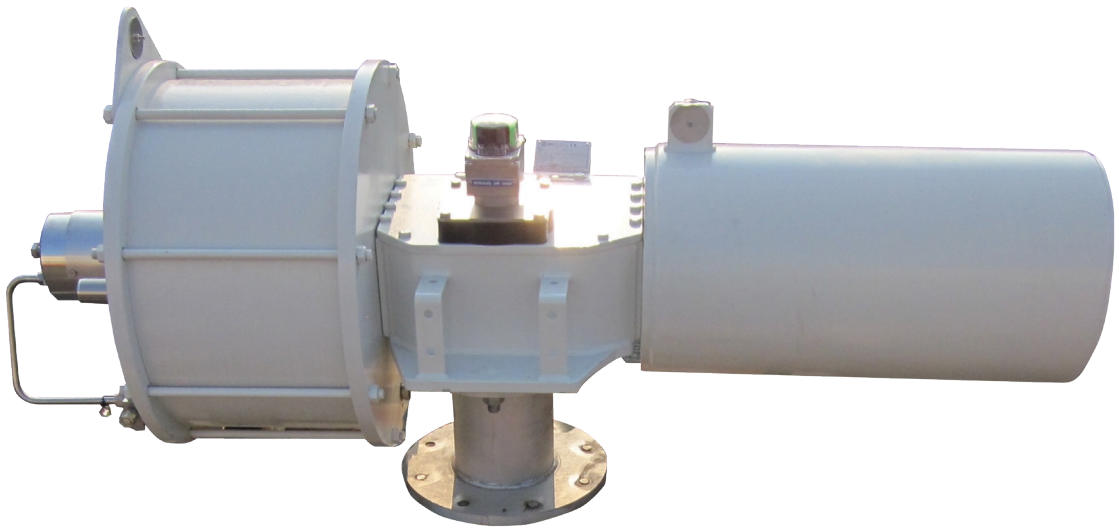


# Biffi ALGAS-QA (Quick Acting)

## Spring-Return Pneumatic Actuator



**Revision Details**

Rev.	Date	Description	Prepared	Checked	Approved
2	June 2021	General update (Migration to new template)			
1	March 2018	Updated data plate	Ermanni	Orefici	Vigliano
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## NOTICE

Biffi Italia s.r.l. has taken every care in collecting and verifying the documentation contained in this Installation, Operation and Maintenance Manual. Nevertheless, Biffi Italia s.r.l. does not provide any guarantees for this manual. Biffi Italia s.r.l. will not be responsible for any mistakes contained in it or for any damage either accidental or due to the use of this manual. The information herein contained is reserved property of Biffi Italia s.r.l. and is subject to being modified without notice.

# Section 1: General Warnings

## NOTICE

The manual is an integral part of the machine, it should be carefully read before carrying out any operation and it should be kept for future references.

## 1.1 Generalities

Biffi Italia s.r.l. actuators are conceived, manufactured and controlled according to the Quality Control System in compliance with EN ISO 9001 international regulation.

### 1.1.1 Applicable Regulation

EN ISO 12100:2010:	<b>Safety of machinery – General principles for design – Risk assessment and risk reduction</b>
2006/42/EC:	<b>Machine directive</b>
2014/68/EU:	<b>Directive for pressure PED equipment</b>
2014/35/EU:	<b>Directive for low voltage equipment</b>
2014/30/EU:	<b>Directive for the electromagnetic compatibility</b>
2014/34/EU:	<b>Directive and safety instructions for use in hazardous area</b>

## 1.1.2 Terms and Conditions

Biffi Italia s.r.l. guarantees that all the items produced are free of defects in workmanship and manufacturing materials and meet relevant current specifications, provided they are installed, used and serviced according to the instructions contained in the present manual. The warranty can last either one year from the date of installation by the initial user of the product, or eighteen months from the date of shipment to the initial user, depending on which event occurs first. All detailed warranty conditions are specified in the documentation forwarded together with the product. This warranty does not cover special products or components not warranted by subcontractors, or materials that were used or installed improperly or were modified or repaired by unauthorized staff. In the event that a fault condition be caused by improper installation, maintenance or use, or by irregular working conditions, the repairs will be charged according to applicable fees.

**The warranty and Biffi Italia s.r.l. liability shall lapse in the event that any modification or tampering whatsoever be performed on the actuator.**

## 1.1.3 Electrostatic Charge

An electrostatic charge risk is present on the actuator surface; in case of cleaning, use only antistatic cloth; in case of maintenance, avoid all rubbing/frictions that could electrostatically charge the equipment.

## 1.1.4 Noise Emission

The verification of the noise of the actuated valve is at valve maker care. Biffi points out that the actuator's noise can be considered negligible since it is an equipment for regular on-off or intermittent use.

If the integral quick exhaust valve is present, we recommend using ear PPE (personal protective equipment) to avoid any possible acoustic discomfort.






## 1.2 Identification Plate

### **WARNING**

It is forbidden to modify the information and the marks without previous written authorization by Biffi Italia s.r.l.

The plate fastened on the actuator contains the following information (Figure 1).

Figure 1 Data Plate

		BIFFI ITALIA Fiorenzuola d' Arda 29017(PC) - ITALY			
ORDER _____					
MODEL _____					
S/N _____				AMB. TEMP. _____	
TAG N° _____				ND _____	
SUPPLY PRES. RANGE _____				MOP _____	
FL. GROUP _____		PED CAT. _____		FL. TYPE _____	
CYL. PS _____		CYL. TS _____		MM/YYYY _____	
CYL.PT _____		TEST DATE _____		CYL WEIGHT _____	
		Ref.: _____		LY: _____	
				ISO _____	

## 1.3 Description of the Actuator

“ALGAS-QA” quick acting spring-return pneumatic low pressure actuators, are suitable for the operation of quarter turn valves (ball valves, butterfly valves, plug valves). These actuators are suitable to achieve a very short time in emergency operation performed by the spring, independently from the flow capacity of supply lines to the actuator.

In fact, the quick operation is requires normally only to bring the valve to the “safe” position. The operating time can be lower than one second, depending on the process characteristics, valve size and operating pressure.

The actuator is made up of a weatherproof scotch yoke mechanism transforming the linear movement of the pneumatic cylinder (or mechanical manual override, if foreseen) and of the spring into the rotary movement, which is necessary for operation. The pneumatic cylinder is fitted with an integral “quick exhaust valve” directly assembled on the end flange.

Furthermore, the cylinder has a specific dumping system to gradually reduce the speed in the last portion of the valve stroke, avoiding possible impact damages to the valve trim and to the actuator itself.

The spring-return pack incorporates up to four springs, fully encapsulated in a factory welded cartridge: this ensures safety to personnel and simplifies assembly. The spring action can be easily changed in the field from to close in to open or from to open in to close (modular design).

The angular stroke of the yoke is adjustable between 82° and 98° by means of the external mechanical stops screwed into the end flange of the pneumatic cylinder and into the end flange of the spring-return pack . The cover of the scotch yoke mechanism is arranged for the assembly of the required accessories (position-transmitter, signaling-limit switches, positioner, etc.) by means of proper matching units. The above mentioned accessories are operated by the actuator drive sleeve.

The housing of the scotch yoke mechanism has a flange with threaded holes to fix the actuator to the valve either directly or, if required, with the interposition of an adaptor flange or a mounting bracket.

The actuator yoke has a hole with keyways suitable for the assembly of an insert bush or a stem extension. Their internal hole is machined (by Biffi or at Customer's care), according to the shape and dimensions of the valve stem.

Biffi can supply different types of control system following Customer's requirements.

**Table 1. Single Acting Pneumatic Actuators ALGAS Series**

	ALGAS	XXX	K	YYYYY	ZZZZ	F	S
<b>Actuator series</b> Always ALGAS							
<b>Actuator model</b>							
<b>Scotch yoke version</b> C Canted S Symmetric							
<b>Spring cartridge model</b>							
<b>Cylinder size</b>							
<b>Fail-safe action</b> CL Spring to close OP Spring to open							
<b>Version</b> - Standard QA Quick Acting							

The expected lifetime of actuator is approximately 25 years.

## Section 2: Installation

### 2.1 Checks to be Carried Out on Receiving the Actuator

1. If the actuator arrives already assembled onto the valve, the settings of the mechanical stops and of the microswitches (if existing) has already been made by the person who assembled the actuator onto the valve. If the actuator arrives separately from the valve, the settings of the mechanical stops and of the microswitches (if existing) must be checked and, if necessary, carried out while assembling the actuator onto the valve.
2. Check that the actuator has not been damaged during transport. If necessary, repair all damages to the paint-coat, etc.
3. Check that the model, the serial number of the actuator and the performance data written on the data plate are in accordance with those described on the order acknowledgement, test certificate and delivery note.
4. Check that the fitted accessories comply with those listed in the order acknowledgement and the delivery note.

### 2.2 Storage

(For handling and lifting procedure, please refer to following Figures: 6, 7 and 8.)

The actuators leave the factory in excellent working conditions and with an excellent finish (these conditions are guaranteed by an individual inspection certificate); in order to maintain these characteristics until the actuator is installed on the plant, it is necessary to observe a few rules and take appropriate measures during the storage period.

1. Make sure that plugs are fitted in the air connections and in the cable entries. The plastic plugs, which close the inlets, do not have a weatherproof function, but are only a means of protection against the entry of foreign matter during transport. If long-term storage is necessary and especially if the storage is outdoors, metal plugs must replace the plastic protection plugs, which guarantee a complete weatherproof protection.
2. If the actuators are supplied separately from the valves, they must be placed onto a wooden pallet so as not to damage the coupling flange to the valve. In case of long-term storage, the coupling parts (flange, drive sleeve, insert bush) must be coated with protective oil or grease. If possible, blank off the flange by a protection disk.
3. In case of long-term storage, it is advisable to keep the actuators in a dry place or to provide at least some means of weather protection. If possible, it is also advisable, to periodically operate the actuator with filtered, dehydrated and lubricated air; after such operations all the threaded connections of the actuator and the valves of the control panel (if existing) should be carefully plugged.

