



USER INSTRUCTIONS

LPC Pneumatic Compact Actuator Series
Single Acting & Double Acting

FCD LFENIM0002-06-A4-05/21

Installation
Operation
Maintenance





Limitorque Fluid Power Systems

USER INSTRUCTIONS

LPC ACTUATOR SERIES

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1 STANDARD INFORMATION

USING FLOWSERVE VALVES, ACTUATORS AND ACCESSORIES CORRECTLY

The following instructions are designed to assist in unpacking, installing and performing maintenance on Flowserve products. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance.

In most cases Flowserve actuators and accessories are designed for specific applications with regard to medium, pressure and temperature. For this reason, they should not be used in other applications without first contacting the manufacturer.

1.1. TERMS CONCERNING SAFETY

The safety terms **DANGER**, **WARNING**, **CAUTION** and **NOTE** are used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.



DANGER: indicates that death, severe personal injury and/or substantial property damage will occur if proper precautions are not taken.



WARNING: indicates that death, severe personal injury and/or substantial property damage can occur if proper precautions are not taken.



CAUTION: indicates that minor personal injury and/or property damage can occur if proper precautions are not taken.




NOTE: indicates and provides additional technical information, which may not be very obvious, even to qualified personnel.

Compliance with other, not particularly emphasized notes, with regard to transport, assembly, operation and maintenance and with regard to technical documentation (e.g., in the operating instruction, product documentation or on the product itself) is essential, in order to avoid faults, which in themselves might directly or indirectly cause severe personal injury or property damage.

1.2. GENERAL USAGE

To prolong actuator life, use only clean, dry pneumatic supply fluids. Lubricated fluids are not required for LPL actuators. Pay attention to follow positioner and other control prescriptions, regarding supply fluid instrument air.

The LPC actuator standard ambient temperature range is: -29°C to 100°C (-20°F to 212°F). Low temperature -60°C (-76°F) and High temperature 160°C (320°F) ranges (polar, cold, arid and tropical temperature requirements in accordance with IEC 60721) are available with different materials of construction. In any case, please refer to the temperature range indicated in actuator nameplate.

 **NOTE:** For PED certified applications the standard operating temperature range is -20°C to 100°C (-4°F to 212°F). For lower temperature applications the range can be extended to -40°C to +100°C (-40°F to 212°F) or -50°C to +100°C (-58°F to 212°F) with different materials of construction. In any case, please refer to the temperature range specified on the actuator nameplate.

It is the end user's responsibility to guarantee that the ambient temperature is in accordance with actuator nameplate indications.



WARNING: Do not exceed the minimum and maximum allowable temperatures indicated on the actuator nameplate. Additional factors like the valve and pipe temperatures, sun direct exposure and other environmental conditions shall be considered, not to exceed the temperature range.



WARNING: Do not exceed the allowable pressure range of the supply fluid, as stated in the actuator nameplate. It is very important to make the standard maintenance at all safety components. In case of PED certified cylinders, the value of design pressure of the cylinder is indicated on a specific and separate nameplate. It is necessary to verify that the supply line to the actuator does not exceed the design pressure stated in the cylinder nameplate.




NOTE: The standard supply fluids are instrument air and nitrogen. Different types of fluids may be used only after Flowserve verification. In case of PED certified cylinders, the fluid category is indicated on the specific nameplate on the cylinder.



WARNING: Only use the recommended type of fluid that is indicated on the nameplate and/or in the contract.



NOTE: The supply fluid must be properly filtered. In case of positioner and/or other components installed on the control panel, take care that the cleanliness, the filtration and the dehydration of the supply fluid are in accordance with the requirements of these accessories indicated on their own maintenance and user manuals.

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1.3. PROTECTIVE CLOTHING

Flowserve products are often used in dangerous applications (e.g., extremely high pressures, dangerous, flammable, combustible, toxic or corrosive media). When performing service, inspection or repair operations, always ensure that the valve and actuator are depressurized and that the valve has been cleaned and is free from harmful substances. In such cases pay particular attention to personal protection equipment (protective clothing, gloves, glasses, etc.).

1.4. QUALIFIED PERSONNEL

Only qualified personnel should perform installation, operation or maintenance activities. Qualified personnel are people who, on account of their training, experience, instruction and their knowledge of relevant standards, specifications, accident prevention regulations and operating conditions, have been authorized by those responsible for the safety of the plant to perform the necessary work and who can recognize and avoid possible dangers.



NOTE: The operations of installation and maintenance on LPC Actuators can be performed by qualified personnel ONLY.

1.5. OTHER REQUIREMENTS FOR IN-PLANT INSTALLATION


- Pipelines must be correctly aligned to ensure that the valve is not fitted under tension.
- If not expressly agreed, fire protection is not supplied along with the actuator and it must be provided by the user.

1.6. SPARE PARTS

Use only Flowserve brand original spare parts. Flowserve cannot accept responsibility for any damages that occur from using spare parts or fastening materials from other manufacturers. If Flowserve products (especially sealing materials) have been in storage for long periods, check them for corrosion or deterioration before usage. A table with the list of the main spare parts for standard ON/OFF applications can be found in Table 1 of Paragraph 4.8.

1.7. SERVICE/REPAIR

To avoid injury to personnel or damage to products, safety terms must be strictly adhered to. Modifying this product, substituting non-factory parts, or using maintenance procedures other than as outlined in this instruction manual could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties.

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Between actuator and valve there are moving parts. To avoid injury, Flowserve provides pinch-point-protection in the form of cover plates, especially where side-mounted positioners are fitted. These protections are according to Machine Directive 2006/42/EC recommendations. If these plates are removed for inspection, service or repair, special attention is required. After completing work, the cover plates must be refitted.

In addition to the operating instructions and the obligatory accident prevention directives valid in the country of use, all recognized regulations for safety and good engineering practices must be followed.



WARNING: Before products are returned to Flowserve for repair or service Flowserve must be provided with a certificate which confirms that the product has been decontaminated and is clean. Flowserve will not accept deliveries if a certificate has not been provided (a form can be obtained from Flowserve).

1.8. ACTUATOR LIFTING AND HANDLING

Only Allen wrenches and hexagonal wrenches of few sizes are required for the overall operations. The lifting equipment consists of commercial chains and slings of adequate dimensions.

In order to prevent damage to actuator accessories, before starting the lifting operations, ensure that the lifting tools, like chain and clevis hook, are in the correct position and don't interfere with the control panel and related tubing.

For determination of correct lifting equipment always check actuator weight. This information is always available in Order Documentation supplied along with actuator. Usually actuator weight is reported on the packing slip and on the overall-dimensions drawings.

LPC actuators are provided with special lifting points, consisting of male/female eyebolts or lifting lugs. Lifting points position and type varies according to weight, dimensions and construction features of individual LPC models. In order to identify the location of the lifting points, refer to Order Documentation supplied with the actuator.

For actuator weight, please, refer to Tables 9 and 10. For the general actuator dimensions please refer to LPC technical bulletin LFENTB0002, available on www.flowserve.com.



CAUTION: Lifting and handling of the actuator should be done by qualified personnel and in compliance with the laws and regulations in force.



WARNING: During the lifting operations do not stand under the actuator. The actuator should be handled with appropriate lifting equipment



DANGER: Actuator lifting lugs or eyebolts are appropriate for actuator lifting only. They are not designed to support the combined weight of the valve and actuator assembly together.

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WARNING: ONLY for LPC-05 and LPC-10 models



DANGER: For lifting and handling, use the lifting lugs on the housing and on the tail flange.



Figure 1a: Use of Lifting Lug on the housing

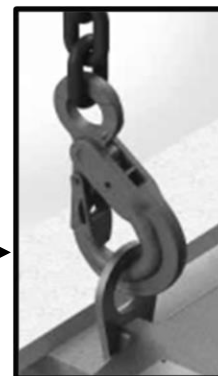


Figure 1b: Use of Lifting Lug on the tail flange

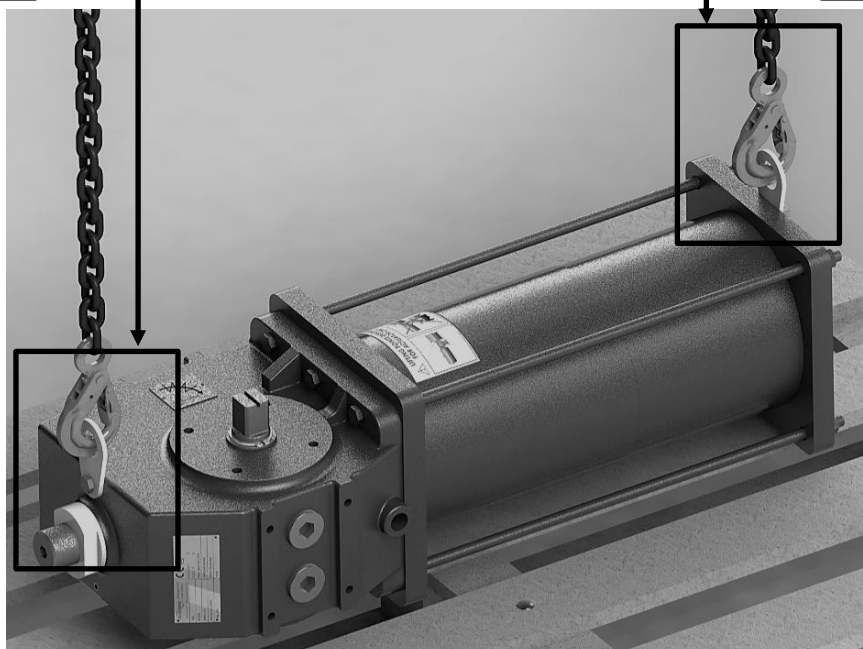


Figure 1: Correct Lifting of LPC-05 and LPC-10 Actuator



WARNING: For lifting and handling use the appropriate lifting arrangement. Do not lift the actuator with the valve assembled.



WARNING: After transportation, inspect the components to look for any damage.



DANGER: NEVER lift the actuator with the valve assembled.



WARNING: ONLY for LPC-12 and LPC-14 models



DANGER: For lifting and handling, use the lifting points on the housing and on the tail flange.

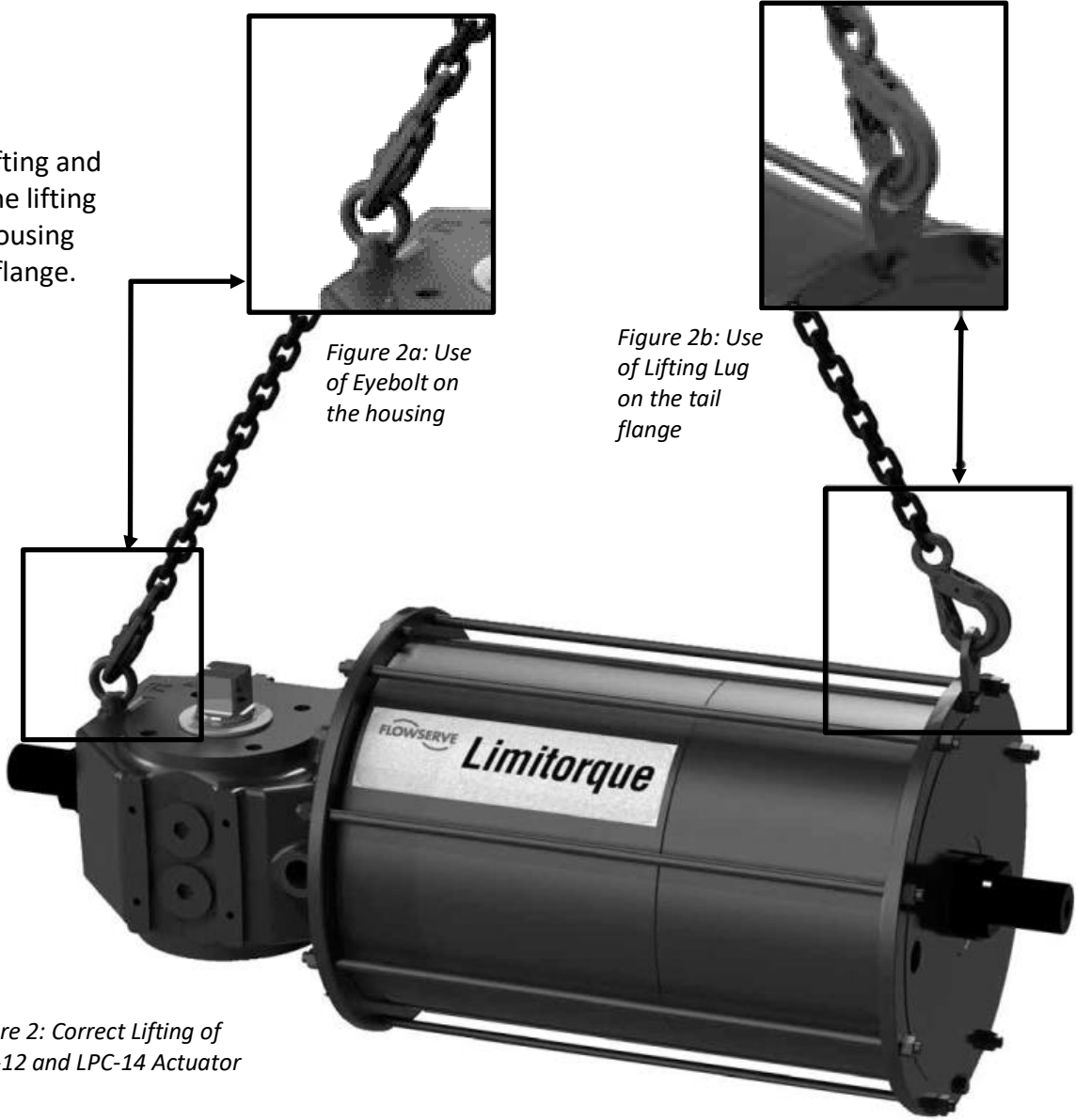


Figure 2: Correct Lifting of LPC-12 and LPC-14 Actuator



WARNING: For lifting and handling use the appropriate lifting arrangement. Do not lift the actuator with the valve assembled.



