Installation, Operation and Maintenance Manual
FCIM-20197-EN Rev. 0
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Biffi ALGAS

Version: Base, QA and with Manual Operator Actuators

BIFFI

Revision Details

Revision	Date	Manual	Description	Prepared	Checked	Approved
0	December 2024	Biffi ALGAS	General update (Migration to new template)	Lecini	Franco	Toscani
Last revision	Various Data	ALGAS MAN 604A REV. 5	Starting point manuals	Ermanni	Orefici	Vigliano
		ALGAS MAN 604C REV. 3		N/A	N/A	N/A
		ALGAS MAN 604A_EAC REV. 5		Ermanni	Orefici	Vigliano
		ALGAS MHP MAN 689 REV. 7		N/A	N/A	N/A
		ALGAS MHW-MRHW MAN MAN 604-1A REV. 7		N/A	N/A	N/A
		ALGAS MHW-MRHW MAN MAN 604-1C REV. 1		Ermanni	Orefici	Vigliano
		ALGAS MHW-MRHW MAN MAN 604-1A_EAC REV. 5		Ermanni	Orefici	Vigliano
		ALGAS-QA MAN 616 REV. 6		Ermanni	Orefici	Vigliano
		ALGAS-QA MAN 616C REV. 2		Ermanni	Orefici	Vigliano
		ALGAS-QA MAN 616_EAC REV. 6		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 (IOM) 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:	Safety of machinery – General principles for design – Risk assessment and risk reduction
2006/42/EC:	Machine directive
2014/68/EU:	Directive for pressure equipment (PED)
2014/35/EU:	Directive for low voltage equipment
2014/30/EU:	Directive for the electromagnetic compatibility
2014/34/EU:	Directive and safety instructions for use in hazardous area

For EAC:

TR TS 004/2011:	Customs Union Technical Regulation (For safety of low voltage equipment)
TR TS 010/2011:	Customs Union Technical Regulation (For safety of low voltage equipment)
TR TS 012/2011:	Customs Union Technical Regulation (For safety of equipment operated in explosive atmosphere)
TR TS 020/2011:	Customs Union Technical Regulation (Electromagnetic Compatibility of Technical Products)
TR TS 032/2013:	Customs Union Technical Regulation (For safety of Excess Pressure Equipment)

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 this manual. The warranty can last either one year from the date of installation by the initial user of the product, or eighteen (18) 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 if 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 Personal Protective Equipment (PPE) to avoid any possible acoustic discomfort.

Figure 1. Ear PPE

1.2 Identification Plate (Nameplate)

⚠ 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 (Figures 2 and 3).

Figure 2. Nameplate Base (Sample)

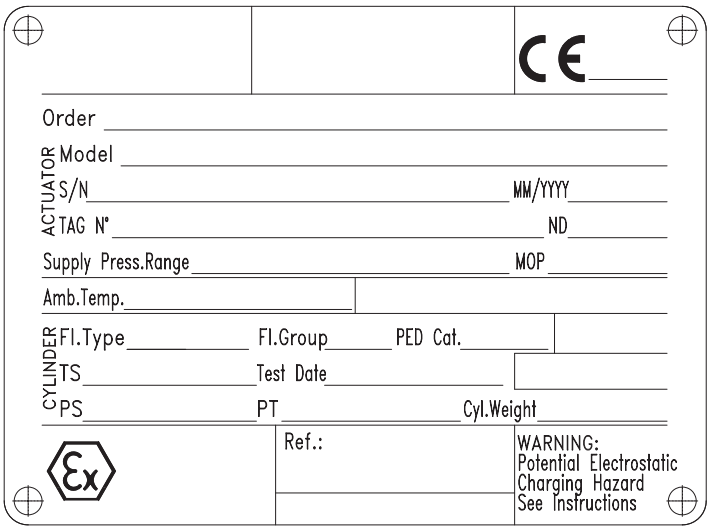
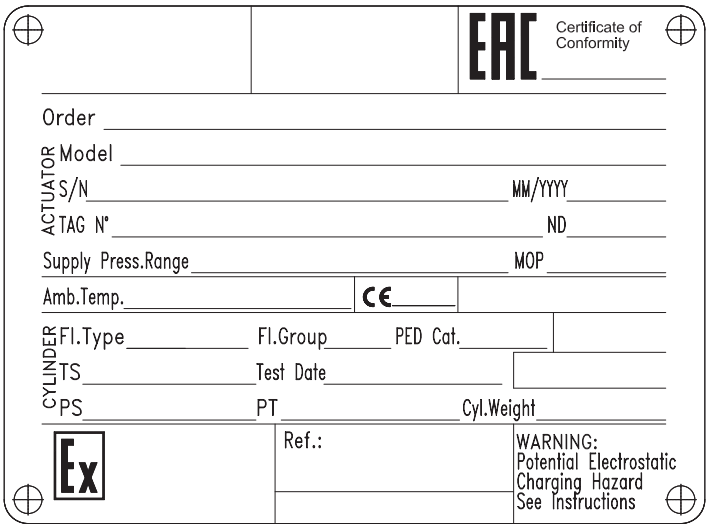


Figure 3. Nameplate for EAC Version (Sample)



1.3 Description of the Actuator

ALGAS low pressure pneumatic spring-return 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 into open or from to open into 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 care), according to the shape and dimensions of the valve stem.

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

In addition for ALGAS MHP:

The MHP hydraulic manual override is used to manually operate the actuator in case there is a lack of air supply. The MHP unit consists of a hydraulic cylinder mounted at the end flange of the pneumatic cylinder.

The hydraulic control unit consists of:

- Hand pump
- Hydraulic check valve
- Oil tank
- Relief valve
- Stop valve

Table 1. Selection Guide

Code	ALGAS	XXX	K	-	YYYYY	-	ZZZZ	-	F	S	C
Actuator series											
Scotch yoke mechanism size											
Yoke shape											
C Canted											
S Symmetric											
Spring cartridge size											
Cylinder size											
Internal diameter in mm											
Spring action											
CL Closing											
OP Opening											
Service											
Blank Standard											
QA Quick-acting											
Manual override											
Blank No manual override											
MHP Manual hand pump											
MHW Manual handwheel											
MRHW Manual reduced handwheel											

The expected lifetime of an actuator is approximately 25 years.

Section 2: Installation

2.1 Checks to Be Carried Out Upon 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) have 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

⚠ WARNING

The actuators should remain in their cases until required for installation.

⚠ CAUTION

Pay attention to use the proper tool to open the case and the tool inside.

For handling and lifting procedure, please refer to Figures 12, 13 and 14.

⚠ WARNING

The actuator mounting bracket is to support the actuator only. Under no circumstances should the valve be suspended from the actuator.

⚠ CAUTION

Before testing or cycling be sure to remove all the appropriate port plugs. Storage time is counted as part of the service interval.

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. Make sure that all seals are not exposed to very high or very low temperatures and gas for a prolonged period of time.
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. In cases where actuators are not be cycled during extended dormant conditions, slight seal leakage may occur during start-up. If this occurs, multiple cycling will flex the seals and significantly improve the seal function. If leakage persists, installation of new seals may be required.
3. In case of long-term storage (>1 year), 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 or nitrogen with 99% purity; 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

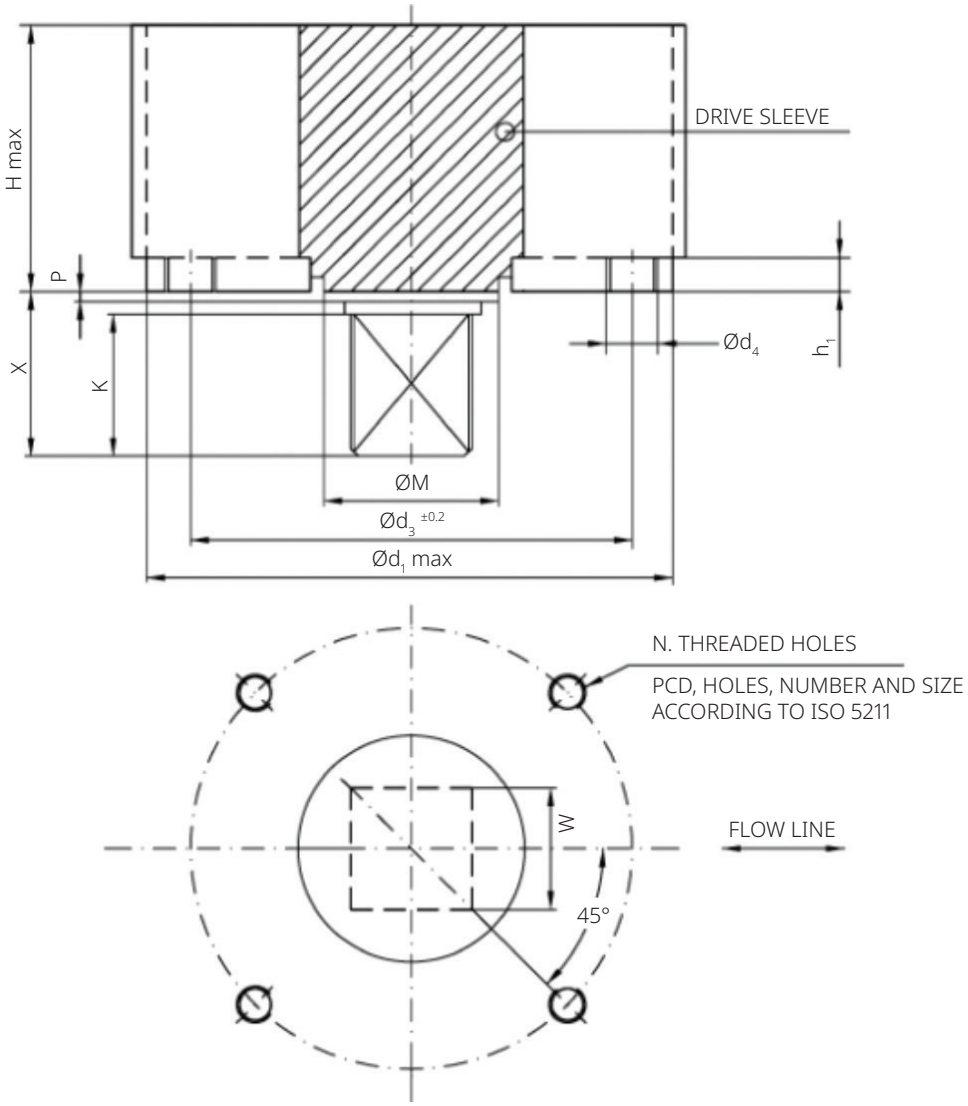
2.3.1 Types of Assembly

2.3.1.1 Coupling

For coupling to the valve, the housing is provided with a flange with threaded holes according to Biffi base tables (SCN6200; SCN6200-1; SCN6201; SCN6201-1; SCN6201-3; SCN6201-5). 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 “base” configuration. For the biggest actuator models, the actuator flange can be machined in accordance with the valve flange dimensions.

The yoke is bored with keyways for coupling to the valve stem, the dimensions of which are according to Biffi base tables SCN2600 and SCN2601 (Tables 2 to 8).

