



# *USER INSTRUCTIONS*

## *LPC Pneumatic Compact Actuator Series Single Acting & Double Acting*

FCD LFENIM0002-03-AQ – 08/16

*Installation  
Operation  
Maintenance*



*Experience In Motion*

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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 as required on the LPC Actuator Series. 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 LPC 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 field located in the actuator nameplate.

**NOTE:** For PED applications, the standard operating temperature range is -20°C/+100°C. 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 field located in the actuator nameplate.

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

**▲ WARNING:** It is recommended to respect the minimum and maximum allowable temperatures indicated on the actuator nameplate. More factors like the valve and pipe temperatures, sun direct exposure and other environmental conditions shall be considered, not to exceed the temperature range.

**▲ WARNING:** It is recommended not to exceed the allowable pressure range of the supply fluids, as stated in the actuator nameplate. It is very important to make the standard maintenance at all safety components. In case of PED 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 air and nitrogen. Different types of fluids may be used only after Flowserve verification. In case of PED cylinders the type of fluid is indicated on the specific nameplate on the cylinder.

**▲ WARNING:** It is recommended to use the type of fluid indicated on the nameplate (PED cylinders) 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 hydration of the supply fluid are in accordance with the requirements of these accessories indicated on their own maintenance and user manuals.

## 1.3 Protective Clothing

Flowserve products are often used in dangerous applications (e.g., extremely high pressures, 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.

## 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 for corrosion or deterioration before using these products. A table with the list of the main spare parts for standard ON/OFF applications with the interval times can be found in Paragraph 4.4 in Table 1.

## 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 could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties.

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 a few sizes are required for the overall operations. The lifting equipment consists on commercial chains and slings of adequate dimensions.

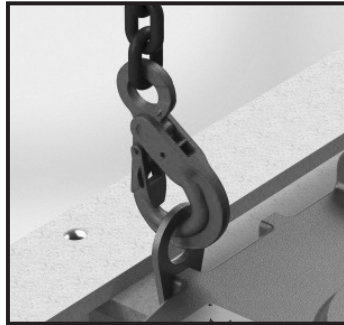
In order to prevent damage to actuator accessories, before starting the lifting operations, ensure that the lifting tools, like chain and clevis hook, are in the correct position and don't interfere with the control panel and related tubing.

- ▲ **CAUTION:** Lifting and handling of the actuator should be done by qualified personnel and in compliance with the laws and regulations in force.
- ▲ **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 assembly together. During the lifting operations do not stand under the lifted actuator. The actuator should be handled with appropriate lifting equipment. The weight of the actuator is reported on the packing slip and on the overall-dimensions drawing furnished with the documents accompanying the actuator.

For actuator weight, please refer to Figure 23 in the Annex section. For the general actuator dimensions, please refer to LPC technical bulletin LFENTB0002, available on [www.flowserve.com](http://www.flowserve.com).

### 1.8.1 Lifting Arrangement of LPC-05 and LPC-10 models

Figure 1a: Use of Lifting Lug



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

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

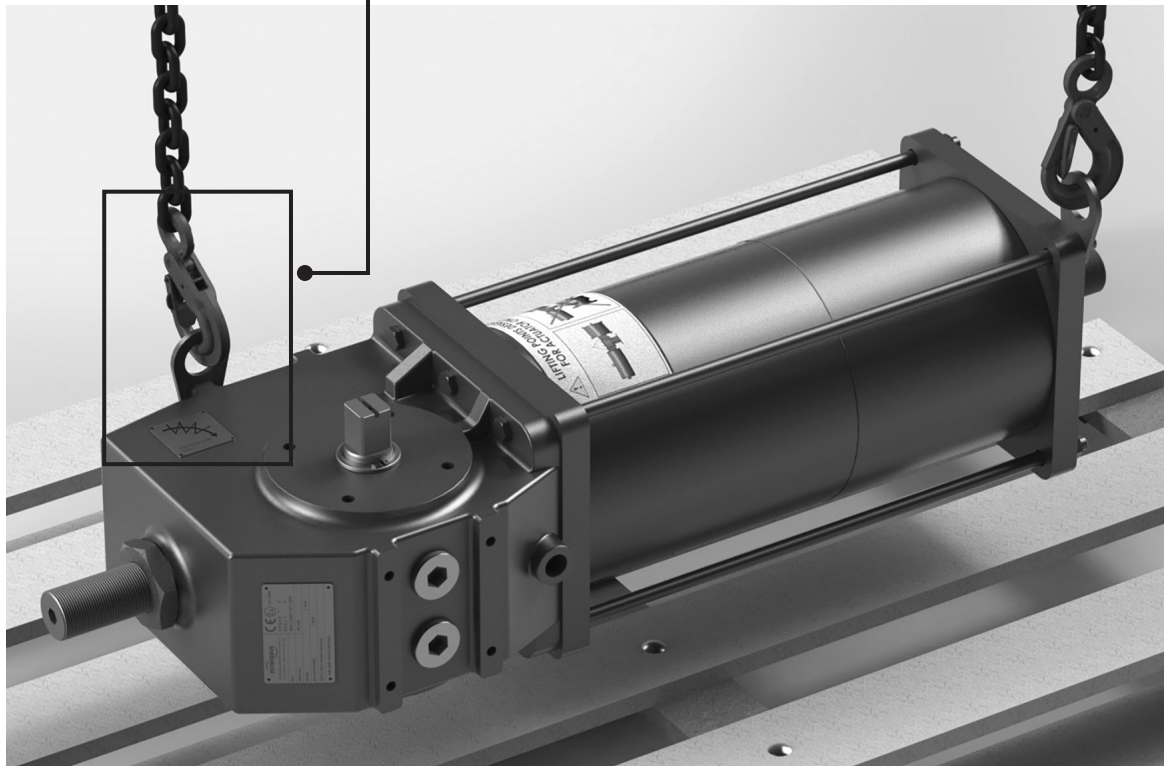


Figure 2a: Correct Lifting of LPC-05 and LPC-10 Pneumatic Actuator Models

1.8.2 Lifting Arrangement of LPC-12 and LPC-14 Models

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

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

Figure 1b: Use of Lifting Lug



Figure 2b: Correct lifting of LPC-12 and LPC-14 pneumatic actuator models



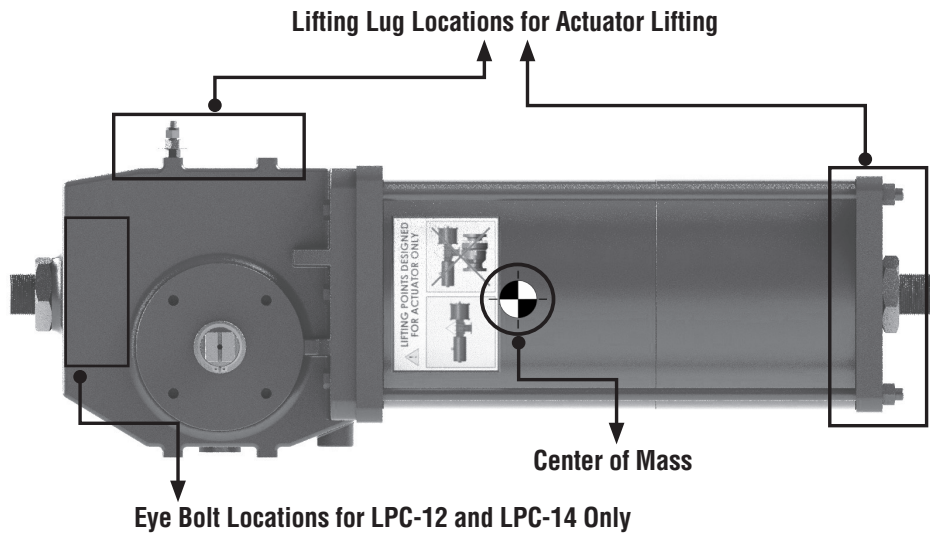


Figure 3: Single Acting Actuator Center of Gravity Position and Lifting Arrangement