WARNING: After transportation, inspect the components to look for any damage.



DANGER: NEVER lift the actuator with the valve assembled.

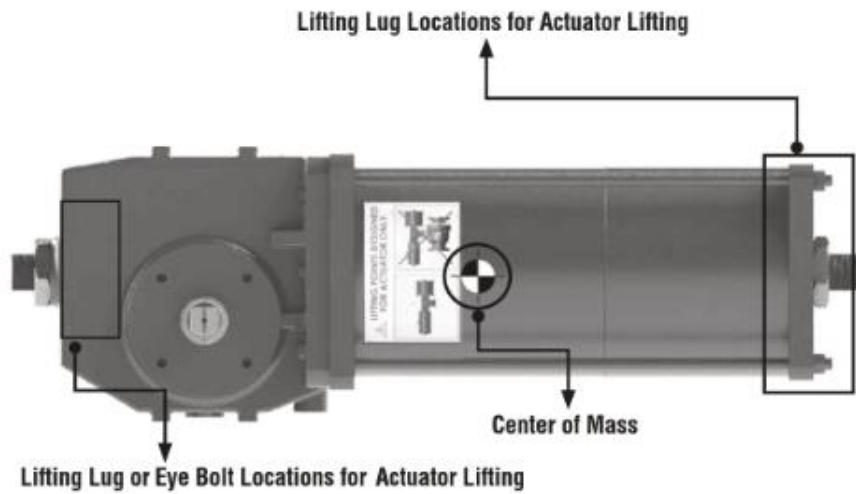


Figure 3: Single Acting Actuator Center of Gravity Position and Lifting Arrangement for LPC-05, LPC-10, LPC-12 and LPC-14

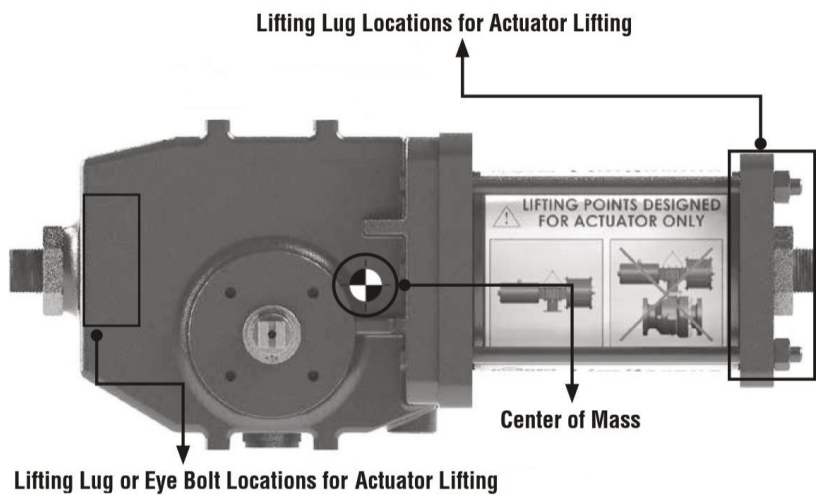


Figure 4: Double Acting Actuator Center of Gravity Position and Lifting Arrangement for LPC-05, LPC-10, LPC-12 and LPC-14



WARNING: For lifting and handling use the appropriate lifting arrangement. Do not lift the actuator with the valve assembled.



WARNING: After transportation, inspect the components to look for any damage.



DANGER: NEVER lift the actuator with the valve assembled.

1.9. STORAGE

Flowserve actuators are typically provided with an epoxy resin coating or with other painting systems as agreed with the customer. This means that Flowserve products are well protected from corrosion. Nevertheless, in order to maintain good working conditions and a good finish, until the actuator is installed in the plant, it is necessary to follow a few rules during the storage period:

- 1.9.1. Flowserve products must be stored adequately in a clean, dry environment.
- 1.9.2. Ensure that plastic caps are fitted to protect the pneumatic connections and the cable entries, to prevent the ingress of foreign materials. These caps should not be removed until the product is actually mounted into the system.
- 1.9.3. If the storage is outdoors, or if long-term storage is necessary, (more than four months), the plastic protection plugs must be replaced with metal plugs, because the plastic plugs are not weatherproof, whereas the metal ones guarantee weatherproof protection.
- 1.9.4. The actuator must be placed on a wooden pallet, in order to not damage the coupling base and avoid the other surfaces resting on the ground.

In case of long-term storage (more than four months), additionally perform the following measures:

- a) Coat the coupling parts (spool piece base, flanges, bushings, joints) with protective oil or grease.
- b) If possible, blank off the spool piece base flange with a protection disk.
- c) Provide a tarpaulin cover or some other means of protection, especially if the storage is outdoors.
- d) It is important to periodically operate the actuator with filtered, dehydrated and lubricated air while in storage.

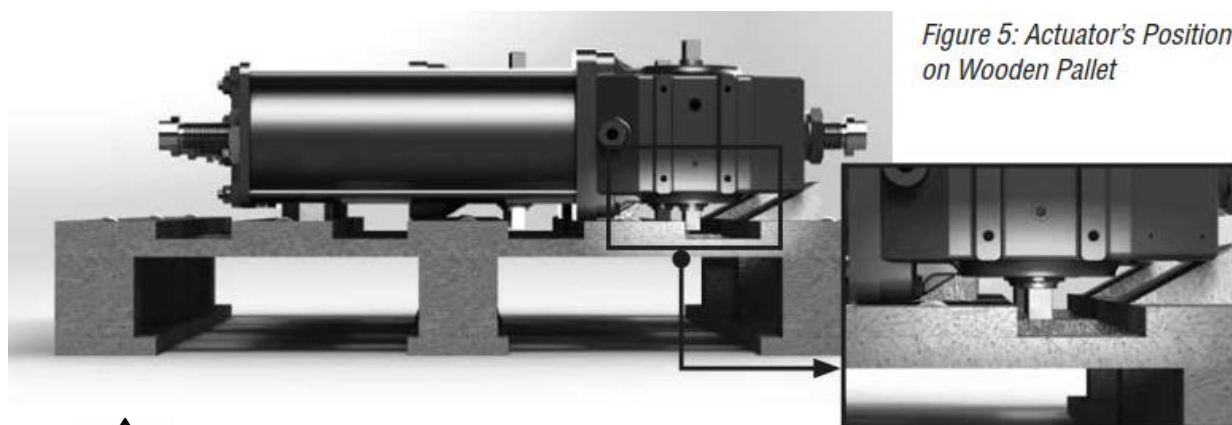



Figure 5: Actuator's Position on Wooden Pallet



CAUTION: Do not lean the actuator on cylinder tie rods

Figure 6: Position of the Output Shaft

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1.10. VALVE AND ACTUATOR VARIATIONS

These instructions cannot claim to cover all details of all possible product variations, nor can they provide information for every possible example of installation, operation or maintenance. If there are any uncertainties in this respect particularly in the event of missing product-related information, clarification must be obtained via the appropriate Flowserve sales office.

1.11. UNPACKING

- 1.11.1. Each delivery includes a packing slip. When unpacking, check all delivered actuators and accessories using this packing slip.
- 1.11.2. Report transportation damage to the carrier immediately.
- 1.11.3. In case of discrepancies, contact your nearest Flowserve location.
- 1.11.4. If necessary, retouch minor damage to the paint coating which may have occurred during transport or storage.



WARNING: Ensure that the addendum “ATEX/PED/Machinery Directive Safety Manual - LPS-LDG-LGO-LHS-LHH Actuators” (doc. LFENEU000A) accompanies this manual, when the actuator is under one (or more) of the following European Directives:

- 2006/42/EC - Machinery Directive
- 2014/34/EU - ATEX Directive
- 2014/68/EU - PED Directive

If this addendum is not available to you, please contact Flowserve.



NOTE: When the actuator has SIL requirements according to IEC 61508, ensure that the “LPC Series Functional Safety Manual” accompanies this manual and is referred to for equipment usage.



NOTE: Pneumatic cylinder design is based on seismic acceleration of 0.5 g provided as reference by EN 1998-1:2004. It is under user’s responsibility to verify that seismic loads of the geographical installation region of the actuator are in conformity with the reference acceleration value of 0.5 g. For any support, please contact your Flowserve Limitorque representative.

2 INSTALLATION INSTRUCTIONS

The LPC range of Limatorque pneumatic actuator is a robust, lightweight modular Scotch yoke design, available in both spring return and double acting configurations; with torque range up to 5.500 Nm (up to 4.060 ft-lbs), with a mounting base in compliance with ISO 5211 and Figures 26 and 27 “LPC Mounting Interface Dimensions”. It may also be customized.



WARNING: Actuator operation/pressure limitations must be in accordance with Technical Bulletin (LFENTB0002); contact Flowserve to get the last version.

LPC actuators are suitable for use in on/off, modulating and control applications. They can also be used in safety services such as emergency shutdown (ESD) or high-integrity pressure protection systems (HIPPS). LPC actuators permit to perform Safety Functions through one of the two following “fail actions”: “Fail Close” or “Fail open”, by choosing the suitable design configuration (in case of single acting actuators) or by choosing the suitable pneumatic control system (in case of double acting actuators).



WARNING: Actuator operation/pressure limitations must be in accordance with the job documentation supplied along with the actuator, and with main data reported on actuator nameplate. If you are not in possession of all relevant information for the correct operation of the actuator, contact Flowserve before starting any activity.

2.1. VALVE AND ACTUATOR CHECK



DANGER: Before installation check the order-no., serial-no. and/or the tag-no. to ensure that the valve/actuator is correct for the intended application.



NOTE: The air supply port and discharge are indicated by dedicated plates positioned close to the ports, as shown in Figure 7. In case of a double acting actuator, the ports for the air supply are identified by a number, according to ISO 5599-2.



NOTE: The fail safe direction of rotation is identified by a dedicated plate, as shown in Figure 8, in accordance with EN 15714-3.



Figure 7: Air Supply

Figure 8: Fail CW Plate. According to EN15714-3 Standard



Figure 9: Standard Nameplate Position



Figure 10: Nameplate Sample

Before starting any installation activity, check also that Actuator pressure limitations and environmental limitations (Ambient Temperature and, if applicable, Explosion Risk Marking), are in accordance with plant requirements. This Information is always reported on actuator nameplate, as shown in typical Actuator Nameplate, shown in Figure 10.

Before mounting the actuator to the valve, manually open and close the valve (if possible), to ensure it is not stuck. Be sure valve and Limatorque open and closed positions coincide (i.e., valve closed, position=actuator closed position). The assembly position of the actuator, with reference to the valve, has to be in accordance with the plant requirements and Job Order Documentation.

2.2. CONNECTION WITH VALVE AND MOUNTING KIT

The LPC actuator is usually supplied with bracket/spool piece already assembled Stem adapters / coupling joint are assembled during connection with valve, through the steps described here below. To assemble the actuator onto the valve, perform the following steps:

- 2.2.1.** Check the mounting surfaces, of actuator bracket and valve and check the stem adapters to assure proper fit. In particular, clean the flanges of valve and spool bracket to remove oils and greases since the torque is transmitted by friction. Also, remove any rust that may have occurred during storage
- 2.2.2.** Secure the valve (possibly with the stem oriented vertically) in Close position in case of Single Acting Fail Close actuator and in Open position in case of Single Acting Fail Open actuator; in case of Double Acting Fail Last actuator, secure the valve in the same Close/Open position as the actuator that will be installed onto the valve.
- 2.2.3.** Install the centering ring on the valve side of the bracket (if any).
- 2.2.4.** Install valve stem adaptor.
- 2.2.5.** Lift the actuator by the special lift points (eyebolts), using a proper lifting system. Position the actuator over the valve and lower to engage the stem adaptor to the actuator bore. Continue to lower until the spool piece sits on valve mounting surface. This coupling has to take place without force and only with the weight of the actuator. The mounting bolts (or studs) of the valve should easily fit into the bolt holes of the spool piece without any binding. If needed, turn or stroke the actuator a few degrees and/or adjust the actuator travel-stops. The mounting nuts (or bolts) connecting the base of the spool piece to the valve flange must be evenly tightened according to tightening torque table without lubricant (Tables 6 and 7 in Annex section).



