Model, operating pressure and temperature.
4. Product code.
5. Month and year of production
6. Working pressures: nominal and maximum
7. Standard flanging

Supplemental marking according to ATEX Directive (see section 8)

Marking instructions where the temperature is different from the standard one:

- low temperature version: T.min.= -50°C T.max= 60°C
- high temperature version: T.min.= -20°C T.max= 150°C



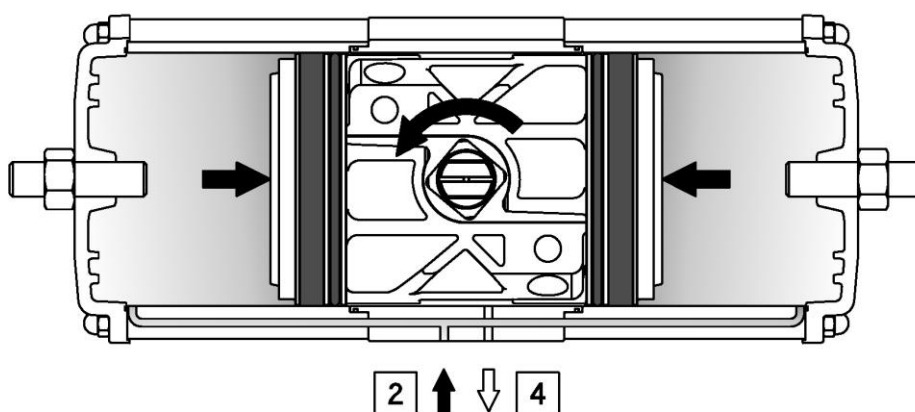
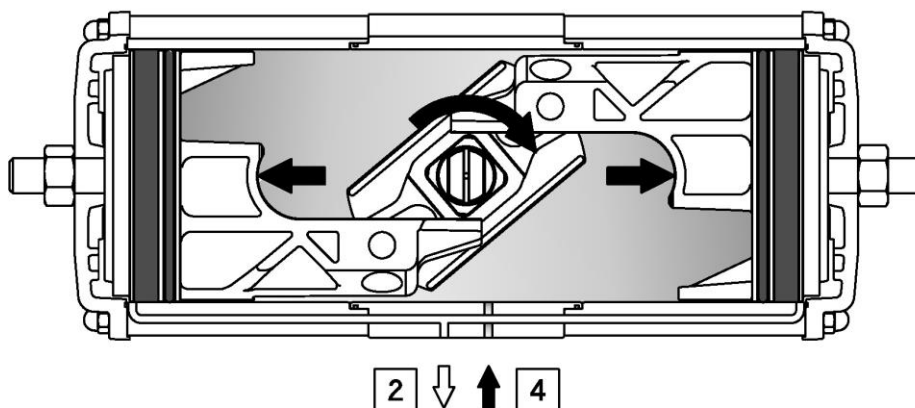
1. Name of the company in charge of marketing the product in the E.U.
2. Address of the company in charge of marketing the product in the E.U.
3. Model, operating pressure and temperature.
4. Class of compliance with the rules and level of protection "c", gas group IIB or IIC, temperature class TX.
5. Name of Technical File deposited with a Notified Body.
6. Product code.
7. Month and year of production.

3) OPERATION AND ROTATION DIRECTION

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Double Acting.

The pistons of standard GD actuators are mounted as shown below. This provides the highest torque at the valve start opening for valve clockwise to close. Both limit positions of the pistons travel can be fine adjusted (see pg.10).