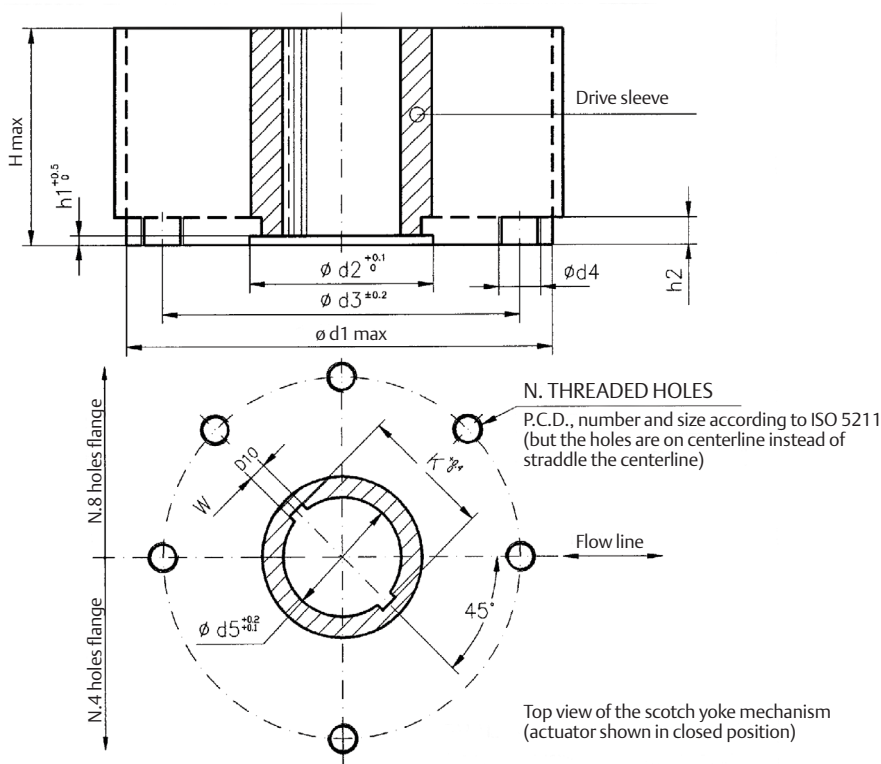
## 2.3 Assembling the Actuator onto the Valve

### 2.3.1 Types of Assembly

For coupling to the valve, the housing is provided with a flange with threaded holes according to Biffi standard tables (SCN 6200; SCN 6200-1; SCN 6201; SCN 6201-1). The number, dimensions and diameter of the holes are made in accordance with ISO 5211, but for actuator models 0.3 to 6 the holes are drilled on the centerline in order to allow an easier assembly of an intermediate flange, when required. This intermediate flange (or spool-piece) can be supplied when the valve flange cannot directly match the actuator flange in its “standard” configuration. For the biggest actuator models, the actuator flange can be machined in accordance with the valve flange dimensions.

The yoke has bored with keyways for coupling to the valve stem, the dimensions of which are according to Biffi standard tables SCN 6200\* and SCN 6201\*.

**Figure 2 Coupling Dimensions - Models 0.3 to 6**



**Table 2. SCN 6200**

Dimensions in millimeters

Actuator model	Ø d <sub>1</sub>	Ø d <sub>2</sub>	Ø d <sub>3</sub>	Ø d <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ø d <sub>5</sub>	W	K
0.3	240	93	165	M20	4	5	17	127	70	12	75,6
0.9	310	112	254	M16	8	5	19	150	86	14	93,6
1.5	360	144	298	M20	8	6	19	190	112	18	119,0
3	430	195	356	M30	8	9	23	200	157	25	167,8
6	520	250	406	M36	8	14	29	260	200	28	212,8

Figure 3 Coupling Dimensions - Models 14, 18, 32, 35, 42

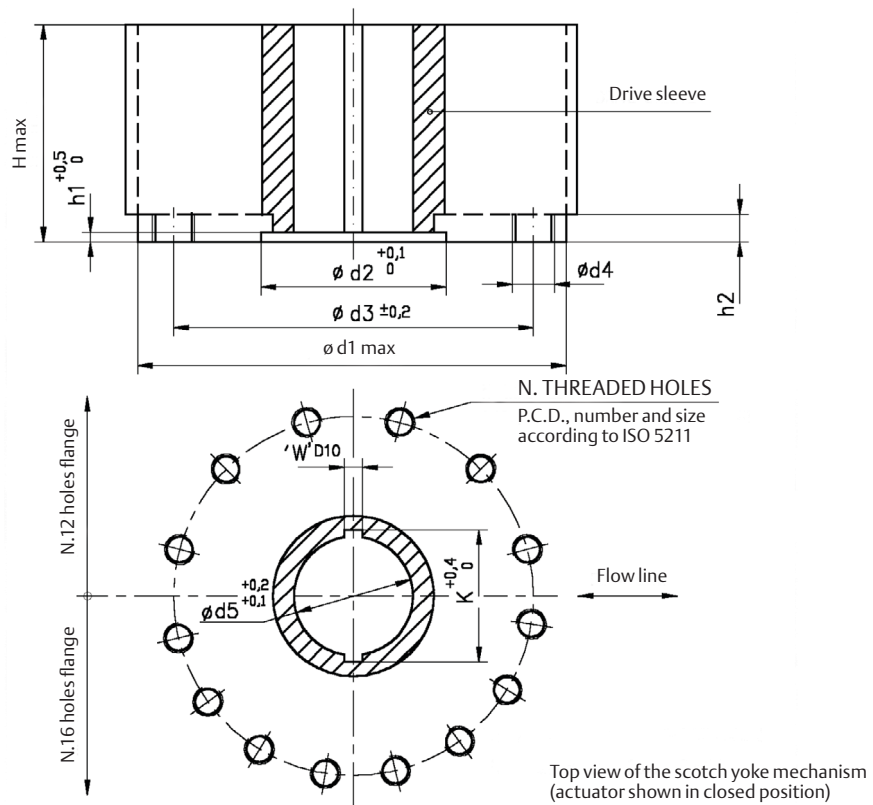


Table 3. SCN 6201

Dimensions in millimeters

Actuator model	$\varnothing d_1$	$\varnothing d_2$	$\varnothing d_3$	$\varnothing d_4$	N	$h_1$	$h_2$	H max	$\varnothing d_5$	W	K
14	580	250	483	M36	12	10	29	340	175	45	195,8
18	680	290	603	M36	16	12	32	350	200	45	220,8
32	780	290	603	M36	16	12	32	400	220	50	242,8
35	780	315	603	M36	16	11	32	400	240	50	242,8
42	840	310	603	M36	16	12	32	400	220	50	242,8

Figure 4 Coupling Dimensions - Models 50, 60

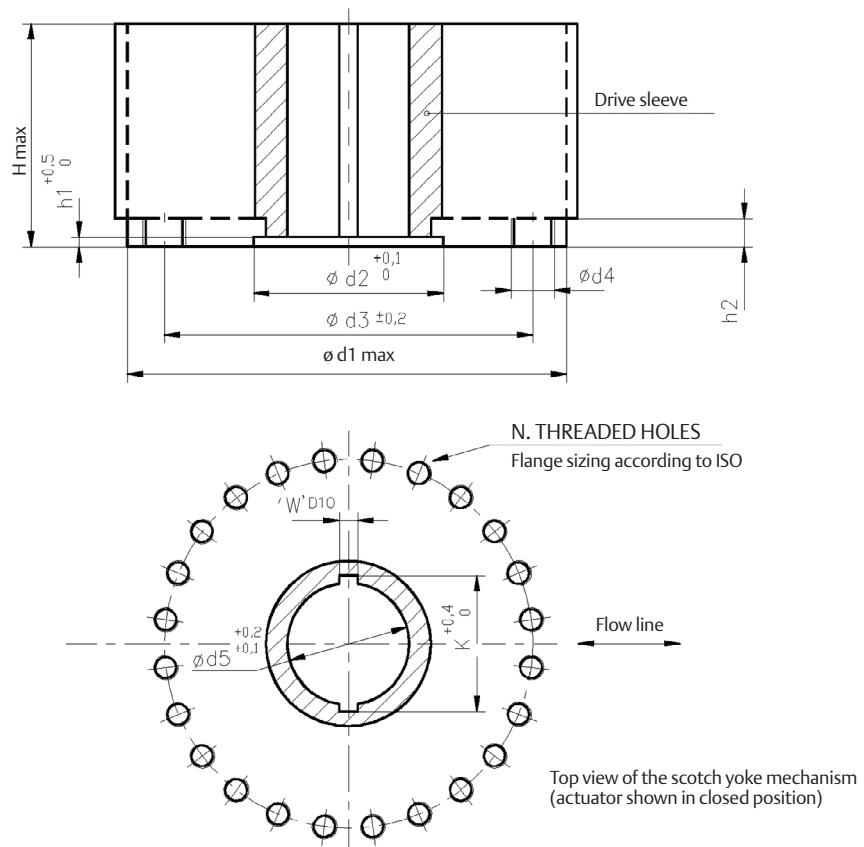


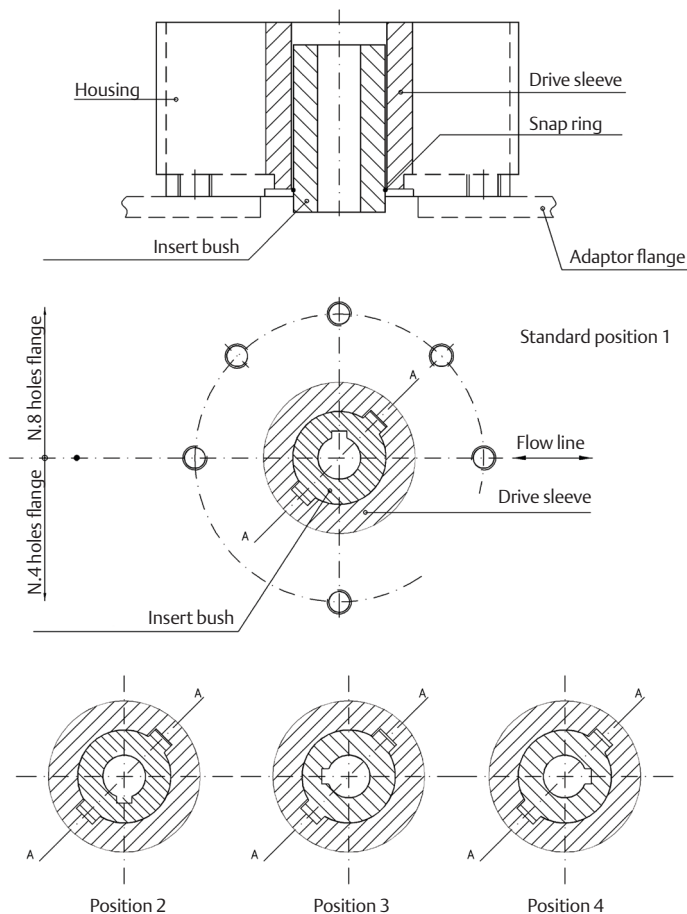
Table 4. SCN 6201-1

Dimensions in millimeters

Actuator model	$\phi d_1$	$\phi d_2$	$\phi d_3$	$\phi d_4$	N	$h_1$	$h_2$	H max	$\phi d_5$	W	K
50	800	315	698	M36	24	10	32	430	240	56	264,8
60	840	315	698	M36	24	10	32	430	240	56	264,8

If required, for the standard models size 0.3 to 6, Biffi can supply an insert bush with unmachined bore in accordance with Biffi standard table SCN 6202. On request the insert bush bore can be machined by Biffi to couple the valve stem, provided its dimensions match the maximum stem acceptance of the bush according to Biffi table TN1005, enclosed. The particular execution of the flange and bushing allow the actuator to be rotated by 90° in 4 different positions according to the following figure:

**Figure 5** Insert Bush + Intermediate Coupling Flange



**Table 5.**

Position 2	Position 3	Position 4
Rotate insert-bush 180° around vertical-standard position (1)	Rotate insert-bush 180° around axis A-A, from position 2	Rotate insert-bush 180° around axis A-A, from position 1
<b>Insert bush turned upside down</b>		

The Biffi insert bush with 2 external keys at 45° allows to position the keyway for the valve every 90°. Consequently, actuator can be mounted in 4 positions at 90° on top of the valve. For biggest actuator models, the bore of the yoke can be machined according to the dimensions of valve stem.