Figure 4. Coupling Dimensions - Actuator Model 0.1 (SCN6200-1 - Rev. 15/10/19)



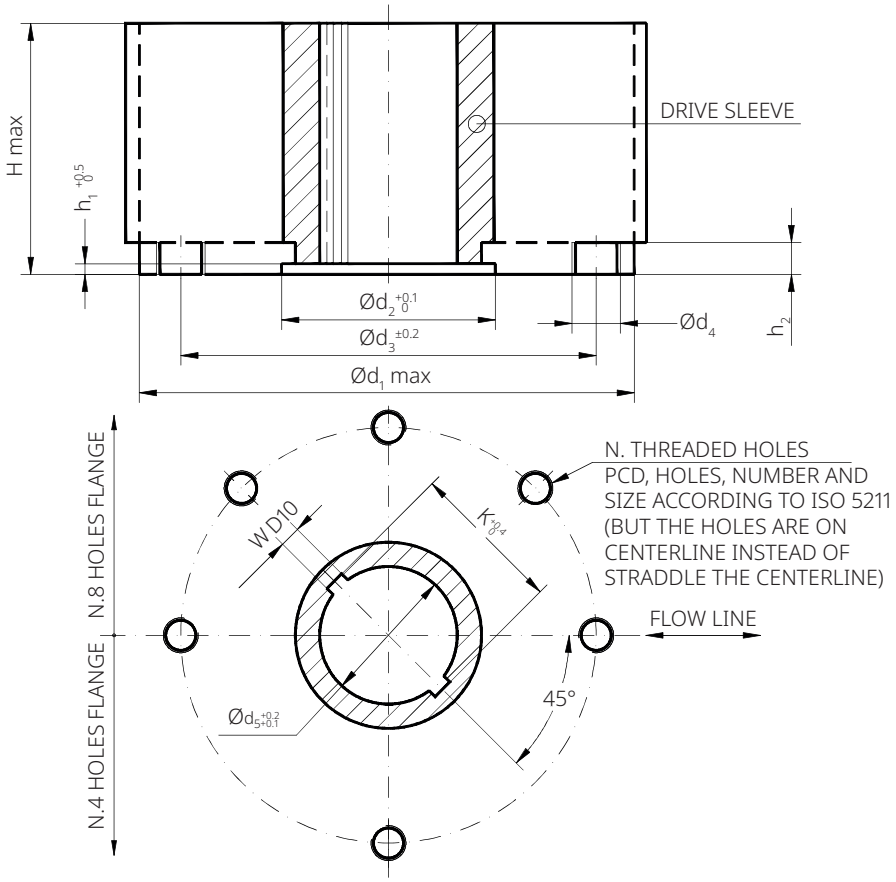
TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 2. SCN6200-1 - Rev. 15/10/19

Actuator Model	$Ød_1$	$Ød_3$	$Ød_4$	ØM	N	P	h_1	H max	W	K	X
0.1	220	102	M10	50	4	7	17	121	22	25	32

NOTE:
All dimensions are in millimeters.

Figure 5. Coupling Dimensions - Actuator Models 0.3 to 6 (SCN6200E - Rev. 15/10/19)



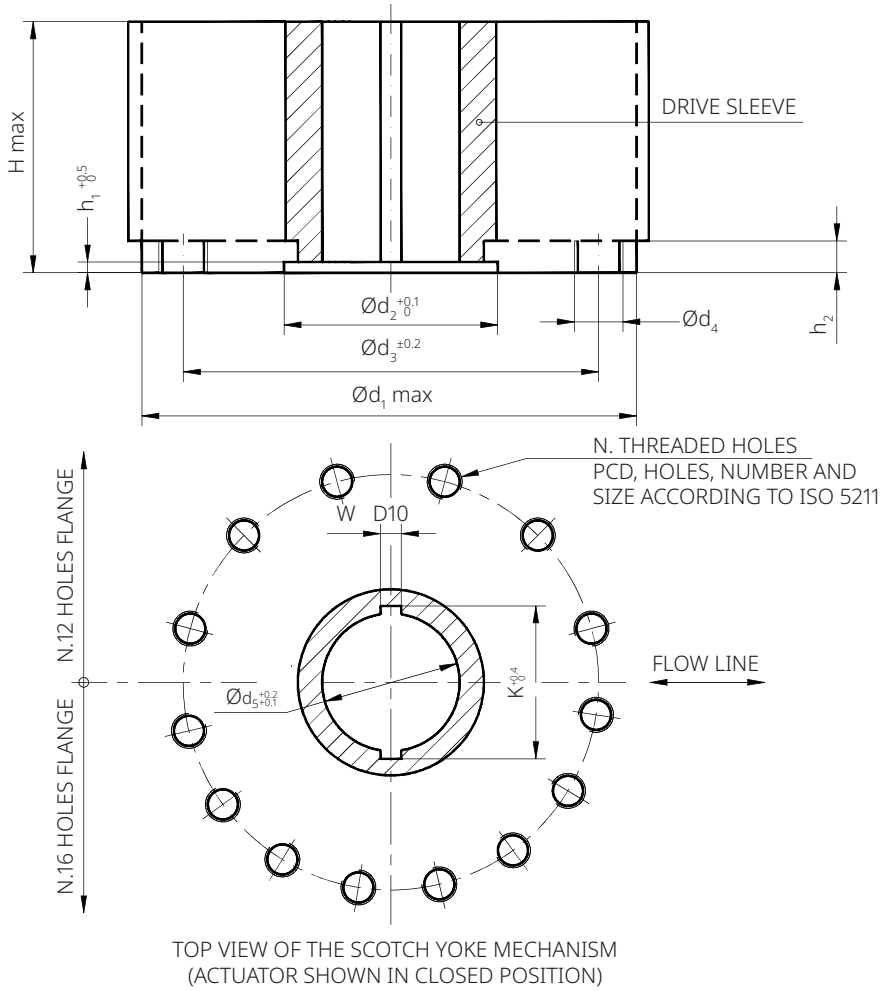
TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 3. SCN6200E - Rev. 15/10/19

Actuator Model	$Ød_1$	$Ød_2$	$Ød_3$	$Ød_4$	N	h_1	h_2	H max	$Ød_5$	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

NOTE:
All dimensions are in millimeters.

Figure 6. Coupling Dimensions - Actuator Model 14 (SCN6201E - Rev. 16/06/20)



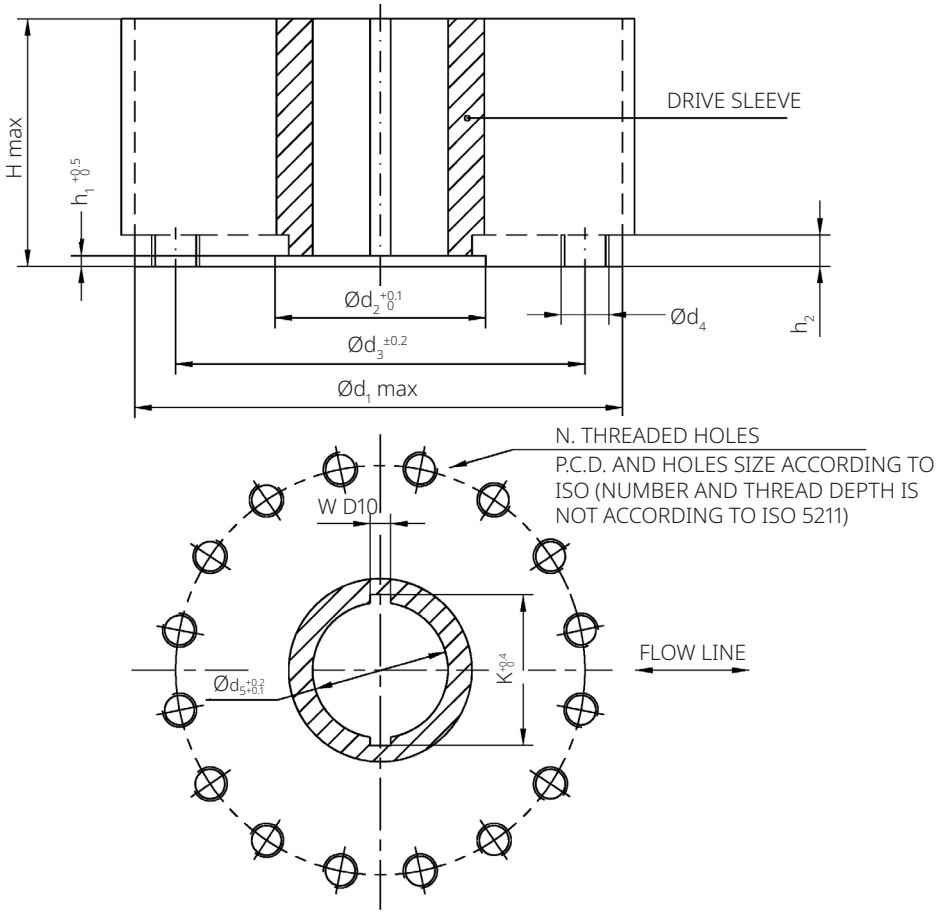
TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 4. SCN6201E - Rev. 16/06/20

Actuator Model	$Ød_1$	$Ød_2$	$Ød_3$	$Ød_4$	N	h_1	h_2	H max	$Ød_5$	W	K
14	580	250	483	M36	12	10	29	340	170	45	195.8

NOTE:
All dimensions are in millimeters.

Figure 7. Coupling Dimensions - Actuator Models 18 and 32 (SCN6201E - Rev. 16/06/20)



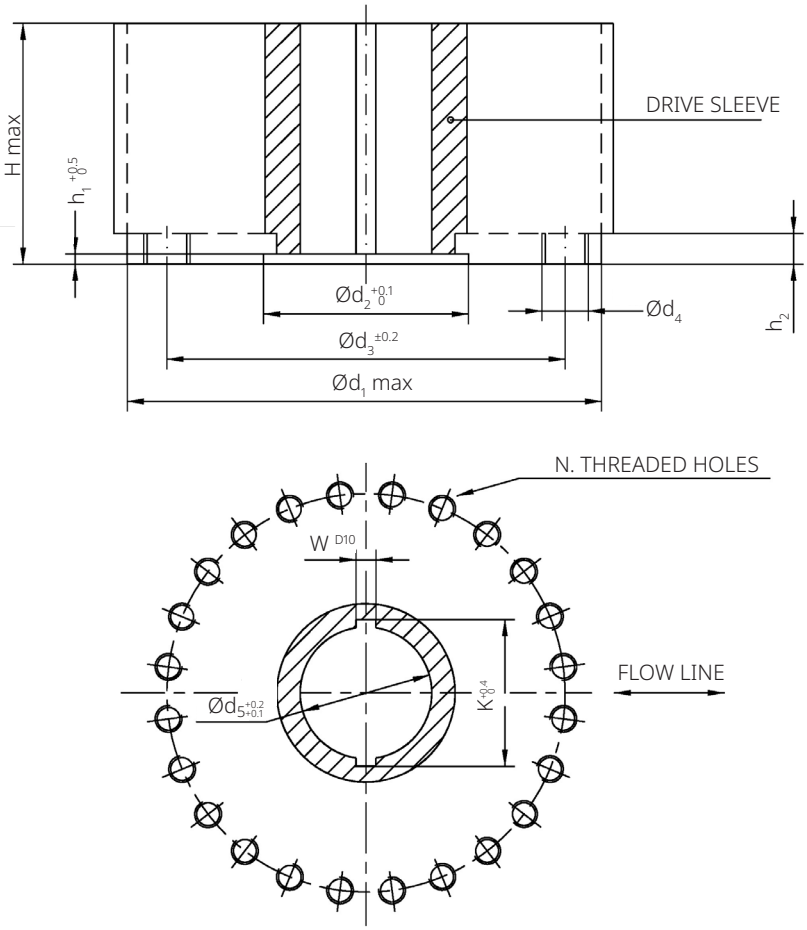
TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 5. SCN6201E - Rev. 16/06/20

Actuator Model	$Ød_1$	$Ød_2$	$Ød_3$	$Ød_4$	N	h_1	h_2	H max	$Ød_5$	W	K
18	680	290	603	M36	16	12	32	350	200	45	220.8
32	780	310	603	M36	16	12	32	400	220	50	242.8

NOTE:
All dimensions are in millimeters.

