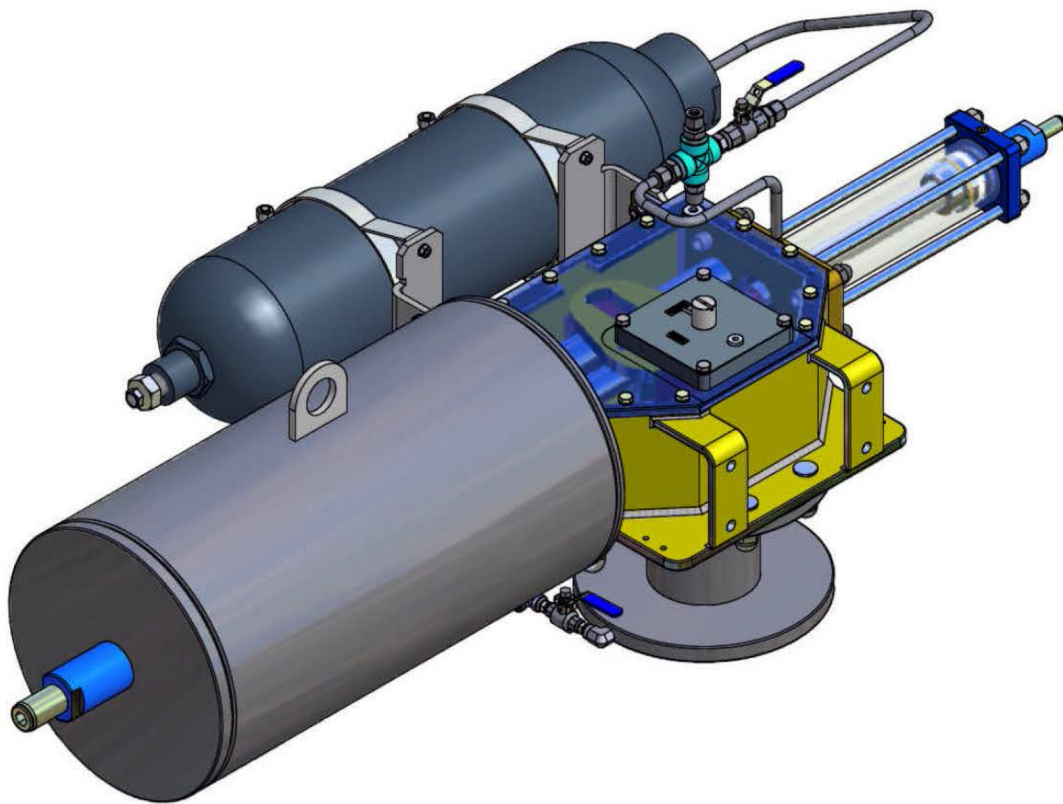


# ASSEMBLY, ADJUSTMENT AND MAINTENANCE INSTRUCTIONS

## LEDEEN® QUARTER TURN SUBSEA ACTUATORS MERMAID S-SERIES (SHALLOW WATER)



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**NOTES:**

## GENERAL INFORMATION

- The actuators are delivered with plugged connections. The connections must remain plugged if not utilized or must be re-plugged with the relevant plug or reconnected after any testing operation.
- The manual should be used by an experienced service technician or operator.
- Please keep this manual near the actuator so that it is available for future consultation.
- For questions or clarifications please contact [www.c-a-m.com](http://www.c-a-m.com).
- To request new copies of the manual please contact [www.c-a-m.com](http://www.c-a-m.com).
- The manufacturer reserves the right to modify, without prior notice, the characteristics of the equipment described in this publication and is not obligated to update any products and manuals previously issued.

### EXPLANATION OF WARNING SYMBOLS (where applicable)



*Before carrying out any operation on the actuator, the electric power supply (if present) must be shut-off.*



*Risk of explosion: before carrying out any operation on the actuator, the actuator must be isolated from the hydraulic supply source.*



*Before carrying out any operation on the actuator, the control group (if present) must be discharged from the pressure therein trapped; particular care shall be taken on storage tanks and pressure filters.*



*Every operation on the actuator must be performed by qualified personnel equipped with safety clothes and devices (gloves, helmet, glasses, etc.).*



*During the operation on the actuator, the operator must pay attention to the presence of liquids potentially noxious for the health and the environment.*

---

## I. PRELIMINARY VERIFICATIONS ON RECEIPT OF THE MATERIAL

Warning:



The following steps must be completed on receipt of the material:

1. Check the completeness of the supplies by referring to the packing list.
2. Carry out a preliminary verification in order to ensure:
  - a. the integrity of the material and the absence of damages;
  - b. the integrity of the painting. if necessary, carry out the paint touch up by following the instructions of the painting specification (please refer to the technical documentation);
  - c. the presence of the plugs on all the hydraulic and (where present) electrical connections.

---

## II. STORAGE AND PRESERVATION

Warning:



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### A. Storage Conditions

Follow the instructions below if storage of the actuator is necessary:

- The actuator must be stored in a warehouse adequately protected against harmful environment.
- The recommended ambient temperature is:

minimum	+5 °C (41° F)
maximim	+40 °C (104° F)

---

### B. Preservation Conditions

To assure proper operation of the equipment after installation, the following procedures must be performed during storage:

- Keep the actuators lifted from the ground.
- Protect all unpainted parts with grease.
- In case the actuator is provided with a pressure compensating system, do not expose the actuator to direct sunlight in order to avoid any overpressure in the same system.

**Note:** Before installing the actuator, perform one complete cycle (opening and closing) and verify that it works correctly.

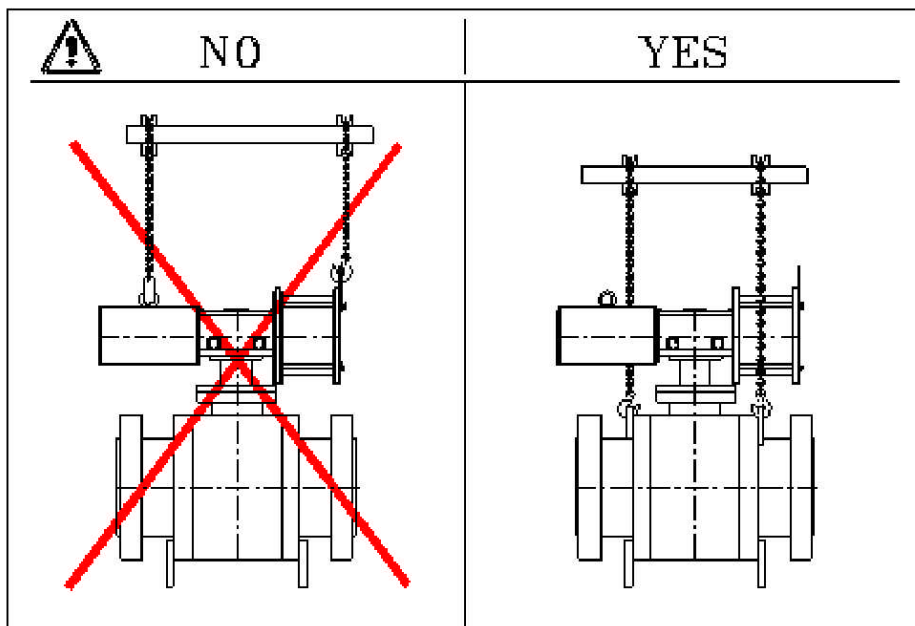
### III. ACTUATOR LIFTING

Warning:



**Important:** These instructions refer to the lifting of the actuator only, not assembled on the valve.

Do not attempt to lift the actuator-valve assembly by using the lifting points of the actuator.



