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Keeping the World Flowing
for Future Generations

CQP range

Compact pneumatic actuator
Single spring and double-acting



Installation, commissioning and maintenance manual

Contents

Section	Page	Section	Page
1. Introduction	3	11. Removal from valve	11
2. Standards and regulations	3	12. Operation	12
3. General information	4	12.1 Description	12
4. Health and safety	4	12.2 Angular stroke regulation	14
4.1 Residual risks	4	12.3 Upper stop bolt setting	15
4.2 Thermal risks	4	12.4 Lower stop bolt setting	16
4.3 Noise	4	12.5 Limit switch setting	16
4.4 Health risks	4	12.6 Pneumatic supply	17
4.5 Mechanical risks	4	12.7 Pneumatic connections	17
4.6 Vibration risks	5	12.8 Electrical connections	19
5. Labels and nameplates	5	12.9 Start up	19
6. Operating limits	6	13. Dismantling and disposal	20
6.1 Allowed fluid types	6	14. Rotork sales and service	20
6.2 Expected lifetime	6	15. Troubleshooting	21
6.3 Tightening torque chart	6	16. Periodic maintenance	22
7. Handling and lifting	7	17. Part list	31
7.1 Lifting recommendations	7	18. Grease specification	33
7.2 Lifting instructions	7	18.1 Grease	33
8. Storage	9		
9. Long term storage	9		
10. Installation on valve	10		
10.1 Preliminary actions	10		
10.2 Instructions	10		

This manual contains important safety information. Please ensure it is thoroughly read and understood before installing, operating or maintaining the equipment.

Rotork reserves the right to modify, amend and improve this manual without notice.

Rotork is not responsible for damage or injury caused by the failure to observe the instructions contained herein.

1. Introduction

This manual covers maintenance aspects and instructions specific to the CQP range of actuators.

CQP actuators are available in two different configurations:

- Type A CQP actuator
- Type B CQP actuator

Type A is supplied with external tie rods.

Type B is supplied with threaded mounting flanges.

Type A and Type B have the same operating characteristics and can be considered identical for the purposes of this manual. Any differences between Type A and Type B are clearly shown where applicable.

In this manual, warning indications are represented by icons, according to ISO 7010 safety signs:



Generic danger



Hand crush/pinch point



Electrocution



Explosive material

Customer service

For technical assistance, please contact Rotork customer service:

E-mail: rfs.international@rotork.com

Rotork, Via Padre Jacques Hamel, 138B, Porcari, Lucca, 55016, IT. Tel: +39 0583-222-1

Rotork plc, Brassmill Lane, Bath, UK. Tel +44 (0)1225 733200

2. Standards and regulations

Actuators destined for European member states and the United Kingdom have been designed, built and tested according to the quality control system, in compliance with the EN ISO 9001:2015 standard and with the following regulations/directive.

- 2006/42/EC: Machinery Directive (MD)
- S.I. 2008 No. 1597: The Supply of Machinery (Safety) Regulations 2008
- 2014/68/EU: Pressure Equipment Directive (PED)
- S.I. 2016 No.1105: Pressure Equipment (Safety) Regulations 2016 (PE(S)R)
- 2014/34/EU: Directive for safety equipment and systems to be used in potentially explosive atmospheres (ATEX)
- S.I. 2016 No. 1107: The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016
- 2014/30/EU: Electromagnetic Compatibility Directive (EMC)
- S.I. 2016 No. 1091: Electromagnetic Compatibility Regulations 2016
- BS EN ISO 12100: Machinery Safety Directive
- BS EN 60079-14: Explosive atmospheres - Part 14: Electrical installations design, selection and erection
- BS EN 1127-1: Explosive atmospheres - Explosion prevention and protection - Basic concepts and methodology
- BS EN ISO 80079-36: Non Electrical equipment for explosive atmospheres - Basic methods and requirements
- BS EN ISO 80079-37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection construction safety "c", control of ignition "b", liquid immersion "k"
- IEC 60079-46: Explosive atmospheres - Part 46: Equipment assemblies
- BS EN ISO 7010: Safety Signals
- BS EN 13445: Unfired Pressure Vessel

3. General information

This manual is produced to enable a competent user to install, operate and maintain the Rotork CQP compact pneumatic actuator.

The mechanical installation must be carried out as outlined in this manual and in accordance with any relevant national standard codes of practice.

Maintenance and operation must be carried out in accordance with the National Legislation and Statutory Provisions relating to the safe use of this equipment, applicable to the site of installation.

Any inspection or repair in a hazardous area must not be undertaken unless it conforms to National Legislation and Statutory Provisions relating to the specific hazardous area.

Only Rotork approved replacement parts should be used. Under no circumstances should any modification or alteration be carried out on the equipment, as this could invalidate the conditions under which its certification was granted.

Only trained and experienced operators can install, maintain and repair Rotork actuators. Work undertaken must be carried out in accordance with instructions in this manual. The user and those persons working on this equipment must be familiar with their responsibilities under any statutory provisions relating to the health and safety of their workplace.

Operators must always wear appropriate Personal Protective Equipment (PPE) in line with the existing plant regulations.

Appropriate usage

Rotork CQP actuators have been specifically developed with a helical mechanism that transforms linear piston motion into quarter-turn valve stem rotation to operate various valve types and sizes.

⚠ Improper use can damage the equipment or cause dangerous situations for health and safety. Rotork declines any responsibility for damage to people and/or objects resulting from the use of the equipment for applications different from those described in this manual.

⚠ Hazardous area usage: Only use devices approved for hazardous area use. These devices will have an EX type label fixed to them. Before installation and operation in a potentially explosive atmosphere, read and follow the information and instructions on the EX label and any additional EX instructions in the documentation received with the device.

4. Health and safety

Before installing the equipment, verify it is suitable for the intended application. If unsure consult Rotork.

4.1 Residual risks

Residual risks resulting from equipment risk evaluation performed by Rotork.

4.2 Thermal risks

Risk	Hot/cold surface during normal operation (RES_01).
Preventive measures	Operators should wear protective gloves.

4.3 Noise

Risk	Noise >85 dB during operation (RES_05).
Preventive measures	Operators should wear ear protections. Operators should not stand near the equipment during operation.

4.4 Health risks

Risk	Pressurised fluid ejection during normal operation (RES_02).
Preventive measures	All fittings must be properly sealed. All fixing clamps must be correctly tightened and sealed.
Risk	Risk of intoxication (according to the type of medium utilised) (RES_06).
Preventive measures	Operators must use PPE and any other equipment (breathing apparatus) based on the type of supply medium.

4.5 Mechanical risks

Risk	Uncontrolled movement (remote operation) (RES_03).
Preventive measures	Ensure that the actuator cannot be operated remotely. Prior to starting, remove the pneumatic supply, vent all pressure vessels, and remove electrical power.
Risk	Presence of moving parts (centre body, valve adapter) (RES_04).
Preventive measures	Do not perform start-up or test the actuator if the cylinder tube is removed.
Risk	Loss of stability with possible parts projection (RES_08).
Preventive measures	Do not disassemble the actuator in case of malfunctioning. Follow instructions in the present manual and contact Rotork.

4. Health and safety

Risk	Presence of potential energy (RES_10) during dismantling.
Preventive measures	Do not disassemble the actuator during dismantling. Follow instructions in the present manual and contact Rotork.

4.6 Vibration risks

Risk	Vibration risk (RES_11).
Preventive measures	Foresee periodic maintenance procedure to verify tightening.

5. Labels and nameplates

The following label is applied externally to the actuator:

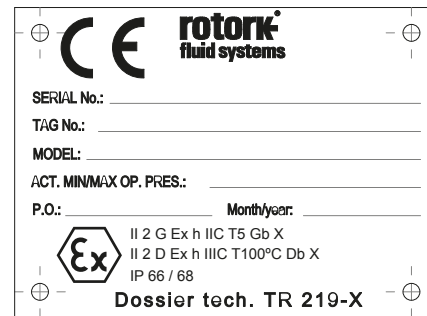


Fig 5.1 Actuator label

EX type of protection: constructional safety “c”.

T5 temperature class is provided even if the actuator has no internal heat source. Maximum actuator temperature is near the environmental or exercise fluid temperature, whichever is the greater. Normal operating temperature is -30 to +100 °C (-22 to +212 °F). The temperature range is specified in the project specific technical documentation. Special applications out of previous range are available upon request.

EX plate does not indicate the maximum environmental and/or exercise fluid temperature; this information is reported within the project-specific technical documentation.

IP grade protection: IPX8M is related to submersion of 1 metre for 72 hours.

For CE (PED) marked actuator the following label is also used:

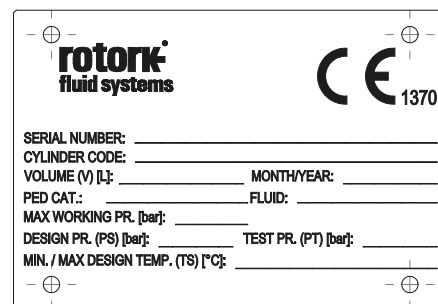


Fig 5.2 Actuator PED label

Label removal is not allowed.

6. Operating limits

Temperature: -30 to +100 °C for standard applications
-20 to +100 °C for PED applications

Design pressure: 12 barg

⚠ Do not use the equipment outside its operating limits.