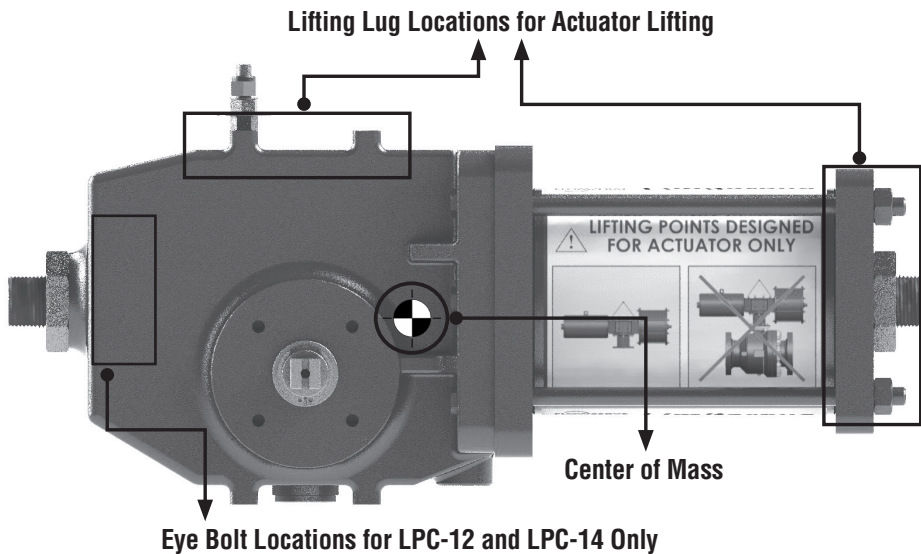


Figure 4: Double Acting Actuator Center of Gravity Position and Lifting Arrangement

- ▲ **WARNING:** For lifting and handling use appropriate lifting lugs, installing on the rear of the housing and on the tail flange, as shown in Figure 2. It is recommended not to use the lifting lug to lift the actuator with the valve assembled.
- ▲ **WARNING:** After transportation, inspect the components to look for any damage.

## 1.9 Storage

In many cases Flowserve products are manufactured from stainless steel. Products not manufactured from stainless steel 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 outdoor, or if long-term storage (more than four months) is necessary, the plastic protection plugs have to be replaced by metal plugs, because the plastic plugs have no weatherproof function, whereas the metal ones guarantee a 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.

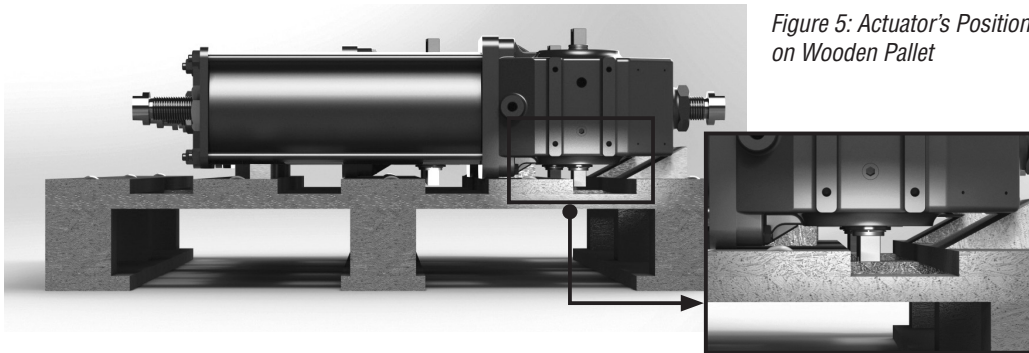


Figure 5: Actuator's Position on Wooden Pallet

Figure 6: Position of the Output Shaft

## 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. This means that the instructions normally include only the directions to be followed by qualified personnel where the product is being used for its defined purpose. 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 Manual” accompanies this manual, when the actuator is under one (or more) of the following European Directives:

- 2006/42/EC – Machinery Directive
- 94/9/EC – ATEX Directive
- 97/23/EC – PED Directive

If “ATEX/PED/Machinery Directive Manual” is not in your hands, 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 Limatorque representative.

# 2

## Installation Instructions

The LPC range of Limatorque pneumatic actuators is a robust, lightweight modular Scotch yoke design, available in both spring return and double acting configurations. Available with valve interface in compliance with ISO 5211, or customized upon request.

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

### 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.

Figure 7: Air Supply Plate



Figure 8: Fail CW Plate, According to EN 15714-3 Standard

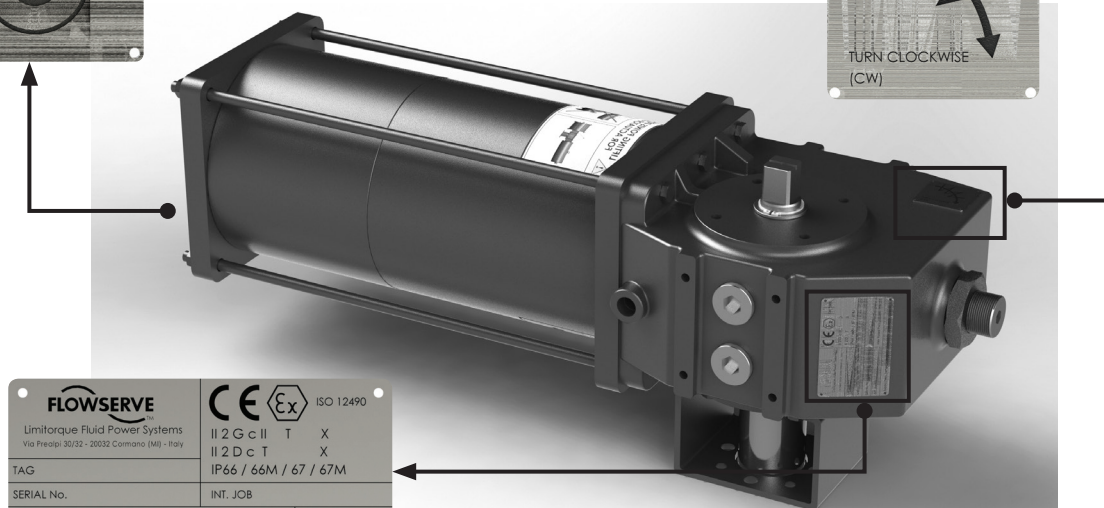


Figure 9: Standard Nameplate Position

<b>FLOWERVE</b>		<b>CE</b>	<b>Ex</b>	ISO 12490
Limatorque Fluid Power Systems Via Prealpi 30/32 - 20032 Comano (MI) - Italy				
TAG		II 2 G c II T X II 2 D c T X IP 66 / 66M / 67 / 67M		
SERIAL No.		INT. JOB		
MODEL		YEAR		
MAX RATED PRESS.		MOP		
SUPPLY PRESS. RANGE (Min/Max)				
● AMB. TEMP. RANGE (Min/Max)				

Figure 10: Nameplate Sample

**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, in accordance with ISO 5599-2.

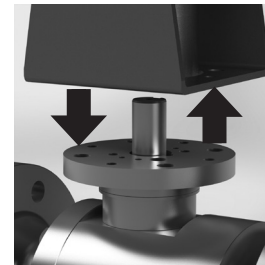
**NOTE:** The fail-safe direction of rotation is identified by a dedicated plate, as shown in Figure 8 , in accordance with EN 15714-3.

Before mounting the actuator on the valve, manually open and close valve (if possible), to ensure it is not stuck. Be sure valve and Limatorque actuator rotate in the same direction and are in the same position (i.e., valve closed, actuator closed). The assembly position of the actuator, with reference to the valve, has to be in accordance with the plant requirements (actuator axis parallel or perpendicular to the pipeline axis).

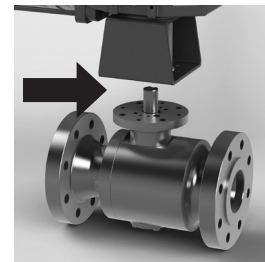
## 2.2 Connection With Valve and Mounting Kit

The LPC actuator is usually supplied with the spool piece already assembled. To assemble the actuator onto the valve, perform the following steps:

2.2.1 Check the mounting surfaces, the stem adaptor and the spool piece to assure proper fit. Clean the flanges of the valve and spool piece 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 vertical) in the 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. Lubricate the valve stem in order to ease the assembly. Place the stem adaptor on the valve stem.



2.2.3 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.



2.2.4 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 (Table 4 in Annex section).



**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.

- ▲ **WARNING:** In case of spool piece (or adapter flange) installation by the client, it is mandatory to refer to the “Mounting Interface Dimensions” paragraph of Technical Bulletin No. LFENTB0002, or to follow more specific instructions included in the job documentation supplied along with the actuator.
- ▲ **CAUTION:** The actuator lifting and handling should be made by qualified personnel and in compliance with the laws and provisions in force.
- ▲ **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 assembly together. During the lifting operations do not stand under the lifted 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 documents accompanying the actuator.

