rotork®

Keeping the World Flowing
for Future Generations

LH/D range

Installation, commissioning
and maintenance manual

Double-acting pneumatic actuators

Contents

Section			Page
1.	**Introduction**		**03**
2.	**Standards and regulations**		**03**
3.	**General information**		**04**
4.	**Health and safety**		**05**
	4.1	Residual risks	05
	4.2	Thermal risks	05
	4.3	Noise	05
	4.4	Health risks	05
	4.5	Mechanical risks	05
5.	**Labels and nameplates**		**05**
6.	**Operating limits**		**06**
	6.1	Allowed fluid types	06
	6.2	Expected lifetime	06
	6.3	Tightening torque chart	06
7.	**Handling & lifting**		**07**
	7.1	Handling	07
	7.2	Lifting recommendations	07
	7.3	Lifting instructions	07
8.	**Storage**		**08**
9.	**Long-term storage**		**08**
10.	**Installation on valve and earthing**		**09**
	10.1	General	09
	10.2	Preliminary actions	09
	10.3	Instructions	09
	10.4	Assembly configurations	10

Section			Page
11.	**Removal from valve**		**10**
12.	**Operation**		**11**
	12.1	Actuator operating description	12
	12.2	Manual override	12
	12.3	Operation with hydraulic pump	13
	12.4	Linear stroke setting	14
	12.5	Hydraulic power supply	15
	12.6	Hydraulic connections	15
	12.7	Electrical connections	16
	12.8	Start up	16
13.	**Dismantling and disposal**		**17**
14.	**Rotork sales and service**		**17**
15.	**Troubleshooting**		**18**
16.	**Periodic maintenance**		**19**
	16.1	Hydraulic cylinder seals replacement	20
	16.2	Hydraulic piston and piston rod seals assembling instructions	25
17.	**Grease and hydraulic oil specifications**		**27**
	17.1	Grease	27
	17.2	Hydraulic oil specification	28
18.	**Appendix A – Sectional drawings**		**30**

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

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

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

1. Introduction

This manual is produced to enable a competent user to install, operate, adjust, inspect, maintain, dismantle and dispose Rotork LH/D series actuators.

Work safety implies the observance of all the safety warnings and instructions contained herein.

All Rotork actuators are tested prior to dispatch. Project documentation is shipped with the actuator.

Up-to-date general information on Rotork products is available on our website www.rotork.com.

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


Generic danger


Hand crush/pinch point


Electrocution


Explosive material


Toxic substance

Customer service

For technical assistance, please contact Rotork customer service:

E-mail: rfs.internationalservice@rotork.com

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

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

When contacting customer service, specify the serial number and the actuator model.

This information is visible on the nameplate located on the adapter spool (See Section 5). Customer service can then quickly identify the supplied actuator.

Rotork offers a vast range of services, such as preventive maintenance, revision of actuators or training.

2. Standards and regulations

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

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

3. General information

This manual is produced to enable a competent user to install, operate and maintain the Rotork LH/D actuator.

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

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

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

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

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

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

Appropriate usage

Rotork LH/D range actuators have been specifically developed to automate quarter-turn valves, such as ball valves, butterfly valves or plug valves installed on pipelines for oil & gas transport and distribution.

⚠ **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.**

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

IECEx certification

The IECEx EUT 25.0021X Certificate of Conformity (CoC) only covers non-electrical actuators described here. Any kind of assembly created by the end user or electrical accessories are not covered by this CoC.

The end user must follow special conditions for safe use detailed in document PUB010-046.

IECEx marking of LH actuators is as follows:

Ex h IIC T5 Gb
Ex h IIIC T100°C Db
Tambient down to -40°C, up to +100°C

Please refer to the actuator IECEx nameplate.

4. Health and safety

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

4.1 Residual risks

Residual risks resulting from equipment risk evaluation performed by Rotork.

4.2 Thermal risks

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

4.3 Noise

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

4.4 Health risks

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

4.5 Mechanical risks

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

5. Labels and nameplates

The following label is applied externally to the actuator:

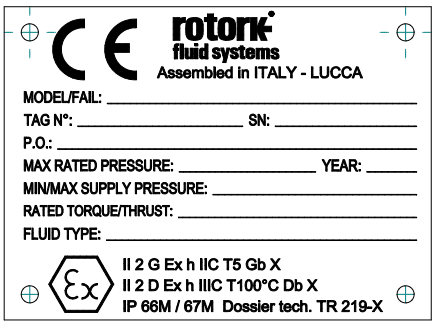


Fig 5.1 Actuator label

EX type of protection: constructional safety "c".

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

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

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

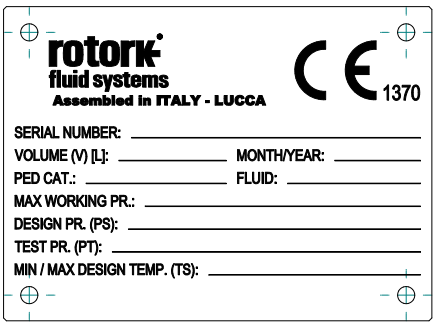


Fig 5.2 Actuator PED label

Label removal is not allowed.

Temperature: -30 to +100 °C (-22 to +212 °F) for standard applications
-20 to +100 °C (-4 to +212 °F) for PED applications
-40 to +100 °C (-40 to +212 °F) for low temperatures
-60 to +100 °C (-76 to +212 °F) for ultra-low temperatures

Design pressure: up to 250 barg, refer to job documentation.

Operating pressure: refer to job documentation.

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

Prevent external surface temperature from reaching 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 exceed 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

RH actuators are designed to be operated with hydraulic oil ISO 4406 class 16/14/11.

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

6.2 Expected lifetime

The expected lifetime is at least 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

⚠ This tightening torque table is not applicable to Section 10.2. When installing actuator on the valve, tighten bolts or nuts of the connecting stud bolts to the correct torque, in accordance with the size and material characteristics of the bolts installed by the customer.

7.1 Handling

The actuator is supplied packed on pallets suitable for normal handling. Handle the actuator with care to avoid damaging the actuator assembly. Never stack pallets.

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

7.2 Lifting recommendations

Lift the actuator using the double chain slings; harness the actuator as shown in Fig 7.2. Adjust the chains to keep the actuator in vertical position.

- The lifting device and the sling must be suitable rated for the actuator weight and dimensions
- The sling must be in a good state at all times, to prevent injuries and/or accidents. Do not use damaged slings
- The sling must not be shortened with knots or bolts or any other makeshift device; hooks that make part of the slings should always be used for shortening
- 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. Only lift the actuator/valve assembly using the valve 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.**

7.3 Lifting instructions

NOTE: Actuator weight, dimensions and the centre of gravity are contained within the documentation supplied for the specific job. Personnel operating the actuator or parts of it must consult all the documentation before performing any operations.

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

- Prior to lifting the actuator, remove electrical power and vent all pressure vessels (if present)
- Angle β must be between 0° and 45° as shown in Fig 7.1

⚠ **The actuator must remain vertical; balance the load. Use only main lifting lugs.**

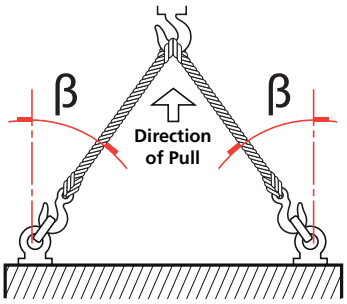


Fig 7.1 Lifting angle

Fig 7.2 Actuator lifting

8. Storage

Rotork actuators have been fully tested before leaving the factory.