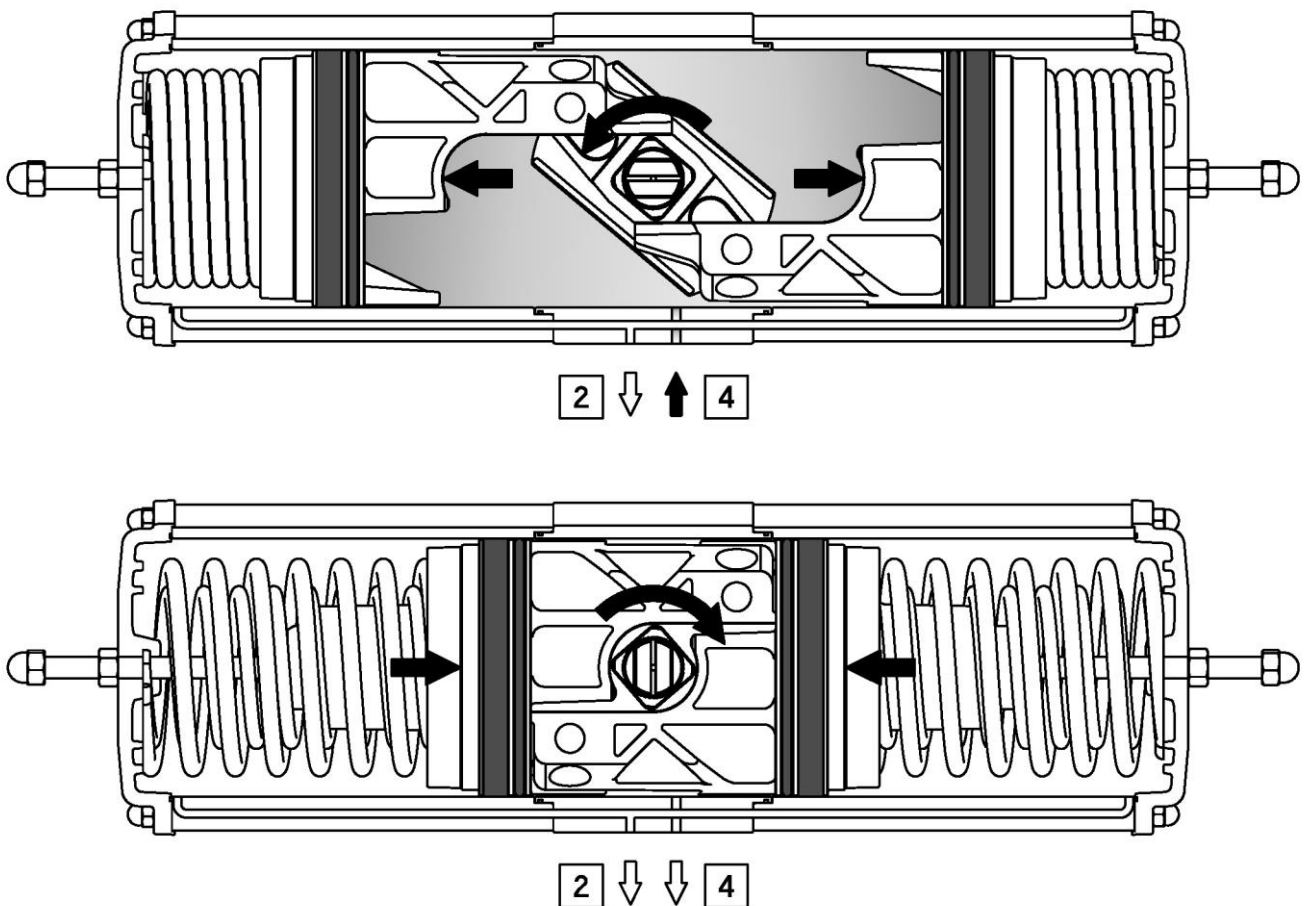


The port 2 is in connection with the cylinder side chambers, supplying the pressurised air in port 2 the standard Double Acting actuator drive shaft rotates counter clockwise to open, while the port 4 is in connection with the intermediate chamber and when pressurised the drive shaft rotates clockwise to close.

Single Acting, Spring Return fail to Close.

The pistons of standard GS actuators are mounted as shown below. Although spring force is diminished, the geometry of the mechanism provides a greater torque at the end of the spring stroke. Both limit positions of the pistons travel can be fine adjusted (see pg.10).

Caution. In order to avoid suction of dust or dirt inside of the actuator chambers during the spring action, install a filter on the port 2



The port 4 is in connection with the intermediate chamber and when pressurised the drive shaft rotate counter clockwise to open.

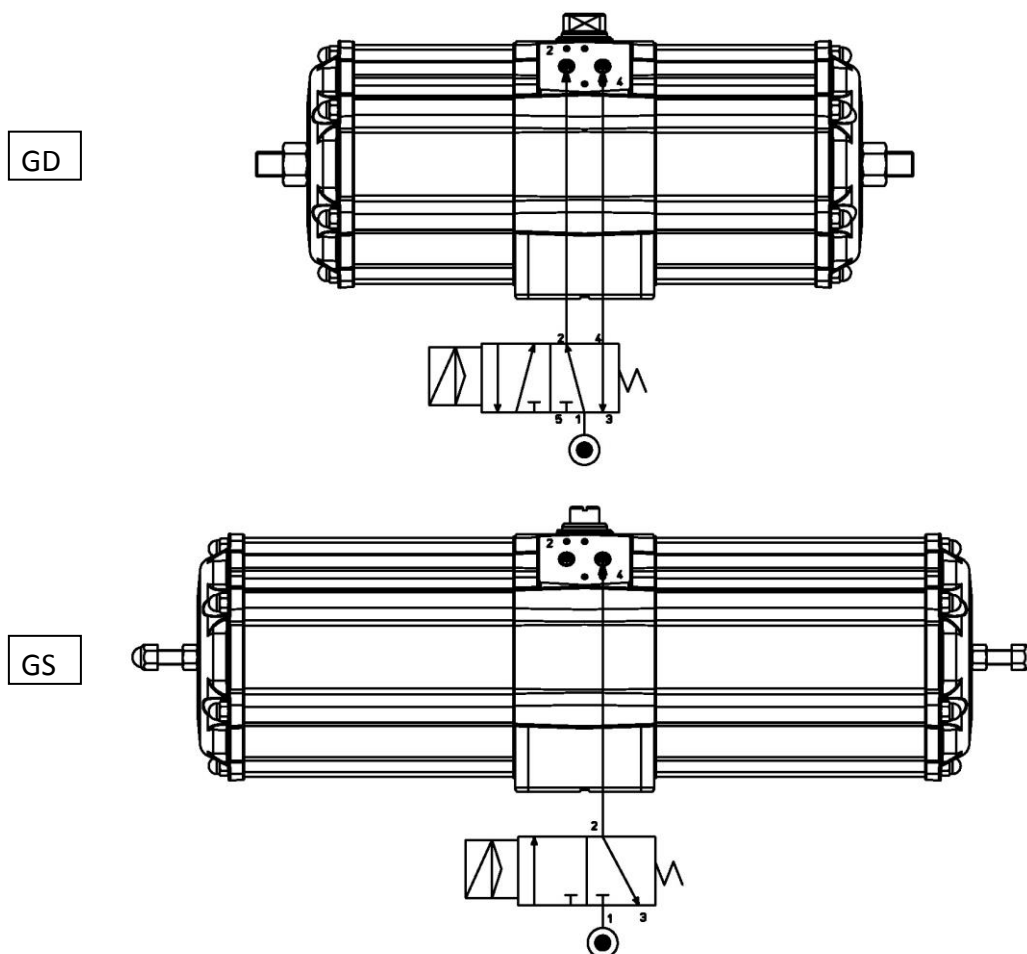
Important.