The lifting equipment consists of commercial chains and slings of adequate dimensions according to the weight of the actuator. Please refer to the Assembly Specification document provided.

Refer to the following tables for standard commercial equipment.






## LIFTING DEVICES MAXIMUM WORKLOAD



Chain Diameter (mm)	CMU/tonn 1 arm	CMU/tonn 2 arms		CMU/tonn 3 & 4 arms	
		$0^\circ < \beta \leq 45^\circ$ $0^\circ < \alpha \leq 90^\circ$	$45^\circ < \beta \leq 60^\circ$ $90^\circ < \alpha \leq 120^\circ$	$0^\circ < \beta \leq 45^\circ$ $0^\circ < \alpha \leq 90^\circ$	$45^\circ < \beta \leq 60^\circ$ $90^\circ < \alpha \leq 120^\circ$
		Factor 1.4	Factor 1.0	Factor 2.1	Factor 1.5
6	1.12	1.6	1.12	2.36	1.7
7	1.5	2.12	1.5	3.15	2.24
8	2	2.8	2	4.25	3
10	3.15	4.25	3.15	6.7	4.75
13	5.3	7.5	5.3	11.2	8
16	8	11.2	8	17	11.8
19	11.2	16	11.2	23.6	17
20	12.5	17	12.5	26.5	19
22	15	21.2	15	31.5	22.4
26	21.2	30	21.2	45	31.5
32	31.5	45	31.5	67	47.5

**Figure 1**  
Chains



C.M.U.	Width	Load in %				
		100 %	200 %	140 % from 7° to 45°	80 %	100 % from 45° to 60°
						
1 T	30	1000	2000	1400	800	1000
1,5 T	50	1500	3000	2100	1200	1500
2 T	60	2000	4000	2800	1600	2000
2,5 T	75	2500	5000	3500	2000	2500
3 T	90	3000	6000	4200	2400	3000
4 T	120	4000	8000	5600	3200	4000
5 T	150	5000	10,000	7000	4000	5000
6 T	180	6000	12,000	8400	4800	6000
8 T	240	8000	16,000	11,200	6400	8000
10 T	300	10,000	20,000	14,000	8000	10,000
15 T	240	15,000	30,000	21,000	12,000	15,000
20 T	300	20,000	40,000	28,000	16,000	20,000

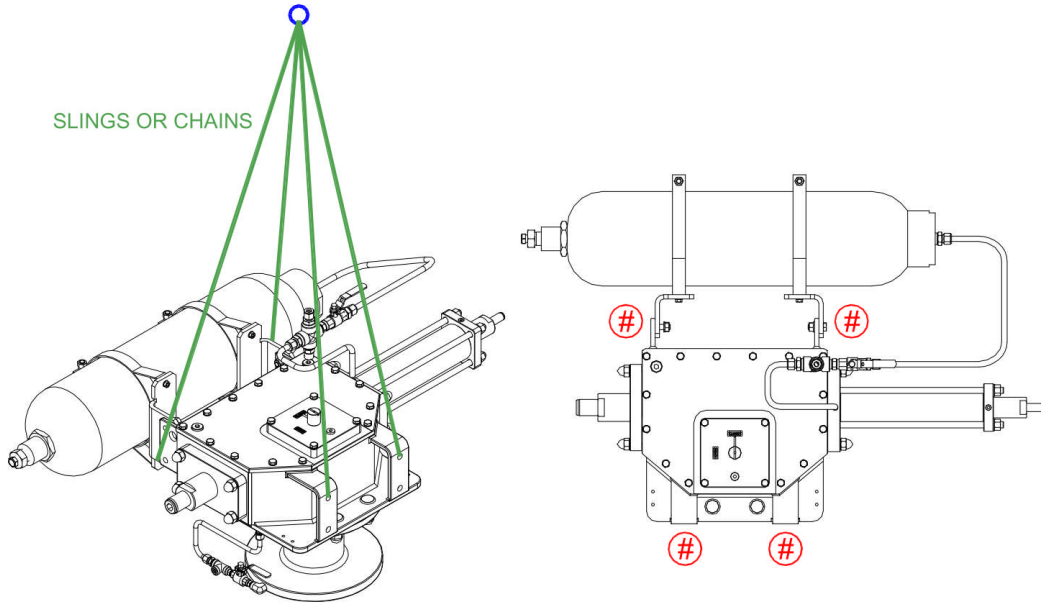


**Figure 2**  
*Slings*

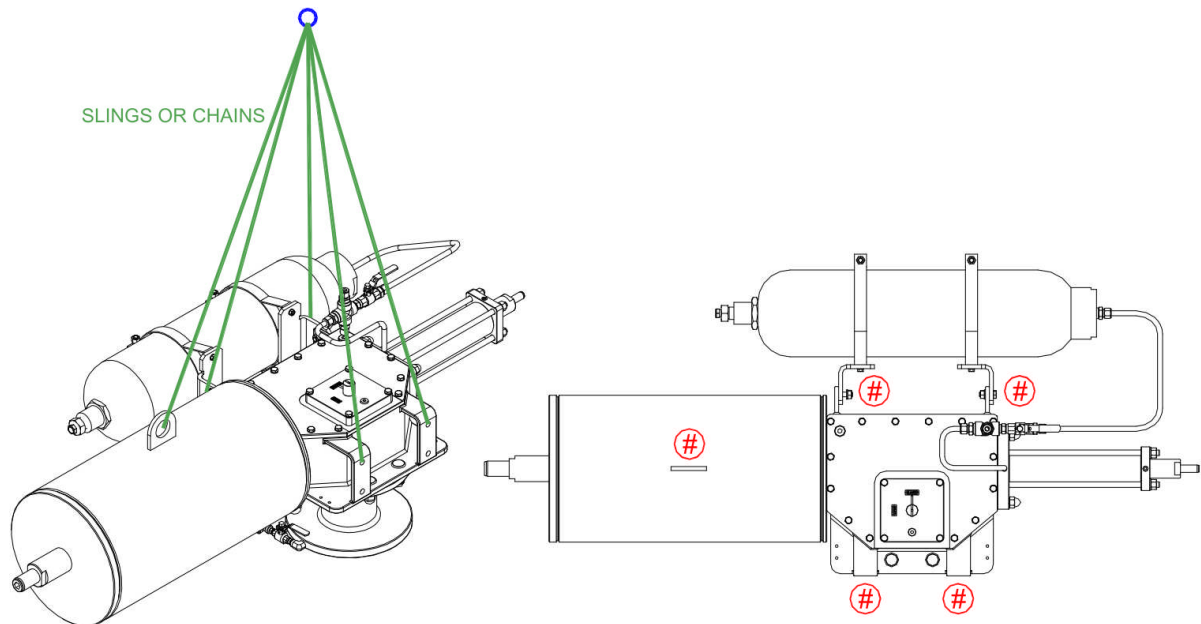
**Notes:** In order to prevent any damage to the actuator equipment, before starting the lifting operations, please double check that the lifting tools are away from the control panel (if present) and avoid any interference with the ancillaries, like the pressure compensator and relevant connecting tubing.