6.1 Allowed fluid types

The pneumatic actuator is designed to be operated with dry air or dry, sweet natural gas with particles filtering $\leq 40 \mu\text{m}$ (Class 7 according to ISO 8573-1, Table 1), pressure dew point $\leq -20^\circ\text{C}$ or, at least, 10°C below the ambient temperature (Class 3 according to ISO 8573-1, Table 2), total concentration of oil $\leq 5 \text{ mg/m}^3$ (Class 4, according to ISO 8573-1, Table 3); if not differently specified in the specific project documentation.

6.2 Expected lifetime

The expected lifetime is greater than 25 years, in normal service conditions and with planned maintenance.

6.3 Tightening torque chart

RECOMMENDED TIGHTENING TORQUE (Class 8.8 bolts)		
Bolt size	Nm	Ft. Lbs
M6	8.5	6
M8	20	15
M10	40	30
M12	55	40
M14	110	81
M16	220	162
M20	430	317
M22	425	313
M24	585	431
M27	785	579
M30	1250	921
M33	1400	1030
M36	1750	1290

7. Handling and lifting

⚠ Only trained and experienced personnel should handle/lift the actuator.

The actuator is supplied packed on pallets suitable for normal handling.

⚠ Handle the actuator with care. Never stack pallets.

7.1 Lifting recommendations

- The lifting device and the sling must be suitably rated for the actuator weight and dimensions
- Do not use damaged sling(s)
- The sling must not be shortened with knots or bolts or any other makeshift device
- Do not use pneumatic piping or electric cabling for lifting purposes
- Do not drill holes, weld eye bolts or add any other type of lifting device on the actuator external surface
- Do not lift the actuator and valve combination with the actuator lifting lugs. Only lift the actuator/valve assembly using the valve lifting lugs
- Every assembly must be evaluated separately for a safe and correct lifting
- Avoid pulls or abrupt movements during lifting. Avoid pushing the load
- During lifting operations, do not handle the slings and/or the actuator

⚠ Do not step underneath suspended load.

7.2 Lifting instructions

NOTE: Indication of weight, centre of gravity, lifting points are reported within specific project documentation.

Consult the project specific documentation before lifting.

- Prior to lifting the actuator, remove electrical power and vent all pressure vessels (if present)
- Hook a double chain sling on the lifting lugs as shown in Fig 7.1.

⚠ The actuator must remain vertical; balance the load.

- Angle β must always be between 0° and 45° as shown below.

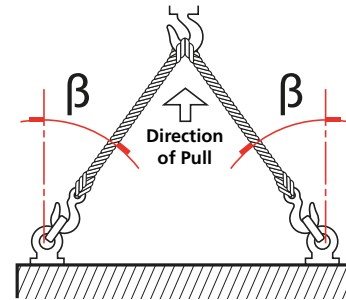


Fig 7.1 Vertical lifting

7. Handling and lifting

The actuator can be lifted and installed in horizontal position also, according to the valve and pipeline installation.

To lift the actuator in horizontal mode:

- Remove the two plugs on the threaded holes, that will be used for lifting, on bottom and end flange

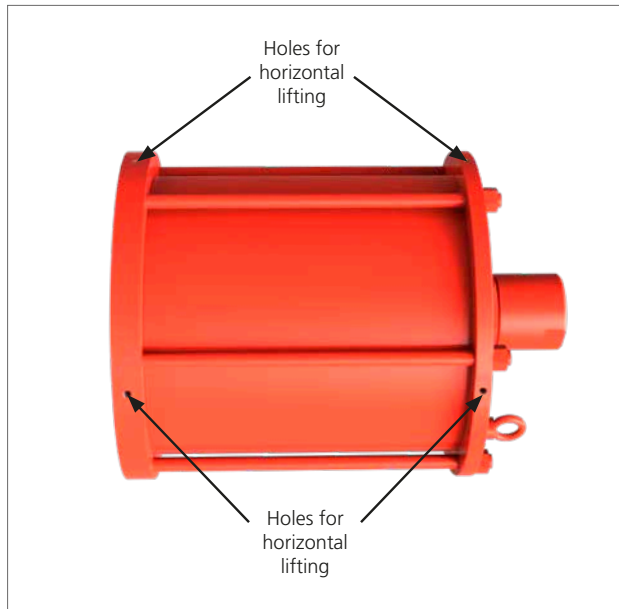


Fig 7.2 Holes for horizontal lifting

- Install two lifting lugs of appropriate dimensions on opposite threaded holes on bottom and end flange (lifting lugs are not provided with the actuator)
- Hook a double chain sling on the lifting lugs as shown in Fig 7.3

⚠ The actuator must remain horizontal; balance the load.

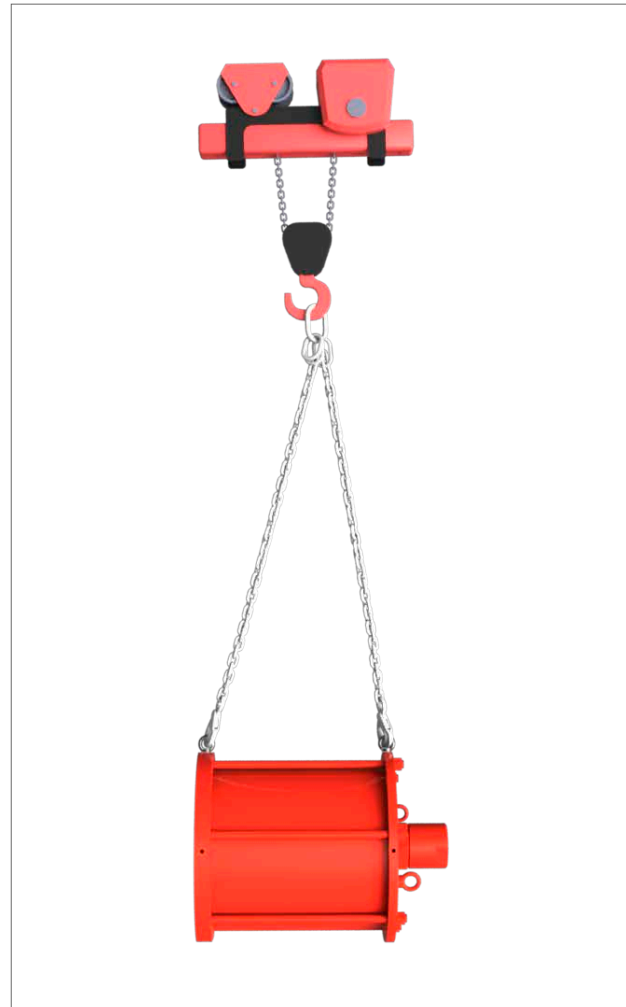


Fig 7.3 Horizontal lifting

8. Storage

Rotork actuators have been fully tested before leaving the factory.

In order to keep the actuator in good condition until installation, the following measures are recommended, as a minimum:

- Check the presence and assembling of dust plugs
- Store in a dry, well-aired place. Avoid long-term direct exposure to sunlight
- Keep the actuator on its shipping pallet until installation

⚠ Never put the actuator directly on the ground.

- Protect the valve coupling area (adapter flange) with rust-preventive oil e.g. Mobilarma LT or equivalent
- Protect against weather action, covering the actuators with appropriate polyethylene sheets
- Check the actuator condition every 6 months and verify the above protection measures remain in place

⚠ Remove packaging only at the installation time.

⚠ Actuator vent ports must be protected with a polyethylene sheet to prevent water ingress during storage.

9. Long term storage

If long term storage is necessary, further operations must be carried out to maintain the actuator in a good working condition:

- Replace the plastic plugs with metal plugs
- Store in a dry, well-aired place. Avoid long-term direct exposure to sunlight
- Stroke the actuator every 12-months:
 - Cycle the actuator (using filtered, dehydrated air) to the working pressure indicated on the nameplate
 - Cycle the actuator with all the existing controls (i.e. two complete strokes - one open, one closed) at least five times
- Disconnect the pneumatic and electric (if present) supply from the actuator, and carefully close all the threaded connections of the actuator
- Remove electrical components covers (if present) to ensure control terminals are clean and free from oxidation and humidity. Reassemble the covers
- In case of storage for over 12 months prior to installation, it is recommended to operate the actuator to verify correct operation

10. Installation on valve

Before proceeding, read and understand the health and safety information.

NOTE: The pipeline valve must be properly secured prior to performing the following operations according to instructions provided by the valve's manufacturer.

⚠ Prior to performing any operations check the operating drawings and TAG numbers.

Consult Rotork for any additional information.

10.1 Preliminary actions

⚠ Verify the EX classification of the actuator is compatible with the plant zoning. Refer to the actuator nameplate.

- The centreline of the cylinder is usually aligned to the centreline of the associated pipework
- Ensure all fasteners are adequately tightened, to avoid loosening during operation, taking into account the vibrations induced by the dynamics of the pipeline
- Piping used to provide pneumatic supply to the actuator must be free from contaminants and debris. Ensure tubing runs are adequately fastened and supported to minimise repetitive stress induced by the dynamics of the pipeline.
- Ensure there are no leaks from any pneumatic connections. Tighten as required.

10.2 Instructions

The assembling can be performed by direct mounting using the actuator housing flange with threaded holes and valve adapter.

