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for Future Generations



LP/S Range

Pneumatic Actuator
Single-Acting Configuration



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 Actuator Code and Design | 13 |
| 4.1 Residual Risks | 4 | 12.3 Operating Description | 14 |
| 4.2 Thermal Risks | 4 | 12.4 Manual Override | 14 |
| 4.3 Noise | 4 | 12.5 Mechanical Manual Override Single-Acting Actuator | 15 |
| 4.4 Health Risks | 4 | 12.6 Hydraulic Manual Override Single-Acting Actuator | 17 |
| 4.5 Mechanical Risks | 4 | 12.7 Linear Stroke Setting | 18 |
| 4.6 Magnetic Risks | 5 | 12.8 Pneumatic Power Supply | 21 |
| 4.7 Electrostatic Risks | 5 | 12.9 Pneumatic Connections | 21 |
| 5. Labels and Nameplates | 5 | 12.10 Electrical Connections | 22 |
| 6. Operating Limits | 6 | 12.11 Start Up | 22 |
| 6.1 Allowed Fluid Types | 6 | 13. Dismantling and Disposal | 23 |
| 6.2 Expected Lifetime | 6 | 14. Rotork Sales and Service | 23 |
| 6.3 Tightening Torque Chart | 6 | 15. Troubleshooting | 24 |
| 7. Handling and Lifting | 7 | 16. Periodic Maintenance | 25 |
| 7.1 Lifting Recommendations | 7 | 17. Part List | 79 |
| 7.2 Lifting Instructions | 7 | 18. Grease and Hydraulic Oil Specification | 87 |
| 8. Storage | 9 | 18.1 Grease | 87 |
| 9. Long Term Storage | 9 | 18.2 Hydraulic Oil | 87 |
| 10. Installation on Valve | 10 | | |
| 10.1 Preliminary Actions | 10 | | |
| 10.2 Instructions | 10 | | |
| 10.3 Assembly Configurations | 11 | | |

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.

Due to wide variation in the terminal numbering of actuator products, actual wiring of this device should follow the print supplied with the unit.

1. Introduction

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

General information on Rotork fluid powered actuators is included in the User Manual, delivered separately.

In this manual, warning indications are represented by icons, per ISO 7010 Safety Signs:



Generic danger



Hand crush/pinch point



Electrocution



Explosive material

Customer Service

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2. Standards and Regulations

Actuators destined for European member states have been designed, built and tested per the Quality Control System, in compliance with the EN ISO 9001:2015 standard and with the following regulations/directive.

- 2006/42/EC: Machinery Directive
- 2014/68/EU: Pressure Equipment Directive (PED)
- 2014/34/EU: Directive for safety equipment and systems to be used in potentially explosive atmospheres (ATEX)
- 2014/30/UE: Electromagnetic Compatibility Directive
- EN ISO 12100: Machinery Safety Directive
- EN 60079-14: Explosive atmospheres – Part 14: Electrical installations design, selection and erection
- ISO 80079-36: Non-electrical equipment for explosive atmospheres – Basic method and requirements
- EN 1127-1: Explosive atmospheres – Explosion prevention and protection
- ISO 80079-37: Non-electrical equipment for explosive atmospheres – Non-electrical type of protection construction safety “c”, control of ignition sources “b”, liquid immersion “k”
- UNI EN ISO 7010: Safety Signals
- EN13445: Unfired Pressure Vessels

3. General Information

This manual is produced to enable a competent user to install, operate and maintain the Rotork LP Actuator Single-Acting (LP/S).

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 Protection Devices (PPDs) in line with the existing plant regulations.

Appropriate Usage

Rotork LP range actuators have been specifically developed to motorize linear valves, such as gate valves, or globe valves.

⚠ 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 the present manual.

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. |
| Risk | In the presence of dust, equipment surface temperature must not exceed 2/3 of the ignition temperature of the dust. Dust ignition temperature is reduced by 75 °C if a 5 mm thick coating builds up. |
| Preventive measures | Keep equipment surfaces clean by planning regular cleaning maintenance using a suitable wet anti-static cloth. |

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 | Pressurized 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 utilized) (RES_06). |
| Preventive measures | Operators must use P.P.Ds and any other equipment (breathing apparatus) based on the type of supply medium. |

4.5 Mechanical Risks

| | |
|---------------------|---|
| Risk | Uncontrolled movement (remote operation) (RES_03) (This risk is applicable only for actuators provided with control panel). |
| Preventive measures | Assure that the actuator cannot be operated remotely. Prior to starting, remove 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. |

4. Health and Safety

| | |
|---------------------|--|
| 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 manual and contact Rotork. |
| Preventive measures | Foresee periodic maintenance procedure to verify tightening. |
| Risk | Presence of potential energy (RES_10) during dismantling. |
| Preventive measures | Do not disassemble the actuator during dismantling. Follow instructions in the manual and contact Rotork. |

4.6 Magnetic Risks

| | |
|---------------------|--|
| Risk | Risk of magnetic field/disturbance and exothermic reactions. |
| Preventive measures | The end user shall assure that actuator and its components are installed far from magnetic field, electro-magnetic field, radioactive source, electroacoustic transducer which could modify its behaviour. (This mitigation is applicable only for actuators provided with control panel). Avoid maintenance operations with acid/basic solutions. |

4.7 Electrostatic Risks

| | |
|--------------------|---|
| Risk | Non-conductive parts of the equipment can build an electrostatic charge which is dangerous in hazardous areas. |
| Preventive measure | Do not polish/rub surfaces with a dry cloth. Only clean equipment surfaces with a suitable wet anti-static cloth. Operators must wear suitable anti-static clothing and use tools that will not generate a static charge. The user must ensure the operating environment and any materials surrounding the actuator cannot lead to a reduction in the safe use of, or the protection afforded by, the actuator. |

5. Labels and Nameplates

The following label is applied externally to the actuator:

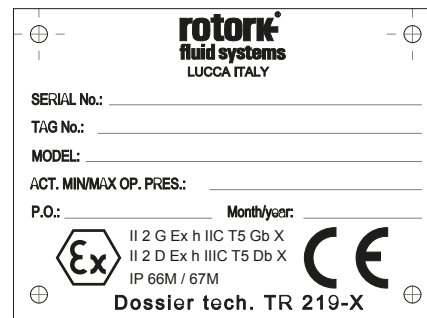


Fig 5.1 Actuator label

ATEX Type of Protection: constructional safety "c".

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

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

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

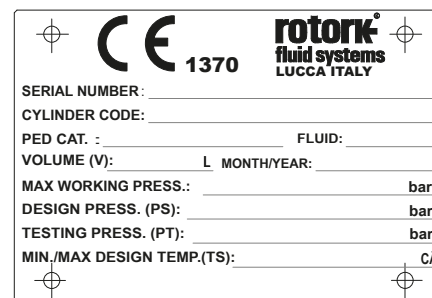


Fig 5.2 Actuator PED label

Label removal is not allowed.

6. Operating Limits

Temperature: -30 to +100 °C for standard applications
-20 to +100 °C for PED applications
-40 to +100 °C for low temperature application
-60 to +100 °C for ultra-low temperature application

Design pressure: up to 12 barg

Operating pressure: up to 12 barg

⚠ Do not use the equipment outside its operating limits. Verify operating limits on the nameplate.

Prevent external surface temperature to reach the ignition point in potentially explosive environments.

The actuator surface temperature is strictly dependent on the temperature of the process fluid used and by the irradiation's conditions. The end-user must check the surface temperature of the assembly, so that this cannot go over the minimum gas ignition's temperature, which classifies the area with the explosion's risk.

Dust and debris accumulated on the actuator will slow down its cooling and contribute to the increase of its external temperature.

6.1 Allowed Fluid Types

The pneumatic actuator is designed to be operated with Gas, Instrument air with particles filtering $\leq 40 \mu\text{m}$ (Class 7 according ISO 8573-1, table 1), pressure dew point $\leq -20 \text{ }^\circ\text{C}$ (Class 3 according ISO 8573-1, table 2), total concentration of oil $\leq 5 \text{ mg/m}^3$ (Class 4, according ISO 8573-1, table 3); if not differently specified in specific project documentation.

⚠ Do not use the actuator in presence of naked flames.

6.2 Expected Lifetime

Expected lifetime 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 |
| M48 | 5000 | 3688 |
| M64 | 9200 | 6786 |

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
- For lifting purposes, use only suitable lifting tools
- 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
- Every assembly must be estimated 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

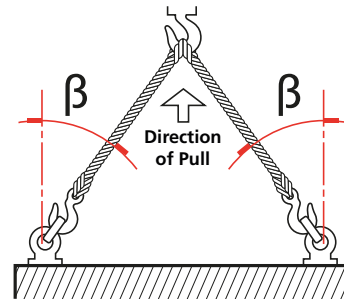
NOTE: Indication of weight, centre of gravity, lifting points are reported within specific project documentation.

For non-horizontal actuator orientation, please consult project specific documentation before lifting.

- Prior to lifting the actuator, remove electrical power and vent all pressure vessels (if present)
- In case of actuator equipped with 2 eye bolts, hook the chains on them both, as shown in Fig 7.1
- In case of actuator equipped with 4 eye bolts, hook the chains on the 4 of them, as shown in Fig 7.2

⚠ The actuator must remain vertical; balance the load.

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



7. Handling and Lifting



Fig 7.1 Lifting LPIS type 0



Fig 7.2 Lifting LPIS type 1 and type 2

8. Storage

Rotork actuators are fully tested before leaving the factory.

To keep actuator in good condition until installation, at least the following measures are recommended:

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

⚠ Never put the actuator directly on the ground.

- Actuator must be positioned with the centre body cover upwards
- Protect the valve coupling area (adapter flange and coupling joint, etc.) 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 six months and verify the above protection measures remain in place

⚠ Remove package only at the installation time.

⚠ Actuator vent ports must be protected with 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 name plate
 - Cycle the actuator with all the existing controls (i.e. two complete strokes – one open, one closed) at least five times
 - Cycle the actuator fitted with the mechanical manual override or hydraulic manual override by means of the override for four complete strokes
 - 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 valve should be properly secured prior to performing the following operations according to instructions provided by the Valve 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 ATEX classification of the actuator is compatible with the plant zoning. Refer to actuator nameplate.

- The centreline of the cylinder is usually perpendicular to the centreline of the associated pipe work
- Ensure all fasteners are adequately tightened, to avoid loosening during operation, considering the vibrations induced by the dynamics of the pipeline
- Piping used to provide power to the actuator must be free from contaminants and debris. Ensure tubing runs are adequately fastened and supported to minimize repetitive stress induced the dynamics of the pipeline. Ensure there are no leaks from any gas connections. Tighten as required

10.2 Instructions

The actuator assembly on valve can be performed using an adapter and a coupling joint between the actuator and the valve.

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

Installation must be performed by qualified personnel.

⚠️ Hands must be kept away from the coupling area.

To assemble the actuator onto the valve, proceed as follows:

- Actuator is supplied in the fail position (for single-acting). Set the valve in the right position per the actuator fail position. Check the position of the actuator by means of the actuator stem position or on the limit switch box (if present)
- The actuator is supplied with the spool piece installed – do not remove it
- Clean the coupling flange of the valve and remove anything that might prevent adherence to the actuator flange. Grease shall be completely removed
- Place the valve in a vertical position

Standard coupling is constituted by the following standard parts (see Fig 10.1):

- Actuator side joint
- Coupling clamp
- Ring
- Screws

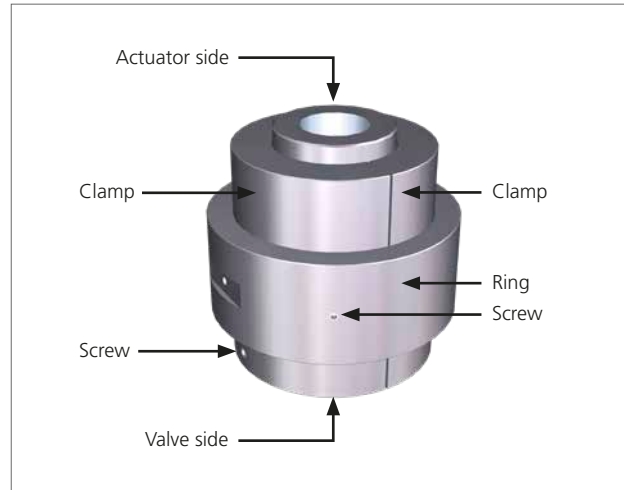


Fig 10.1 Standard coupling parts

- Fasten the actuator side joint on the actuator stem
- Fasten the valve side joint on the valve stem
- Lift the actuator according to instructions in section 7
- Place the ring on the actuator stem holding it with the hand and lower the actuator on the valve – the two joints are now in touch
- Place the two clamps on the joints
- Lower the ring in position and fasten all the screws
- Tighten bolts or nuts between actuator spool piece and valve top flange 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 painting specification

10. Installation on Valve

10.3 Assembly Configurations



Fig 10.2 Actuator/valve assembling example

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 customer service.

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

- Cut off electrical power supply
- Cut off pneumatic supply
- Release any pressure from the control group
- Remove the supply pipes from the actuator
- Remove control and signal lines from electric components (if any)
- Sling the actuator in line with the instructions given in section 7
- Unscrew bolts or 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 end user safety program 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 pipeline gas 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 LP/S series actuators are pneumatic single-acting – spring-return actuators specifically designed to provide efficiency and reliability in heavy duty services.

These actuators can be assembled in a ‘spring down’ (LP/SD) or in a ‘spring up’ (LP/SU).

Model LP/SD is air to retract actuator stem, while spring extend it.

Model LP/SU is air to extend actuator stem, while spring retract it.

Main components of a LP/S actuator are:

- A **pneumatic cylinder**, made of carbon steel.
The cylinder tube is electroless nickel plated internally, to assure perfect dynamic seal, corrosion resistance and low friction. Carbon steel piston with dynamic O-ring seal and guide sliding ring allow for friction reduction which avoid sticking even after long standstill periods.
Chromium plated and polished piston rod ensures a corrosion resistance and low friction. The piston rod is supported by bushing made of bronze and Teflon to reduce friction and to guarantee a long operating life.
The dynamic cylinder seals are specifically designed to enable the use without lubrication.
- A **spring cartridge** consisting of an enclosure containing a frame assembled spring package that prohibits the spring from extending beyond a pre-set length. The container allows safe installation and removal of the whole cartridge assembly.
- An **adapter spool open type** made in carbon steel, with bottom flange machined per the valve flange and it is removable from the actuator. The open adapter allows for easy visual position indication and is suitable for installing a limit switch box, junction box etc.
- A **connecting joint** made of nickel plated carbon steel for mating the actuator piston rod to the valve stem.
An optional coupling with hammer blow effect that facilitates release of wedge gate valves is available upon request.

Upon request, LP series actuators can be equipped with additional accessories (limit switches box, positioner, position transmitter, control panel, etc.)

Use only control devices supplied by Rotork.

 **Installation of any accessory on the bare actuator must preserve the actuator Ingress Protection level.**

12. Operation

12.2 Actuator Code and Design

Below the actuator reading key:

| | | | | | |
|--|----------|---------------|--------------|--------------|------------------|
| ACTUATOR TYPE L = Linear Type | L | P / SD | - 935 | A / M | - C1 - HP |
| SUPPLY TYPE P = Pneumatic | | | | | |
| ACTION SD = Single-Acting Spring Down SU = Single-Acting Spring Up | | | | | |
| CYLINDER SIZE in mm | | | | | |
| TEMPERATURE LP (Pneumatic) A = Standard B = High C = Low E = Extreme Low | | | | | |
| SPRING CODE E, B, D, E, W15, W13, W3, H, L, F, M, G, Y18, W19, W16, W25 | | | | | |
| SIZE M1, M2, A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D2, D3 | | | | | |
| MANUAL OVERRIDE TYPE MH, MHD, HP | | | | | |

The LP/S actuator is available accordingly to 3 designs:

- Type 0
- Type 1
- Type 2

Below the applicability chart per each type, based on the cylinder size and spring code.

| Actuator cylinder size | Spring | Type |
|------------------------|-----------|------|
| 140 | all sizes | 0 |
| 180 | D | 1 |
| | B | 0 |
| 200 | AB | 0 |
| | D | 1 |
| 235 | AB | 0 |
| | DE | 1 |
| | E | 1 |
| | D | 1 |
| | W15 | 1 |
| 250 | W13 | 1 |
| | W3 | 1 |
| | all sizes | 1 |
| 280 | all sizes | 1 |
| 300 | all sizes | 1 |
| 335 | all sizes | 1 |
| 385 | all sizes | 1 |
| 435 | all sizes | 1 |
| 485 | all sizes | 1 |
| 535 | all sizes | 1 |
| 585 | all sizes | 1 |
| 635 | all sizes | 1 |
| 685 | all sizes | 1 |
| 735 | all sizes | 2 |
| 785 | all sizes | 2 |
| 835 | all sizes | 2 |
| 935 | all sizes | 2 |
| 940 | all sizes | 2 |

Description of the 3 designs is as follows.

Actuator LP/S Type 0

Main components of LP/S type 0 actuator are shown in Fig 12.1 and Fig 12.2.

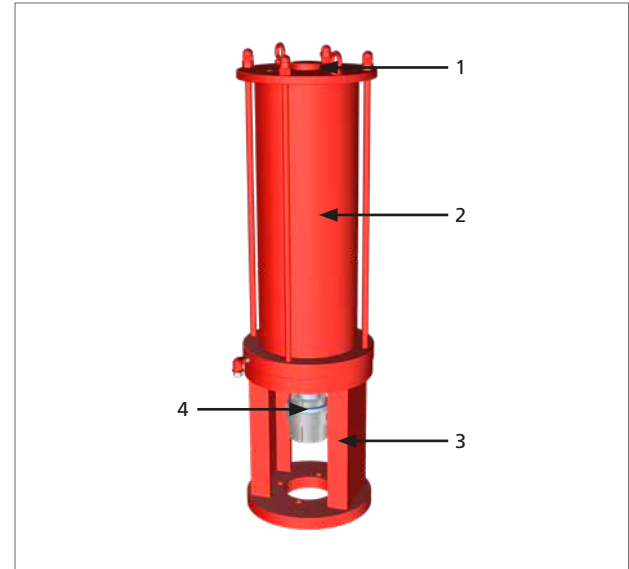


Fig 12.1 LP/S Type 0 without stop bolt main components



Fig 12.2 LP/S type 0 with stop bolt main components

Table 1: LP/S type 0 Parts List

| IT | DESCRIPTION | QTY |
|----|------------------|-----|
| 1 | Plug | 1 |
| 2 | Cylinder tube | 1 |
| 3 | Spool piece | 1 |
| 4 | Valve connection | 1 |
| 5 | Stop bolt | 1 |

12. Operation

Actuator LP/S Type 1 and 2

Main components of LP/S type 1 and type 2 actuator are shown in Fig 12.3, Fig 12.4, Fig 12.5 and Fig 12.6.

Type 1 and type 2 differs in the spring package type installed, but since the latter must not disassembled for safety reasons, from a maintenance point of view can be regarded as identical.

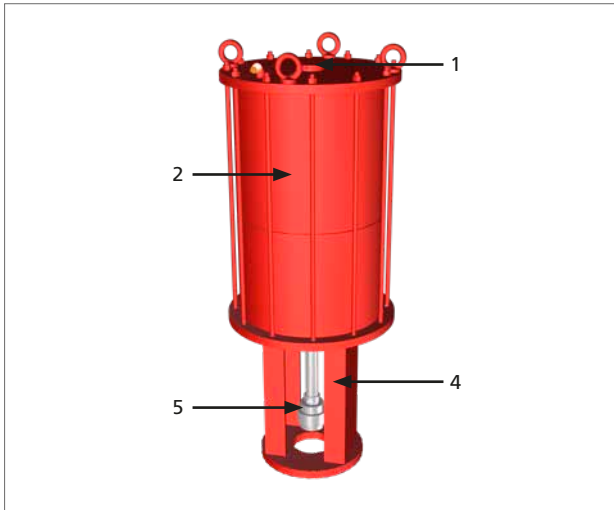


Fig 12.3 LPIS type 1/type 2 without stop bolt main components

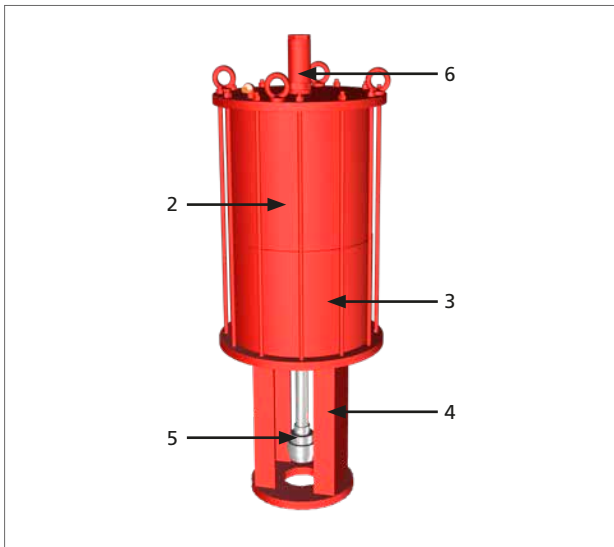


Fig 12.4 LPIS type 1/type 2 with stop bolt main components

Table 2: LPIS type 1/type 2 Parts list

| IT | DESCRIPTION | QTY |
|----|------------------|-----|
| 1 | Plug | 1 |
| 2 | Spring cartridge | 1 |
| 3 | Cylinder tube | 1 |
| 4 | Spool piece | 1 |
| 5 | Valve connection | 1 |
| 6 | Stop bolt | 1 |

12.3 Operating Description

Please refer to the Operating Diagram supplied for the specific actuator.

12.4 Manual Override

The LP series can be fitted with an emergency manual override suitable to operate the actuator in the event of fluid supply failure.

This device can be of mechanical screw type operated by means of a handwheel, or of hydraulic type, with a hydraulic cylinder operated using a hydraulic hand pump.

⚠ A maximum operating time of the manual override of 24 hours, for maintenance or testing, is recommended.

Note: The use of manual override is not recommended in SIL applications. If it is necessary, strictly follow instructions reported in the following paragraphs.

Before operating the mechanical manual override, ensure that the cylinder is not pressurized and that the actuator is in the fail position, then proceed as indicated in the following paragraphs.

Important: It is recommended to regularly clean the "M" jackscrew and grease it afterwards.

Use a Molykote HSC PLUS grease.

⚠ After each use, verify that the manual override has been disengaged before returning to remote operation.

The manual override can be of mechanical type or hydraulic type.

12. Operation

12.5 Mechanical Manual Override Single-Acting Actuator

The mechanical manual override can be of two types:

- Type MH: With a jackscrew with protection pipe
- Type MHD: With a jackscrew with protection pipe and a declutch able handwheel

Type MH mechanical manual override



Fig 12.5 Type MH mechanical override up to actuator cylinder size 200

Type MH mechanical manual override

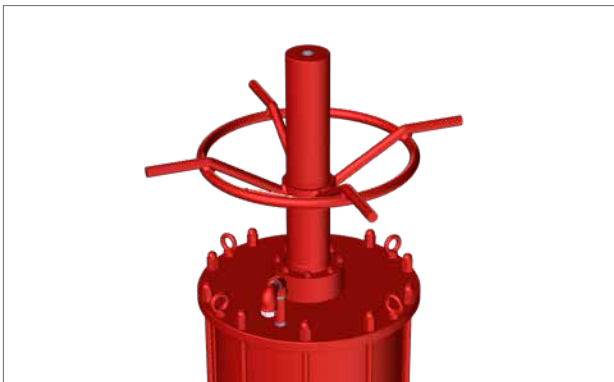


Fig 12.6 Type MH mechanical override up to actuator cylinder size 385

Fail to close, single-acting actuator:

- Rotate the handwheel counter-clockwise to open the valve

Fail to open, single-acting actuator:

- Rotate the handwheel clockwise to close the valve

Instructions to engage or disengage the override are reported on the plate installed on manual override:



Fig 12.7 Type MH manual override plate

⚠ Before re-starting the actuator with air supply, rotate the jackscrew again to set the actuator in its original position.