## 2.3.2 Valve Stem with Vertical Axis

### NOTICE

The lifting and handling of the actuator must be done by qualified personnel and in accordance with the laws and regulations in force. Avoid the lifted actuator to be hung above the personnel.

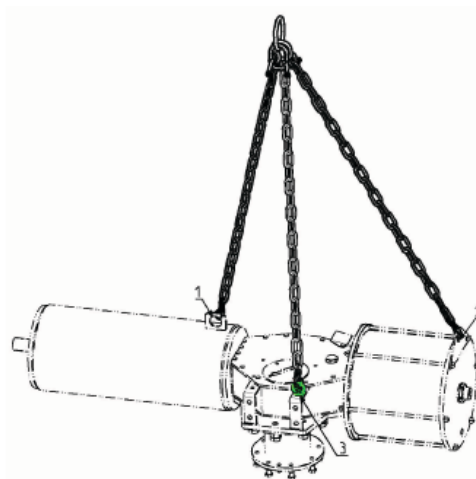
### ⚠ WARNING

The actuator must be lifted by means of a suitable lifting apparatus. The weight of the actuators is indicated in the technical documentation attached to the equipment itself. For lifting and moving the actuator, use only hooks fitted with safety latch, like the one, for example, shown in Figure 6.

Figure 6 Example of hook with safety latch



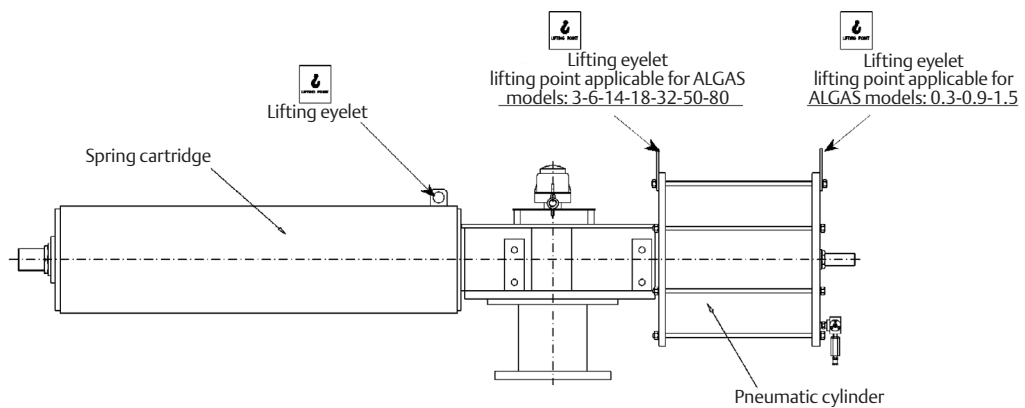
Figure 7 Lifting points



Lifting points: 1-2 (mandatory), 3 (balancing)

Lift ALGAS-QA actuators (pneumatic spring-return) by means of the proper lifting points represented and indicated on actuator by sticking labels. Also refer to Figures 8 for lifting points positions.

**Figure 8** Lifting Points for ALGAS-QA

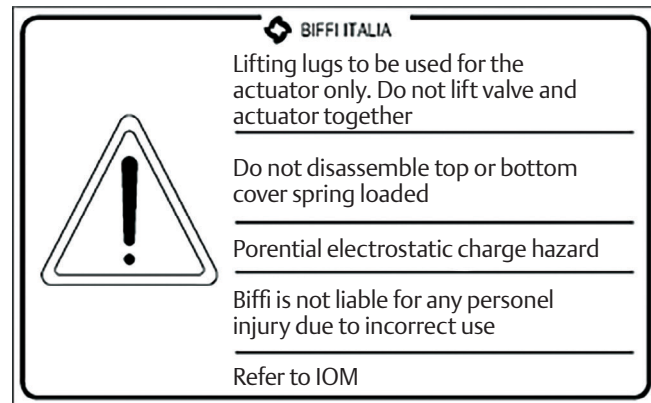
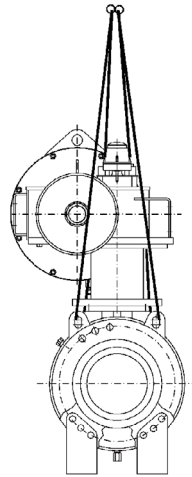


- For lifting unbalanced loads, use ropes of different lengths or chains with adjustable length.
- Check each time the conditions of all lifting equipment used and discard it if not in perfect working order.
- Do not knot or twist the ropes so as not to reduce the lifting capacity or produce torsional effects on the load being lifted.
- Use the utmost caution and remain at a safe distance from lifted actuator unless absolutely necessary; do not stand or pass under suspended loads.
- Pay attention in putting under tension the ropes to prevent the load shifting sideways in an uncontrolled manner.
- Use slings of such length that the angles of the leg from vertical are as narrow as possible ( $\alpha_{MAX} < 20^\circ$ ).
- During handling, do not transport the suspended actuator above staff members in charge of the operation.

### **⚠ WARNING**

Do not use the lifting eyelets on actuator to lift valve + actuator assembly.

Figure 9



## **⚠ WARNING**

Any lifting method different from what described above is strictly forbidden. Biffi reject any responsibility for damages to goods or injuries to persons coming from wrong lifting operations.

The actuator can be assembled onto the valve flange either by using the actuator-housing flange with threaded holes, or by the interposition of an adaptor flange or a spool piece.

The actuator drive sleeve is generally connected to the valve stem by an insert bush or a stem extension. The assembly position of the actuator, with reference to the valve, must comply with the plant requirements (cylinder axis parallel or perpendicular to the pipeline axis).

To assemble the actuator onto the valve proceed as follows:

1. Check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions.
2. Bring the valve to the position related to the actuator spring operation.
3. Lubricate the valve stem with oil or grease in order to make the assembly easier. Be careful not to pour any of it onto the flange.
4. Clean the valve flange and remove anything that might prevent a perfect adherence to the actuator flange and especially all traces of grease, since the torque is transmitted by friction.
5. If an insert bush or stem extension for the connection to the valve is supplied separately, assemble it onto the valve stem and fasten it by tightening the proper stop dowels.
6. Bring the actuator to the position caused by the spring operation.

7. Connect a sling to the support points of the actuator and lift it: make sure the sling is suitable for the actuator weight. When possible, it is easier to assemble the actuator to the valve if the valve stem is in the vertical position. In this case the actuator must be lifted while keeping the flange in the horizontal position.
8. Clean the actuator flange and remove anything that might prevent a perfect adherence to the valve flange and especially all traces of grease.
9. Lower the actuator onto the valve in such a way that the insert bush, assembled on the valve stem, enters the actuator drive sleeve. This coupling must take place without forcing and only with the weight of the actuator. When the insert bush has entered the actuator drive sleeve, check the holes of the valve flange. If they do not meet with the holes of the actuator flange or the stud bolts screwed into them, the actuator drive sleeve must be rotated; feed the actuator cylinder with air at proper pressure, indicated on data-sheet for actuator.
10. Tighten the nuts of the connecting stud bolts evenly with the torque prescribed in the table. The stud bolts must be made of ASTM A320 L7 steel; the nuts must be made of ASTM A194 grade 2 steel.
11. If possible, operate the actuator to check that it moves the valve smoothly.

**Table 6. Torque Table**

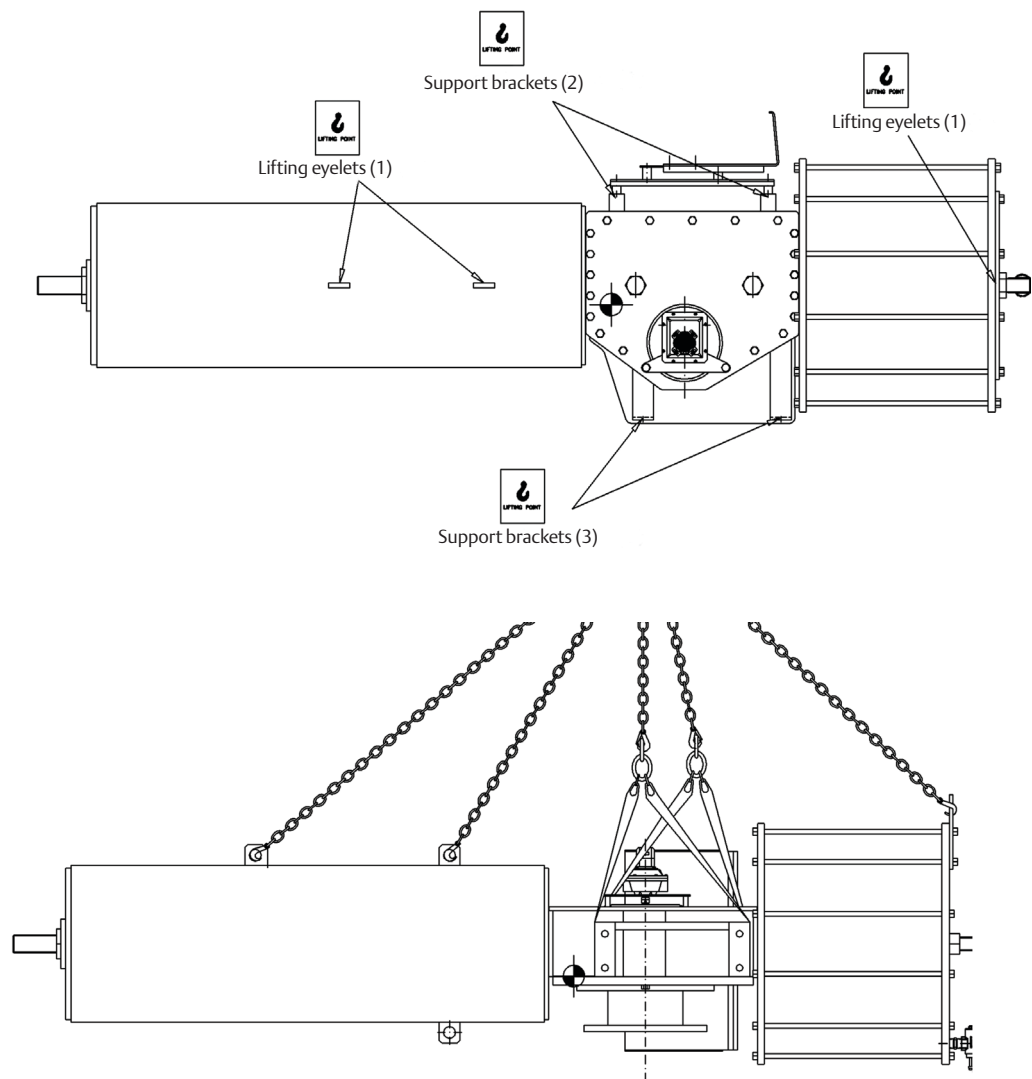
Thread size	Recommended tightening Torque (Nm)
M8	20
M10	40
M12	70
M14	110
M16	160
M20	320
M22	420
M24	550
M27	800
M30	1100
M33	1400
M36	1700