In order to keep the 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 packaging 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

IMPORTANT – The hydraulic power unit, the hydraulic pipe and the fitting used for operating the actuator must be flushed and cleaned to ISO 4406 Class 17/15/12 prior to connecting to the actuator.

- Cycle the actuator with a hydraulic oil supply, ISO 440, CLASS 17/15/12 as minimum cleanliness level, 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 5 times
- Cycle the actuator fitted with hydraulic manual override by means of the override for 4 complete strokes
- Disconnect the hydraulic 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

10.1 General

Before proceeding, read and follow out the health and safety information in Section 4.

Before assembling the actuator on the valve, verify that the valve is well-fixed and able to support the weight of the actuator.

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

10.2 Preliminary actions

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

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

- Ensure that the coupling dimensions of the valve, flange and stem meet the actuator coupling dimensions.
- Clean the valve and actuator coupling flanges, removing anything that might prevent electrical connection and adherence to the actuator flange interface: grease and paint residuals must be completely removed, if present.
- Place the valve stem in a vertical position to facilitate assembling.
- The actuator is supplied with piston rod fully extended. Ensure that the actuator and valve have the same position, before proceeding with the assembling.
- 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 minimise repetitive stress induced the dynamics of the pipeline. Ensure there are no leaks from any gas connections. Tighten as required.

⚠ Verify the EX classification of the actuator is compatible with the plant zoning. Refer to actuator nameplate. The end user shall guarantee the valve earthing and the equal voltage potential between the valve and the actuator.

10.3 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:

- The actuator is supplied with the spool piece installed – do not remove it
- Clean the valve and actuator coupling flanges, removing anything that might prevent electrical connection and adherence to the actuator flange interface: grease and paint residuals must be completely removed, if present
- 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

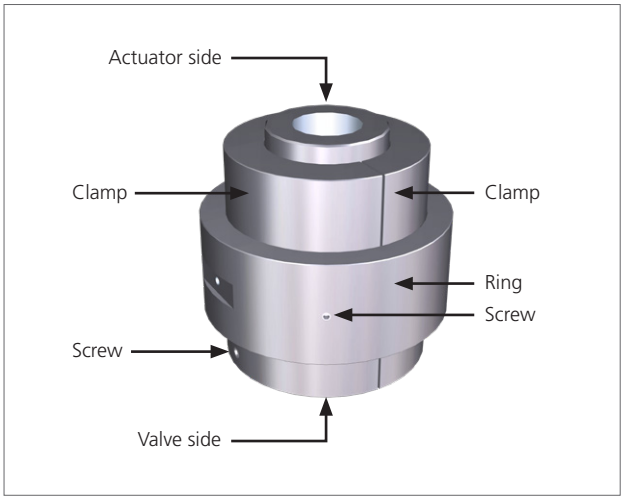


Fig 10.1 Standard coupling parts

- 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

10. Installation on valve and earthing

- Clean and degrease the coupling bolts, stud bolts, nuts and the threads on adapter spool bottom flange (if stud bolts are not installed). Apply a thin layer of thread sealing product (Loxeal 55.03 or equivalent Loctite 243) on threaded connection
- 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

⚠ **Attention: End user should verify the electrical correctness of coupling, performing a standard continuity test between actuator and valve.**

10.4 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 LH/D series actuators are hydraulic double-acting actuators specifically designed to operate gate or globe valves.

Actuator design characteristics are shown on the data plate attached to the actuator itself.

These actuators can be fitted with an emergency manual override suitable to operate the actuator in the event of fluid supply failure. This device is of hydraulic type, operated using a hydraulic hand pump.

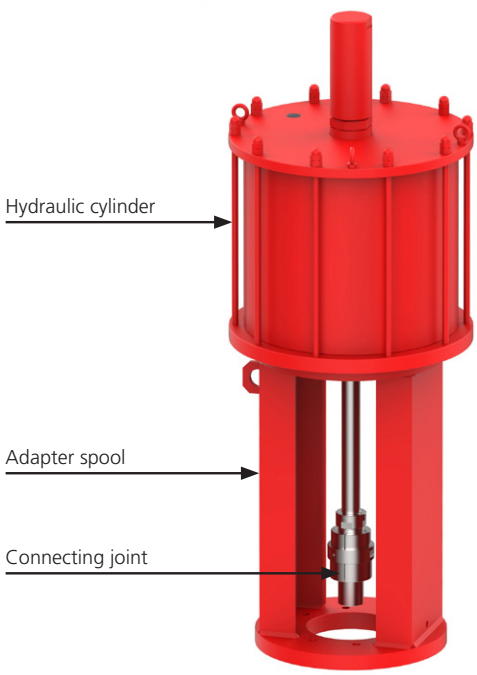


Fig 12.1 LH/D actuator basic components

The main components of these units are the following (See Fig 12.1 and Appendix A)

- A hydraulic 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 floating seal and guide sliding rings allow for friction reduction which avoid sticking, even after long standstill periods.

  A chromium-plated piston rod ensures a perfectly dynamic seal, 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.

- An adapter spool open type made in carbon steel, with bottom flange machined according to the valve flange. Spool is removable from the cylinder. 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, LH/D series actuators can be equipped with additional accessories (mechanical travel stoppers, limit switch box boxes, positioners, position transmitters, etc.).

Use only control devices supplied by Rotork.

⚠ Installation of any accessory on the bare actuator must preserve the actuator ingress protection level.

⚠ Installation must be performed according to IEC 60079-14 and the end user must follow special conditions for safe use detailed in document PUB010-046.

⚠ The IECEx EUT 25.0021X Certificate of Conformity (CoC) only covers non-electrical actuators described here. Any kind of assembly created by the end user or electrical accessories are not covered by this CoC.

The end user must follow special conditions for safe use detailed in document PUB010-046.

12.1 Actuator operating description

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

In case of use of LH/D actuators in SIL applications the System Integrator must fulfill all requirements reported in par. 11.2.11 of standard IEC61511-1.

12.2 Manual override

The LH/D series actuator can be fitted with a hydraulic manual override (HP1 type) suitable to operate the valve in case of fluid supply failure.

⚠ 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 this paragraph.

Description

Refer to Fig.12.2. The unit consists of two main components:

- The pump/tank assembly (2)
- 3/2 Local /remote selector valve (3, 10)

The hand pump (7) supplies high-pressure fluid to either side of the hydraulic cylinder depending on the position of the pump's open/close selector valve (3).

The selector valve handle is moved from a disengaged centre position to left or right. This will pressurise the selected cylinder chamber, to allow the actuator manual stroking.

The selector valves (10) are used to select between remote/ manual operation.

With the selector valves (10) in the position as shown in Fig 12.2, the actuator can only be operated from remote.

Installation

The pump/tank assembly must be installed in a vertical position with respect to the floor. The fill port/breather (9) must be turned upward to avoid any oil discharge from the fill port/breather.