12. Operation

Type MHD mechanical manual override

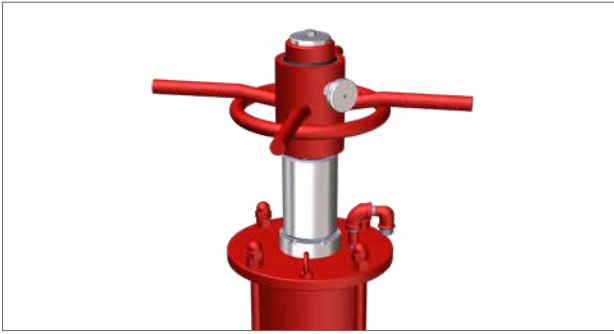


Fig 12.8 Type MHD mechanical override up to actuator cylinder size 200



Fig 12.9 Type MHD mechanical override up to cylinder size 385

- ENGAGE PROCEDURE: Pull disengaging knob and handwheel at the same time; rotate the handwheel until the manual override gets engaged
- DISENGAGE PROCEDURE: Pull disengaging knob and push the handwheel, at the same time

When the manual override is disengaged, the handwheel operation is neutral and the actuator can be operated pneumatically.

Instructions to engage or disengage the override are reported on the plate installed on manual override:

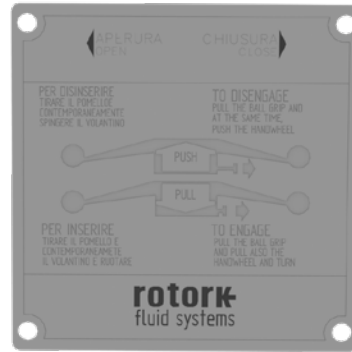


Fig 12.10 Instructions plate for MHD manual override

Fail to close, single-acting actuator:

- Rotate the handwheel counter-clockwise to open the valve

Fail to open, single-acting actuator:

- Rotate the handwheel clockwise to close the valve

⚠ Before re-starting the actuator with air supply, rotate the jackscrew again to set the actuator in its original position.

12. Operation

12.6 Hydraulic Manual Override Single-Acting Actuator

Type HPA hydraulic manual override

The unit consists of two main components:

- the hydraulic cylinder
- the pump/tank assembly

The hand pump (1) supplies high-pressure fluid to the hydraulic cylinder (2) that will stroke the actuator and compress the spring.

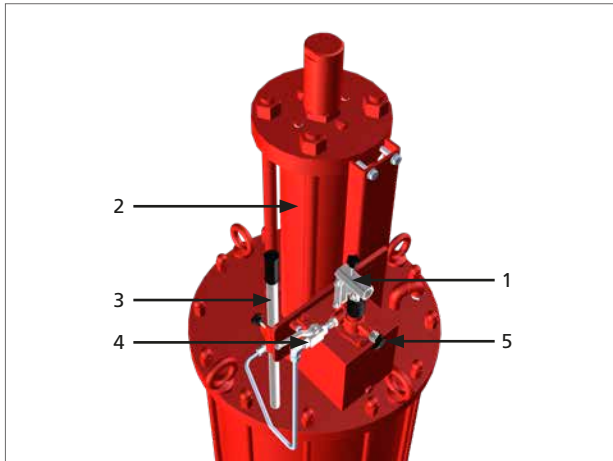


Fig 12.11 Type HPA manual override

Installation

The oil tank must be installed in a vertical position with respect to the floor. The fill port/breather (4) must be turned upward to avoid any oil discharge from the fill port/breather of the tank.

NOTE: Before starting-up the actuator with a hydraulic override, check if the plug (4) has been replaced with a breather to prevent oil discharge from the tank during shipment.

If not, replace the plug with the breather.

Proper oil level is approximately 25 mm (1") below the fill/breather port.

Oil level should be checked with the tank in a vertical position and with the actuator in fail position (spring decompressed).

Filling procedure

If the actuator is shipped without oil in the HPA, please refer to filling procedure described in PM-LP-005.

Operation with Hydraulic Pump

- The manual valve (4) must be in the open position
- Close the on/off selector valve (5) by turning in fully clockwise
- Operate the pump (1) via the handle (3) will stroke the actuator and compress the spring
- When the actuator has reached the desired position of travel, it can be locked in position by closing the manual valve (4)
- To allow the spring to decompress, the manual valve (4) must be moved to the open position and the on/off selector valve (5) backed out by turning anti-clockwise

⚠ After each use, verify that the manual override has been disengaged.

12. Operation

12.7 Linear Stroke Setting

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

Contact the valve manufacturer to set the valve mechanical stops.

⚠️ An incorrect setting of linear stroke could cause damages to actuator, valve and/or to personnel.

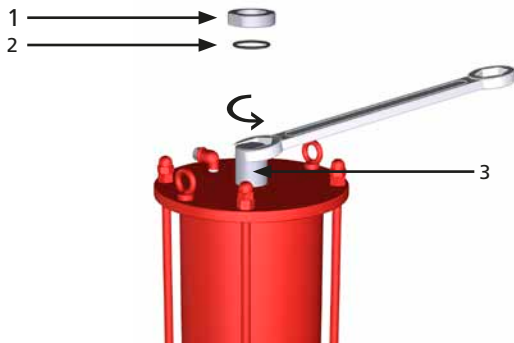
Single-acting actuator type 0, cylinder stop bolt setting

Perform the following operations as first setting.

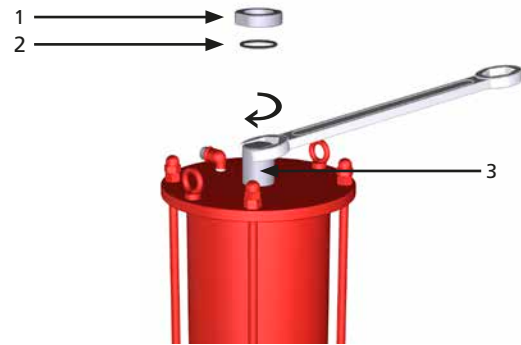
Adjust the stop bolt located in the end flange of the cylinder as follows:



- A. Verify the absence of pressure
- B. Loosen stop nut (1) and remove the O-ring (2)
- C. Slowly pressurize the cylinder to detach stop bolt from piston



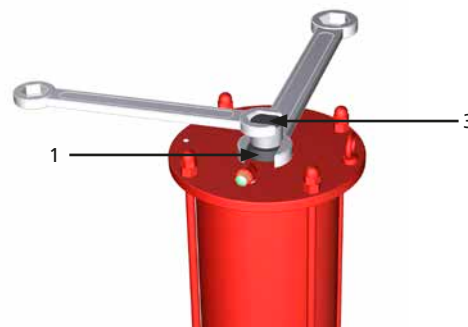
- D. With the help of a suitable size wrench, rotate the stop bolt (3) counter clockwise to increase the stroke
- E. Remove the pressure
- F. Verify the newly obtained position with one stroke
- G. Repeat operations A to F, until the desired stroke is obtained



- H. With the help of a suitable size wrench, rotate the stop bolt (3) clockwise to decrease the stroke
- I. Remove the pressure
- J. Verify the newly obtained position with one stroke
- K. Repeat operations H to J, until the desired stroke is obtained
- L. Re-position the O-ring (2) between flange and the stop nut (1)



- M. Hold the stop bolt (3) with a wrench and carefully tighten the stop nut (1)

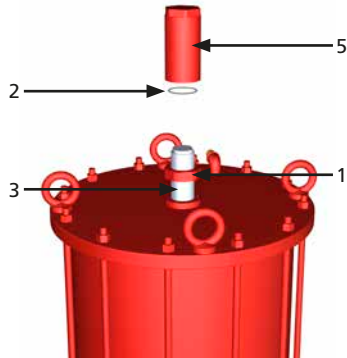


12. Operation

Single-acting actuator, type 1 and type 2, cylinder stop bolt setting

Perform the following operations as first setting.

Adjust the stop bolt located in the end flange of the cylinder as follows:



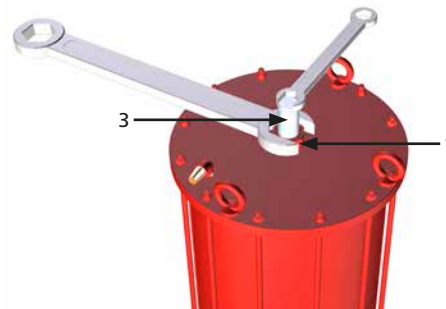
- A. Verify the absence of pressure
- B. Remove cap nut (5) and O-ring (2)
- C. Loosen stop nut (1)
- D. Slowly pressurize the cylinder to detach stop bolt from piston



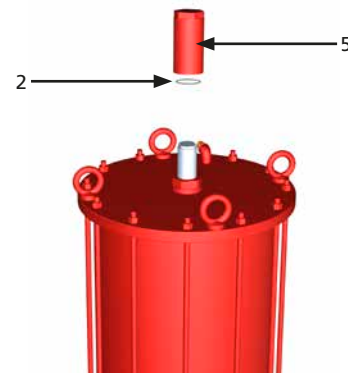
- E. With the help of a suitable size wrench, rotate the stop bolt (3) counter clockwise to increase the stroke
- F. Remove the pressure
- G. Verify the newly obtained position with one stroke
- H. Repeat operations E to G, until the desired stroke is obtained



- I. With the help of a suitable size wrench, rotate the stop bolt (3) clockwise to decrease the stroke
- J. Remove the pressure
- K. Verify the newly obtained position with one stroke
- L. Repeat operations I to L, until the desired stroke is obtained



- M. Hold the stop bolt (3) with a wrench and carefully tighten the stop nut (1)



- N. Re-position the O-ring (2) and verify it is correctly positioned. Tighten cap nut (5)

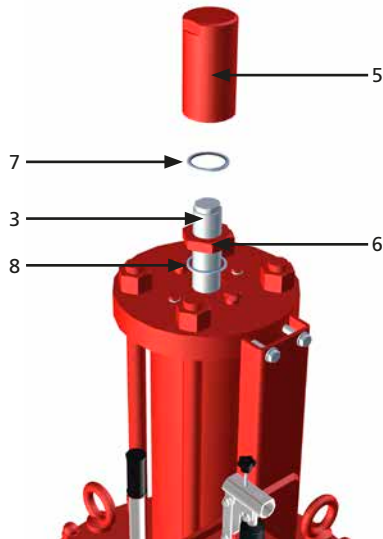
12. Operation

Single acting actuator with HPA type manual override, cylinder stop bolt setting

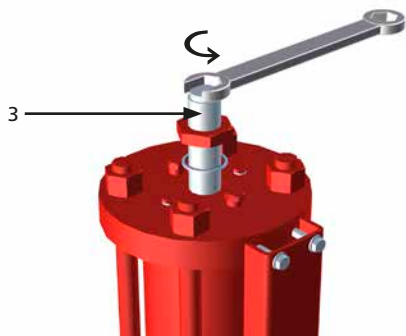
Perform the following operations as first setting.

Adjust the stop bolt located in the end flange of the hydraulic cylinder, as follows:

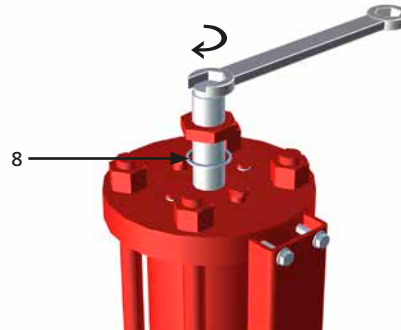
- A. Verify the absence of pressure
- B. Loosen cap nut (5) with relative seal washers (7) and (8) and loosen stop nut (6)



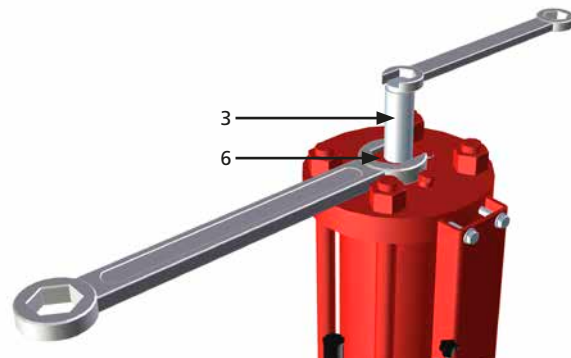
- C. Slowly pressurize the cylinder to detach stop bolt (3) from piston
- D. To increase linear stroke, rotate stop bolt (3) anti-clockwise
- E. Remove pressure
- F. Verify the newly obtained position with one stroke
- G. Repeat operations A to F, until the desired stroke is obtained



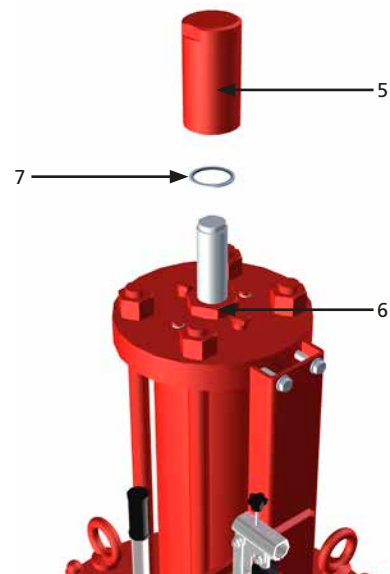
- H. To decrease linear stroke, rotate stop bolt (3) clockwise
- I. Remove pressure
- J. Verify the newly obtained position with one stroke
- K. Repeat operations A to C and H to K, until the desired stroke is obtained



- L. Position seal washer (8)
- M. Hold stop bolt (3) with a wrench and tighten the stop nut (6)



- N. Insert seal washer (7) and verify it is correctly positioned. Hold stop nut (6) with a wrench and tighten cap nut (5)



12. Operation

12.8 Pneumatic Power Supply

Verify allowed supply pressure range on actuator label.

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

12.9 Pneumatic Connections

Preliminary Operations

- Verify sizes of pipes and fittings according to 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 to the applicable operating diagram, please refer to specific job for details.

⚠ Depending upon the control circuit design, pneumatically powered actuators may exhaust the power supply gas into the atmosphere during normal operation. This may present an unacceptable hazard.

⚠ Do not feed a single-acting actuator from the spring container side after having removed the exhaust silencer, especially if the line valve is blocked.

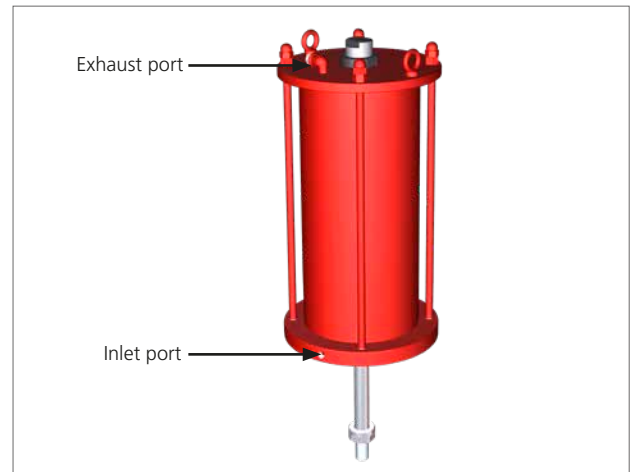


Fig 12.12 Inlet / Exhaust port for spring down actuator

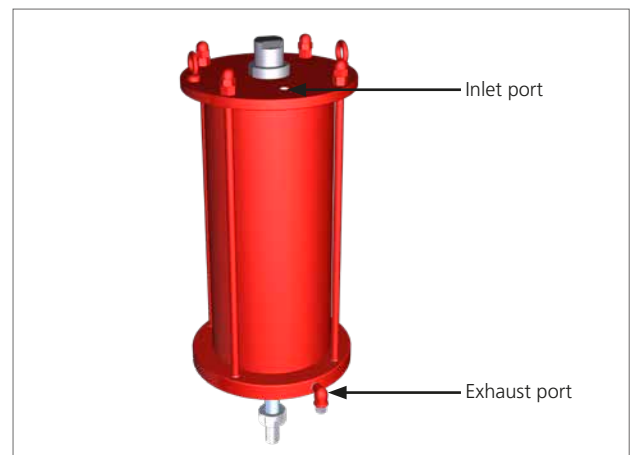





Fig 12.13 Inlet / Exhaust port for spring up actuator

12. Operation

12.10 Electrical Connections


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

 **Access to live electrical conductors is forbidden in hazardous areas unless done under a special permit. Otherwise, all power should be isolated and the unit moved to a non-hazardous area for repair.**

 **Prevent electrostatic charges in potentially explosive areas.**

Electrical connection can be performed as follows:


- Remove power supply
- Remove the plastic protection plugs from the cable entries
- Use only appropriately certified reduction fittings, cable glands, fittings and explosion-proof cables
- The cable glands must be tightened in the threaded inlets, to guarantee the waterproof and explosion proof 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 be suitable for the electrical power required
- Insert the connection cables through 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, to guarantee sealing and 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

 **Actuator and electrical components must be protected from electrical sparks, lightning, magnetic or electro-magnetic fields, at user's care.**

12.11 Start Up

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


- Medium 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. Otherwise remove presence of rust and repair the damaged parts following the applicable painting specifications
- Actuator and all its parties work as expected
- 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. End user shall indicate and maintain the grounding connections on the actuator.**


13. Dismantling and Disposal

Prior to dismantling the actuator, ensure no parts are still under pressure.

For Single-Acting Actuator

 The spring cartridge module contains potential energy due to compressed elastic elements.

After removing the spring cartridge from the centre body, the spring cartridge must be returned to the manufacturer's plant, upon agreement with Rotork.

 Grease and oil must be disposed of safely in accordance with the local environmental laws and regulations.

- Dismount the actuator, separate and divide the various components according to the type of material
- Dispose of the pieces of steel, cast iron and aluminium 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 specialized disposal sites

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 the best service in the world. Contact your local Rotork representative or the factory direct 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 manufacture'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 position (see job specific documentation) |
| 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 |
| | | <ul style="list-style-type: none"> Fault of pipeline valve | <ul style="list-style-type: none"> Consult the valve manufacture'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"> Reassemble the actuator to the valve (section 10) |
| | | <ul style="list-style-type: none"> Valve blocked | <ul style="list-style-type: none"> Consult the valve manufacture's documentation |
| | | <ul style="list-style-type: none"> Stop bolts wrong setting | <ul style="list-style-type: none"> Adjust stop bolt setting according to Linear Stroke Setting instructions (section 12.7) |
| 5 | Leakages | <ul style="list-style-type: none"> Stop bolts wrong setting | <ul style="list-style-type: none"> Adjust stop bolt setting according to Linear Stroke Setting instructions (section 12.7) |
| | | <ul style="list-style-type: none"> Worn seals | <ul style="list-style-type: none"> Replace seals according to instructions reported in PM-LP-006, PM-LP-007 (section 16) |
| 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 manufacture'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 |
| 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 thrust produced at supply pressure exceeds the required valve thrust |
| | | <ul style="list-style-type: none"> Leakage from cylinder | <ul style="list-style-type: none"> Replace seals according to instructions reported in PM-LP-006, PM-LP-007 (section 16) |

For other problems, please contact Rotork.

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* | * | |
| Verify welding. In case of anomalies contact RFS | 6* | * | |
| Breather cleaning | 6* | * | |
| Check pneumatic connections for leaks. Tighten pipe fittings as required | - | 1* | |
| Cleaning | - | 1* | PM-LP-001 |
| Visual check of painting. Verify absence of damages. Repair if necessary according to painting specification | - | 1* | |
| Functional test | - | 1* | PM-LP-002 |
| Functional test by manual override | - | 1* | PM-LP-003 |
| Check electrical components (if present) and grounding connections | - | 1* | PM-LP-004 |
| Check threaded connections (bolts, studs and nuts) with valve. If necessary tighten to the recommended torque, in accordance with the size and the characteristics of the fastener material installed by the customer | | 1* | |
| Single-acting actuator hand pump oil replacement (if present) | - | 5* | PM-LP-005 |
| Pneumatic cylinder seals replacement type 0 | - | 5* | PM-LP-006a |
| Pneumatic cylinder seals replacement type 1 and type 2 | - | 5* | PM-LP-006b |
| Hydraulic cylinder for manual override seals replacement | - | 5* | PM-LP-007 |
| Manual handwheel MH and MHD seals replacement – LP/SD and LP/SU actuator, cylinder up to size 235 | - | 5* | PM-LP-008a |
| Manual handwheel MH and MHD seals replacement – LP/SD and LP/SU actuator, from size 235 to 385 | - | 5* | PM-LP-008b |

(*) 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 frequency.