Special Double Acting version and Spring Return fail to open actuators with different piston positions have different rotation to close and to open: please follow their special instructions.

- Connection schema

Actuator operation functionality remote control should be done by means of direct solenoid valve connection to the actuator standard interface VDE/VDI 3845 NAMUR, or by means of pipes screwed on the ports marked with the numbers 2 and 4 and connected to a separate control cabinet.

Fig 3,1 – Typical air connection schema.



- Rotation direction.

In accordance with the international standard ISO 5599-2 the actuator air ports connection position, location, orientation and form shall be clearly identified and marked with the numerate 2 and 4.

Standard Double Acting and Simple Acting Spring Return actuators shall be Clockwise (CW) direction to valve Close, and Counter Clockwise (CCW) direction to valve Open.

4) Safety notice

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- The actuator should be used within the pressure mentioned limits only, operating the actuator over the pressure limit will damage the internal actuator parts.
- Operating the actuator over or under the temperature limits will damage the internal and external parts.
- Operating the actuator in corrosive environments without the required external protection will damage the actuator.

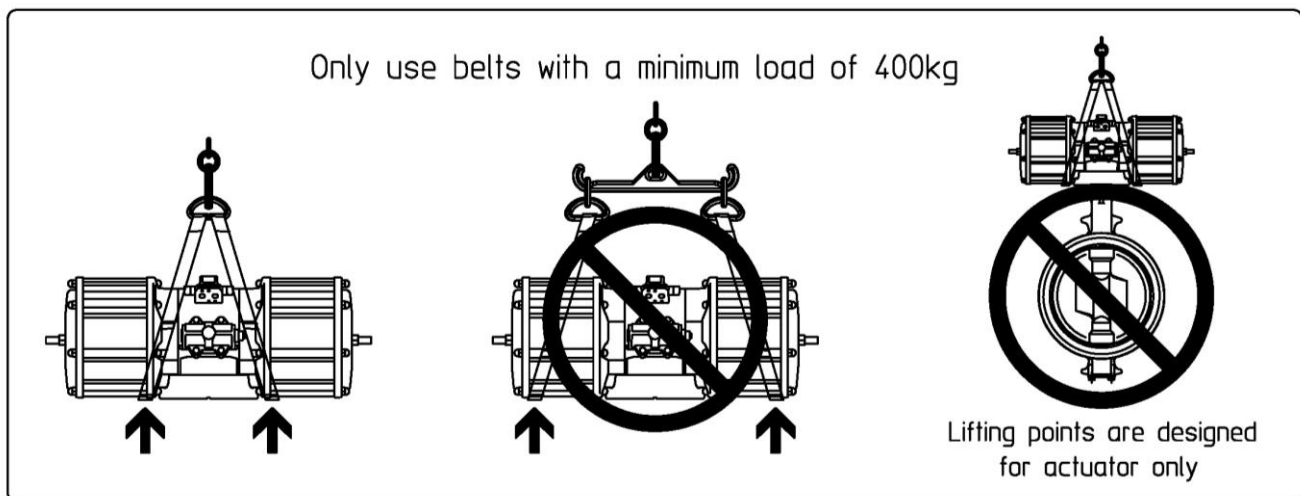
- Before installation, service or maintenance verify that the actuator is not pressurised, disconnect the air lines and make sure that the air ports are vented
- Do not remove the end caps while the actuator is installed in the line, or while the actuator is under pressure.
- Do not disassemble the caps end spring cartridge, this operation should be done by Actuatech trained personnel only, this operation could cause personal injury.
- Before mounting the actuator onto the valve make sure that the valve rotation is according with the actuator operating rotation, and the upper shaft slot orientation is also correct.
- Before installing the actuated valve do cycling test for a while to ensure the correct mechanical mounting and actuator/valve operations.
- The actuator installation shall be done according to and in observance with the local and national laws regulation.
- **Actuatech Srl can not be responsible for any damage to people, animals or things due to an improper use of the product.**

5) Installation instruction.

The principle of the actuator application is to open and close the connected part turn valve installed in a plant, without the manual operation, by remote control by means of an electric-pneumatic connection.

The normal sizing of actuators requires a 20%-30% safety margin over the valve breakaway torque to handle valves. Plant design, chemical and physical flow characteristics and environmental condition could increase the safety factor to apply to actuator sizing.

To lift the actuator using the right belts, see drawing below.



Before performing any installation operation, verify the actuator and valve conditions according to the safety notice above described.

Moreover, the utmost clearness is required during valve installation of the air supply connection to the actuator. All the connection parts such as reductions, joints, plates, brackets and equipment must be clean and dirty free.

Before assembling the actuator on to the valve make sure that both items are correctly oriented, depending upon which direction of rotation is required.

- Before starting the actuator installation, should be done a visual actuator control to verify its physical condition after transportation and storage.
- Control through the shaft slot or caps the actuator position
- Read carefully the Actuatech instruction sheet included in the cardboard box
- Read the actuator limits and performances marked on the actuator body to verify its suitability
- Remove the protection label stickers from the ports
- Before fitting the actuator on the valve, clean the valve and the actuator from the dust and dirt.
- Verify the valve position, close or open, and the rotation direction.

- Verify the actuator position and rotation according with the valve requirement and operation, especially for Spring Return installation Fail to Close or Fail to Open.
- Spring Return Fail to Close actuators are always supplied in the close position.
- While Spring Return Fail to Open are always supplied in the open position.

Valve/Actuator assembly:

A) Direct mounting.