Lift the actuator by utilizing the suitable lifting points (indicated in the following drawings with the # symbol).

### A. Double Acting Actuators



### B. Spring Return Actuators



## IV. ASSEMBLY

### A. Assembling Actuator onto the Valve

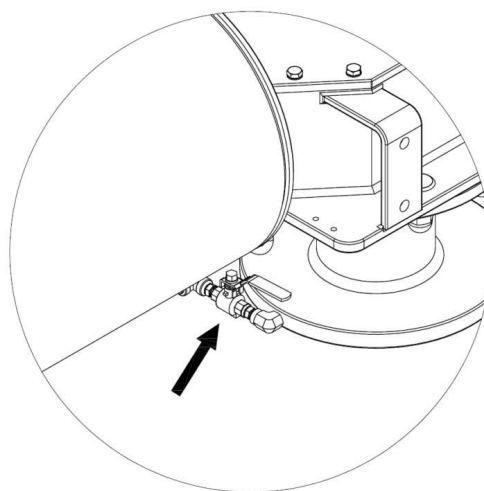
**Warning:**



**Note:** No special tools are required for these operations, only Allen wrenches, hexagonal wrenches and torque wrenches of the required sizes.

1. Clean the top flange of the valve.
2. Lubricate the shaft of the valve with oil or grease.
3. Place the actuator in the same position of the valve supplying pressure to the hydraulic cylinder.
4. Lift the actuator by following the instructions in Section IV.
5. Clean the actuator flange.
6. Install the O-ring on the provided groove after having properly cleaned and lubricated the seal.
7. Connect the valve shaft inside the stem adapter and lower the actuator on the valve.
8. Tighten the nuts between the spool piece flange and the valve one.
9. The torque to apply to the bolts is as per the table STC1325 provided in Technical Documentation.

**Warning:** For actuators provided with compensation system already filled (see Section VII on page 15), open the stop valve placed near the adapter piece (indicated in figure 3).



**Figure 3**

Non Teflon-Coated Tie-Rods				
Tie Rod Type	Pitch mm	Tightening – Nm ( ± 5%)		
		Mat. (1)	Mat. (2)	Mat. (3)
M 8	1,25	20	26	25
M 10	1,50	39	51	49
M 12	1,75	68	90	86
M 14	2,00	96	126	121
M 16	2,00	151	197	189
M 18	2,50	206	270	259
M 20	2,50	295	386	295
M 22	2,50	406	532	406
M 24	3,00	509	666	509
M 27	3,00	755	988	617
M 30	3,50	1019	1334	834
M 33	3,50	1198	1568	751
M 36	3,00	1656	2168	1039
M 39	3,00	2144	2807	1345
M 42	3,00	2710	3547	
M 45	3,00	3383	4428	
M 48	3,00	4147	5429	
M 52	3,00	5338	6989	
M 56	4,00	6440	8431	
M 60	4,00	8011	10487	
M 64	4,00	9838	12878	
M 68	4,00	11940	15631	
M 72	4,00	14299	18718	
M 76	4,00	16296	22158	
M 80	4,00	19882	26027	
M 85	4,00	24033	31462	
M 90	4,00	28729	37609	
M 95	4,00	33949	44442	
M 100	4,00	37296	52142	
M 105	6,00	41312	57757	
M 110	4,00	45923	64203	
M 120	4,00	60094	84015	
M 150	6,00	115566	161568	

Teflon-Coated Tie-Rods				
Tie Rod Type	Pitch mm	Tightening – Nm ( ± 5%)		
		Mat. (1)	Mat. (2)	Mat. (3)
M 8	1,25	15	19	18
M 10	1,50	29	38	37
M 12	1,75	51	67	64
M 14	2,00	82	108	103
M 16	2,00	129	169	162
M 18	2,50	177	231	222
M 20	2,50	252	330	252
M 22	2,50	348	456	348
M 24	3,00	436	571	436
M 27	3,00	647	847	529
M 30	3,50	873	1143	715
M 33	3,50	1198	1568	751
M 36	3,00	1656	2168	1039
M 39	3,00	2144	2807	1345
M 42	3,00	2710	3547	
M 45	3,00	3383	4428	
M 48	3,00	4147	5429	
M 52	3,00	5338	6989	
M 56	4,00	6440	8431	
M 60	4,00	8011	10487	
M 64	4,00	9838	12878	
M 68	4,00	11940	15631	
M 72	4,00	14299	18718	
M 76	4,00	16926	22158	
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M 85	4,00	24033	31462	
M 90	4,00	28729	37609	
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M 100	4,00	37296	52142	
M 105	6,00	41312	57757	
M 110	4,00	45923	64203	
M 120	4,00	60094	84015	
M 150	6,00	115566	161568	

**Note:** Column Mat.(1) applicable to the following materials:  
A193 87M, A320 L7M, A453 Gr.6608, 8S 4882, A193 87 (> M 100)

Column Mat.(2) applicable to the following materials:  
A320 L7, A320 L43, A193 87, 39NiCrMo3 (<= M 100)

Column Mat.(3) applicable to the following materials:  
A 193 88 Classe 2 (<= M 39)

Load required for the hydraulic pre-tightening is calculated based on the stress applied to the tie rod(% Sn). This load shall be increased on the base of the load lost during the pre-tightening (Cp).

Cp value reported in the table is for reference only and should be calculated again before every application.

## V. ACTUATOR ADJUSTMENTS

**Warning:**

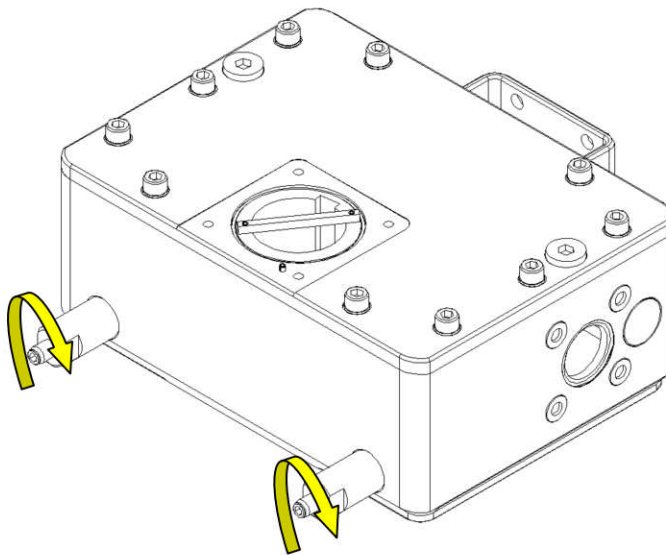


**Note:** No special tools are required for these operations, only Allen wrenches and hexagonal wrenches of the required sizes.