### 2.3.3 Valve Stem with Horizontal Axis

The actuator can also be lifted to assemble directly onto the valve with stem with horizontal axis. To make a correct lifting procedure proceed as follow:

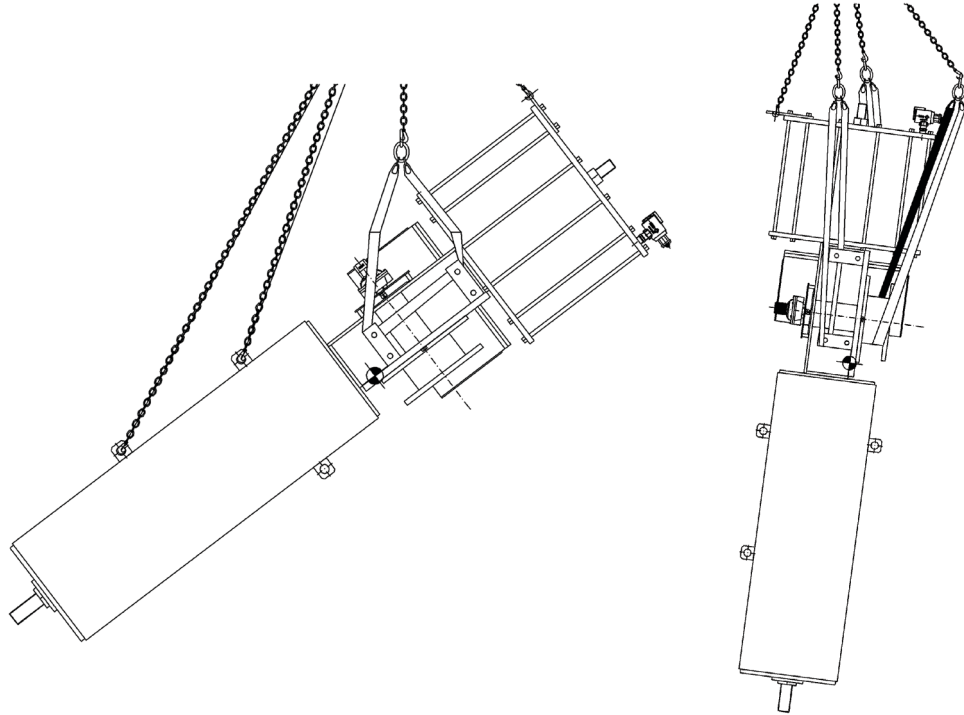
1. Connect properly the actuator lifting points 1 with chains, and connect by suitable slings the support brackets 2 and 3.

Figure 10



2. Balance the weight and lift the actuator to make possible rotation of actuator in its final mounting position, with cylinder on top, or spring container placed on top, as shown in Figure 11.

---

**Figure 11**

3. Clean the actuator flange and remove anything that might prevent a perfect adherence to the valve flange and especially all traces of grease.
4. Lift the actuator near to the valve in such a way that the insert bush, assembled on the valve stem, enters the actuator drive sleeve without forcing the coupling. When the insert bush has entered the actuator drive sleeve, check the holes of the valve flange. If they do not meet with the holes of the actuator flange or the stud bolts screwed into them, the actuator drive sleeve must be rotated; feed the actuator cylinder with air at proper pressure, indicated on data sheet for actuator.
5. Tighten the nuts of the connecting stud bolts evenly with the torque prescribed in the table. The stud bolts must be made of ASTM A320 L7 steel; the nuts must be made of ASTM A194 grade 2 steel.
6. If possible, operate the actuator to check that it moves the valve smoothly.

## Section 3: Operation and Use

### 3.1 Operation Description

The actuator is operated by:

1. Pressurized motor fluid
2. Elastic return of compression helicoidally spring

In the first case, the alimentation fluid pressurizes a chamber of the cylinder and compresses the spring (Figure 12); this determines the linear motion of the piston and the consequent rotation motion of the scotch yoke mechanism to which valve stem is coupled. The fluid contained in the other chamber is discharged through the return line.

In the second case, cutting off or in case of lack of pressure to the cylinder and to the pilot of the fast discharge valve, the opening of the latter is determined, the fast discharge of motor fluid, the quick extension of the spring and the consequent fast operation of the actuator. The motor fluid going out from one chamber of the cylinder partially returns in the other chamber and partially flows through the discharge line.

The last part of the cylinder stroke is strongly slowed down by a damper with 2 bypass system that throttles the outlet of the motor fluid. Figure 12 shows the diagram angular stroke/time. Bypass action must be regulate to make more slowly the last part of cylinder stroke (see Section 3.4.1).

The power and control systems are supplied on specific customer demand.

For the relevant information please refer to the specific documentation supplied.

**Figure 12 Angular Stroke/Quick Operation Time Diagram**

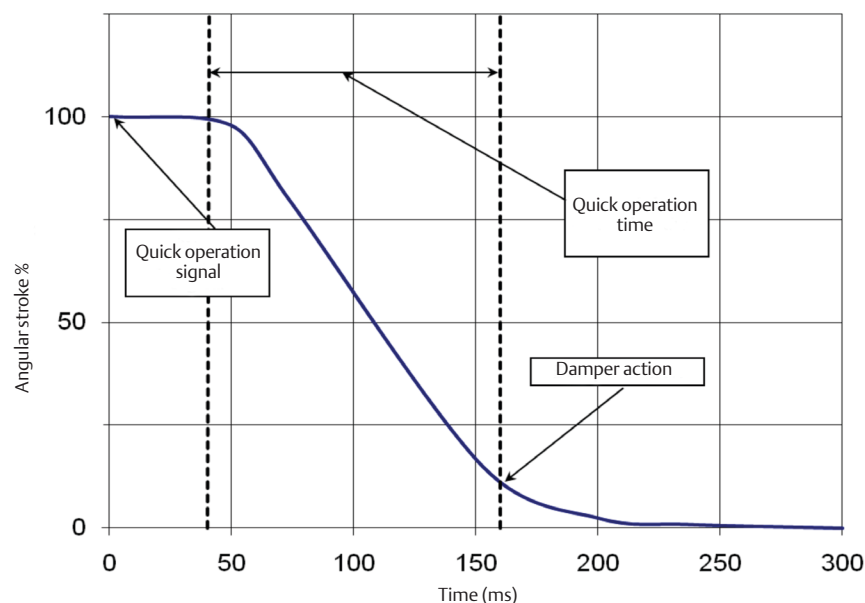
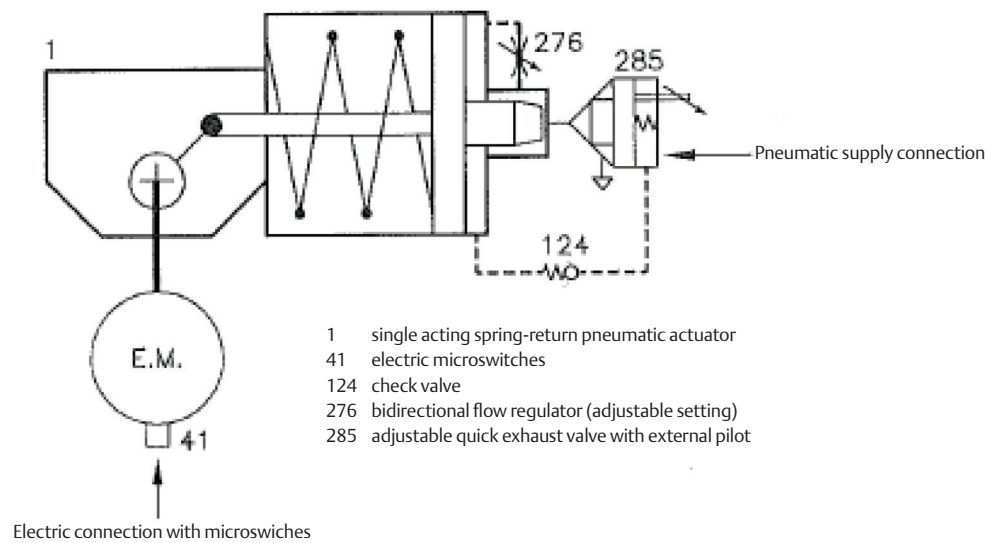


Figure 13 Generic Operating Diagram



### Pneumatic Control to Open

- Pressurize permanently the pneumatic supply line.

### Pneumatic Control to Close

- De-pressurize the pneumatic supply line.  
The air is exhausted from the cylinder through the quick exhaust valve 285 and the actuator moves quickly in closing.

**Note:** the closing time is adjustable by the setting screw on valve 285.

## 3.2 Residual Risks

### **⚠ WARNING**

The actuator has parts under pressure. Use the due caution.  
Use individual protections provided for by the laws and provisions in force.

## 3.3 Operations

The operations are carried out sending the proper signal through the control system in compliance with customer specifications.

Please refer to the functional diagram and specific documentation supplied.

## 3.4 Calibration of the Quick Operation Time

The calibration of the quick operation time of the actuator is carried out through the adjustment of the quick exhaust valve positioned in the tail flange of the pneumatic cylinder (Figure 14).

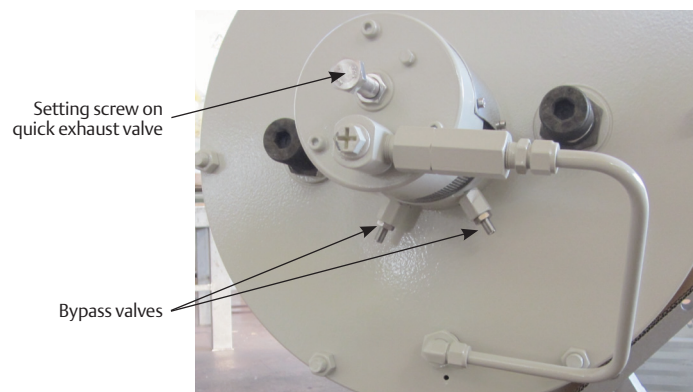
The calibration of the operation time is made by Biffi Italia s.r.l according to customer requirements and to technical data sheet included in technical documentation. If necessary, it is possible to modify or to reset the operating time.