WARNING: In case of spool piece/bracket installation by the client, it is mandatory to refer “Mounting Interface Dimensions” provided with order documentation, or to follow more specific instructions also included in the job documentation supplied along with the actuator. These assembling instructions include details of prescribed stud bolts and their maximum allowable threaded length.



WARNING: The lifting lugs or eyebolts are appropriate for actuator lifting only. They are **not designed to support the combined weight of the valve and actuator together**. During the lifting operations do not stand under the actuator. The actuator should be handled with appropriate lifting means. The weight of the actuator is reported on the packing slip and on the overall-dimensions drawing furnished with the documentation accompanying the actuator.





NOTE: In some cases, the coupling between valve and actuator can be direct, without the need of a spool piece. In these cases, Flowserve can provide an intermediate adaptor flange (fitted under the actuator base) and a special bushing to be inserted into the yoke bore.



CAUTION: actuator lifting, and handling should be made by qualified personnel and in compliance with the laws and provisions in force

2.3. TRAVEL-STOP BOLT AND ACCESSORIES

Actuated valves may require accurate travel-stop adjustments to obtain optimum performance and valve seat life. If necessary, adjust the travel-stop bolt of the actuator for the proper open/close valve positions, per valve manufacturer's recommendations.

The LPC actuators have travel-stop adjustments in both the clockwise and counter-clockwise directions. The +/- 5-degree adjustment feature provides shaft rotation from 80 to 100 degrees overall.

The adjustment of the travel-stop is performed in accordance with the following steps. After the adjustment of the travel-stop, pneumatically stroke the actuator several times to assure proper operation. If the actuator is equipped with limit switches, positioner or other accessories, adjust them at this time.



DANGER: Do not attempt this maintenance operation with cylinder under pressure



WARNING: Before performing any maintenance operation it's mandatory to remove the pressure inside the cylinder. Make sure that the pneumatic connection ports of the cylinder are disconnected and open to the ambient. Also make sure that all pneumatic supplies to the control unit and all power supplies are disconnected. Make sure that the actuator is in the fail position, i.e., that it is not locked in a position with the spring compressed because of jams or by means of locking tools.



WARNING: In order to prevent damage of the actuator, during the travel-stop adjustment do not exceed the values of -5 degrees and 95 degrees.

2.3.1. Pneumatic cylinder travel-stop bolt adjustment

Refer to figure 11 and 12 for next instructions and descriptions.



DANGER: Always make a check in order to have a safety engagement of the stopper bolt in the tail flange during this operation. In case of need to fully remove the travel stop, it is mandatory do not have pressure inside the cylinder in order to avoid any possible risk for the operators.



DANGER: refer to Figures 28 and 28a for maximum distance “A”, in order to have a safety engagement of the stopper bolt in the tail flange during this operation. In case of need to fully remove the travel stop, when exceed the maximum distance “A” it is mandatory to don’t have the pressure inside the cylinder in order to avoid risks for the operators.



NOTE: If necessary in order to facilitate unscrewing of the cylinder stopper bolt and only for spring return actuator, feed the pneumatic cylinder from the air connection port placed on the tail flange (the flange where the stopper is screwed) at minimum necessary pressure to facilitate stopper unscrewing (starting from 0 barg and slowly increasing the pressure up to max 2 barg in order until the spring begins to compress, and stopper get free from piston load);



NOTE: the following procedure can be applied even for the adjustment of the stop bolt installed on the center body for double effect actuators.

2.3.1.1 Using appropriate wrench, hold still the stopper bolt (19) and using a second screw, unscrew the stopper nut (20).

2.3.1.2 Fully remove the stopper nut (20).

2.3.1.2 Fully remove the o-ring (21).

2.3.1.4 Manually screw or unscrew the stopper bolt (19) in the flange (23), (or in the housing (30)) using appropriate wrench, until desired position has been reached. Do not use automatic devices (e.g. electric/air screwier, etc...);

2.3.1.5 Manually slip the new o-ring (21) properly in front of flange (23) (or in front of the housing (30)), taking attention to not make cuts in it because of stopper sharp threads;



NOTE: Do not use stopper nut (20) to drag the o-ring (21) on the stopper bolt (19);

2.3.1.7 Screw the stopper nut (20);

2.3.1.8 Using appropriate wrench, hold still the stopper bolt (19) and using a second screw, tighten the stopper nut (20).



NOTE: Always replace the O-Ring (21) during travel stop adjustment.

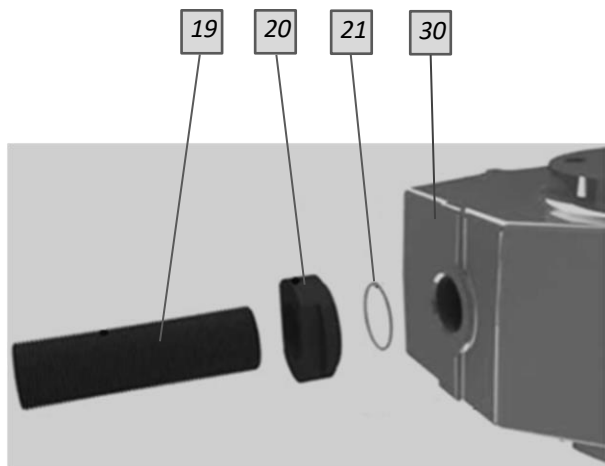


Figure 11: Housing Standard Stopper Exploded View

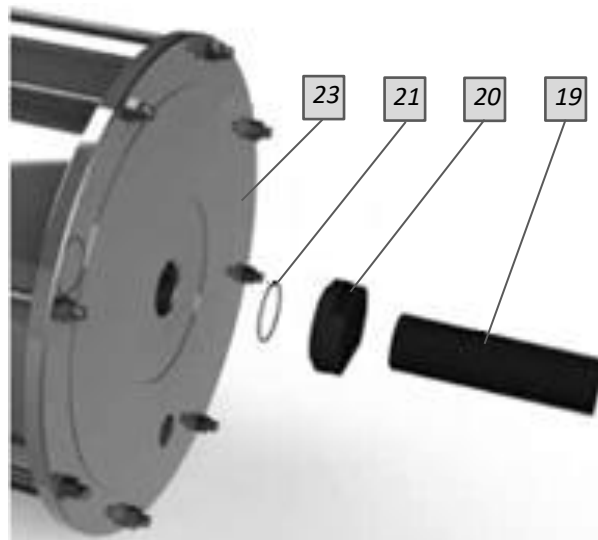


Figure 12: Cylinder Standard Stopper Exploded View

2.3.2. Pneumatic cylinder travel-stop bolt adjustment (version with enclosed stopper bolt protection)

Refer to figure 13 for next instructions and descriptions



NOTE: If necessary in order to facilitate unscrewing of the cylinder stopper bolt and only for spring return actuator, feed the pneumatic cylinder from the air connection port placed on the tail flange (the flange where the stopper is screwed) at minimum necessary pressure to facilitate stopper unscrewing (starting from 0 barg and increasing the pressure slowly up to max 2 barg in order to facilitate unscrewing, until the spring begins to compress, and stopper get free from piston load).



DANGER: In order to have a safety engagement of the stopper bolt in the tail flange during this operation. In case of need to fully remove the travel stop. It is mandatory do not have pressure inside the cylinder in order to avoid any possible risk for the operators.



DANGER: refer to Figure 28 and Figure 28a for maximum distance “A”, in order to have a safety engagement of the stopper bolt in the tail flange during this operation. In case of need to fully remove the travel stop, when exceed the maximum distance “A” it is mandatory to don’t have the pressure inside the cylinder in order to avoid risks for the operators.



NOTE: the following procedure can be applied even for the adjustment of the stop bolt installed on the center body for double effect actuators.

- 2.3.2.1 Using appropriate wrench, hold still the stopper bolt protection (C) and using a second screw, unscrew the protection plug (E).
- 2.3.2.2 Remove the o-ring of the protection plug (D).
- 2.3.2.3 Using appropriate wrench, hold still the stopper bolt (A) and using a second screw, unscrew the stopper bolt protection (C).
- 2.3.2.4 Remove the o-ring of the stopper bolt protection (B), by unscrewing it.
- 2.3.2.5 Manually screw or unscrew the stopper bolt (A) in the flange (or in the housing) using appropriate wrench until desired position has been reached. Do not use automatic devices (e.g. electric/air screwier, etc...);
- 2.3.2.6 Insert a new o-ring if the old one is damaged, for the stopper bolt protection (B).
- 2.3.2.7 Screw the stopper bolt protection (C)
- 2.3.2.8 Using appropriate Allen key, hold still the stopper bolt (A) and using a second screw, tighten the stopper bolt protection (C).
- 2.3.2.9 Insert a new o-ring for the protection plug (D).
- 2.3.2.10 Manually screw the protection plug (a) on the stopper bolt protection (C).
- 2.3.2.11 Using appropriate wrench, hold still the stopper bolt protection (C) and using a second screw, tighten the plug (E).



NOTE: Always replace the O-Rings (B and D) during travel stop adjustment.

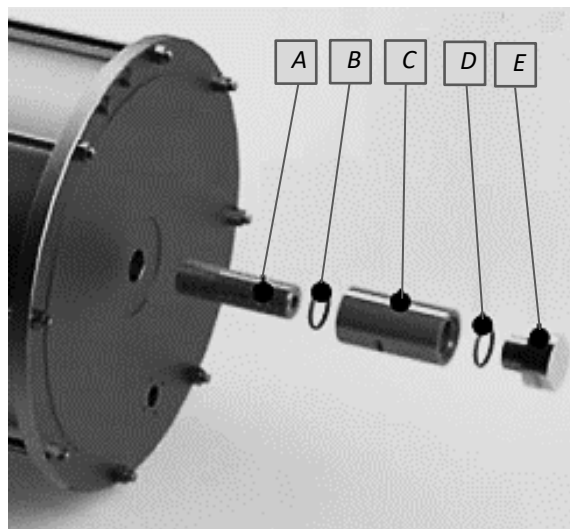


Figure 13 - Enclosed Stopper Exploded View

2.4. GROUNDING SYSTEM

For the actuator earthing, use the special grounding kit, shown in 14, 15, 16 and 18.

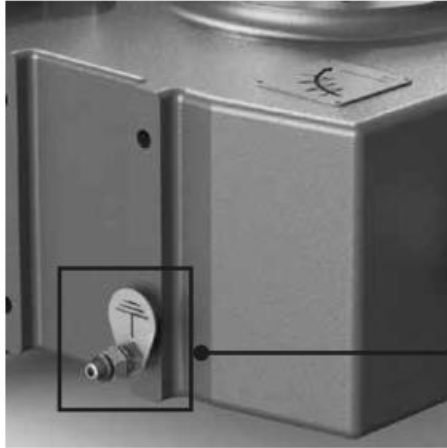


Figure 14: Grounding Kit Exploded View

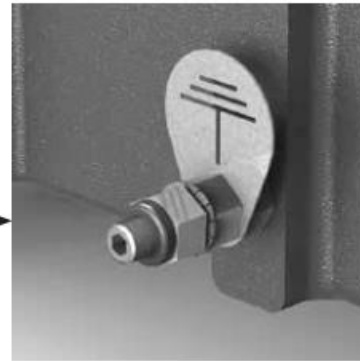


Figure 15 Grounding Kit Assembled

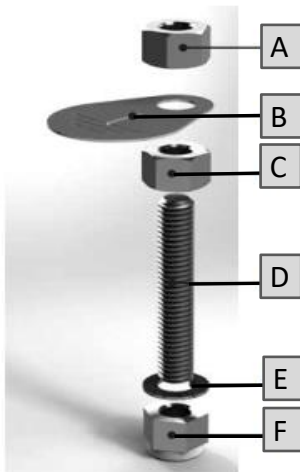


Figure 16 - Grounding Kit Detail

Letter	Description
A	High Nut
B	Ground Nameplate
C	High Nut
D	Grub Screw
E	Lock Washer
F	High Locking Nut with Nylon Insert

Figure 17 - Grounding Kit list of Components

2.5. INITIAL OPERATION

Before initial operation of the actuator, perform the following checks:

- 2.5.1. Check that all electrical supply, control and signal lines are properly connected, by following the dedicated customer procedures.
- 2.5.2. Check that the pressure and quality of the supply fluids are as prescribed.
- 2.5.3. Check the absence of leaks in the pneumatic connections. If necessary, tighten the pipe fittings.
- 2.5.4. Check that the environmental conditions are compatible with the design conditions. For information, contact Flowserve.

2.6. FAIL OPEN AND FAIL CLOSE CONFIGURATION

The actuator is designed for work in both configurations: fail open and fail close. For conversion from one configuration to the other, refer to next paragraph.