### A. End Stops Adjustment

The actuator is shipped with a preliminary adjustment, but not based on the specific valve stroke. If it is necessary to change the adjustment, proceed as follows:

1. Loosen the locking nuts counter-clockwise for only a 1/4 turn to avoid leaking of the compensating fluid, then rotate the dowels to the required position.
2. Tighten the locking nut when completed.
  - a. For GS Actuators:
    - on the actuator frame:

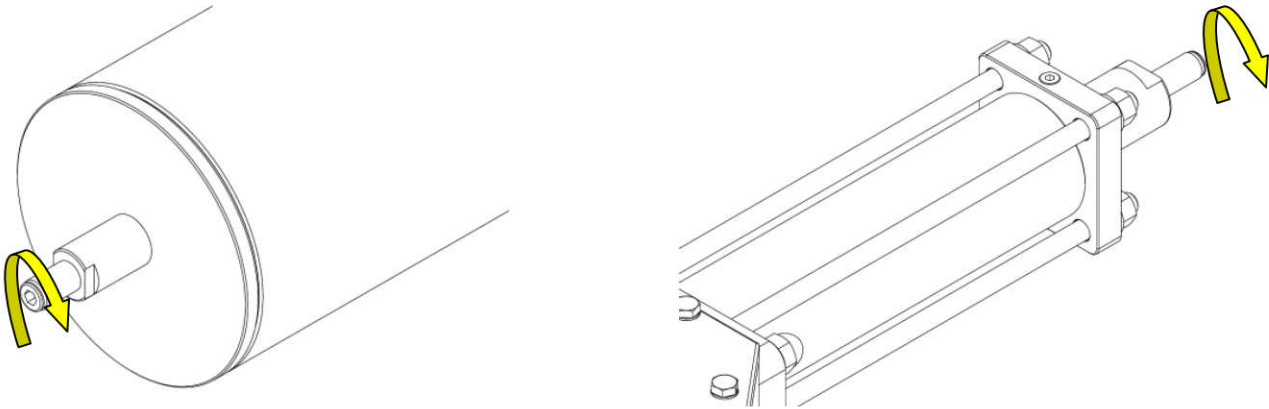


By rotating the dowels clockwise, the angular stroke is reduced; by unscrewing the dowels the angular stroke is increased.

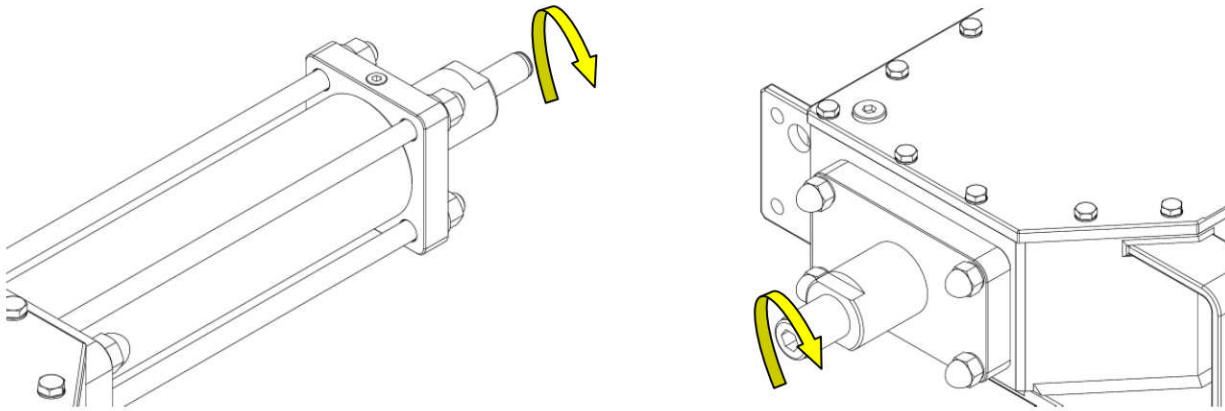
**Note:** In case of spring return actuators, before adjusting the end stop relevant to the cylinder, it is necessary to pressurize the same with low pressure in order to reduce the pressure developed by the spring thrust against the end stop to be adjusted.

b. For SY Actuators:

- on the spring container and the cylinder for spring return actuators:



- on the cylinder and the frame for double acting actuators:



By rotating the dowels clockwise, the angular stroke is reduced; by unscrewing the dowels the angular stroke is increased.

**Note:** In case of spring return actuators, before adjusting the end stop relevant to the cylinder, it is necessary to pressurize the same with low pressure in order to reduce the pressure developed by the spring thrust against the end stop to be adjusted.

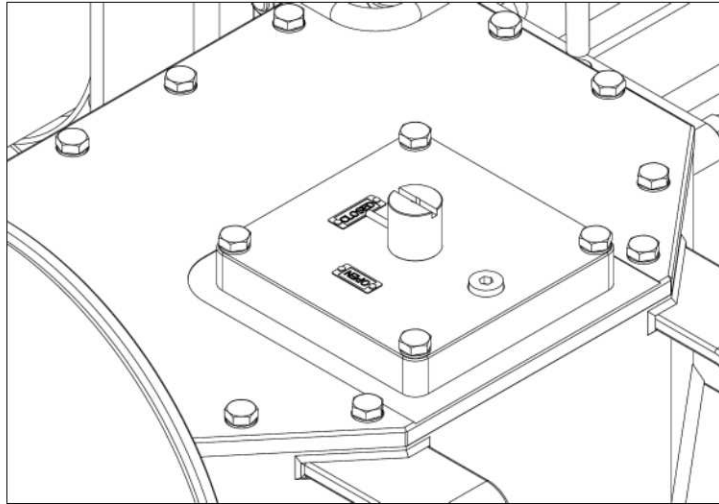
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## VI. POSITION INDICATOR ALIGNMENT

Verify the correct indication of the actuator position by the local position indicator:

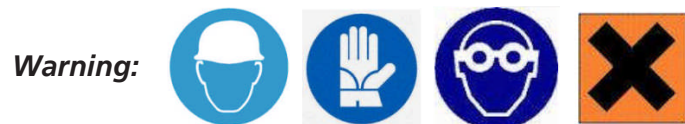
“OPEN” when the actuator is in open position.

“CLOSED” when the actuator is in closed position.



---

## VII. ACTUATOR COMPENSATION SYSTEM FILLING AND CHECK



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### A. Compensation System Filling

The compensation system filling has to be carried out in accordance to procedure UTP-SM-50, last revision, paragraph 3, provided in the Assembly Specification document.