To carry out the adjustment, use an adequate Allen wrench and follow these steps (Figure 14):

- Loosen the locknut
- Screw with a screwdriver the setting screw to increase the operation time
- Unscrew with a screwdriver the setting screw to decrease the operation time
- After the adjustment is over screw the locknut

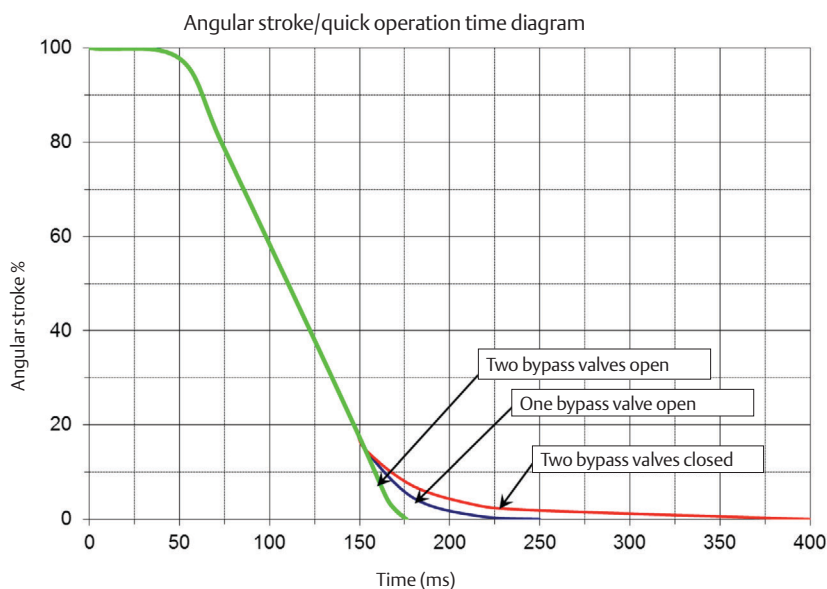
The procedure is absolutely general. It is applicable both fail-to-open and fail-to-close actuators.

**Figure 14** Adjustment of Operating Time



### 3.4.1 Bypass Adjustment

**Figure 15** Bypass Action to Angular Stroke / Quick Operation Time Diagram



Remove the protection cap from adjusting needle-valve and turn it clockwise to increase throttling-action and consequently to slow the last part of cylinder stroke. To decrease throttling-action, turn the needle for bypass in anti-clockwise direction .

To reduce more the operating time (higher speed) unscrew both Bypass screws (see diagram in Figure 15).

#### NOTICE

To correctly calibrate the quick operation time it is necessary to arrange the data acquisition using a position transmitter and an oscillographic recorder compatible with required time. If specific signals are built on by specific instrumentation, please refer to dedicated documentation.

## 3.5 Setting of the Angular Stroke

It is important that the mechanical stops of the actuator (and not those of the valve) stop the angular stroke at both extreme valve position (fully open and fully closed), except when this is required by the valve operation (e.g. metal seated butterfly valves).

The travel stop screws are screwed into the end flange of the pneumatic cylinder, depending on actuator different configuration (i.e. spring to open or spring to close), and spring cartridge.

The setting of the open valve position is performed by adjusting the travel stop screw on the left side of the actuator.

The setting of the closed valve position is performed by adjusting the travel stop screw on the right side of the actuator.

### 3.5.1 Angular Stroke Setting - Two Travel Stop Screws Placed in the End Flange of Pneumatic Cylinder

#### **WARNING**

Do not change the setting in case of disassembly of the actuator of the valve.

To set the two travel stop screws in the flange of the pneumatic cylinder, proceed as follows, see Figure 16:

1. Supply pressure to the cylinder to reduce trust on the stop screws.
2. Unscrew the protection plugs (1) with Allen wrench C1 (12 mm).
3. Unloose the stop setting screw covers (2) with wrench C2 (60 mm).
4. Adjust the travel stop screws (3) with Allen wrench C3 (17 mm).
5. Rotate anticlockwise to increase the angular stroke, rotate clockwise to reduce it.
6. Verify that both travel stop screws protrude by the same distance from the cylinder end flange face (f) by means of a caliber (h), see Figure 17.
7. Reduce or stop cylinder supply to verify the angular stroke.
8. Repeat operation until the required angular stroke is attained.
9. Tighten the two stop setting-screw covers (2).
10. Tighten the protection plugs (1).

Figure 16

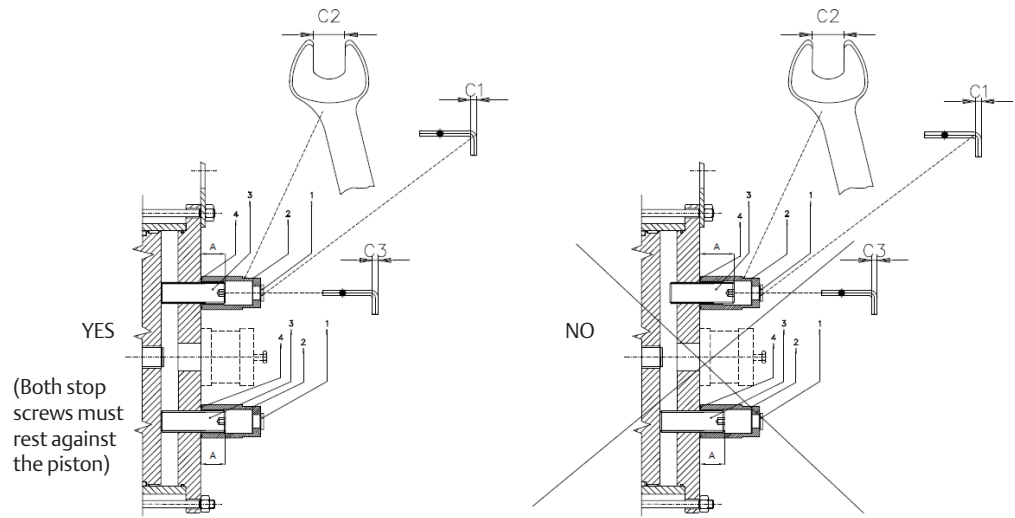
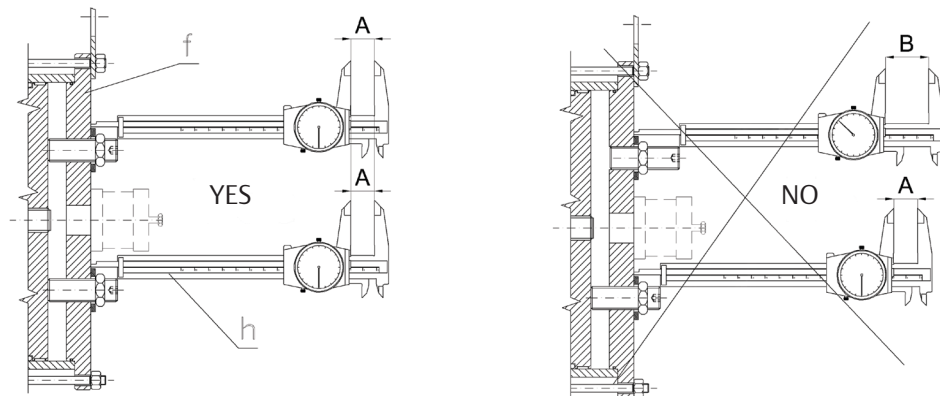
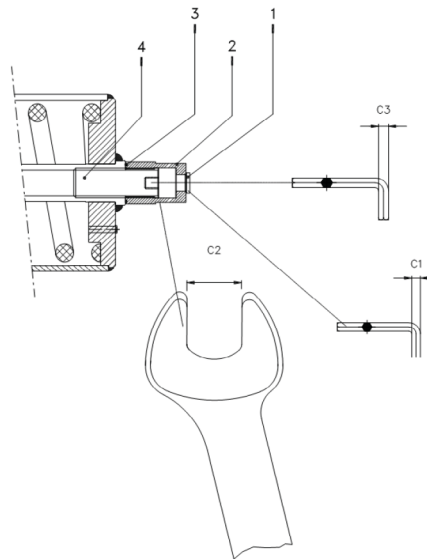


Figure 17



## 3.5.2 Stop Screw Screwed on the End Flange of Spring Container

Figure 18



For the adjustment of the travel stop screw proceed as follows, see Figure 18.

1. Unscrew the protection plugs (1) with Allen wrench C1 (12 mm).
2. Unloose the stop setting-screw covers (2) with wrench C2 (80 mm).
3. Adjust the travel stop screws (4) with Allen wrench C3 (17 mm).
4. If the stop-screw is too hard to be operated, reduce or remove the cylinder pressure, in order to move the mechanism far from the screw. Operate the setting screw and then pressurize again the cylinder to reach end position.
5. If the actuator angular stroke is stopped beyond the end position, screw the stop screw by turning it clockwise until the valve reaches the correct position.
6. Tighten the two stop setting screw covers (2).
7. Tighten the protection plugs (1).

## 3.6 Microswitches Calibration (Applicable to Biffi Limit Switch Box Model Only)

### NOTICE

Operate only the micro-switch corresponding to the direction of operation being carried out, as clearly reported on the microswitch.

### WARNING

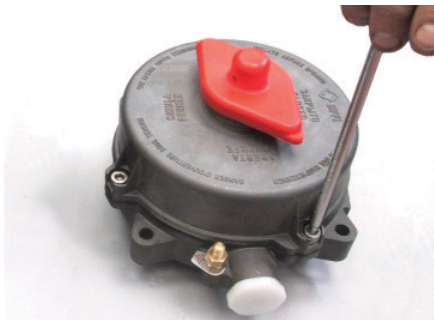
If different microswitches assembly or limit switch box is supplied, please refer to the specific documentation.

Microswitches are placed inside a special box (Figure 19).

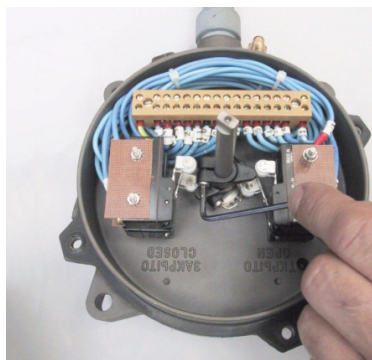
For microswitches calibration please refer to the relative wiring diagram and follow these steps:

- Unscrew the fastening screws of the cover (Figure 19).
- Remove the cover paying attention not to deteriorate the gasket and the cylindrical and flat coupling surfaces.
- Operate the actuator (in opening or closing) with local pneumatic or hydraulic operation (Section 3.3).
- Unscrew the screw of the operating cam relative to the microswitch to calibrate and adjust it according to the settings (Figure 20).
- Tighten the screw.
- Operate the actuator and adjust any other microswitch with the procedure already described.
- Position the cover making sure the cam-carrier shaft grips with the index dragging shaft.
- Check that the cover and the index show the proper position of the valve (Figure 21).
- Tighten the screws.