## 2.3 Travel-stop Bolts and Accessories

All actuated valves require accurate travel-stop adjustments at both ends of the stroke to obtain optimum performance and valve seat life. Adjust the travel-stop bolts of the actuator for the proper open and 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-stops is performed in accordance with the following steps. Refer to Figure 26.

- Pneumatic cylinder stop (19): Loosen the hex nut (20) with a proper wrench. Screw or unscrew the stop (19), using a proper Allen key, while keeping the hex nut stationary. Tighten the hex nut.
- Housing stop (19): Loosen the hex nut (20) with a proper wrench. Screw or unscrew the stop (19), using a proper Allen key, while keeping the hex nut stationary. Tighten the hex nut.

Adjust the travel stop bolts of the actuator for the proper open and closed valve positions, per valve manufacturer’s recommendations. Pneumatically stroke the actuator several times to ensure proper operation. If the actuator is equipped with a switch, positioner or other accessories, adjust them at this time.

Limitorque can provide two different solutions of stop bolts as shown in Figures 11 and 12:

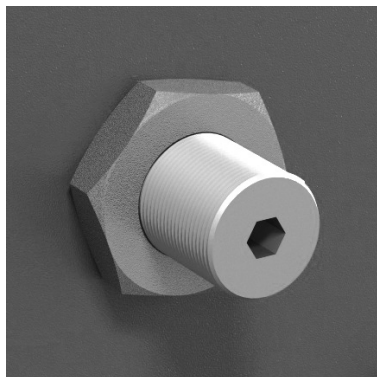


Figure 11: Standard Stop Bolt

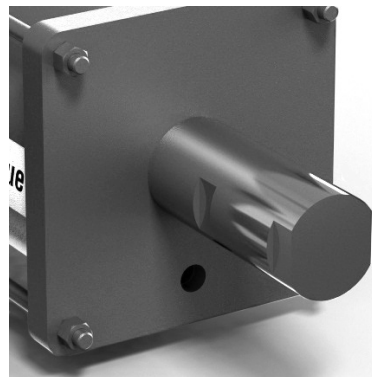


Figure 12: Enclosed Protected Stop Bolt Available Upon Request and Suitable for Severe/saline Environmental Conditions



## 2.4 Grounding System

For the actuator earthing, use the grounding kit, shown in Figures 13 and 14:

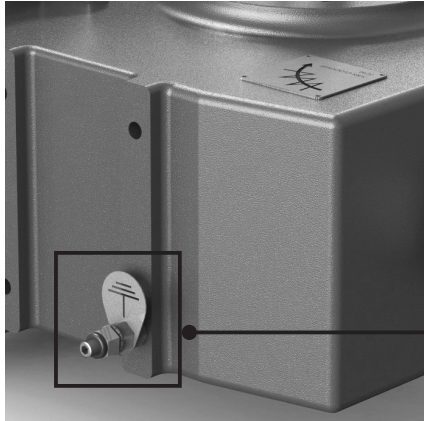


Figure 13: Grounding Kit Position

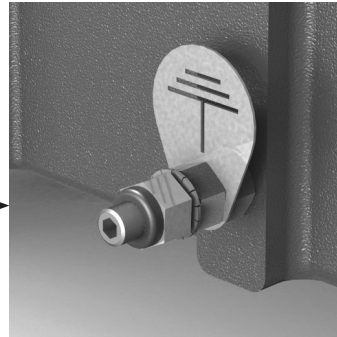


Figure 14: Grounding Kit Detail

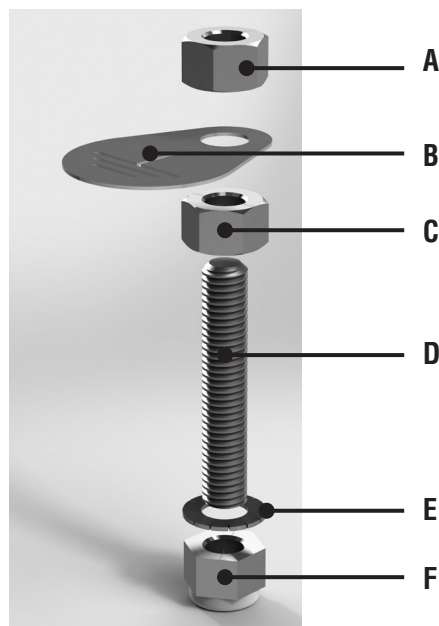


Figure 15: Grounding Kit – Exploded View

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

## 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.

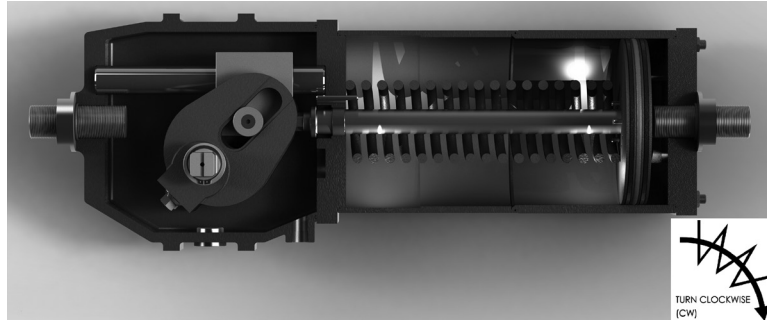


Figure 16: Single Acting Actuator Configuration: Fail Close – Fail Clockwise

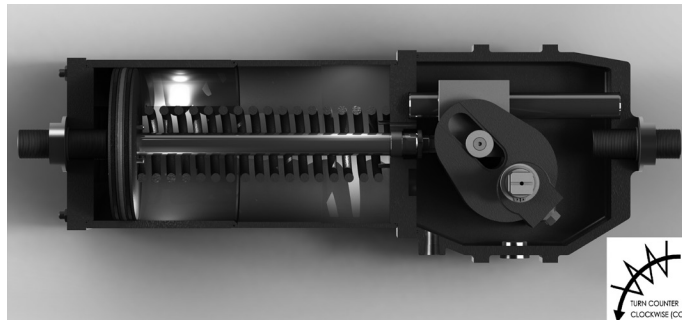


Figure 17: Single Acting Actuator Configuration: Fail Open – Fail Counter Clockwise

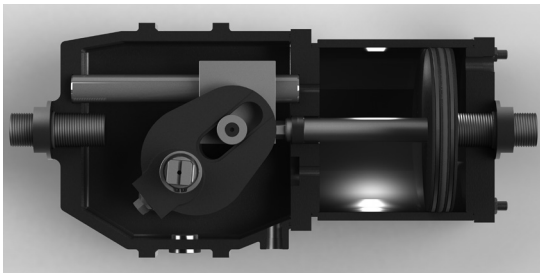


Figure 18: Double Acting Actuator Configuration – Close Position

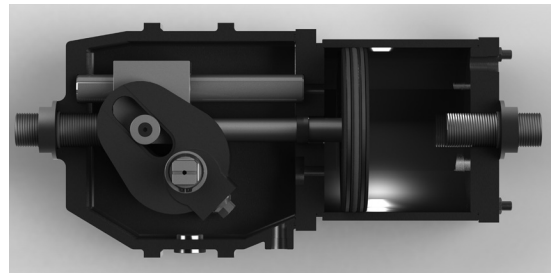


Figure 19: Double Acting Actuator Configuration – Open Position



Figure 20: Fail Close Configuration With Valve

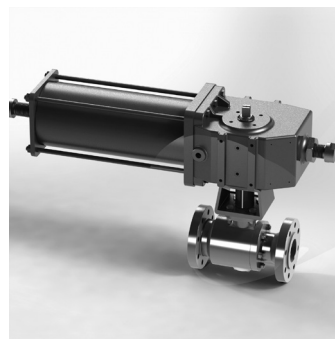


Figure 21: Fail Open Configuration With Valve

# 3 Field Conversion

For field conversion from fail open (CCW) to fail close (CW) and vice versa, follow the following steps.