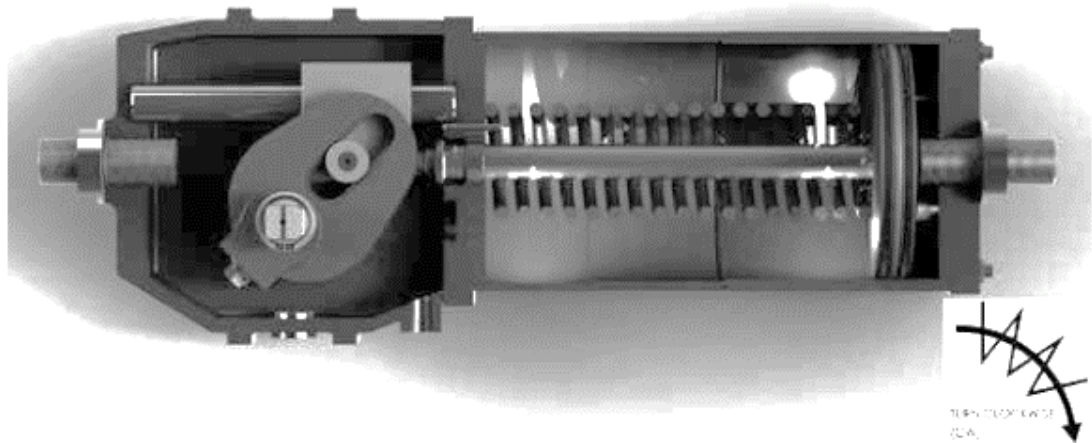


Figure 18 – Single Acting Actuator Configuration: Fail Close-Fail Clockwise

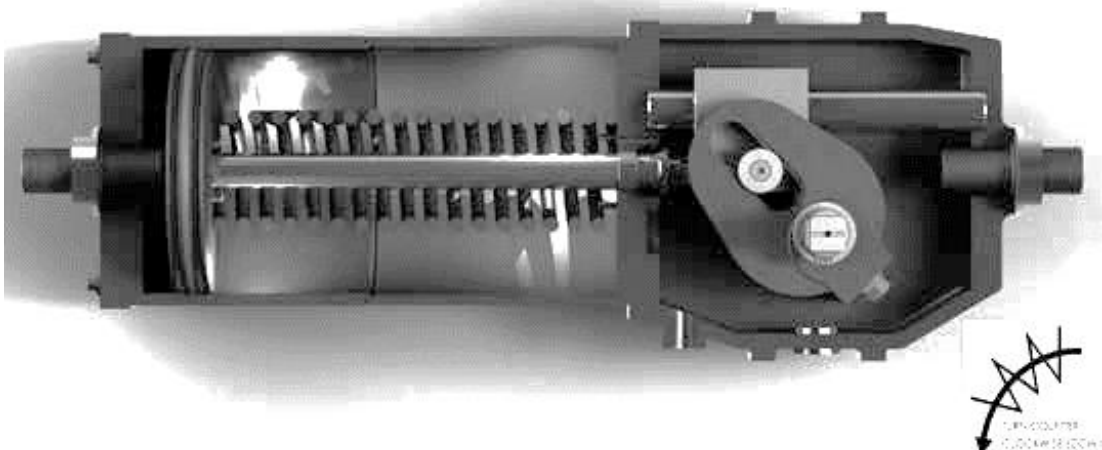


Figure 19 – Single Acting Actuator Configuration: Fail Open-Fail Counter Clockwise

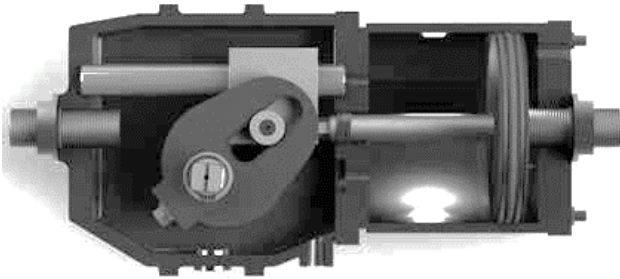


Figure 20: Double Acting Actuator Configuration – Close Position

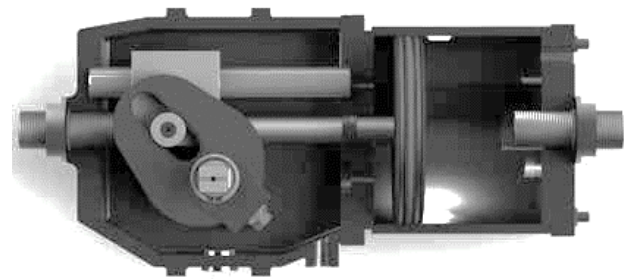


Figure 21: Double Acting Actuator Configuration – Open Position



Figure 22: Fail Close configuration with valve

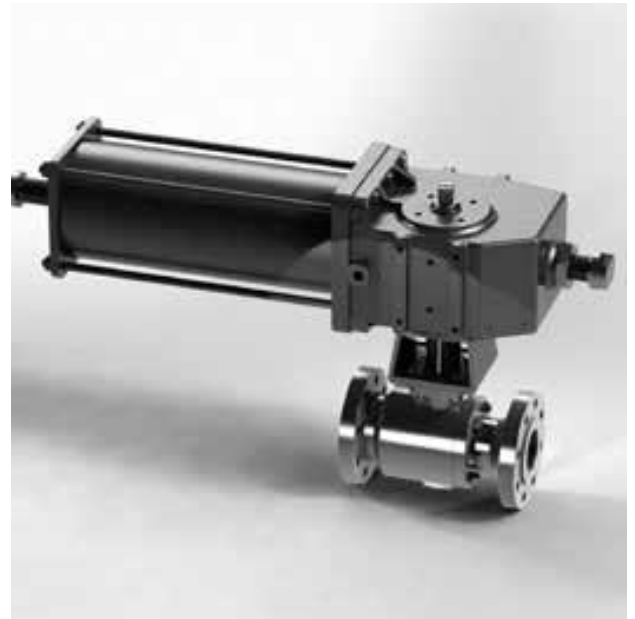


Figure 23: Fail Open configuration with valve

3 FIELD CONVERSION

Field Conversion from Fail Clockwise to Fail Counterclockwise or Vice Versa (for Spring Return Actuators)



NOTE: No additional adapter kit is required for LPC actuator fail action conversion.



NOTE: Disassembling of the actuator from the valve is required during the fail action conversion.



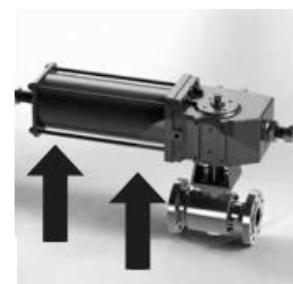
WARNING: A change in actuator's fail action must be noted on the actuator's nameplate.

3.1. ACTUATOR DISASSEMBLED FROM THE VALVE



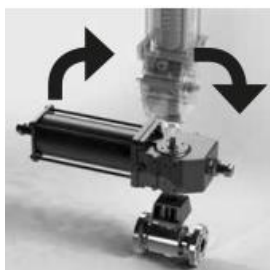
WARNING: Ensure that the pneumatic connection ports of the cylinder are disconnected. Also make sure that all pneumatic supplies to the control unit and all power supplies are disconnected. Finally, make sure that the actuator is in fail position, i.e., that it is not locked in a position with the spring compressed by means of locking devices.

3.1.1. Starting with the actuator in a fail open (CCW) configuration, remove the actuator from the valve, keeping the spool adaptor installed onto the valve.



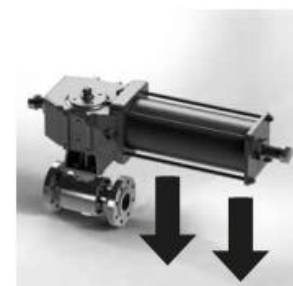
1

3.1.2. Rotate the actuator.



2

3.1.3. Reassemble in the new position the actuator onto the spool piece and the valve. Now the actuator is in a fail close (CW) execution. Similar steps will apply for conversion from fail close (CW) to fail open (CCW).



3

4 MAINTENANCE INSTRUCTIONS

4.1. MAINTENANCE - INTRODUCTION

LPC actuators do not need maintenance for long periods, even when working in severe conditions. The LPC actuators features a 25-year design life, under proper conditions of service, installation, operation and recommended maintenance.

LPC actuators used for standard “ON-OFF” services do not need particular activities of periodic ordinary maintenance, with the exception of periodic visual inspections with functional tests, on the basis of which it is possible to establish replacements of components, which over time may be subject to wear (if exceeding the guaranteed cycles in accordance with EN15714) or aging. For more details refer to paragraph 4.2.



NOTE: Information provided in present paragraph refers to LPS actuators used for standard “ON-OFF” services. Actuators intended to other services (for example, high-cycles, modulating or other) need dedicated Information. For details, contact your local Flowserve Limitorque Service representative.

For LPC actuators, extraordinary maintenance is necessary in case of malfunctions detected:

- a) during unexpected events occurring in normal operation;
- b) during periodic inspections / tests.


In the event of a detected malfunction, in order to identify the cause and activities to be performed, refer to Chapter **Error! Reference source not found.** “Troubleshooting”. Depending on malfunction causes, Instructions on how to perform possible extraordinary maintenance on actuator modules are provided from paragraph **Error! Reference source not found.** “Actuator Extraordinary Maintenance” onwards.

LPC Series actuators are designed to offer the greatest ease of operation during assembly, disassembly and maintenance. The maintenance and disassembly do not require special equipment, nor special or large wrenches. Furthermore, joints among the moving parts of the actuator are made exclusively through pins and screws.

For the maintenance of any installed accessory and/or control equipment installed on the actuator, follow the recommendation of individual Instruction Manuals.



NOTE: Operations of maintenance on LPC Actuators can be performed by qualified personnel ONLY.

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4.2. ACTUATOR ORDINARY MAINTENANCE



NOTE: Information provided in present paragraph refers to LPS actuators used for standard “ON-OFF” services. Actuators intended to other services (for example, high-cycles, modulating or other) need dedicated Information. For details, contact your local Flowserve Limatorque Service representative.

For Actuators used in Standard ON/OFF applications it is recommended that they are periodically checked (at least every 5 years), through visual inspections with functional tests.

During Visual Inspections perform the following steps:

- Check that all signals (pneumatic and electric) correctly arrive to the actuator;
- Check that the pressure of the supply fluid is within the required range;
- Visually inspect all external surfaces and visible seals of the actuator;
- Carry out a few opening and closing operations, involving all the components of the control unit, checking that the actuator operates correctly, performing the complete strokes, and within required operating times, without increasing noise or jamming during the stroke;
- Check for the absence of leaks in the Pneumatic connections. If necessary, tighten the fittings of the pipes;
- Check the functionality of the manual override (If present);
- Check the paint coating. If some areas are damaged due to accidental events, retouch them according to the painting specifications.



NOTE: Actuators intended to SIL certified systems must be subjected to additional diagnostic tests, with frequency and operational details established in accordance with SIS (Safety Instrumented System) requirements.




NOTE: In general, it is recommended a critical evaluation of the frequency of visual inspections, and, if necessary, to intensify them or to foresee a Scheduled Preventive Maintenance, depending on:

- Criticality of the service conditions;
- Criticality of the type of application.

In case of scheduled preventive maintenance, please refer to paragraph **Error! Reference source not found.** “Actuator Extraordinary Maintenance” for instructions on how to perform the replacement of components contained in spare parts kits.

If during visual inspections a malfunction is detected, in order to identify the causes and the activities to be performed, refer to Chapter **Error! Reference source not found.** “Troubleshooting”. Depending on malfunction causes, Instructions on how to perform possible extraordinary maintenance on actuator modules are provided from paragraph **Error! Reference source not found.** “Actuator Extraordinary Maintenance” onwards.

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4.3. ACTUATOR EXTRAORDINARY MAINTENANCE

In case of extraordinary maintenance, or in case of scheduled preventive maintenance, involving the lubrication and substitution of actuator components (in table 1 Par.4.8 the list of spare parts for ON/OFF applications to be replaced due to aging, also within guaranteed cycles of EN15714) by means of disassembling and reassembling activities on actuator, refer to instructions reported in following paragraphs, related to main actuator modules (Center body and Air-Spring module). Always also refer to notes mentioned in paragraph 1.2 “GENERAL USAGE”.

LPC actuator is furnished pre-lubricated, with a sufficient amount of lubricants for its entire life cycle. However, during scheduled maintenance or in case of extraordinary maintenance, when necessary, it is possible to lubricate the components for which lubrication is foreseen, using greases and oils having characteristics in accordance to Tables reported here below.