---

**Figure 19** Microswitches box



---

**Figure 20** Cam adjustment


If the index (Figure 21), does not signal the proper position of the valve but is turned by 90°:

- Remove the roll pin placed on the position indicator (index).
- Turn the indicator until reaching its proper positioning.
- Put the roll pin back in its position.

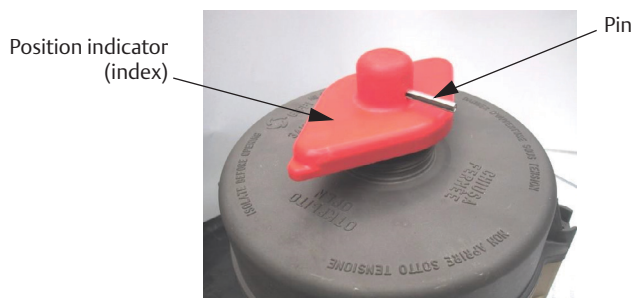
## NOTICE

End of stroke microswitches should be operated before the stop of the stroke of the actuator due to mechanical stops. Adjust the relative cams properly.

---



---

**Figure 21** Position indicator and pin for microswitches box


## 3.7 Preparation for Start-up

### 3.7.1 Pneumatic Connections

Connect the actuator to the pneumatic feed line with fittings and pipes in accordance to the plant specifications. They must be sized correctly in order to guarantee the necessary airflow for the operation of the actuator, with pressure drops not exceeding the maximum allowable value. The shape of the connecting piping must not cause excessive stress to the inlets of the actuator. The piping must be suitably fastened so as not to cause excessive stress or loosening of threaded connections, if the system undergoes strong vibrations.

Every precaution must be taken to ensure that any solid or liquid contaminants, which may be present in the pneumatic pipe-work to the actuator, are removed to avoid possible damages to the unit or loss of performance.

The inside of the pipes used for the connections must be well cleaned before use: wash them with suitable substances and blow through them with air or nitrogen. The ends of the tubes must be well debarred and cleaned.

Once the connections are completed, operate the actuator and check that it functions correctly, that the operation times meet the plant requirements and that there are no leaks in the pneumatic connections.

### 3.7.2 Electrical Connections

Connect the electrical feed, control and signal lines to the actuator, by linking them up with the terminal blocks of the electrical components. In order to do this, the housing covers must be removed without damaging the coupling surfaces, the O-rings or the gaskets. Remove the plugs from the cable entries.

For electrical connections use components (cable glands, cables, hoses, conduits) which meet the requirements and codes applicable to the plant specifications (mechanical protection and/or explosion-proof protection). Screw the cable glands tightly into the threaded inlets, so as to guarantee the weatherproof and explosion-proof protection (when applicable).

Insert the connection cables into the electrical enclosures through the cable glands, and connect the cable wires to the terminals according to the applicable wiring diagram. If conduits are used, it is advisable to carry out the connection to the electrical enclosures by inserting hoses so as not to cause anomalous stress on the housing cable entries.

Replace the plastic plugs of the unused enclosure entries by metal ones, to guarantee perfect weatherproof tightness and to comply with the explosion-proof protection codes (where applicable). Once the connections are completed, check that the controls and signals work properly.

## 3.8 Start-up

During the start-up of the actuator, proceed as follows:

1. Check that the pressure and quality of the air supply (filtering degree, dehydration) are as prescript. Check that the feed voltage values of the electric components (solenoid valve coils, microswitches, pressure switches, etc.) are as prescript.
2. Check that the actuator controls work properly (remote control, local control, emergency controls, etc.).
3. Check that the required remote signals (valve position, air pressure, etc.) are correct.
4. Check that the setting of the components of the actuator control unit (pressure regulator, pressure switches, flow control valves, etc.) meet the plant requirements.
5. Check that there are no leaks in the pneumatic connections. If necessary, tighten the nuts of the pipe fittings.
6. Remove all rust and, in accordance with the applicable painting specifications, repair paint-coat that has been damaged during transport, storage or assembly.

## Section 4: Operational Tests and Inspections

### **NOTICE**

To ensure the guaranteed SIL grade, according to IEC 61508, the functionality of actuator must be checked with regular intervals of time, as described in the Safety Manual.

---

## Section 5: Maintenance

### NOTICE

Before carrying out any maintenance operation, it is necessary to close the pneumatic feed line and exhaust the pressure from the actuator cylinder and from the control unit, to ensure safety of maintenance staff.

### ⚠ WARNING

Installation, commissioning and maintenance and repair works should be carried out by qualified staff. Please refer to warning on Section 1.

## 5.1 Routine Maintenance

ALGAS actuators have been designed to work for long periods in the severest conditions with no need for maintenance.

### NOTICE

Periodicity and regularity of inspections is particularly influenced by specific environmental and working conditions. They can be initially determined experimentally and then be improved according to actual maintenance conditions and needs.

Anyway, every 2 years of operation the following is recommended:

1. Check that the actuator operates the valve correctly and with the required operating times. If the actuator operation is very infrequent, carry out a few opening and closing operations with all the existing controls (remote control, local control, emergency controls, etc.), if this is allowed by the conditions of the plant.
2. Check that the signals to the remote control desk are correct.
3. Check that the air supply pressure value is within the required range.
4. If there is an air filter on the actuator, bleed the condense water accumulated in the cup by opening the drain cock. Disassemble the cup periodically and wash it with soap and water; disassemble the filter: if this is made up of a sintered cartridge, wash it with nitrate solvent and blow through with air. If the filter is made of cellulose, it must be replaced when clogged.
5. Check that the external components of the actuator are in good conditions.
6. Check all the paint-coat of the actuator. If some areas are damaged, repair the paint-coat according to the applicable specification.
7. Check that there are no leaks in the pneumatic connections. If necessary, tighten the nuts of the pipe fittings.

## 5.2 Extraordinary Maintenance

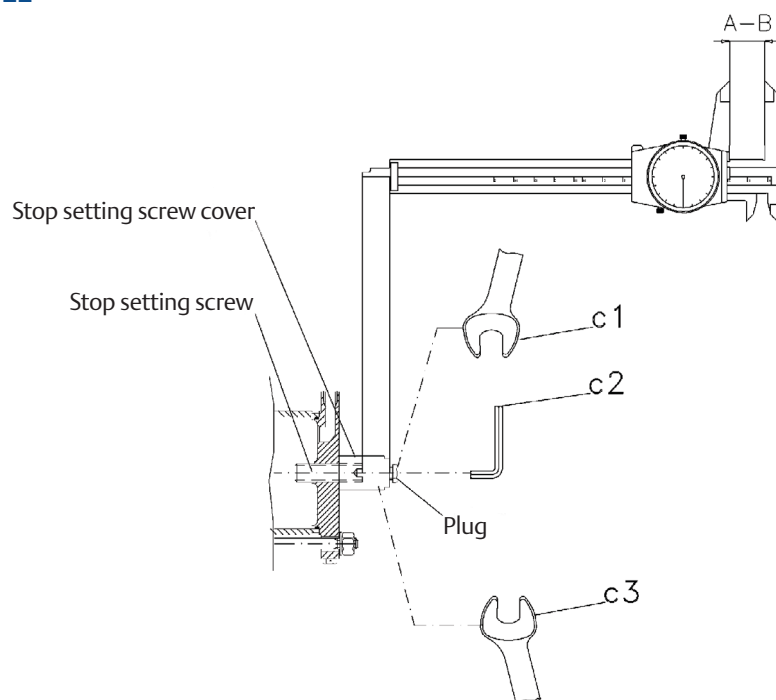
If there are leaks in the pneumatic cylinder or a malfunction in the mechanical components, or in case of scheduled preventive maintenance, the actuator must be disassembled and seals must be replaced with reference to the following general sectional drawing and adopting the following procedures.

### **⚠ WARNING**

If the actuator can be operated, it is essential to take it to fail-safe position, with the spring totally extended, otherwise the actuator should be disassembled from the valve and follow the steps described below.

- Remove the plug from the cover of the adjustment screw.
- Record the length between end flange and stop setting screw, as in Figure 22 below.
- Bring the adjustment screw back to the maximum to let the spring loosen.

**Figure 22**



### **⚠ WARNING**

Before disassembling the cylinder, make sure the above operation of spring release is done.

## 5.2.1 Replacement of Cylinder Seals

Refer to Figure 23 for sectional drawing.

1. Measure the protrusion of the stop screw (26) with reference to the end flange (22) surface, so as to be able to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed.
2. Loosen the protection cover (25) and unscrew the stop screws (26) until it is removed from the end flange (22) together with the covers (25).
3. Unscrew the nuts (16) from the tie rods (18) from the side of the end flange: they must be gradually unscrewed all at the same time.
4. Slide off the end flange (22) and the tube (19).

### 5.2.1.1 Seals Replacement

Prior to reassemble check that the actuator components are in good conditions and clean. Lubricate all the surfaces of the parts, which move in contact with other components, by recommended grease. If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with protective oil or grease film. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.

1. Replace the O-ring (47) of the head flange (17).
2. Replace the O-ring (49) and the guide sliding ring (48) of the piston (21).
3. Replace the O-ring (47) of the end flange (22).
4. Remove the O-rings (79) from the stop screw covers (25). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the O-ring is.
5. Screw the new O-rings with the protection covers onto the stop screw until it touches the end-flange.

