

BIFFI ALGAS SPRING RETURN PNEUMATIC ACTUATOR

INSTALLATION, OPERATION AND MAINTENANCE MANUAL



1 GENERAL WARNINGS

IMPORTANT

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 12100-1: 2005:

Safety of machinery: basic notions, general design principles.

Part 1-Basic terminology, method.

EN ISO 12100-2: 2005:

Safety of machinery: basic notions, general design principles.

Part 2-Technical principles and specification.

2006/42/EC: **Machine directive**

97/23/EC: **Directive for pressure PED equipment (until 18th July 2016) 2014/68/EU from 19th July 2016**

2006/95/EC: **Directive for low voltage equipment (until 19 April 2016) 2014/35/EU from 20 April 2016**

2004/108/EC: **Directive for the electromagnetic compatibility (until 19 April 2016) 2014/30/EU from 20 April 2016**

94/9/EC: **Directive and safety instructions for use in hazardous area (until 19 April 2016) 2014/34/EU from 20 April 2016**

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.

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NOTE

Biffi Italia S.r.l. pays the highest attention to collecting and verifying the documentation contained in this user manual. However Biffi Italia S.r.l. is not liable for any mistakes contained in this manual, for damage or accidents due to the use of the latter. The information contained is of exclusive reserved ownership of Biffi Italia S.r.l. and may be modified without prior notice.

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FIGURE 1
Data plate



1.2 IDENTIFICATION PLATE

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).

1.3 DESCRIPTION OF THE ACTUATOR

ALGAS low pressure pneumatic spring return actuators are suitable for the operation of quarter turn valves (ball valves, butterfly valves, plug valves) in both ON-OFF and modulating heavy-duty service.

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 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.

The expected lifetime of the actuator is approximately 25 years.

SELECTION GUIDE

Code:	ALGAS	XXX	K	-	YYYYY	-	ZZZZ	-	F	S	C
Actuator series											
Scotch yoke mechanism size											
Yoke shape											
C											
S											
Spring cartridge size											
Cylinder size											
Internal diameter in mm											
Spring action											
CL											
OP											
Service											
Blank											
QA											
Manual override											
Blank											
MHP											
MHW											
MRHW											

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 micro switches (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 micro switches (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 5A, 5B, 5C).

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 ACTUATOR ASSEMBLY ON 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 (SCN6200; SCN6200-1; SCN6201; SCN6201-1). 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 can not 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 SCN6200* and SCN6201*.

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FIGURE 4A
Actuator models 0.3 to 6

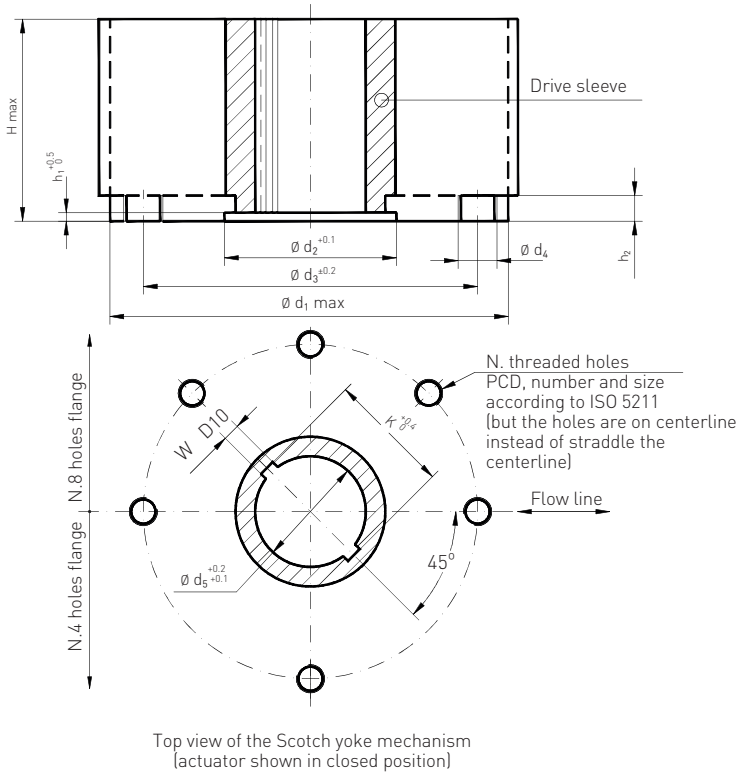
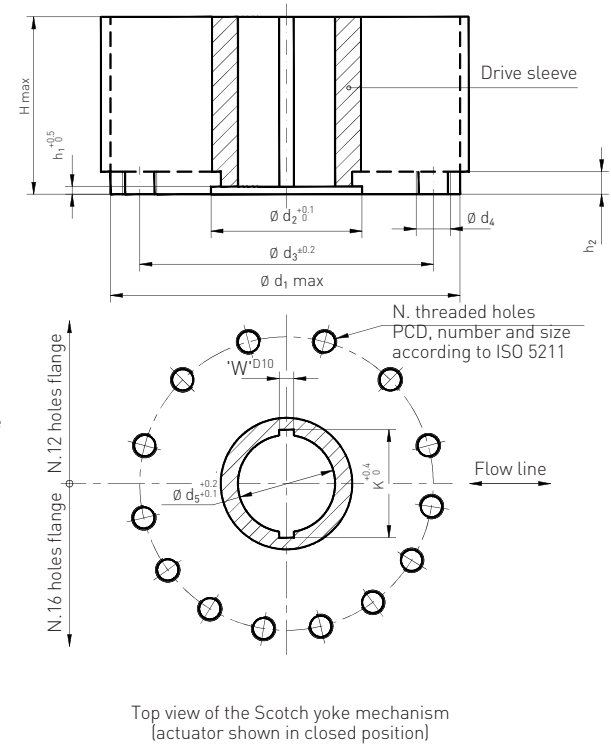