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-LP-001 | | Page: 1/1 |
|---|---|-----------|
| Component: Single-acting actuator | Task: Cleaning | |
| Equipment, Tools, Materials: Air Compressor Project documentation (Design and Operating pressure values) | Warnings:  | |
| Preliminary Operations: | | |
| Description:  Remove electric and pneumatic supply before proceeding. 1. Remove dust from actuator external surface with a dust rag and 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-LP-002 | | Page: 1/1 |
|---|--|-----------|
| Component: Single-acting 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 the stroke several times by local and remote (if applicable) control <p> Actuator could exhaust medium supply in the atmosphere during normal operation. Wear PPD including breathing device in function of type of medium supply used.</p> <ol style="list-style-type: none">3. Verify actuator is correctly working4. Note the stroke time(s)5. Verify stroke time(s) are as required <p>In case of stroke times out of required range refer to Troubleshooting ID 4, 5 (section 15) to restore.</p> | | |



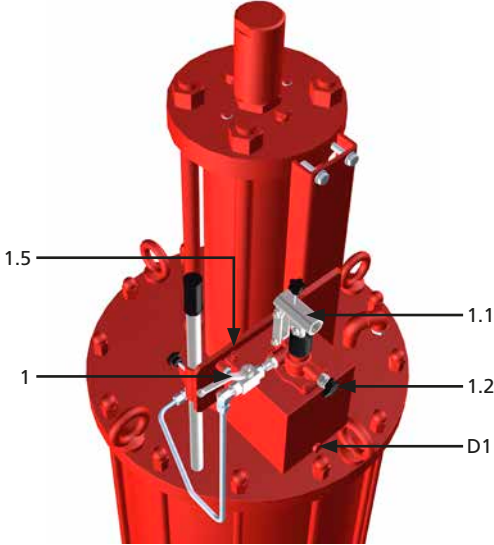
16. Periodic Maintenance

| PM-LP-003 | | Page: 1/1 |
|--|--|-----------|
| Component: Mechanical manual override | Task: Manual override functional test | |
| Equipment, Tools, Materials: Project documentation | Warnings:  | |
| Preliminary Operations: | | |
| Description: | | |
| Opening operation | | |
| <ol style="list-style-type: none">1. Verify the absence of pressure2. Verify the actuator is in its fail position, spring relaxed (for single-acting actuator)3. Move the mechanical manual override according to instructions reported in Manual Override (section 12.4) to stroke the actuator4. Verify the actuator reaches the desired position | | |
|  Before re-starting the actuator with air supply, disengage the manual override to set the actuator in its original position. After each use, verify that the manual override has been disengaged before returning to remote operation. | | |



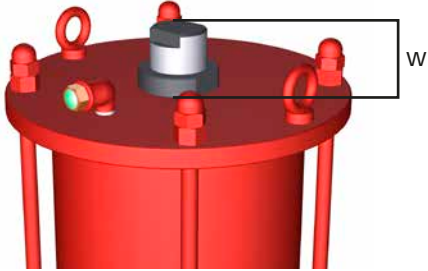

16. Periodic Maintenance

| | | PM-LP-004 | Page: 1/1 |
|---|--|-----------|-----------|
| Component: Electrical components (if present) | Task: Check electrical components (if present) and grounding connections | | |
| Equipment, Tools, Materials: Project documentation | Warnings:  | | |
| Preliminary Operations: | | | |
| Description: | | | |
| <p> Switch off electric power supply before working on electrical devices. Read and follow the safety precautions reported in the Manufacturer's Maintenance Manual. Risk of temporary modification of the component protection.</p> <p>Use only antistatic clothes.</p> <ol style="list-style-type: none"> 1. Remove cover from electric components 2. Check electric device components 3. Verify tightness of terminal blocks 4. Verify absence of humidity and oxidation 5. Check cable gland seals 6. Verify grounding connection and restore if necessary | | | |


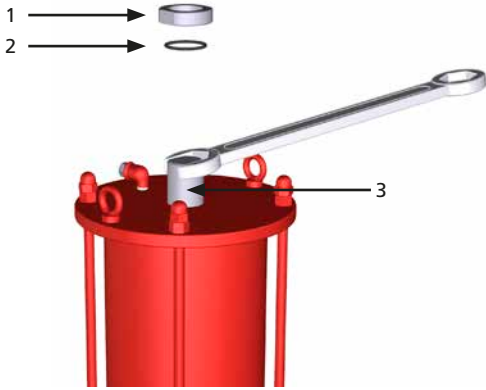
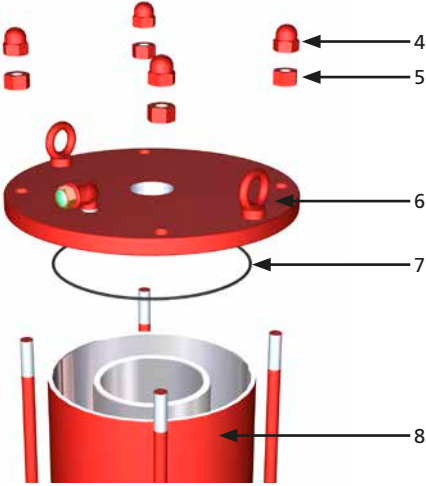
16. Periodic Maintenance

| PM-LP-005 | | Page: 1/1 |
|---|--|-----------|
| Component: Hydraulic manual override for single-acting actuator | Task: Hydraulic oil replacement | |
| Equipment, Tools, Materials: Project documentation Wrench | Warnings:  | |
| Preliminary Operations: | | |
| Description: Tasks must be executed with the tank in vertical position and with the actuator in fail position. Verify the absence of pneumatic pressure. Correct oil level is approximately 25 mm (1") below the fill/breather port. | | |
| Drain procedure | | |
| <ol style="list-style-type: none"> 1. Make sure the actuator is in fail safe position (spring released) 2. Remove breather/plug (1.5) 3. Place containers under drain port (D1) to collect the fluid 4. Remove plugs (D1) 5. Discharge oil 6. Tighten plug (D1) back in its seat with a wrench <p> Used hydraulic fluid must be disposed of safely.</p> |  | |
| Filling procedure | | |
| <ol style="list-style-type: none"> 7. Fill with oil from the fill /breather port (1.5) up to 25 mm (1") below the port 8. Close stop valve (1.2) and verify that stop valve (3) is open 9. Install the pump lever and operate pump (1.1) to fully compress the spring 10. Ensure the oil level in the tank does not drop below the intake tube 11. Slowly open stop valve (1.2) to allow the actuator the return to the fail position 12. Repeat the pump operation procedure from 2 to 3 times 13. Pressurize and keep the cylinder pressurized from 3 to 5 minutes, to settle the oil level 14. Slowly open stop valve (1.2) to allow the actuator the return to the fail position 15. Check the oil level. If necessary, fill in from the fill /breather port (1.5) up to 25 mm (1") below the port <p>Important: Do not exceed this fluid level.</p> <ol style="list-style-type: none"> 17. Reinstall the tank breather (1.5) and return the lever to the storage holder | | |



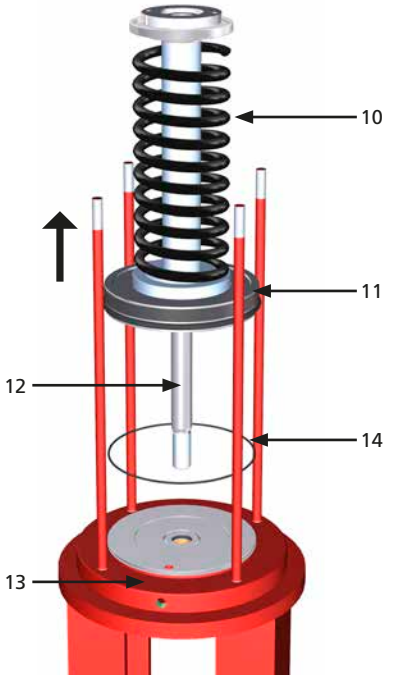
16. Periodic Maintenance

| | | PM-LP-006a | Page: 1/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting clump Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| Description: Note: the following instructions apply to single-acting actuator unless otherwise specified.  Cut-off power supply and electric power supply (if present) before performing any operation. Adequate lifting devices and suitable for the weight must be applied by skilled personnel. Preliminary actions <ol style="list-style-type: none"> 1. Remove actuator from valve and remove all couplings as well (section 11) 2. Position the actuator on a workbench (if possible) or in a stable position and in a clean and closed area 3. Remove any control equipment (if present). Refer to the project specific documentation 4. Remove pneumatic pipes | | | |
| APPLICABLE TO TYPE 0 WITH STOP BOLT ONLY (5) 5. Measure length (W) | |  | |
| 6. Hold stop bolt (3) with a wrench and loosen and remove stop nut (1) | |  | |


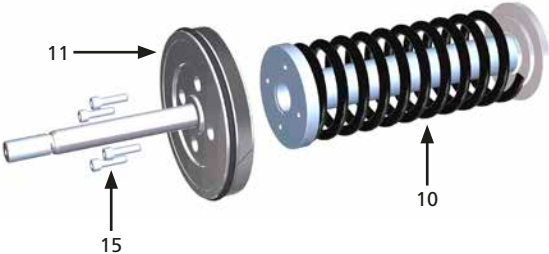
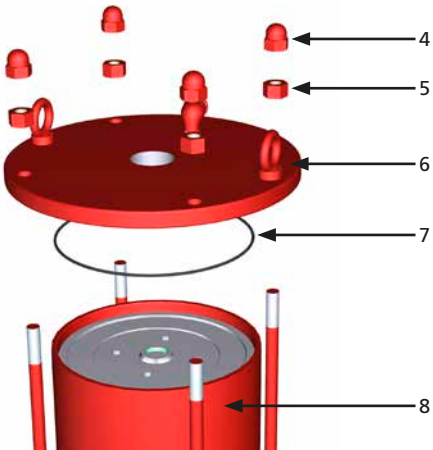
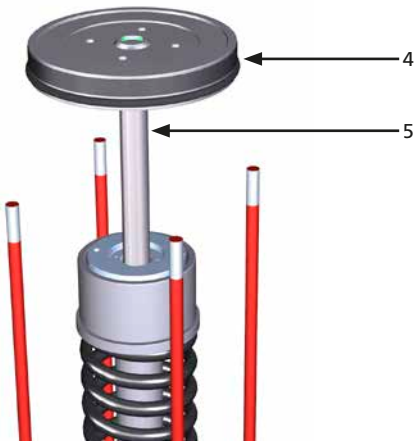
16. Periodic Maintenance

| PM-LP-006a | | Page: 2/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>7. Remove O-ring (2) 8. Fully unscrew stop bolt (1)</p> <p>If the stop bolt is hard to unscrew, pressurise the cylinder and unscrew stop bolt by 3-4 turns.</p> <p>Depressurize the cylinder; check if the stop bolt turns freely. If necessary, repeat the operation.</p> <p>⚠ Do not unscrew the stop bolt completely while the cylinder is pressurized.</p> |  | |
| <p>INSTRUCTION VALID FOR SPRING DOWN ONLY</p> <p>9. Unscrew blind nuts (4) and nuts (5) 10. Remove end flange (6) with O-ring (7) 11. Remove cylinder tube (8) using suitable lifting tools</p> <p>⚠ If, during the nuts (4) unfastening the end flange (6) suffers a continuous load upwards along with nuts (4), stop and fasten back the nuts (4). Contact Rotork Service Department.</p> <p>At the beginning of the nuts (4) unfastening the flange (6) will be pushed upwards by the pre-compressed spring load. If the upwards load continues till the nuts (4) are almost fully unfastened, stop and fasten them back. Contact Rotork Service Department.</p> |  | |


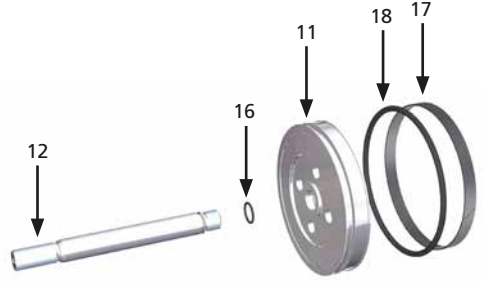
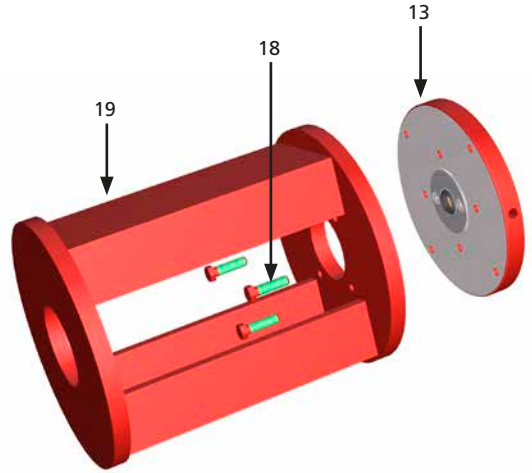
16. Periodic Maintenance

| | | PM-LP-006a | Page: 3/10 |
|---|--|---|------------|
| Component: Single-acting actuator | | Task: LP type O pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 12. Remove spacer (9) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 13. Slide spring cartridge (10) piston (11) and piston rod (12) away from head flange (13) 14. Remove O-ring (14) | |  | |


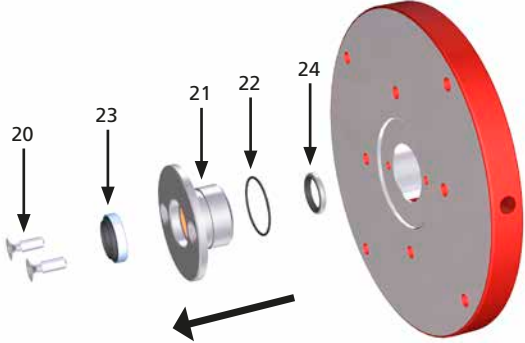
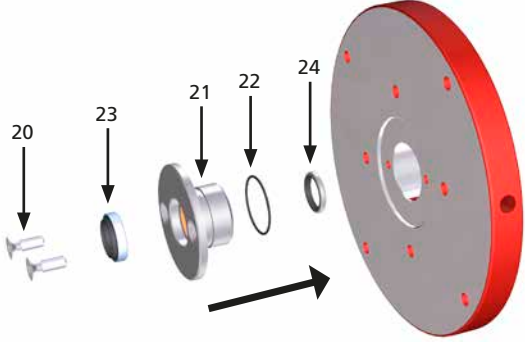
16. Periodic Maintenance

| PM-LP-006a | | Page: 4/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 15. Unfasten screws (15) and remove spring cartridge away from piston (11) |  | |
| INSTRUCTION VALID FOR SPRING UP ONLY 16. Unscrew blind nuts (4) and nuts (5) 17. Remove end flange (6) with O-ring (7) 18. Remove cylinder tube (8) using suitable lifting tools |  | |
| INSTRUCTION VALID FOR SPRING UP ONLY 19. Slide piston (11) and piston rod (12) |  | |


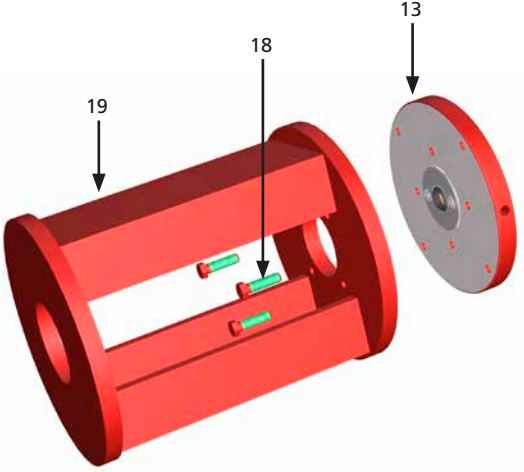

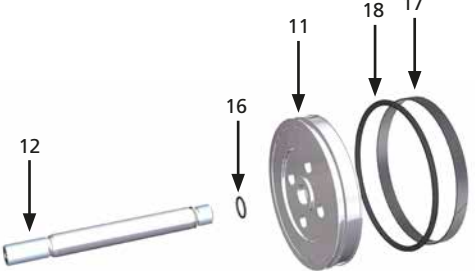
16. Periodic Maintenance

| PM-LP-006a | | Page: 5/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 20. Hold piston (11) and unscrew piston rod (12) 21. Remove sliding ring (17) and O-ring (18) from the piston 22. Remove O-ring (16) |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 23. Unfasten screws (18) and remove head flange (13) from the valve adaption (19) |  | |


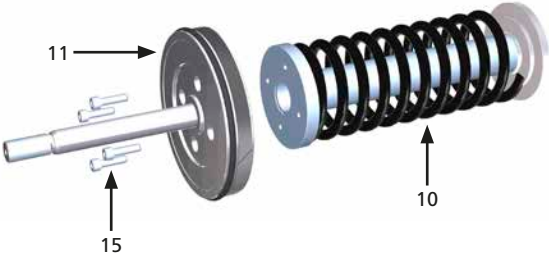
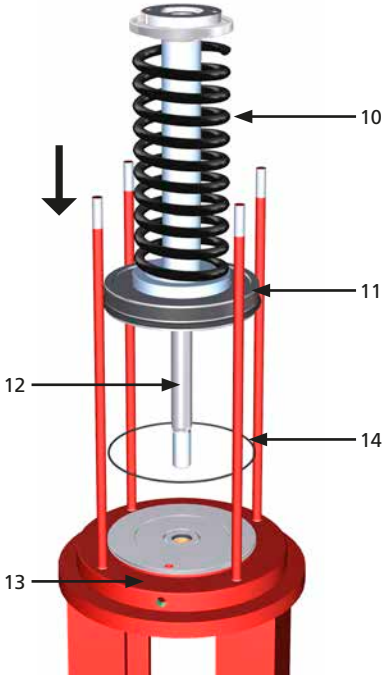
16. Periodic Maintenance

| PM-LP-006a | | Page: 6/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP | | |
| <ul style="list-style-type: none"> 24. Unfasten screws (20) and remove flange (21) 25. Remove O-ring (22) and seals (23) and (24) |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP | | |
| <ul style="list-style-type: none"> 26. Carefully clean the seals grooves 27. All the removed parts must be thoroughly cleaned, inspected and de-burred as necessary 28. Replace all seals and lubricate them with a grease film 29. Lubricate all sliding parts. Use only recommended grease | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP | | |
| <ul style="list-style-type: none"> 30. Replace O-ring (22) and seals (23) and (24) 31. Replace flange (21) and fasten screws (20) |  | |



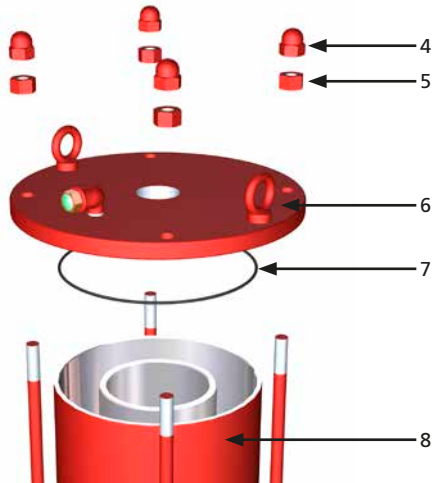
16. Periodic Maintenance

| PM-LP-006a | | Page: 7/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 32. Position head flange (13) on valve adaption (19) and fasten screws (18) |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 33. Replace O-ring (16) into the piston (11) 34. Hold piston (11) and screw piston rod (12) 35. Replace sliding ring (17) and O-ring (18) from the piston  When holding the piston, make sure the piston is not scratched or deformed. |  | |



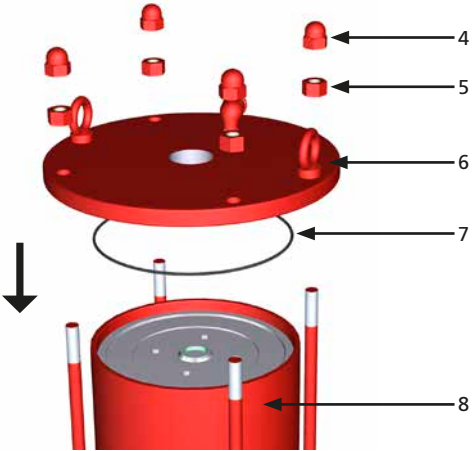
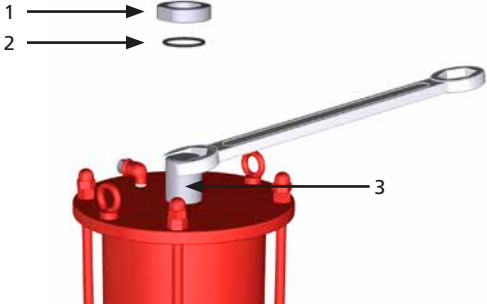
16. Periodic Maintenance

| PM-LP-006a | | Page: 8/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 36. Re-install spring cartridge on piston (11) and fasten screws (15) |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 37. Replace O-ring (14) 38. Slide spring cartridge (10) piston (11) and piston rod (12) on head flange (13) |  | |



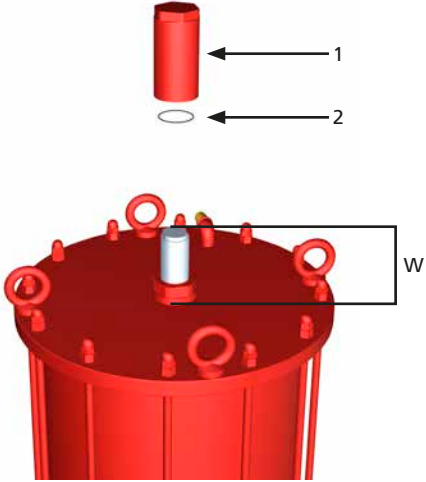

16. Periodic Maintenance

| | | PM-LP-006a | Page: 9/10 |
|---|--|---|------------|
| Component: Single-acting actuator | | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 39. Replace spacer (9) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 36. Replace cylinder tube (8) using suitable lifting tools 37. Replace end flange (6) with O-ring (7) 38. Fasten blind nuts (4) and nuts (5) | |  | |


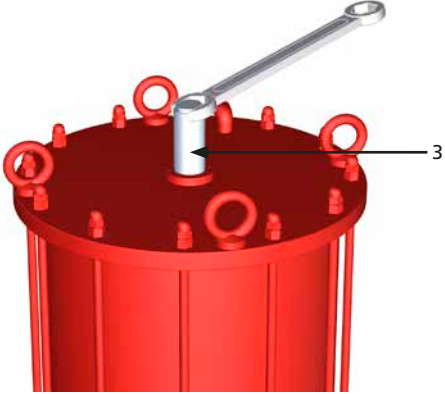
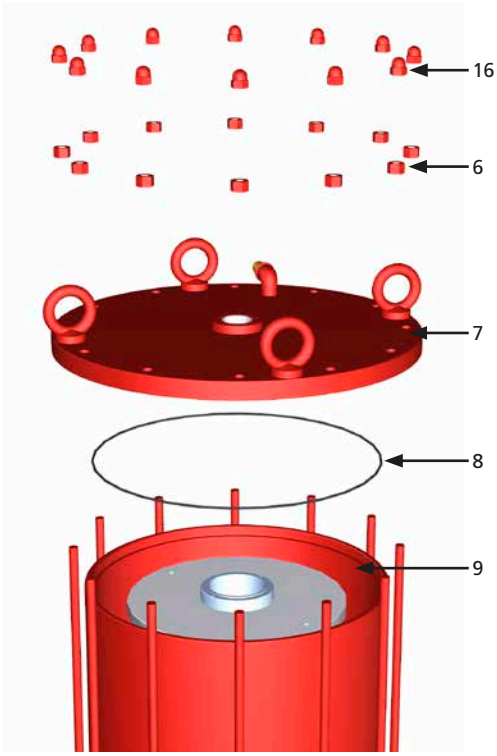
16. Periodic Maintenance

| PM-LP-006a | | Page: 10/10 |
|---|---|-------------|
| Component: Single-acting actuator | Task: LP type 0 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR SPRING UP ONLY 40. Slide piston (11) and piston rod (12) |  | |
| INSTRUCTION VALID FOR SPRING UP ONLY 41. Replace cylinder tube (8) using suitable lifting tools 42. Replace end flange (6) with O-ring (7) 43. Fasten blind nuts (4) and nuts (5) |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 44. With the help of a wrench, screw the stop bolt (3) into the cylinder flange until length W is achieved 45. Insert the O-ring (2) and, holding the stop bolt (3) with a wrench, tighten the stop nut (1) Refer to Linear Stroke Setting instructions (section 12.7) to adjust the stop bolt position. |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 46. Assemble the control panel, if any, on the central body 47. The actuator must be tested before it is assembled on the valve 48. Place the actuator in a stable position, e.g. on a workbench 49. Connect the pneumatic supply to the actuator and cycle the actuator several times, verify smooth functioning and absence of leakages 50. Check painted parts, if necessary repaint them in accordance with the applicable painting specifications 51. The actuator is now ready to be assembled on the valve | | |


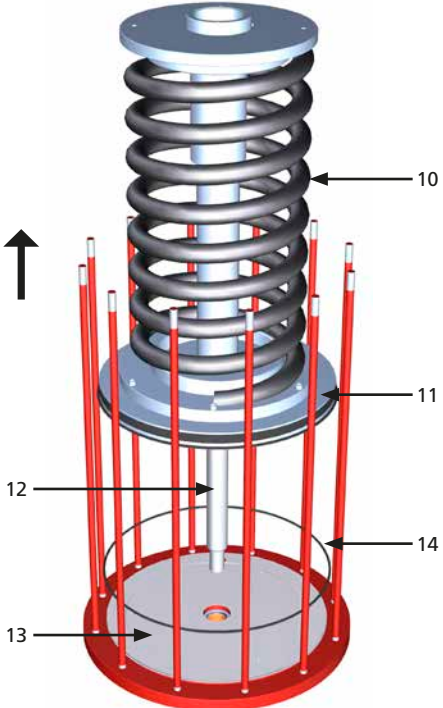
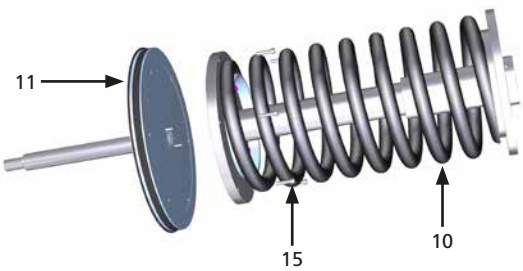
16. Periodic Maintenance

| | | PM-LP-006b | Page: 1/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting clump Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| Description: Note: the following instructions apply to single-acting actuator unless otherwise specified.  Cut-off power supply and electric power supply (if present) before performing any operation. Adequate lifting devices and suitable for the weight must be applied by skilled personnel. Preliminary actions <ol style="list-style-type: none"> 1. Remove actuator from valve and remove all couplings as well (section 11) 2. Position the actuator on a workbench (if possible) or in a stable position and in a clean and closed area 3. Remove any control equipment (if present). Refer to the project specific documentation 4. Remove pneumatic pipes | | | |
| APPLICABLE TO TYPE 0 WITH STOP BOLT ONLY (5) <ol style="list-style-type: none"> 5. Remove cap nut (1) and O-ring (2) 6. Measure length (W) | |  | |
| <ol style="list-style-type: none"> 7. Hold stop bolt (3) with a wrench and loosen and remove stop nut (4) 8. Remove O-ring (5) | |  | |