Figure 8. Coupling Dimensions - Actuator Model 50 (SCN62011 - Rev. 15/10/19)



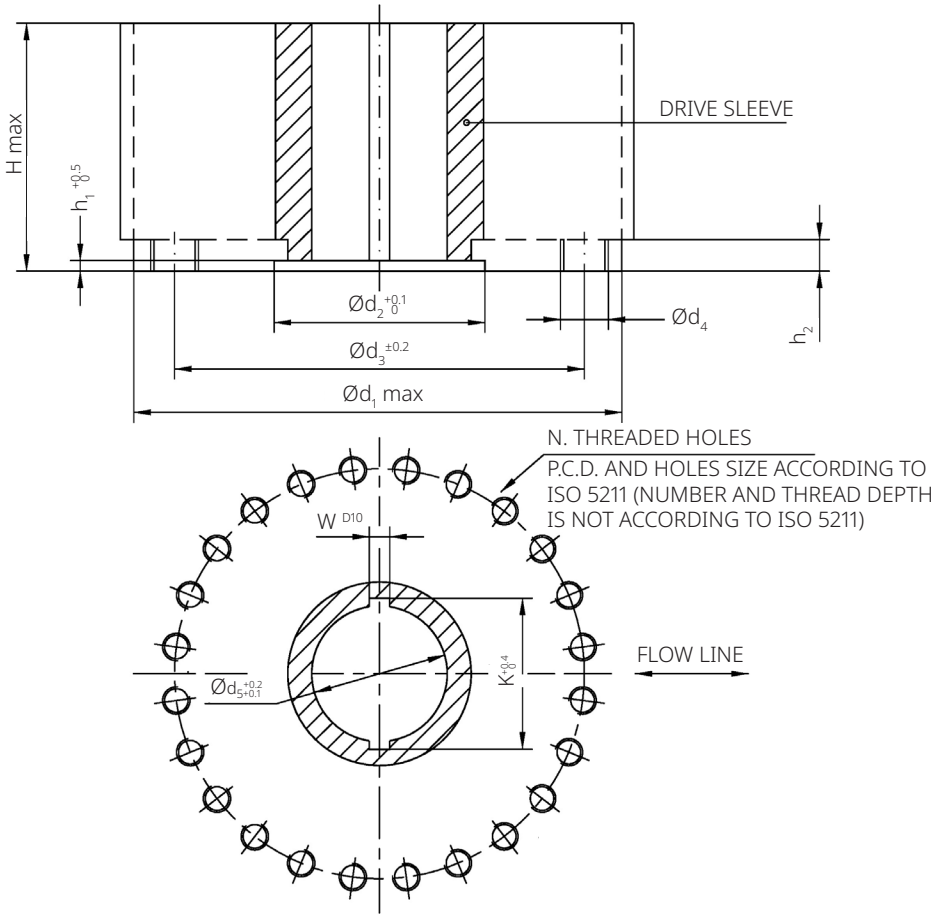
TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 6. SCN62011 - Rev. 15/10/19

Actuator Model	$Ød_1$	$Ød_2$	$Ød_3$	$Ød_4$	N	h_1	h_2	H max	$Ød_5$	W	K
50	800	315	698	M36	24	10	32	430	240	56	264.8

NOTE:
All dimensions are in millimeters.

Figure 9. Coupling Dimensions - Actuator Models 65 and 80 (SCN62013 - Rev. 19/06/20)



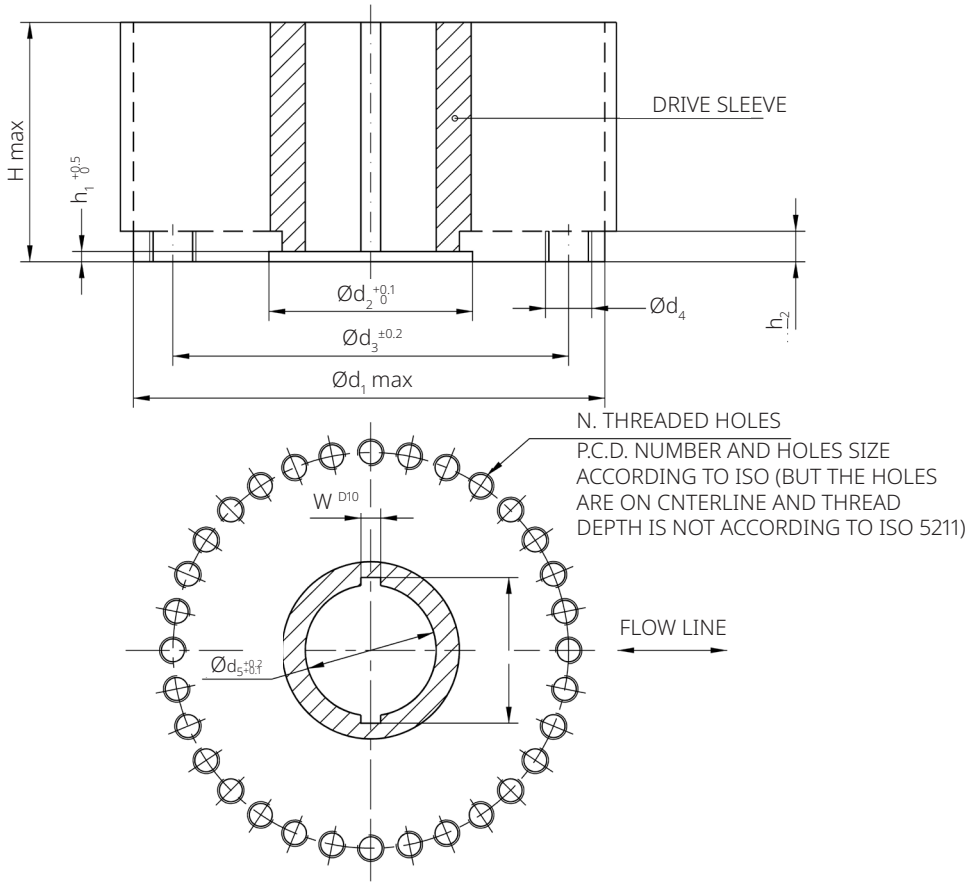
TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 7. SCN62013 - Rev. 19/06/20

Actuator Model	Ød$_1$	Ød$_2$	Ød$_3$	Ød$_4$	N	h$_1$	h$_2$	H max	Ød$_5$	W	K
65	910	370	813	M42	24	12	37	540	280	46	327.4
80	900	970	813	M42	24	12	37	540	280	46	327.4

NOTE:
All dimensions are in millimeters.

Figure 10. Coupling Dimensions - Actuator Model 100 (SCN62015 - Rev. 22/07/22)



TOP VIEW OF THE SCOTCH YOKE MECHANISM
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 8. SCN62015 - Rev. 22/07/22

Actuator Model	Ød$_1$	Ød$_2$	Ød$_3$	Ød$_4$	N	h_1	h_2	H max	Ød$_5$	W	K
100	1200	450	1042	M42	32	8	57	600	300	70	328.8

NOTE:
All dimensions are in millimeters.

2.3.1.2 Coupling with Insert Bush

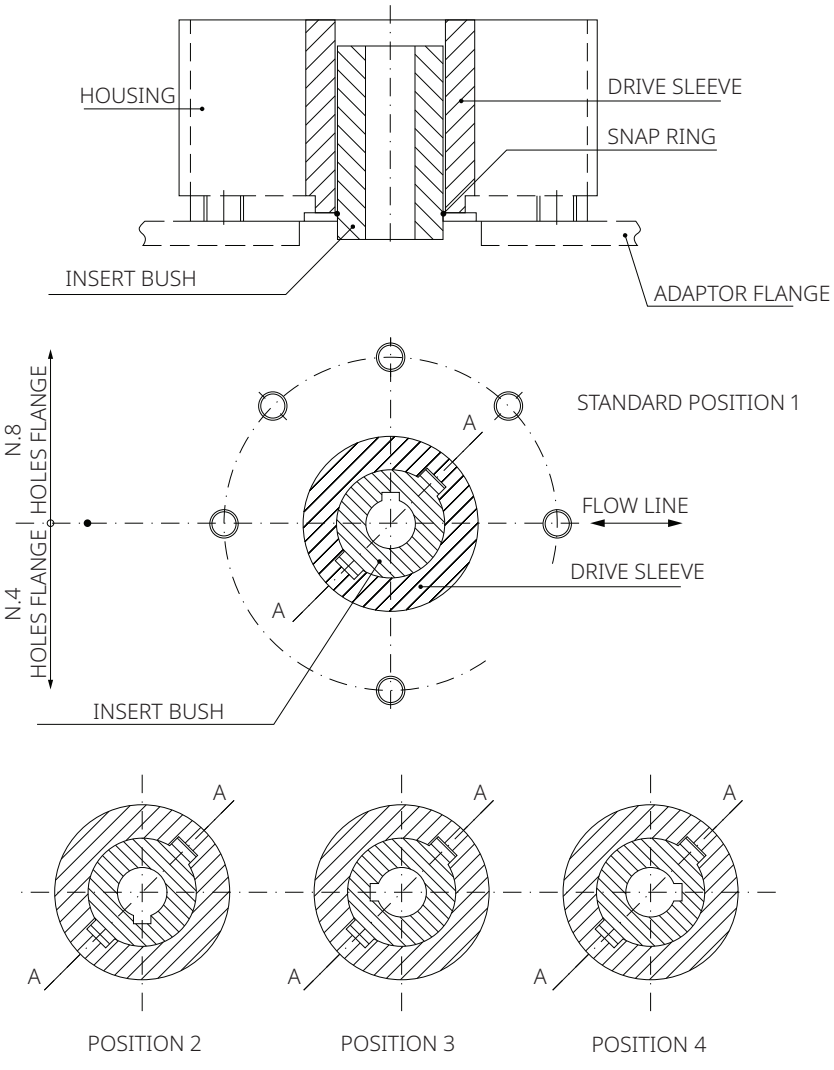
If required, for the base models size 0.3 to 6, Biffi can supply an insert bush with unmachined bore in accordance with Biffi base table SCN6202. On request, the insert bush bore can be machined by Biffi to couple the valve stem, provided its dimensions match the maximum stem acceptance of the bush according to Biffi table TN1005 (ask factory or refer to TDS), and refer to Figure 11. The particular execution of the flange and bushing allow the actuator to be rotated by 90° in 4 different positions according to Figure 11:

Table 9. Insert Bush Setting

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	

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

Figure 11. Insert Bush + Intermediate Coupling Flange



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 hanging the lifted actuator above any personnel.

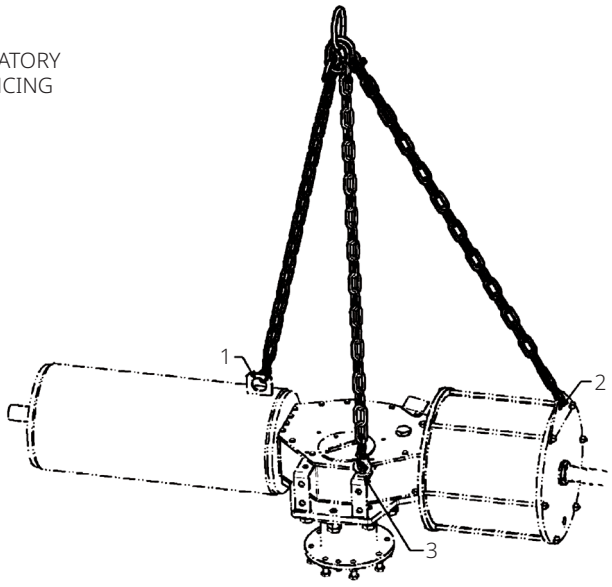
⚠ WARNING

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 12. Example of Hook with Safety Latch

Figure 13. Lifting Points Location

LIFTING POINTS:
1 AND 2 = MANDATORY
3 = BALANCING



Lift ALGAS actuators (pneumatic spring-return) by means of the proper lifting points represented and indicated on actuator by sticking labels. Refer to the figures in this section to understand the lifting points position of the actuator model.

- **For lifting unbalanced loads, use ropes of different lengths or chains with adjustable length.**
- **Always check the condition 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 the lifted actuator unless absolutely necessary; do not stand or pass under suspended loads.**
- **Pay attention when putting the ropes under tension to prevent the load from shifting sideways in an uncontrolled manner.**
- **Use slings of such length that the angles of the leg from vertical are as narrow as possible (αMAX < 20°).**
- **During handling, do not transport the suspended actuator above staff members in charge of the operation.**

⚠ WARNING

Do not use the lifting eyelets on the actuator to lift the 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 personnel coming from incorrect 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 the 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 Grade L7 steel; the nuts must be made of ASTM A194 Grade 2 steel. See Table 10.
11. If possible, operate the actuator to check that it moves the valve smoothly.