FIGURE 4B
Actuator models 14 to 42



COUPLING DIMENSIONS MODELS 0.3 TO 0.6 (mm)

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
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	96.6
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

COUPLING DIMENSIONS MODELS 14 TO 42 (mm)

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

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FIGURE 4C
Actuator models 50 and 60

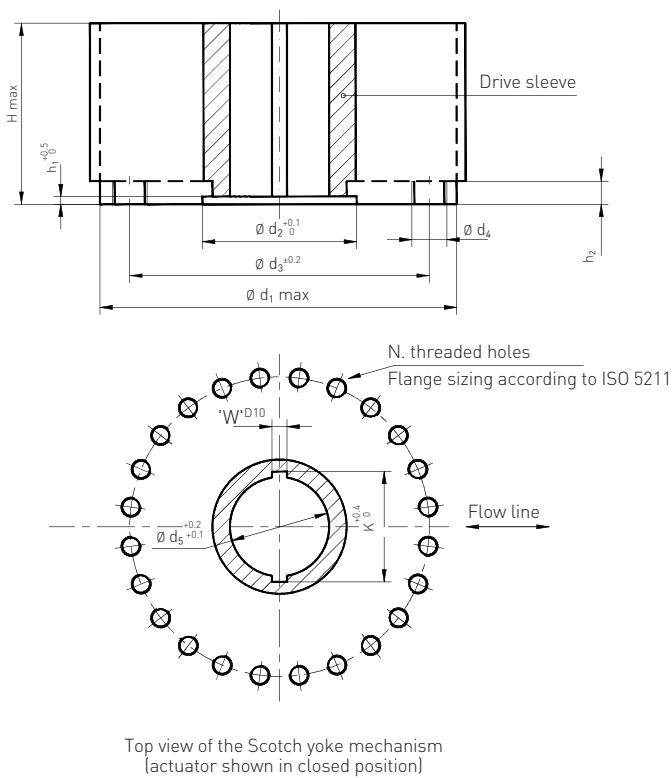
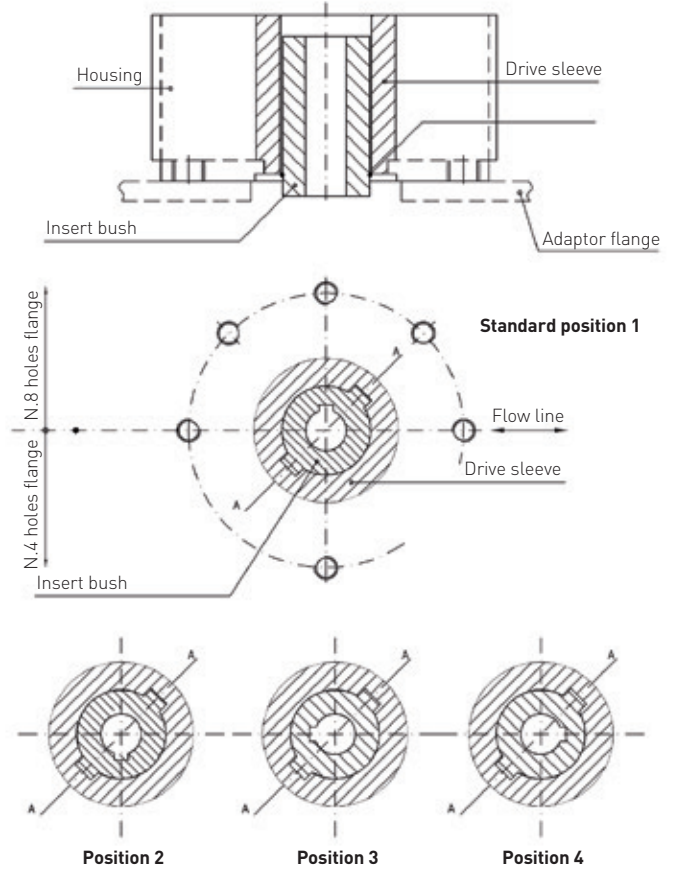


FIGURE 4D
Insert bush + intermediate coupling flange



COUPLING DIMENSIONS MODELS 50 AND 60 (mm)

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
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 un-machined bore in accordance with Biffi standard table SCN6202. 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 doc.: TN1005, enclosed. The particular execution of the flange and bushing allow the actuator to be rotated by 90° in 4 different positions according to figure 4D.

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.

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
Insert bush turned upside down		

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2.3.2 Valve stem with vertical axis

IMPORTANT

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.

Lift ALGAS actuators (pneumatic spring return) by means of the proper lifting points represented and indicated on actuator by sticking labels. Also refer to figure 5C for lifting points positions.

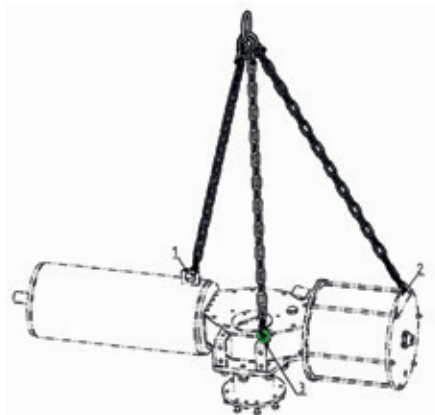
WARNING

DO NOT USE the lifting eyelets on actuator to lift valve + actuator assembly.