16. Periodic Maintenance

| PM-LP-006b | | Page: 2/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>9. Fully unscrew stop bolt (3)</p> <p>If the stop bolt is hard to unscrew, pressurise the cylinder and unscrew stop bolt by 3-4 turns.</p> <p>Depressurize the cylinder; check if the stop bolt turns freely. If necessary, repeat the operation.</p> <p>⚠ Do not unscrew the stop bolt completely while the cylinder is pressurized.</p> |  | |
| <p>INSTRUCTION VALID FOR SPRING DOWN ONLY</p> <p>10. Unscrew blind nuts (16) and nuts (6)</p> <p>11. Remove end flange (7) with O-ring (8)</p> <p>12. Remove cylinder tube (9) using suitable lifting tools</p> <p>⚠ If as soon as you start unfastening nuts (6) the end flange (7) suffers a load upwards along with nuts (6), stop and fasten back the nuts (6). Contact Rotork Service Department.</p> |  | |

16. Periodic Maintenance

| | | PM-LP-006b | Page: 3/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 13. Slide spring cartridge (10) piston (11) and piston rod (12) away from head flange (13) 14. Remove O-ring (14) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 15. <i>Actuator type 1</i> – Unfasten screws (15) and remove spring cartridge away from piston (11) 16. <i>Actuator type 2</i> – Remove spring cartridge away from piston (11) | |  | |

16. Periodic Maintenance

PM-LP-006b

Page: 4/10

Component: Single-acting actuator

Task: LP type 1 and type 2 pneumatic cylinder seals replacement

Equipment, Tools, Materials:

Spare seals
Wrench
Lifting tools
Project documentation

Warnings:

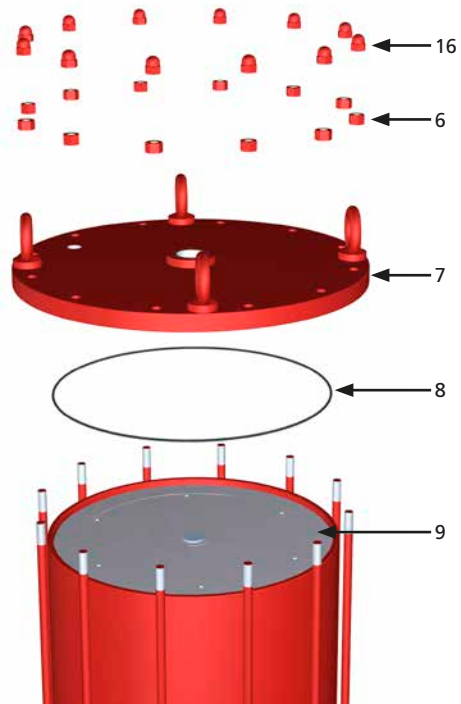


Preliminary Operations: Removal from Valve

INSTRUCTION VALID FOR SPRING UP ONLY

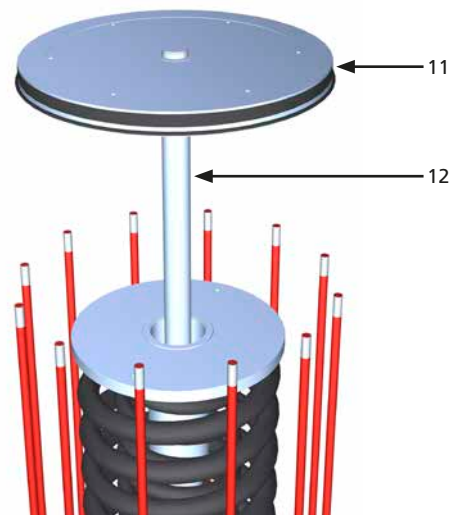
17. Unscrew blind nuts (16) and nuts (6)
18. Remove end flange (7) with O-ring (8)
19. Remove cylinder tube (9) using suitable lifting tools

⚠ If as soon as you start unfastening nuts (6) the end flange (7) suffers a load upwards along with nuts (6), stop and fasten back the nuts (6). Contact Rotork Service Department.



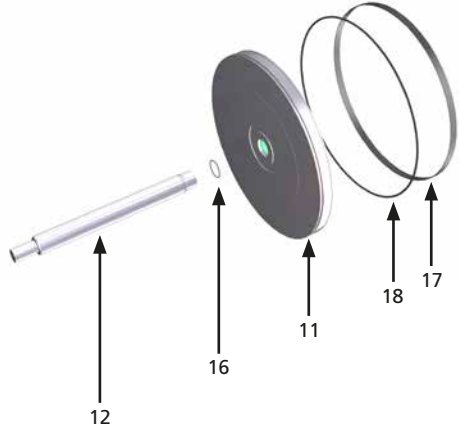
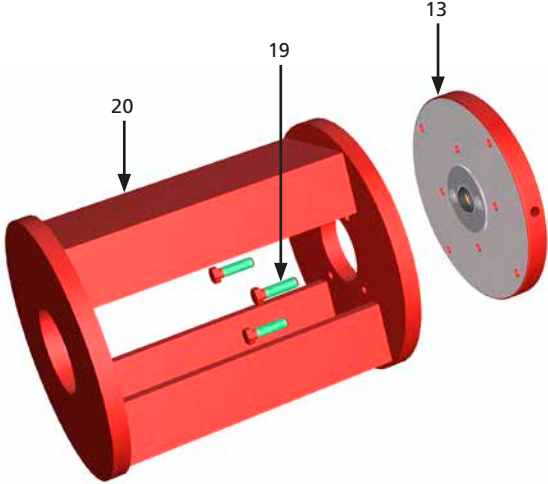


INSTRUCTION VALID FOR SPRING UP ONLY


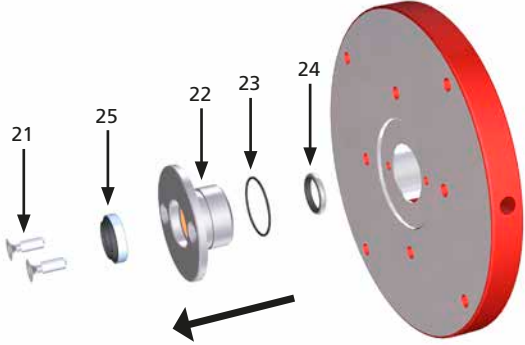
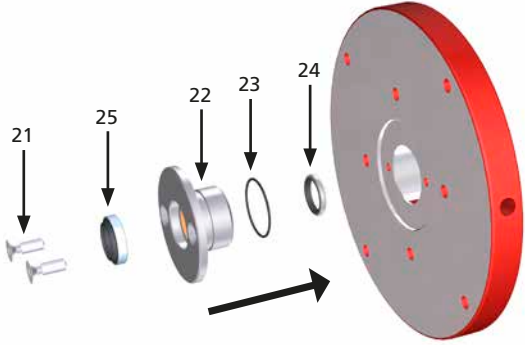
20. Slide piston (11) and piston rod (12)




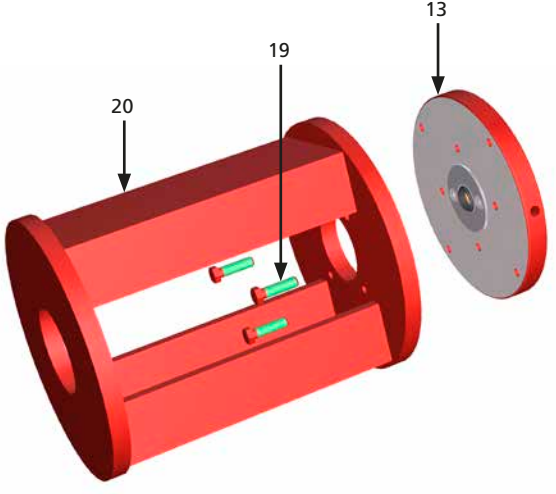

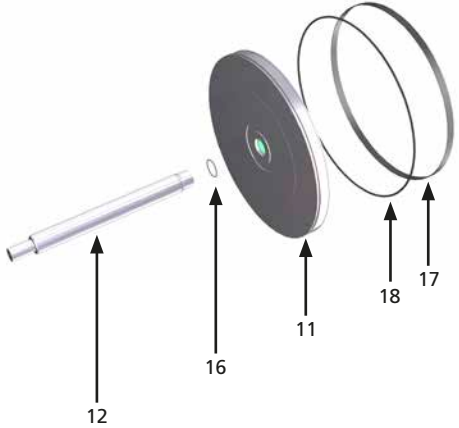
16. Periodic Maintenance

| PM-LP-006b | | Page: 5/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 21. Hold piston (11) and unscrew piston rod (12) 22. Remove sliding ring (17) and O-ring (18) from the piston 23. Remove O-ring (16)  When holding the piston, make sure the piston is not scratched or deformed. |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 24. Unfasten screws (19) and remove head flange (13) from the valve adaption (20) |  | |


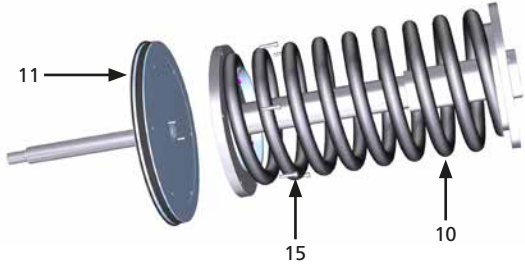
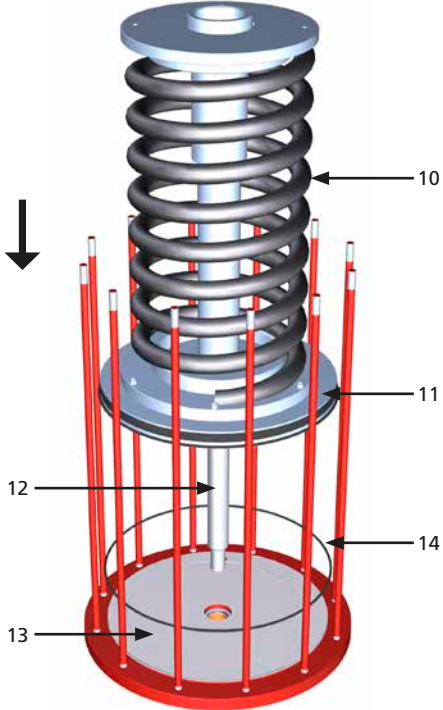
16. Periodic Maintenance

| PM-LP-006b | | Page: 6/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 25. Unfasten screws (21) and remove flange (22) 26. Remove O-ring (23) and seals (24) and (25) |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 27. Carefully clean the seals grooves 28. All the removed parts must be thoroughly cleaned, inspected and de-burred as necessary 29. Replace all seals and lubricate them with a grease film 30. Lubricate all sliding parts. Use only recommended grease | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 31. Replace O-ring (23) and seals (24) and (25) 32. Replace flange (22) and fasten screws (21) |  | |


16. Periodic Maintenance

| PM-LP-006b | | Page: 7/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 33. Position head flange (13) on valve adaption (20) and fasten screws (19) |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP 34. Replace O-ring (16) into the piston (11) 35. Hold piston (11) and screw piston rod (12) 36. Replace sliding ring (17) and O-ring (18) from the piston  When holding the piston, make sure the piston is not scratched or deformed. |  | |


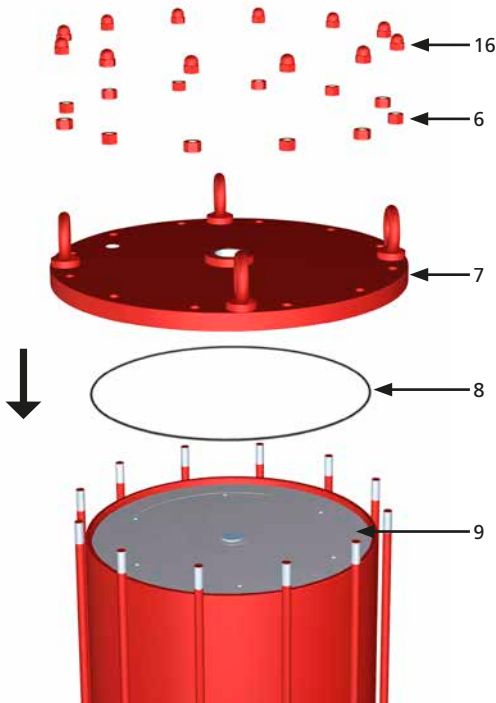
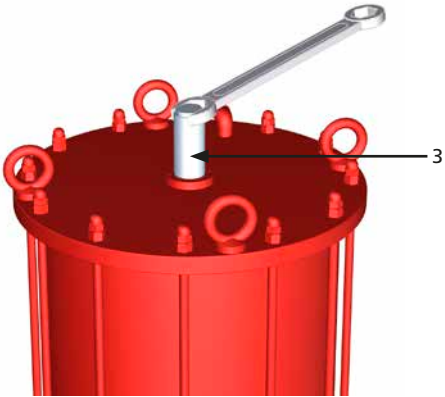
16. Periodic Maintenance

| PM-LP-006b | | Page: 8/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 37. <i>Actuator type 1</i> – Re-install spring cartridge (10) on piston (11) and fasten screws (15) |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 38. Replace O-ring (14) on head flange (13) 39. Slide spring cartridge (10) piston (11) and piston rod (12) on head flange (13) |  | |




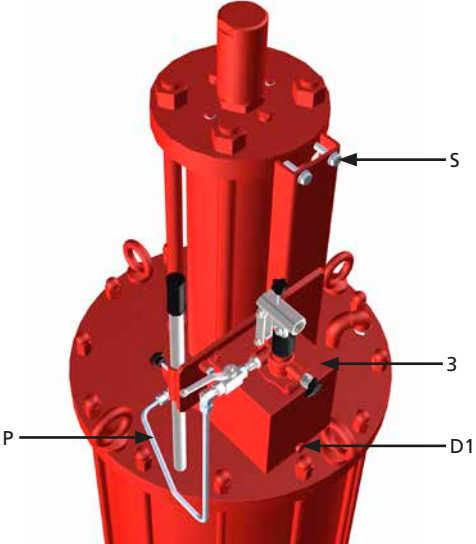
16. Periodic Maintenance

| | | PM-LP-006b | Page: 9/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 39. Replace cylinder tube (9) using suitable lifting tools 40. Replace end flange (7) with O-ring (8) 41. Fasten nuts (6) and blind nuts (16) | | | |
| INSTRUCTION VALID FOR SPRING UP ONLY 40. Slide piston (11) and piston rod (12) | | | |


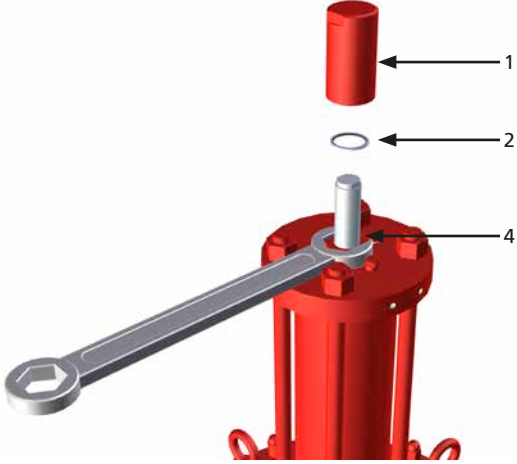
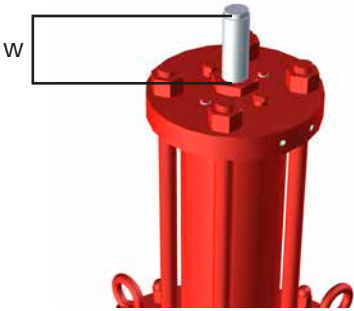

16. Periodic Maintenance

| PM-LP-006b | | Page: 10/10 |
|---|---|-------------|
| Component: Single-acting actuator | Task: LP type 1 and type 2 pneumatic cylinder seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR SPRING UP ONLY</p> <ol style="list-style-type: none"> 41. Replace cylinder tube (9) using suitable lifting tools 42. Replace end flange (7) with O-ring (8) 43. Fasten nuts (6) and blind nuts (16) |  | |
| <p>INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP</p> <ol style="list-style-type: none"> 44. With the help of a wrench, screw the stop bolt (3) into the cylinder flange until length W is achieved 45. Insert the O-ring (2) and, holding the stop bolt (3) with a wrench, tighten the stop nut (1) <p>Refer to Linear Stroke Setting instructions (section 12.7) to adjust the stop bolt position.</p> |  | |
| <p>INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP</p> <ol style="list-style-type: none"> 46. Assemble the control panel, if any, on the central body 47. The actuator must be tested before it is assembled on the valve 48. Place the actuator in a stable position, e.g. on a workbench 49. Connect the pneumatic supply to the actuator and cycle the actuator several times, verify smooth functioning and absence of leakages 50. Check painted parts, if necessary repaint them in accordance with the applicable painting specifications 51. The actuator is now ready to be assembled on the valve | | |


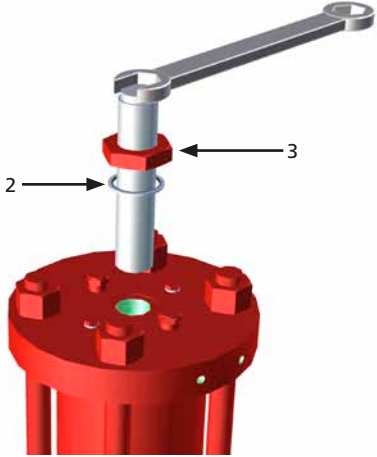
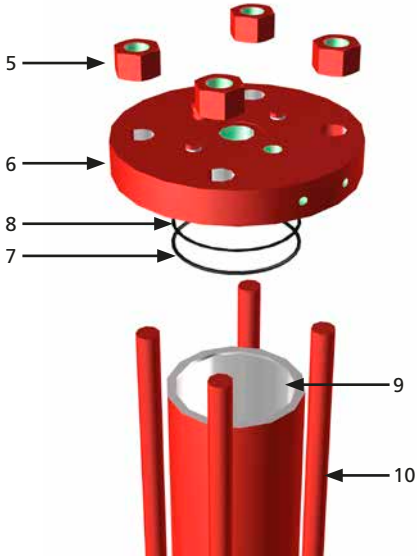
16. Periodic Maintenance

| | | PM-LP-007 | Page: 1/10 |
|--|---|---|------------|
| Component: Single-acting actuator | | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| Description: Note: the following instructions apply to single-acting actuator unless otherwise specified.  Cut-off power supply and electric power supply (if present) before performing any operation. | | | |
| Preliminary actions <ol style="list-style-type: none"> 1. Verify Actuator is in the fail position (single acting) and not pressurized. 2. Remove actuator from valve (section 11) 3. Position the actuator on a workbench (if possible) or in a stable position and in a clean and closed area 4. Remove any control equipment (if present). Refer to the project specific documentation 5. Remove pipes | | | |
| <ol style="list-style-type: none"> 6. Remove plug (D1) 7. Discharge oil 8. Tighten plug (D1) back in its seat with a wrench 9. Remove hydraulic pipe (P) 10. Unscrew bolts (S) and remove hydraulic pump assembly (3)  Used hydraulic fluid must be disposed of safely. |  | | |


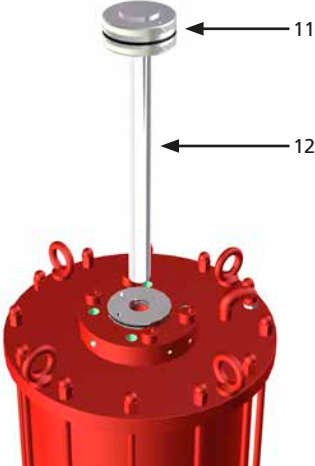


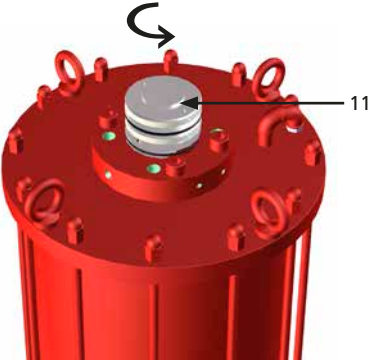
16. Periodic Maintenance

| PM-LP-007 | | Page: 2/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| 11. Hold stop nut (4) with a wrench, unscrew and remove cap nut (1) with seal washer (2) |  | |
| 12. Measure length (W) |  | |
| 13. Loosen the stop nut (4) |  | |


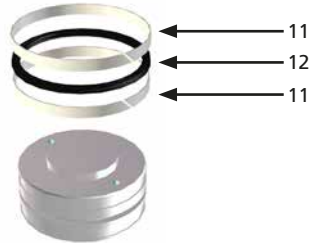
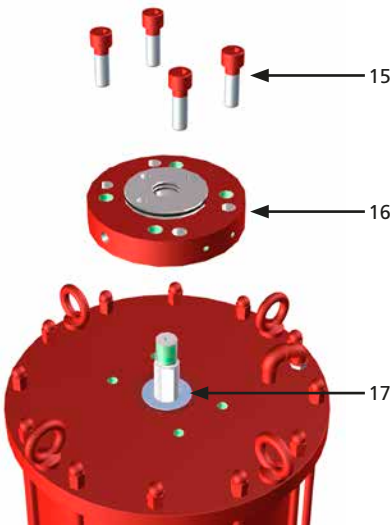
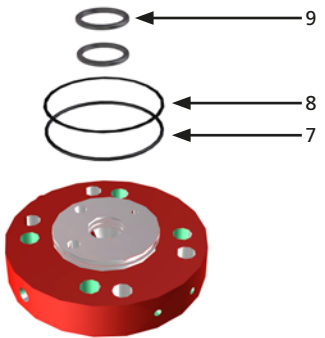
16. Periodic Maintenance

| | | PM-LP-007 | Page: 3/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| 14. Fully unscrew stop bolt (3) and remove seal washer (2) 15. Sustain the hydraulic cylinder adequately | |  | |
| INSTRUCTION VALID FOR SPRING DOWN AND SPRING UP 16. Remove bolts (5) 17. Remove flange (6), O-ring (7) and anti-extrusion ring (8) 18. Remove hydraulic cylinder (9) and tie rods (10) | |  | |