**NOTE:**

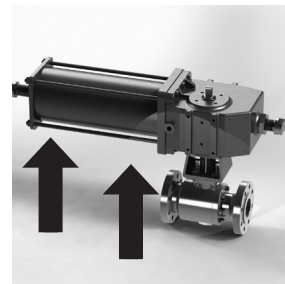
- An additional adapter kit is not required for field conversion
- Disassemble the actuator from the valve before carrying out the conversion

**▲ WARNING:** A change in an actuator’s fail-safe position/direction must be noted on the actuator’s nameplate.

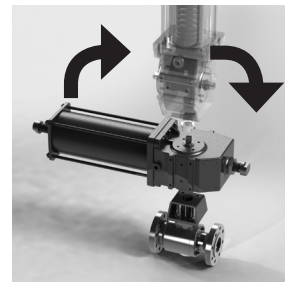
## 3.1 Actuator Disassembled From the Valve

**▲ 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 safe position.

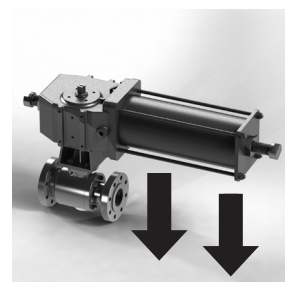
3.1.1 Starting with the actuator in a fail open (CCW) configuration, remove the actuator from the valve, keeping the spool adaptor installed onto the valve.



3.1.2 Rotate the actuator.



3.1.3 Reassemble in the new position the actuator onto the spool piece and the valve referring to Table 5. Now the actuator is in a fail close (CW) execution. Similar steps will apply for conversion from fail close (CW) to fail open (CCW).





# 4 Maintenance Instructions

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 or special or large wrenches. Furthermore, the joints among the moving parts of the actuator are made exclusively through pins and not using bolts to be tightened with specific torques.

LPC actuators do not need maintenance for long periods, even if they are working in severe conditions. The LPC actuator features a 25-year design life depending on service conditions, proper installation, operating and maintenance. In order to achieve this industry-leading design life, in-field maintenance is prescribed to be performed every five years of operations.

However, if actuator operation happens infrequently, it is recommended to periodically check the actuator, performing the following steps:

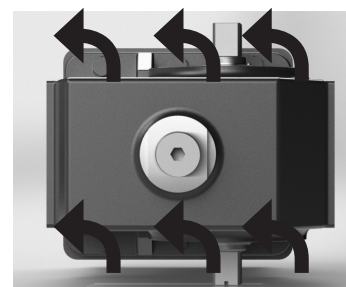
- In the plants where it is possible, carry out a few opening and closing operations, involving all the control unit components, checking that the actuator operates correctly and within the required stroking times.
- Check that all the signals (pneumatic and electric) arrive correctly to the actuator and that the supply fluid pressure is within the required range. Check for the absence of leaks in the pneumatic connections. If necessary, tighten the pipe fittings.
- Check the paint coating. If some areas are damaged due to accidental events, retouch them according to the painting specifications.

In case of scheduled preventive maintenance, or following accidental events, refer to the following maintenance instructions regarding the main actuator components (pneumatic cylinder and housing).

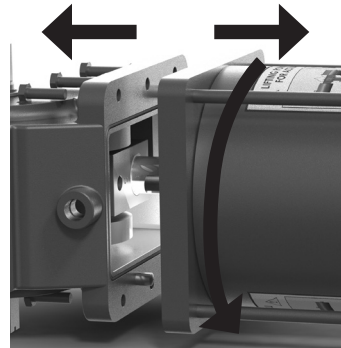
**NOTE:** In the LPC compact actuator series, in single acting execution, it is not possible to perform spring can maintenance, since the spring is located inside the pneumatic cylinder; the periodic service operations are possible only on the housing and on the pneumatic cylinder. For any issue related to spring can, it is essential to replace the entire spring and cylinder assembly.

The following instructions are referred to both standard maintenance inside Scotch yoke housing and to the entire spring and cylinder assembly replacement. The reference drawings for the instructions reported in the following paragraphs are exploded views of single acting and double acting actuators, included as Figure 26.

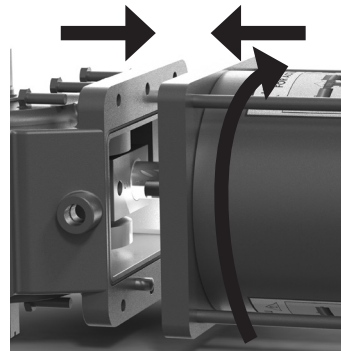
- 4.0.1 Unscrew and remove the six screws (29) which connect housing with spring can assembly.



4.0.2 Separate spring and cylinder assembly from housing and unscrew the piston rod (11) from the guide block (13), turning counterclockwise the whole spring can assembly.



4.0.3 Remove the spring and cylinder assembly replace with a new one, and re-mount the six screws (29) in according with the torque table 7 included in the Annex section.



The actuator is furnished with lubricant sufficient for all its life cycle. In case of scheduled or extraordinary maintenance, it is possible to lubricate the parts of the housing with the following greases:

**For standard temperature conditions (-29 to +100°C)**

<i>Grease Characteristics*</i>	
Worked Penetration [dmm]	280
Dropping Point ASTM [°C]	190
Base Oil Viscosity at 40°C [mm²/s]	100

\* Grease suggested: AGIP MUP2 or equivalent

**For low temperature conditions (lower limit -60°C)**

<i>Grease Characteristics*</i>	
Worked Penetration [dmm]	296
Dropping Point ASTM [°C]	260+
Base Oil Viscosity at -40°C [mm²/s]	3.1

\* Grease suggested: AEROSHELL 7 or equivalent

For different conditions, contact Flowserve.

For low temperature -60°C (-76°F) and high temperature 160°C (320°F) applications, consult Flowserve Limitorque Fluid Power Systems.

## 4.1 General Disassembly Instructions

- 4.1.1 Disconnect all air and electrical supplies from actuator;
- 4.1.2 Before dismounting the actuator, remove all accessories from actuator.
- 4.1.3 The reference drawings for the instructions reported in the following paragraphs are exploded views of single acting and double acting actuators, included as Figure 26.

## 4.2 Pneumatic Cylinder Maintenance

The standard pneumatic cylinder maintenance mainly consists in the replacement of all parts that may degrade in the course of time, even in the absence of faults. These components are the O-rings and the sliding elements of the piston. The substitution of cylinder components (or of the whole cylinder) is not expected over the entire actuator life. However, accidental events may result in damage to these components. In these cases, proceed as described in the following steps.

There are two possible types of maintenance: standard maintenance which can be performed in the field without the need to remove the pneumatic cylinder from the actuator, and a more thorough maintenance, following unexpected events, which often can be performed only after removing the cylinder from the actuator.

**⚠ DANGER:** It's recommended to not accomplish this maintenance operation with cylinder under pressure.

### Standard In-field Maintenance

**⚠ WARNING:** Before performing any maintenance operation on 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 fail safe position, i.e., that it is not locked in a position with the spring compressed by means of locking devices.

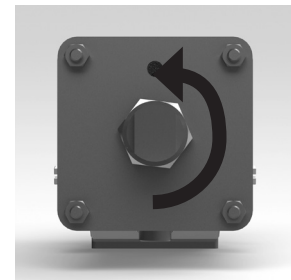
**⚠ WARNING:** Use the pneumatic cylinder only for the intended function it has been designed for.

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

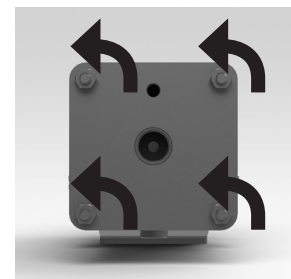
**NOTE:** In the LPC Compact Actuator Series, in single acting execution, the spring is located inside the pneumatic cylinder, as shown in Figures 16 and 17.

Perform the following steps with reference to Figure 26.

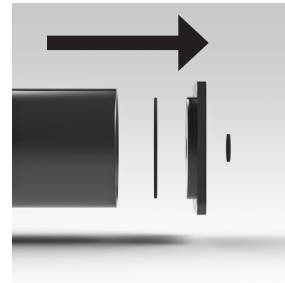
4.2.1 Unscrew and remove the travel stop of the pneumatic cylinder (19). For removing the stop, refer to the indications given in paragraph 2.3.



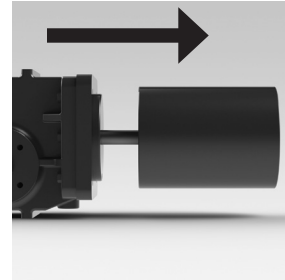
4.2.2 Remove four tie rods (16) positioned on the cylinder by unscrewing the nuts (18) on the sides of the End Flange and unscrewing the tie rods from the adaptor flange (26).