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### B. Compensation System Filling Check

The check of the filling of the compensation system has to be performed in accordance to the above mentioned procedure UTP-SM-50, last revision, paragraph 4.

## VIII. VERIFICATIONS BEFORE DEPLOYMENT

**Warning:**



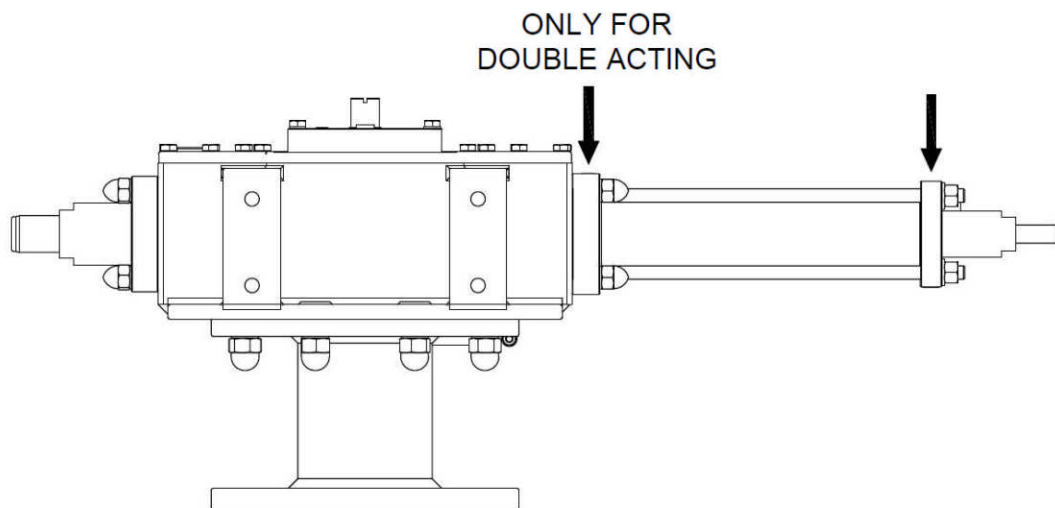
**Note:** No special tools are required for these operations, only Allen wrenches and hexagonal wrenches of the required sizes.

### A. Functional Verification

Carry out two complete strokes of the actuator with the hydraulic supply and (where applicable) with the spring in order to verify that:

- the operation is smooth throughout its stroke;
- there is no evidence of stick-slip or mechanical restraint;
- the indication of the local position indicator is correct. If not, carry out the position indicator alignment as described in the relevant paragraph;
- (where applicable) the operation of the limit switches is correct.

If it is necessary, purge the air from the cylinder by loosening the plug(s) placed on top of the flange(s) (see figure 4) and by performing some opening/closing operations until only oil comes out from the hole(s). Then, tighten the plug(s).



**Figure 4**



---

## IX. MAINTENANCE

*Warning:*



*Note: No special tools are required for these operations, only Allen wrenches and hexagonal wrenches of the required sizes.*

---

### A. Ordinary Maintenance

Maintenance should not be required on the actuator when:

- the actuator has been properly stored before installation;
  - the installation onto the valve has been carried out correctly;
  - the adjustments have been performed correctly. The compensation system filling has been carried out in accordance to the instructions, where applicable;
  - the deployment has been performed correctly.
- 

### B. Special Maintenance

- Any operation of special maintenance of the actuator has to be performed after having brought the actuator to the surface.
  - In case the actuator is provided with compensation system and it is necessary to disassemble it from the valve, close the stop valve placed near the adaptor piece.
- 

## X. ACTUATOR SEALS REPLACEMENT

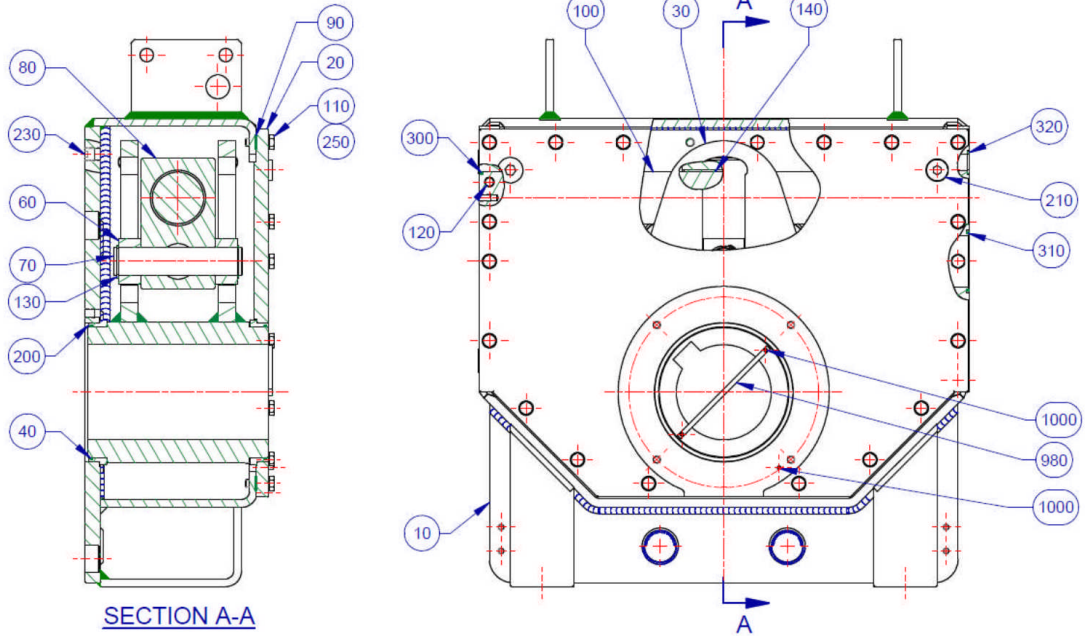
When the seals need to be replaced (for example, in case of leakage), it is necessary to carry out the following operations:

1. The compensation system (if present) must be emptied before proceeding with the actuator disassembly.
  2. Check, before re-assembly, that the seats of the seals are clean and lubricated.
- 

### A. Frame

The seals to be replaced in the frame are (refer to figure 5):

- the seals between frame and cover (item 90);
- the seals between frame and cylinder (item 320);
- the seals between frame and end stroke cover (item 320, for SY double acting actuators), between frame and side cover (item 320, for GS double acting actuators) and between frame and spring container (item 320, for spring return actuators).