Figure 14. Lifting Points Warnings

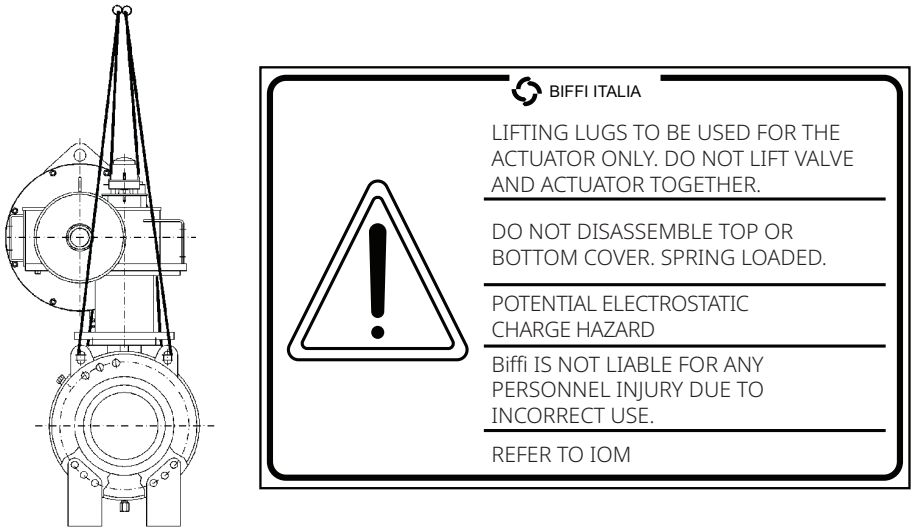


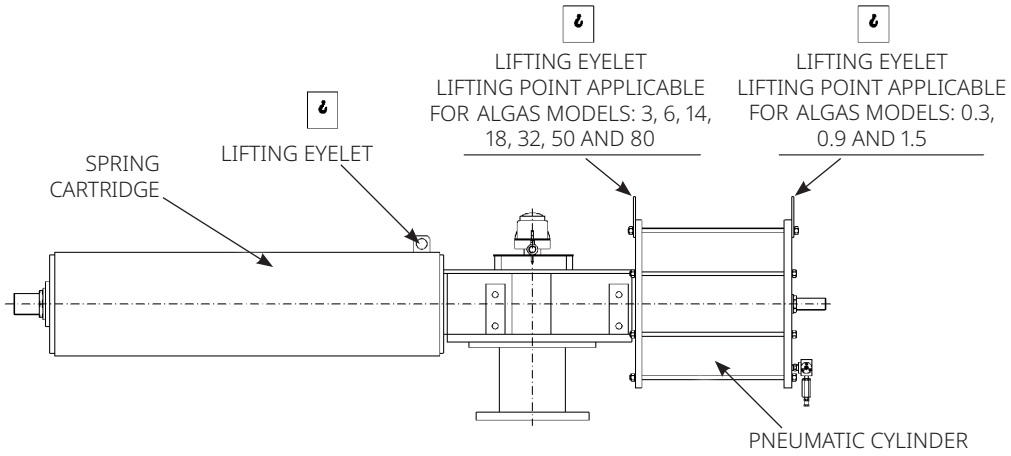
Table 10. Bolts Recommended Torque

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

Refer to the figures below to understand the lifting points position of the actuator model.

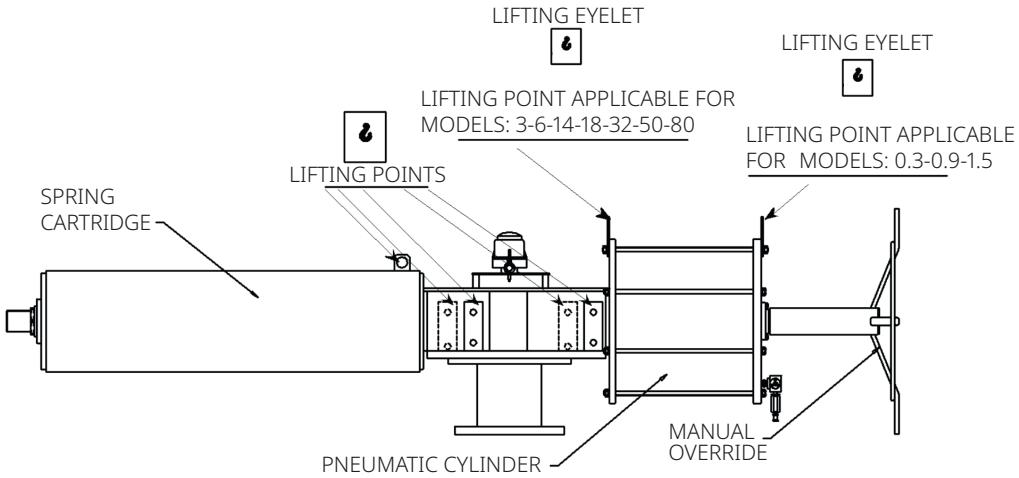
1. Lifting points for ALGAS and ALGAS-QA with or without stop setting screw.

Figure 15. Lifting Eyelet Locations



2. Lifting points for ALGAS-MHW with or without stop setting screw.

Figure 16. Lifting Eyelet Locations



3. Lifting points for ALGAS MHP.

Figure 17. Lifting Eyelet Locations

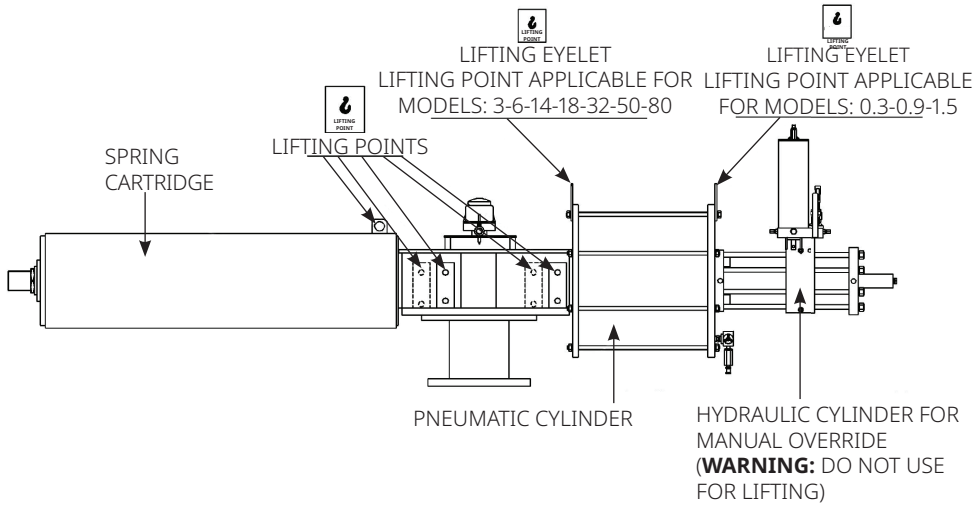
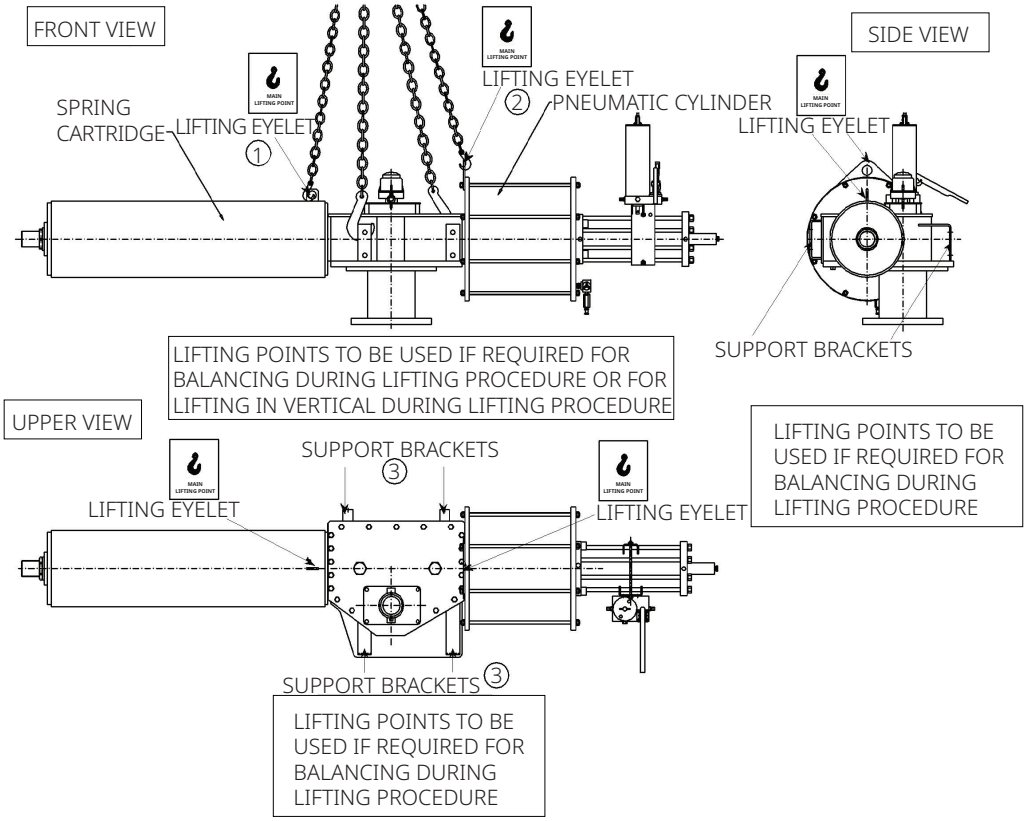


Figure 18. Lifting Points: 1-2 (Obligatory), 3 (Balancing)

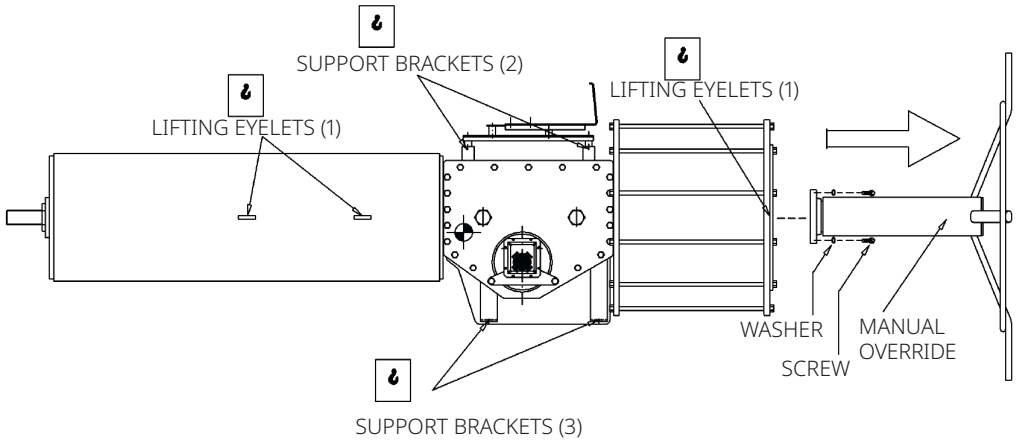


2.3.3 Valve Stem with Horizontal Axis

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. Refer to Figure 19 to understand the lifting point position of the actuator model that the user own:

1. If the user have ALGAS MHW or MRHW, remove the manual override (unscrewing the 4 fixing screws with its washers) to make the lifting operations easier.

Figure 19. ALGAS MHW/MRHW



2. Properly connect the actuator lifting points 1 with chains, and connect by suitable slings the support brackets 2 and 3 (see Figures 20 and 21).
3. Balance the weight and lift the actuator until it is possible to rotate the actuator to its final mounting position, with the cylinder on top or the spring container placed on the bottom, as shown in Figures 20 and 21.
4. Clean the actuator flange and remove anything that might prevent a perfect adherence to the valve flange and especially all traces of grease.
5. 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.
6. 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 Grade L7 steel; the nuts must be made of ASTM A194 grade 2 steel.
7. For ALGAS MHW or MRHW, reassemble the manual override with 4 fixing screws and washers.
8. If possible, operate the actuator to check that it moves the valve smoothly.