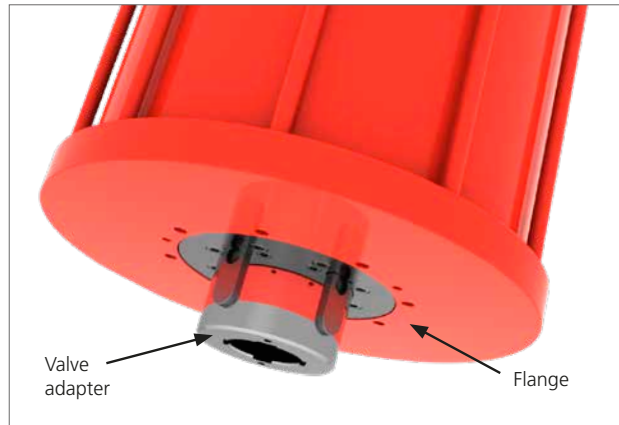


Fig 10.1 Valve adapter-particular (Type A actuator)

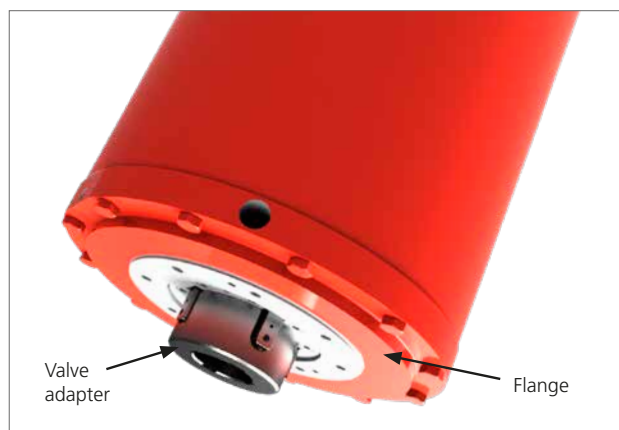


Fig 10.2 Valve adapter-particular (Type B actuator)

The assembly position of the actuator must be in accordance with the actuator design, plant requirements and the valve model.

In order to assemble the actuator onto the valve, proceed as follows:

- Verify the coupling dimensions of the valve flange and stem; they must meet the actuator coupling dimensions
- Set the valve in the closed position. The actuator is supplied in the closed position. Check the position of the actuator by means of the position indicator on the limit switch (if present)
- Clean the coupling flange of the valve and remove anything that might prevent adherence to the actuator flange. Grease shall be completely removed
- Lubricate the valve stem with oil or grease, to facilitate assembling

10. Installation on valve

- Lift the actuator according to Handling and Lifting instructions (Section 7)
- If possible, place the valve stem in a vertical position to facilitate assembling - in this case the actuator must be lifted while the coupling flange is kept in the horizontal position
- Align the actuator adapter flange grooves with the valve coupling stem
- Do not exert any force while lowering the actuator onto the valve

Installation must be performed by qualified personnel.

⚠ Hands must be kept away from the coupling area.

- Fix the actuator to the valve by means of threaded connections (bolts, stud bolts and nuts)
- Tighten the bolts or the nuts of the connecting stud bolts to the correct torque, in accordance with the size and material characteristics of the bolts installed by the customer

⚠ Support the actuator until fully installed and fixing bolts are correctly tightened.

- Check for possible damage to the paint-work and repair if necessary, according to the painting specification

⚠ Actuator vent ports must be installed facing downwards to prevent water ingress during service.



Fig 10.3 Actuator installation on valve

11. Removal from valve

The end user is in charge of removing the actuator from the valve.

⚠ Removal shall be performed only by qualified staff, wearing/using appropriate personal protection devices.

⚠ Do not remove the actuator if the valve is blocked in the intermediate position. Contact Rotork Site Services.

To disassemble the actuator from the valve, proceed as follows:

- Cut off electrical power supply
- Cut off pneumatic supply
- Remove the supply pipes from the actuator
- Release any pressure from the control group
- Remove control and signal lines from electric components (if any)
- Sling the actuator in line with handling and lifting instructions (Section 7)
- Unscrew the bolts or the nuts from the stud bolts fixing the actuator to the valve
- Lift and remove the actuator from the valve

12. Operation

The following instructions must be followed and integrated into the end user safety programme when installing and using Rotork products. Read and save all instructions prior to installing, operating and servicing this product.

Follow all warnings, cautions and instructions marked on and supplied with the product.

Install equipment as specified in Rotork installation instructions and as per applicable local and national codes of practice. Connect all products to the proper pneumatic sources.

When replacement parts are required, ensure that the qualified service technician uses only replacement parts specified by Rotork.

Substitutions will invalidate any hazardous area certification and may result in fire, electrical shock, other hazards or improper operation.

12.1 Description

The actuator consists of a cylindrical body containing a guide tube with vertical grooves connected to the bottom flange and a tube with helical grooves connected to the pneumatic piston. The transformation of linear movement into a rotary quarter turn motion is performed by combining one set of pin and one set of key movements. The pins are positioned within the helical slots of the tube with helical grooves and fixed on upper part of the drive shaft. The pins transmit a rotary movement to the drive shaft by moving along the helical slots of tube that is moving vertically due to pneumatic piston thrust. A set of keys, fixed on the lower part of tube with helical grooves, move along linear slots on the tube with vertical grooves allowing the drive shaft to transmit the rotary movement to the valve whilst preventing any rotation by the actuator piston.

The main components of the compact spring return actuator are shown in Fig 12.1, Fig 12.2 for Type A actuators Fig 12.3 and Fig 12.4, for Type B actuators.

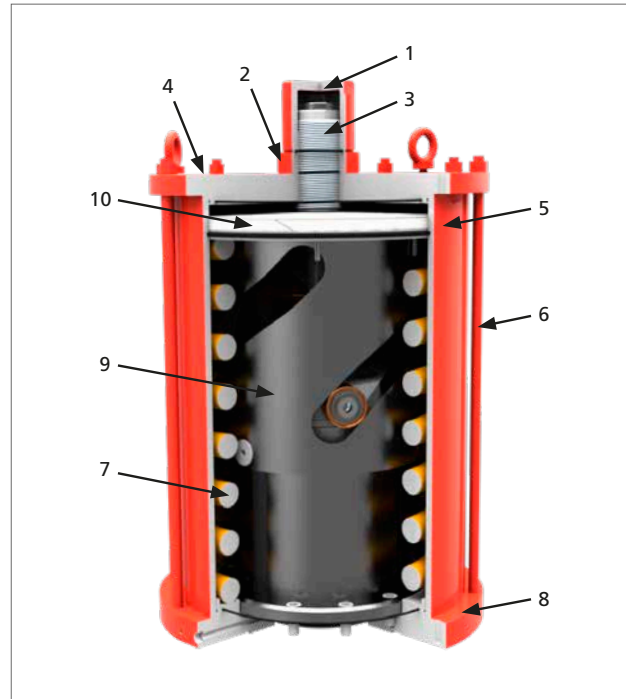


Fig 12.1 Pneumatic compact spring return actuator – Type A: external tie rods parts description

1	End cap
2	Stop nut
3	Upper stop bolt
4	End flange
5	Cylinder tube
6	Tie rod
7	Spring
8	Head flange
9	Mechanism
10	Piston

12. Operation

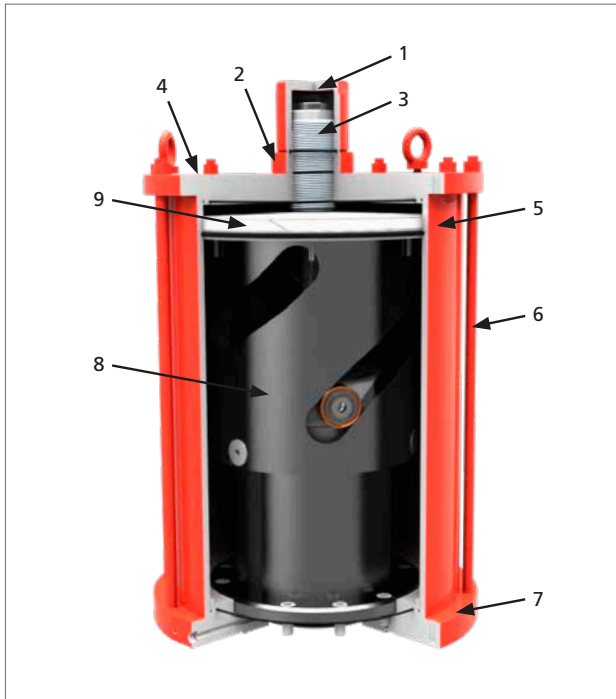


Fig 12.2 Pneumatic compact double effect actuator – Type A:
external tie rods part description

1	End cap
2	Stop nut
3	Upper stop bolt
4	End flange
5	Cylinder tube
6	Tie rod
7	Head flange
8	Mechanism
9	Piston

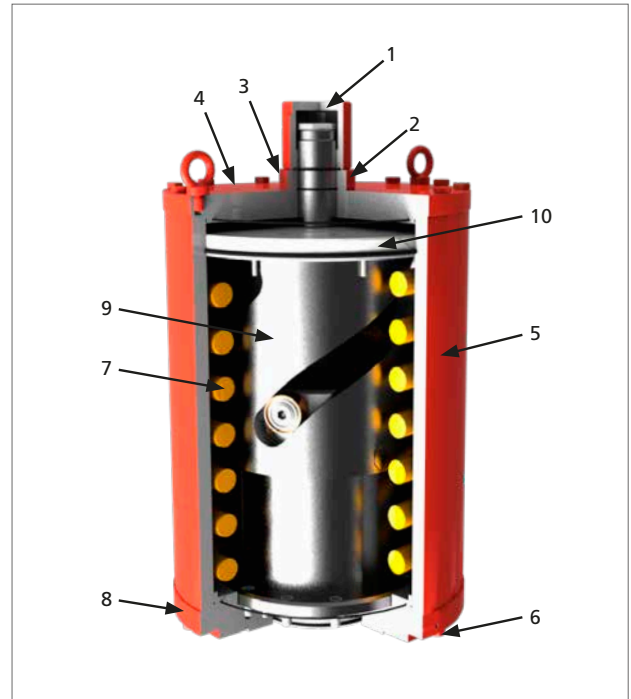


Fig 12.3 Pneumatic compact spring return actuator – Type B:
threaded flanges parts description