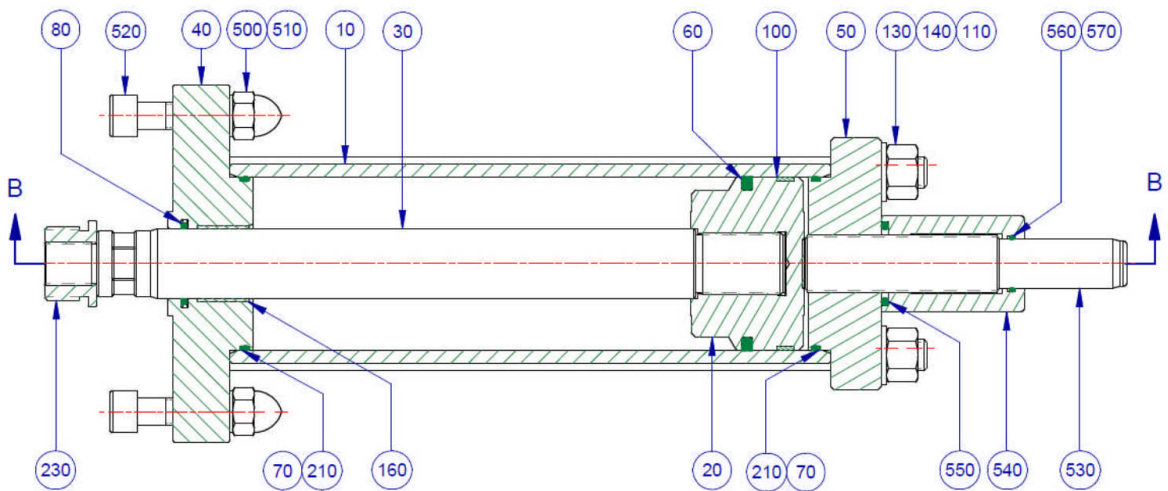


**Figure 5**

**B. Cylinder**

The following seals are to be replaced in the cylinder (refer to figure 6):

- the piston O-ring (item 60);
- the O-rings (items 70 & 210) between liner and flanges;
- the rod O-ring (item 80);
- the O-ring (item 550) between screw and end flange;
- the O-ring (items 560 & 570) between cap and screw.

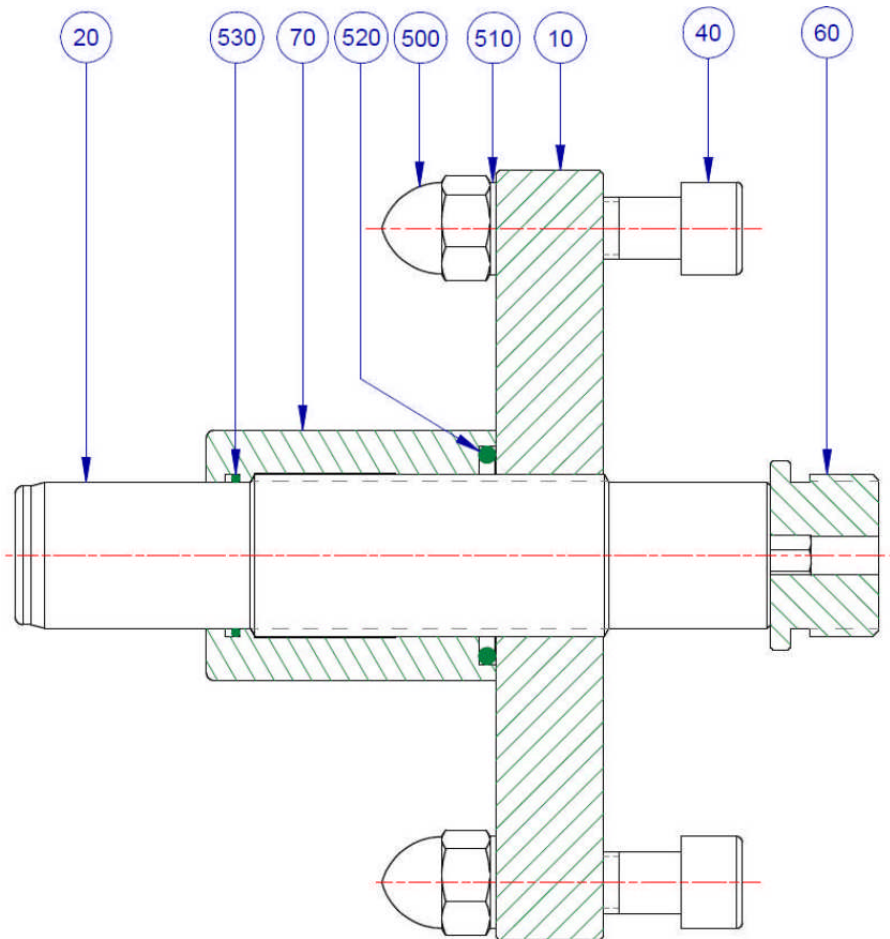


**Figure 6**

### C. End Stroke Cover (only for SY double acting actuators)

The seals to be replaced in the end stroke cover are (refer to figure 7):

- the O-ring (item 520) between screw and flange;
- the O-ring (item 530) between cap and screw.



*Figure 7*

## XI. BLADDER OF PRESSURE COMPENSATOR REPLACEMENT

The replacement of the bladder of pressure compensator has to be carried out in accordance to the manufacturer's instructions.

## XII. COMPENSATION FLUID REPLACEMENT

- The compensation system fluid replacement has to be carried out in accordance to the procedure **UTP-SM-50**, last revision, paragraph 3 provided in the Assembly Specification document.
- After the compensation system fluid replacement, perform the compensation system check in accordance to the above mentioned procedure, **UTP-SM-50**, last revision, paragraph 4.

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## BLADDER ACCUMULATORS LOW PRESSURE LIQUID SEPARATOR

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### I. COMMISSIONING AND MAINTENANCE

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#### A. Delivery Conditions

- Depending on the size and quantity ordered, the bladder(s) are shipped in boxes, cartons, pallets or wooden boxes on request.
- Unless otherwise required, certificates and documentation are provided together with the accumulators.

---

#### B. Handling

- The original packaging is suitable for handling and storage.
- Where necessary, suitable lifting equipment should be used to support the weight of the accumulators.
- Protect the packaging from impact and handle it with care.

---

#### C. Storage

- During storage in the warehouse, leave the product in its original packaging and keep it away from heat sources and naked flames. The storage temperature should be between +10°C and +40°C.
- For six months of storage, make sure that lubrication fluid inside is compatible with bladder polymer.

- After six years of storage, it is essential to replace all elastomeric parts before commissioning.

**The following actions are strictly forbidden:**

- welding, riveting or screwing any item of the accumulator;
- engraving or permanently stamping the surfaces of the accumulator shell and / or carrying out other operations that could affect or change the mechanical properties of the accumulator;
- using the accumulator as a structural element. It should not be subjected to stresses or loads;
- changing the data of the nameplate and/or accumulator without the permission of the manufacturer;
- or using a (dangerous) fluid of Group 1 with equipment designed and manufactured for fluids of Group 2.

---

#### **D. Installation**

Before installation, a visual check must be performed to verify that the accumulator has not suffered any damage during shipping/handling.

1. Verify that the requested type matches what is stamped on the nameplate. The accumulators may be installed in any position (horizontal or vertical) and the nameplate must be visible. Proceed carefully with the assembly so that no abnormal force affects the pipes connected directly or indirectly to the accumulator. To accomplish this, we recommend the use of supporting components and also fastening to avoid the transmission of vibrations.
2. Make sure that the accumulator is connected to the hydraulic circuit by suitable connection devices.
3. Make sure the fluid is compatible with the elastomer of the bladder. Check that the maximum allowed accumulator pressure is equal to or greater than the one of the hydraulic circuit and that the temperature during operation is maintained within the range expected. Make sure that the fluid does not contain contaminants and/or abrasives.