Figure 20. For All Types of Actuator

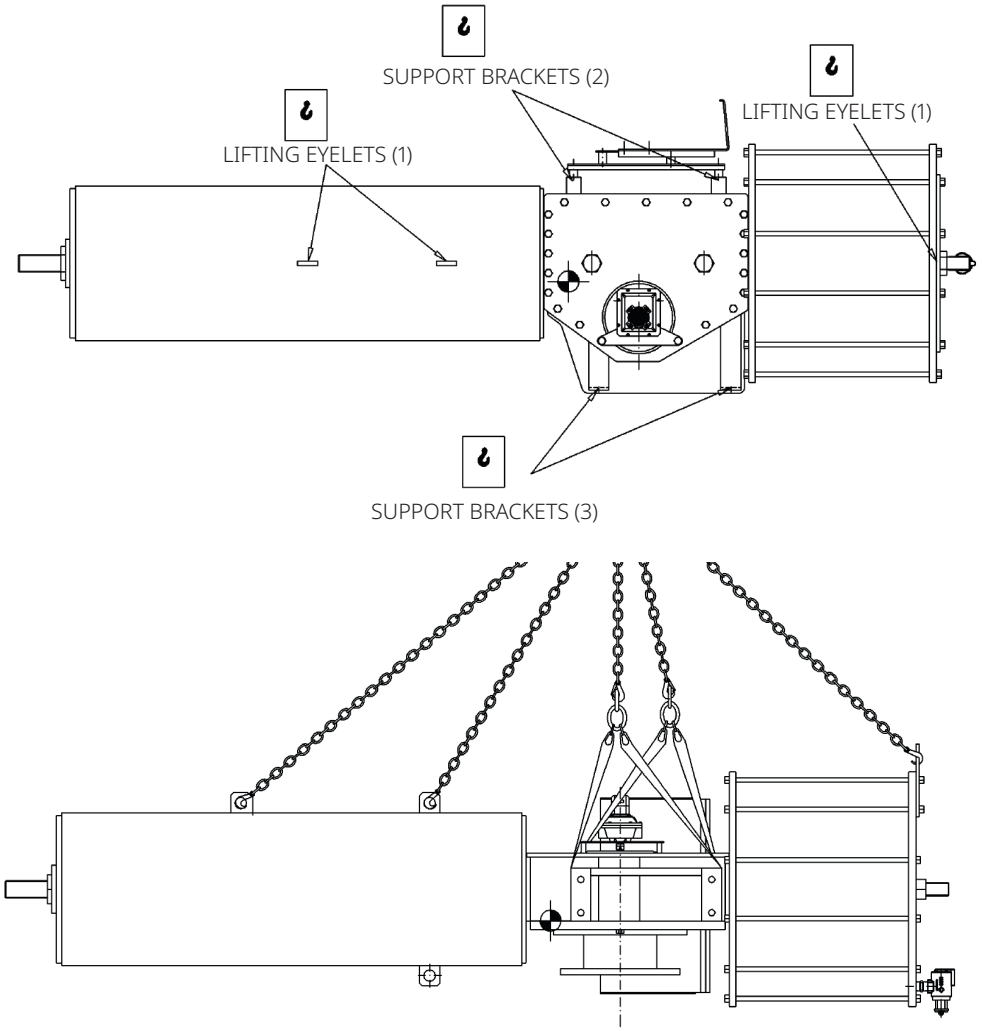
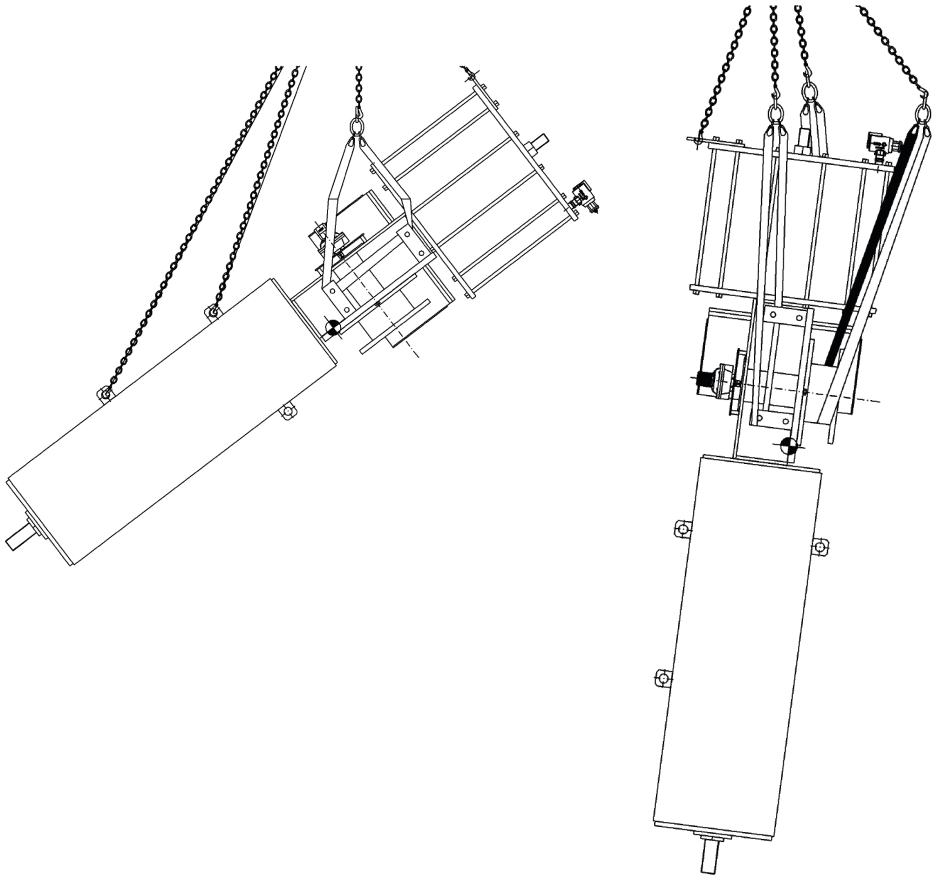


Figure 21. For All Types of Actuator



Section 3: Operation and Use

NOTICE

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

Section 3.1 to 3.4.1 refers only to ALGAS-QA with or without stop setting screw cover.

3.1 Operation Description

The actuator is operated by:

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

In the first case, the alimentation fluid pressurizes a chamber of the cylinder and compresses the spring (Figure 23); 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 22 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 22. Angular Stroke/Quick Operation Time Diagram

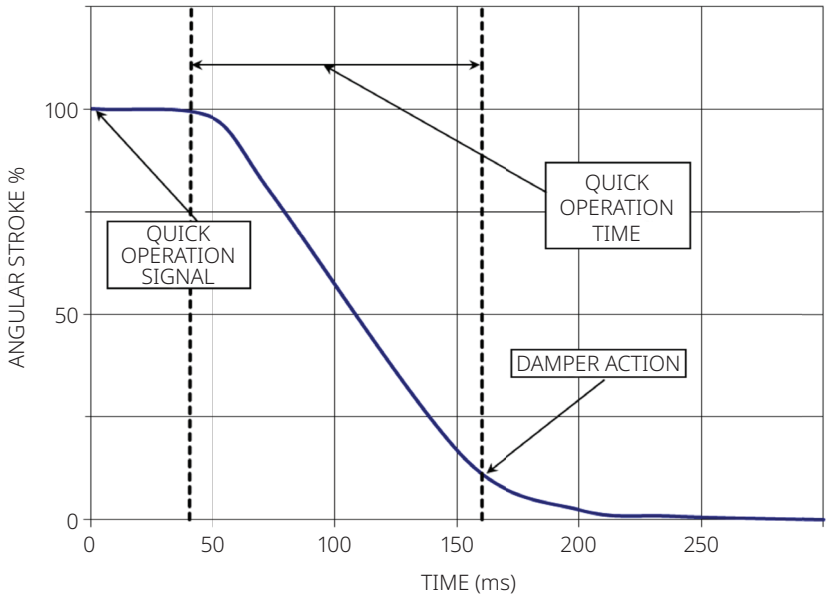
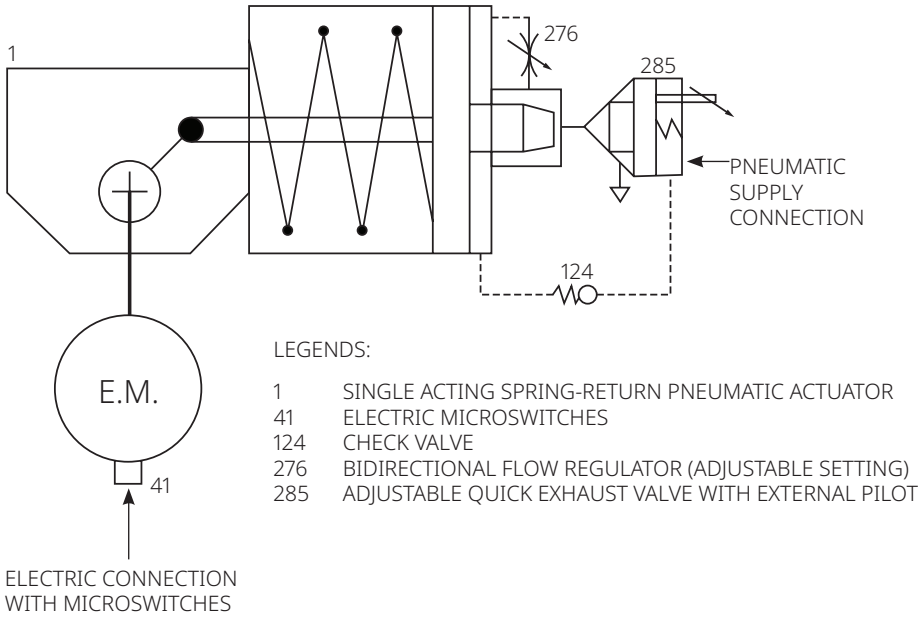


Figure 23. Generic Operating Diagram



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 24).

The calibration of the operation time is made by Biffi 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 24):

- 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 to both fail-to-open and fail-to-close actuators.

Figure 24. Adjustment of Operating Time

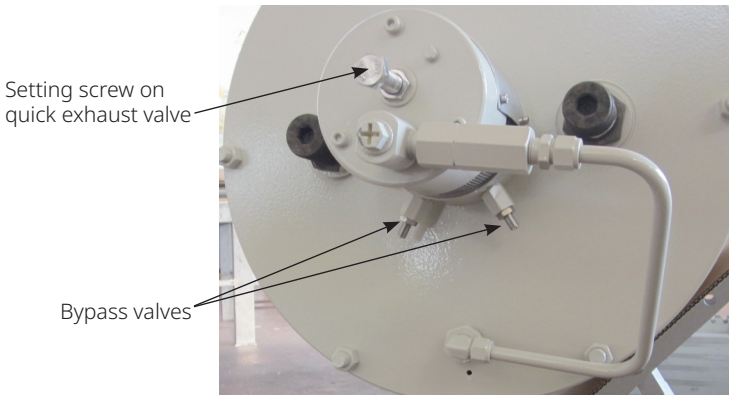
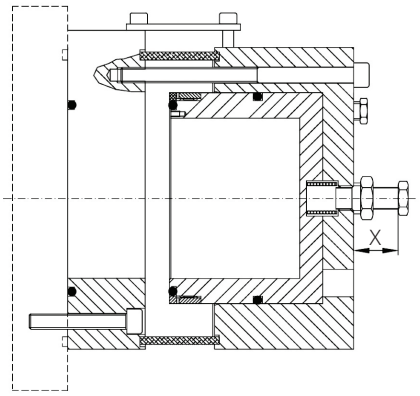
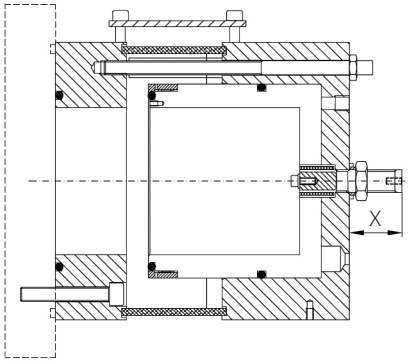