1	End cap
2	Stop nut
3	Upper stop bolt
4	End flange
5	Cylinder tube
6	Screws
7	Spring
8	Head flange
9	Mechanism
10	Piston

12. Operation

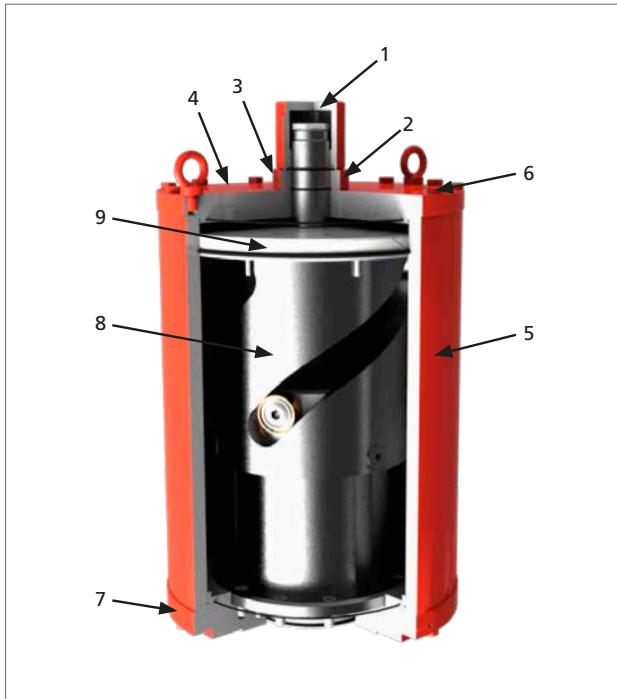


Fig 12.4 Pneumatic compact double effect actuator – Type B: threaded flanges parts description

1	End cap
2	Stop nut
3	Upper stop bolt
4	End flange
5	Cylinder tube
6	Screws
7	Head flange
8	Mechanism
9	Piston

12.2 Angular stroke regulation

⚠ Certain valves incorporate their own stops. For such valves, it is recommended that the actuator stop bolt positions coincide with the valve stop position.

⚠ Do not use the actuator outside $90^\circ \pm 5^\circ$ operating range.

A compact actuator is fitted with two stop bolts for the stroke regulation in both directions. Stop bolts are both located in the end flange (3).

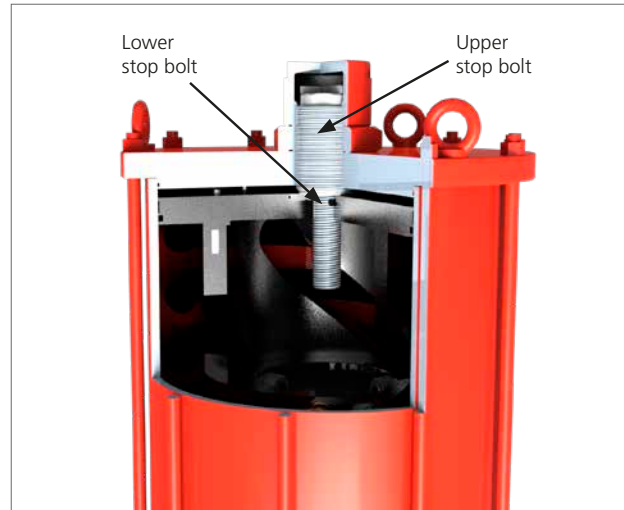


Fig 12.5 Stop bolt particular

12. Operation

12.3 Upper stop bolt setting

To regulate the upper stop bolt:

- Unscrew and remove the end cap (1). Use a proper tool to perform the operation. The end cap is provided with a key grip to facilitate screwing/unscrewing



- Loosen the stop nut (2)
- Slowly pressurise the cylinder to detach the stop bolt from the piston
- To reduce the actuator stroke, screw the stop bolt (3)



- To increase the actuator stroke, unscrew stop bolt (3)



- Perform an actuator stroke to verify the end position. Adjust the upper stop bolt again, if necessary

⚠ During the upper stop bolt regulation, pay attention not to completely screw the stop bolt. Ensure that a minimum number of threads (L) remains screwed.

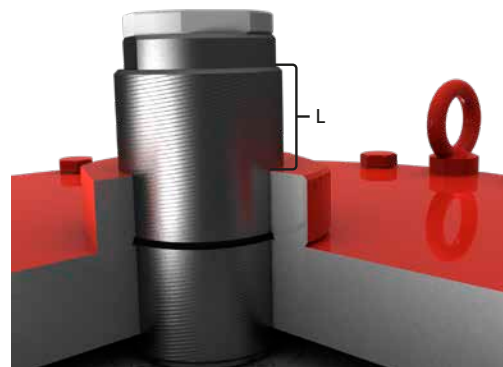


Fig 12.6 Upper stop bolt regulation: minimum number of threads

The minimum number of threads is specific for each actuator size. Refer to job documentation for detailed indication.

12. Operation

12.4 Lower stop bolt setting

To regulate the lower stop bolt:

- Unscrew and remove the end cap (1). Use a proper tool to perform the operation. The end cap is provided with a key grip to facilitate screwing/unscrewing



- Verify the stop nut (2) is correctly tightened
- Remove the closure cap (if present)
- Use an Allen key of correct dimension to regulate the lower stop bolt
- Screw the lower stop bolt to reduce stroke



- Unscrew the lower stop bolt to increase the stroke



- Perform an actuator stroke to verify end position. Adjust lower stop bolt again, if necessary

12.5 Limit switch setting

In case the actuator is provided with limit switches, their setting should be done by the user during the actuator testing operations on the valve.

⚠ The limit switches must be set so that they are actuated slightly earlier than the actuator angular stroke is stopped by the mechanical stops.

⚠ Before performing any operation on electric components, read and follow the safety precautions reported in the manufacturer's maintenance manual. Risk of temporary modification of the component protection.

Switch off the power supply prior to removing cover from the limit switch box.

- Remove the box cover

Closing limit switch

Instruction	Mechanically operated limit switches	Proximity limit switches
Place the actuator/valve in the fully closed position		
Disengage the close limit cam		
Rotate the close limit cam until the closing switch is active		
Engage the cam into the splined retainer		

Opening limit switch

Instruction	Mechanically operated limit switches	Proximity limit switches
Place the actuator/valve in the fully open position		
Disengage the open limit cam		
Rotate the open limit cam until the opening switch is active		
Engage the cam into the splined retainer		

12. Operation

NOTE: Where 3 or more limit switches are fitted, move the actuator to the extra signaling position(s) and set the cams for each location.

- Cycle the valve CLOSED and OPEN several times to ensure proper calibration
- Reassemble the box cover, verifying the cover seal is correctly positioned
- Turn the cover shaft manually, aligning it to the switch box shaft, and engage it
- Verify whether the position indicator correctly indicates the valve position
- Reconnect power supplies

For more information refer to the limit switch manufacturer's literature.



Fig 12.7 Typical limit switch box

Limit switch box could be different according to project specific requirements. Refer to project specific documentation for further details.

Limit switch box could require support structure to be connected to the actuator; this can be different according to project specific requirements. Refer to project specific documentation for further details.

12.6 Pneumatic supply

Verify allowed supply pressure range on the actuator label.

⚠ Verify medium composition. Contact Rotork to check the compatibility with the supply medium.

12.7 Pneumatic connections

Preliminary operations

- Verify sizes of pipes and fittings per applicable plant specifications
- Clean the inside of the connection pipes by washing them with a suitable detergent and by blowing air into them
- The connecting pipes must be properly shaped and fixed to prevent stress or loosening of threaded connections

NOTE: For tapered-thread fluid connections, apply a thin layer of thread sealing product (Loctite 577 or equivalent) to ensure a good seal.

⚠ Connect the pneumatic power source in accordance with the applicable operating diagram, please refer to specific job instructions for details.

12. Operation



Fig 12.8 Inlet/exhaust port (Type A)



Fig 12.10 Inlet/exhaust port and breathing port (Type B)




Fig 12.9 Breathing port (Type A)

Refer to the specific operating diagram for specific application configuration.