---

#### **E. Repair**

In case of failure, scheduled maintenance or resting, it is necessary to remove the accumulator from the system.

1. Prior to removal, isolate the accumulator from the installation and discharge pressure of the liquid.
2. All bladder accumulators may be repaired. This may consist of replacing the bladder and the seals.
3. To ensure functionality and security, it is recommended to use only original spare parts.

**F. Disassembly**

1. Fasten the accumulator firmly in a vice or on a bench in a horizontal position, taking care not to damage the outer surface.



2. Remove the nameplate.



3. Unscrew the vent screw.



4. Using a suitable wrench, unscrew the fluid valve (anti-extrusion plate).



5. Remove the anti-extrusion plate.



6. Fold bladder somewhat and withdraw by turning it slightly.

### G. Refitting

	Tightening Torques in N•m		
	0.7 - 1.5 liters	3 - 5 liters	3 - 5 liters
Fluid Port Anti-Extrusion Plate	50 + 5	60 + 60	100 +10
Bleed Screw	10 +2	10 +2	10 +2

### H. Cleaning And Testing

Clean all metallic parts on accumulator using an organic reducer and visually inspect the valves for a clean bladder. Isopropanol can be used to clean it.

Visually inspect the bladder for faults such as signs of corrosion on the inside of the container. In the event of coated containers, check the condition of the coating. Replace the parts deemed to be damaged; the O-rings must always be replaced.





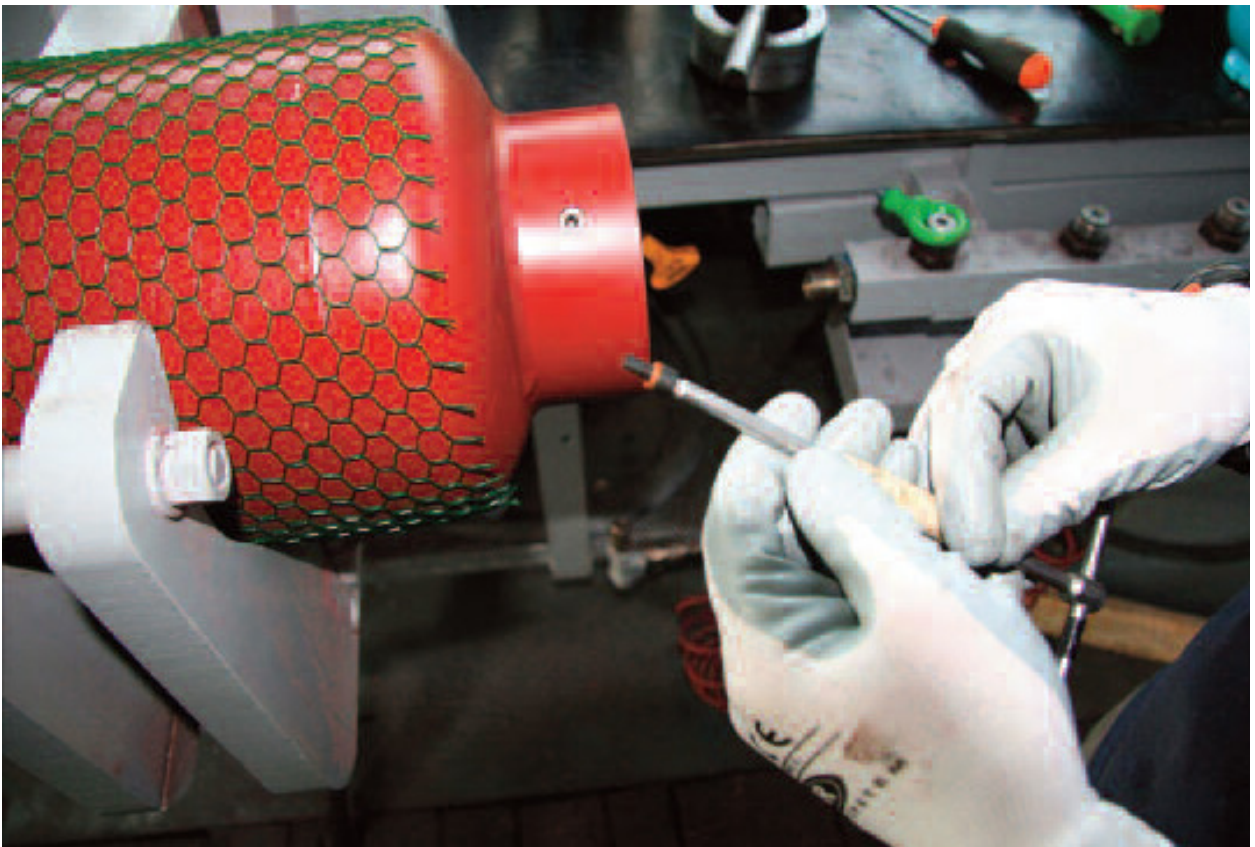
1. Drain air from bladder by pressing together.



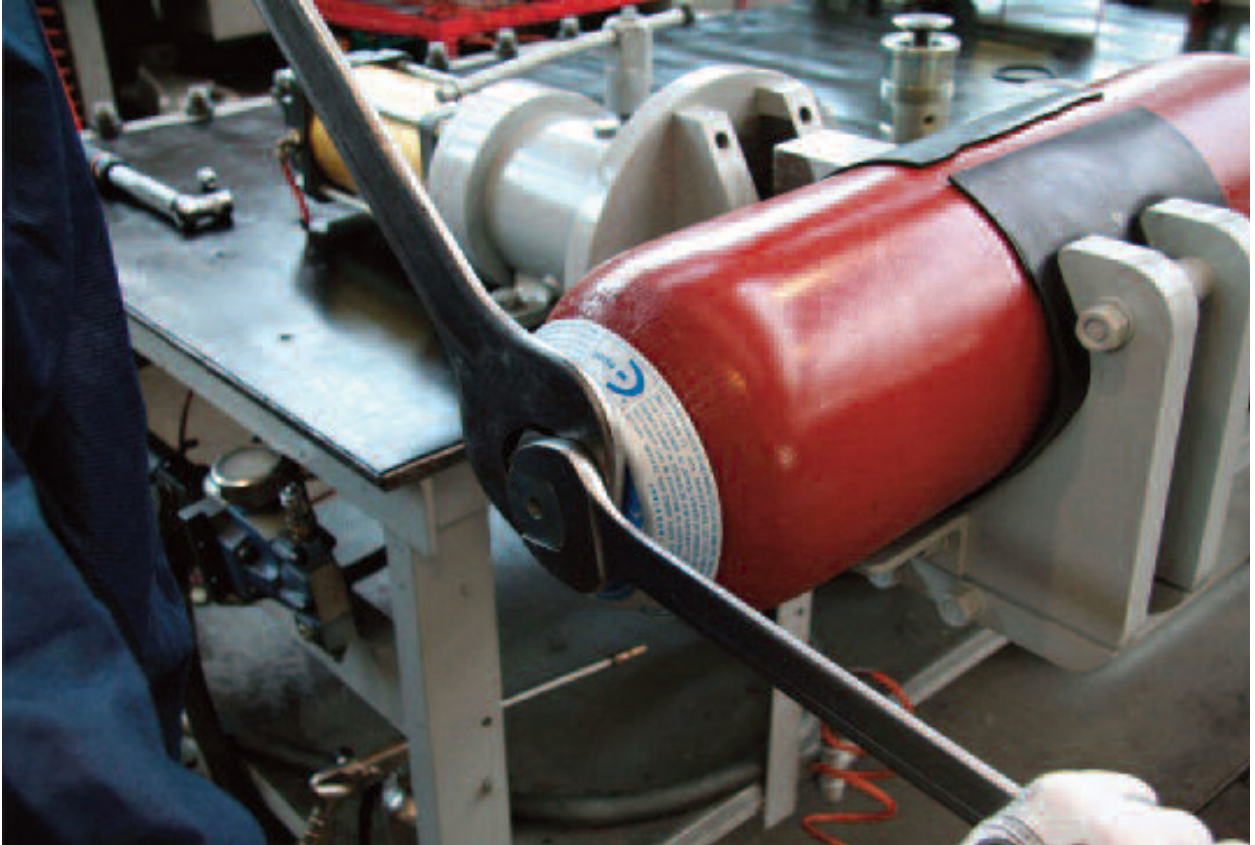
2. Carefully moisten the inside of the bladder and the container with used medium (roll container).