Figure 25. Integral Quick-Acting Detail



MAXIMUM UNSCREWING FOR SETTING-SCREW DUMP VALVE MODELS:
FLOW DIAMETER 40 mm - SCREW M12X50, X= 38 mm
FLOW DIAMETER 70 mm - SCREW M16X70, X= 59 mm
FLOW DIAMETER 100 mm - SCREW M16X80, X= 59 mm

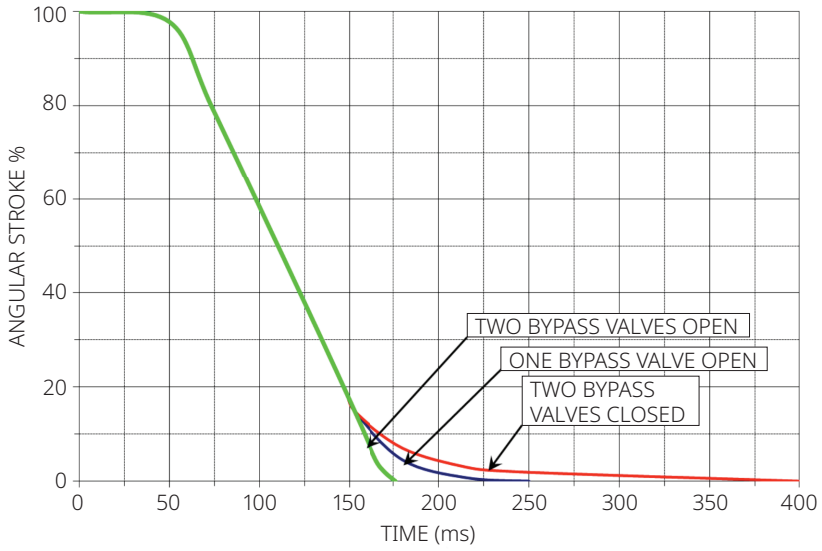
Figure 26. Integral Quick-Acting Detail



MAXIMUM UNSCREWING FOR SETTING-DOWEL DUMP VALVE MODELS:
FLOW DIAMETER 150 mm - DOWEL 20X120, X=94 mm
FLOW DIAMETER 250 mm - DOWEL 20X120, X=98 mm

3.4.1 Bypass Adjustment

Figure 27. 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 counterclockwise direction.

To reduce more the operating time (higher speed), unscrew both bypass screws (see diagram in Figure 27).

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 necessary, please refer to the test instrumentation manuals for more details.

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 Travel Stop Screw Screwed at the End Flange of Pneumatic Cylinder

3.5.1.1 ALGAS and ALGAS-QA

For the adjustment of the travel stop screws, proceed as follows:

See Figure 28.

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 counterclockwise 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).

Figure 28. Travel Stop Detail

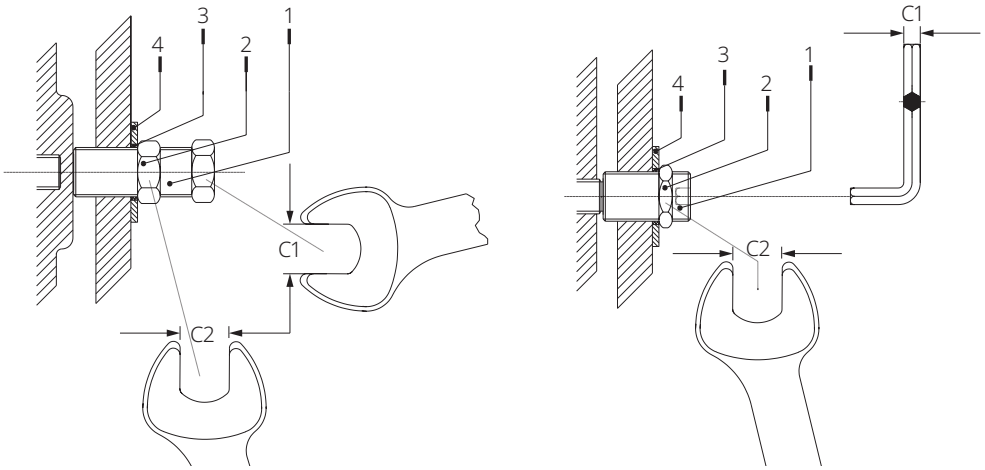


Table 11. Travel Stop Adjustment Tools Size

Pneumatic Cylinder Size	Wrench C1 (mm)	Wrench C2 (mm)
85	30	41
100	30	41
135	30	30
175	30	30
235	30	30

Table 12. Travel Stop Adjustment Tools Size

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

3.5.1.1.1 Angular Stroke Setting in Case of Two Travel Stop Screws in the End Flange of Pneumatic Cylinder for ALGAS-QA

To set the two travel stop screws in the flange of the pneumatic cylinder, proceed as follows (see Figure 29 and refer to Table 13):

1. Supply pressure to the cylinder to reduce trust on the stop screws.
2. Unscrew the lock nuts (D) with a proper wrench (C2).
3. Adjust the travel stop screws (G) with a proper wrench (C1).
4. Rotate counterclockwise to increase the angular stroke, rotate clockwise to reduce it.
5. 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 34):
6. Reduce or stop cylinder supply to verify the angular stroke.
7. Repeat operation until the required angular stroke is attained.
8. Tighten the two lock nuts (D).

Figure 29. Travel Stop Adjustment Warning

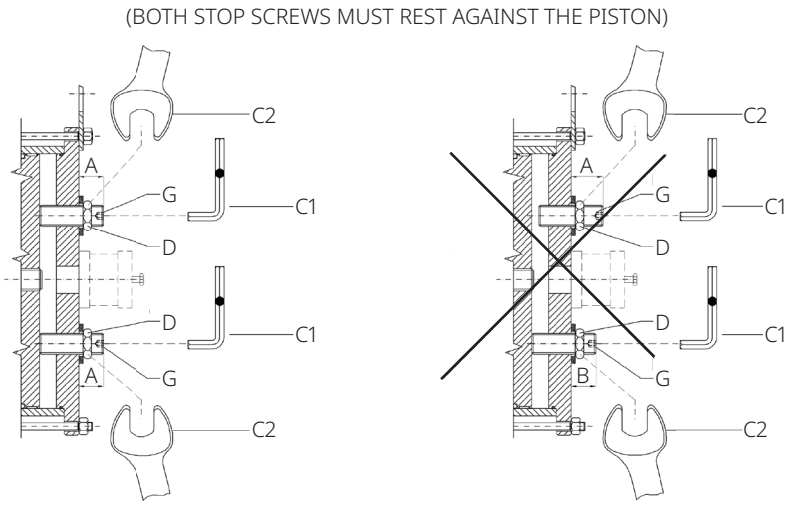


Figure 30. Travel Stop Adjustment Warning

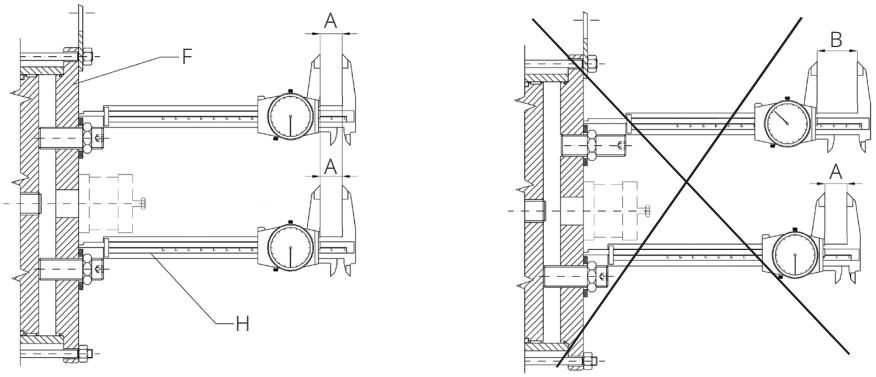


Table 13. Travel Stop Adjustment Tools Size

Pneumatic Cylinder Size	Wrench C1 (mm)	Wrench C2 (mm)
006	46	41
008	46	41
009	46	41
0100	46	41
0150	46	41
0200	17	60
0350	17	60
0400	17	60
0700	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

3.5.1.2 ALGAS with MHP

For the adjustment of the travel stop screws, proceed as follows:

1. Remove the protection plug (T) with proper wrench (C1).
2. Loosen the stopper-protection with a proper wrench (C3).
3. If the actuator angular stroke is stopped before reaching the end position (fully open or closed), unscrew the stop screw (G) by turning it counterclockwise with a proper wrench (C2), until the valve reaches the right position. When unscrewing the stop screw, keep attention that the protection still with a wrench so that the sealing washer does not withdraw together with the screw.
4. 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.
5. Tighten the protection for stopper and the plug (T).

Figure 31. Travel Stop Detail

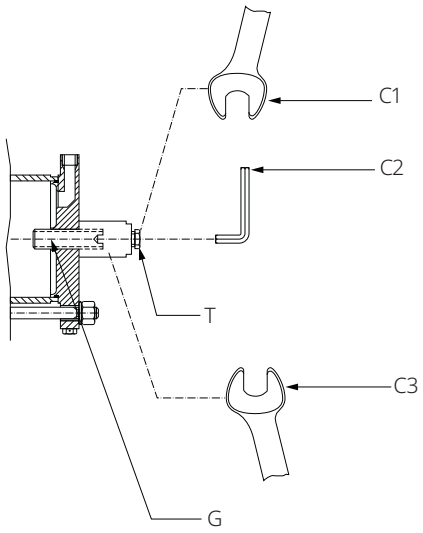


Table 14. Travel Stop Adjustment Tools Size

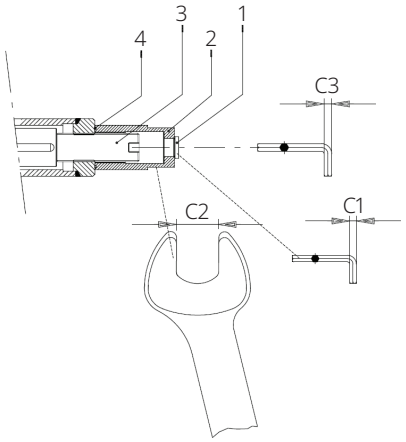
Hydraulic Cylinder Size	Wrench C1 (mm)	Wrench C2 (mm)	Wrench C3 (mm)
075	22	10	36
100	22	10	36
135	22	10	36
175	22	14	46
200	27	14	46
235	27	17	65
280	27	17	65
300	36	17	110

3.5.1.3 ALGAS, ALGAS with MHW Or MRHW with Stop Setting Screw Cover

For the adjustment of the travel stop screws proceed as follows (see Figure 32):

1. Unscrew the protection plugs (1) with Allen wrench (C3).
2. If the actuator angular stroke is stopped before reaching the end position (fully open or closed), unscrew the stop screw cover (item 2) with wrench (C2) and unscrew the stop setting screw (3) with an Allen wrench (C3) by turning it counterclockwise, and actuate the handwheel of manual override 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 does not withdraw together with the screw.
3. Tighten the stop setting screw cover, after having correctly placed the seal ring (4).
4. If the actuator angular stroke is stopped beyond the end position (fully open or closed valve), actuate the handwheel of manual override and screw the stop screw by turning it clockwise until the valve reaches the right position.
5. Tighten the stop setting screw cover, after having correctly placed the seal ring (4).

Figure 32. Travel Stop Screw Screwed on the End of Mechanical Manual Override



3.5.1.4 ALGAS MHW or MRHW without Stop Setting Screw Cover

For the adjustment of the travel stop screws proceed as follows (see figures below):

1. Loosen the locknut (2).
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 counterclockwise, and actuate the handwheel of manual override until the valve reaches the right position. When unscrewing the stop screw, keep the locknut still with a wrench so that the sealing washer does not withdraw together with the screw.
3. Tighten the locknut, after having correctly placed the threaded seal washer (3 and 4).
4. If the actuator angular stroke is stopped beyond the end position (fully open or closed valve), actuate the handwheel of manual override and screw the stop screw by turning it clockwise until the valve reaches the right position.
5. Tighten the locknut after having correctly placed the threaded seal washer (3 and 4).