WARNING

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

FIGURE 5A



Lifting points for ALGAS actuators
1, 2 = Lifting points (obligatory)
3 = Balancing point

FIGURE 5B

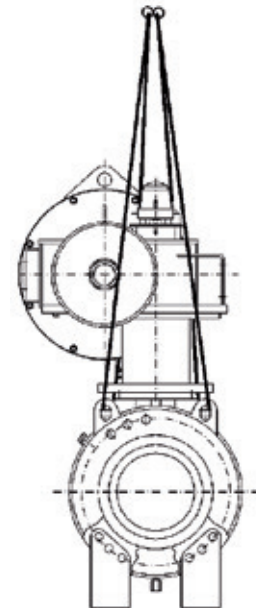
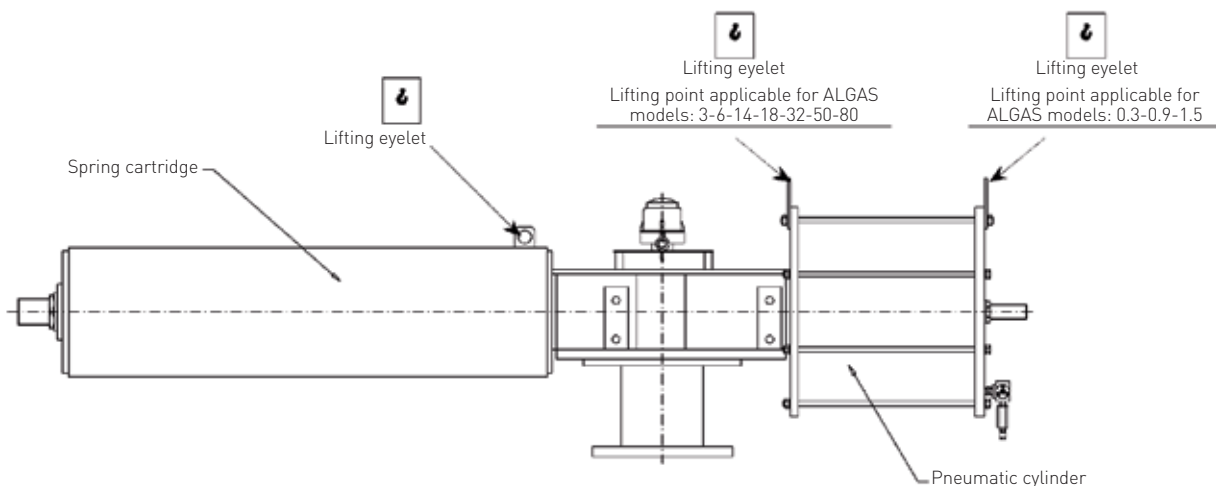


FIGURE 5C
Lifting points for ALGAS actuators



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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.

NUTS TIGHTENING TORQUE

Threading	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

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

FIGURE 6A

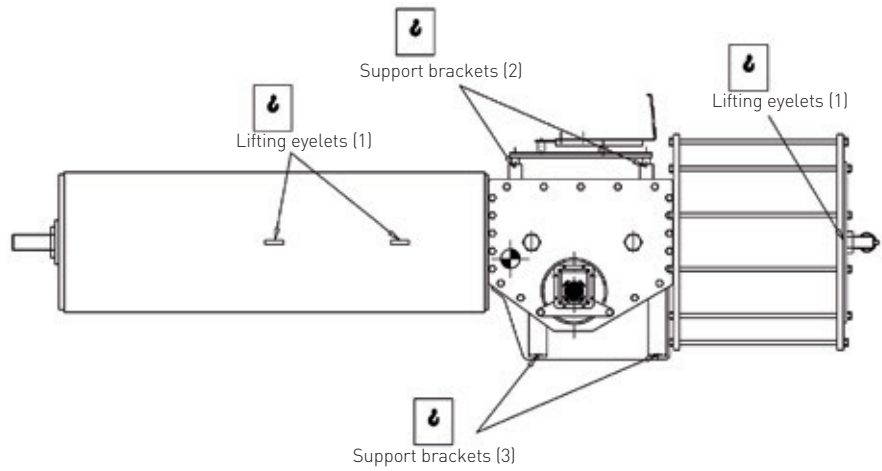


FIGURE 6B

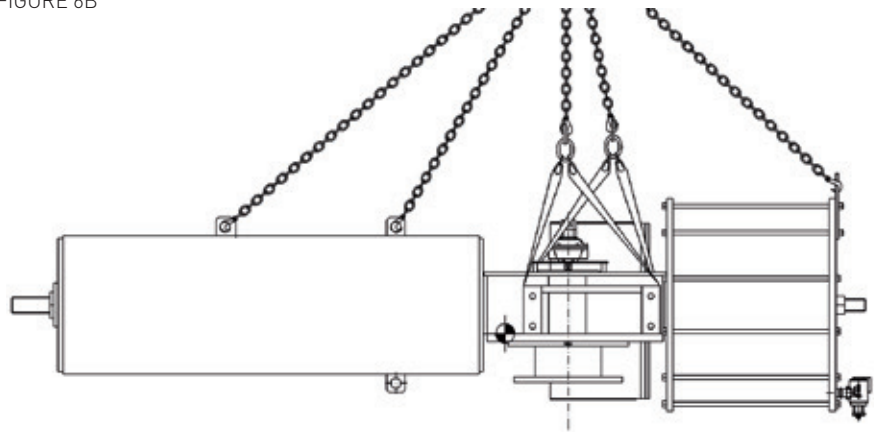


FIGURE 6C

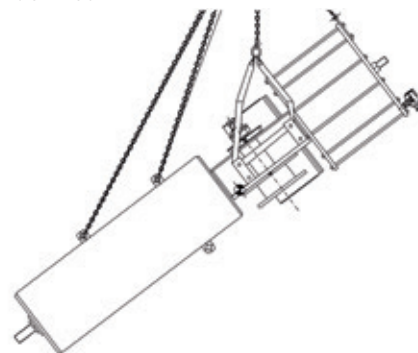


FIGURE 6D



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3 OPERATION AND USE

3.1 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.