Note: Before the actuator is started-up with a hydraulic override, verify if breather (9) has been replaced with a plug to prevent oil discharge from the tank during shipment. If so, replace the plug with the breather.

Regular 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 piston rod in the fully retracted position.

Filling procedure

If the actuator is shipped without oil in the hydraulic manual override, please refer to filling procedure described in PM-LH-005.

12.3 Operation with hydraulic pump

Manual operation

- The hydraulic bypass valve (8) must be in the closed position
- For HPC overrides, the Local/Remote selector valve (10) must be in the Local position
- Selection of operating direction is made by moving the Open/Close selector valve (3) toward the end of the cylinder to be pressurised
- If the actuator is fitted with optional flow control valves (11/12), the valve in the return line for the cylinder side being exhausted must be Open
- Operating the pump (7) will stroke the actuator
- When manual operation is complete, return the Open/Close selector to the middle position and the hydraulic bypass valve to the Open position
- For HPC overrides, the Local/Remote selector valve (10) must be returned to the Remote position

Power operation

- The hydraulic bypass valve (8) must be in the Open position
- For HPC overrides, the Local/Remote selector valve (10) must be in the Remote position.
- The Open/Close selector valve (3) must be in the middle position
- If the actuator is fitted with optional flow controls (11/12), they must be Open. The amount the flow controls are open will affect the remote operation speed. The flow controls can also be closed to lock the actuator in last position

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

Table 1: HP override for double-acting actuators

ITEM	DESCRIPTION
1	Hydraulic cylinder
2	Hydraulic manual override assembly
3	Open/Close selector valve
4	Pressure relief valve (factory set)
5	Hydraulic reservoir
6	Drain plug
7	HP push/pull pump
8	Hydraulic bypass valve
9	Fill port / vented plug
10	Local/Remote selector valve (HPC only)
11	Adjustable flow control valve (optional)
12	Adjustable flow control valve (optional)

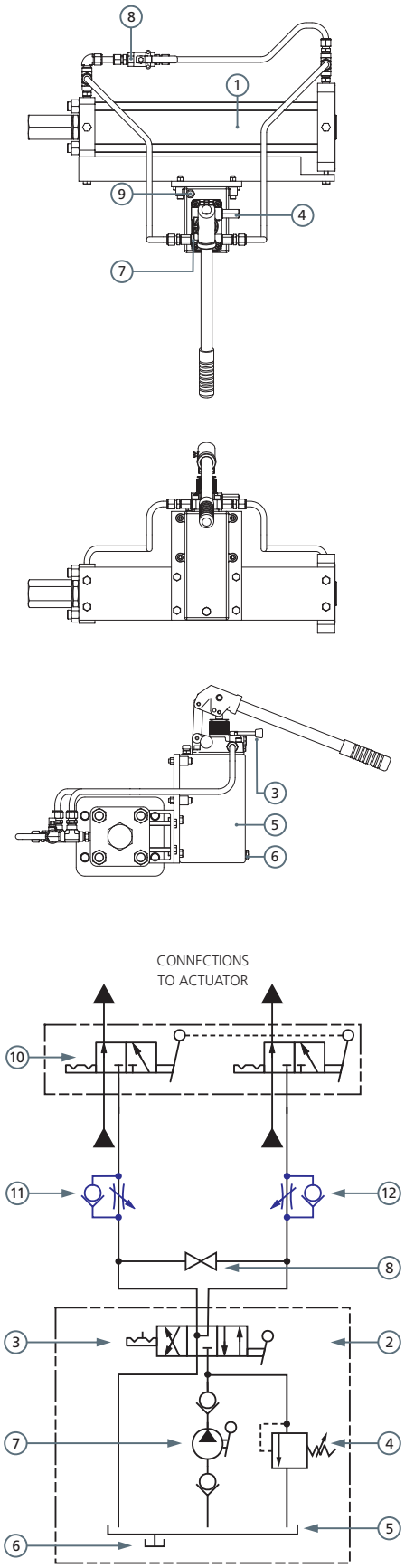


Fig 12.2

12.4 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.

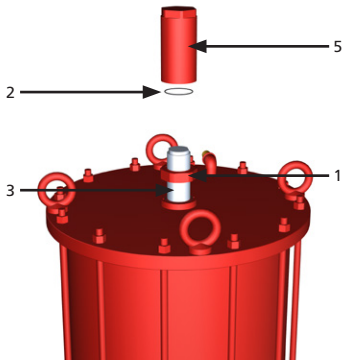
⚠ An incorrect setting of angular stroke could cause damages to the actuator, valve and/or to personnel.

⚠ During the angular stroke setting procedure, an oil leakage from the stop bolt is expected.

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 pressurise 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

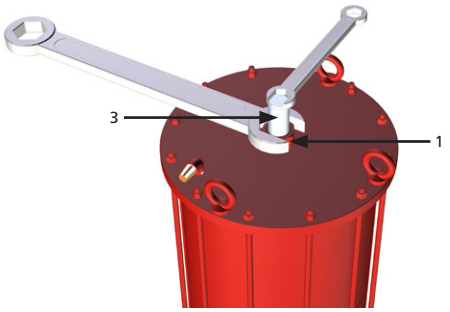
H. Repeat operations E to G, until the desired stroke is obtained

I. With the help of a suitable size wrench, rotate the stop bolt (3) clockwise to decrease the stroke

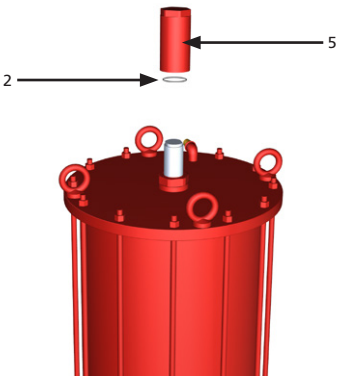
J. Remove the pressure

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)

NOTE: for some cylinder sizes O-rings (2) are replaced by seal washers – the above procedure is applicable as well.

12.5 Hydraulic power supply

Verify allowed supply pressure range on actuator label.

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

12.6 Hydraulic connections

Preliminary operations:

A. Verify sizes of pipes and fittings per applicable plant specifications

B. Clean the inside of the connection pipes by washing them with a suitable detergent and by blowing air into them

C. 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 (Loxeal 56-14 or equivalent) to ensure a good seal.

⚠ **Connect the hydraulic power source in accordance to the applicable operating diagram, please refer to specific job for details.**