Figure 33. Travel Stop Detail

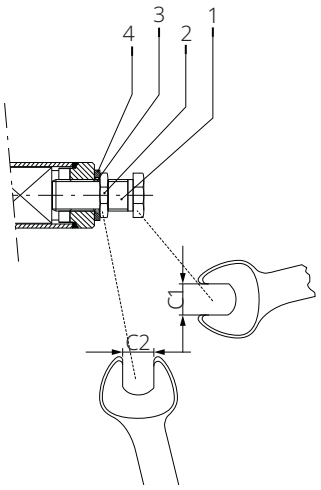


Table 15. Travel Stop Adjustment Tools Size

Actuator Size	Wrench C1 (mm)	Wrench C2 (mm)
0.3	30	30
0.9	30	30
1.5	30	30
3	30	30

Figure 34. Travel Stop Detail

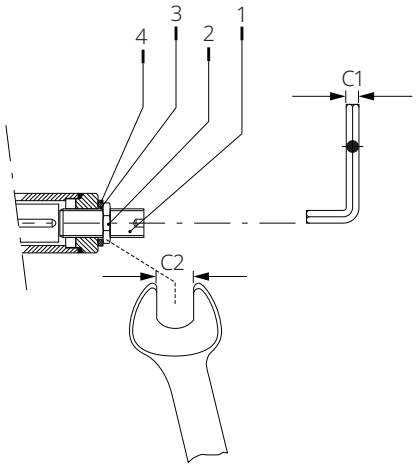


Table 16. Travel Stop Adjustment Tools Size

Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
6	17	55
14	17	55
18	17	55

3.5.1.5 ALGAS-QA

To set the two travel stop screws in the flange of the pneumatic cylinder, proceed as follows, see Figure 35:

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 counterclockwise 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).
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 35. Travel Stop Adjustment Warning

(BOTH STOP SCREWS MUST REST AGAINST THE PISTON)

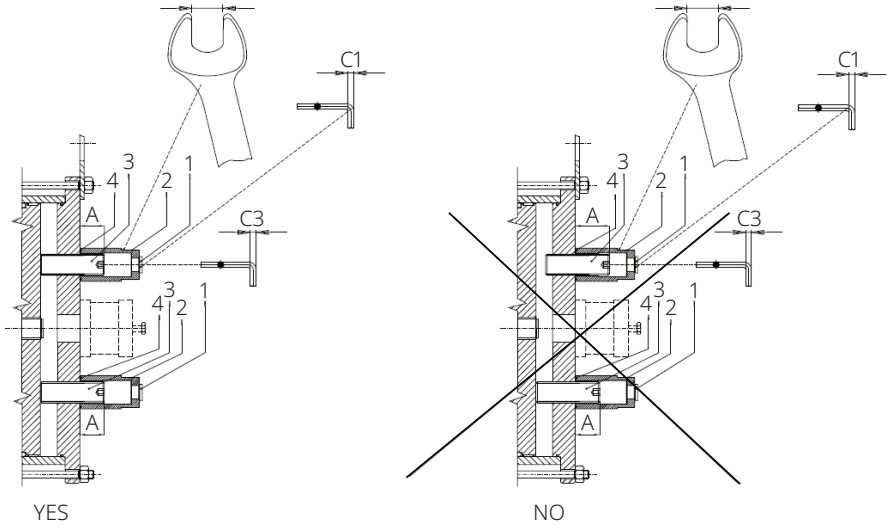
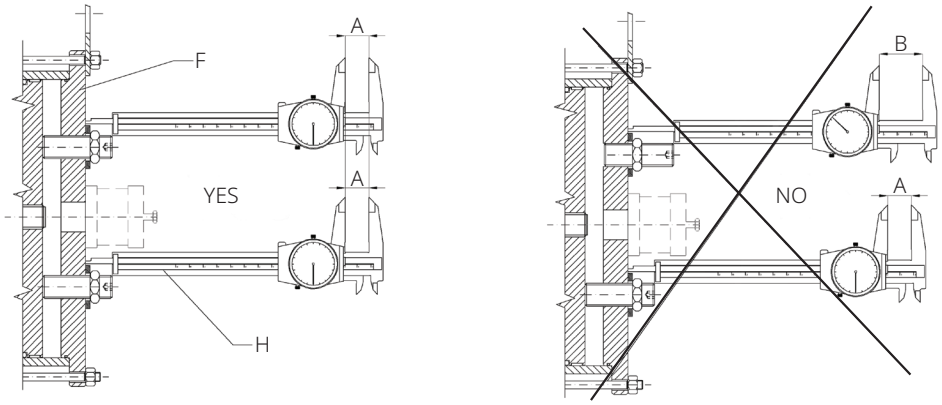


Figure 36. Travel Stop Adjustment Warning

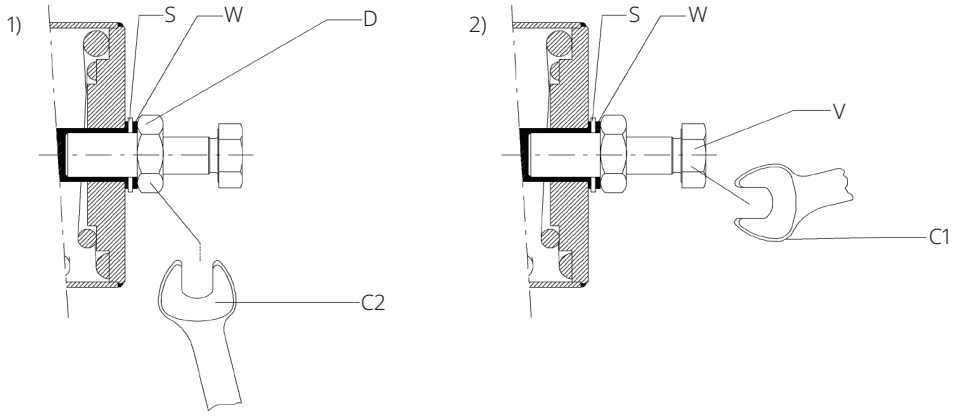


3.5.2 Stop Screw Screwed on the End Flange of Spring Container

3.5.2.1 ALGAS, ALGAS with MHW, MRHW or MHP, ALGAS-QA, without Stop Setting Screw Cover

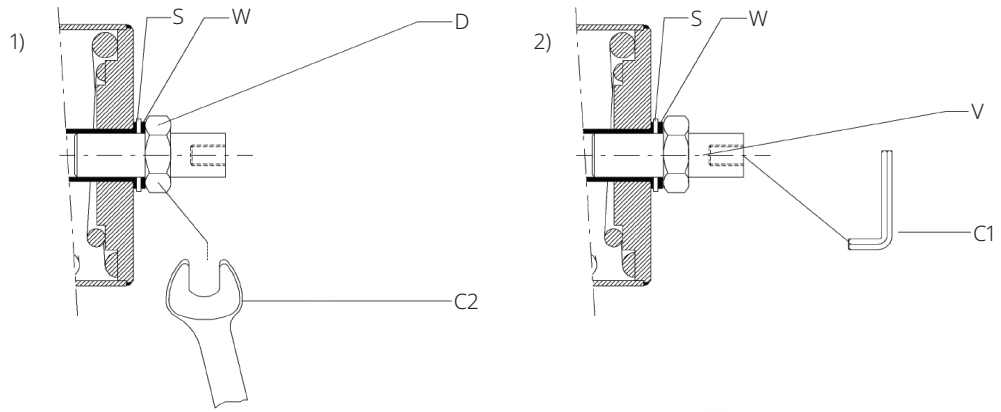
For the adjustment of the travel stop screw for models 006 to 150, proceed as follows:

Figure 37. Travel Stop Detail



For the adjustment of the travel stop screw for models 200 to 19600, proceed as follows:

Figure 38. Travel Stop Detail



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 counterclockwise until the valve reaches the correct position.
3. If the stop screw is too hard to be operated, reduce or remove the cylinder pressure to move the mechanism far from the screw. Operate the setting screw and then pressurize 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 Tables 17 and 18:

Table 17. Travel Stop Adjustment Tools Size

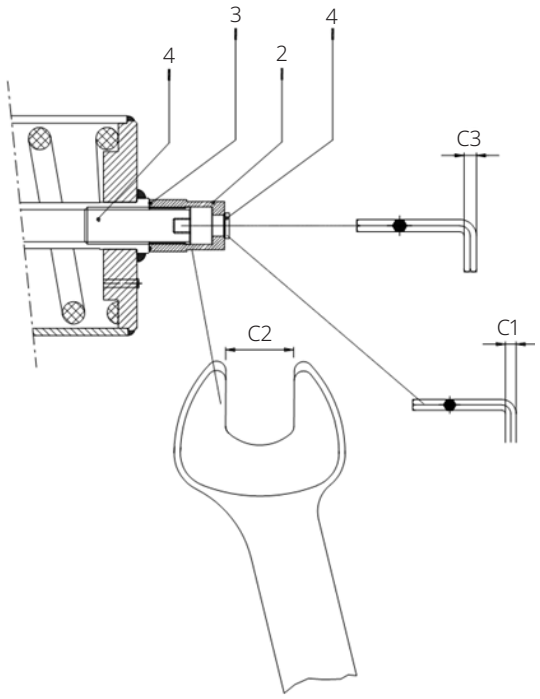
Spring Container Size	Wrench C1 (mm)	Wrench C2 (mm)
006	46	41
008	46	41
009	46	41
0100	46	41
0150	46	41

Table 18. Travel Stop Adjustment Tools Size

Spring Container Size	Wrench C1 (mm)	Wrench C2 (mm)
0200	17	60
0250	17	60
0300	17	60
0350	17	60
0400	17	60
0420	17	60
0700	17	60
0800	17	80
0850	17	80
0950	17	80
1100	17	80
1200	17	80
1200R	17	80
1600	17	80
2000	17	80
2000R	17	80
2100	17	100
2200	17	100
2450	17	100
2500	17	100
3800	17	100
3900	17	100
4200	17	100
5000	17	100
5050	17	100
5100	17	100
5400	17	100
8300	17	100
9200	17	100
9400	17	100
9600	17	100
9800	17	100
9900	17	100
10500	17	100
11000	17	100
12000	17	100
15000	17	130
15400	17	130
15600	17	130
17300	17	130
18400	17	130
18600	17	130
18700	17	130
19400	17	130
19600	17	130
19700	17	130

3.5.2.2 ALGAS MHW or MRHW and ALGAS-QA with Stop Setting Screw Cover

Figure 39. Travel Stop Detail



For the adjustment of the travel stop screw, proceed as follows (see Figure 39):

1. Unscrew the protection plugs (1) with an Allen wrench (C1).
2. Unloose the stop setting screw covers (2) with a wrench (C2).
3. Adjust the travel stop screws (4) with an Allen wrench (C3).
4. If the stop screw is too hard to be operated, reduce or remove the cylinder pressure to move the mechanism far from the screw. Operate the setting screw and then pressurize the cylinder to reach the 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 Calibration of Microswitches (Sample)

Refer to the dedicated Safety Instructions Manual for limit switch box different from the sample proposed.

⚠ WARNING

Refer only to technical documentation related to installed switch box model. If different microswitches assembly or limit switch box is supplied, please refer to the specific documentation.

NOTICE

For mounting interface dimension of the Limit Switch box on the cover of the actuator, please refer to TN1163V (for metric dimension) or TN1163VU (for imperial dimension).

NOTICE

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

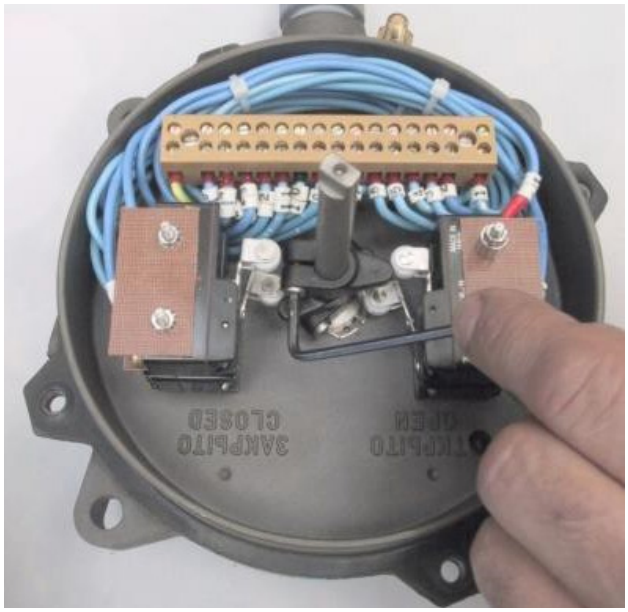
Microswitches are placed inside a special box (Figure 40).