Valve actuator Direct mounting is the best solution to avoid plays between valve stem and actuator drive shaft. For a direct mounting you should have the same standard flange connection on valve and actuator as well as the valve stem dimensions that fit perfectly with the actuator drive. Before installation please verify that the actuator and valve flange ISO connections are the same size; verify that the valve stem size and shape is suitable for direct mounting, if necessary, use a drive reduction.

Fit the valve stem into the actuator drive shaft connection, and bolt together the two ISO flanges.

B) Mounting plate connection.

In case direct mounting is not possible cause of little differences in actuator/valve flanges or drives sizes, mounting plates adapters with suitable flanges dimensions allows an easy connection living a sufficient space for the valve/actuator drive adapter.

C) Bracket & Joint connection.

Wherever for technical reason the plant installation requires a distance between actuator and valve, or the valve flange and/or stem are not standard, and in any case, where the valve/actuator connection could not be possible, a bracket and joint is the right answer. The Bracket is a steel bridge that allows to connect the valve with its own flange connection in one side and with the suitable actuator connection onto the opposite side, living a space in between for a steel joint connection. The joint allows a drive connection between the actuator and the valve stem indispensable in case of stem key drive and flat head.

Chose the suitable flange bracket and the required joint connections to fix the actuator onto the valve very tight without any plays.

Actuatech actuator with its draining channels system on the flange connection pattern is especially designed for valve direct mounting. This system allows to drop away any possible flow coming from the valve stem that with valve/actuator direct mounting could damage the actuator.

Screw torque wrench setting

SIZE	TORQUE Nm
M10	45-50
M12	80-85
M14	125-135
M16	190-200
M20	370-390

Stroke adjustment

Both actuator versions Double acting and Spring return, are provided as standard with 10° stroke adjustment.

For stroke adjustment instruction see table below:

Actuator type	Stroke adjustment instruction sheet
GD2880	8_0827
GD3840	8_0826
GD5760	
GD8000	
GS1440	8_0830
GS1920	8_0829
GS2880	
GS4000	

6) MATERIALS AND THEIR DURABILITY

Life time 20 years or number of cycles as per EN15714-3 2009 (see table below).

Nominal torque ^a Nm	Piston or vane actuator Minimum number of cycles ^b	Maximum stroking time for testing, based on 0-90° s
≤125	500 000 ^c	3
≤1 000	500 000	5
≤2 000	250 000	8
≤8 000	100 000	15
≤32 000	25 000	20
≤63 000	10 000	30
≤125 000	5 000	45
≤250 000	2 500	60

^a Based on EN ISO 5211.
^b One cycle consists of nominal 90° angular travel in both directions (i.e. 90° to open + 90° to close). For angular travel other than 90°, the endurance shall be agreed between the purchaser and the manufacturer/supplier.
^c For thermoplastic actuators the minimum number of cycles shall be 250 000.

Should it be necessary to replace its pistons sealing, these operations must be done by Actuatech trained people with proper tools, we recommend returning the actuator to Actuatech where the actuator will be overhauled and than tested for a correct replacement.

On request Actuatech will be willing to provide its sealing Kits.

WARNING: Actuatech declines any responsibility for the products repaired by third parties

Material list

For components and material lists see table below:

Actuator type	Components and material list sheet
GD2880	1_1861
GD3840	1_1922 (90° Rotation Version 1_1781)
GD5760	1_1862
GD8000	1_1915
GS1440	1_1863
GS1920	1_1922 (90° Rotation Version 1_1781)
GS2880	1_1864
GS4000	1_1916

7) MAINTENANCE

The Actuotech SpA actuator, when installed and used properly, does not require maintenance, under normal use, as it's provided with sufficient lubrication for standard duration.

Send the actuator directly to Actuotech S.p.A. for inspection or extraordinary maintenance

If the cap or piston seals need to be replaced, Actuotech S.p.A. can supply a kit containing spare parts.

WARNING: The seals must be replaced by qualified personnel and with the appropriate tools. Actuotech S.p.A. declines all responsibility for products that are repaired by third parties

REPLACING THE SEALS

Disassembly.

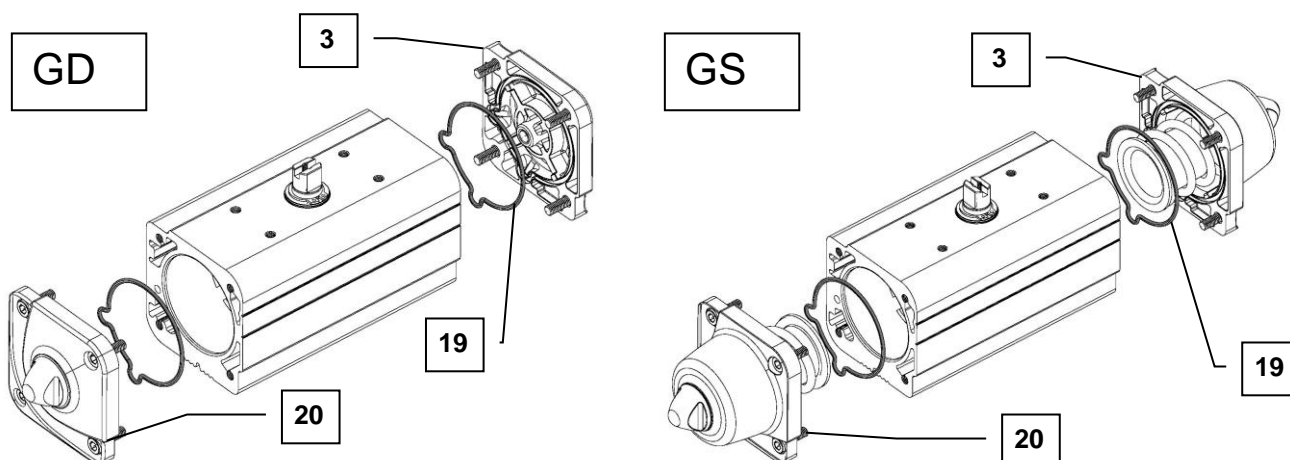
Actuator disassembly operation must do with the actuator free from any pneumatic and electric connection and dismantled from the valve.