12. Operation

12.8 Electrical connections

 **Check electrical components supply voltage, before start-up.**


Electrical connection can be performed as follows:

- Remove the power supply
- Remove the covers of the electric components
- Remove the plastic protection plugs from the cable entries
- Use only appropriately certified reduction fittings, cable glands, fittings and explosionproof cables
- The cable glands must be tightened into the threaded inlets, to guarantee the waterproof and explosionproof protection
- Pay attention to the correct installation of the O-rings of the cable glands to prevent water and debris infiltration inside electric components
- The size of the electric supply cable must suit the electric power demand
- Insert the connection cables through the cable glands and perform assembly according to the cable gland manufacturer's instructions
- Connect the cable wires to the terminal blocks in accordance with the applicable wiring diagram
- Electric connections must be made by using rigid conduits and trailing cables to prevent mechanical stresses in the cable entries
- On the unused entries of the junction box, replace the plastic plugs with approved metal plugs, in order to guarantee sealing and to comply with explosion safety protection codes
- Assemble the covers of the electric components, paying attention to seals
- Once connections have been completed, check electrical components functionality

12.9 Start up

During the start-up of the actuator, it is necessary to check whether:

- Supply pressure is as prescribed
- The feed voltage values of electrical components (solenoid valves coils, limit switches, pressure switches etc., if applicable) are as prescribed
- Actuator controls such as remote control, local control, emergency control etc. (if applicable) work properly
- Input remote signals are correct
- The setting of control unit components is according to the plant requirements
- Pneumatic connections show no leakage. If necessary, tighten fittings
- The painted parts have not been damaged during transport, assembling or storage operations. On the contrary, after having removed rust, repair the damaged parts following the applicable painting specifications
- Actuator and all of its parties work as expected. Perform, at least, one functional complete stroke (open/close)
- Operating time is in accordance with requirements

 **The end user must guarantee equal voltage potential between the valve and the actuator and provide appropriate grounding. The end user shall indicate and maintain the grounding connections on the actuator.**

13. Dismantling and disposal

⚠ Remove power supply pressure before removing and disassembling the equipment.

Disassemble only control panel equipment (if present) and dismantle according to the following:

- Dispose of the pieces of steel, cast iron and aluminum alloys as metal scraps
- Dispose of the rubber, PVC, resins etc. separately, in accordance with the existing national and regional regulations
- Electric components are to be separately disposed of on specialised disposal sites

⚠ Single-acting actuator contain spring potential energy.

⚠ Actuator cannot be disassembled by the end user. Actuator has to be returned to the manufacturer's plant, upon agreement with Rotork.

Actuators manufactured after 1993 do not contain asbestos or its by-products.

14. Rotork sales and service

If your Rotork actuator has been correctly installed and sealed, it will give years of trouble-free service. Should you require technical assistance or spares, Rotork guarantees one of the highest levels of service in the flow control industry. Contact your local Rotork representative or the factory directly at the address on the nameplate, quoting the actuator type and serial number.

Some actuators have a special spare parts list. Refer to the project-specific documentation for further details.

15. Troubleshooting

ID	FAILURE	POSSIBLE CAUSES	CORRECTIVE MEASURES
1	Incorrect valve position	<ul style="list-style-type: none"> Fault of pipeline valve 	<ul style="list-style-type: none"> Consult the valve manufacturer's documentation
2	Incorrect indication of valve position	<ul style="list-style-type: none"> Incorrect signal from limit switches 	<ul style="list-style-type: none"> Check limit switches (Section 12.5)
3	Incorrect movement	<ul style="list-style-type: none"> Irregular supply of operating medium 	<ul style="list-style-type: none"> Verify the supply pressure and adjust as necessary
		<ul style="list-style-type: none"> Worn parts 	<ul style="list-style-type: none"> Contact Rotork
		<ul style="list-style-type: none"> Fault in control panel equipment (if present) 	<ul style="list-style-type: none"> Contact Rotork customer service
		<ul style="list-style-type: none"> Fault of pipeline valve 	<ul style="list-style-type: none"> Consult the valve manufacturer's documentation
4	Valve stroke not fully completed	<ul style="list-style-type: none"> Insufficient gas flow 	<ul style="list-style-type: none"> Increase gas supply flow
		<ul style="list-style-type: none"> Incorrect assembly between actuator and valve 	<ul style="list-style-type: none"> Perform assembling according to INSTALLATION ON VALVE (Section 10)
		<ul style="list-style-type: none"> Valve blocked 	<ul style="list-style-type: none"> Consult the valve manufacturer's documentation
		<ul style="list-style-type: none"> Stop bolts wrong setting 	<ul style="list-style-type: none"> Adjust stop bolt setting following instructions in ANGULAR STROKE REGULATION (Section 12.2)
5	Leakages	<ul style="list-style-type: none"> Stop bolts wrong setting 	<ul style="list-style-type: none"> Adjust stop bolt setting following instructions in ANGULAR STROKE REGULATION (Section 12.2)
		<ul style="list-style-type: none"> Worn seals 	<ul style="list-style-type: none"> Type A actuator: Perform actions in the following order. <ol style="list-style-type: none"> 1) Replace turning flange seal (PM-CQP-003) 2) Replace piston seals (PM-CQP-004) Type B actuator: Perform actions in the following order. <ol style="list-style-type: none"> 1) Replace turning flange seal (PM-CQP-005) 2) Replace piston seals (PM-CQP-006)
6	Actuator moves too fast	<ul style="list-style-type: none"> No pressure on pipeline 	<ul style="list-style-type: none"> Restore pipeline pressure
		<ul style="list-style-type: none"> Supply pressure greater than allowed range values 	<ul style="list-style-type: none"> Verify the supply pressure and adjust as necessary
7	Actuator moves too slow	<ul style="list-style-type: none"> Fault on pipeline valve (valve hardened) 	<ul style="list-style-type: none"> Consult the valve manufacturer's documentation
		<ul style="list-style-type: none"> Supply pressure lower than allowed range values 	<ul style="list-style-type: none"> Verify the supply pressure and adjust as necessary
		<ul style="list-style-type: none"> Possible internal undue friction 	<ul style="list-style-type: none"> Contact Rotork Site Services
8	Loss of power	<ul style="list-style-type: none"> Inadequate supply pressure 	<ul style="list-style-type: none"> Ensure that the supply pressure is above the minimum operating pressure of the actuator and that the output torque produced at supply pressure exceeds the required valve torque.
		<ul style="list-style-type: none"> Leakage from cylinder 	<ul style="list-style-type: none"> Type A actuator: Perform actions in the following order. <ol style="list-style-type: none"> 1) Replace turning flange seal (PM-CQP-003) 2) Replace piston seals (PM-CQP-004) Type B actuator: Perform actions in the following order. <ol style="list-style-type: none"> 1) Replace turning flange seal (PM-CQP-005) 2) Replace piston seals (PM-CQP-006)

For other problems, please contact Rotork customer service.

16. Periodic maintenance

Rotork recommends performing the following checks to help comply with the rules and regulations of the country of final installation:

⚠ Remove pressure before proceeding with maintenance operations, discharge any accumulators or tanks (if present), except where otherwise indicated.

Periodic maintenance schedule




MAINTENANCE ACTIVITY	PERIODICITY		REFERENCE
	Months	Years	
Visual check of external components and control groups	6*	*	
Check pneumatic connections for leaks. Tighten pipe fittings as required	-	1*	
Cleaning	-	1*	PM-CQP-001
Visual check of painting. Verify absence of damages. Repair if necessary according to painting specification	-	1*	
Functional test	-	1*	PM-CQP-002
Check electrical components and grounding connections	-	1*	
Turning flange seals replacement (Type A actuator)	-	4*	PM-CQP-003
Cylinder seals replacement (Type A actuator)	-	4*	PM-CQP-004
Turning flange seals replacement (Type B actuator)	-	4*	PM-CQP-005
Cylinder seals replacement (Type B actuator)	-	4*	PM-CQP-006

(* The time between maintenance tasks will vary depending on the medium and service conditions. Refer to End User Plant Preventive Maintenance Program for specific task periodicity.


For functional safety applications refer to safety manual.

Specific maintenance could be necessary for specific application. Refer to job documentation for eventual additional maintenance tasks.




16. Periodic maintenance

		PM-CQP-001	Page: 1/1
Component: Actuator	Task: Cleaning		
Equipment, tools, materials: Air compressor Project documentation (design and operating pressure values)	Warnings: 		
Preliminary operations:			
Description:			
 Remove pneumatic supply before proceeding.			
1. Remove dust from external surfaces by blowing air			
 Do not polish/rub non-metal surfaces with a dry cloth. The tools and cleaning procedures must not produce sparks or create adverse conditions in the environment during maintenance operations, to prevent potential explosion hazards. Prevent electrostatic charges in potentially explosive areas.			