**For Temperature Conditions
-29 °C to +100 °C**

Grease Characteristics*	
Worked Penetration [dmm]	280
Dropping Point ASTM [°C]	190
Viscosity at 40 °C [mm ² /s]	100
*Grease Suggested: AGIP MUP2 or equivalent	

**For high Temperature Conditions
-29 °C to +160 °C**

Grease Characteristics*	
Worked Penetration [dmm]	280
Dropping Point ASTM [°C]	290
Viscosity at 40 °C [mm ² /s]	220
* Grease Suggested: ENI GREASE LCX2/220 or equivalent	

**For low Temperature Conditions
-60 °C to +100 °C**

Grease Characteristics*	
Worked Penetration [dmm]	296
Dropping Point ASTM [°C]	260+
Viscosity at -40 °C [mm ² /s]	1150
* Grease Suggested: AEROSHELL7 or equivalent	

**For all Temperature Conditions
-60 °C to +100 °C**

Oil for O-Rings and cylinder internal parts lubrication*	
Flashpoint [°C]	198
Density [kg/m ³] at 15°C	1074
Viscosity at 40 °C [mm ² /s]	222
* Oil Suggested: SHELL OMALA S4WE220 or equivalent	

For different conditions, contact your local Flowserve representative.



NOTE: If it is foreseen to exceed the minimum guaranteed cycle life in accordance to EN15714, a more detailed assessment is required, taking into consideration service conditions and actuator configuration, to define recommended spare parts list and intervals of maintenance. For further information, please contact your Flowserve representative.



NOTE: For maintenance of manual overrides (if installed) follow recommendations on the dedicated Manual Overrides IOM.

4.4. GENERAL DISASSEMBLY INSTRUCTIONS

Figure 24a: LPC Double Acting variant
Pneumatic Module Exploded View

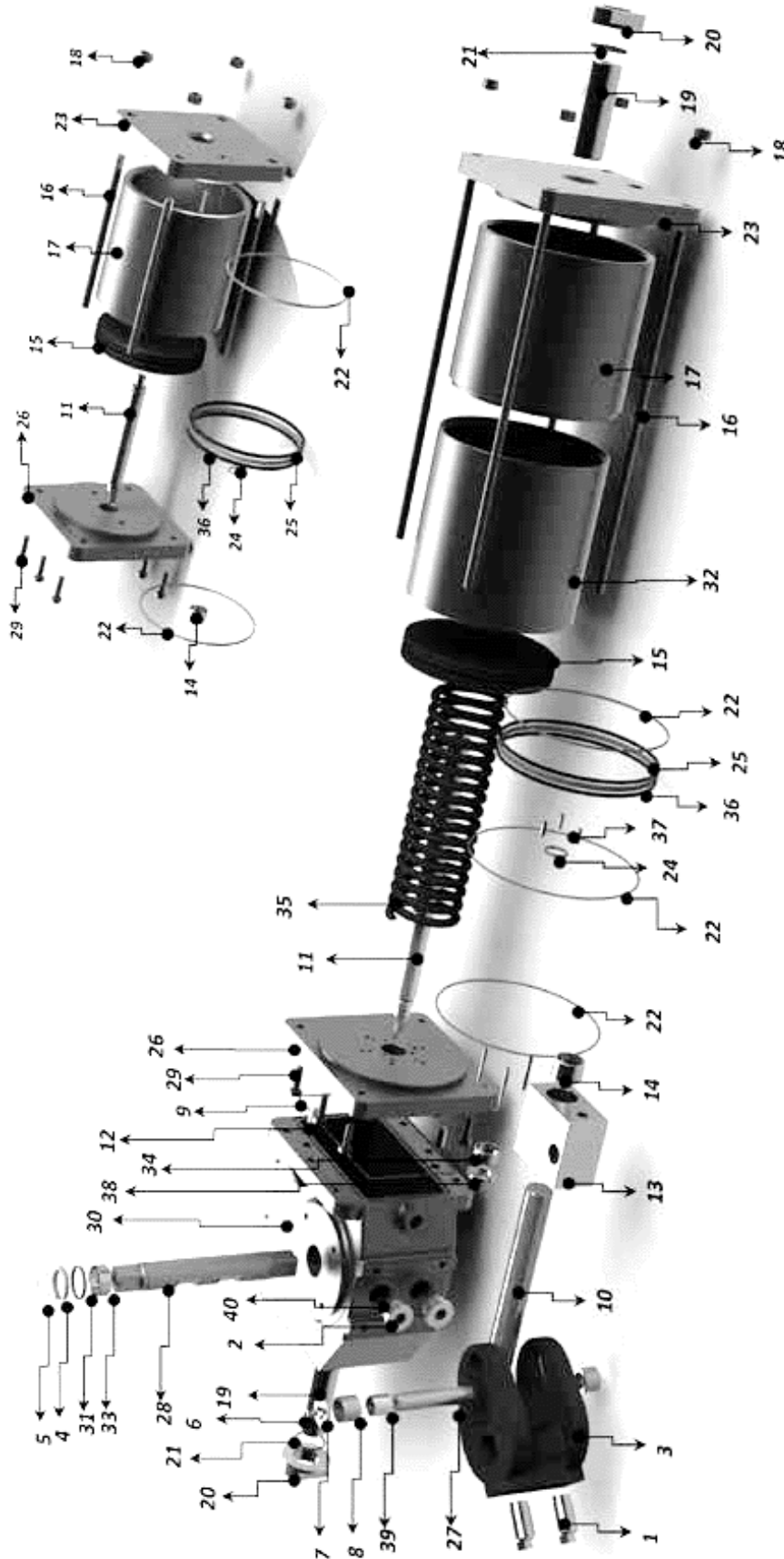


Figure 24: LPC Single Acting Exploded View

Num	Description	Qty	Spare
1	Grub Screw	2	
2	Plug	2	
3	Scotch Yoke	1	
4	Bushing	2	
5	Retaining Ring	2	
6 ⁽¹⁾	Screw	2	
6 ⁽²⁾	Retaining Ring	2	
7	Washer	2	
8	Roller Bearing	2	
9	O-Ring	1	X •
10	Guide Bar	1	
11	Piston Rod	1	
12	Pin	2	
13	Guide Block	1	
14	Bushing	2	
15	Piston	1	
16	Tie Rod	4**	
17	Spring Can	2	
18	Hex Nut	4**	
19	Stop Bolt	2	
20	Hex Nut	2	

Num	Description	Qty	Spare
21	O-Ring	2	X •
22	O-Ring	3**	X •
23	End Flange	1	
24	O-Ring	1	X •
25	O-Ring	1	X •
26	Head Flange	1	
27	Yoke Pin	1	
28	Output Shaft	1	
29	Screw	6	
30	Housing	8**	
31	O-Ring	2	X •
32	Spacer	1	
33	DU Bushing	2	
34	Bushing	1	
35	Spring	1	
36	Tape Guide	2	X •
37	Bar Pin	6	
38	Spanner Nut	1	
39	Bushing	2	
40 ⁽²⁾	O-Ring	2	X •

X Maintenance spare parts for on/off applications (for aging within guaranteed cycles of EN15714)

- Spare parts that can be replaced without removing the actuator from the valve

(1): Only for LPC-05 and LPC-10 models

(2): Only for LPC12 and LPC14 models

** Variable number depending on model

Figure 24b: LPC Actuator Exploded View list of components

The LPC Series actuator is available in two different configurations, single acting and double acting, composed by the main parts shown in Figure 24. Before proceeding with other disassembling activities, perform the following preliminary steps.

- 4.4.1. Disconnect all pneumatic and electrical supplies from actuator;
- 4.4.2. Before dismounting the actuator remove control panel, all accessories from actuator;
- 4.4.3. The reference drawings for the instructions reported in the following paragraphs are the exploded views of single acting and double acting actuators, included as Figures 24, 24a and 24b.



DANGER: Do not attempt any maintenance operation with cylinder under pressure.



DANGER: for LPC compact actuators, in single acting execution, it is not possible to disassemble pre-compressed spring from the assembling that keep it compressed. Service operations are possible only as for below instructions (Paragraphs 4.5, 4.6 and 4,7).

If other type of maintenance is required, refer to your Flowserve representative for instructions.

4.5. SUBSTITUTION OF AIR-SPRING MODULE

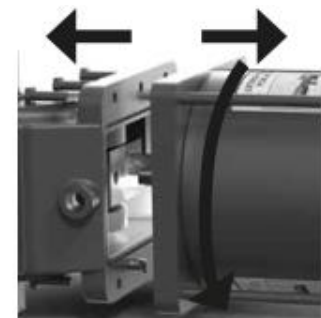


WARNING: Ensure that the pneumatic connection ports of the cylinder are disconnected. Also make sure that all pneumatic supplies to the control unit and all power supplies are disconnected. Finally, make sure that the actuator is in the fail-safe position with the pre-compressed spring at its maximum released position.

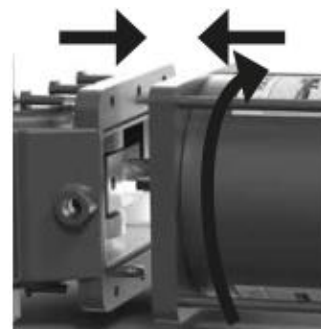
4.5.1. Unscrew and remove the six screws (29) which connect housing with air-spring module assembly.

**1**

4.5.2. Separate air-spring module assembly from housing and unscrew the piston rod (11) from the guide block (13), turning counterclockwise the whole air-spring module assembly

**2**

4.5.3. Remove the air-spring module assembly, replace with a new one, supplied by Flowserve Service Dept. (always check for the coincidence between old and new one), mount it following the reverse procedure than that described at points 4.5.1 and 4.5.2. Tighten the six screws (29) in accordance with torque table included in the Annexes section.

**3**

4.6. PNEUMATIC CYLINDER MAINTENANCE

The pneumatic cylinder maintenance mainly consists in the replacement of those parts that may degrade over time for aging (within guaranteed cycles of EN15714), even in the absence of faults. These components are the o-rings and the sliding elements of the piston.

The substitution of cylinder components not subjected to aging (or of the whole cylinder) is not expected over the entire actuator life (within guaranteed cycles of EN15714). However, accidental events may result in damage to these components. In these cases, proceed as described in the following steps.

The maintenance for replacing components degrading for aging can be performed in the field without the need to remove the whole cylinder from the actuator.



WARNING: Before performing any maintenance operation on the cylinder it's mandatory to remove the pressure inside the cylinder itself. Make sure that the pneumatic connection ports of the cylinder are disconnected and open to the ambient. Also make sure that all pneumatic supplies to the control unit and all power supplies are disconnected. Make sure that the actuator is in the fail position.



WARNING: Use the pneumatic cylinder only for the intended function it has been designed for.



WARNING: In the case of PED cylinders, for any maintenance operations that involve the partial or total removal of the cylinder (not including adjustment operations of the end stopper) contact Flowserve to ensure the preservation of PED certification.



NOTE: During the maintenance operations inside the cylinder it's suggested to have a visual check of its internal parts, in order to guarantee their integrity.



NOTE: In the LPC Compact Actuator Series, in single acting execution, the spring is located inside the pneumatic cylinder, as shown in Figure 24.

4.6.1. Unscrew and remove the travel stop of the pneumatic cylinder (19). For removing its components, refer to the indications given in Paragraph 2.3.



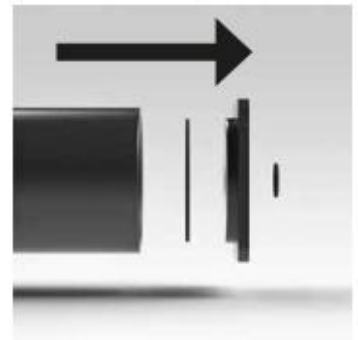
1

- 4.6.2.** Remove four tie rods (16) positioned on the cylinder by unscrewing the nuts (18) on the sides of the End Flange and unscrewing the tie rods from the head flange (26).



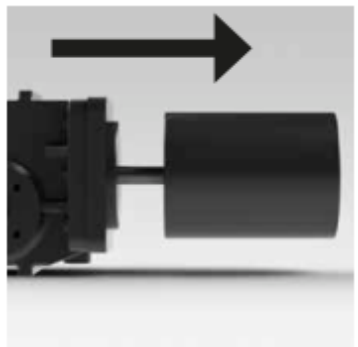
2

- 4.6.3.** Remove carefully the end flange (23) from the can (17). Remove the two O-rings (21 and 22) from the end flange.



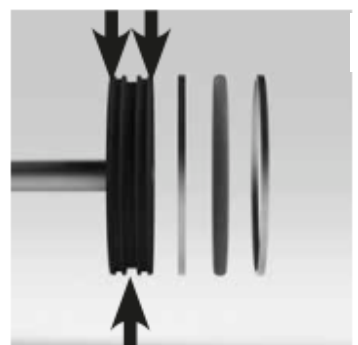
3

- 4.6.4.** Finally, remove the can (17) without damaging or making scratches onto the inner can surface.