Verify that the actuator is air bag free, and the spring return actuator is completely in its springs rest position.

Check that the air port 2 and 4 are absolutely vented.

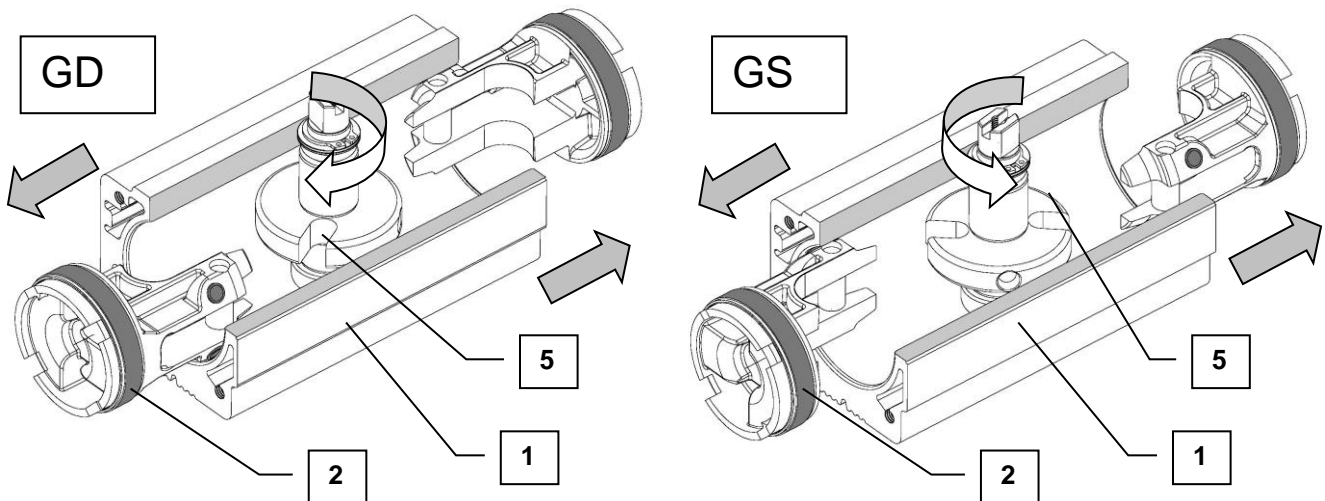
Use proper tools only.

- A) Loosen the end cap screws (part N° 20) in cross sequence to remove the end caps (part n° 3), in case of force on the screws that means that the actuator is still under air or spring action and the operation should be discontinued until the action is removed. The end caps contain a sealing O-ring (part N° 19) on its seat that should be checked before replacement.

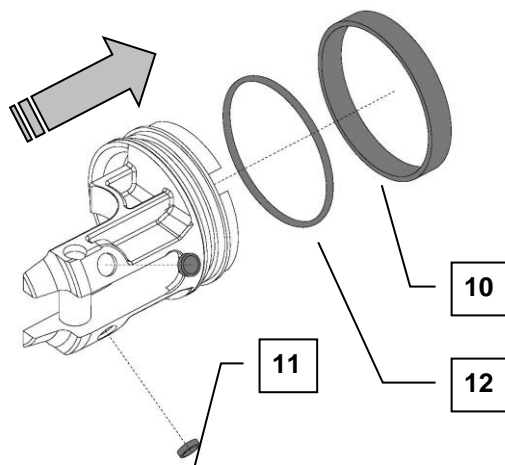


Caution. The Spring Return end caps cartridges (Parts N° 3 + 18+24+19+23+22+21) are a safety device, where the preloaded spring is set to avoid the dangerous spring jumping. Do not release the screw (part N° 21) to remove the spring from its seat, this operation must be done by Actuotech technician only.

- B) Hold the actuator in the vice and rotate the drive shaft until the pistons (part N°2) are released from the scotch-yoke grooves (part N° 5), then slip off the pistons from the cylinder (part N° 1). Do not use compressed air to remove the pistons from the body, this operation could cause personal injuries.



- C) The dynamic seal (part N° 10), O-ring (part N° 12) and supports (part N° 11) should be checked before replacement. Do not use sharp tools to cut the dynamic seal and O-ring or remove the supports from the piston as this may cause furrows or marks.