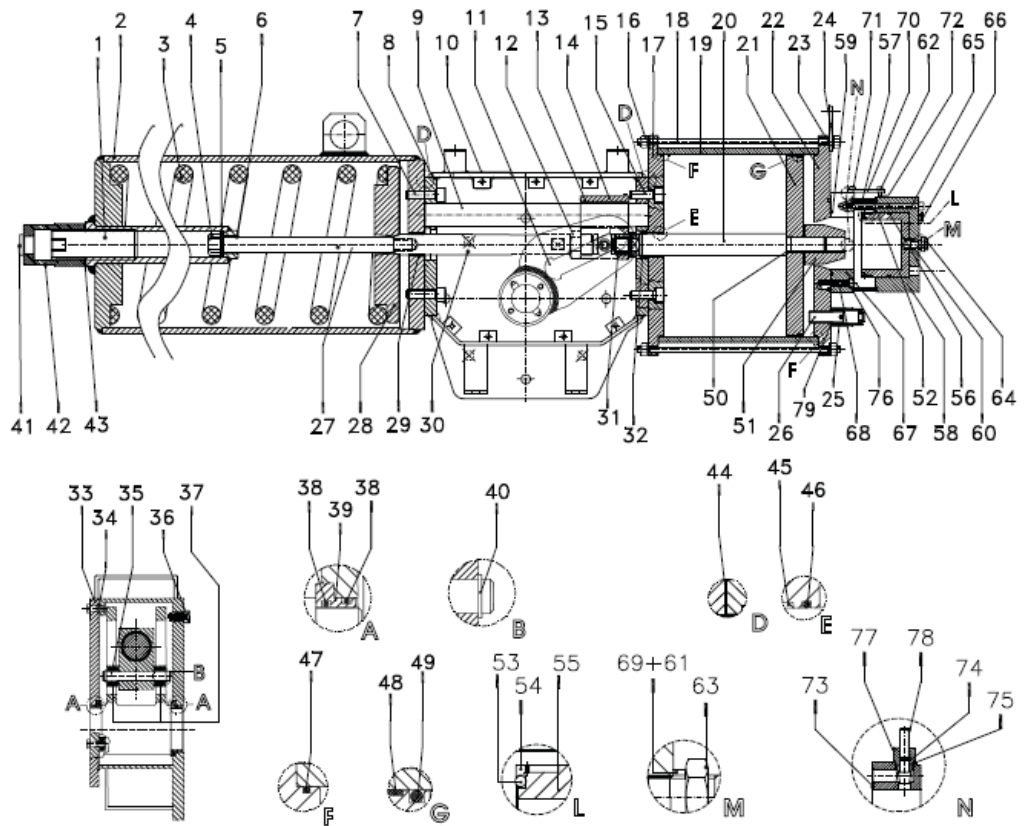
### 5.2.1.2 Cylinder Reassembling

1. Carefully clean the inside of the tube (19) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate the inside surface of the tube and the bevels at the ends. Slide the tube onto the piston taking care not to damage the piston O-ring (49) and the head flange O-ring (47).
2. Assemble the end flange by centering it on the inside diameter of the tube, taking care not to damage the O-ring (47).
3. Assemble the washer (24) and the nuts (16) onto the tie rods (18). Tighten the nuts to the recommended torque, alternating between opposite corners.
4. Screw the stop screw (26) into the threaded hole of the end flange until it reaches its original position (the same protrusion with reference to the flange surface). To make the operation easier feed the pneumatic cylinder with air (if possible) in order to compress the spring.
5. Tighten the protection covers (25).

#### NOTICE

After maintenance operations carry out a few actuator operations (5 - 10) to check that its movement is regular, that there is no air leakage through the seals and to eliminate any oil residues in the air circuit, deriving from the lubrication of the seals during the replacement phase.

Figure 23 ALGAS - QA "Quick Acting" spring-return pneumatic actuator



**Table 7. Parts List**

Item	Description	Item	Description
1	Stop setting screw	41	Plug
2	Spring container	42	Stop setting screw cover
3	Spring	43	O-ring
4	Nut	44	Gasket
5	Shoulder washer	45	Piston rod bushing
6	Rod bushing	46	O-ring
7	Screw	47	O-ring
8	Housing	48	Guide sliding ring for piston
9	Guide bar	49	O-ring
10	Cover gasket	50	O-ring
11	Yoke	51	Damper
12	Plug	52	Spacer
13	Bushing	53	O-ring
14	Guide block	54	Piston ring nut
15	Screw	55	Piston
16	Nut	56	O-ring
17	Head flange	57	Filter
18	Tie rod	58	Body
19	Cylinder tube	59	O-ring
20	Piston rod	60	Spring
21	Piston	61	Sealing washer
22	End flange	62	Screw
23	Lifting eyelet	63	Nut
24	Spring washer	64	Screw (adjustable)
25	Stop setting screw cover	65	Screw
26	Stop setting screw	66	Plug
27	Guide rod	67	Spacer
28	Spring thrust flange	68	Screw
29	Rod bushing	69	Washer
30	Container rod	70	Cover
31	Adaptor bush	71	Screw
32	Washer	72	Spacer
33	Cover	73	O-ring
34	Screw	74	O-ring
35	Guide block pin	75	O-ring
36	Vent valve	76	Washer
37	Sliding block	77	Ring nut
38	O-ring	78	Flow control screw
39	Yoke bushing	79	O-ring
40	Retainer ring		

## 5.3 Lubrication of Mechanism

For normal duty, the scotch yoke mechanism of the actuator is lubricated "for life". In case of high load and high frequency of operation it may be necessary to periodically restore lubrication: it is advisable to apply a generous coating of grease on the contact surfaces of the yoke and bushings, on the yoke link grooves, on the sliding blocks, on the guide bar.

For this operation it is necessary to disassemble the mechanism cover. In larger actuators the lubrication can be performed through the inspection holes of the cover after removing the plugs.

The following grease is used by Biffi for standard working temperature and suggested for re-lubrication:

**Table 8 . Lubrication**

AGIP MU/EP/2		AEROSHELL GREASE 7 or equivalent	
To be used in standard temperature conditions:	(-30 °C/+85 °C)	To be used in low temperature conditions:	(-60 °C/+65 °C)
NLGI consistency:	2	Color:	Buff
Worked penetration:	280 dmm	Physical state:	Semi-solid at ambient temperature
ASTM Dropping Point:	185 °C	Odor:	Slight
Base oil viscosity at 40 °C:	160 mm <sup>2</sup> /s	Density:	966 kg/m <sup>3</sup> at 15 °C
ISO Classification:	L-X-BCHB 2	Flash Point:	> 215 °C (COC) (Based on synthetic oil)
DIN 51 825:	KP2K – 20	Dropping point:	260 °C (ASTM D-566)
Equivalent to:	ESSO BEACON EP2 BP GREASE LTX2 SHELL ALVANIA GREASE R2 ARAL ARALUB HL2 CHEVRON DURALITH GREASE EP2 CHEVRON SPHEEROL AP2 TEXACO MULTIFAK EP2 MOBILPLEX 47 PETROMIN GREASE EP2	Product code:	001A0065
		Infosafe No.:	ACISO GB/eng/C

## 5.4 Dismantling and Demolition

Before starting the disassembly, a large area should be created around the actuator to allow any kind of movement without problems of further risks created by worksite.

### **WARNING**

Before disassembling the actuator, it is necessary to close the pneumatic feed line and discharge pressure from the cylinder of the actuator, from the control unit and from the accumulator tank, if present.

The opposition of pneumatic supply is discharged from the cylinder by the linear movement generated from the spring release. It moves actuator and consequently the valve, in its fail-safe position.

If actuator is still mounted onto the valve, loosen the threaded connections between valve and actuator (screws, tie rods, nuts).

Lift the actuator using the proper lifting points (see Section 2.3.2).

If the actuator needs storage, before demolition, see Section 2.2.

### **NOTICE**

The demolition of the actuator both concerning any electrical and mechanical part should be made by specialized staff.

Separate the parts composing the actuator according to their nature (e.g. metallic and plastic materials, fluids etc.) and send them to different waste collection sites, as provided by the laws and provisions in force.

# Section 6: Troubleshooting

## 6.1 Failure or Breakdown Research

**Table 9. Troubleshooting**

Event	Possible cause	Remedy
Actuator does not work	Lack of power supply	Restore it
	Lack of pneumatic supply	Open line interception valve
	Blocked valve	Repair or replace
	Wrong position of the distributor of the manual hydraulic group	Restore correct position
	Failure of the spring	Call Biffi Italia s.r.l. customer service
	Failure of the control group	Call Biffi Italia s.r.l. customer service
	Unexpected intervention of torque limit-device	Call Biffi Italia s.r.l. customer service
Actuator too slow	Low supply pressure	Restore (Section 1.4)
	Low supply pressure	Restore (Section 1.4)
	Wrong calibration of flow regulator valves	Restore (Section 3.6)
	Bad functioning of quick exhaust valve	Call Biffi Italia s.r.l. customer service
Actuator too fast	Wear of the valve	Replace
	High supply pressure	Restore (Section 1.4)
	Bad functioning of booster/quick exhaust valve	Call Biffi Italia s.r.l. customer service
Leakages on hydraulic or pneumatic circuits	Wrong calibration of flow regulator valves	Restore (Section 3.6)
	Deterioration and/or damage to gaskets	Call Biffi Italia s.r.l. customer service
Incorrect position of the valve	Wrong adjustment of mechanical stops	Restore (Section 3.4)
	Wrong warning of microswitches	Restore (Section 3.5)
Hydraulic manual pump does not work	Handle positioned on remote control	Position the handle on the indication of the operation to make
	Leakages on the check valve of the hydraulic control group	Call Biffi Italia s.r.l. customer service