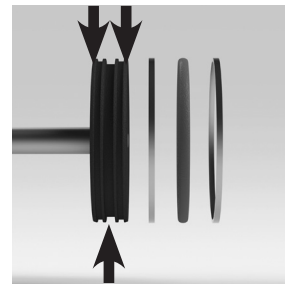
4.2.3 Remove carefully the end flange (23) from the can (17). Remove the two O-rings (21 and 22) from the end flange.



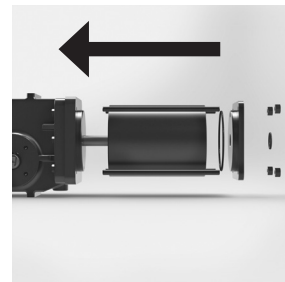
4.2.4 Finally, remove the can (17) without damaging or making scratches onto the inner can surface.



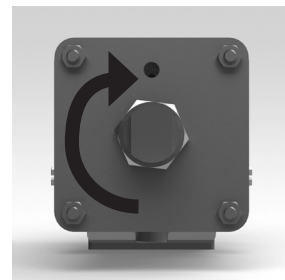
4.2.5 Remove the O-ring (25) and finally the two guide-rings (36) from the piston (15). Clean all the surface of piston and flanges in contact with these components with a clean rag and solvent compatible with O-ring material (for information, contact Flowserve). Brush the O-ring grooves with a light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



4.2.6 Reassemble the parts of the cylinder with the reverse procedure as described in points 4.2.1 to 4.2.4. The tie rods should be tightened using a torque wrench, applying a torque according to tightening table 3 included in Annex Section.



4.2.7 Readjust the travel stops as instructed in paragraph 2.3.



**NOTE:** After the standard maintenance steps, stroke the actuator a few times to check for normal operation.

## 4.3 Housing and Scotch Yoke Maintenance

Standard maintenance of the 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 located on the Scotch yoke housing. It's recommended to accomplish this maintenance operation only after removing the supply pressure from the Scotch yoke housing inlet port.

### Standard In-field Maintenance

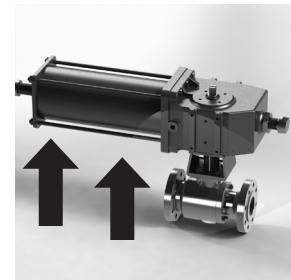
Unscrew the housing stop bolt (19) and apply a film of grease (with an applicator) directly on the Scotch yoke's sliding surface.

**NOTE:** Take note of the length of the stop bolt before making the standard maintenance and reassemble it at the same length.

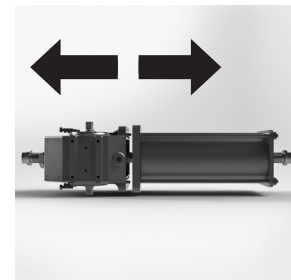
### Special Maintenance

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

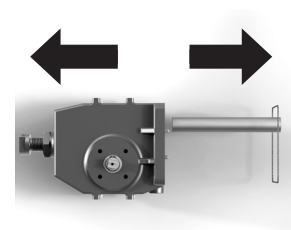
- 4.3.1 Remove the actuator from the valve.



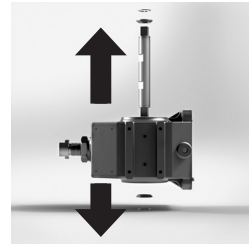
- 4.3.2 Remove the pneumatic cylinder, unscrewing the six screws (29) and unbolting the piston rod (11) to the guide block (13).



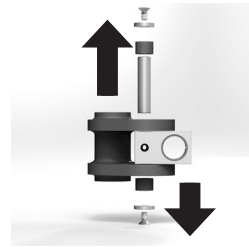
- 4.3.3 Remove the guide bar (10). Remove the O-ring (9).



4.3.4 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).



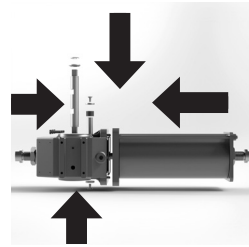
4.3.5 Remove the Scotch yoke (3) from the housing, unscrew upper and lower screws (6) and pull out the two washers (7) and roller bearings (8).



4.3.6 Apply a grease film on the slider surface of the yoke wings (3) and the roller bearings (8). For grease characteristics, see the tables included in Chapter 4. Replace the O-ring (9).



4.3.7 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.



## 4.4 Spare Parts

The main spare parts and the interval time for standard ON/OFF applications are listed in the table below. Maintenance for standard ON/OFF applications is required after 1500 cycles and/or after five years of usage, whichever occurs first.

To obtain spare parts lists specific for each job/order, please contact your Flowserve Limatorque representative. Part numbers are referred to in Figure 26.

Number	Description	Maintenance	Interval Times	Actuator Removal From the Valve
9	O-Ring	5 years	1500 Cycles	Not required (*)
21	O-Ring			
22	O-Ring			
24	O-Ring			
25	O-Ring			
31	O-Ring			
36	Guide Ring			Required
40	O-Ring	Not required (*)		

Table 1: Spare Parts List for Standard ON/OFF Applications

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

# 5 Troubleshooting

To prevent the actuator from not functioning properly or a reduction in performance, first ensure that the installation and the adjustment operations are carried out completely in accordance with this manual.

**▲ WARNING:** When attempting to identify faults, it is very important to observe all the regulations and instructions about safety. Read all the paragraphs of this manual concerning maintenance before opening for inspection or starting to repair any actuator 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.
	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 other electrical/electronic components.
	The valve is blocked.	Check that valve is free to rotate. If necessary, disassemble the actuator from the valve.
	Exhaust port(s) obstructed.	Screw cap(s) must be disengaged. Ensure vent ports are free. If not, clean them of any obstructions and clean the dust excluders, if present.
Problems with lubricants.	Ensure that the actuator is properly lubricated, and that there is no solidified grease among sliding parts or rotating parts. If actuator lubrication is inadequate or improper, apply a uniform lubricant layer. Follow the instructions for center body and cylinder maintenance (par. 4.2 and 4.3). Consult Flowserve for proper oil and grease to be used.	

Troubleshooting Table		
Problem	Possible Cause	Solution
The actuator does not move.	A moving part is seized up.	Check if any moving part is blocked. If so, follow the maintenance instructions given in the relevant paragraphs of this manual or in special maintenance operating instructions in paragraph 4.3.
	Leakages of the pneumatic cylinder.	A significant air leak may prevent the actuator from operating. Ensure that there aren't any leaks of the pneumatic cylinder. If possible, detect them using a leak finder spray. Check also that there are not leaks across the piston. If leaks are present, follow the cylinder maintenance instructions given in paragraph 4.2.
	The actuator model is not the correct one, or is not suitable for the plant conditions.	Check the actuator nameplate and the plant requirements. If there are mismatches, contact Flowserve Service Department.
	Spring problems (if actuator is a single acting model).	Check the proper functioning of the spring can. If problems are found, contact the Flowserve Service Department.
		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 the Testing Certificate. If there are significant differences you should contact Flowserve Service Department.
A lockout device has been inserted and forgotten in that position.	Disconnect the lockout module.	
The valve does not shut off properly and there are leaks.	The actuator is not correctly adjusted.	Adjust the end stops of the pneumatic cylinder and of the spring can until the valve is leak-tight across the seat. Follow the instructions given in the paragraph about Travel-stop bolts (2.3).
The valve does not fully perform the stroke, during opening or closing.	The actuator is not correctly adjusted.	As above, check the position of the end stop in opening and closing direction. If necessary, adjust them. Follow the instructions given in paragraph 2.3.
	Exhaust port(s) obstructed.	Screw cap(s) must be disengaged. Ensure vent ports are free. If not, clean them of any obstructions and clean the dust excluders, if present.
	Actuator torque lower than required.	In order to do 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 values necessary to move the actuator yoke and perform a stroke (for double acting models). Compare the measured values with the ones reported on the Testing Certificate. If there are significant differences you should contact Flowserve Service Department.
During the stroke the actuator exhibits excessive amounts of backlash.	Some components are excessively worn.	Identify and replace these components, according to the procedure described in paragraphs 4.2 and 4.3.
In case of other problems not listed in this table, you should contact the 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 are to be decommissioned permanently must have the stored energy in the spring neutralized. For LPC and LPS actuators, the spring module can be safely disassembled from the actuator 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 not transmitted to the actuator. To disassemble the spring module from the actuator follow the instructions provided at Paragraph 4.1 of this manual.