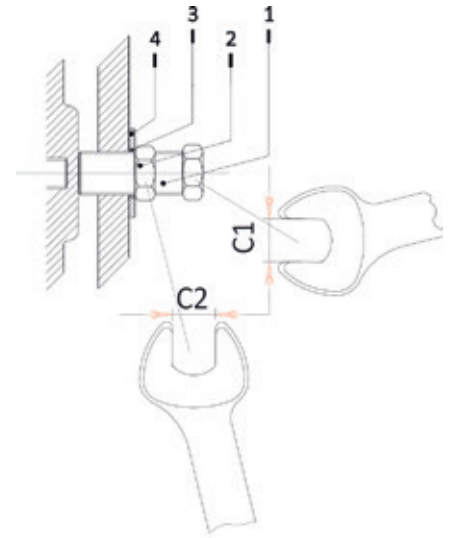
3.1.1 Travel stop screw screwed on the end flange of pneumatic cylinder

For the adjustment of the travel stop screws proceed as follows (see figures 7A, 7B):

1. Loosen the lock nut (2) with a proper wrench (c2).
2. If the actuator angular stroke is stopped before reaching the end position (fully open or closed), unscrew the stop screw (1) by turning it anticlockwise with a proper wrench (c1), until the valve reaches the right position. When unscrewing the stop screw, keep the lock nut still with a wrench so that the sealing washer (3) does not withdraw together with the screw.
3. If the actuator angular stroke is stopped beyond the end position (fully open or closed valve), screw the stop screw by turning it clockwise until the valve reaches the right position.
4. Tighten the lock nut (2).

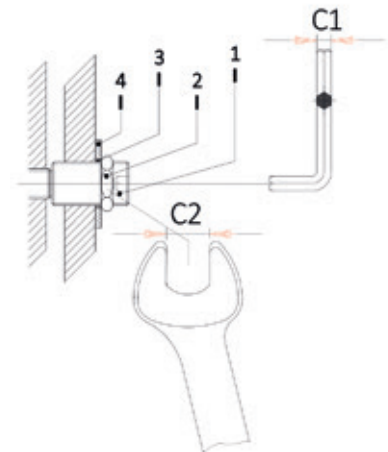
Pneumatic cylinder size	Wrench c1 (mm)	Wrench c2 (mm)
85	30	41
100	30	41
135	30	30
175	30	30
235	30	30

FIGURE 7A



Pneumatic cylinder size	Wrench c1 (mm)	Wrench c2 (mm)
280	17	55
335	17	55
385	17	55
435	17	55
485	17	55
535	17	55
585	17	55
635	17	55
735	17	55
785	17	55
835	17	55
885	17	55
935	17	55
1000	17	55
1100	17	55
1200	17	55
1300	17	80
1450	17	80

FIGURE 7B



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3.1.2 Stop screw screwed on the end flange of spring container

For the adjustment of the travel stop screw proceed as follows [see figures 8A-8D]:

1. Loosen the lock nut 'd'.
 2. If the actuator angular stroke is stopped before reaching the end position, unscrew the stop screw 'v' by turning it anticlockwise until the valve reaches the correct position.
 3. 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.
 4. 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.
 5. Tighten the lock nut, after having correctly placed the threaded seal washer 's' and 'w'.
- To operate the adjustments refer to the following tables.

FIGURE 8A, 8B
Spring cartridge model: from 006 to 150

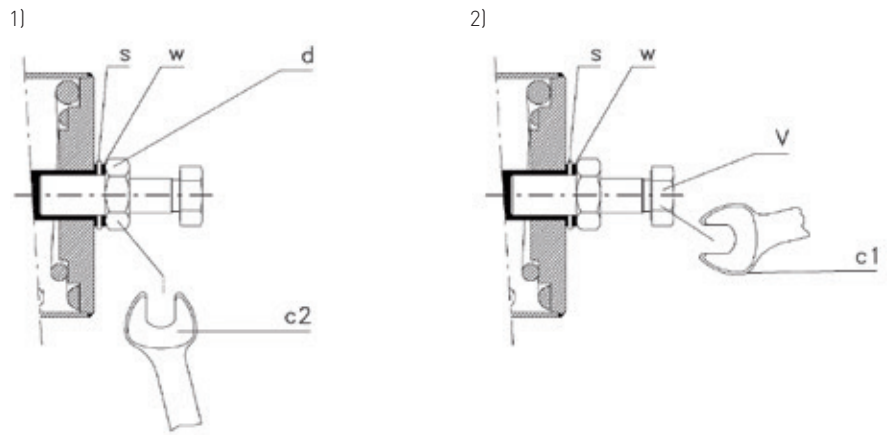
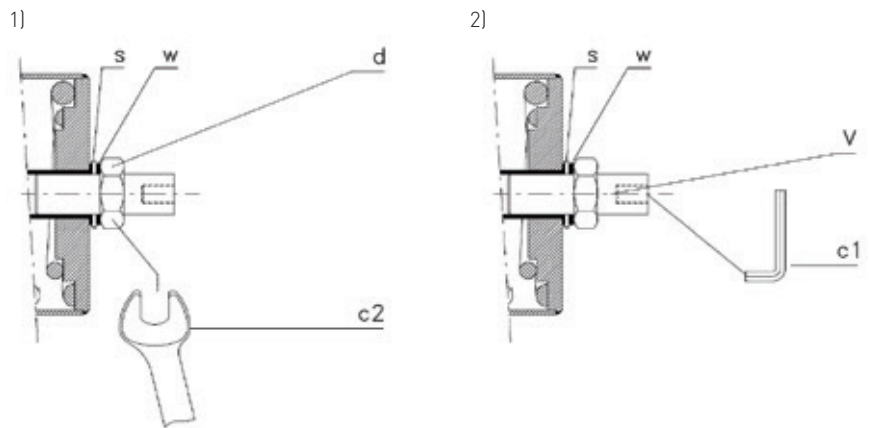


FIGURE 8C, 8D
Spring cartridge model: from 200 to 15600



Spring container size	Wrench c1 (mm)	Wrench c2 (mm)
006	46	41
008	46	41
009	46	41
100	46	41
150	46	41

Spring container size	Wrench c1 (mm)	Wrench c2 (mm)
200	17	60
350	17	60
400	17	60
700	17	60
1100	17	80
1200	17	80
2000	17	80
2500	17	100
3800	17	100
5100	17	100
5400	17	100
8300	17	100
9600	17	100
9800	17	100
11000	17	100
15000	17	130
15600	17	130

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3.2 CALIBRATION OF MICROSWITCHES (WITH SAFETY INSTRUCTIONS FOR LIMIT SWITCH BOX)

If the actuator is delivered separately from the valve, it is necessary to check, and, if required, to adjust, the settings of the position signalling microswitches.