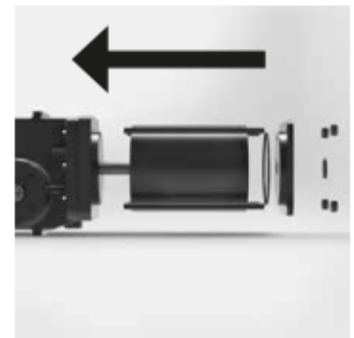
4

- 4.6.5.** Remove the O-ring (25) and finally the two guide-rings (36) from the piston (15). Clean all the surface of piston and flanges in contact with these components with a clean rag and solvent compatible with O-ring material (for information, contact Flowserve). Brush the O-ring grooves with a light oil film and install the new O-rings. Spread a thin layer of oil on the bottom of the tape guide grooves and install new tape guides. Clean the internal surface of the tube and lubricate with a protective oil film.



5

4.6.6. Reassemble the parts of the cylinder with the reverse procedure as described in points 4.6.1 to 4.6.4. The tie rods should be tightened using a torque wrench, alternating between opposite holes, applying a torque according to tightening tables 4 and 5 included in Annex Section.



6

4.6.7. Readjust the travel stops as instructed in paragraph 2.3.



7



NOTE: After the maintenance steps described above, stroke the actuator a few times to check for proper operation.

4.7. HOUSING AND SCOTCH YOKE MAINTENANCE

Maintenance of the Scotch yoke housing may take place in the field.



WARNING: Ensure that the pneumatic connection ports of the cylinder are disconnected. Also make sure that all pneumatic supplies to the control unit and all power supplies are disconnected. Finally, make sure that the actuator is in the fail-safe position.



WARNING: In LPC Double Acting version, the actuator is fed using two pneumatic inlet ports, one located on the cylinder end flange and the other one may be located on the Scotch yoke housing or in some versions on the cylinder head flange. It's recommended to accomplish this maintenance operation only after removing the supply pressure from the Scotch yoke housing inlet port.

A- GREASING OF SCOTCH YOKE

Remove the stopper bolt kit from the housing. For removing its components, refer to the indications given in paragraph 2.3. Apply a film of grease (with an applicator) directly on scotch-yoke mechanisms sliding

surfaces.

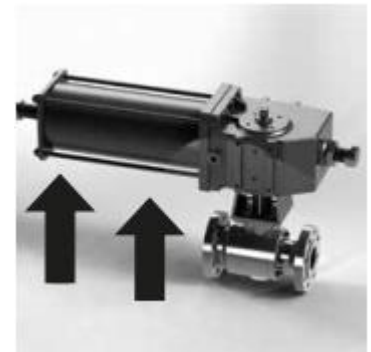


NOTE: Take note of the length of the portion of stop bolt protruding from center body, before starting any activity of standard maintenance. Once finished, reassemble it at the same length.

B- DEEPER EXTRAORDINARY MAINTENANCE

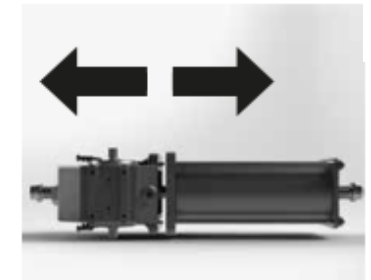
If it is necessary to carry out a deeper extraordinary maintenance inside the housing, perform the following steps.

4.7.1. Connect a lifting system to the eyebolts /lifting lugs of the actuator. Disassemble the bolting between valve bracket and actuator. Lift and remove actuator from the valve. Care should be taken to choose a lifting system suitable for the weight of the actuator.



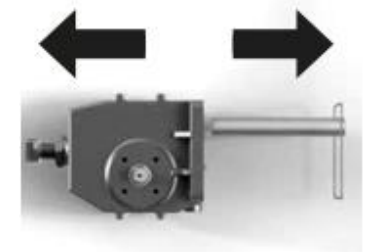
1

4.7.2. Remove the pneumatic cylinder, unscrewing the six screws (29) and unbolting the piston rod (11) from the guide block (13), as described in paragraph 4.5.



2

4.7.3. Remove the o-ring (9) and the guide bar (10) from the housing.



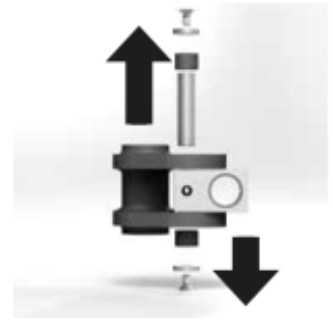
3

4.7.4. Remove the retaining rings (5), the bushes (4) and the O-rings (31); unscrew the caps (2) and finally, unscrew the two bolts (1). Now, pull out the output shaft (28) from the housing (30).



4

4.7.5. Remove the Scotch yoke (3) mechanism from the housing, unscrew upper and lower screws (6). Pull out the two washers (7) and roller bearings (8).



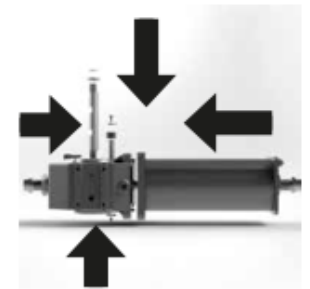
5

4.7.6. Apply a grease film on the sliding surfaces of the yoke wings (3) and of the roller bearings (8). For grease characteristics, see the tables included in paragraph 4.3. Replace the O-ring (9)



6

4.7.7. Reassemble the parts of the housing using a reverse procedure as previously described. Tighten the screws in accordance with the torque tables included in Annex section.



7

4.8. SPARE PARTS

The main possible spare parts for LPC actuators used in ON/OFF applications are listed in the table below.

Depending on chosen actuator configuration other spare parts may be required. To obtain spare parts lists specific for each job/order, please contact your Flowserve Limitorque representative.

Part numbers are referred to in Figure 24.

Num	Description	Qty
9	O-Ring	1
21	O-Ring	1
22	O-Ring	3**
24	O-Ring	1

Num	Description	Qty
25	O-Ring	1
31	O-Ring	1
36	Tape Guide	1
40**	O-Ring	1

** Variable number depending on model

Table 1: LPC Spare Parts List for ON/OFF applications
(for aging within guaranteed cycles of EN15714).

5 TROUBLESHOOTING

To prevent the actuator from not functioning properly or having a reduction in performances, first ensure that the installation and the adjustment operations are carried out completely in accordance with this manual and with all possible relevant additional instructions.



WARNING: When attempting to identify faults, it is very important to observe all the regulations and instructions about Safety and Health at Work. Read all the paragraphs of this manual concerning maintenance before opening the actuator for inspection or before starting to repair any of its components. If in doubt, choose **SAFETY FIRST**.

The following table lists potential problems along with corresponding causes and possible solutions. If a malfunction cannot be identified and eliminated using the table, please contact a Flowserve representative.

Troubleshooting Table		
Problem	Possible cause	Solution
The actuator does not move.	Actuator has not been properly installed.	Check that all the Pneumatic connections and that all the Pneumatic components have been installed correctly and are in accordance with the actuator operating mode.
		Check that the actuator is properly connected to the valve and that there aren't problems in the mounting kit.
	Supply pressure problems.	Check that sufficient supply pressure is available at actuator inlet port. If possible, place a gauge in line and monitor the pressure level, in order to discover unexpected pressure drops.
CONTINUE ...		



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Troubleshooting Table

Problem	Possible cause	Solution
<p>... CONTINUE</p> <p>The actuator does not move.</p>	Problems in the control panel (if present).	Check the correct functioning of the control panel. In particular, check all the Pneumatic and electric connections
		Check the correct level of supply voltage for solenoid valves and for other electrical/electronic components.
	Inlet / Exhaust port(s) obstructed.	Ensure Inlet/Exhaust ports are free and not obstructed by residues due to improper air filtration. If not, clean them (and possible dust excluders) of any obstructions. Possible Exhaust Screw cap(s) must be disengaged.
	Leakage of the Pneumatic cylinder.	A significant air leak may prevent the actuator from operating. Ensure that there aren't any leaks in the Pneumatic cylinder. Check also that there are not leaks across the piston. If possible, slightly pressurize the cylinder, then section the final part of Pneumatic supply line and detect if pressure drops over time are present, by means of a pressure transmitter. If possible, detect leakages towards the external environment using a leak finder spray. If leaks are present, follow the cylinder maintenance instructions given in paragraph 4.6.
	The valve is blocked.	Check that the valve moves freely. If necessary, disassemble the actuator from the valve.
	Spring problems (if actuator is a single acting version).	Check the proper functioning of the spring module. If problems are found, contact the Flowserve Service Department. In particular, perform the following test: disassemble the actuator from the valve and measure the minimum pressure values necessary to move and compress the spring. Compare the measured values with the ones reported on Testing Certificate. If there are significant differences, contact Flowserve Service Department.
CONTINUE ...		

In case of other problems not listed in this table, contact Flowserve Service Department.



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Troubleshooting Table

Problem	Possible cause	Solution
<p>... CONTINUE</p> <p>The actuator does not move.</p>	A moving part is seized up.	If all the above causes can be excluded, please contact Flowserve Service Department.
<p>The valve does not fully perform the stroke, in opening or closing direction, or, The valve does not shut off properly and leaks are found.</p>	The actuator model is not the correct one or is not suitable for the plant environmental conditions.	Check the actuator nameplate and relevant documentation. Then check the order requirements and installation conditions. If there are mismatches, contact Flowserve Service Department.
	A lockout device has been inserted and forgotten in that position.	Disconnect the lockout module.
	The actuator is not properly adjusted.	Adjust the stopper bolt(s) until the valve is leak-tight across the seat. Follow the instructions given in paragraph 2.3 about Travel-stopper bolts adjustment.
	Inlet / Exhaust port(s) partially obstructed.	Ensure Inlet/Exhaust ports are free and not partially obstructed by residues due to improper air filtration. If not, clean them (and possible dust excluders) of any obstructions.
	Actuator torque lower than required.	In order to perform a check it is necessary to perform the following test: disassemble the actuator from the valve and measure the minimum pressure values necessary to move and compress the spring (if the actuator is a single acting model) or the minimum pressure values necessary to move the actuator and perform a full stroke (for double acting models). Compare the measured values with the values reported on the Testing Certificate. If significant differences are present, contact Flowserve Service Department.
	A moving part is seized up.	If all the above causes can be excluded, please contact Flowserve Service Department.

In case of other problems not listed in this table, contact Flowserve Service Department.



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Troubleshooting Table

Problem	Possible cause	Solution
During the stroke the actuator exhibits excessive amounts of backlash.	Some components are excessively worn.	Identify and replace possible worn out components, according to the procedure described in the relevant paragraphs of this manual, or in any special maintenance operating instructions.
Abnormal Increase of maneuver time (in opening or closing direction)	Supply pressure problems / Decrease in supply air flow rate.	Check that a sufficient supply pressure level and flow rate are available at actuator inlet port. If possible, place a gauge in line and monitor the pressure values, in order to discover unexpected pressure drops.
	Problems in the control panel (if present).	See instructions at point "The actuator does not move".
	Inlet / Exhaust port(s) partially obstructed.	See instructions at point "The valve does not fully perform the stroke".
	Problems with lubricants.	Ensure that the actuator is properly lubricated, and that there is no solidified grease among sliding parts. If actuator lubrication is inadequate or improper, apply a new uniform lubricant layer. Follow the instructions for extraordinary maintenance (par.4.3 and followings4.6). Contact Flowserve for further advices about proper oil and grease to be used.
	A moving part is (partially) seized up.	If all the above causes can be excluded, please contact Flowserve Service Department.

In case of other problems not listed in this table, contact Flowserve Service Department.



Limitorque Fluid Power Systems

USER INSTRUCTIONS

LPC ACTUATOR SERIES

Doc. Number: LFENIM0002-06-A4-05/21

Revision: 06

Date: 05/ 2021

Troubleshooting Table

Problem	Possible cause	Solution
Actuator movement jerky / not fluid / not linear	Supply pressure problems / Decrease in supply air flow rate.	See instructions at point "Abnormal Increase of maneuver time".
	Problems with lubricants.	See instructions at point "Abnormal Increase of maneuver time".
	valve requiring irregular or excessively high torque.	Check that jerky / not fluid / not linear movement is not due to valve problems. In particular, perform the following test: disassemble the actuator from the valve and measure the minimum pressure values necessary to move and compress the spring (if the actuator is a single acting model) or the minimum pressure values necessary to move the actuator and perform a full stroke (for double acting models). Compare the measured values with the values reported on the Testing Certificate. Furthermore, check that movement of the actuator disconnected from the valve is fluid and linear. If actuator functioning is as expected, the problem is reasonably due to the valve, requiring torques higher than stated ones.
	A moving part is (partially) seized up.	If all the above causes can be excluded, please contact Flowserve Service Department.
In case of other problems not listed in this table, contact Flowserve Service Department.		

6 DISPOSAL OF DECOMMISSIONED ACTUATORS



WARNING: Before disassembling the actuator from the valve, and before any decommissioning activity, ensure that the pneumatic connection ports of the cylinder are disconnected and open to the ambient. Also make sure that power and pneumatic supplies are turned off, and bleed any pressurized parts of the actuator, control panel and pneumatic tubing (including air tanks, if present). Verify that the actuator is in fail safe position, i.e., that it is not locked in a position with the spring compressed by means of locking devices.