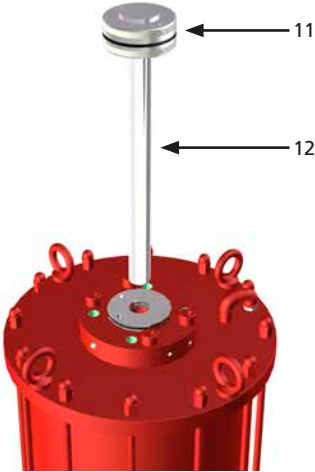
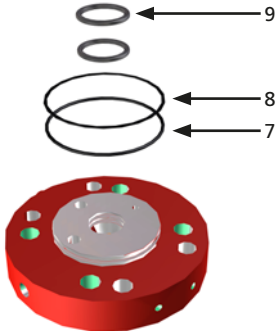
16. Periodic Maintenance

| PM-LP-007 | | Page: 4/10 |
|--|---|------------|
| Component: Single-acting actuator | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR SPRING UP ONLY</p> <p>19. Remove piston (11) and piston rod (12) assembly</p> |  | |
| <p>INSTRUCTION VALID FOR SPRING UP ONLY</p> <p>20. Remove sliding rings (13) and O-ring (14)</p> |  | |
| <p>INSTRUCTION VALID FOR SPRING DOWN ONLY</p> <p>21. Unfasten the piston (11) with a pin spanner wrench</p>  |  | |


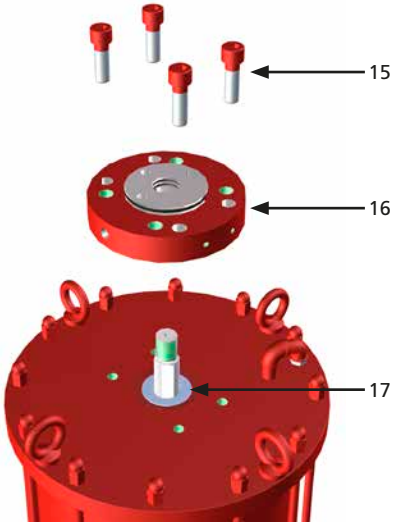
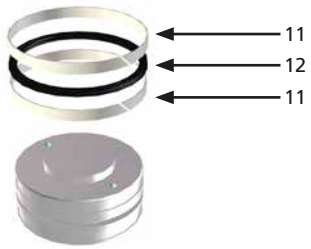

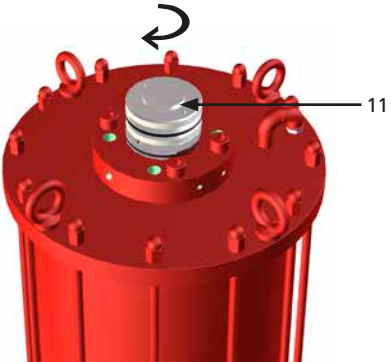
16. Periodic Maintenance

| | | PM-LP-007 | Page: 5/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 22. Remove sliding rings (11) and O-ring (12) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 23. Unfasten screws (15) and remove flange (16) 24. Remove O-ring (17) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 25. Remove, O-ring (7) and anti-extrusion ring (8) 26. Remove lip seal rings (9) | |  | |
| INSTRUCTION VALID FOR BOTH SPRING DOWN AND SPRING UP | | | |
| <ol style="list-style-type: none"> Carefully clean the seals grooves All the removed parts must be thoroughly cleaned, inspected and de-burred as necessary Replace all seals and lubricate them with a grease film Lubricate all sliding parts. Use only recommended grease | | | |


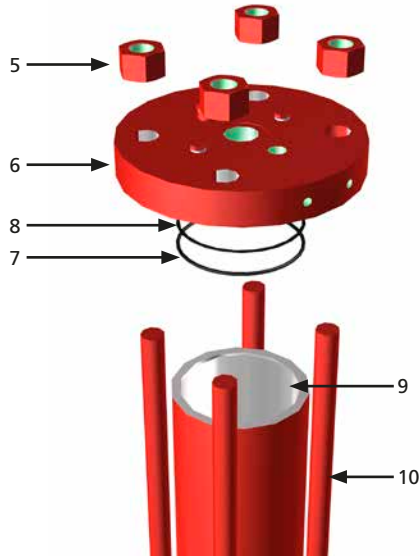
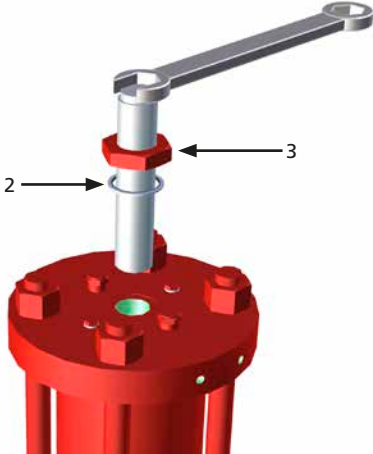
16. Periodic Maintenance

| PM-LP-007 | | Page: 6/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR SPRING UP ONLY 27. Replace sliding ring (11) and O-ring (12) |  | |
| INSTRUCTION VALID FOR SPRING UP ONLY 28. Replace piston (11) and piston rod (12) assembly |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 29. Replace O-ring (7) and anti-extrusion ring (8) 30. Replace lip seal rings (9) |  | |



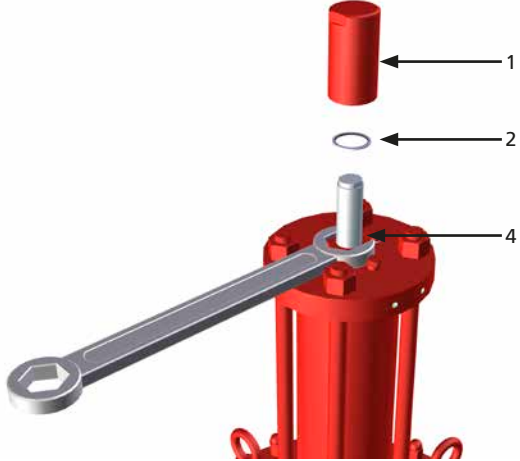
16. Periodic Maintenance

| | | PM-LP-007 | Page: 7/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 31. Replace O-ring (17) 32. Replace remove flange (16) and fasten screws (15) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 33. Replace sliding rings (11) and O-ring (12) | |  | |
| INSTRUCTION VALID FOR SPRING DOWN ONLY 34. Fasten the piston (11) with a pin spanner wrench  | |  | |


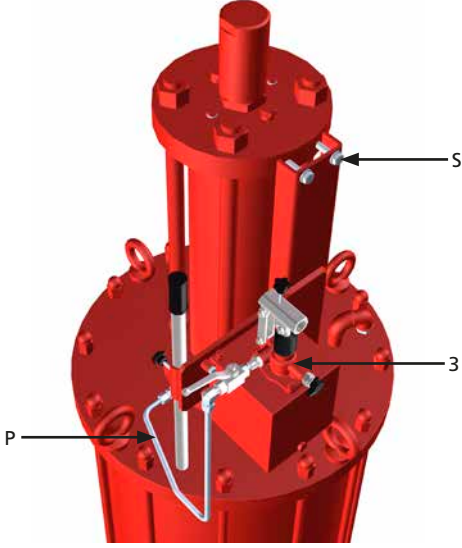
16. Periodic Maintenance

| PM-LP-007 | | Page: 8/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR SPRING DOWN AND SPRING UP</p> <p>35. Position hydraulic cylinder (9) and tie rods (10)</p> <p>36. Replace O-ring (7) and anti-extrusion ring (8) on flange (6)</p> <p>37. Lower flange (6) and fasten bolts (5)</p> |  | |
| <p>38. Assemble seal washer (2) in its correct position and stop bolt (3) to length W</p> |  | |



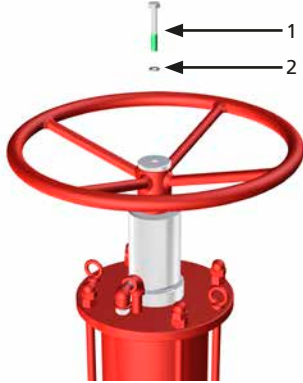
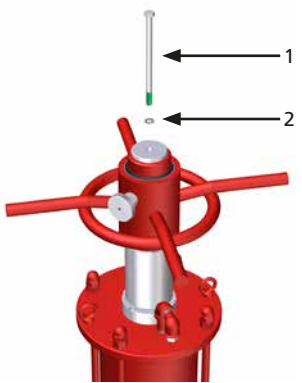
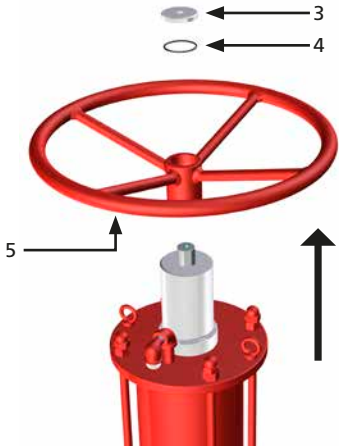
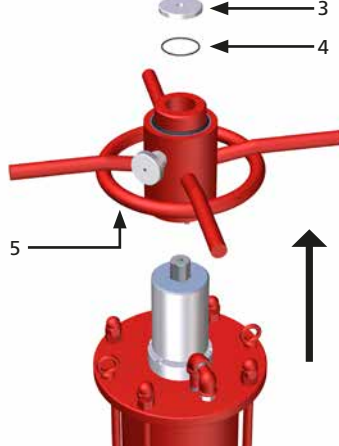
16. Periodic Maintenance

| | | PM-LP-007 | Page: 9/10 |
|--|--|---|------------|
| Component: Single-acting actuator | | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| 39. Hold stop bolt with a wrench and tighten stop nut (4) | |  | |
| 40. Hold stop nut (4) install seal washer (2) in its correct position and tighten cap nut (1) | |  | |

16. Periodic Maintenance

| PM-LP-007 | | Page: 10/10 |
|---|---|-------------|
| Component: Single-acting actuator | Task: Hydraulic cylinder for manual override seals replacement | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <ul style="list-style-type: none"> 41. Assemble hydraulic pump (3) with its support and tighten bolts (S) 42. Install pipe (P) |  | |
| <ul style="list-style-type: none"> 43. Use the hand pump to cycle the actuator and check the absence of leakages 44. Check painted parts and if necessary paint according to painting cycle | | |

16. Periodic Maintenance

| | | PM-LP-008a | Page: 1/8 |
|---|---|---|-----------|
| Component: Single-acting actuator | | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder up to size 235 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting clump Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| Description: | | | |
| Note: the following instructions apply to single-acting actuator unless otherwise specified. | | | |
|  Cut-off power supply and electric power supply (if present) before performing any operation. Adequate lifting devices and suitable for the weight must be applied by skilled personnel. | | | |
| Preliminary actions | | | |
| <ol style="list-style-type: none"> 1. Remove actuator from valve and remove all couplings as well (section 11) 2. Position the actuator on a workbench (if possible) or in a stable position and in a clean and closed area 3. Remove any control equipment (if present). Refer to the project specific documentation 4. Remove pneumatic pipes | | | |
| 5. Remove screw (1) and seal (2) | MH HANDWHEEL  | MHD HANDWHEEL  | |
| 6. Remove cap (3), O-ring (4) and handwheel (5) | MH HANDWHEEL  | MHD HANDWHEEL  | |

16. Periodic Maintenance

PM-LP-008a

Page: 2/8

Component: Single-acting actuator

Task: Manual Handwheel **MH** and **MHD** seals replacement
LP/SD and LP/SU actuator, cylinder up to size 235

Equipment, Tools, Materials:

Spare seals
Wrench
Lifting tools
Project documentation

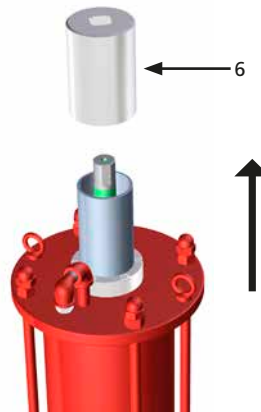
Warnings:



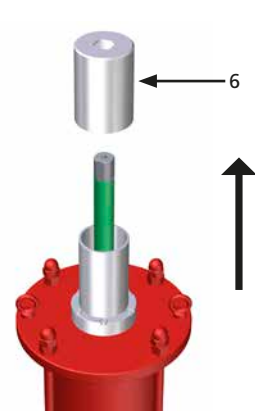
Preliminary Operations: Removal from Valve

7. Remove protective cap (6)

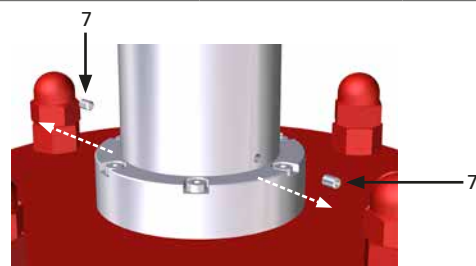
LP/SD



LP/SU

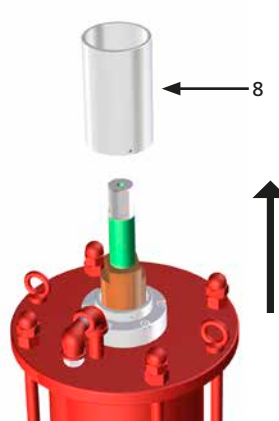


8. Remove grub screws (7)

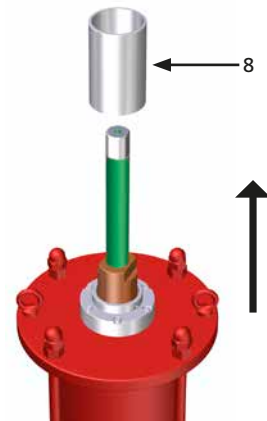


9. Remove protective tube (8)

LP/SD



LP/SU



16. Periodic Maintenance

PM-LP-008a

Page: 3/8

Component: Single-acting actuator

Task: Manual Handwheel **MH** and **MHD** seals replacement
LP/SD and LP/SU actuator, cylinder up to size 235

Equipment, Tools, Materials:

Spare seals
Wrench
Lifting tools
Project documentation

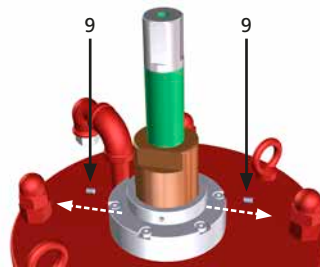
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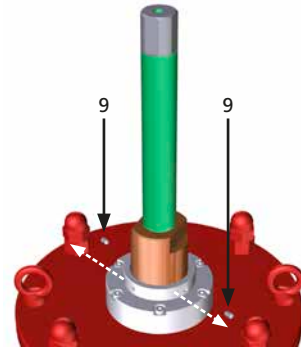
Preliminary Operations: Removal from Valve

10. Remove grub screws (9)

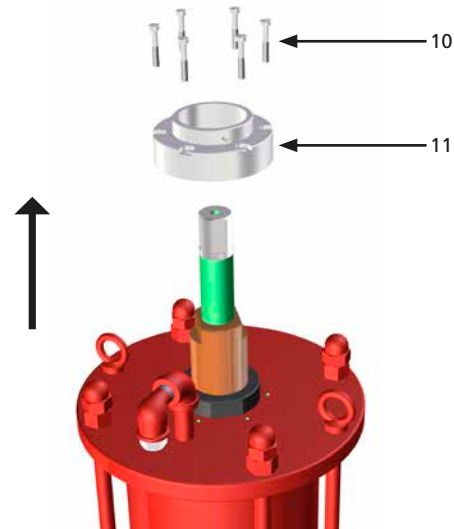
LP/SD



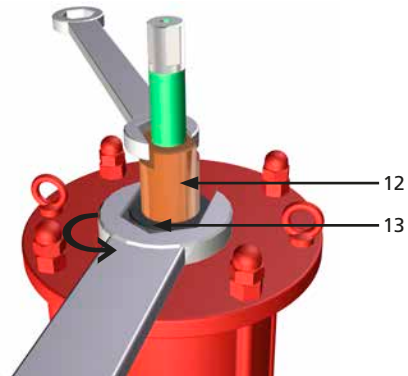
LP/SU




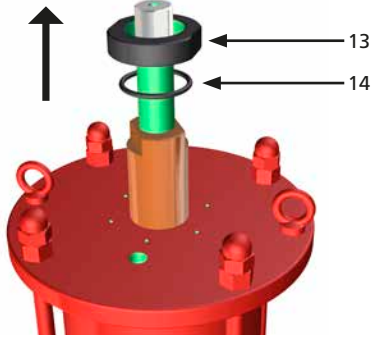
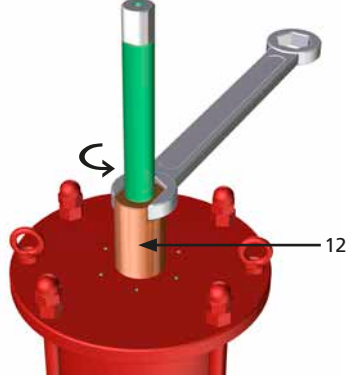
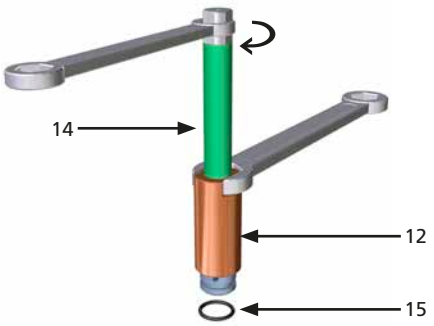
11. Remove screws (10)
12. Remove protection flange (11)




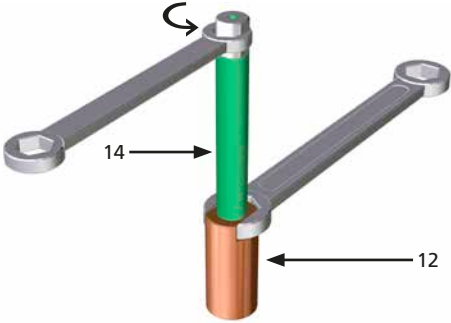
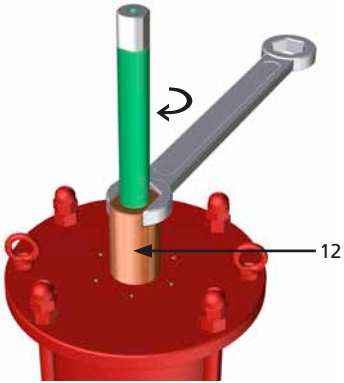
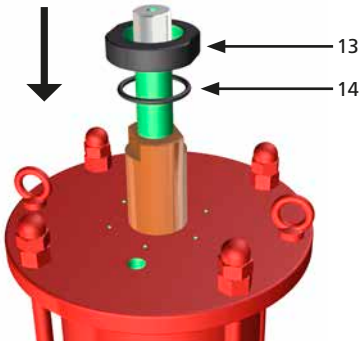
13. Holding stop bolt (12) with a wrench,
unfasten nut (13) with a wrench




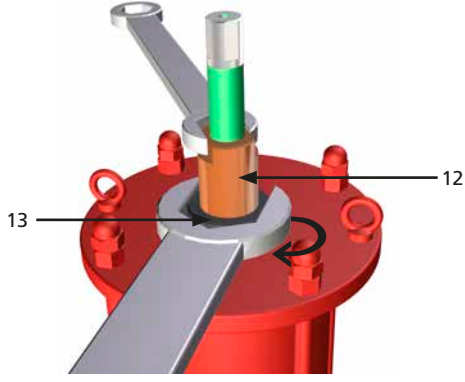
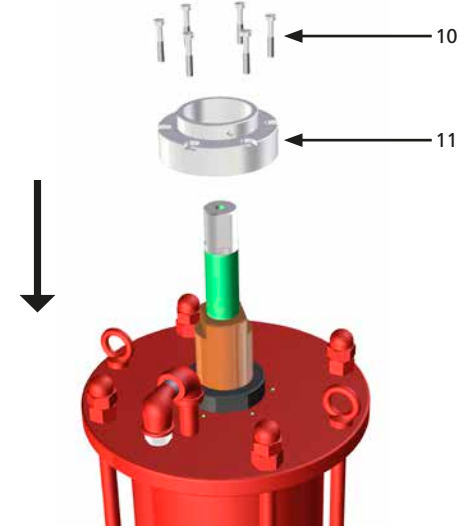
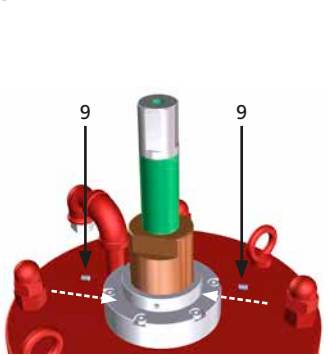
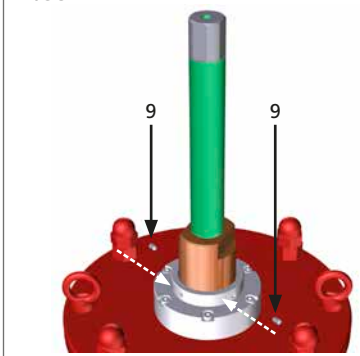
16. Periodic Maintenance

| PM-LP-008a | | Page: 4/8 |
|---|--|-----------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder up to size 235 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| 14. Remove nut (13) and O-ring (14) |  | |
| INSTRUCTION VALID FOR LP/SU ONLY 15. Unfasten stop bolt (12) with a wrench |  | |
| INSTRUCTION VALID FOR LP/SU ONLY 16. Holding stop bolt (12) with a wrench, fasten screw (14) with a wrench till O-ring (14) is accessible 17. Remove and replace O-ring (15) |  | |

16. Periodic Maintenance

| PM-LP-008a | | Page: 5/8 |
|---|---|-----------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder up to size 235 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR LP/SU ONLY 18. Holding stop bolt (12) with a wrench, un-fasten screw (14) with a wrench to place it back in the original position |  | |
| INSTRUCTION VALID FOR LP/SU ONLY 19. Fasten stop bolt (12) with a wrench |  | |
| 20. Place a new O-ring (14) and replace nut (13) |  | |

16. Periodic Maintenance

| PM-LP-008a | | Page: 6/8 |
|--|--|---|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder up to size 235 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| 21. Holding stop bolt (12) with a wrench, fasten nut (13) with a wrench |  | |
| 22. Replace protection flange (11) 23. Fasten screws (10) |  | |
| 24. Replace grub screws (9) | LP/SD  | LP/SU  |

16. Periodic Maintenance

PM-LP-008a

Page: 7/8

Component: Single-acting actuator

Task: Manual Handwheel **MH** and **MHD** seals replacement
LP/SD and LP/SU actuator, cylinder up to size 235

Equipment, Tools, Materials:

Spare seals
Wrench
Lifting tools
Project documentation

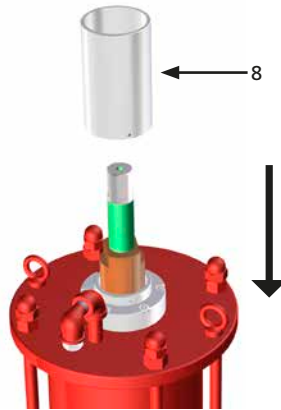
Warnings:



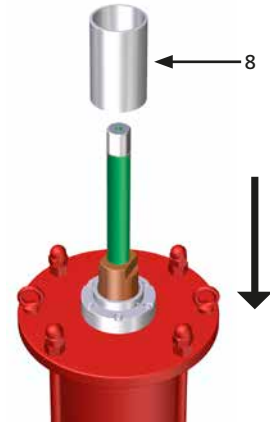
Preliminary Operations: Removal from Valve