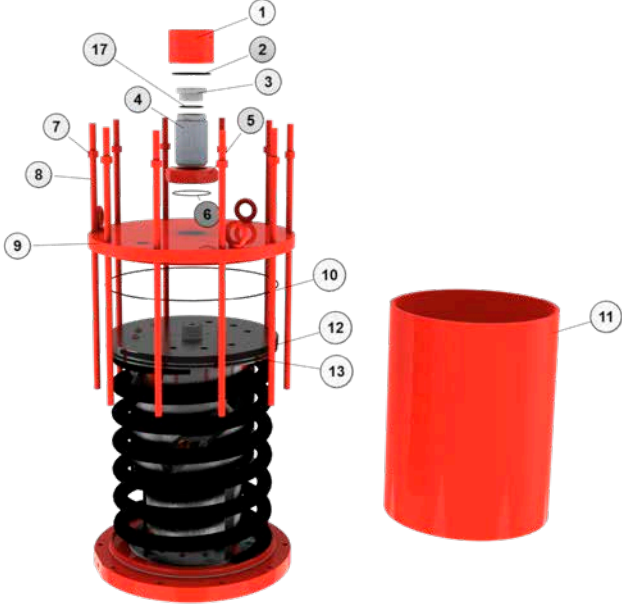
16. Periodic maintenance

PM-CQP-002		Page: 1/1
Component: Actuator	Task: Functional test	
Equipment, tools, materials: Chronometer Project documentation (required stroke times)	Warnings: 	
Preliminary operations:		
Description: NOTE: Actuator must be connected to the pneumatic supply to perform the following test. <ol style="list-style-type: none">1. Operate the actuator2. Perform one closing stroke and one opening stroke3. Verify actuator's movement is smooth and linear4. Verify stroke time(s) are as required <p>⚠ Actuator discharges medium gas during normal operation. Pay attention during test. Do not stand near exhaust port.</p> <p>In case of stroke times out of required range refer to Troubleshooting ID 3 (Section 15) to restore.</p>		


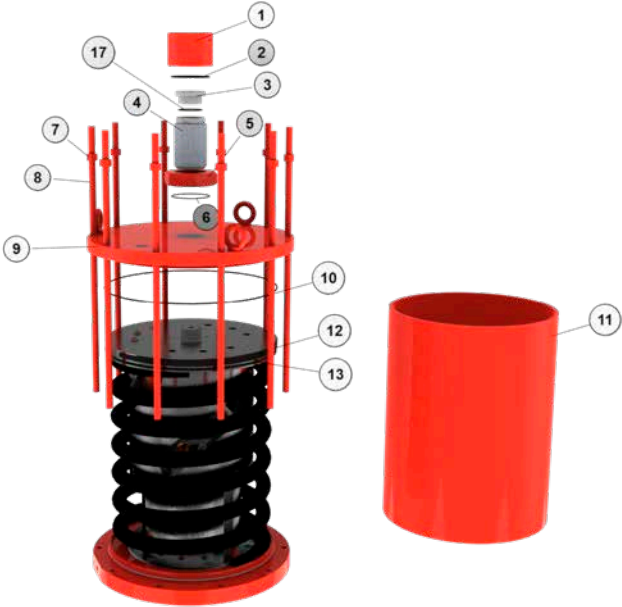
16. Periodic maintenance

		PM-CQP-003	Page: 1/1
Component: Actuator (Type A)		Task: Cylinder seals replacement - turning flange	
Equipment, tools, materials: Lifting equipment Spare parts		Warnings: 	
Preliminary operations: Removal from valve (Section 11)			
Description:  Cut-off power supply and electric power supply (if present) before performing any operation. <ul style="list-style-type: none"> Remove the actuator from the valve (Section 11) This maintenance task must be performed in a clean workshop, free from dust Position the actuator on a workbench The actuator must be in its safety position, spring relaxed (in case of single effect).			
Disassembly of turning flange Before proceeding with the following operation ensure that the cylinder group is completely assembled. Don't execute the following operation if tie rods or any other part of the cylinder group are disassembled or unscrewed. <ul style="list-style-type: none"> Place the actuator on a proper bench in horizontal position Seals substitution <ul style="list-style-type: none"> Unscrew the hex socket bolt (14) Remove the turning flange (15) Remove the O-ring (16) Carefully clean the seals groove All the removed parts should be thoroughly cleaned, inspected and de-burred as necessary Replace all the mentioned seals and lubricate them with a grease film Reassembly <ul style="list-style-type: none"> With the actuator in horizontal position, reinstall turning flange (15) with O-ring (16) Reinstall and tighten hex socket bolt (14) according to the recommended torque and following a "cross bolt torque tightening" sequence Final testing The actuator must be tested. <ul style="list-style-type: none"> Place the actuator in a stable position, e.g. on a workbench Connect the pneumatic supply to the actuator and cycle the actuator several times, in order to check if it works smoothly and if there are any leakages through the seals Check if the painted parts have been damaged during disassembly and/or reassembly. If necessary, repaint them in accordance with the applicable painting specifications 			



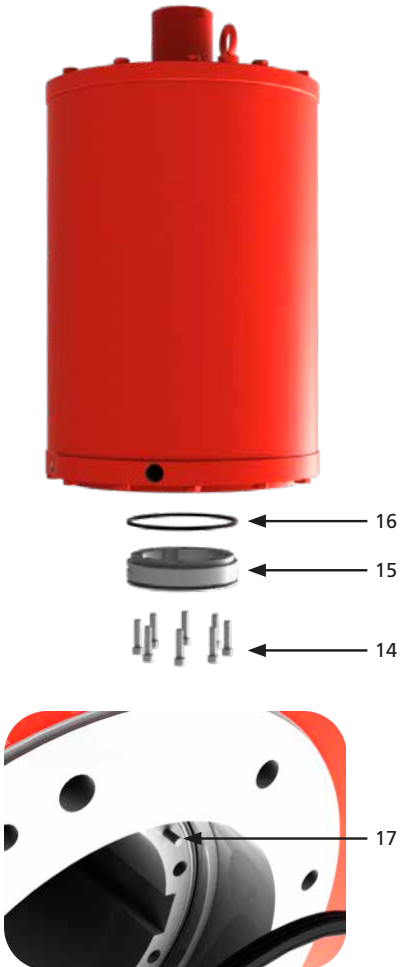
16. Periodic maintenance

PM-CQP-004		Page: 1/2
Component: Actuator (Type A)	Task: Cylinder seals replacement - piston seals	
Equipment, tools, materials: Lifting equipment Spare parts	Warnings: 	
Preliminary operations: Removal from valve (Section 11), PM-CQP-003		
Description:		
<p>⚠ Cut-off power supply and electric power supply (if present) before performing any operation.</p> <ul style="list-style-type: none"> Remove the actuator from the valve (Section 11) This maintenance task must be performed in a clean workshop, free from dust Position the actuator on a workbench <p>Actuator must be in its safety position, spring relaxed (in case of single effect). Before executing this procedure verify that the connecting screws (14) are correctly assembled and tightened on enclosure flange.</p>		
<p>Disassembly of the stop bolt</p> <p>Ensure that the turning flange is correctly assembled and tightened before proceeding.</p> <p>The actuator must be in vertical position.</p> <ul style="list-style-type: none"> Hold the stop nut with a wrench, then unscrew and remove cap nut (1) Remove O-ring (2) Measure the distance between the upper stop bolt and the end flange (2) surface. This measure will be useful during re-installation Hold upper stop bolt (4) with a wrench and unscrew locking nut (5) Remove the O-ring (6) Unscrew and remove stopper plug (3) Remove the O-ring (17) Remove the upper stop bolt (4) 		
<p>Disassembly of cylinder</p> <p>Ensure that the turning flange is correctly assembled and tightened before proceeding.</p> <p>The actuator must be in the vertical position.</p> <ul style="list-style-type: none"> Unscrew the hex socket bolt (7) Unscrew the tie rods (8) Lift the end flange (9) and the cylinder tube (11) by means of the lifting lugs Remove the piston sliding ring (12) and O-ring (13) If the O-ring (10) is damaged, replace it 		
<p>Seals substitution</p> <ul style="list-style-type: none"> Carefully clean the seals groove All the removed parts should be thoroughly cleaned, inspected and de-burred as necessary Replace all the mentioned seals and lubricate them with a grease film Lubricate all sliding parts with a recommended grease film 		


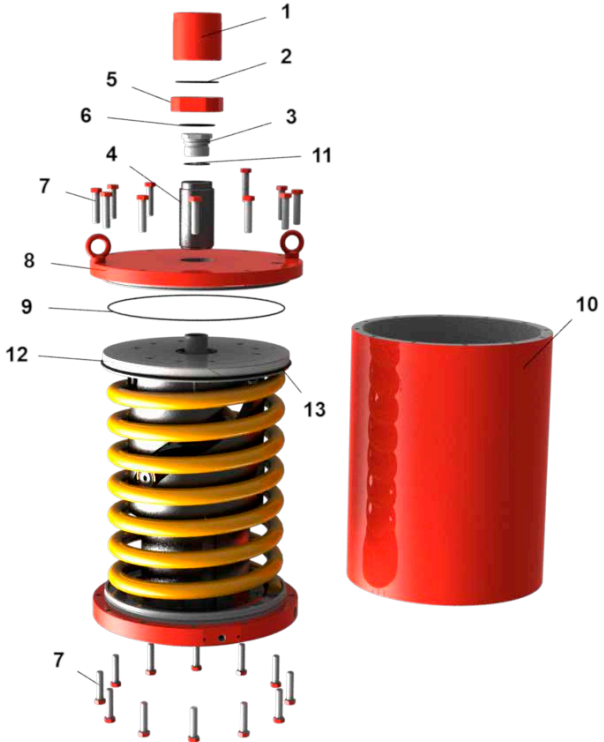
16. Periodic maintenance

		PM-CQP-004	Page: 2/2
Component: Actuator (Type A)		Task: Cylinder seals replacement - piston seals	
Equipment, tools, materials: Lifting equipment Spare parts		Warnings: 	
Preliminary operations: Removal from valve (Section 11), PM-CQP-003			
<p>Reassembly</p> <ul style="list-style-type: none"> Reinstall the cylinder tube (11) Position the end flange (9) with the O-ring (10) Reinstall tie rods (8) and tighten according to the recommended torque, following a "cross bolt torque tightening" sequence Install the upper stop bolt (4) according to the distance measured before Replace the O-ring (17) and install the stopper plug (3) Install the lock nut (5) with the O-ring (6) Screw the end cap (1) with the O-ring (2) <p>Final testing</p> <p>The actuator must be tested before it is assembled on the valve.</p> <ul style="list-style-type: none"> Place the actuator in a stable position, e.g. on a workbench Connect the pneumatic supply to the actuator and cycle the actuator several times, in order to check if it works smoothly and if there are any leakages through the seals Check if the painted parts have been damaged during disassembly and/or reassembly. If necessary, repaint them in accordance with the applicable painting specifications <p>The actuator is now ready to be assembled on the valve</p>			