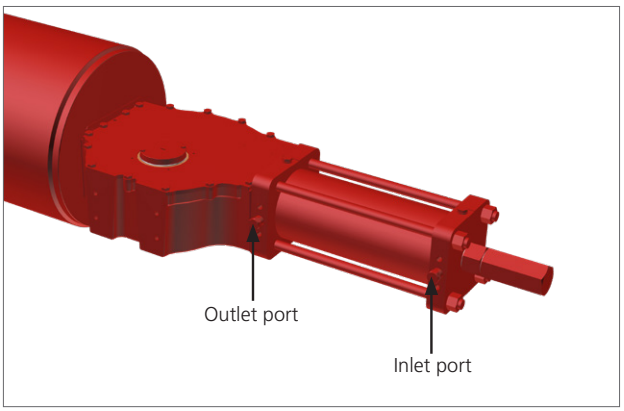


Fig 12.3 Inlet/outlet port for single-acting actuator

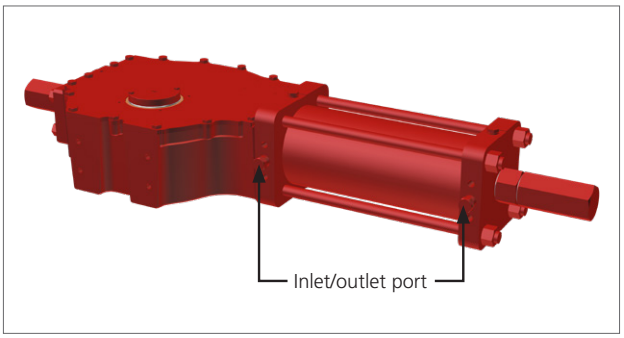


Fig 12.4 Inlet exhaust port for double-acting actuator

12.7 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 must 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 the power supply
- Remove the plastic protection plugs from the cable entries
- Use only appropriately-certified reduction fittings, cable glands, fittings and explosionproof cables
- The cable glands must be tightened in the threaded inlets, to guarantee the waterproof and explosion 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 per the electric power demand
- Insert the connection cables through cable glands and perform assembly per 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.

⚠ Installation must be performed according to IEC 60079-14 and the end user must follow special conditions for safe use detailed in document PUB010-046.

12.8 Start up

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

- The 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 per the plant requirements
- Hydraulic 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. The final user shall indicate and maintain the grounding connections on the actuator.

13. Dismantling and disposal

Rotork actuators are designed and built to provide a long life. At the end of their operative life, they will have to be removed from the valve and subsequently disposed of.

⚠ Prior to dismounting the actuator, depressurise the system, if still under pressure. Verify if the hydraulic accumulator (if applicable) is depressurised, otherwise slowly open the drain valve and discharge the oil from the accumulator. Use the gas charging and testing devices to release any remaining.

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

- Actuators are built-in modules and this facilitates dismounting.
- Dismount the actuator and separate the various sections and 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.
- Electrical components are to be separately disposed of on specialised 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 one of the highest levels of service in the flow control industry. Contact your local Rotork representative or the factory directly at the address on the nameplate, quoting the actuator type and serial number.

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

15. Troubleshooting

ID	FAILURE	POSSIBLE CAUSES	CORRECTIVE MEASURES
1	Erratic movement	• Irregular supply of operating medium	• Check operating medium for consistent supply pressure and correct as necessary.
		• Worn parts	• Dismantle. Visually inspect for significant wear. Actuator replacement may be required.
		• Faulty control panel equipment (if present)	• Contact Rotork customer service
		• Faulty pipeline valve	• Consult the valve manufacturer's documentation.
2	Incorrect valve position	• Incorrect signal from limit switches (if present)	• Check limit switch position.
		• Fault of pipeline valve	• Consult the valve manufacturer's documentation
3	Insufficient valve stroke	• Insufficient air supply to produce the stroke	• Increase air supply flow
		• Debris left in the cylinder during maintenance	• Disassemble the cylinder to remove debris. Reassemble the cylinder. (See Section 16.1)
		• Fault of pipeline valve	• Consult the valve manufacture's documentation
4	Leakages from cylinder	• Worn seals	• Disassemble the cylinder and replace the seals. Reassemble the cylinder. (See Section 16.1).
5	Loss of power	• Inadequate supply pressure	• 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.
		• Incorrect speed control settings	• Adjust the speed controls to increase or decrease the flow.
		• Pipe work blocked, crushed or leaking	• Examine the pipework for blockages, crushed pipes or leakages. Clear or replace as necessary.
		• Fault of control panel equipment (If present)	• Contact the Rotork customer service
		• High valve thrust or sizing	• Consult the valve manufacturer's documentation
		• If occurs from the pneumatic cylinder:	• Disassemble the cylinder module and replace the seals. Reassemble the cylinder. (See Section 16.1).

For other problems please contact Rotork customer service

16. Periodic maintenance

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

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

Periodic maintenance schedule

MAINTENANCE ACTIVITY	PERIODICITY		REFERENCE
	Months	Years	
Visual check of external components and control groups	6*	*	
Verify welding. In case of anomalies contact Rotork	6*	*	
Breather cleaning	6*	*	
Check hydraulic connections for leaks. Tighten pipe fittings as required	-	1*	
Cleaning	-	1*	
Visual check of painting. Verify absence of damages. Repair if necessary per painting specification	-	1*	
Functional test	-	1*	
Functional test by manual override	-	1*	
Check electrical components (if present) and grounding connections	-	1*	
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*	
Double-acting actuator hand pump oil replacement (if present)	-	5*	
Hydraulic cylinder and centre body seals replacement (single- and double-acting actuator)	-	5*	See Section 16.1

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

For functional safety applications refer to safety manual.

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

16.1 Hydraulic cylinder seals replacement

Preparation

- Remove the actuator from the valve (see Section 11).
- The actuator modules are to be disassembled in a clean area, free of dust.
- Place the actuator in a vertical and in a stable position, on the wooden supports.
- Remove any component (control panel, and other component fitted to the actuator) that hinder the cylinder removal (refer to the project-specific documentation for the details).

Hydraulic cylinder removal

(See Fig 16.1)

- Hook the double chain slings on the eye bolts on the cylinder end flange.
- Unscrew bolts (7) they must be gradually unscrewed all at the same time.
- Lift and remove the cylinder from the adapter spool.

Hydraulic cylinder disassembly

See Fig 16.2

- Drain the hydraulic oil from the cylinder by removing drain plugs (9 & 17) from the cylinder head and end flange.
- Unscrew set screw (3) from joint (6).

Important: Remove the possible dents caused by the set screw on the stem thread by means of the drill.

- Hold stem (7) with a wrench placed on the stem flats and then unscrew joint (6) with a hook wrench with round noses.
- Unscrew and remove hex socket bolts (32) and remove centring ring (31).
- Unscrew plug (20).