3. Install the anti-extrusion plate.



4. Bleed screw with sealing ring. Mount the bleed screw with its sealing ring.



5. Assemble the nameplate.

Make sure that the fittings and the pipes are not subject to losses and, if necessary, use soap and water. Tighten the protective caps manually.

**Note:** *If needed, decontaminate the fluid used prior to demolishing or recycling the accumulator.*

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## SPARE BLADDERS



---

### I. TECHNICAL DATA

- THE BLADDER, used in the standard version of the accumulators of all the series, is made in butadiene-acrylonitrile rubber (NBR) with medium-high ACN content which we have denoted "standard nitrile" and distinguished with the letter P. The "P" bladder is above all suitable for use with mineral oils but also gives excellent results with many other liquids.
- The operating temperature range is between  $-20$  and  $+80^{\circ}\text{C}$ . For special requirements, temperatures exceeding the above limits, special liquids, etc., the bladder can be supplied in the following materials:
  - Nitrile for low temperatures (F)
  - Nitrile for hydrocarbons (H)
  - Hydrogenated Nitrile (K)
  - Butyl (B)
  - Ethylene-propylene (E)
  - Neoprene (N)
  - Epichlorohydrin (Y)
  - Viton (V)

*Note: Not all the sizes of bladders are available in all the materials. Please consult our Technical Service Department before ordering.*

---

### II. DESCRIPTION

The bladder is made by two different and separable parts. One is the rubber bladder of which the main feature lies in an original and well-developed process that allows the construction in a single piece. The other seal is connected on the bladder mechanically. This unique method allows the seal to connect to the same bladder different types.

---

### III. MAINTENANCE



*Note: No special tools are required for these operations, only Allen wrenches and hexagonal wrenches of the required sizes.*

---

#### A. Special Maintenance

- Any operation of special maintenance of the actuator has to be performed after having brought the actuator to the surface.
- In case the actuator is provided with compensation system and it is necessary to disassemble it from the valve, close the stop valve placed near the adaptor piece.

---

### IV. COMPENSATION FLUID REPLACEMENT

- The compensation system fluid replacement has to be carried out in accordance to the procedure **UTP-SM-50**, last revision, paragraph 3 provided in the Assembly Specification document.
- After the compensation system fluid replacement, perform the compensation system check in accordance to the above mentioned procedure, **UTP-SM-50**, last revision, paragraph 4.

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## SAFETY

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### I. POWER SUPPLY CONNECTION (IF APPLICABLE)

Before carrying out any operation on the actuator, check that the power supply is off.  
Before connecting the actuator:

- verify the absence of the power supply and always connect the ground cable to the actuator first;
- check that the power supply line characteristics are in accordance with the nameplate and installation manual data.

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### II. RECOMMENDATIONS

Check that the ground resistance complies with the limits allowed by the National Laws relevant to the country where the actuator is installed.

- If the actuator is stored/installed in a hazardous area, do not use naked flames and/or devices that could cause sparks.
- At the end of any intervention on the actuator please check that all the boxes and covers are properly closed.
- The operators assigned to the actuator's maintenance must be authorized personnel or otherwise must have attended a training course dedicated to the use and maintenance of the actuator.

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## REMARKS

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### ORIGINAL SPARE PARTS

The use of non genuine LEDEEN® spare parts by Customer exempts LEDEEN from any responsibility for indemnity on claims.

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### OPERATIVE STAFF

The maintenance staff assigned to the LEDEEN product must have the qualified technical preparation to perform the function. The lack of the above-mentioned preparation, included therein the unavailability to attend adequate training courses by specialized LEDEEN technicians at its workshop, cannot be charged to the company LEDEEN who will be considered exempt from any responsibility claims. Also the lack of knowledge by the operative personnel of the manuals and instruction books supplied by LEDEEN in the languages indicated in the supply contract cannot be imputed to LEDEEN.

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### DAMAGES DERIVED FROM USE

Any damage derived from corrosion, fouling, pollution, oxidation, wear or gradual deterioration of the materials, for which the customer did not specify the adaptibility limits, will be at the Customer's own loss.

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### MODIFICATION OF THE ACTUATOR

Damages derived from any modification made by the customer without prior authorization of LEDEEN, especially if not in accordance to the initial conditions established in the buying order, will be at the Customer's own loss.

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### ACTUATOR DISPOSAL

To dispose of actuator at the end of its operating life, please carry out the following procedures:

1. Open the frame enclosure.
2. Remove the lubricants taking care not to pollute the environment.
3. Clean the frame internally using a mixture of water and degreasing soap.
4. Dispose of the cleaning fluid and lubricants extracted from the actuator, according to the local laws regarding the disposal of waste material.
5. After disabling the actuator, all casings must be sent to the scrapping service.
6. In case of replacement of any part, it must be handled and disposed of as listed in the owner's manual.

In case the actuator is provided with spring container:

**WARNING:** *DO NOT OPEN AND/OR FORCE THE SPRING CONTAINER. The spring container contains one or more compressed springs. A forced or non-controlled opening of the container can cause the non-controlled and violent ejection of material potentially harmful to people and/or capable of causing damage to property.*



*The opening and disposal of the spring container must be carried out only by authorized personnel.*

*Please contact LEDEEN in case of any doubt or for further information.*

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**NOTES:**