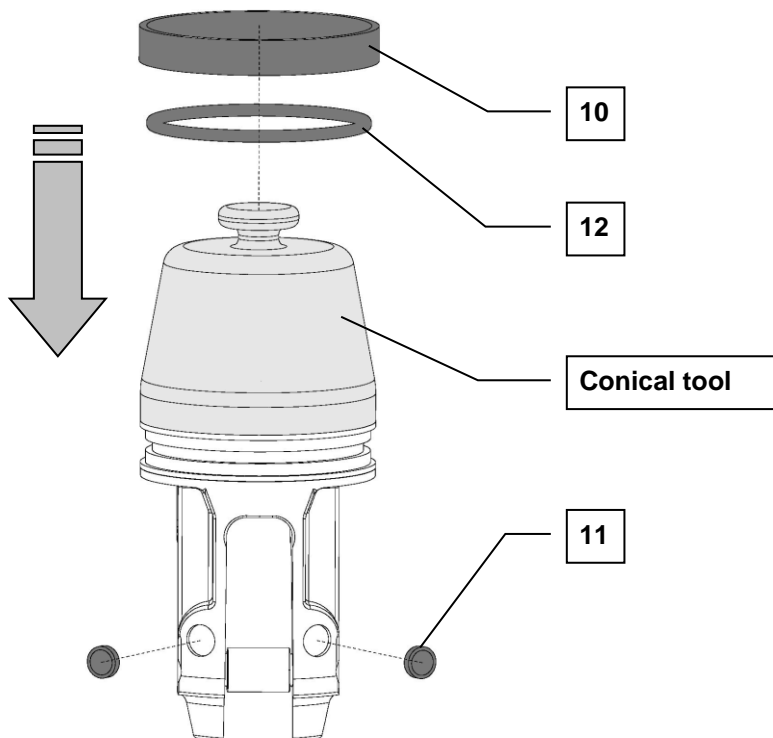


- D) When the components are disassembled, they should be properly cleaned, and wear checked prior to being greased and reassembled. In case the sealing parts are too much worn out use new parts from the spare parts kit.

WARNING. Due to Actuatch scotch-yoke shaft blow-out security system the shaft disassembly operation must be carried out by Actuatch technician only.

Assembly.

- A) O-ring (part N° 12) and dynamic seal (part N° 10) shall be greased and mounted onto the piston seat using a proper conical tool (see the drawing) that allows an easy and perfect slip-in of the items without any damages.

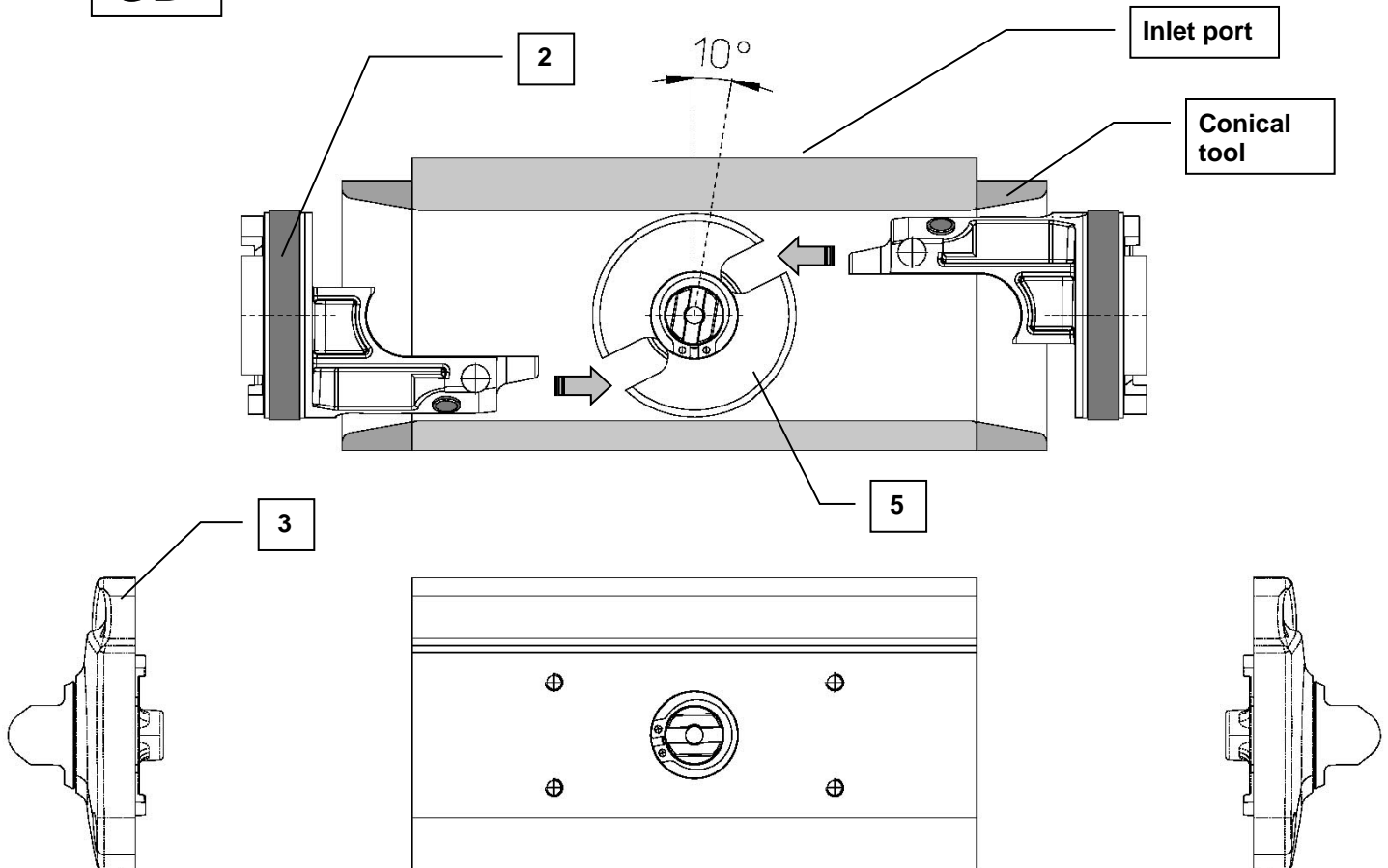


- B) Push into its piston seats the P.T.F.E. supports (part N° 11).
 C) Grease the pistons (part N° 2) on the replaced parts (parts N° 10+11+12), and the piston bearings (part N° 8).
 D) Grease the internal cylinder surface (part N° 1).
 E) Position the scotch-yoke shaft (part N° 5) in order to have the groves in position for the pistons insertion and the right shaft required direction of rotation.
 F) Insert the pistons (part N°2), using a proper conical tool (see the drawing), in the scotch-yoke grooves (part N° 5) and press simultaneously the two pistons inside of the cylinder (part N° 1). The Actuatch scotch-yoke system will avoid pistons misalignment. Holding the actuator on a vice rotate the shaft to verify the shaft rotation direction and the easy movement.
 G) Replace the sealing O-ring (part N° 19) on its caps seat (part N° 3) and grease it. Fit the end caps to the body screwing the screws in cross (part N° 20).