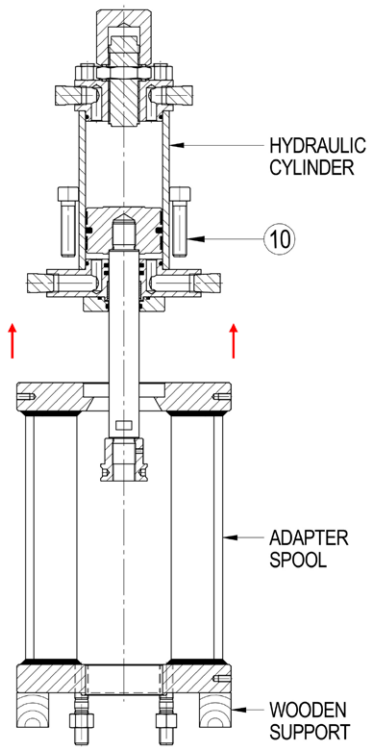


Fig 16.1 Hydraulic cylinder removal

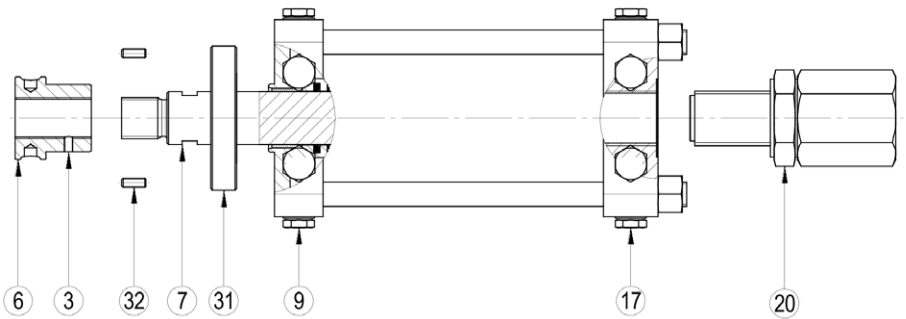


Fig 16.2 Joint and centering ring removal

See Fig 16.3

- Unscrew nuts (18) from tie rods (15).
- Remove end flange (16) from the cylinder tube.
- Remove cylinder tube (14).
- Screw two eyebolts into piston (13).
- Hook the double chain slings onto the eye bolts.
- Lift piston (13) and slide off piston rod (7) from head flange (8).

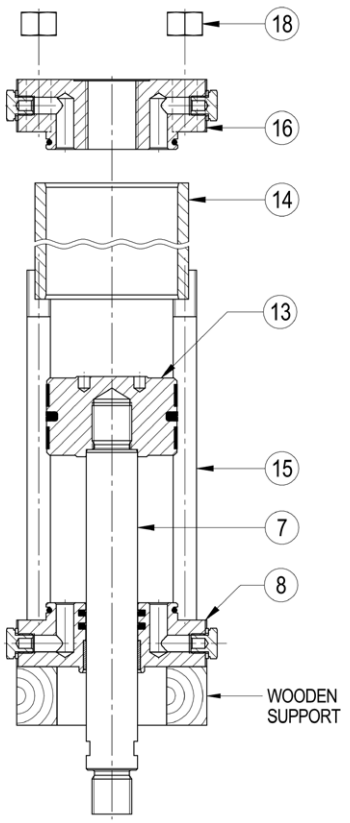


Fig 16.3 Cylinder disassembly

Piston/piston rod disassembly

See Fig 16.4

- Hold piston (13).
- Unscrew piston rod (7) from the piston, using a open end wrench.

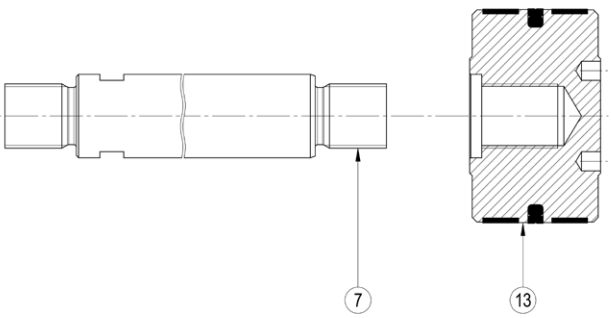


Fig 16.4 Piston/piston rod disassembly

Seals replacement

See Fig 16.5

- Remove O-ring (33) and scraper ring (34) from centring ring (31).
- Remove O-ring (24), back-up rings (if present), seals (28) and sliding bush (30) from head flange (8).
- Remove seal (12), and sliding rings (11) from piston (13).
- Remove O-ring (22) and back-up rings (if present) from end flange (16).
- Remove O-ring (21) from plug (20).
- Check if sliding bushing (30) is in a good condition otherwise replace it.
- Carefully clean the seals grove.

All the removed parts should be thoroughly cleaned, inspected and de-burred as necessary.

Replace all the aforementioned seals and lubricate them with a grease film.

Lubricate all sliding parts.

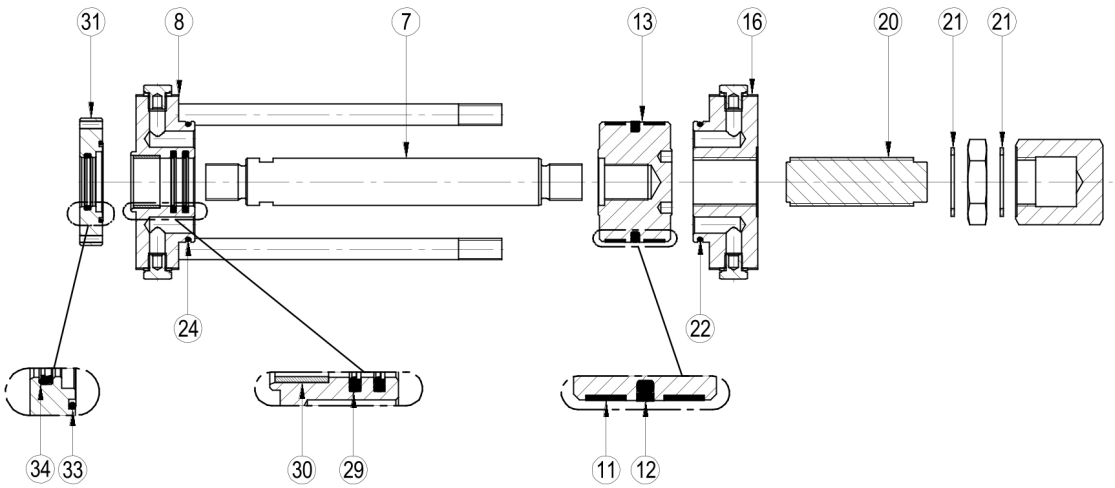


Fig 16.5 Seals replacement

Piston/piston rod preassembly

See Fig 16.6

- Hold piston (13).
- Screw piston rod (7) into the piston, using a open end wrench.

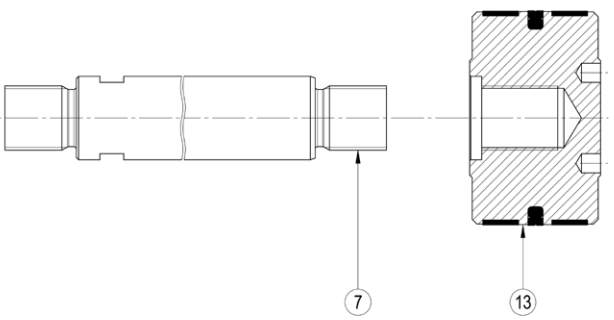


Fig 16.6 Piston/piston rod preassembly

Cylinder reassembly

See Fig 16.7

- Install piston rod (7) by sliding it into head flange (8).
- Remove eye bolts from piston (13).
- Install cylinder tube (14) on head flange (8) by sliding it over piston (13).
- Install end flange by centering it on the inside diameter of cylinder tube (14).
- Assemble hex nut (18) onto tie rod (15).
- Tighten the nut to the recommended torque (see Section 6.3), following a "cross bolt torque tightening" sequence.

See Fig 16.8

- Install the plug (20) into the end flange.
- Assemble hex plugs (9 &17).
- Install the centering ring (31) onto the head flange and tighten the hex socket bolts (32).
- Install joint (6) onto piston rod (7).
- Hold stem (7) with a wrench and tighten joint (6) with a hook wrench with round noses.
- Fasten the joint to the piston rod with set screw (3).