IMPORTANT

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

WARNING

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

IMPORTANT

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.

WARNING

Do not open when energized or when an explosive atmosphere is present.

WARNING

Electrostatic hazard, clean only with damp cloth.

3.3 CALIBRATION OF THE OPERATING TIME (OPTIONAL - IF FORESEEN)

The calibration of the operating 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's possible to modify or reset the operating time through two flow regulation valves placed between the control valves enclosure and the pneumatic cylinder (figure 18).

To carry out the adjustment, use an adequate Allen wrench and follow these steps (figure 18):

- Loosen the locknut.
- Screw with a screwdriver the setting screw to increase the operating time.
- Unscrew with a screwdriver the setting screw to decrease the operating 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.

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3.4 PREPARATION FOR START-UP

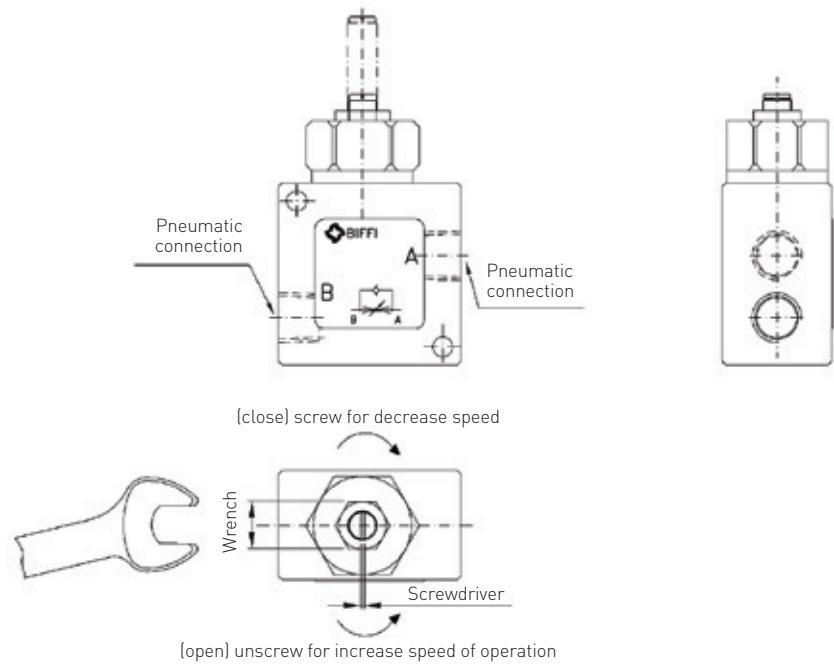
3.4.1 Pneumatic connections

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 operating times meet the plant requirements and that there are no leaks in the pneumatic connections.

3.4.2 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).

FIGURE 18
Example of operating time adjustment (if foreseen)



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.

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3.5 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, micro-switches, 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 not 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.

4 OPERATIONAL TESTS AND INSPECTIONS

IMPORTANT

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

For safety related applications, the following test operation has to be performed:

1. Full stroke of actuator once a year.
2. Partial stroking test at least every six months (if applicable, please refer to operating diagram and operate accordingly).
3. Visual inspection-checks, according to chapter 5, but with a frequency of once a year.

For standard applications please refer to chapter 5.

5 MAINTENANCE

IMPORTANT

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.

5.1 ROUTINE MAINTENANCE

ALGAS actuators are designed to operate long-term in heavy-duty operating conditions, without maintenance needs.

IMPORTANT

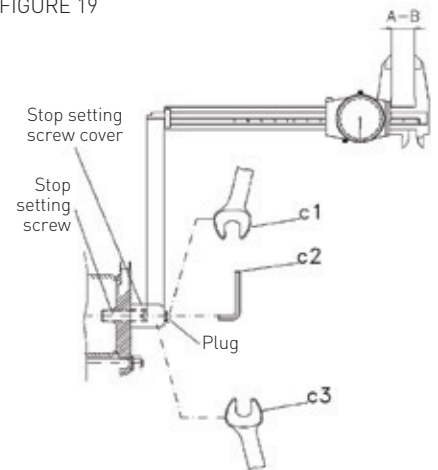
Periodicity and regularity of inspections is particularly influenced by specific environmental and working conditions.

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.

FIGURE 19



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5.2 EXTRAORDINARY MAINTENANCE

If there are leaks in the hydraulic cylinder, 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 these steps:

- Remove the plug (26) from the cover of the adjustment screw (20).
- Record the length between end flange and stop-setting screw, as in figure 19.
- Bring the adjustment screw back to the maximum (26) to let the spring loosen.

WARNING

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

5.2.1 Replacement of cylinder seals

Refer to the following 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 lock nut (25) and unscrew the stop screw (26) until it is removed from the end flange (22) together with the nut (25), the washer (51) and the sealing washer (50).
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 oil (SHELL OMALA S4 WE 320 or equivalent). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with protective oil film. Assemble the new O-ring into its groove and lubricate it with a protective oil 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 sealing washer (50) from the stop screw (26). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the sealing washer is.
5. Screw the new sealing onto the stop screw until it touches the nut (25).
6. Assemble the washer (51) onto the sealing washer.

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. Check that the sealing washer (50) and the washer (51) are in contact with the end flange (22) surface.
6. Tighten the lock nut (25).