N.B. For the screw torque wrench setting see pg. 10.

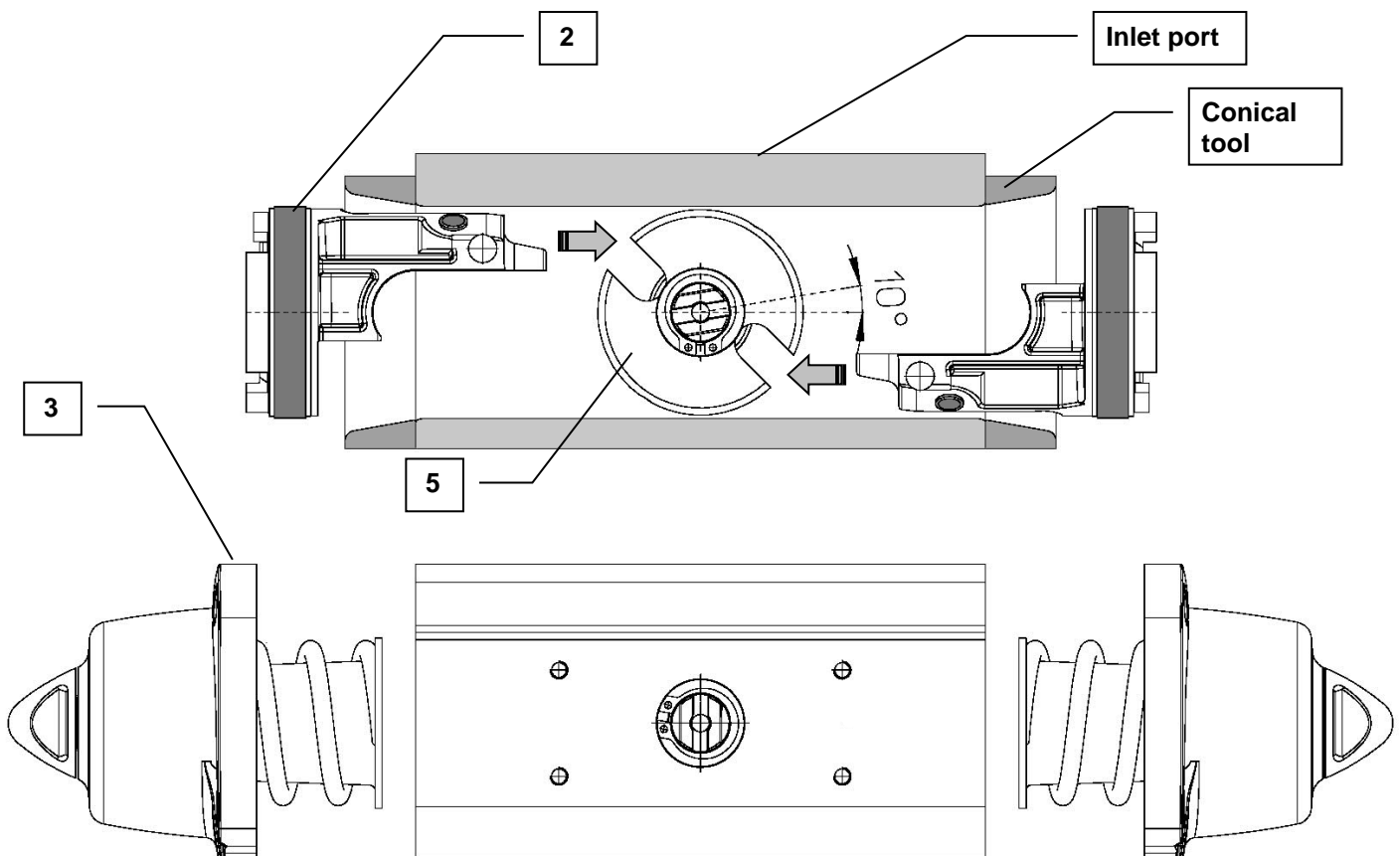
- Double Acting version assembly

GD



- Spring return version assembly

GS



8) ATEX SPECIFICATION

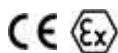
In conformance with the European Directive ATEX 2014/34 UE for the suitability of the equipment intended for the use in Potentially Explosive Atmosphere, Actuatech declare the conformity of the scotch-yoke actuator of the above mentioned ATEX directive in the limits of its Classification and Zone Classification.