Once the Spring Module is disassembled from the actuator, the spring inside the spring module can be neutralized in different ways depending on the equipment available on site. Please contact your Flowserve Limitorque representative to receive a dedicated procedure for Spring Module disassembly, in order to safely perform this operation in the most appropriate way according to available equipment and tools.

**▲ WARNING:** 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 and scotch-yoke housing, follow the instructions provided respectively at Paragraph 4.2 and 4.3 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 Annex

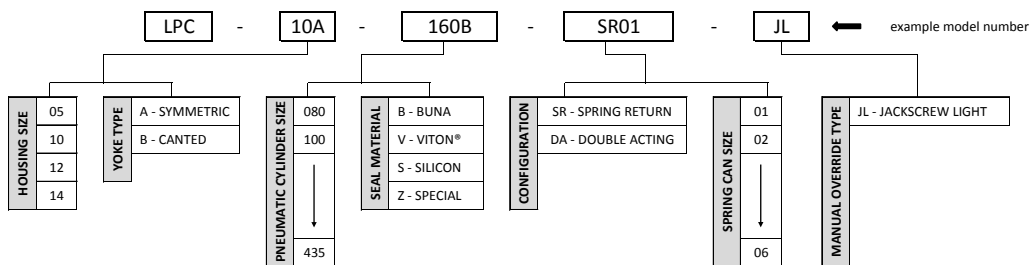


Figure 22: LPC Model Selection Table

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 2: Seals Material

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TIE RODS DIAMETER	TORQUE [Nm]
4xM10	20
4xM12	45
8xM12	60
8xM16	110

Table 3: Torque Table for both Standard and PED cylinder tie rods without lubricant (Num. 16, 18 with reference to Figure 26)

SCREW DIAMETER	Torque [Nm]
M3	0,8
M4	1,9
M5	3,8
M6	6,6
M8	16
M10	32
M12	54
M14	88
M16	136
M18	189
M20	268
M22	369
M24	461
M27	683
M30	926
M33	1257
M36	1614
M39	2095
M42	2586
M45	3237
M48	3910
M52	5034
M56	6270
M60	7790
M64	9373

Table 4: Torque Table for Screws without Lubricant applicable also to Mounting Kit – Exclusions: Tie Rods (see Table 3), Stud Bolts screwed into scotch yoke housing (see Table 5); Grub Screws of Scotch Yoke (see Table 6); Screws between housing and Pneumatic Cylinder (see Table 7)

Actuator Model	Stud Bolts Diameter	Torque [Nm]
LPC-05	M8	16
LPC-10	M12	55
LPC-12	M16	136
LPC-14	M20	268

Table 5: Torque Table for stud bolts of scotch-yoke housing coupling interface.

**IMPORTANT:** During studs assembly use Loctite 542 or equivalent.

Actuator Model	Grub Screw Diameter	Torque [Nm]
LPC-05	M20	268
LPC-10	M30	926
LPC-12	M36	775
LPC-14	M42	1241

Table 6: Torque Table for Grub Screws of Scotch Yoke (Num. 1 with reference to Figure 26).

**IMPORTANT:** During grub screw assembly use Loctite 270 or equivalent.

Screw Diameter	Torque [Nm]
M8	21
M10	42
M12	72
M14	116

Table 7: Torque Table for Screws between housing and pneumatic cylinder (Num. 29 with reference to Figure 26)

Figure 23: Modules Weight

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

LPC

-

05X

-

080Y

-

SR01

← example model n°

HOUSING SIZE		PNEUMATIC CYLINDER SIZE						END STOPS KIT (*)	
		Ø CYLINDER	SPRING	LPC - 05	LPC - 10	LPC - 12	LPC - 14		
LPC - 05	21 (45)	080Y	SR01	17 (38)	-	-	-	LPC - 05	1,5 (3,4)
		080Y	SR02	18 (39)	-	-	-		
		100Y	SR01	21 (46)	32 (70)	-	-		
		100Y	SR02	21 (46)	-	-	-		
		100Y	SR03	21 (46)	-	-	-		
		120Y	SR01	24 (53)	35 (77)	-	-		
LPC - 10	29 (64)	120Y	SR02	24 (53)	37 (82)	-	LPC - 10	2,6 (5,6)	
		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)	-			-
LPC - 12	53 (117)	140Y	SR03	28 (62)	44 (98)	-	LPC - 12	2,6 (5,6)	
		140Y	SR04	29 (65)	-	-			-
		140Y	SR05	30 (65)	-	-			-
		140Y	SR06	30 (65)	-	-			-
		160Y	SR01	34 (76)	50 (111)	49 (108)			-
		160Y	SR02	33 (73)	50 (110)	51 (113)			-
LPC - 14	76 (167)	160Y	SR03	33 (73)	57 (126)	60 (132)	LPC - 14	5,7 (12,5)	
		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	-	63 (138)	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)	-	-				
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 (226)				
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	-	-	-	234 (517)				
435Y	SR02	-	-	-	238 (525)				
435Y	SR03	-	-	-	249 (548)				
435Y	SR04	-	-	-	223 (491)				
435Y	SR05	-	-	-	254 (559)				
435Y	SR06	-	-	-	270 (596)				

Spring Cylinder Assembly Weights (\*\*)

Notes:  
 (\*) End Stops Kit are inclusive of the end stop assemblies that are installed on the both on the pneumatic cylinder side and the scotch yoke housing side.  
 (\*\*\*) In LPC single acting version, the spring is located inside the pneumatic cylinder.

weights in kg (lbs)

Weights may be subject to changes over time. For the accurate measurement please contact Flowserve

**WEIGHT TABLE - Double Acting Actuators**

LPC
-
05X
-
080Y
-
DA
← example model n\*

HOUSING SIZE		PNEUMATIC CYLINDER SIZE					END STOPS KIT (*)	
		Ø CYLINDER	05	10	12	14		
LPC - 05	21 (45)	080 DA	12 (27)	-	-	-	1,5 (3,4)	
LPC - 10	29 (64)	100 DA	15 (33)	27 (60)	-	-	2,6 (5,6)	
LPC - 12	53 (117)	120 DA	17 (38)	31 (68)	-	-	2,6 (5,6)	
LPC - 14	76 (167)	140 DA	20 (45)	33 (74)	27 (59)	-	2,6 (5,6)	
		160 DA	25 (54)	42 (92)	30 (66)	-	5,7 (12,5)	
		180 DA	-	44 (97)	33 (73)	38 (84)		
		200 DA	-	44 (96)	37 (81)	-		
		220 DA	-	53 (116)	#VALUE!	-		
		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)		