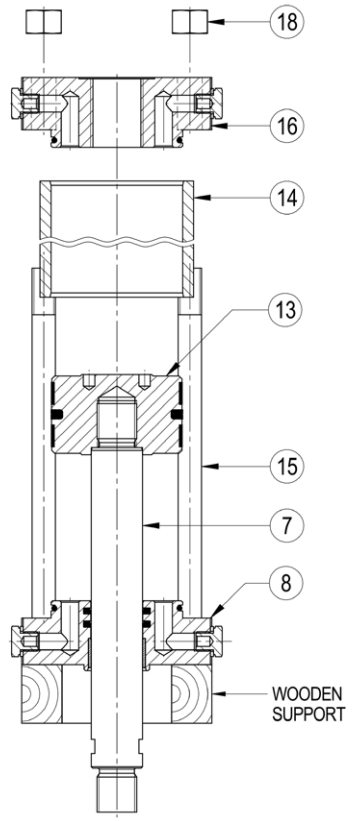


Fig 16.7 Cylinder reassembly

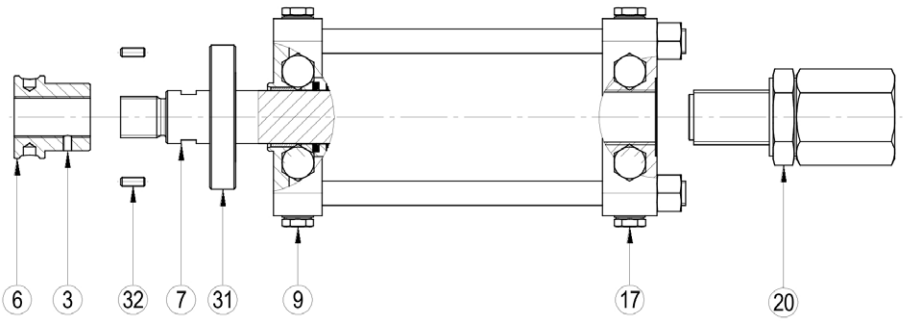


Fig 16.8 Centring ring and joint reassembly

Flushing and testing

Before assembling the hydraulic cylinder onto the adapter spool, it is necessary to flush the cylinder.

Connect the cylinder to the flushing unit and flush the cylinder until the ISO 4406, class 17/15/12 cleanliness level has been achieved.

Check if the cylinder works smoothly and continuously and if there are any leakages through the seals.

Disconnect the flushing unit from the cylinder and plug the connections.

Cylinder reinstallation

See Fig 16.9

- Place the cylinder onto the adapter spool.
- Fasten the cylinder by screwing the bolts (10). Tighten the bolts to the recommended torque (see Section 6.3), following a "cross bolt torque tightening" sequence.

Final reassembly and testing

- Assemble the removed components (e.g. control panel) if any.

The actuator must be tested before it is assembled on the valve.

- Place the actuator in a stable position.
- Connect a portable hydraulic power unit to the cylinder and cycle the actuator several times, in order to check if it works smoothly and if there are any leakages through the seals.

Important – The hydraulic power unit, hydraulic pipe and fitting used for operating the cylinder must be flushed and cleaned to a minimum of ISO 4406 Class 17/15/12 cleanliness level prior to connecting to the cylinder.

- Check if the painted parts have been damaged during disassembly and/or reassembly. If necessary, repaint them in accordance with the applicable painting specifications.

The actuator is now ready to be assembled on the valve.

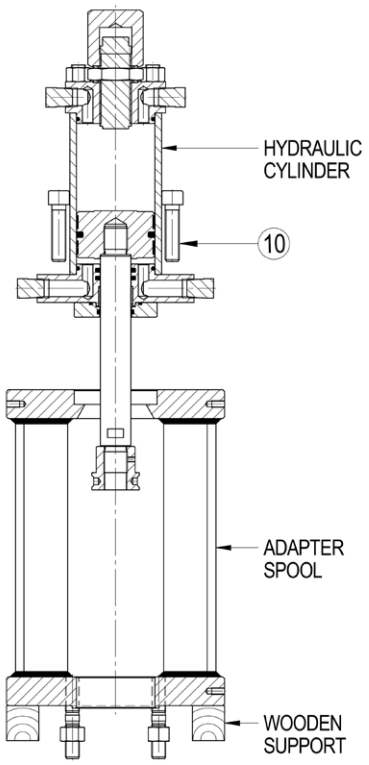


Fig 16.9 Cylinder reinstallation

16.2 Hydraulic piston and piston rod seals assembling instructions

Fig 16.10 Piston seal

Piston seals installation

Install the new piston seal as follows:

See Fig 16.23

A. Assemble the O-ring as deep as possible in the groove, paying attention not to damage it.

   Heat the Glyd Ring (in some oil or water or with a hot air fan) to approximately +80 to +100°C to make it more elastic and to widen it more easily so it fits on the piston

B. Assemble the Glyd Ring using the installation aids (if available) or by hand. Once it has been mounted, size the Glyd Ring with the appropriate sizing sleeve or insert it into the cylinder by hand. It will shrink back into its original form. Use no sharp edged tools to expand the ring.

C. Assemble the Quad Ring into the Glyd Ring without intertwining them.

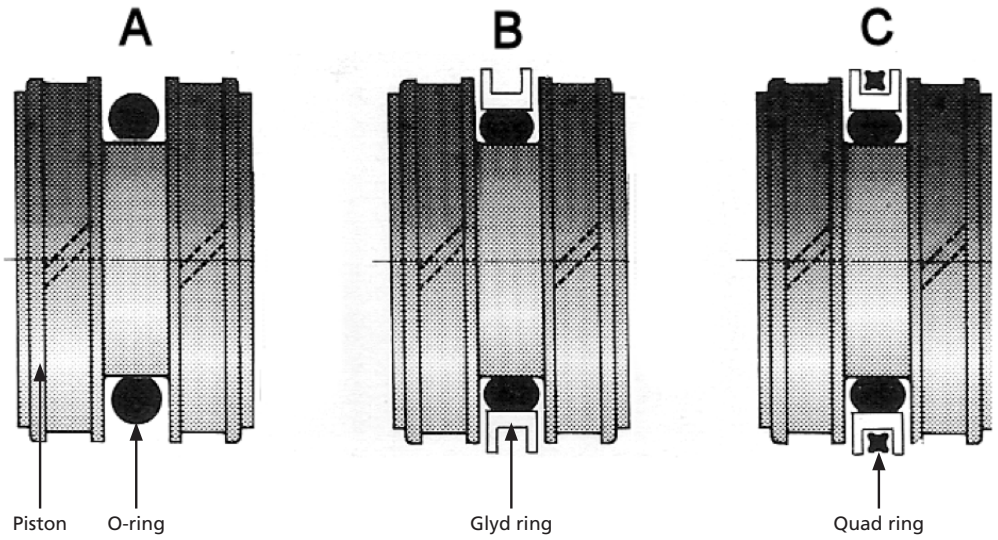


Fig 16.11 Piston seal installation

Piston rod seals installation

Install the new piston rod seal as follows:

- Remove the O-ring from the seal and place it into the groove.
- Fold the seal ring as illustrated in Fig 16.13. The seal must have no sharp bends.
- Place the seal ring in compressed form into the groove and push against the O-ring in the direction of the arrow as shown in Fig 16.14.