25. Replace protective tube (8)

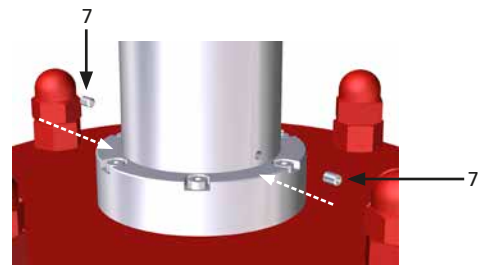
LP/SD



LP/SU

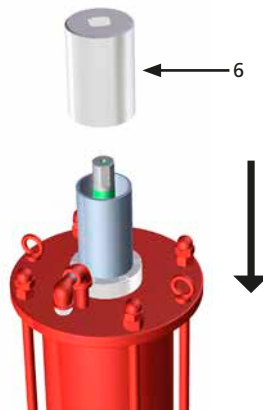


26. Replace grub screws (7)

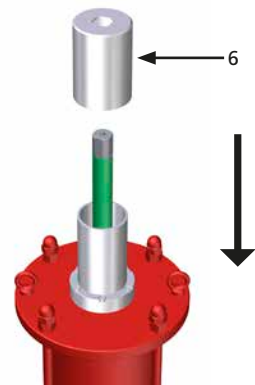


27. Replace protective cap (6)



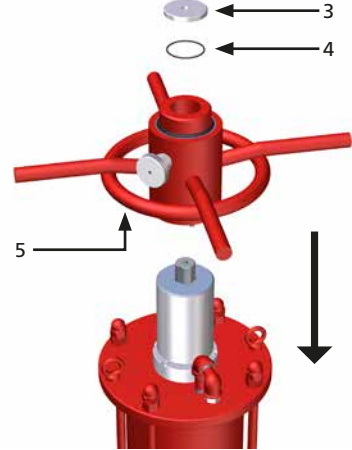
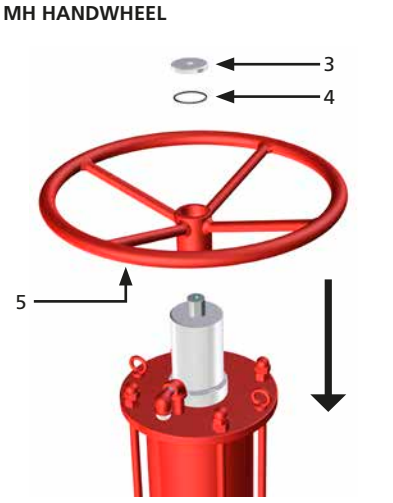
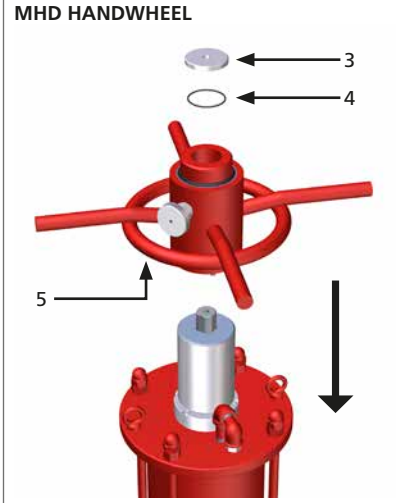
LP/SD





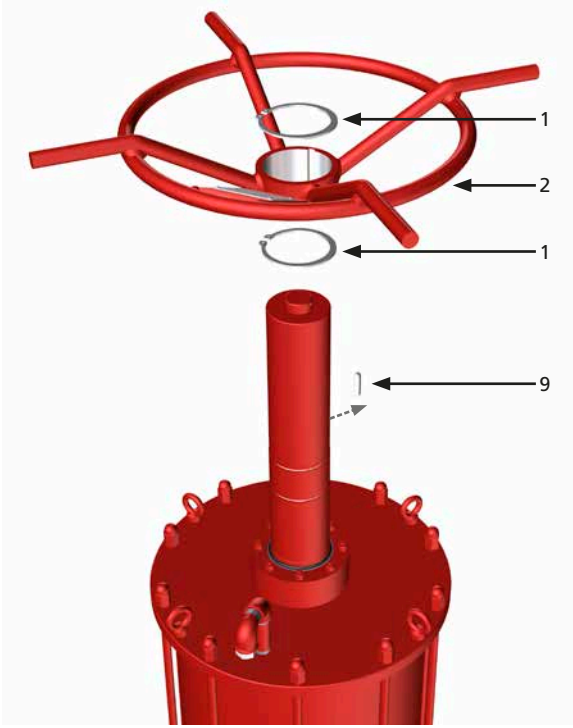
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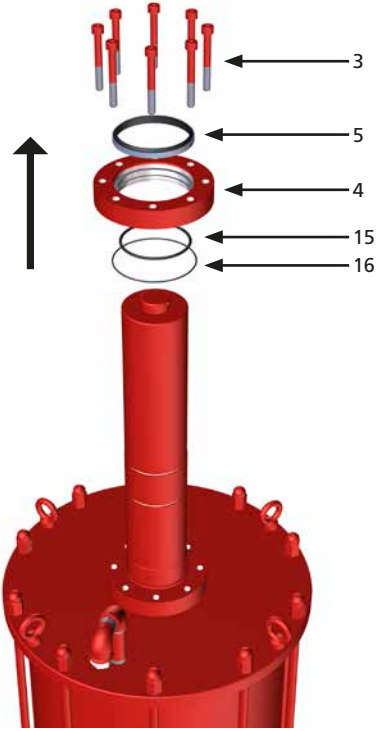
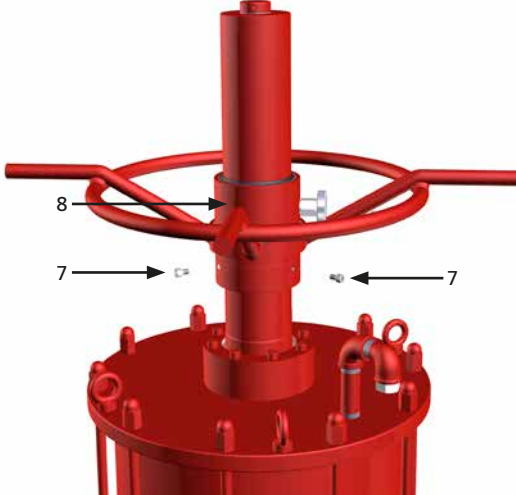
16. Periodic Maintenance

| | | PM-LP-008a | Page: 8/8 |
|--|--|--|---|
| Component: Single-acting actuator | | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder up to size 235 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| 28. Replace handwheel (5), O-ring (4) and cap (3) | MH HANDWHEEL  | MHD HANDWHEEL  | |
| | 29. Replace seal (2) and screw (1) | MH HANDWHEEL  | MHD HANDWHEEL  |

16. Periodic Maintenance

| PM-LP-008b | | Page: 1/10 |
|---|---|------------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting clump Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| Description: Note: the following instructions apply to single-acting actuator unless otherwise specified.  Cut-off power supply and electric power supply (if present) before performing any operation. Adequate lifting devices and suitable for the weight must be applied by skilled personnel. Preliminary actions <ol style="list-style-type: none"> 1. Remove actuator from valve and remove all couplings as well (section 11) 2. Position the actuator on a workbench (if possible) or in a stable position and in a clean and closed area 3. Remove any control equipment (if present). Refer to the project specific documentation 4. Remove pneumatic pipes | | |
| INSTRUCTION VALID FOR MH HANDWHEEL ONLY <ol style="list-style-type: none"> 5. Remove circlips (1) and handwheel (2) 6. Remove key (9) |  | |

16. Periodic Maintenance

| PM-LP-008b | | Page: 2/10 |
|--|--|------------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR MH HANDWHEEL ONLY</p> <ol style="list-style-type: none"> 7. Un-fasten screws (3) 8. Remove flange (4) and dust excluder (5) 9. Remove O-rings (15) and (16) |  | |
| <p>INSTRUCTION VALID FOR MHD HANDWHEEL ONLY</p> <ol style="list-style-type: none"> 10. Remove 3 screws (7) from flange (8) |  | |

16. Periodic Maintenance

PM-LP-008b

Page: 3/10

Component: Single-acting actuator

Task: Manual Handwheel **MH** and **MHD** seals replacement
LP/SD and LP/SU actuator, **cylinder from size 235 to 385**

Equipment, Tools, Materials:

Spare seals
Wrench
Lifting tools
Project documentation

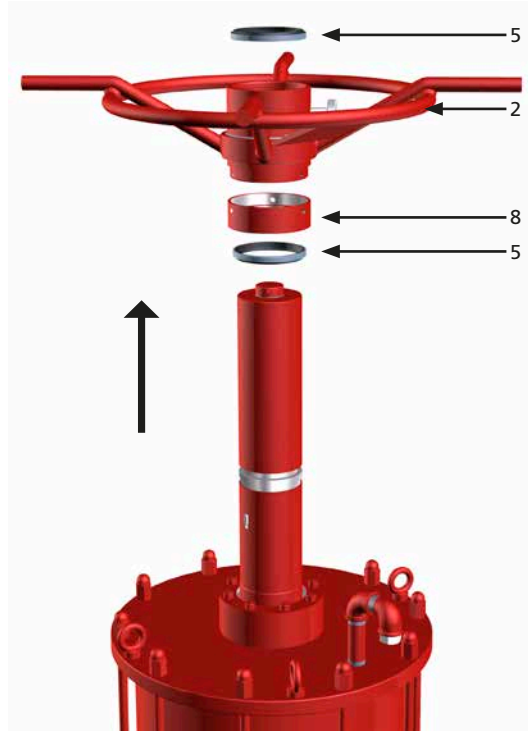
Warnings:



Preliminary Operations: Removal from Valve

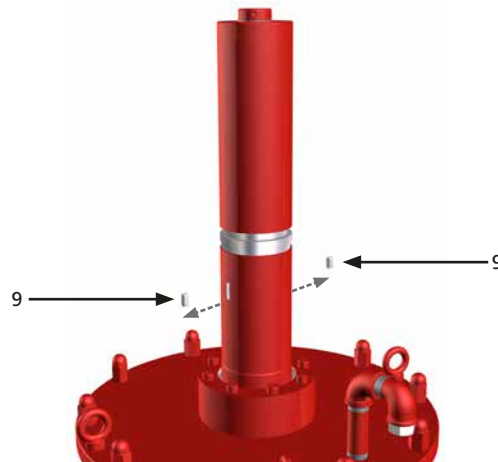
INSTRUCTION VALID FOR MHD HANDWHEEL ONLY

11. Remove handwheel (2) and dust excluders (5)
12. Remove flange (8)


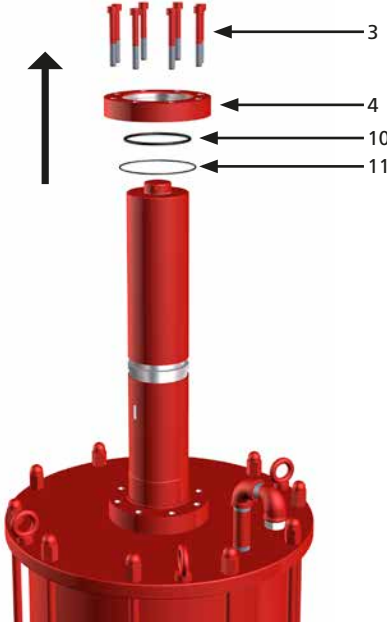
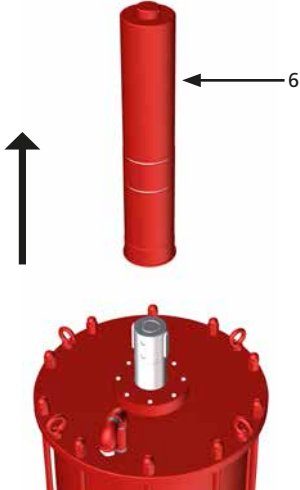
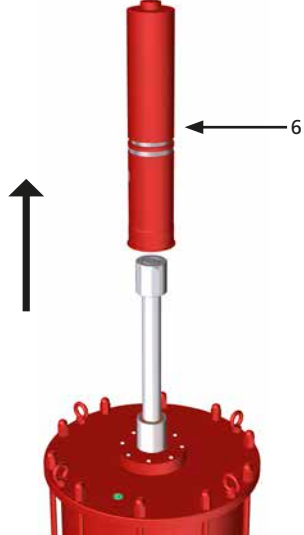


INSTRUCTION VALID FOR MHD HANDWHEEL ONLY


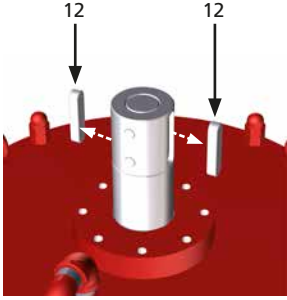
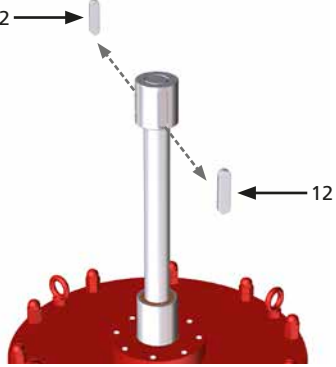
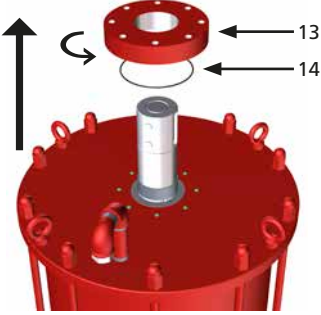
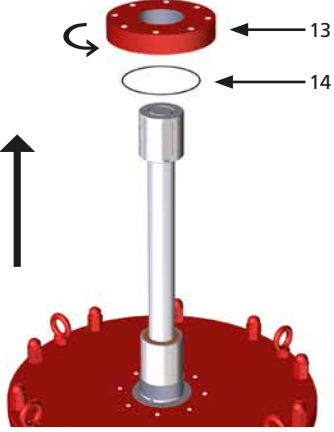
13. Remove keys (9)




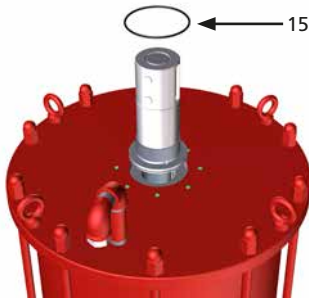
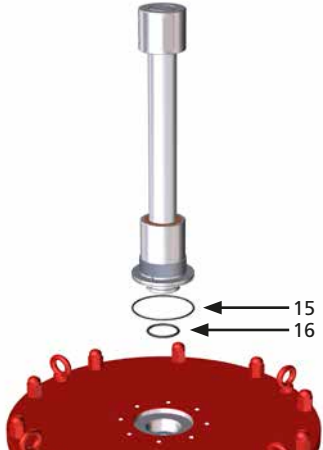
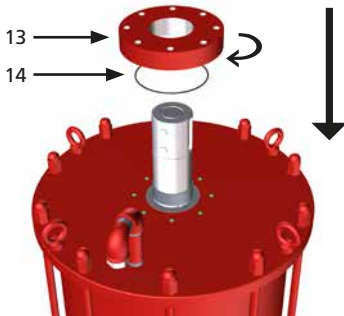
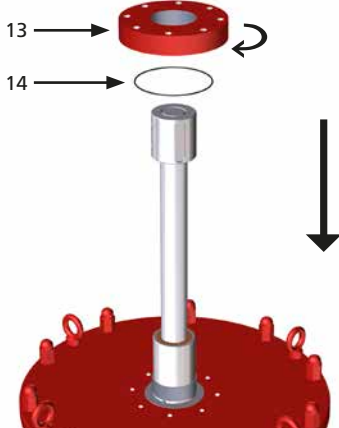
16. Periodic Maintenance

| PM-LP-008b | | Page: 4/10 |
|--|--|--|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| INSTRUCTION VALID FOR MHD HANDWHEEL ONLY 14. Un-fasten screws (3) 15. Remove flange (4) 16. Remove O-rings (10) and (11) |  | |
| INSTRUCTIONS VALID FOR BOTH MH AND MHD HANDWHEEL 17. Remove protective tube (6) | LP/SD ACTUATOR  | LP/SU ACTUATOR  |


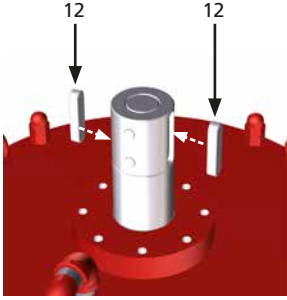
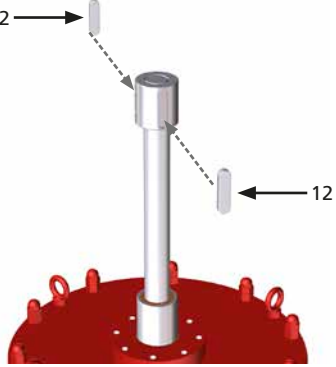
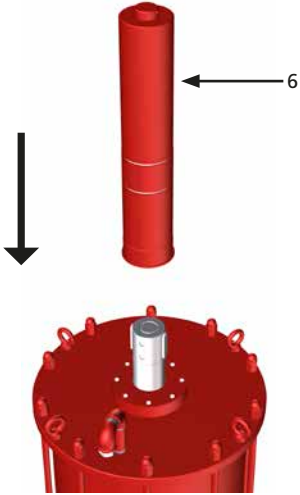
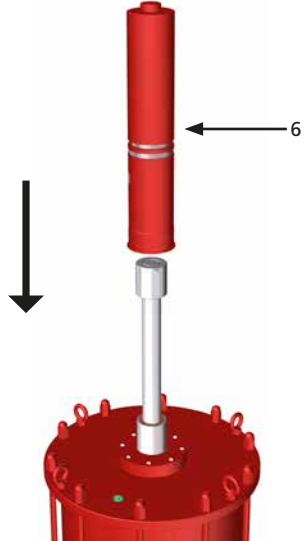
16. Periodic Maintenance

| | | PM-LP-008b | Page: 5/10 |
|--|---|---|------------|
| Component: Single-acting actuator | | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| 18. Remove keys (12) | LP/SD ACTUATOR  | LP/SU ACTUATOR  | |
| 19. Un-fasten flange (13) 20. Remove O-ring (14) | LP/SD ACTUATOR  | LP/SU ACTUATOR  | |


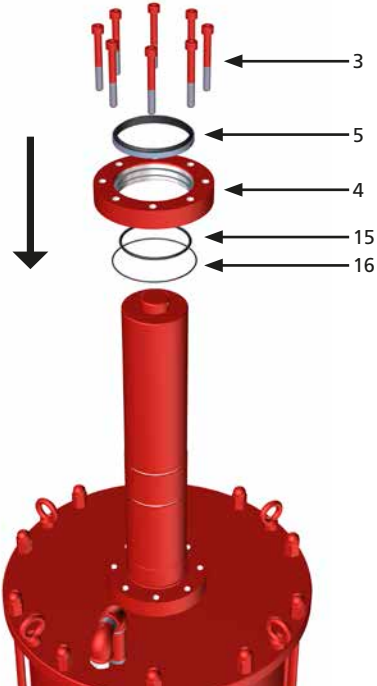
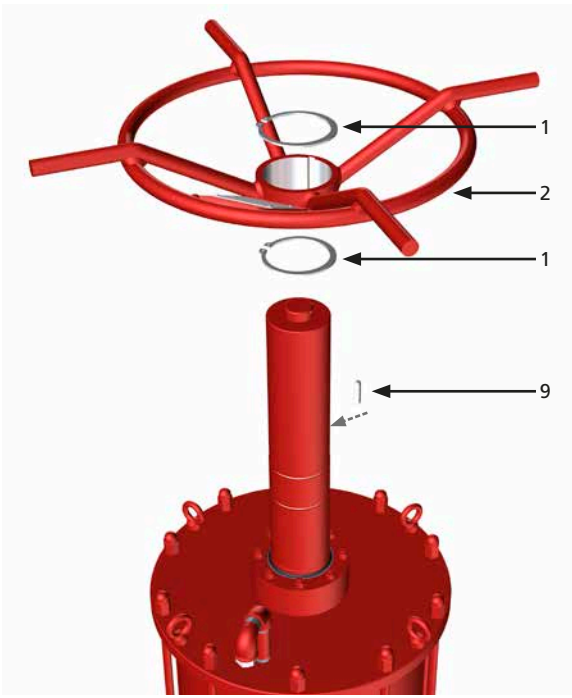
16. Periodic Maintenance

| | | PM-LP-008b | Page: 6/10 |
|---|--|---|--|
| Component: Single-acting actuator | | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| 21. Lift the manual override shaft to access O-ring (15) and (16) and remove them 22. Replace O-ring (15) and (16) | LP/SD ACTUATOR  | LP/SU ACTUATOR  | |
| | 23. Replace O-ring (14) 24. Fasten flange (13) | LP/SD ACTUATOR  | LP/SU ACTUATOR  |


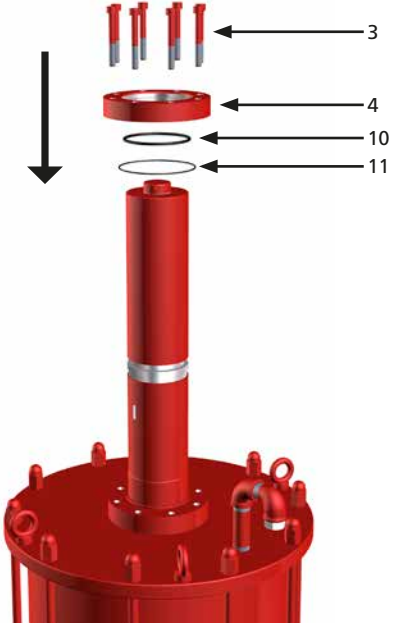
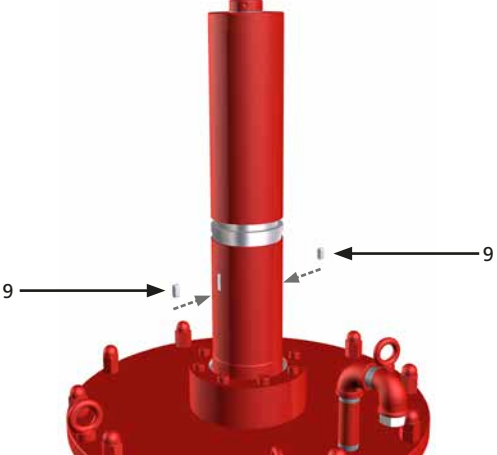
16. Periodic Maintenance

| | | PM-LP-008b | Page: 7/10 |
|--|---|--|---|
| Component: Single-acting actuator | | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | | Warnings:  | |
| Preliminary Operations: Removal from Valve | | | |
| 25. Replace keys (12) | LP/SD ACTUATOR  | LP/SU ACTUATOR  | |
| | INSTRUCTIONS VALID FOR BOTH MH AND MHD HANDWHEEL 26. Replace protective tube (6) | LP/SD ACTUATOR  | LP/SU ACTUATOR  |


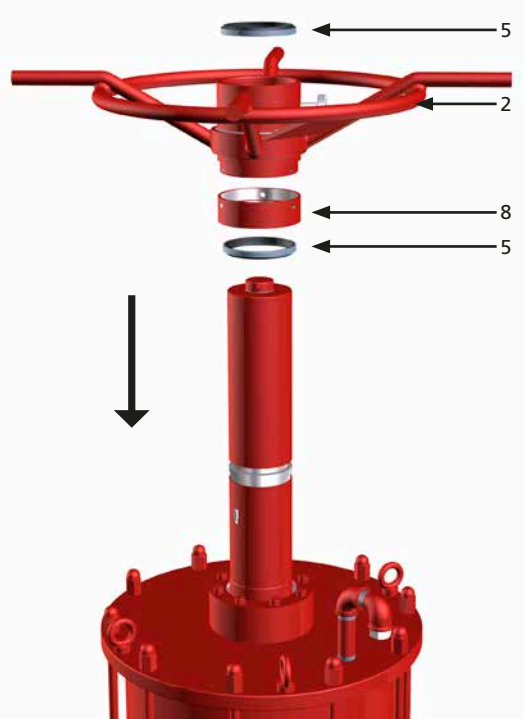
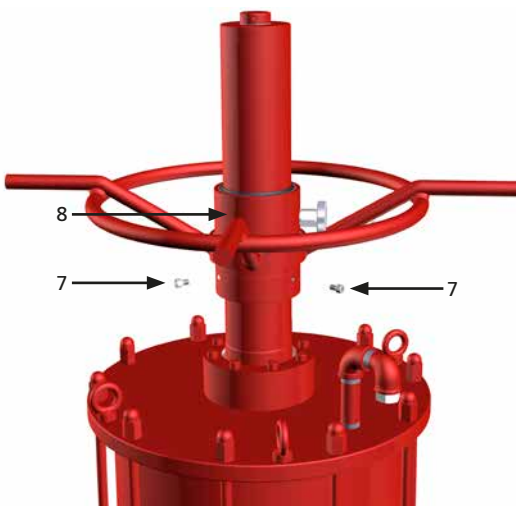
16. Periodic Maintenance

| PM-LP-008b | | Page: 8/10 |
|---|--|------------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR MH HANDWHEEL ONLY</p> <ul style="list-style-type: none"> 27. Replace dust excluder (5) 28. Replace O-rings (15) and (16) 29. Replace flange (4) 30. Fasten screws (3) |  | |
| <p>INSTRUCTION VALID FOR MH HANDWHEEL ONLY</p> <ul style="list-style-type: none"> 31. Replace key (9) 32. Replace circlips (1) and handwheel (2) |  | |