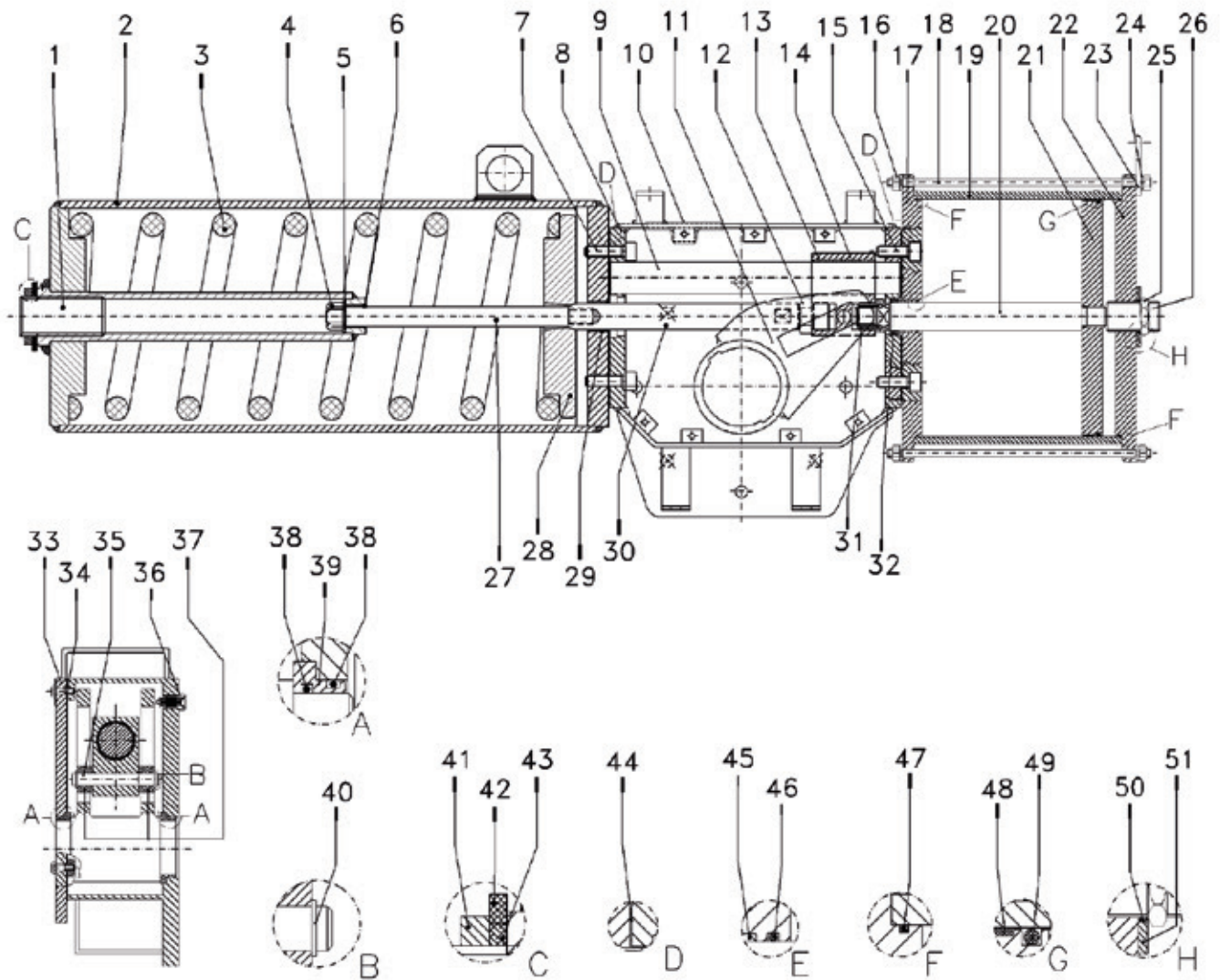
IMPORTANT

AFTER MAINTENANCE OPERATIONS CARRY OUT A FEW ACTUATOR OPERATIONS TO CHECK THAT ITS MOVEMENT IS REGULAR AND THAT THERE IS NO AIR LEAKAGE THROUGH THE SEALS.

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FIGURE 20
ALGAS spring return pneumatic actuator



Item	Description	Item	Description	Item	Description
1	Stop setting screw	19	Cylinder tube	37	Sliding block
2	Spring container	20	Piston rod	38	O-ring
3	Spring	21	Piston	39	Yoke bushing
4	Nut	22	End flange	40	Retainer ring
5	Shoulder washer	23	Lifting eyelet	41	Nut
6	Rod bushing	24	Spring washer	42	Washer
7	Screw	25	Nut	43	Sealing washer
8	Housing	26	Stop setting screw	44	Gasket
9	Guide bar	27	Guide rod	45	Piston rod bushing
10	Cover gasket	28	Spring thrust flange	46	O-ring
11	Yoke	29	Rod bushing	47	O-ring
12	Plug	30	Container rod	48	Guide sliding ring for piston
13	Bushing	31	Adaptor bush	49	O-ring
14	Guide block	32	Washer	50	Sealing washer
15	Screw	33	Cover	51	Washer
16	Nut	34	Screw		
17	Head flange	35	Guide block pin		
18	Tie rod	36	Vent valve		

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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. It's necessary to restore the grease into spring cartridge (for this operation remove the plug on end flange of spring cartridge and restore a generous coating of grease). The following grease is used by Biffi for standard working temperature and suggested for re-lubrication, see table:

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	Odour: Slight
Base oil viscosity at 40°C: 160 mm ² /s	Density: 966 kg/m ³ 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:	Product code: 001A0065
ESSO BEACON EP2	Infosafe No.: ACISO GB/eng/C
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	

5.4 DISMANTLING AND DEMOLITION

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

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 releasing. It moves actuator and consequently the valve, in hits 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 paragraph 3.3.2 and 3.3.3). If the actuator needs storage, before demolition, see paragraph 2.2.

IMPORTANT

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

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

5.5 SPRING CARTRIDGE REMOVAL

WARNING

Do not remove spring cartridge if the actuator is not in its fail safe position. 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. Disassembly works should be carried out by qualified staff.