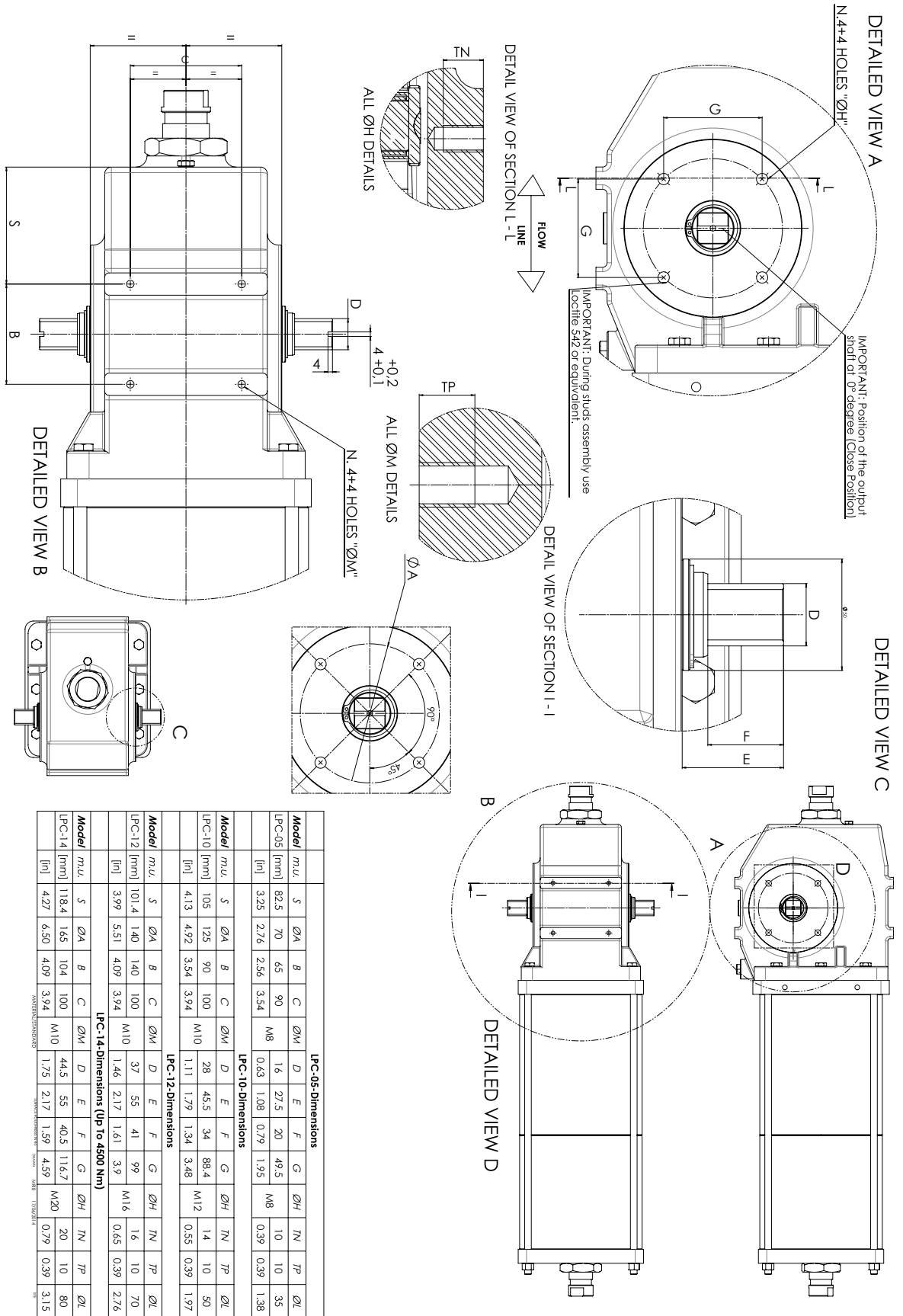
**Double Acting Cylinder Assembly**

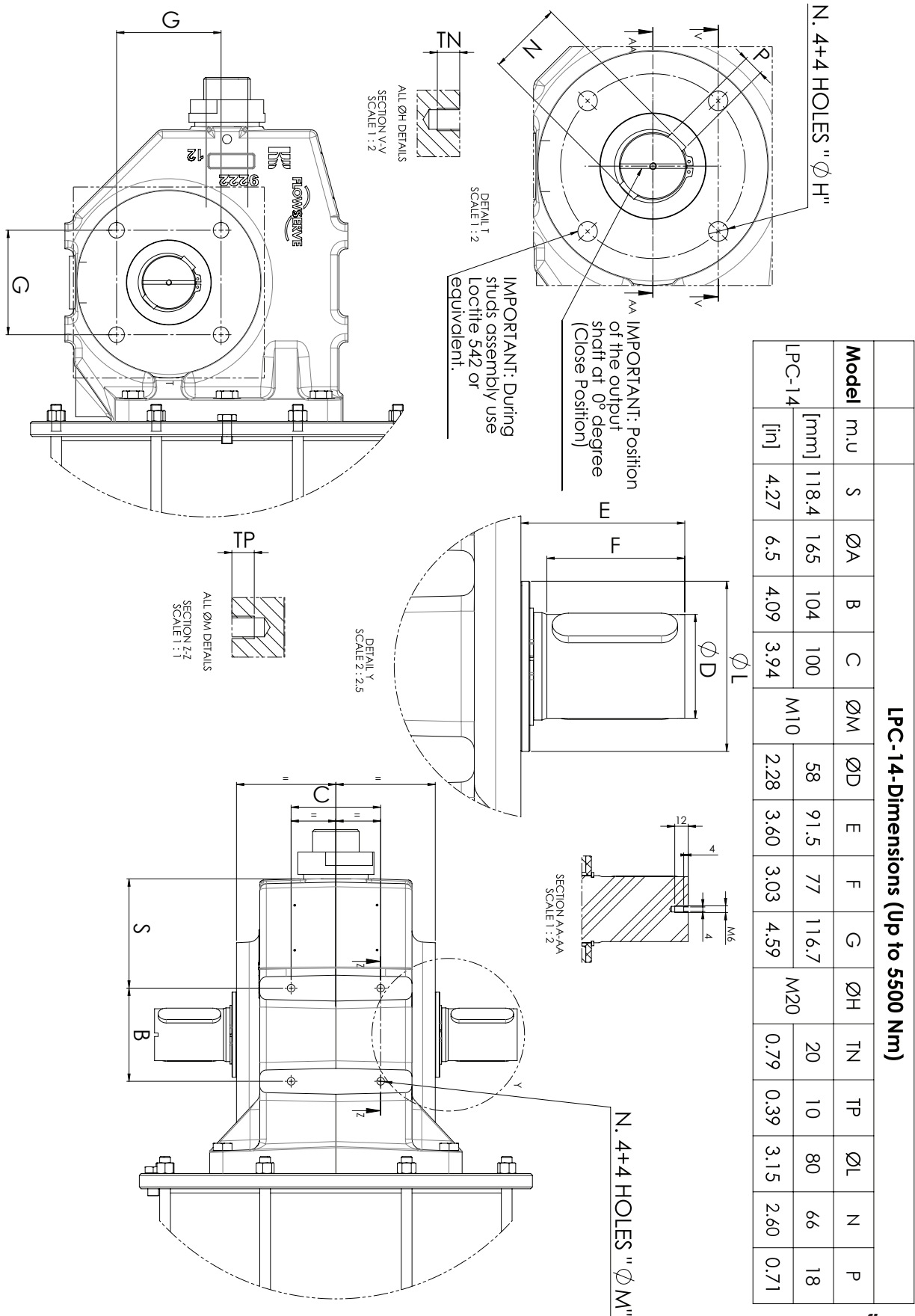
Notes:  
 (\*) End Stops Kit are inclusive of the end stop assemblies that are installed on the both on the pneumatic cylinder side and the scotch yoke housing side.  
 (\*\*\*) In LPC single acting version, the spring is located inside the pneumatic cylinder.

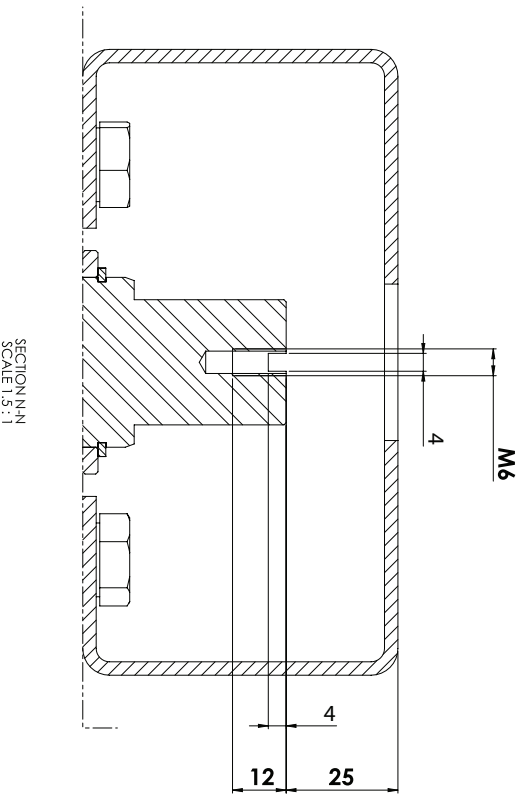
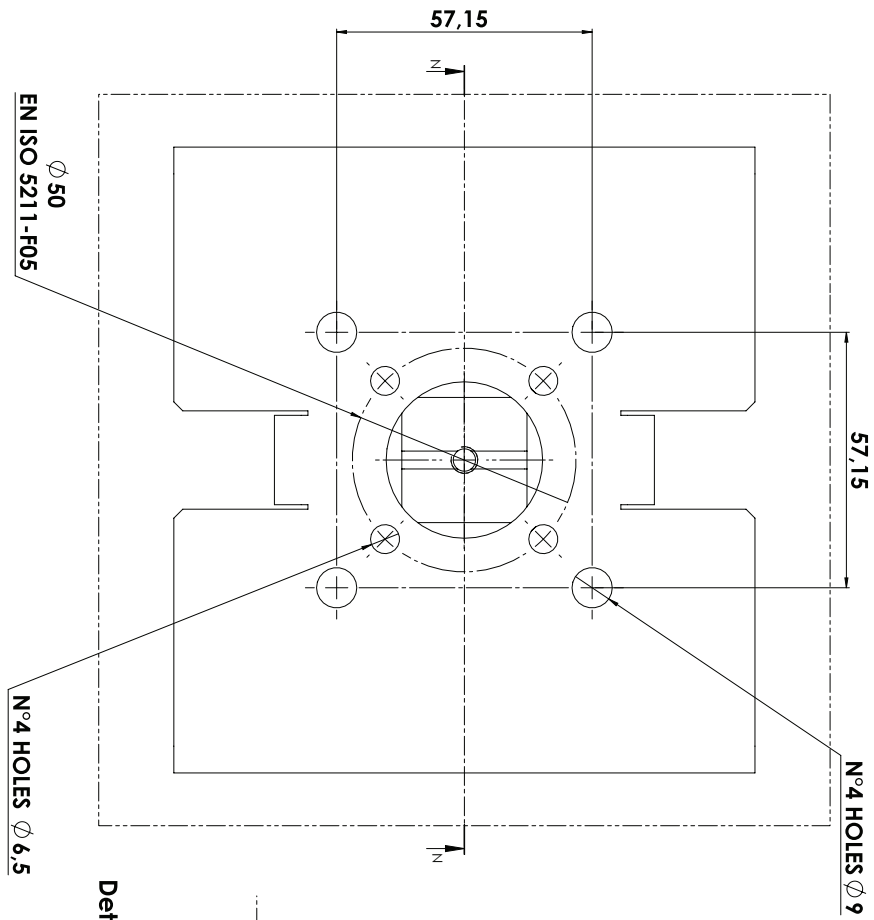
weights in kg (lbs)