Fig 16.12 Piston rod seal

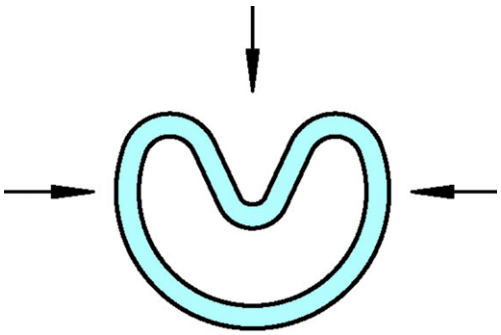


Fig 16.13 Deformation of the seal ring

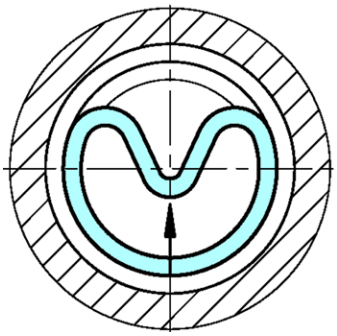


Fig 16.14 Seal ring installation

Note: Care should be taken to ensure that the seal ring faces toward the pressure side (see Fig 16.15).

- After placing it into the groove, form the seal into a ring again in the groove by hand.
- Finally size the seal ring using a mandrel (see Fig 16.16) which should have a chamfer of 10° to 15° over a length of approx. 30 mm.
- The sizing mandrel should be made of a polymer material (e.g. polyamide) with good sliding characteristics and high surface quality in order to avoid damages to the seals.

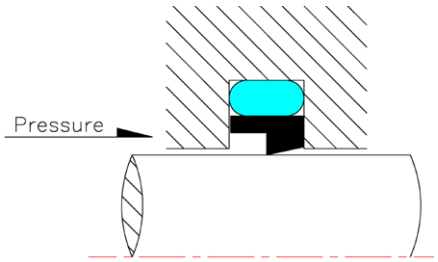


Fig 16.15

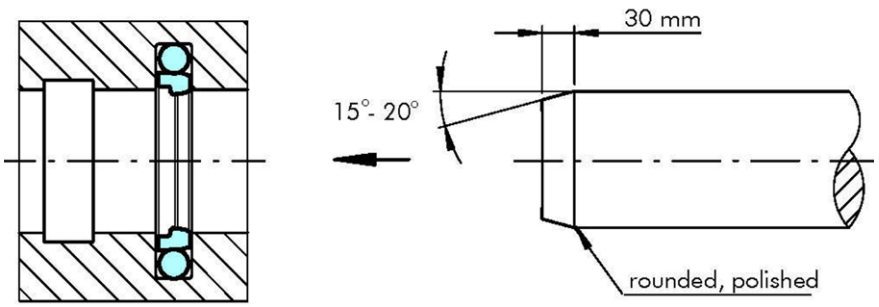


Fig 16.16 Calibration of the installed seal

17. Grease and hydraulic oil specifications

In general, there is no need to lubricate the actuator because its mechanism is lubricated for life. The following grease is used by Rotork to lubricate the sliding components, of the linear actuators and is recommended for a possible lubrication.

17.1 Grease

The following grease is used by Rotork to lubricate the sliding components of the linear actuators for the temperature range -30 to +100 °C (-22 to +212 °F).

Manufacturer:	FUCHS
Trade name: **Colour:**	CEPLATTYN BL WHITE WHITE
NLGI grade:	1-2
Viscosity of oil at 40 °C (104°F) (DIN 51562-1):	300 mm^2/s
Service temperature: **Drop point (ISO 2176):**	-50 to +160 °C (-28 to +320 °F) +220 °C (428 °F)
TIMKEN test	45 lbs

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

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

Lubricate the sliding components, of the linear actuators using the following grease or equivalent for temperature range -60 to +100 °C (-76 to +212 °F).

Manufacturer:	Mobil
Trade name:	MOBILTHHEMP® SHC100TM
NLGI grade:	2
Colour:	Clear brown
Penetration, density, viscosity **Worked penetration at 25 °C (ASTM D 217):** **Viscosity of oil at 40 °C (104 °F) (ASTM D445):**	 280 100 CSt
Temperature **Drop point (ASTM D 2265):**	 >260 °C
Load-carrying capacity, wear protection, service life **Four ball tester (ASTM D 2266)** **Weld load (ASTM D 2596)** **Corrosion protection (ASTM D6138)**	 0.4 mm >200 0

This is the standard grease specification for Rotork linear actuators. If an alternative was specified and/or supplied, please refer to the job-specific documentation, which is available upon request.

17. Grease and hydraulic oil specifications

17.2 Hydraulic oil specification

This is the standard oil specification for Rotork hydraulic manual override and hydraulic cylinders working at temperature between -40 and +100 °C for EX and non-EX application.

Manufacturer:	FUCHS
Trade name:	RENOLIN ZAF 32 MC
Kinematic viscosity, ISO 3104: **-20 °C (-4 °F)** **0 °C (+32 °F)** **+40 °C (+104 °F)** **+100 °C (212 °F)**	 1,528 mm^2/s 282 mm^2/s 32 mm^2/s 6.25 mm^2/s
Viscosity index ISO 2909:	149
Density +15 °C (59 °F), DIN 51 757	840 kg/m^3
Copper corrosion, ISO 2160, degree of corrosion	1-100 A 3, 1-100 A 24
Steel corrosion ISO7120, degree of corrosion: **- procedure A: distilled water** **- procedure B: salt water**	 0 0
FZG A/8, 3/90, failure load stage, ISO 14635-1	>12
Pour point, ISO 3016	-45 °C (-49 °F)
Flash point, ISO 2592	+220 °C (+428 °F)

Equivalent oil to be used:

Manufacturer	MOBIL
Trade name	DTE 10 EXCEL 32
ISO Viscosity Grade	32
Viscosity, ASTM D 445	
cSt @ 40° C	32.7
cSt @ 100° C	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

.

17. Grease and hydraulic oil specifications

This is the standard oil specification for Rotork hydraulic manual override and hydraulic cylinders working at temperature between -40 and +100°C for EX and non-EX application.