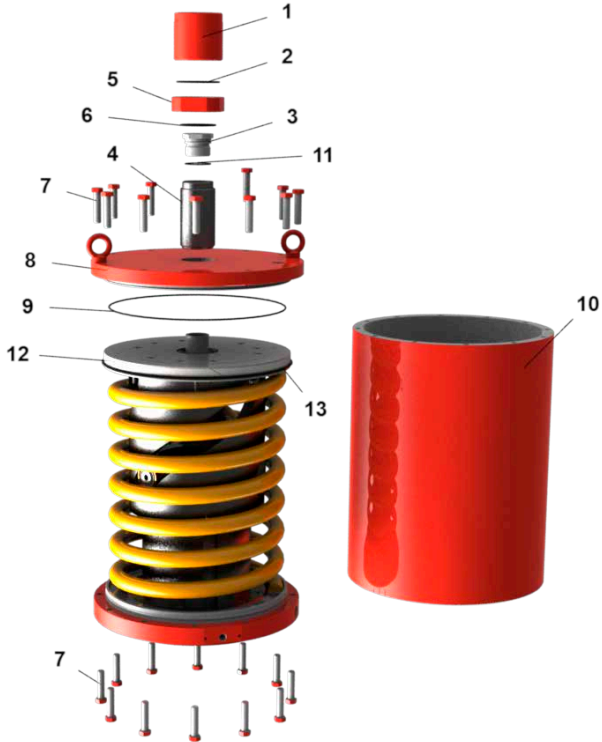
16. Periodic maintenance

		PM-CQP-005	Page: 1/1
Component: Actuator (Type B)	Task: Cylinder seals replacement - turning flange		
Equipment, tools, materials: Lifting equipment Spare parts	Warnings: 		
Preliminary operations: Removal from valve (Section 11)			
Description:  Cut-off power supply and electric power supply (if present) before performing any operation. <ul style="list-style-type: none"> Remove the actuator from the valve (Section 11) This maintenance task must be performed in a clean workshop, free from dust Position the actuator on a workbench The actuator must be in its safety position, spring relaxed (in case of single effect).			
<p>Disassembly of turning flange</p> <p>Before proceeding with the following operation ensure that the cylinder group is completely assembled.</p> <p>Don't execute the following operation if head flange's screws, end flanges screws or any other part of the cylinder group are disassembled or unscrewed.</p> <ul style="list-style-type: none"> Place the actuator on a proper bench in horizontal position <p>Seals substitution</p> <ul style="list-style-type: none"> Unscrew the hex socket bolt (14) Remove the turning flange (15) using suitable lifting devices Remove the O-ring (16) Carefully clean the seals groove All the removed parts should be thoroughly cleaned, inspected and de-burred as necessary Replace all the mentioned seals and lubricate them with a grease film <p>Reassembly</p> <ul style="list-style-type: none"> With the actuator in the horizontal position, reinstall the turning flange (15) with the O-ring (16) using the pin (17) as a reference point for flange centring Reinstall and tighten the hex socket bolt (14) according to the recommended torque and following a "cross bolt torque tightening" sequence <p>Final testing</p> <p>The actuator must be tested.</p> <ul style="list-style-type: none"> Place the actuator in a stable position, e.g. on a workbench Connect the pneumatic supply to the actuator and cycle the actuator several times, in order to check if it works smoothly and if there are any leakages through the seals Check if the painted parts have been damaged during disassembly and/or reassembly. If necessary, repaint them in accordance with the applicable painting specifications 			

16. Periodic maintenance

		PM-CQP-006	Page: 1/2
Component: Actuator (Type B)	Task: Cylinder seals replacement - piston seals		
Equipment, tools, materials: Lifting equipment Spare parts	Warnings: 		
Preliminary operations: Removal from valve (Section 11), PM-CQP-005			
Description:			
<p>⚠ Cut-off power supply and electric power supply (if present) before performing any operation.</p> <ul style="list-style-type: none"> Remove the actuator from the valve (Section 11) This maintenance task must be performed in a clean workshop, free from dust Position the actuator on a workbench <p>The actuator must be in its safety position, spring relaxed (in case of single effect). Before executing this procedure verify that the connecting screws (14) are correctly assembled and tightened on the enclosure flange.</p>			
<p>Disassembly of the stop bolt</p> <p>Ensure that the turning flange is correctly assembled and tightened before proceeding.</p> <p>The actuator must be in the vertical position.</p> <ul style="list-style-type: none"> Hold the stop nut with a wrench, then unscrew and remove the cap nut (1) Remove the O-ring (2) Measure the distance between the upper stop bolt and the end flange (2) surface. This measure will be useful during re-installation Hold the upper stop bolt (4) with a wrench and unscrew the locking nut (5) Remove the O-ring (6) Unscrew and remove the stopper plug (3) Remove the O-ring (11) Remove the upper stop bolt (4) 			
<p>Disassembly of cylinder</p> <ul style="list-style-type: none"> Gradually unscrew the hex socket bolt (7) of the end flange (8), following a cross-bolt unscrewing scheme Lift the end flange (8) by means of the lifting lugs Gradually unscrew the hex socket bolt (7) of the head flange (1), following a cross-bolt unscrewing scheme Carefully remove the cylinder tube (10) by means of proper lifting tools Remove the piston sliding ring (12) and O-ring (13) If the O-ring (9) is damaged, replace it 			
<p>Seals substitution</p> <ul style="list-style-type: none"> Carefully clean the seals groove All the removed parts should be thoroughly cleaned, inspected and de-burred as necessary Replace all the mentioned seals and lubricate them with a grease film Lubricate all sliding parts with a recommended grease film 			

16. Periodic maintenance

PM-CQP-006		Page: 2/2
Component: Actuator (Type B)	Task: Cylinder seals replacement - piston seals	
Equipment, tools, materials: Lifting equipment Spare parts	Warnings: 	
Preliminary operations: Removal from valve (Section 11), PM-CQP-005		
<p>Reassembly</p> <ul style="list-style-type: none"> • Replace the sliding ring (12) and O-ring (13) • Reinstall the cylinder tube (10) • Position the end flange (8) with O-ring (9) • Reinstall screws (7) and tighten according to the recommended torque, following a "cross bolt torque tightening" sequence • Install the upper stop bolt (4) according to the distance measured before • Replace the O-ring (11) and install the stopper plug (3) • Install the lock nut (5) with the O-ring (6) • Screw the end cap (1) with the O-ring (2) <p>Final testing</p> <p>The actuator must be tested before it is assembled on the valve.</p> <ul style="list-style-type: none"> • Place the actuator in a stable position, e.g. on a workbench • Connect the pneumatic supply to the actuator and cycle the actuator several times, in order to check if it works smoothly and if there are any leakages through the seals • Check if the painted parts have been damaged during disassembly and/or reassembly. If necessary, repaint them in accordance with the applicable painting specifications <p>The actuator is now ready to be assembled on the valve</p>		