Spring Return Actuators that must be permanently decommissioned must have the stored energy in the spring neutralized. For LPC and LPS actuators, the spring module, placed inside pneumatic cylinder, can be safely disassembled from the actuator together with the cylinder, if the supply pressure has been removed and the actuator is in its fail safe position: in fact, in this condition, any residual spring preload is avoided. To disassemble the air-spring module from the actuator, follow the instructions provided at Paragraph 4.5 and followings of this manual.

Once the cylinder is disassembled from the actuator, the spring inside it can be neutralized in different ways depending on the equipment available on-site. Please contact your Flowserve Limatorque representative to receive a dedicated procedure for Spring Module disassembly and disposal, in order to safely perform all these operations, in the most appropriate way, according to available equipment and tools.



DANGER: Failure to neutralize the spring contained in the actuator's spring module or to follow these instructions could lead to injury to personnel or property damage.

No other specific actions need be taken on other portions/parts of the actuator for decommissioning. To disassemble pneumatic cylinder, follow the instructions provided in Paragraph 4.6 of this manual.

All disassembled parts of the actuator shall be separated according to their material type (metal, rubber, plastic, oil and grease, electric and electronic equipment ...). Dispose them with support of differentiated waste collection sites, as provided for by the laws and provisions in force.

7 ANNEXES

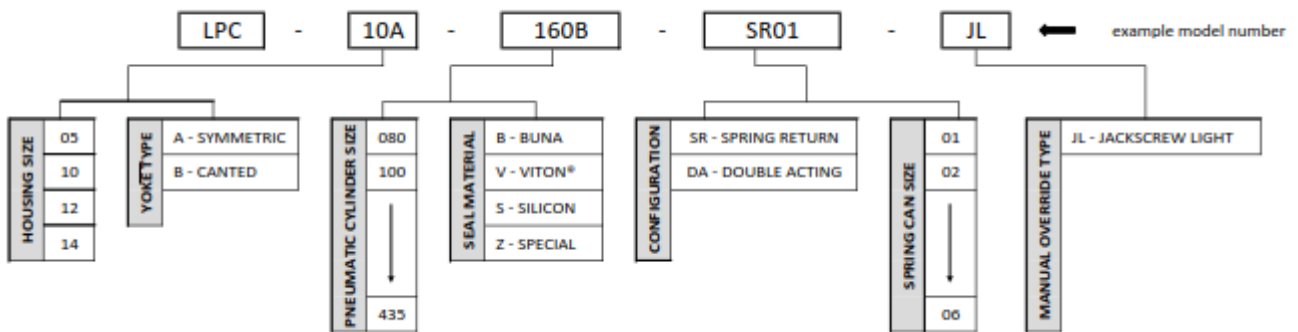


Table 2 – LPC Model Selection table

Code	Material	Temperature Range	Climate Classification According to IEC60721
B	Buna	Std Temp: -29°C to +100°C (-20°F to 212°F)	Tropical & Arid
V	Viton®	Hi Temp: up to +160°C (320°F)	
S	Silicon	Low Temp: down to -40°C (-40°F)	Temperate
Z	Other	Special Applications – Consult Factory	Cold & Polar

Table 3 – Seals Materials

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Cylinder Diameter	Tie Rods Diameter	Torque [Nm]
all LPC05 cylinders sizes	M10	20
100 mm ÷ 200 mm	M12	30
220 mm ÷ 235 mm	M12	45
285 mm ÷ 385 mm	M12	55
435 mm	M16	85

Table 4: Tightening Torque Table for 12 barg Standard (not PED certified) **Cylinder Tie Rods** ASTM A193 B7 /A320 L7, without application of Threads

Cylinder Diameter	Tie Rods Diameter	Torque [Nm]
all LPC05 cylinders sizes	M10	20
100 mm ÷ 200 mm	M12	30
220 mm ÷ 235 mm	M12	45
285 mm ÷ 360 mm	M12	50
385 mm	M12	40
435 mm	M16	85

Table 5: Tightening Torque Table for 12 barg PED Certified **Cylinder Tie Rods** ASTM A193 B7 /A320 L7, without Threads Lubricant.



CAUTION: In case of doubts or materials differing from the ones indicated in caption contact Flowserve for the correct tightening torques to be applied.

Screws	Torque [Nm]
M3	1,1
M4	2,5
M5	5,0
M6	8,6
M8	21,0
M10	42,0
M12	72,0
M14	116,0
M16	180,0
M18	250,0
M20	354,0
M22	487,0

Screws	Torque [Nm]
M24	609,0
M27	901,0
M30	1222,0
M33	1660,0
M36	2131,0
M39	2766,0
M42	3414,0
M45	4273,0
M48	5161,0
M52	6646,0
M56	8277,0
M60	10283,0
M64	12373,0

Table 6: Tightening Torques for **Screws** Class 8.8 or ASTM A193 B7 /A320 L7 with metric coarse thread, without application of threads Lubricant, **screwed in carbon steel components** (IMPORTANT: Tie Rods excluded – see tables 4 and 5 / Screws screwed in cast iron excluded – see table 7)

Screws	Torque [Nm]
M3	0,8
M4	1,9
M5	3,8
M6	6,6
M8	16,0
M10	32,0
M12	54,0
M14	88,0
M16	136,0
M18	189,0
M20	268,0
M22	369,0

Screws	Torque [Nm]
M24	461,0
M27	683,0
M30	926,0
M33	1257,0
M36	1614,0
M39	2095,0
M42	2586,0
M45	3237,0
M48	3910,0
M52	5034,0
M56	6270,0
M60	7790,0
M64	9373,0

Table 7: Tightening Torques for **Screws** Class 8.8 or ASTM A193 B7 /A320 L7 with metric coarse thread, without application of threads Lubricant, **screwed in cast iron components** (IMPORTANT: Tie Rods excluded – see tables 4 and 5 / Screws screwed in carbon steel excluded – see tables 6 / Grub Screws of Scotch Yoke excluded – see tables 8)



CAUTION: In case of doubts or materials differing from the ones indicated in caption contact Flowserve for the correct tightening torques to be applied.



WARNING: During assembly of studs on center body base flange use Loctite 542 or equivalent

Actuator Model	Grub Screws Diameter	Torque [Nm]
LPC-05	M20	195
LPC-10	M30	486
LPC-12	M36	775
LPC-14	M42	1241

Table 8: Torque Table for **Grub Screws of Scotch Yoke** screwed in **cast iron** (Num. 1 with reference to Figure 24).



WARNING: During assembly of grub screw of Scotch Yoke use Loctite 270 or equivalent.



Limatorque Fluid Power Systems

USER INSTRUCTIONS

LPC ACTUATOR SERIES

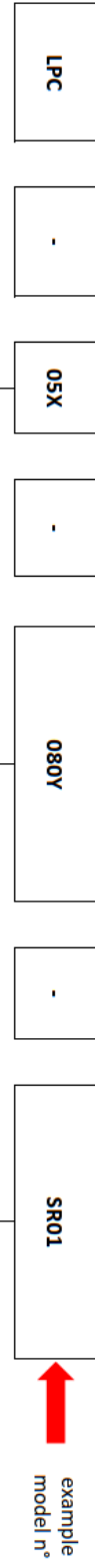
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Revision: 06

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(*) End Stops Kit are inclusive of the end stop assemblies that are installed on the side of housing and pneumatic cylinder
 (**) In LPC single acting version the spring is located inside the pneumatic cylinder

WEIGHT TABLE - SINGLE ACTING (Fail Close/Fail Open)



HOUSING SIZE	
LPC - 05	21 (45)
LPC - 10	29 (64)
LPC - 12	53 (117)
LPC - 14	76 (167)

END STOPS KIT (*)	
LPC - 05	1,5 (3,4)
LPC - 10	2,6 (5,6)
LPC - 12	2,6 (5,6)
LPC - 14	5,7 (12,5)

PNEUMATIC CYLINDER SIZE		LPC - 05	LPC - 10	LPC - 12	LPC - 14
Ø CYLINDER	SPRING				
080Y	SR01	17 (38)	-	-	-
080Y	SR02	18 (39)	-	-	-
100Y	SR01	21 (46)	32 (70)	-	-
100Y	SR02	21 (46)	-	-	-
100Y	SR03	21 (46)	-	-	-
120Y	SR01	24 (53)	35 (77)	-	-
120Y	SR02	24 (53)	37 (82)	-	-
120Y	SR03	24 (54)	-	-	-
120Y	SR04	26 (56)	-	-	-
120Y	SR05	26 (57)	-	-	-
140Y	SR01	28 (61)	38 (85)	45 (99)	-
140Y	SR02	28 (62)	40 (89)	-	-
140Y	SR03	28 (62)	44 (98)	-	-
140Y	SR04	29 (65)	-	-	-
140Y	SR05	30 (65)	-	-	-
140Y	SR06	31 (68)	-	-	-
160Y	SR01	34 (76)	50 (111)	49 (108)	-
160Y	SR02	33 (73)	50 (110)	51 (113)	-
160Y	SR03	33 (73)	57 (126)	60 (132)	-
160Y	SR04	34 (76)	59 (130)	-	-
160Y	SR05	35 (77)	62 (136)	-	-
160Y	SR06	35 (77)	-	-	-
180Y	SR01	55 (121)	53 (117)	70 (155)	-
180Y	SR02	57 (125)	55 (122)	-	-
180Y	SR03	62 (136)	64 (142)	-	-
180Y	SR04	64 (141)	68 (150)	-	-
180Y	SR05	67 (147)	-	-	-
180Y	SR06	70 (153)	-	-	-
200Y	SR01	54 (119)	58 (128)	-	-
200Y	SR02	56 (123)	60 (132)	-	-
200Y	SR03	61 (134)	70 (153)	-	-
200Y	SR04	73 (162)	-	-	-
200Y	SR05	65 (144)	75 (164)	-	-
200Y	SR06	68 (150)	-	-	-
220Y	SR01	64 (142)	-	-	-
220Y	SR02	66 (146)	-	-	-
220Y	SR03	71 (157)	-	-	-
220Y	SR04	73 (162)	-	-	-
220Y	SR05	76 (167)	-	-	-
220Y	SR06	78 (173)	-	-	-

PNEUMATIC CYLINDER SIZE		LPC - 12	LPC - 14
Ø CYLINDER	SPRING		
235Y	SR01	69 (153)	86 (190)
235Y	SR02	72 (158)	90 (199)
235Y	SR03	82 (180)	101 (222)
235Y	SR04	86 (189)	-
235Y	SR05	87 (191)	-
235Y	SR06	96 (212)	-
285Y	SR01	97 (213)	113 (249)
285Y	SR02	100 (220)	117 (258)
285Y	SR03	109 (241)	127 (281)
285Y	SR04	116 (256)	103 (228)
285Y	SR05	117 (258)	-
285Y	SR06	127 (279)	-
335Y	SR01	124 (273)	145 (320)
335Y	SR02	127 (280)	149 (329)
335Y	SR03	138 (304)	160 (352)
335Y	SR04	145 (319)	134 (296)
335Y	SR05	146 (321)	166 (365)
335Y	SR06	155 (342)	182 (402)
360Y	SR01	-	165 (363)
360Y	SR02	-	169 (372)
360Y	SR03	-	179 (395)
360Y	SR04	-	154 (339)
360Y	SR05	-	183 (403)
360Y	SR06	-	202 (444)
385Y	SR01	-	183 (404)
385Y	SR02	-	187 (413)
385Y	SR03	-	198 (436)
385Y	SR04	-	172 (379)
385Y	SR05	-	203 (448)
385Y	SR06	-	220 (485)
435Y	SR01	-	238 (517)
435Y	SR02	-	234 (523)
435Y	SR03	-	249 (548)
435Y	SR04	-	223 (491)
435Y	SR05	-	254 (559)
435Y	SR06	-	270 (596)

Table 9: Weights in kg (lbs) – Weights may be subject to changes. For the accurate measurement please contact your Flowserve representative

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WEIGHT TABLE - DOUBLE ACTING										
LPC	-	05X	-	080Y	-	DA	←	example model n°		
HOUSING SIZE		LPC - 05	21 (45)							
		LPC - 10	29 (64)							
		+					+			
		PNEUMATIC CYLINDER SIZE		Ø CYLINDER	05	10	12	14		
				080 DA	12 (27)	-	-	-		
				100 DA	15 (33)	27 (60)	-	-		
				120 DA	17 (38)	31 (68)	-	-		
				140 DA	20 (45)	33 (74)	27 (59)	-		
				160 DA	25 (54)	42 (92)	30 (66)	-		
				180 DA	-	44 (97)	33 (73)	38 (84)		
				200 DA	-	44 (96)	37 (81)	-		
				220 DA	-	53 (116)	42 (93)	-		
				235 DA	-	-	47 (104)	51 (113)		
				285 DA	-	-	71 (156)	70 (154)		
				335 DA	-	-	93 (205)	100 (220)		
				360 DA	-	-	-	111 (245)		
				385 DA	-	-	-	131 (289)		
				435 DA	-	-	-	175 (385)		
		+		END STOPS KIT (*)						
				LPC - 05	1,5 (3,4)					
				LPC - 10	2,6 (5,6)					
Double Acting Cylinder Assembly										