Manufacturer:	FUCHS
Trade name:	PLANTOLUBE POLAR 15 S
Kinematic viscosity, ISO 3104: **-20 °C (-4 °F)** **+40 °C (+104 °F)** **+100 °C (+212 °F)**	 174 mm^2/s 15 mm^2/s 4.1 mm^2/s
Viscosity index ISO 2909:	199
Density +15 °C (+59 °F), DIN 51 757	899 kg/m^3
Copper corrosion, ISO 2160, degree of corrosion	1-100 A 3
Steel corrosion ISO7120, degree of corrosion: **- procedure A: distilled water** **- procedure B: salt water**	 0 0
FZG A/8, 3/90, failure load stage, ISO 14635-1	>12
Pour point, ISO 3016	-48 °C (-54.4 °F)
Flash point, ISO 2592	+156 °C (+312.8 °F)
Foam sequence I - III, ASTM D 892: **+24 °C (+75.2 °F), immediately / after 10 min** **+93.5 °C (+203.3 °F), immediately / after 10 min** **+24 °C (+75.2 °F) after 93.5 °C (203.3 °F), immediately / after 10 min**	 20/0 ml 30/0 ml 10/0 ml

Equivalent oil to be used:

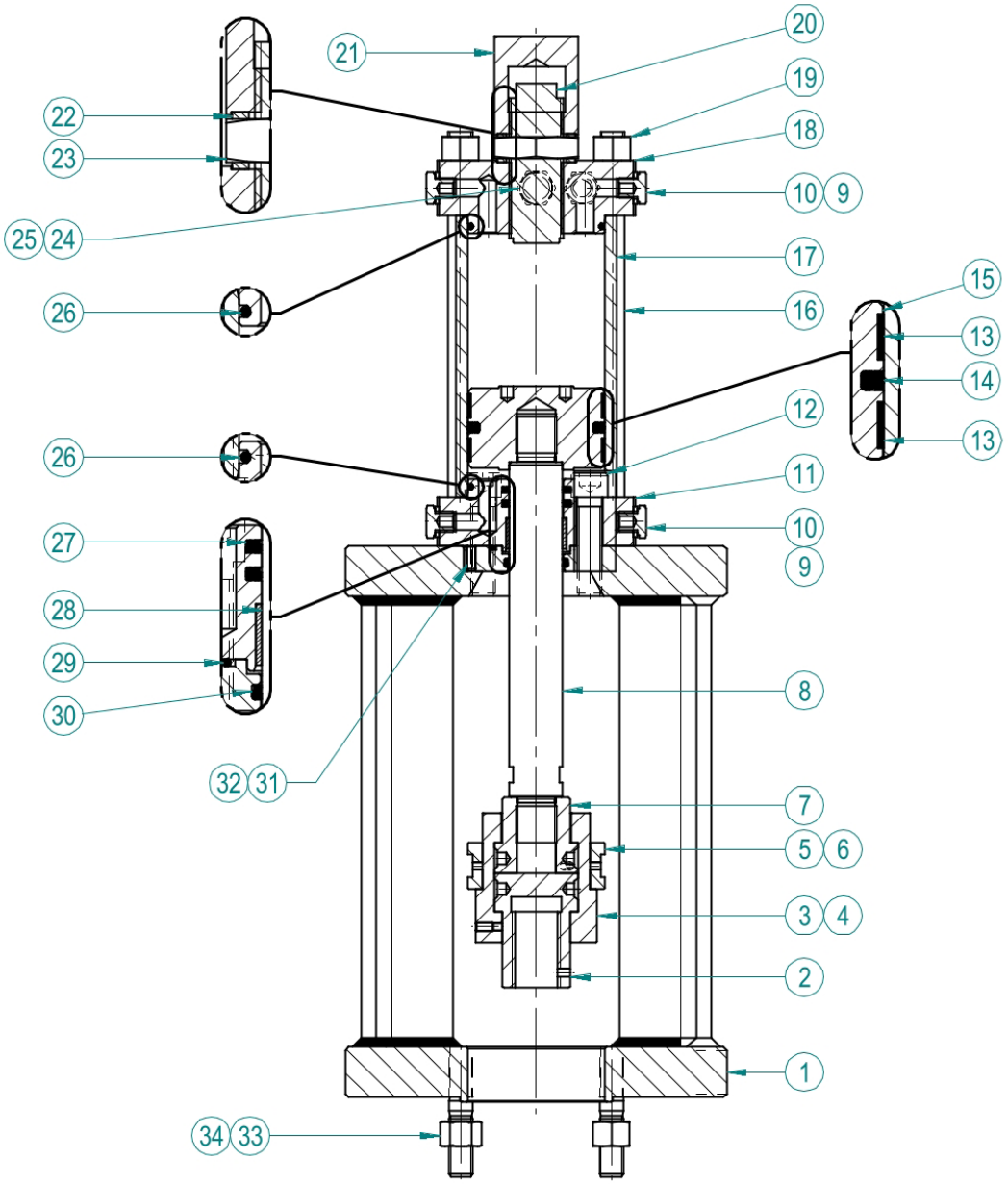
Manufacturer:	MOBIL
Trade Name:	DTE 10 EXCEL 15
ISO Viscosity Grade:	15
Viscosity, ASTM D 445 **cSt @ 40 °C** **cSt @ 100 °C**	 15.8 4.07
Viscosity Index, ASTM D 2270	158
Brookfield Viscosity ASTM D 2983 cP @ -40 °C	2620
Tapered Roller Bearing (CEC L-45-A-99), %Viscosity Loss	5
Density 15 °C, ASTM D 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

This is the standard oil specification for Rotork hydraulic manual override and hydraulic cylinders working at temperature between -60 and +90° C for EX and non-EX 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.

Rev	ECN	Revised	Rev. Approved	Date	Change Description
		YOKES	-	25-08-25	Drawing updated



Template Issue : 24/02/2020-SR

Document type: Assembly Drawing			Dimensions in mm
			Scale 1:4
Created	Cocliti	2013-09-02	
Checked	Talini	2013-09-02	
Approved	Talini	2013-09-02	

Title: DOUBLE-ACTING HYDRAULIC LINEAR ACTUATOR LH/D SERIES

Drawing Number: DSL2093 | Rev: 1-0

Nominal Mass 66 kg | Size A4 | Sheet 1 of 2

18. Appendix A – Sectional drawings

ITEM	DESCRIPTION	MATERIAL		QTY
1	Spool	Carbon steel		1
2	Valve side joint	Stainless steel		1
3	Coupling clamp	Stainless steel		1
4	Set screw	Stainless steel		1
5	Coupling ring	Stainless steel		1
6	Set screw	Stainless steel		3
7	Actuator side joint	Stainless steel		1
8	Stem	Stainless steel		1
9	Bonded seal	SS + NBR85	●	8
10	Pipe plug	Stainless steel		4
11	Head flange	Carbon steel		1
12	Hex socket head cap	Stainless steel		4
13	Guide ring	PTFE + graphite	●	2
14	AQ-seal	PTFE	●	1
15	Piston	Carbon steel		1
16	Tie rod	Alloy steel		4
17	Cylinder tube	Carbon steel (nickel plated)		1
18	End flange	Carbon steel		1
19	Hex nut	Carbon steel (zinc plated)		4
20	Adjustment screw	Alloy steel		1
21	End cap	Stainless steel		1
22	Bonded seal	SS + NBR85	●	2
23	Hex nut	Stainless steel		1
24	Pipe plug	Stainless steel		4
25	Scw hex	Stainless steel		4
26	O-ring	Buna-N	●	2
27	Step seal	PTFE	●	2
28	Sliding bush	Steel + Bronze / PTFE		1
29	O-ring	Buna-N	●	1
30	Scraper ring	SS+NBR85	●	1
31	Set Screw flat socket	Stainless steel		2
32	Centring flange	Stainless steel		1
33	Hex nut	Stainless steel		4
34	Stud bolt	Stainless steel		4

● Recommended spare part

rotork®

Contact us now

mail@rotork.com
www.rotork.com

PUB020-018-00
Issue 07/26