17. Part list

Pneumatic actuator single effect, single spring configuration, Type A

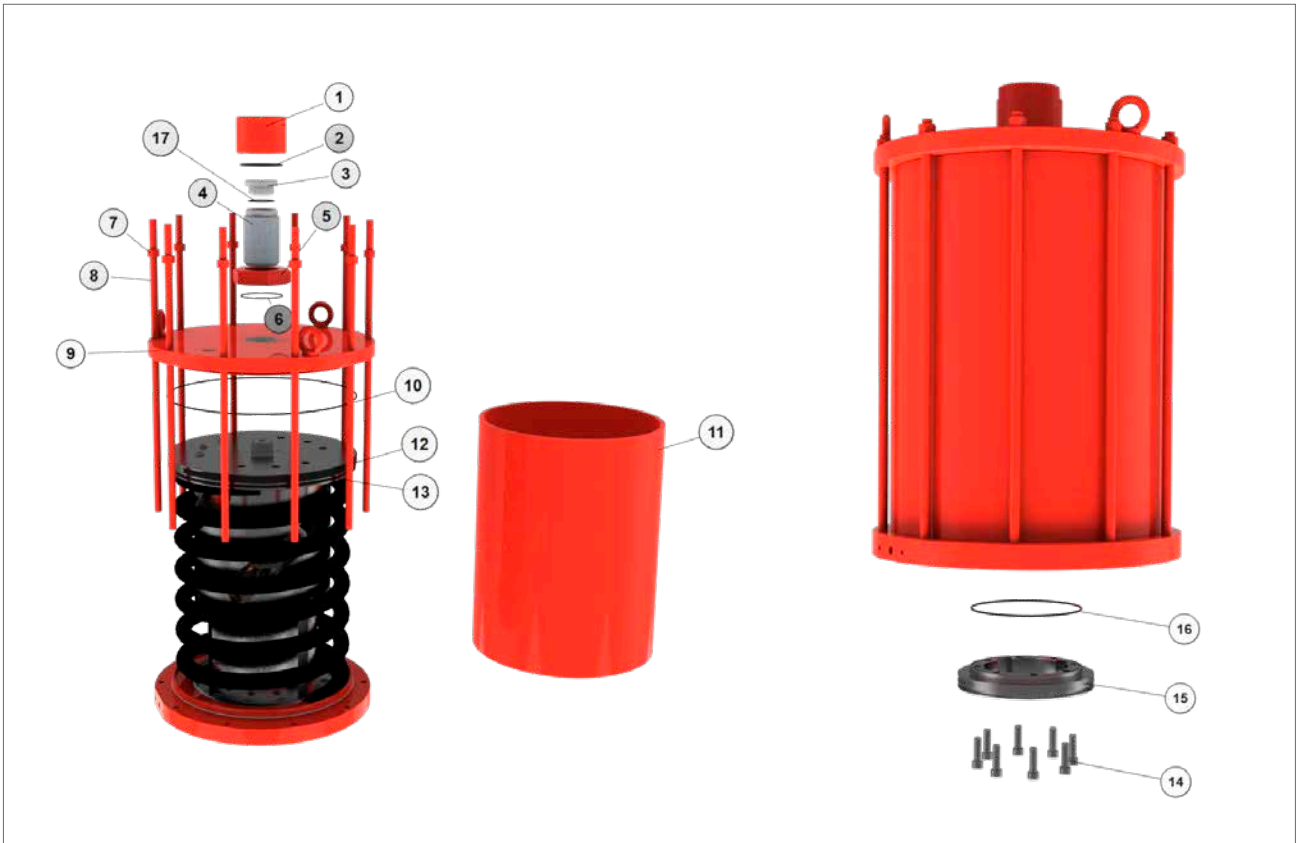


Fig 17.1 Pneumatic actuator single effect, single spring configuration, Type A

ITEM	DESCRIPTION	MATERIAL	QTY	
1	Cap nut	Alloy steel	1	
2	O-ring	Buna-N	1	●
3	Stopper plug	Carbon steel	1	
4	Upper stop bolt	Alloy steel	1	
5	Stop nut	Buna-N	1	●
6	O-ring	Carbon steel	1	
7	Hex bolt (*)	Carbon steel	10	
8	Tie rod (*)	Carbon steel	10	
9	End flange	Carbon steel	1	
10	O-ring	Buna-N	1	●
11	Pneumatic cylinder	Carbon steel (Nickel plated)		

ITEM	DESCRIPTION	MATERIAL	QTY	
12	Sliding ring	PTFE+ Buna-N	1	●
13	O-ring	Buna-N	1	●
14	Hex socket bolt	Stainless steel	8	
15	Turning flange	Carbon steel	1	
16	O-ring	Buna-N	1	●
17	O-ring	Buna-N	1	●

● Recommended spare

(*) Number of tie rods and hex bolts could be different for each specific project, refer to project's documentation

17. Part List

Pneumatic actuator single effect, single spring configuration, Type A

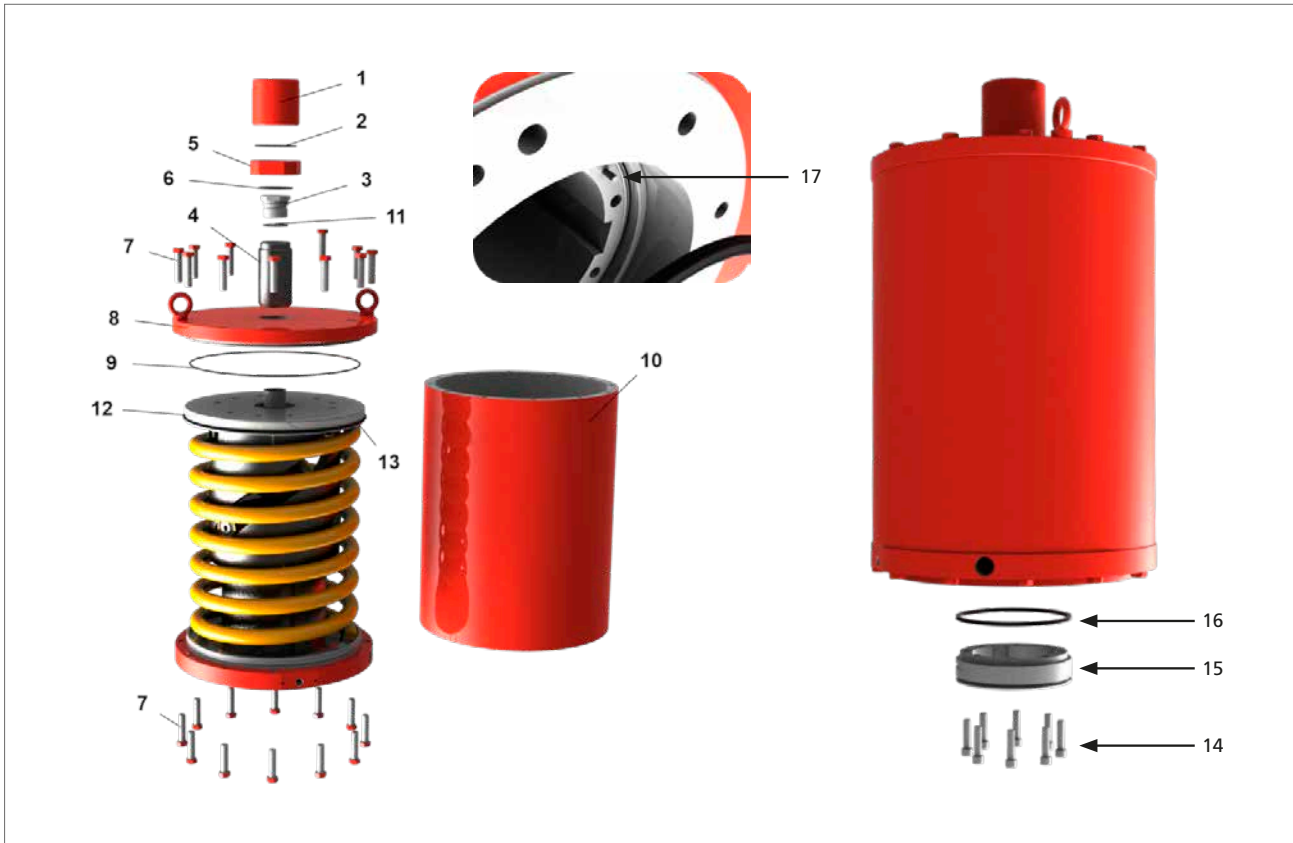


Fig 17.2 Pneumatic actuator single effect, single spring configuration, Type A

ITEM	DESCRIPTION	MATERIAL	QTY	
1	Cap nut	Alloy steel	1	
2	O-ring	Buna-N	1	●
3	Stopper plug	Carbon steel	1	
4	Upper stop bolt	Alloy steel	1	
5	Stop nut	Buna-N	1	●
6	O-ring	Carbon steel	1	
7	Hex bolt (*)	Carbon steel	24	
8	End flange	Carbon steel		
9	O-ring	Buna-N	1	●
10	Pneumatic cylinder	Carbon steel (Nickel plated)	1	
11	O-ring	Buna-N	1	●

ITEM	DESCRIPTION	MATERIAL	QTY	
12	Sliding ring	PTFE+ Buna-N	1	●
13	O-ring	Buna-N	1	●
14	Hex socket bolt	Stainless steel	8	
15	Turning flange	Carbon steel	1	
16	O-ring	Buna-N	1	●
17	Pin	Carbon steel	1	

● Recommended spare

(*) Number of screws could be different for each specific project, refer to project's documentation

18. Grease specification

In general, there is no need to lubricate the actuator because its mechanism is lubricated for life. The standard grease for Rotork CQP actuators is shown below. If an alternative was specified and/or supplied, please refer to the job specific documentation.

18.1 Grease

Lubricate mechanical sliding components of the mechanism using the following grease or equivalent for temperature range $-30^{\circ} < T < +100^{\circ} \text{C}$.

Manufacturer:	Dow Corning Corporation
Trade name: Colour:	MOLIKOTE® P40 Clear brown
Unworked penetration (ISO 2137): Viscosity of oil at 40 °C (104°F) (DIN 51 562):	310-350 mm/10 360 mm ² /s
Service temperature: Drop point (ISO 2176):	-40 to 230 °C (-40 to 446 °F) None
Four ball tester Weld load (Din 51 350 pt.4) Wear scar under 800N load (Din 51 350 pt.5)	3000 N 0.94 mm
Coefficient of friction ^[1] Screw test - μ thread Screw test - μ head	0.16 0.08

1. Coefficient of friction in bolted connection, M12x1.75, 8.8, on blackened surface.

Use following grease or equivalent to lubricate the seals, seal grooves and internal tube of pneumatic cylinders:

Manufacturer:	SHELL
Trade name:	GADUS S5 V25Q
NLGI grade:	2.5
Colour:	Clear brown
Penetration, density, viscosity Viscosity of oil at 40 °C (ASTM D445): Viscosity of oil at 100 °C (ASTM D445):	25 cST 4.8 cST
Temperature Drop point (IP396):	180 °C

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Rotork plc
Brassmill Lane, Bath, UK
tel +44 (0)1225 733200
email mail@rotork.com

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