Note: review paragraph 5.2 Extraordinary maintenance and paragraph 5.4 Dismantling and demolition before proceeding with Spring cartridge removal.

Referring to the general sectional drawing (see figure 20):

1. Remove the actuator from valve.
2. Unscrew and remove the stop setting screw (26) from the cylinder end flange (22).
3. Unscrew the screws (34) from cover plate (33).
4. Remove the cover plate (33) from actuator housing (8).
5. Unscrew and remove the screws (7) from spring cartridge assembly (2).

IMPORTANT

The spring cartridge shall be removed from actuator housing using proper lifting points and suitable lifting apparatus. Refer to paragraphs 2.3.2 and 2.3.3 for general instruction.

6. Slide off the spring cartridge assembly (2) from actuator housing.

5.6 SPRING CARTRIDGE DECOMMISSIONING

WARNING

NEVER OPEN THE SPRING CARTRIDGE ASSEMBLY

The spring cartridge contains compressed spring(s).

The spring(s) decommissioning shall be carried out only by Biffi staff.

Consult with Biffi maintenance service.

6 TROUBLESHOOTING

6.1 FAILURE OR BREAKDOWN RESEARCH

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 group	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
	Wrong calibration of flow regulator valves	Restore
	Bad functioning of quick exhaust valve	Call Biffi Italia S.r.l. Customer Service
	Wear of the valve	Replace
Actuator too fast	High supply pressure	Restore
	Bad functioning of booster/quick exhaust valve	Call Biffi Italia S.r.l. Customer Service
	Wrong calibration of flow regulator valves	Restore
Leakages on hydraulic or pneumatic circuits	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
	Wrong warning of microswitches	Restore
Hydraulic manual pump does not work	Leakages on the check valve of the hydraulic control group	Position the handle on the indication of the operation to make handle positioned on remote control Call Biffi Italia S.r.l. Customer Service

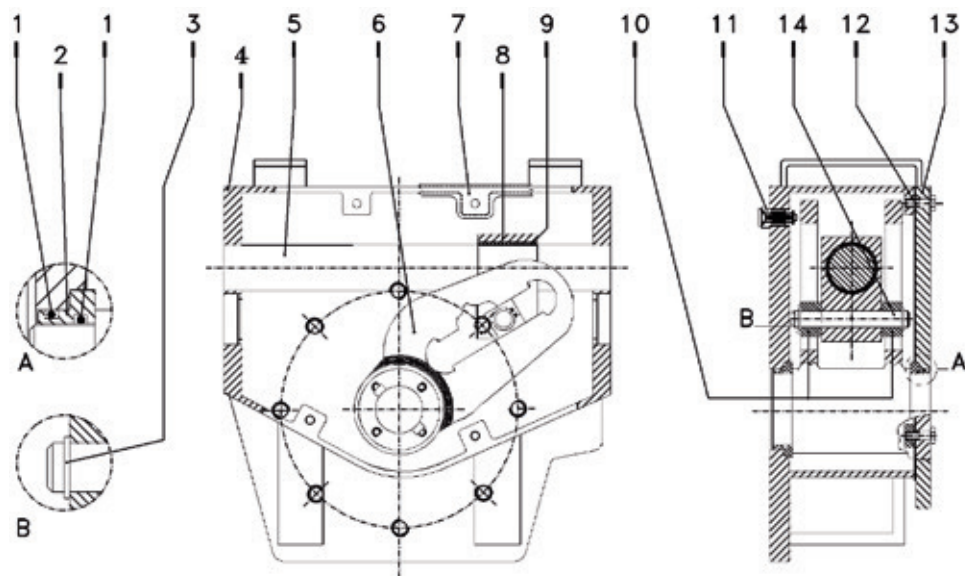
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7 LAYOUTS AND SECTIONAL DRAWINGS

7.1 PARTS LIST FOR MAINTENANCE AND REPLACING PROCEDURE

FIGURE 21
Scotch yoke mechanism



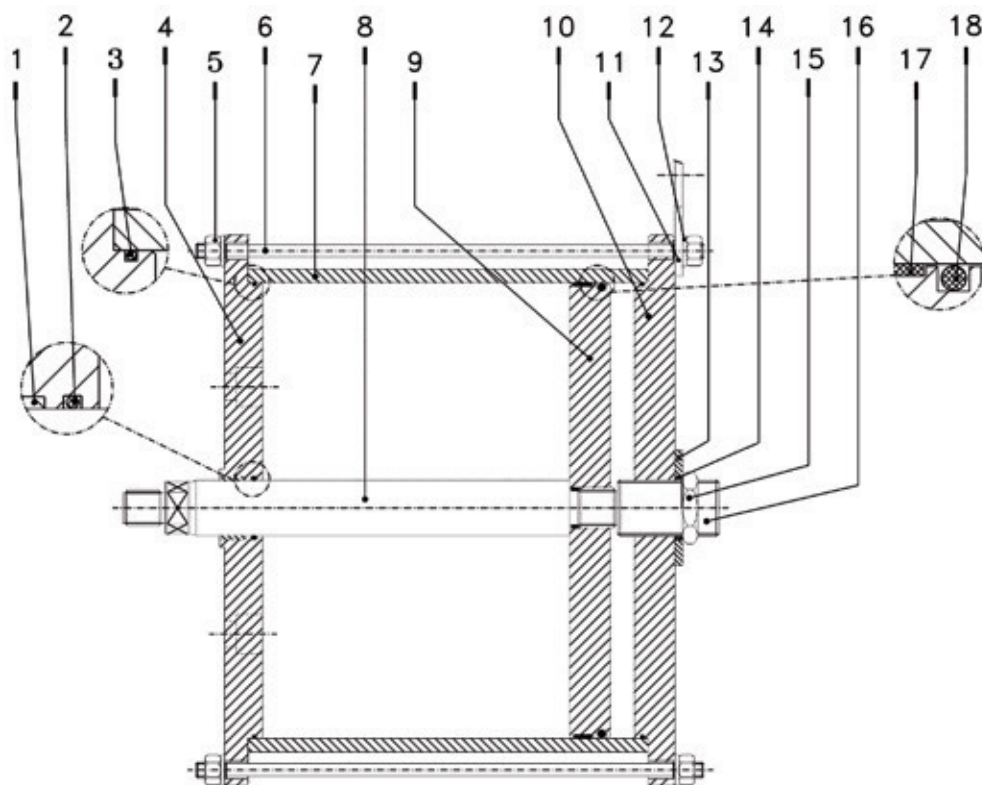
Item	Q.ty	Description	Material
1*	4	O-ring	NBR
2	2	Yoke bushing	Bronze
3	2	Retainer ring	Stainless steel
4	1	Housing	Carbon steel
5	1	Guide bar	Alloy steel
6	1	Yoke	Carbon steel
7*	1	Cover gasket	Fiber
8	1	Guide block	Carbon steel
9	1	Bushing	Steel + bronze + PTFE
10	2	Sliding block	Bronze
11*	1	Vent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