16. Periodic Maintenance

| PM-LP-008b | | Page: 9/10 |
|--|--|------------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR MHD HANDWHEEL ONLY</p> <p>33. Clean the grooves and replace O-rings (10) and (11) into flange (4)</p> <p>34. Replace flange (4)</p> <p>35. Fasten screws (3)</p> |  | |
| <p>INSTRUCTION VALID FOR MHD HANDWHEEL ONLY</p> <p>36. Replace keys (9) into the respective grooves</p> |  | |

16. Periodic Maintenance

| PM-LP-008b | | Page: 10/10 |
|--|--|-------------|
| Component: Single-acting actuator | Task: Manual Handwheel MH and MHD seals replacement LP/SD and LP/SU actuator, cylinder from size 235 to 385 | |
| Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation | Warnings:  | |
| Preliminary Operations: Removal from Valve | | |
| <p>INSTRUCTION VALID FOR MHD HANDWHEEL ONLY</p> <p>37. Replace dust excluder (5) and flange (8) 38. Replace handwheel (2) and dust excluder (5)</p> |  | |
| <p>INSTRUCTION VALID FOR MHD HANDWHEEL ONLY</p> <p>39. Replace 3 screws (7) into flange (8)</p> |  | |

17. Part List

Linear pneumatic actuator type 0 spring down

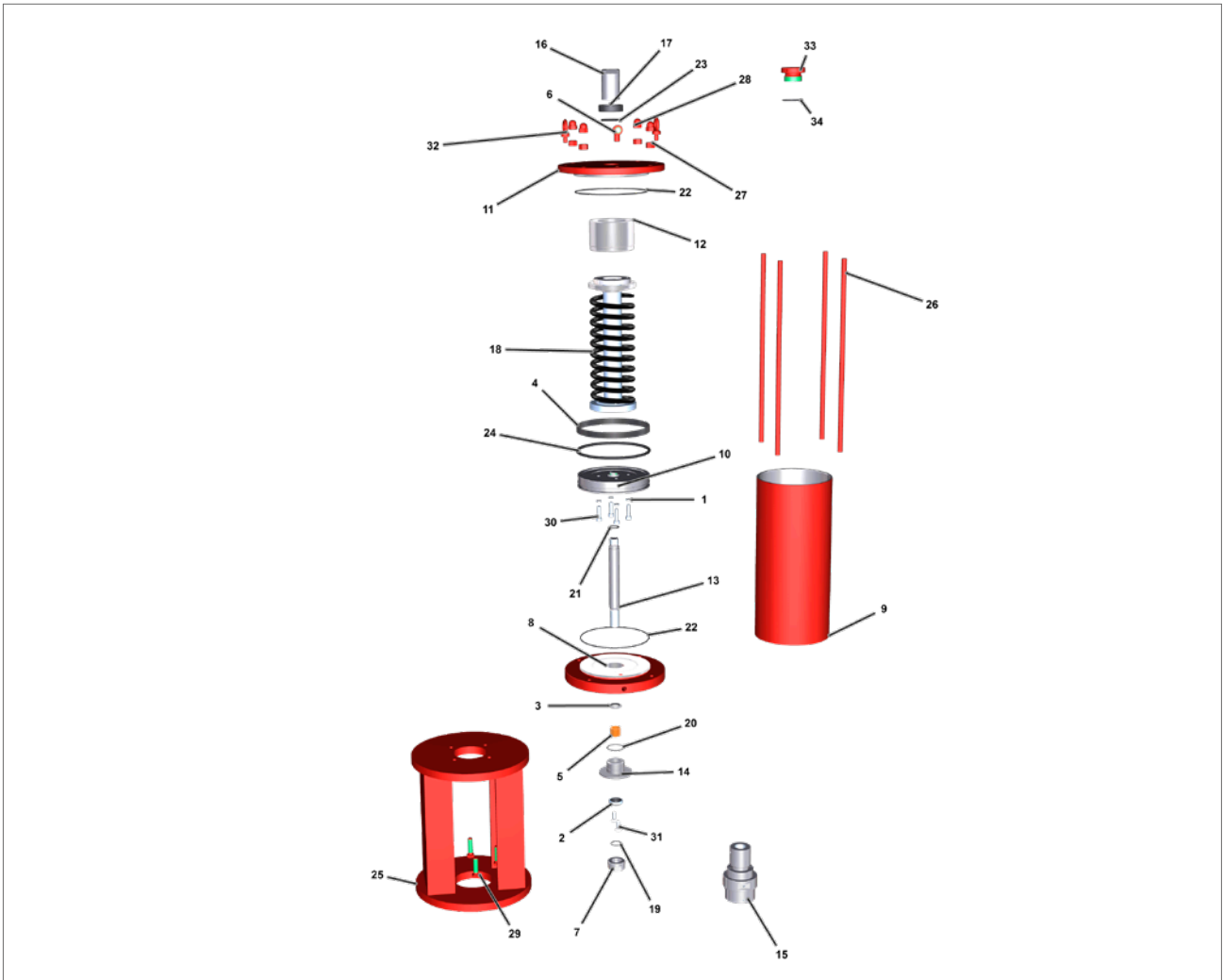


Fig 17.1 Linear pneumatic actuator type 0 spring down

| ITEM | DESCRIPTION | QTY |
|------|----------------------|-----|
| 1 | Seal-Washer | 4 |
| 2 | Scraper seal | 1 |
| 3 | Seal | 1 |
| 4 | Sliding ring | ● 1 |
| 5 | Bushing | 1 |
| 6 | Silencer | 1 |
| 7 | Nut | 1 |
| 8 | Flange | 1 |
| 9 | Pneumatic cylinder | 1 |
| 10 | Piston | 1 |
| 11 | Flange | 1 |
| 12 | External thrust tube | 1 |
| 13 | Stem | 1 |
| 14 | Adapter flange | 1 |
| 15 | Valve coupling | 1 |
| 16 | Stop bolt | 2 |
| 17 | Nut | 1 |
| 18 | Spring package | 1 |

| ITEM | DESCRIPTION | QTY |
|------|-------------------|-----|
| 19 | O-ring | ● 1 |
| 20 | O-ring | ● 1 |
| 21 | O-ring | ● 1 |
| 22 | Cylinder O-ring | ● 2 |
| 23 | O-ring | ● 1 |
| 24 | Piston O-ring | ● 1 |
| 25 | Valve adaption | 4 |
| 26 | Tie rod | 4 |
| 27 | Nut Screw | 4 |
| 28 | Blind nut | 4 |
| 29 | Screw | 4 |
| 30 | Screw | 4 |
| 31 | Countersunk screw | 2 |
| 32 | Eyebolt | 2 |
| 33 | Plug (*) | 1 |
| 34 | Seal-Washer (*) | 1 |

(*) present only if items 16, 17, 23 are not present
 ● Recommended spare part

17. Part List

Linear pneumatic actuator type 0 spring up

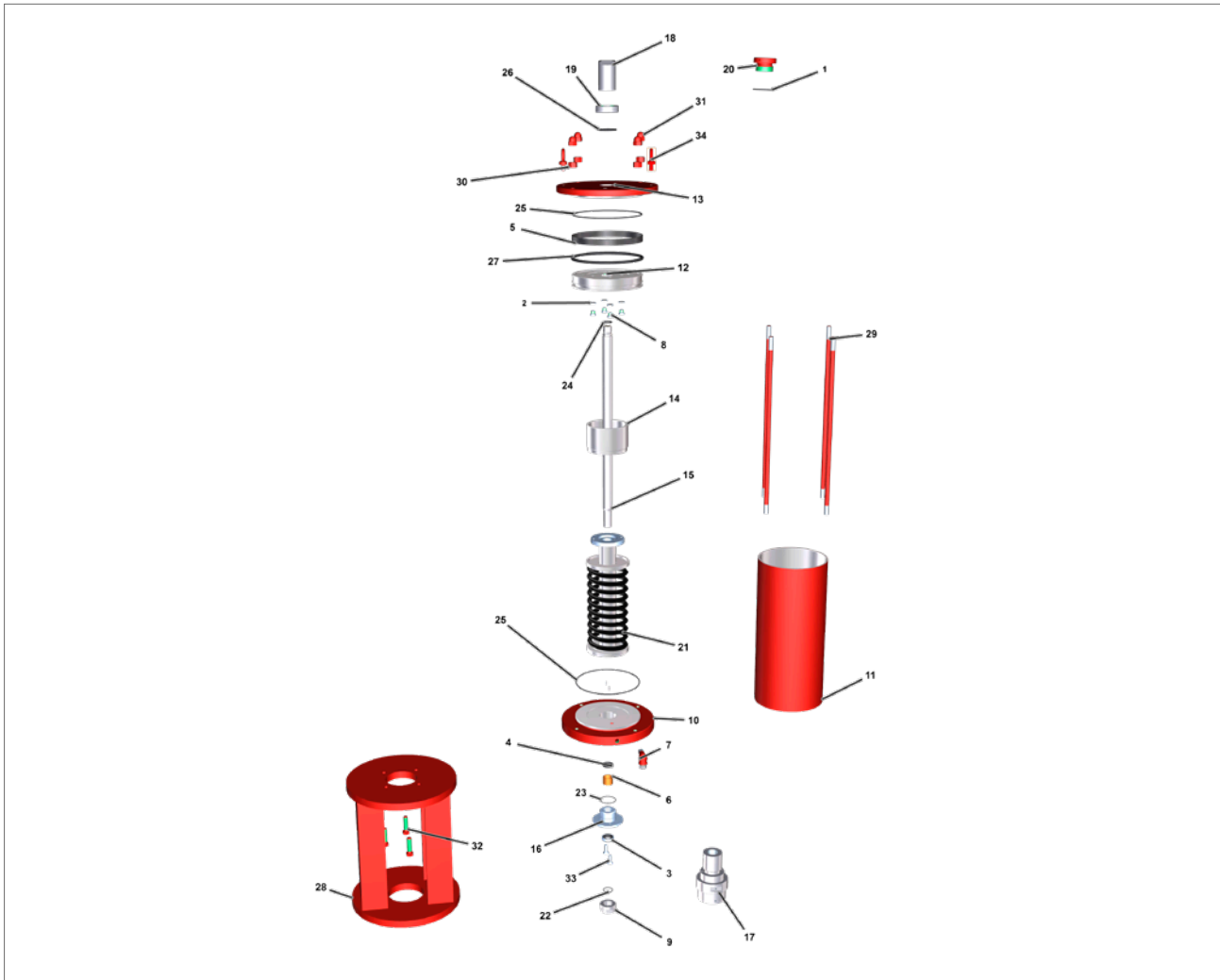


Fig 17.2 Linear pneumatic actuator type 0 spring up

| ITEM | DESCRIPTION | QTY |
|------|----------------------|-----|
| 1 | Seal-Washer (*) | 1 |
| 2 | Seal-Washer | 4 |
| 3 | Scraper seal | 1 |
| 4 | Seal | 1 |
| 5 | Sliding ring ● | 1 |
| 6 | Bushing | 1 |
| 7 | Silencer | 1 |
| 8 | Screws | 4 |
| 9 | Centring ring | 1 |
| 10 | Flange | 1 |
| 11 | Pneumatic cylinder | 1 |
| 12 | Piston | 1 |
| 13 | Flange | 1 |
| 14 | External thrust tube | 1 |
| 15 | Stem | 1 |
| 16 | Adapter flange | 1 |
| 17 | Valve coupling | 1 |
| 18 | Stop bolt | 1 |

| ITEM | DESCRIPTION | QTY |
|------|-------------------|-----|
| 19 | Nuts | 1 |
| 20 | Plug (*) | 1 |
| 21 | Spring package | 1 |
| 22 | O-ring ● | 1 |
| 23 | O-ring ● | 1 |
| 24 | O-ring ● | 1 |
| 25 | Cylinder O-ring ● | 2 |
| 26 | O-ring ● | 1 |
| 27 | Piston O-ring ● | 1 |
| 28 | Valve adaptor | 1 |
| 29 | Tie rod | 4 |
| 30 | Bolt | 4 |
| 31 | Blind bolt | 4 |
| 32 | Screw | 4 |
| 33 | Countersunk screw | 2 |
| 34 | Eyebolt | 2 |

(*) present only if items 18, 19, 26 are not present
 ● Recommended spare part

17. Part List

Linear pneumatic actuator type 1 / type 2 spring down

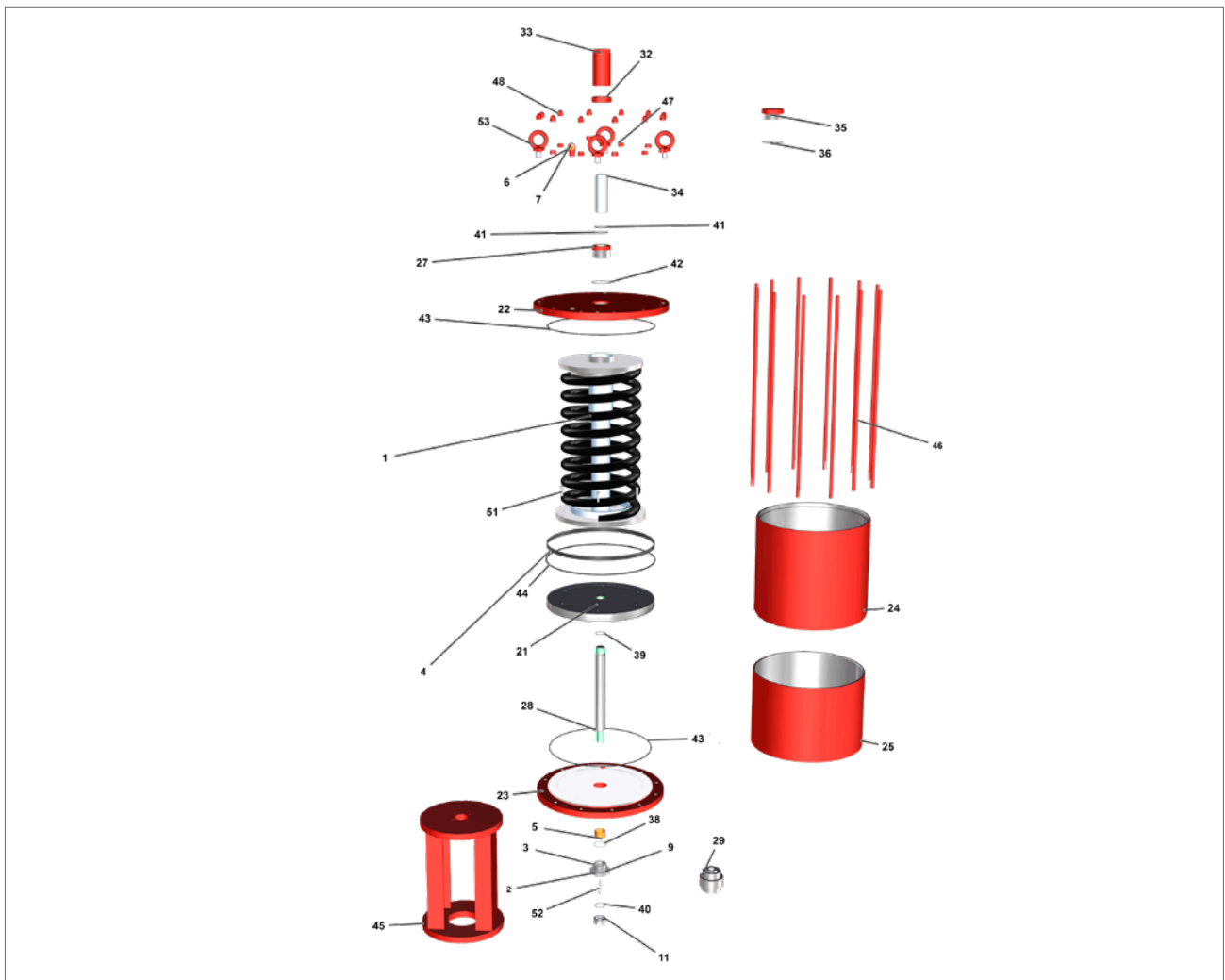


Fig 17.3 Linear pneumatic actuator type 1 / type 2 spring down

| ITEM | DESCRIPTION | QTY |
|------|-----------------|-----|
| 1 | Spring | 1 |
| 2 | Adapter flange | 1 |
| 4 | Sliding ring | ● 1 |
| 5 | Bushing | 1 |
| 6 | Elbow | 1 |
| 7 | Silencer | 1 |
| 11 | Centring ring | 1 |
| 21 | Piston | 1 |
| 22 | Upper flange | 1 |
| 23 | Flange | 1 |
| 24 | Spring canister | 1 |
| 25 | Cylinder | 1 |
| 27 | Plug | 1 |
| 28 | Stem | 1 |
| 29 | Valve coupling | 1 |
| 32 | Nut | 1 |
| 33 | Blind nut | 1 |
| 34 | Stop bolt | 1 |

| ITEM | DESCRIPTION | QTY |
|------|---------------|-----|
| 35 | Plug (*) | 1 |
| 36 | O-ring (*) | ● 1 |
| 38 | O-ring | ● 1 |
| 39 | O-ring | ● 1 |
| 40 | O-ring | ● 1 |
| 41 | O-ring | ● 2 |
| 42 | O-ring | ● 1 |
| 43 | O-ring | ● 2 |
| 44 | Piston O-ring | ● 1 |
| 45 | Valve adaptor | 1 |
| 46 | Tie rod | 12 |
| 47 | Nut | 12 |
| 48 | Blind nut | 12 |
| 51 | Screw | 4 |
| 52 | Screw | 2 |
| 53 | Eyebolt | 4 |

(*) present only if items 32, 33, 34, 41, 42 are not present
 ● Recommended spare part

17. Part List

Linear pneumatic actuator type 1 / type 2 spring up

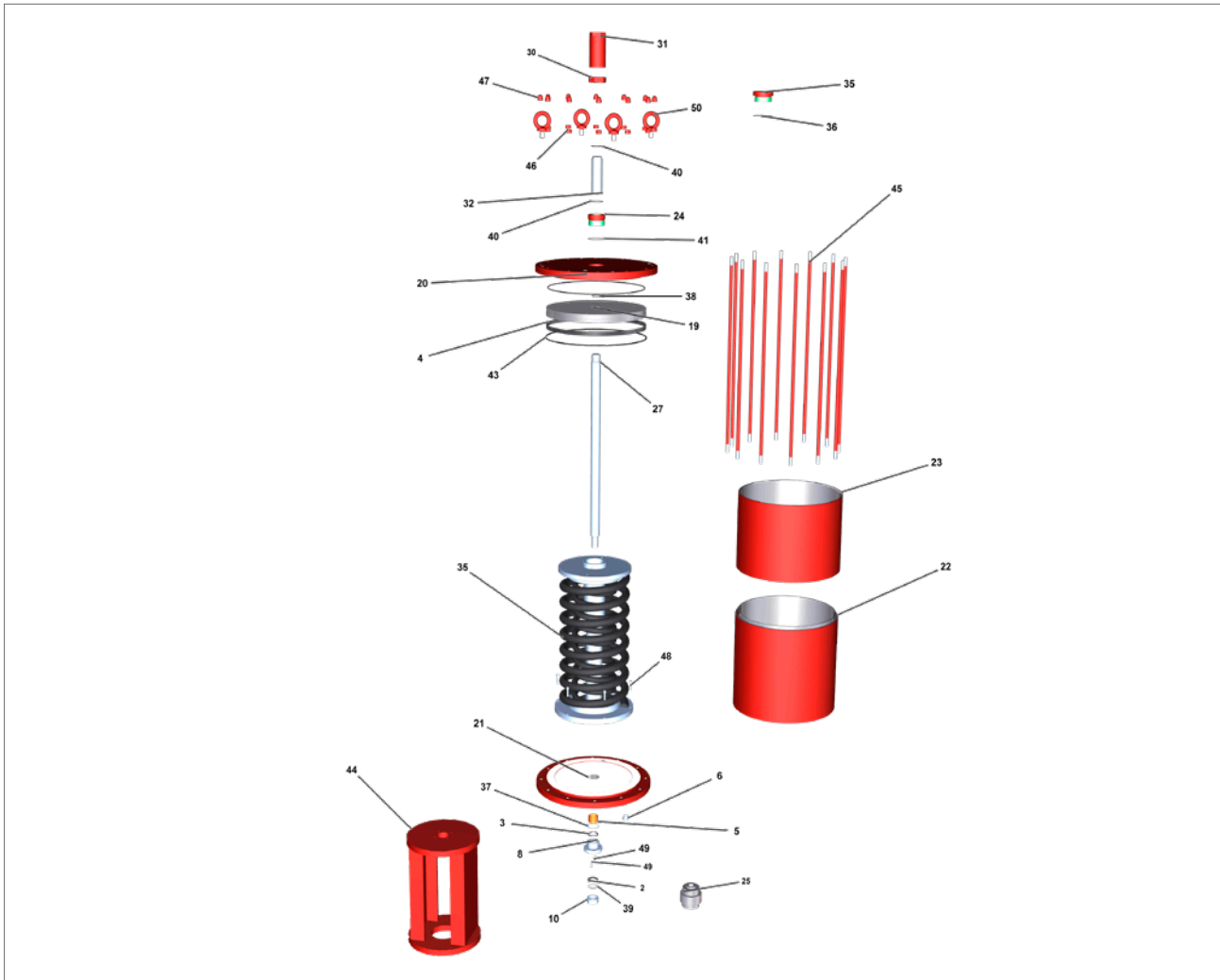


Fig 17.4 Linear pneumatic actuator type 1 / type 2 spring up

| ITEM | DESCRIPTION | QTY |
|------|-----------------|-----|
| 2 | O-ring | 1 |
| 3 | Washer | 1 |
| 4 | Sliding ring | ● 1 |
| 5 | Bushing | 1 |
| 6 | Plug | 1 |
| 8 | Adapter flange | 1 |
| 10 | Centring ring | 1 |
| 15 | Spring | 1 |
| 19 | Piston | 1 |
| 20 | Top flange | 1 |
| 21 | Bottom flange | 1 |
| 22 | Cylinder | 1 |
| 23 | Spring canister | 1 |
| 25 | Valve coupling | 1 |
| 27 | Stem | 1 |
| 30 | Nut | 1 |
| 31 | Blind nut | 1 |
| 32 | Stop bolt | 1 |

| ITEM | DESCRIPTION | QTY |
|------|---------------|-----|
| 33 | Plug (*) | 1 |
| 34 | O-ring (*) | ● 1 |
| 35 | Spring | ● 1 |
| 37 | O-ring | ● 1 |
| 38 | O-ring | ● 1 |
| 40 | O-ring | ● 2 |
| 41 | O-ring | ● 1 |
| 43 | Piston O-ring | ● 1 |
| 44 | Valve adaptor | 1 |
| 45 | Tie rod | 12 |
| 46 | Nut | 12 |
| 47 | Blind nut | 12 |
| 48 | Screw | 6 |
| 49 | Screw | 2 |
| 53 | Eyebolt | 4 |