A) EQUIPMENT CLASSIFICATION:

- Equipment Group II Category 2
- Zone Classification: Suitable for Gas Zone 1, and Dust Zone 21.
- Type of protection: Ex h (with constructional safety 'c')
- Gas group IIC (IIB with coating thickness > 0,2mm)
- Dust group IIIC
- Temperature Class T6, T4, T3 (as per following table)
- EPL: Gb (for Gas), Db (Dust)

Tmax. Fluid and Max T. ambient	Temperature class	Max surface temperature
60°C	T6	T85°C
80°C	T4	T105°C
150°C	T3	T175°C

B) EQUIPMENT MARKING:



II 2G Ex h IIC T6..T3 Gb X
II 2D Ex h IIIC T85°C..T175°C Db X
Tech. file N. 18-80475-AC01

Whenever the actuator may be installed in the Potentially Explosive Atmosphere the operator before starting the installation must observe the suitability of the equipment classification and special installation instruction included that follow the actuator. In case of instruction missing or any doubts please call the Actuatech technical department.

C) EQUIPMENT TECHNICAL SPECIFICATION

Max operating pressure	8,4 bar (7 bar for DA8000)
Ambient temperature T6	$-50 \leq T_a \leq 60^\circ\text{C}$
Ambient temperature T4	$-20 \leq T_a \leq 80^\circ\text{C}$ (Standard)
Ambient temperature T3	$-20 \leq T_a \leq 150^\circ\text{C}$
Max working frequency	1 Hz
Materials	All aluminium alloys used contain less than 7,5% magnesium (Mg) by mass
Seals	NBR (Standard version) FKM (High Temperature version) FVMQ (Low Temperature version)

9) ACTUATORS SPECIAL VERSIONS.

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Actuatech manufactures and supplies special actuators versions for specific actuator use and environmental.

a) External protections.

All the standard version could be supply with different external protection according with the plant ambient working condition (see Actuatech catalogue or contact Actuatech commercial team).

b) Stainless Steel Actuators

For food and chemical plants Actuatech manufacture a Stainless-Steel version. The body and all the external part are made in stainless steel.

The rotary system is the same Scotch-Yoke used for the standard actuators.

For the stainless-steel actuators performances please refers to the standard actuators data tables.

c) Simple Acting spring return Fail to Open.

Spring Return Fail to Open actuators are required when in case of the pressurised air or electrical power supply are off the valve should be automatically opened.

In the fail to open actuators the pistons are inserted into the cylinder like the Double Acting version, and due to the spring force the actuator is Normally Open.

ATTENTION. Nominal torque and torque performances in Spring return Fail to Open version, due to its construction, are different from the Spring Return Fail to Close standard versions. For sizing and application please refer to Actuatech technical department.

10) STORAGE

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The Actuatech actuator has been packaged to provide protection during shipment, however, it can be damaged in transport. Prior to storage, inspect the actuator for shipping damage. Keep the actuators in their original packing box during storage.

It is recommended to keep the actuators in a clean and dry environment at temperatures between -10°C and +60°C until ready for use.

The actuator has two air ports, which are closed by labels for prevent liquids or others material to entering in the actuator during storage.

If the actuators are to be stored for a long period of time before installation, it is recommended to stroke them periodically to prevent setting of the seals.

WARNING

Keep the actuator in its original box until the installation, and store it indoors, in dry and clean environment, at temperatures between -10°C and +60°C to protect them from humidity and dust.

11) TROUBLESHOOTING

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POTENTIAL EFFECT OF FAILURE	POTENTIAL CAUSE OF FAILURE	SOLUTION
Loss or reduction of the supplied torque	Lack of supply	Verify that the actuator has been connected to the pneumatic line correctly
	Air supply not enough to produce required torque	Verify that the supply pressure value corresponds to the functioning requirements (see actuator data plate)
	Air leakage from seals	Verify that the screws are completely tightened
Leaks from the stem upper or lower seals	Stem O-ring seal damage	Contact Actuatech for repair
	Damages on the body	
	Shaft damaged	
Leakage form cylinder caps	Seals damaged	Replace the seals (see "Maintenance" chapter)
Leakage from the ports after manoeuvre	Damaged piston seal	Replace the piston seals (see "Maintenance" chapter)
	Damaged body cylinder	Contact Actuatech for repair
Insufficient valve rotation	Increase of valve manoeuvre torque	Verify the valve release torque and the possibility to replace with a new one
	Air supply not enough to produce required torque	Increase the air supply
	Mechanical stop (if there) not duty adjusted	Adjust the stops by increasing the stroke
	Wrong connection between the actuator and the valve stem	Check the connection elements between the valve and the actuator

12) DISPOSAL OF PRODUCTS AT THE END OF THEIR LIFE CYCLE

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The Actuatech products are designed so that when they are at the end of their life cycle they can be completely disassembled, separating the different materials for the proper disposal and/or recovery. All materials have been selected in order to ensure minimal environmental impact, health and safety of personnel during their installation and maintenance, provided that, during use, they are not contaminated by hazardous substances.

The personnel in charge of the product disposal/recovery, must be qualified and equipped with appropriate personal protective equipment (PPE), according to the product size and the type of service for which the device was intended. The management of waste generated during the installation, maintenance or due to the product disposal, is governed by the rules in force in the country where the product is installed, in any case, the following are general guidelines:

- The metal components (aluminium/steel) can be restored as raw material;
- Seals/sealing elements (NBR, FPM, FVMQ...), as contaminated by fluids from other materials and lubrication, must be disposed of.
- The packaging materials that come with the product, should be transferred to the differentiated collection system available in the country.

13) DECLARATION OF CONFORMITY

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The Actuatech S.p.A. actuators have been designed, manufactured and tested to meet the requirements of the following European standards and are marked, where provided, with the relative CE conformity marking:

- 2006/42/EC Directive "Machinery";
- 2014/34/EU Directive "Equipment and protective systems intended for use in potentially explosive atmospheres" (ATEX).
- Regulation (EC) No 1907/2006 and successive concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).