# Section 7: Layouts and Sectional Drawings

## 7.1 Parts List for Maintenance and Replacing Procedure

Figure 24 Scotch Yoke Mechanism

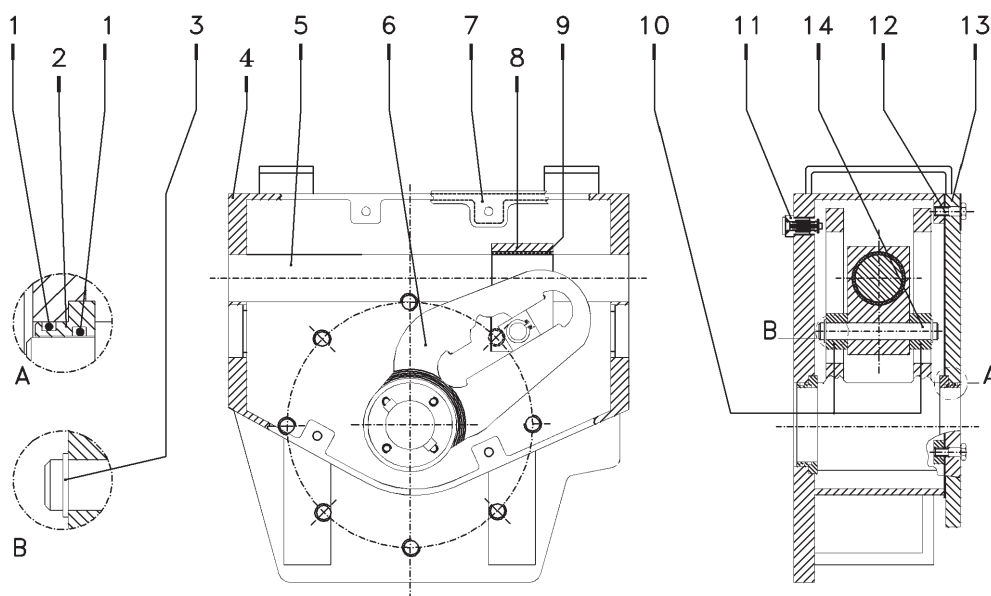


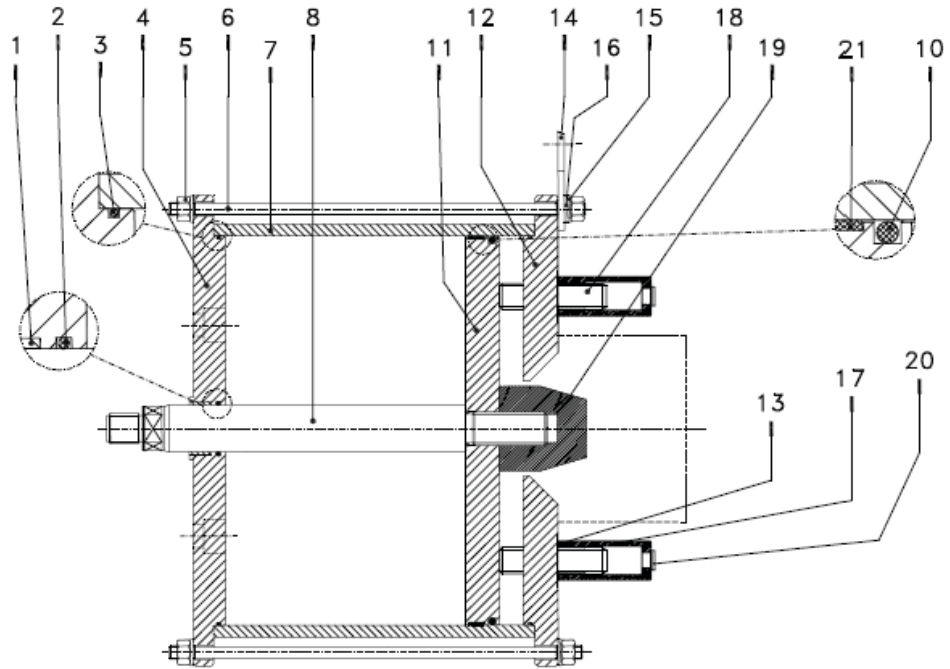
Table 10. Parts List

Item	Qty	Description	Material
1	4	O-ring	* NBR
2	2	Yoke bushing	Bronze
3	2	Retainer ring	Stainless steel
4	1	Housing	Carbon steel
5	1	Guide bar	Alloy steel
6	1	Yoke	Carbon steel
7	1	Cover gasket	* Fiber
8	1	Guide block	Carbon steel
9	1	Bushing	Steel + Bz + Teflon
10	2	Sliding block	Bronze
11	1	Vent valve	* Stainless steel
12	12	Screw	Carbon steel
13	1	Cover	Carbon steel
14	1	Guide block pin	Alloy steel

**NOTE:**

\* recommended spare parts

**Figure 25** Pneumatic cylinder with setting screw protection



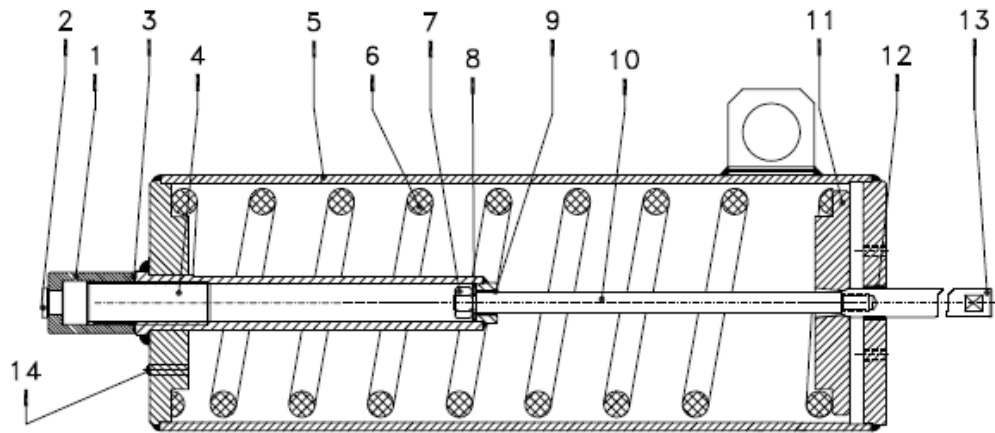
**Table 11.** Parts List

Item	Qty	Description	Material
1	1	Piston rod bushing	Steel + Bz + Teflon
2	1	O-ring	* Viton
3	2	O-ring	* Viton
4	1	Head flange	Carbon steel
5	12	Nut	Alloy steel
6	6	Tie rod	Alloy steel
7	1	Cylinder tube	Carbon steel
8	1	Piston rod	Alloy steel
10	1	O-ring	* Viton
11	1	Piston	Carbon steel
12	1	End flange	Carbon steel
13	2	Sealing washer	* NBR rubber
14	1	Lifting eyelet	Carbon steel
15	12	Spring washer	Carbon steel
16	2	Washer	Carbon steel
17	2	Stop setting screw cover	Carbon steel
18	2	Stop setting screw	Alloy steel
19	1	Damper	Aluminum
20	2	Plug with Viton gasket	Stainless steel + Viton
21	1	Guide sliding ring for piston	* Teflon + Graphite

**NOTE:**

\* recommended spare parts

**Figure 26 Spring cartridge with setting screw protection**



**Table 12. Parts List**

Item	Qty	Description	Material
1	1	Stop setting screw cover	Carbon steel
2	1	Plug with gasket	Stainless steel + Viton
3	1	O-ring	* NBR rubber
4	1	Stop setting screw	Carbon steel
5	1	Spring container (welded assembly)	Carbon steel
6	1	Spring	Carbon steel
7	1	Nut	Carbon steel
8	1	Shoulder washer	Alloy steel
9	1	Rod bushing	Steel + Bz + Teflon
10	1	Guide rod	Alloy steel (chromium plated)
11	1	Spring thrust flange	Carbon steel
12	1	Rod bushing	Steel + Bz + Teflon
13	1	Container rod	Alloy steel (chromium plated)
14	1	Plug	Stainless steel + FKM rubber

**NOTE:**

\* recommended spare parts

Figure 27 Assembly Kit

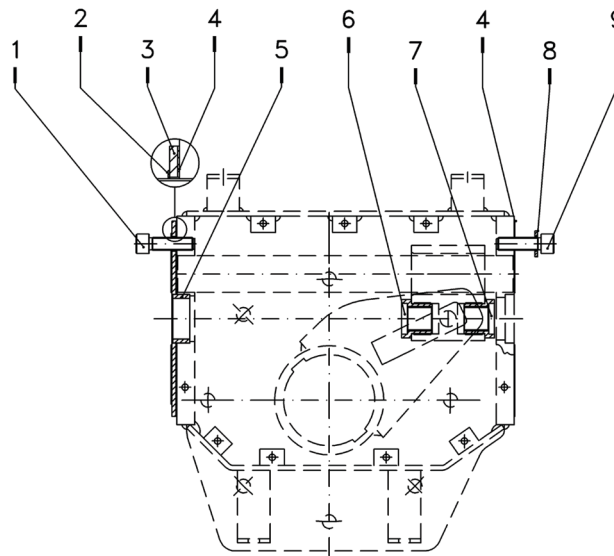


Table 13. Parts List

Item	Qty	Description	Material
1	4	Screw	Alloy steel
2	1	Gasket	* Fiber
3	1	Side plate	Carbon steel
4	2	Gasket	* Fiber
5	1	Washer	Carbon steel
6	1	Adaptor bush	Alloy steel
7	1	Adaptor bush	Alloy steel
8	6	Washer	Carbon steel + rubber
9	6	Screw	Alloy steel

**NOTE:**

\* recommended spare parts

Figure 28 Quick Exhaust Valve

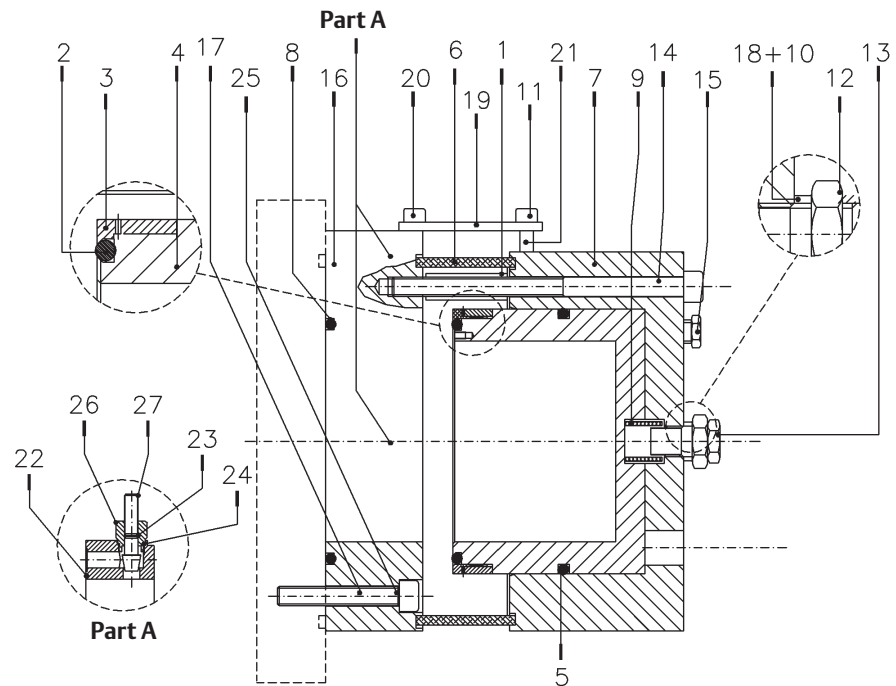


Table 14. Parts List

Item	Qty	Description	Material
1	4	Spacer	Stainless steel
2	1	O-ring	* Viton
3	1	Piston ring nut	Stainless steel
4	1	Piston	Aluminium
5	1	O-ring	* Viton
6	1	Filter	Stainless steel
7	1	Body	Stainless steel
8	2	O-ring	* Viton
9	1	Spring	Spring steel
10	1	Sealing washer	* PVC
11	2	Screw	Stainless steel
12	1	Nut	Stainless steel
13	1	Screw (adjustable)	Stainless steel
14	4	Screw	Stainless steel
15	1	Plug	Stainless steel
16	1	Spacer	Stainless steel
17	4	Screw	Stainless steel
18	1	Washer	Stainless steel
19	1	Cover	Stainless steel
20	2	Screw	Stainless steel
21	2	Spacer	Stainless steel
22	2	O-ring	* Viton
23	2	O-ring	* Viton
24	2	O-ring	* Viton
25	4	Washer	Stainless steel
26	2	Ring nut	Stainless steel
27	2	Flow control screw	Stainless steel

**NOTE:**

\* recommended spare parts

# Section 8: Spare Parts

## 8.1 Spare Parts Order

For spare parts order to the relevant Biffi office, please make reference to Biffi order confirmation concerning all the supply, and serial number of the actuator, refer to Section 1.2 for any specific spare part for a specific actuator model.

**Please send every spare parts request to:**

Biffi Italia s.r.l. - Servizio Assistenza Tecnica Clienti

Tel.: 0523-944523

Fax: 0523-941885

e-mail: [Biffispares@Emerson.com](mailto:Biffispares@Emerson.com)

**Please specify:**

1. actuator model
2. Biffi acknowledgement
3. spare parts code
4. quantity
5. transport condition
6. involved people

## Section 9: Date Report for Maintenance Operations

Last maintenance operation date: (in factory, on delivery):  
..... exec. by : .....  
..... exec. by : .....  
..... exec. by : .....

Next maintenance operation date: ..... exec. by : .....  
..... exec. by : .....  
..... exec. by : .....

Start-up date: ..... (in factory, on delivery).....  
..... (on plant).....

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