Weights may be subject to changes over time. For the accurate measurement please contact Flowserve

Figure 24: Mounting Interface Coupling Dimensions and Standard NAMUR VDE/VDI 3845 Kit details (available as optional item, upon request)







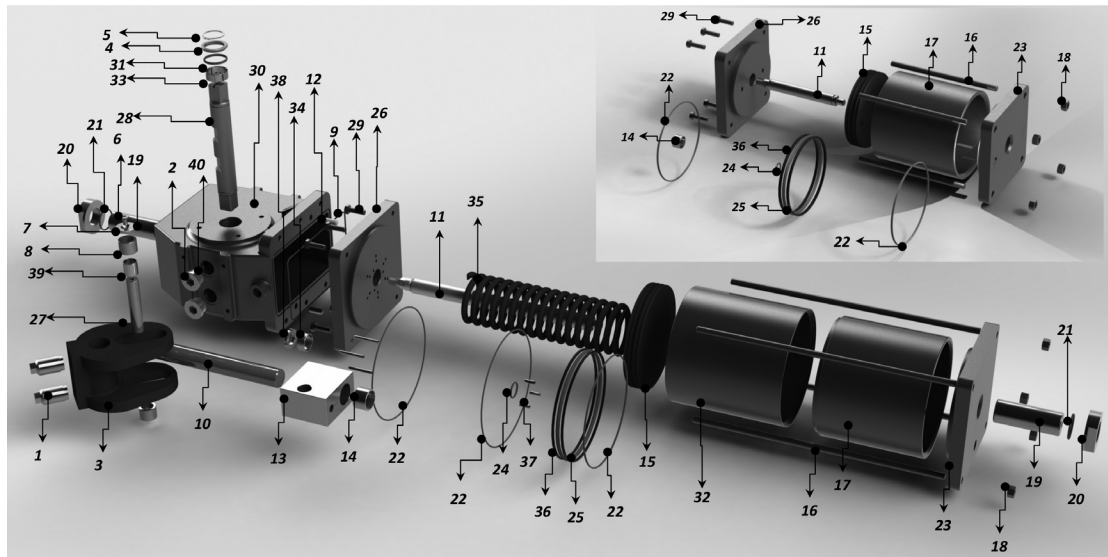
Details of NAMUR VDE/VDI 3845 Adaptor Kit, Available upon Request



Figure 25: Actuator Orientation/Installation

HORIZONTAL POSITION OF THE PIPE LINE - VERTICAL POSITION OF VALVE STEM																																																	
PARALLEL	01 STANDARD CONFIGURATIONS HVP1	02 HVP2	03 HVP3	04 HVP4																																													
	05 HVA1	06 HVA2	07 HVA3	08 HVA4																																													
	VERTICAL POSITION OF THE PIPE LINE - HORIZONTAL POSITION OF VALVE STEM																																																
	PARALLEL	09 STANDARD CONFIGURATIONS VHP1	10 VHP2	11 VHP3	12 VHP4																																												
13 VHA1		14 VHA2	15 VHA3	16 VHA4																																													
HORIZONTAL POSITION OF THE PIPE LINE - HORIZONTAL POSITION OF VALVE STEM																																																	
PARALLEL		17 HHP1	18 HHP2	19 HHP3	20 HHP4																																												
	21 HHA1	22 HHA2	23 HHA3	24 HHA4																																													
	LEGEND																																																
<p><b>NOTES:</b> - This document is applicable to quarter turn actuators, LPS and LPC - (Pneumatic series) and LHS - (Hydraulic Series), in both single acting (spring return) and double acting configurations.</p> <p><b>GENERAL CONFIGURATION:</b> <b>H V P 1</b></p> <p>↑ ↑ ↑ ↑ 1, 2, 3, 4: PANEL CONFIGURATIONS P: PARALLEL TO THE FLOW A: ACROSS TO THE FLOW H: HORIZONTAL VALVE STEM V: VERTICAL VALVE STEM H: HORIZONTAL PIPE LINE V: VERTICAL PIPE LINE</p>																																																	
<table border="1"> <thead> <tr> <th colspan="5">REVISIONS</th> <th>SCALE:</th> <th>SHEET</th> </tr> <tr> <th>REV.</th> <th>DATE</th> <th>DESCRIPTION</th> <th>DESIGNED</th> <th>APPROVED</th> <th>1:25</th> <th>1 OF 1</th> </tr> </thead> <tbody> <tr> <td>001</td> <td>15/05/2015</td> <td>Original Design Revision</td> <td>FFOR</td> <td>PLLD</td> <td></td> <td></td> </tr> <tr> <td colspan="3">DRAWN</td> <td>FFOR</td> <td>05/11/2014</td> <td colspan="2" rowspan="3"> </td> </tr> <tr> <td colspan="3">CHECKED</td> <td>PLLD</td> <td>05/11/2014</td> </tr> <tr> <td colspan="3">APPROVED</td> <td>PLLR</td> <td>05/11/2014</td> </tr> <tr> <td colspan="7"> <p>DESCRIPTION: <b>DUT-066 QUARTER TURN ACTUATOR ORIENTATIONS</b></p> <p>COPYRIGHT - FLOWSERVE CORPORATION ALL RIGHTS RESERVED.</p> <p>REVISION: 002</p> </td> </tr> </tbody> </table>					REVISIONS					SCALE:	SHEET	REV.	DATE	DESCRIPTION	DESIGNED	APPROVED	1:25	1 OF 1	001	15/05/2015	Original Design Revision	FFOR	PLLD			DRAWN			FFOR	05/11/2014			CHECKED			PLLD	05/11/2014	APPROVED			PLLR	05/11/2014	<p>DESCRIPTION: <b>DUT-066 QUARTER TURN ACTUATOR ORIENTATIONS</b></p> <p>COPYRIGHT - FLOWSERVE CORPORATION ALL RIGHTS RESERVED.</p> <p>REVISION: 002</p>						
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Figure 26: Exploded View



Num	Description	Qty	Spare Parts*
1	Grub Screw	2	
2	Plug	2	
3	Scotch Yoke	1	
4	Bushing	2	
5	Retaining Ring	2	
6 <sup>4</sup>	Screw	2	
6 <sup>3</sup>	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 <sup>5</sup>	Tie Rod	4 (8)	
17	Spring Can	2	
18 <sup>5</sup>	Hex Nut	4 (8)	
19	Stop Bolt	2	
20	Hex Nut	2	

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

\* Standard maintenance spare parts for on/off applications

X Spare parts that can be replaced.

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

(1: Quantity of Item 22 is 2 for Double Acting actuators and 3 for Single Acting actuators)

(2: Only the O-rings on the top of the actuator can be replaced without removing the actuator from the valve)

(3: Only for LPC12 and LPC14 models)

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

(5: Quantity variable depending on cylinder size)





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