* Recommended spare parts

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FIGURE 22
Pneumatic cylinder



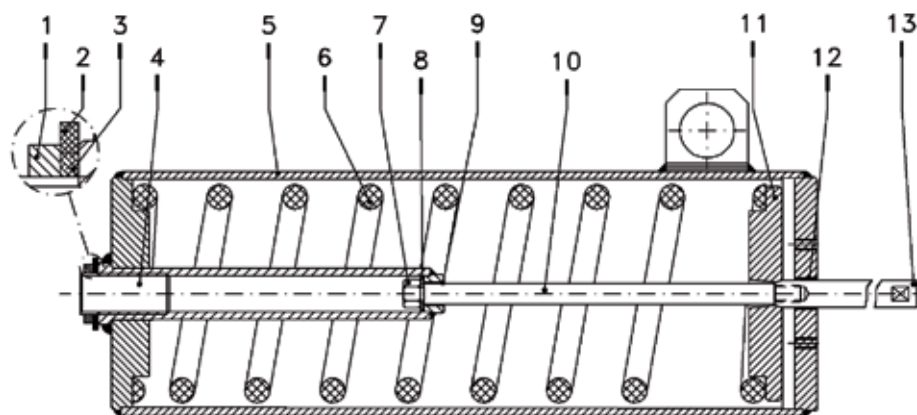
Item	Q.ty	Description	Material
1	1	Piston rod bushing	Steel + bronze + PTFE
2*	1	O-ring	NBR
3*	2	O-ring	NBR
4	1	Head flange	Carbon steel
5	12	Nut	Carbon steel
6	6	Tie rod	Alloy steel
7	1	Cylinder tube	Carbon steel
8	1	Piston rod	Alloy steel
9	1	Piston	Carbon steel
10	1	End flange	Carbon steel
11	1	Lifting eyelet	Carbon steel
12	2	Spring washer	Carbon steel
13	1	Washer	Carbon steel
14*	1	Sealing washer	PVC
15	1	Nut	Carbon steel
16	1	Stop setting screw	Carbon steel
17*	1	Guide sliding ring for piston	PTFE + graphite
18*	1	O-ring	NBR

* Recommended spare parts

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FIGURE 23
Spring cartridge



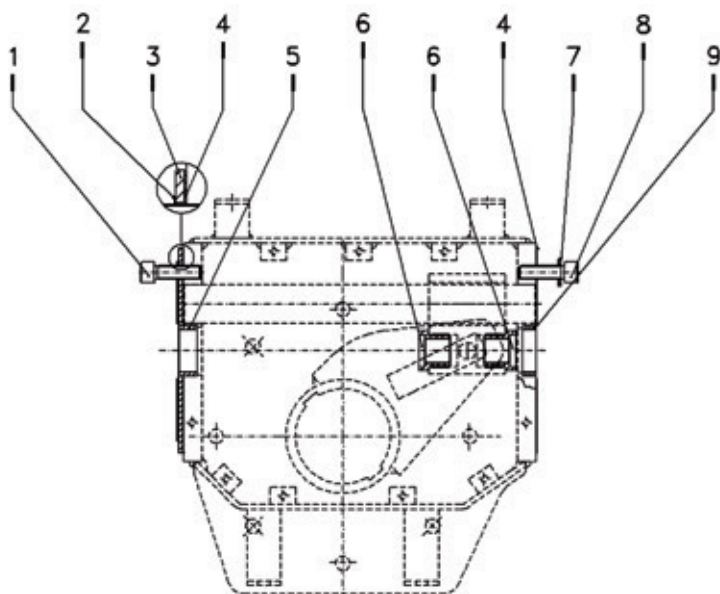
Item	Q.ty	Description	Material
1	1	Nut	Carbon steel
2	1	Washer	Carbon steel
3*	1	Sealing washer	PVC
4	1	Stop setting screw	Carbon steel
5	1	Spring container	Carbon steel
6	1	Spring	Carbon steel
7	1	Nut	Carbon steel
8	1	Shoulder washer	Alloy steel
9	1	Rod bushing	Steel + bronze + PTFE
10	1	Guide rod	Alloy steel (chromium plated)
11	1	Spring thrust flange	Carbon steel
12	1	Rod bushing	Steel + bronze + PTFE
13	1	Container rod	Alloy steel (chromium plated)

* Recommended spare parts

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FIGURE 24
Assembly kit



Item	Q.ty	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

* Recommended spare parts

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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 (par. 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: spareservice@biffi.it

Please specify:
1. Actuator model
2. Biffi acknowledgement
3. Spare parts code
4. Quantity
5. Transport condition
6. Involved people

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).....



Biffi reserves the the right to change product designs and specifications without notice.

Biffi Italia S.r.L.

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