(*) End Stops Kit are inclusive of the end stop assemblies that are installed on the side of housing and pneumatic cylinder

Table 10: Weights in kg (lbs) – Weights may be subject to changes. For the accurate measurement please contact your Flowserve representative

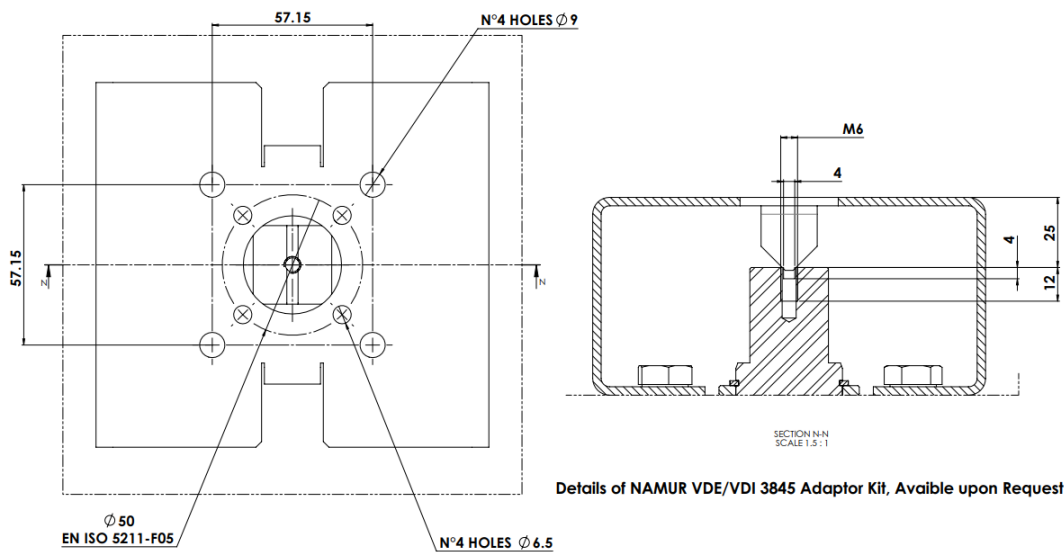
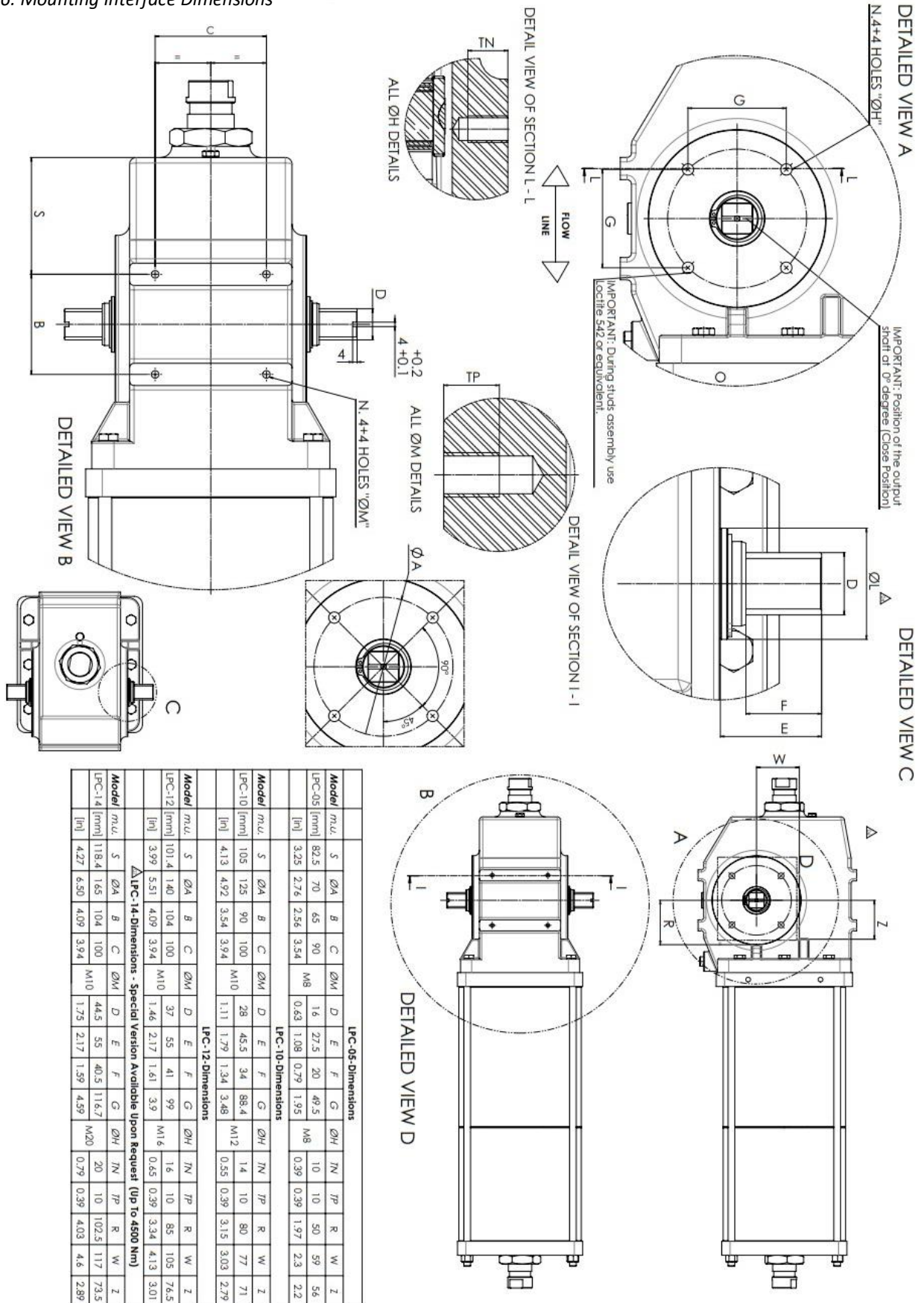


Figure 25: Standard NAMUR VDE/VDI 3845 Kit details (available as optional item, upon request)

other versions are available verify your Job Order documentation or contact your Flowserve representative if required in case of doubts

Figure 26: Mounting Interface Dimensions



other versions are available verify your Job Order documentation or contact your Flowserve representative if required in case of doubts

Figure 27: Mounting Interface Dimensions

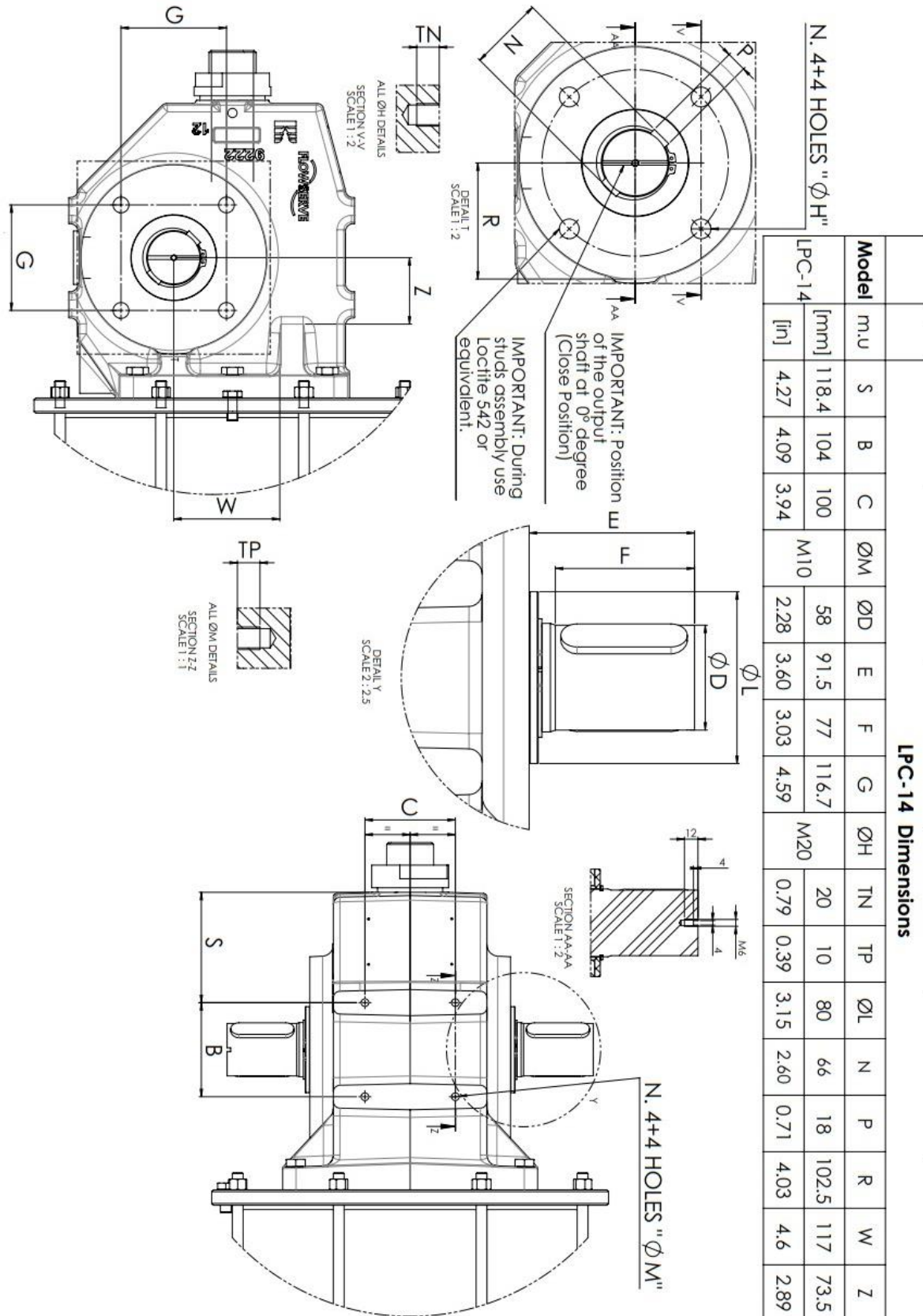
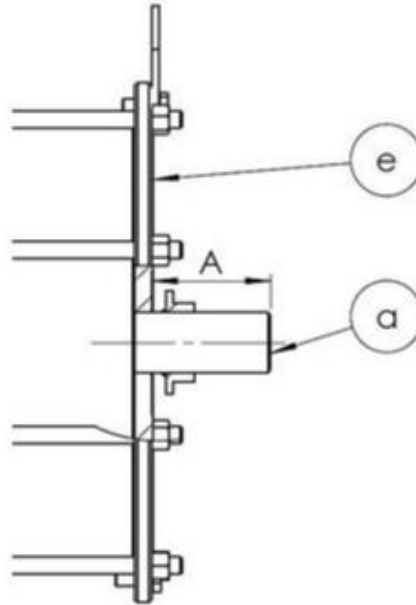


Figure 28: LPC – Distance A with standard stopper bolt mounted



DANGER: The table below is valid only for standard LPC actuator without manual override. The table is not valid for modular stock order. Please refer to the order documentation and contact Flowserve for any suspected situation that may differ from the cases described here.

A - LPC - CYLINDER - MAX STOPPER SAFETY ENGAGEMENT					
		ACTUATOR SIZE			
		LPC-05	LPC-10	LPC-12	LPC-14
LPC - CYLINDER SIZE	80	76	-	-	-
	100	76	81	-	-
	120	76	81	-	-
	140	76	81	96	-
	160	76	81	96	-
	180	-	81	96	126
	200	-	81	96	-
	220	-	81	-	-
	235	-	-	96	121
	285	-	-	91	116
	335	-	-	86	116
	360	-	-	-	116
	385	-	-	-	116
	435	-	-	-	111
		M30	M42	M42	M52
LPC - STOPPER BOLT - SIZE					

Figure 28a: LPC – Cylinder Max stopper safety engagement



Flowserve Limitorque

Fluid-Power Systems

Via delle Industrie 23
20883 Mezzago (MB), Italy
Email: lfpsinfo@flowserve.com

Flowserve U.S. Inc.

Valve Automation Center

14219 Westfair,
West I Houston, Texas 77041, U.S.A.
Email: VACHouston@flowserve.com

Flowserve - India

Plot n.4 1A
Export Promotion Industrial Park
Whitefield, 560066
Bangalore, India
Email:
BGA_applications@flowserve.com

Flowserve - China

Hanwei Plaza 7,
Guanghua Road, Chaoyang District,
Beijing 100004, China
Email:
AutomationAPAC@flowserve.com
AutomationChina@flowserve.com

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visit www.flowserve.com or call:
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