(*) present only if items 30, 31, 32, 40, 41 are not present
 ● Recommended spare part

17. Part List

Hydraulic cylinder for manual override

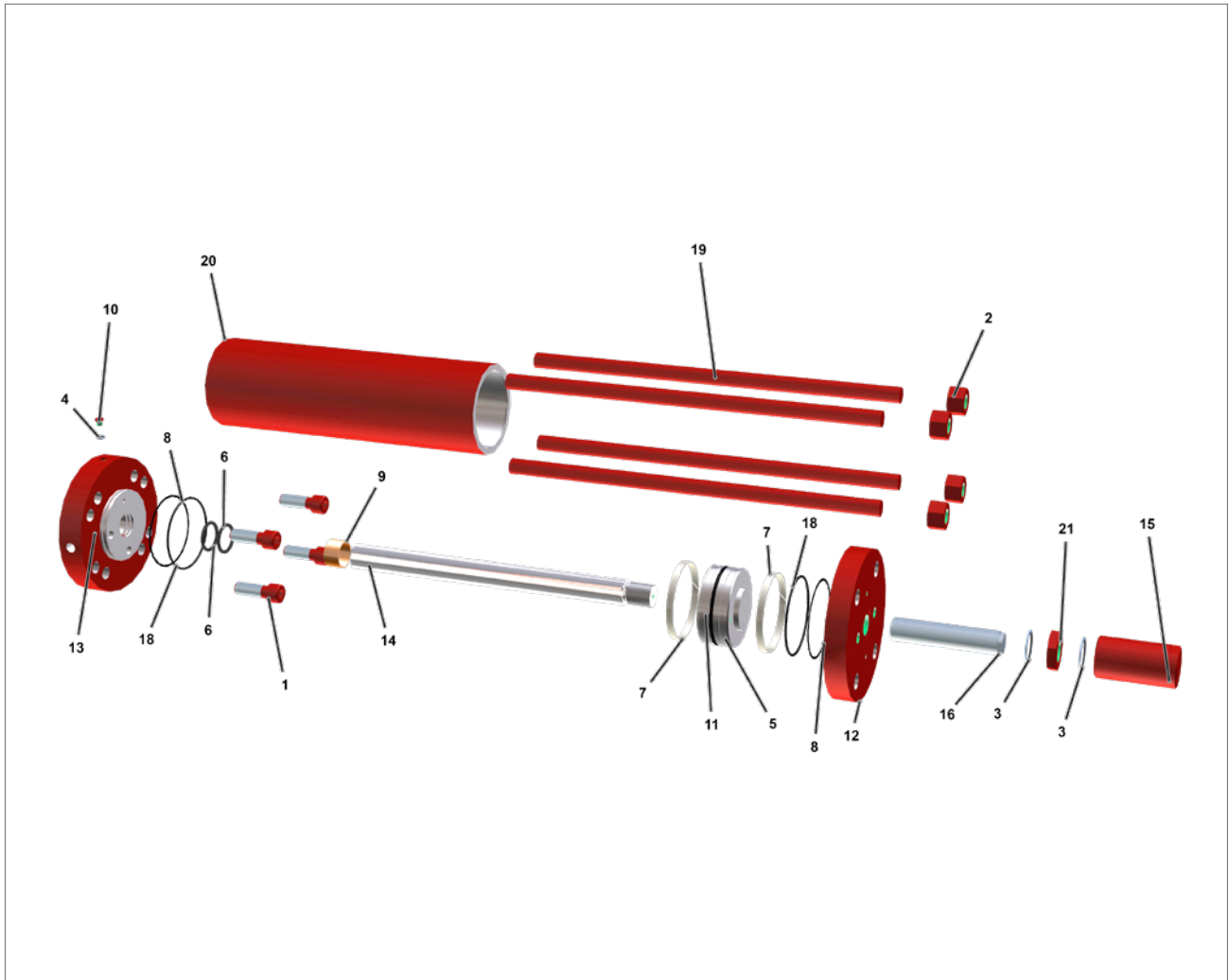


Fig 17.5 Hydraulic cylinder for manual override

| ITEM | DESCRIPTION | | QTY |
|------|--------------------|---|-----|
| 1 | Hex bolt (**) | | 4 |
| 2 | Nut | | 4 |
| 3 | Seal washer/O-ring | | 2 |
| 4 | Washer | | 1 |
| 5 | Piston | | 1 |
| 6 | Piston rod seal | ● | 2 |
| 7 | Sliding ring | ● | 2 |
| 8 | O-ring | ● | 1 |
| 9 | Bushing | | 1 |
| 10 | Plug | | 1 |
| 11 | Piston seal | ● | 1 |

| ITEM | DESCRIPTION | | QTY |
|------|---------------|---|-----|
| 12 | End flange | | 1 |
| 13 | Head flange | | 1 |
| 14 | Piston rod | | 1 |
| 15 | Cap nut | | 1 |
| 16 | Stop bolt | | 1 |
| 18 | Back up ring | ● | 1 |
| 19 | Tie rod (**) | | 4 |
| 20 | Cylinder tube | | 1 |
| 21 | Stop nut | | 1 |

(**) Number of tie rods and nut depending on cylinder size
 ● Recommended spare part

17. Part List

Mechanical manual override MH

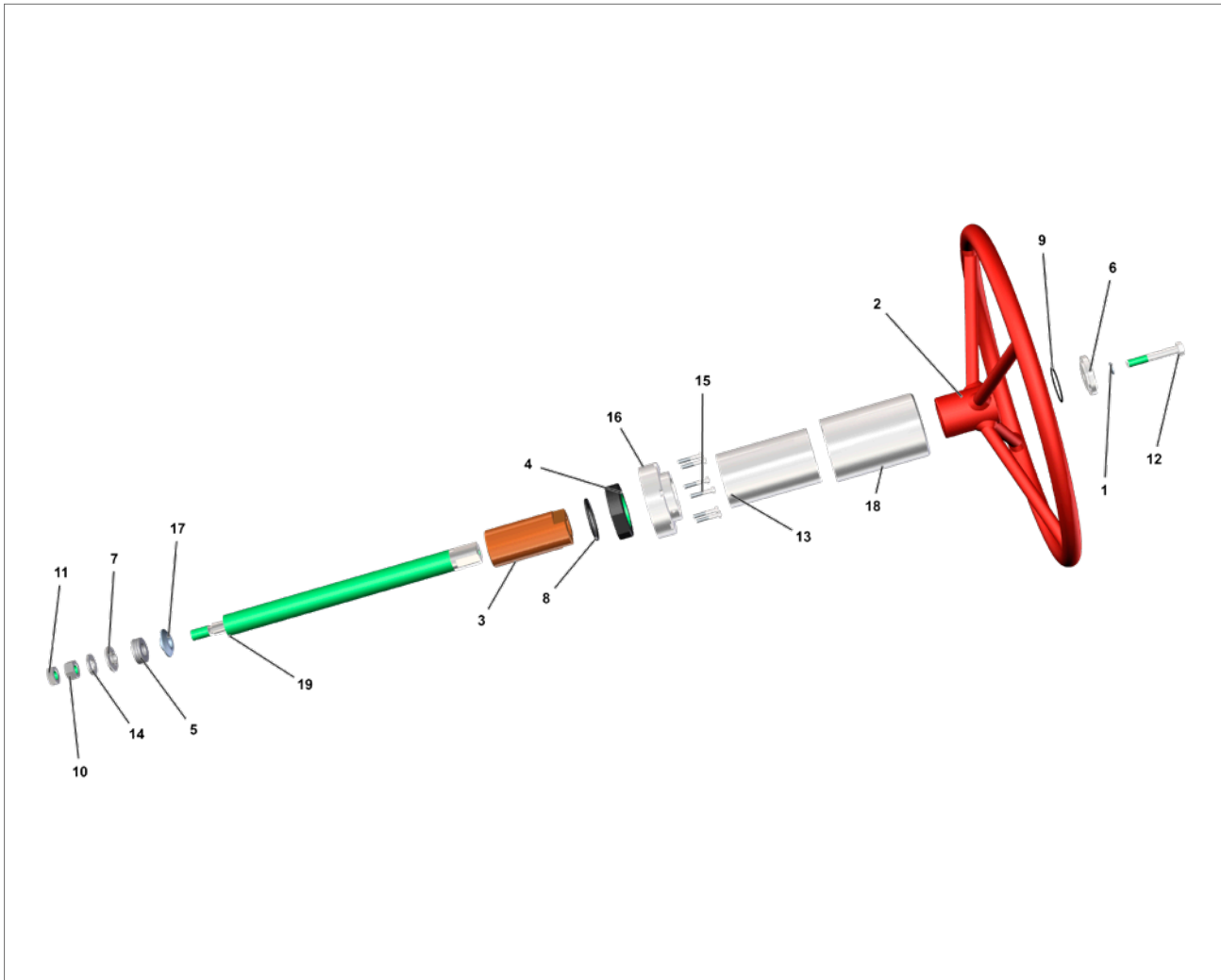


Fig 17.6 Mechanical manual override MH

| ITEM | DESCRIPTION | | QTY |
|------|---------------|---|-----|
| 1 | O-ring | ● | 1 |
| 2 | Handwheel | | 1 |
| 3 | Setting dowel | | 1 |
| 4 | Nut | | 1 |
| 5 | Bearing | | 1 |
| 6 | Cap | | 1 |
| 7 | Back plate | | 1 |
| 8 | O-ring | ● | 1 |
| 9 | O-ring | ● | 1 |
| 10 | Nut | | 1 |

| ITEM | DESCRIPTION | | QTY |
|------|-------------------|--|-----|
| 11 | Nut | | 1 |
| 12 | Screw | | 1 |
| 13 | Protective tube | | 1 |
| 14 | Washer | | 1 |
| 15 | Screw | | 6 |
| 16 | Unscrewing flange | | 1 |
| 17 | Flange | | 1 |
| 18 | Protective cap | | 1 |
| 19 | Jackscrew | | 1 |

● Recommended spare part

17. Part List

Mechanical manual override MH

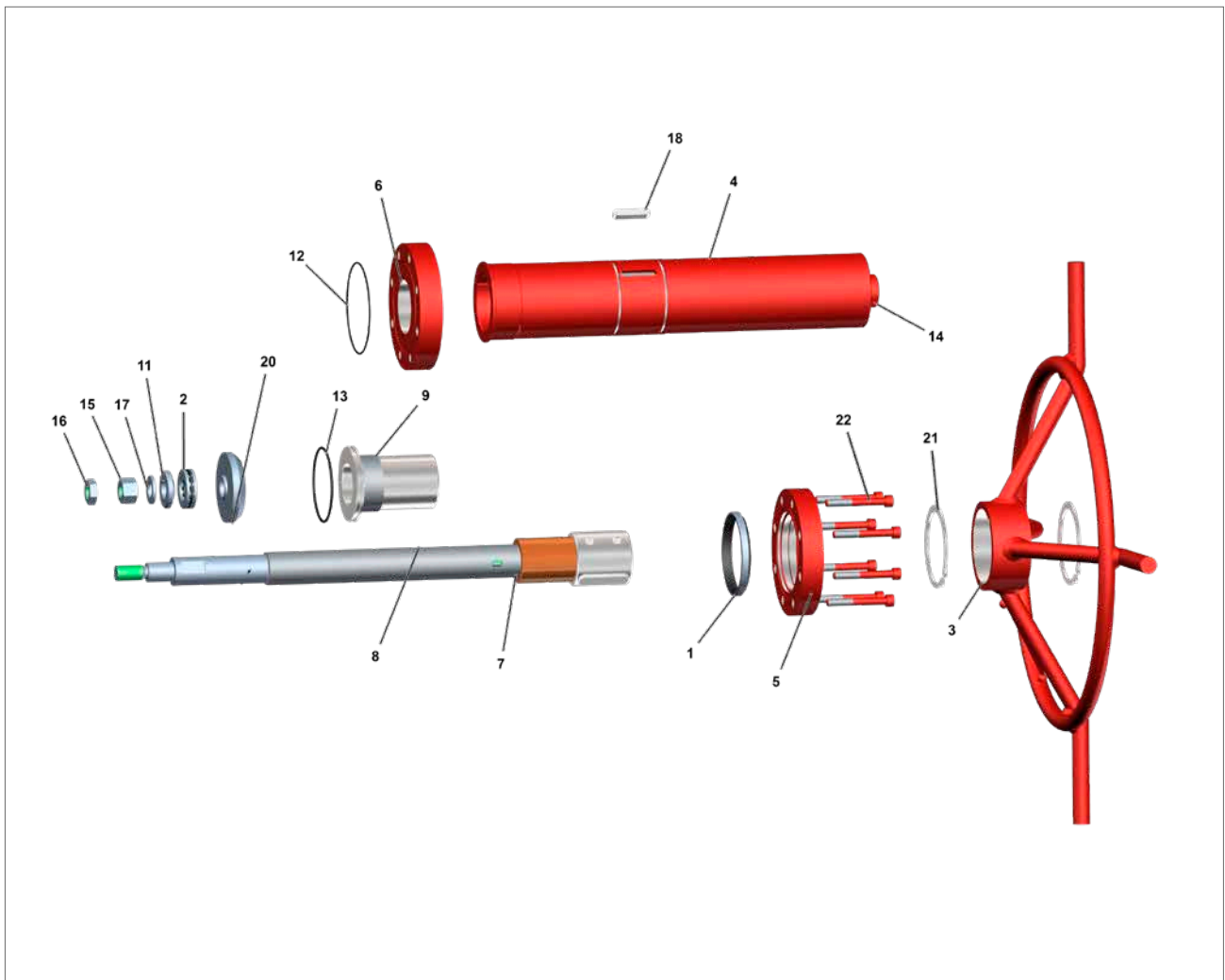


Fig 17.7 Mechanical manual override MH

| ITEM | DESCRIPTION | | QTY |
|------|-----------------|---|-----|
| 1 | Dust excluder | ● | 1 |
| 2 | Bearing | | 1 |
| 3 | Handwheel | | 1 |
| 4 | Protective tube | | 1 |
| 5 | Flange | | 1 |
| 6 | Flange | | 1 |
| 7 | Spindle nut | | 1 |
| 8 | Lead screw | | 1 |
| 9 | Ring nut | | 1 |
| 11 | Plate | | 1 |
| 12 | O-ring | ● | 1 |

| ITEM | DESCRIPTION | | QTY |
|------|-------------|---|-----|
| 13 | O-ring | ● | 1 |
| 14 | Cap | | 1 |
| 15 | Nut | | 1 |
| 16 | Nut | | 1 |
| 17 | Washer | | 1 |
| 18 | Key | | 2 |
| 20 | Plate | | 1 |
| 21 | Circlip | | 2 |
| 22 | Screw | | 8 |

● Recommended spare part

17. Part List

Mechanical manual override MHD

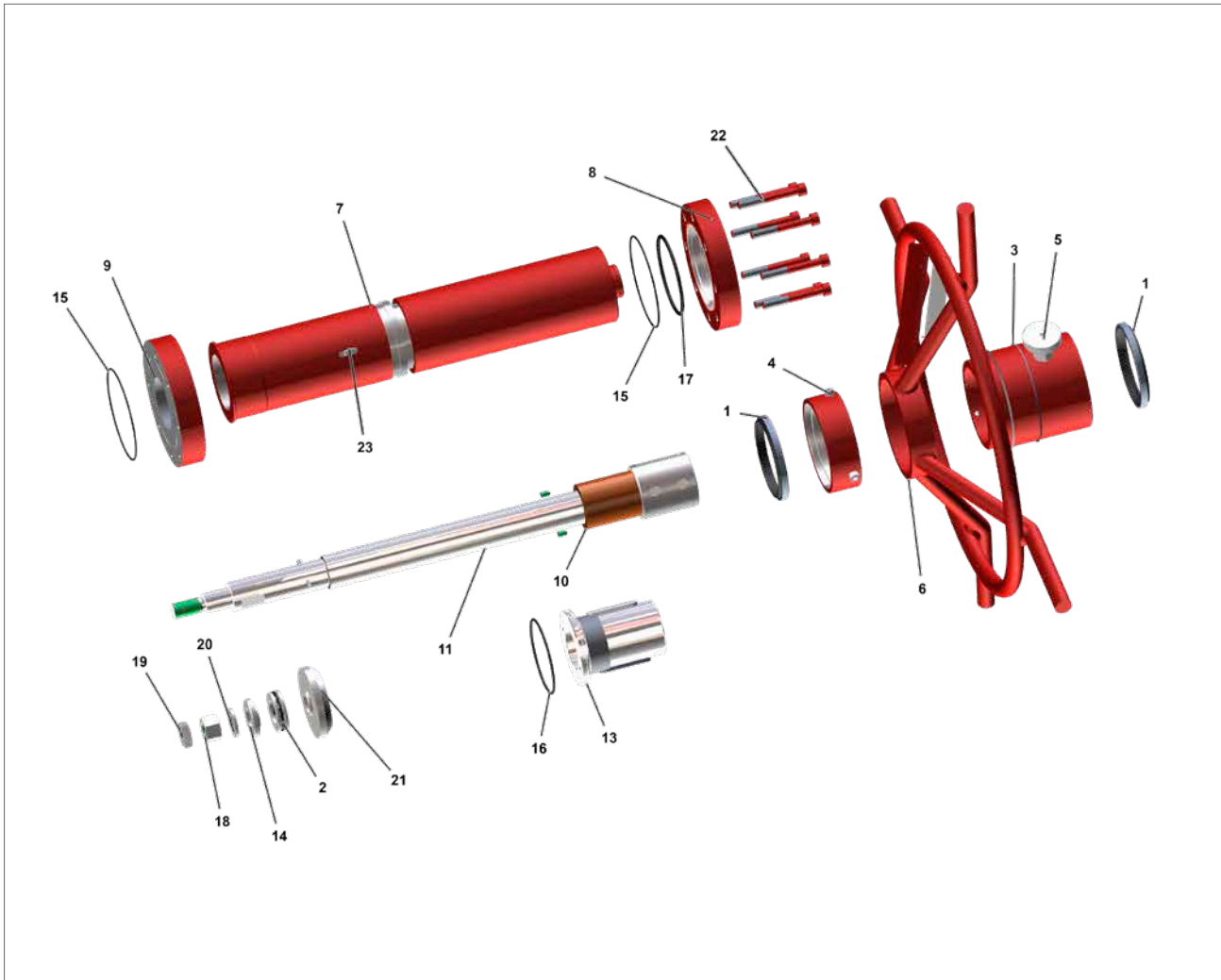


Fig 17.8 Mechanical manual override MHD

| ITEM | DESCRIPTION | QTY |
|------|-----------------|-----|
| 1 | Dust excluder | 2 |
| 2 | Bearing | 1 |
| 3 | Wheel hub | 1 |
| 4 | Screw | 3 |
| 5 | Knob | 1 |
| 6 | Handwheel | 1 |
| 7 | Protective tube | 1 |
| 8 | Flange | 1 |
| 9 | Flange | 1 |
| 10 | Spindle nut | 1 |
| 11 | Lead screw | 1 |
| 13 | Ring nut | 1 |

| ITEM | DESCRIPTION | QTY |
|------|-------------|-----|
| 14 | Plate | 1 |
| 15 | O-ring | 2 |
| 16 | O-ring | 1 |
| 17 | O-ring | 1 |
| 18 | Nut | 2 |
| 19 | Nut | 1 |
| 20 | Washer | 1 |
| 21 | Plate | 1 |
| 22 | Screw | 8 |
| 23 | Key | 2 |

● Recommended spare part

18. Grease and Hydraulic Oil Specification

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

18.1 Grease

Use following grease or equivalent to lubricate the manual override jackscrew and seals 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 |

18.2 Hydraulic Oil

Below is the standard oil specification for Rotork fluid powered actuator hydraulic manual override and hydraulic cylinders working at temperature between -20 °C and +100 °C for ATEX and non-ATEX application.

| | |
|---|-----------------|
| Manufacturer: | MOBIL |
| Trade Name: | DTE 10 EXCEL 32 |
| ISO Viscosity Grade: | 32 |
| Viscosity, ASTM D 445 cSt @ 40 °C cSt @ 100 °C | 32.7 6.63 |
| Viscosity Index, ASTM D 2270 | 164 |
| Brookfield Viscosity ASTM D 2983, cP @ -20°C | 1090 |
| Brookfield Viscosity ASTM D 2983 cP @ -30°C | 3360 |
| Brookfield Viscosity ASTM D 2983 cP @ -40°C | 14240 |
| Tapered Roller Bearing (CEC L-45-A-99), %Viscosity Loss | 5 |
| Density 15° C, ASTM D 4052, kg/L | 0.8468 |
| Copper Strip Corrosion, ASTM D 130, 3 hrs @ 100 °C | 1B |
| Rust Characteristics, ASTM D 665B | Pass |
| FZG Gear Test, DIN 51534, Fail Stage | 12 |
| Pour Point, °C, ASTM D 97 | -54 |
| Flash Point, °C, ASTM D 92 | 250 |
| Foam Sequence I, II, III, ASTM D 892, ml | 20/0 |
| Dielectric Strength, ASTM D877, kV | 49 |
| Acute Aquatic Toxicity (LC-50, OECD 203) | Pass |

18. Grease and Hydraulic Oil Specification

Below is the standard oil specification for Rotork fluid powered actuator hydraulic manual override and hydraulic cylinders working at temperature between -40 °C and +100 °C for ATEX and non-ATEX application.

| | |
|--|-----------------|
| Manufacturer: | MOBIL |
| Trade Name: | DTE 10 EXCEL 15 |
| ISO Viscosity Grade: | 15 |
| Viscosity, ASTM D 445 cSt @ 40 °C cSt @ 100 °C | 15.8 4.07 |
| Viscosity Index, ASTM D 2270 | 158 |
| Brookfield Viscosity ASTM D 2983 cP @ -40 °C | 2620 |
| Tapered Roller Bearing (CEC L-45-A-99), %Viscosity Loss | 5 |
| Density 15 °C, ASTM D 4052, kg/L | 0.8375 |
| Copper Strip Corrosion, ASTM D 130, 3 hrs @ 100 °C | 1B |
| Pour Point, °C, ASTM D 97 | -54 |
| Flash Point, °C, ASTM D 92 | 182 |
| Foam Sequence I, II, III, ASTM D 892, ml | 20/0 |
| Dielectric Strength, ASTM D877, kV | 45 |
| Acute Aquatic Toxicity (LC-50, OECD 203) | Pass |

Below is the standard oil specification for Rotork fluid powered actuator hydraulic manual override and hydraulic cylinders working at temperature between -60 °C and +90 °C for ATEX and non-ATEX application.

| | |
|---|------------------|
| Manufacturer: | TECCEM |
| Trade Name: | SynTop 1003 FG |
| ISO Viscosity Grade: | 3 |
| Viscosity, ASTM D 445 cSt @ -40 °C cSt @ -55 °C cSt @ 40 °C | 73 2.6 3.2 |
| Pour Point, °C, ASTM D 97 | -88 °C |
| Flash Point, °C, ASTM D 92 | 140 °C |
| Density 20° C, kg/L | 0.86 |

An alternative oil may have been specified for your application. Please refer to the job specific documentation.

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PUB020-014-00
Issue 02/22

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