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

- Unscrew the fastening screws of the cover (Figure 40).
- 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 41).
- 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 42).
- Tighten the screws.

Figure 40. Microswitches Box

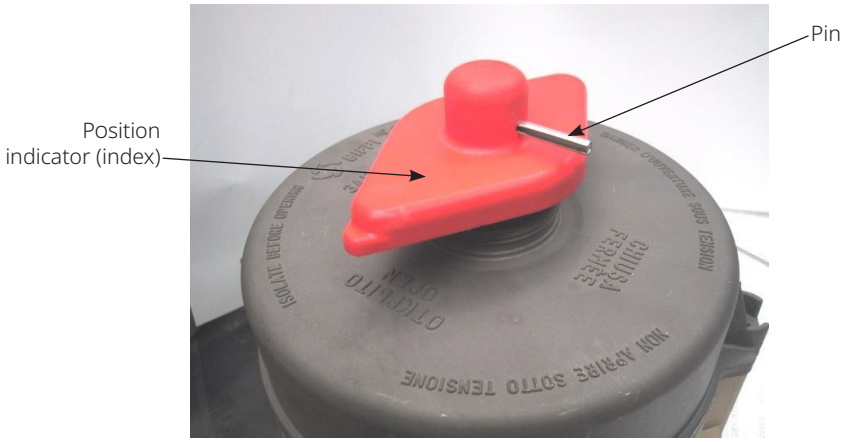
Figure 41. Cam Adjustment Box



If the index (Figure 42), 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.

Figure 42. Position Indicator and Pin for Microswitches Box



3.7 Calibration of Operating Time

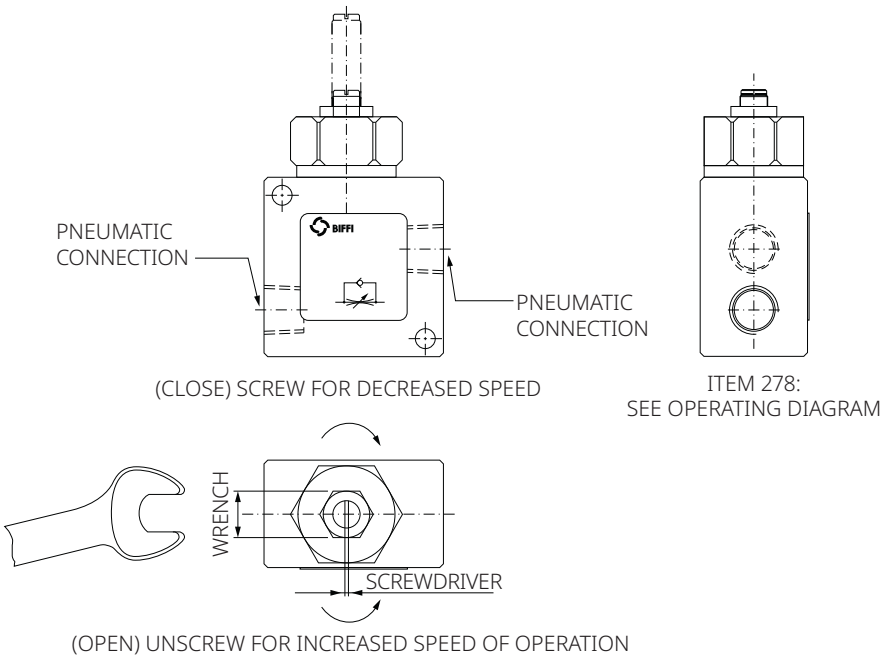
The calibration of the operation time is made by Biffi according to customer requirements and to technical data sheet included in technical documentation. If necessary, it is possible to modify or to reset the operating time through the flow regulation valve placed between the control system and the pneumatic cylinder (Figure 43).

To carry out the adjustment, use an adequate Allen wrench and follow these steps (Figure 43):

- 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 to both fail-to-open and fail-to-close actuators.

Figure 43. Adjustment of Operating Time



3.8 Preparation for Start-Up

3.8.1 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.

NOTICE

If necessary to mount components not in Biffi scope of supply, please check the accessories mounting hole details in the documents TN1028 (for metric dimension) or TN1028U (for imperial dimension).

3.8.2 Electrical Connections

1. 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.
2. 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).
3. Screw the cable glands tightly into the threaded inlets to guarantee the weatherproof and explosion-proof protection (when applicable).
4. 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.
5. If conduits are used, it is advisable to connect to the electrical enclosures by inserting the hoses not to cause anomalous stress on the housing cable entries.
6. 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).
7. Once the connections are completed, check that the controls and signals work properly.

3.9 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 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.

FOR MHP ACTUATOR:

NOTICE

If necessary to mount components not in Biffi scope of supply, please check the accessories mounting hole details in the documents TN1028 (for metric dimension) or TN1028U (for imperial dimension).

Figure 44. Local Remote Label on MHP

3.9.1 Air Quality

According to the ANSI/ISA–7.0.01–1996 Quality Standard for Instrument Air, if not clearly mentioned in the order, Biffi suggests having an air quality with a pressure due point and particle size according to the following sections. The parameters described can be different according to the specific order, conditions, agreements or components installed.

3.9.2 Pressure Dew Point

The pressure dew point as measured at the dryer outlet shall be at least 10 °C / 18 °F below the minimum temperature to which any part of the instrument air system is exposed. The pressure dew point shall not exceed 4 °C / 39 °F at line pressure.

3.9.3 Particle Size

A maximum 40 micrometer particle size in the instrument air system is acceptable for the majority of pneumatic devices. Pneumatic devices that require instrument air with less than 40 micrometer particle sizes shall have additional filtration to meet the particulate size limit for the device. Subsequent to any maintenance or modification of the air system, maximum particle size in the instrument air system should be verified to be less than 40 micrometers.

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.

5.1 Routine Maintenance

ALGAS actuators have been designed to work for long periods in the most severe conditions.

NOTICE

The periodicity and regularity of the inspection plan are particularly influenced by, but not limited to, specific environmental working conditions and the number of cycles performed. On average, replacing consumable, such as O-rings, is recommended every four years. Visual inspections of actuator status may include checks for paint condition and leakage, which are important periodic maintenance activities. The inspection frequency can be adjusted—either extended or reduced—based on specific environmental and working conditions. For example, offshore and near-shore applications require more frequent checks of critical components, including protective coatings, grease on unpainted exposed parts, and materials that are not stainless steel or of superior quality. The frequency of the controls can be initially determined experimentally and then be improved according to maintenance conditions and needs.

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 hydraulic or pneumatic cylinders, a malfunction in the mechanical components, or scheduled preventive maintenance, the actuator must be disassembled, and the seals must be replaced by referring to the general sectional drawing and following the prescribed procedures.

NOTICE

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.

1. Remove the plug from the cover of the adjustment screw.
2. Record the length between end flange and stop-setting screw, as shown in Figure 45.
3. Bring the adjustment screw back to the maximum to let the spring loosen.

⚠ WARNING

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

Figure 45. Travel Stop Adjustment Warning

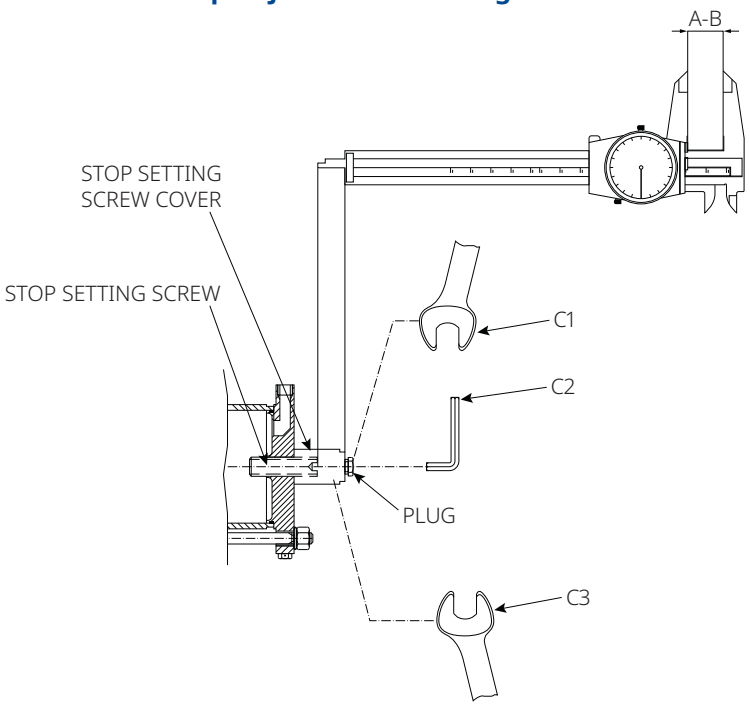


Figure 46. Only for ALGAS

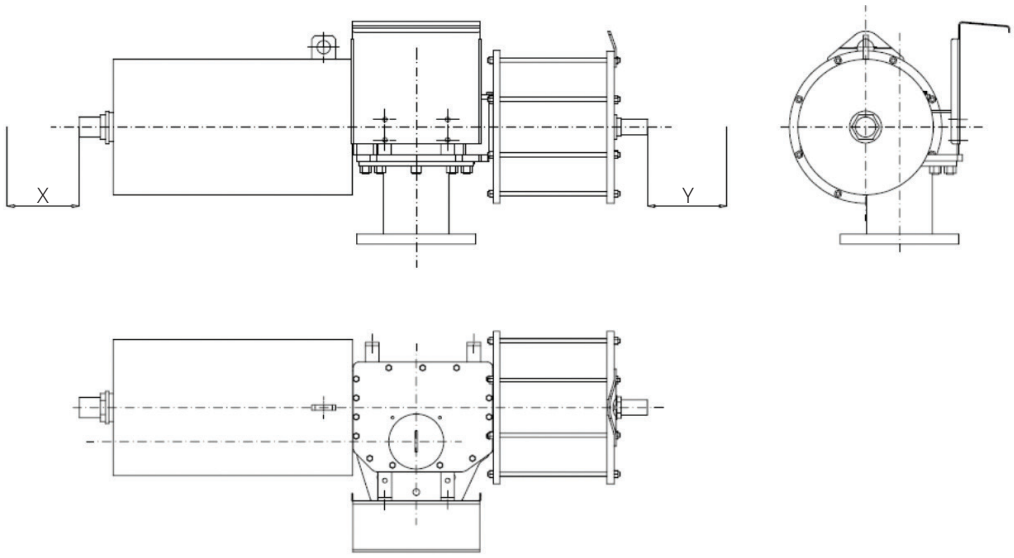


Table 19. Travel Stops Free Space for Setting

Model size	Dimension "X" (Spring Side) (mm)	Dimension "Y" (Cylinder Side) (mm)
0.1	210	300
0.3	210	350
0.9	250	450
1.5	300	450
3	450	600
6	500	800
14	550	800
18	600	900
32 to 42	750	1000
50 to 60	850	1200
65 to 55	900	1200
80	1100	1400

5.2.1 ALGAS Actuator

5.2.1.1 Replacement of Cylinder Seals

Refer to Figure 47.

1. Measure the protrusion of the stop screw (26) with reference to the end flange (22) surface, to be able to easily restore the setting of the actuator mechanical stops, once the maintenance procedures have been completed.
2. Loosen the locknut (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).

5.2.1.1.1 Seals Replacement

Prior to reassembly, check that the actuator components are in good condition and clean. Lubricate all the surfaces of the parts, that move in contact with other components, with recommended grease (Molykote® 2003 or Lubcon Turmoplex LTA 2 if seals are NBR (Nitrile Butadiene Rubber) or Viton® (FKM) or neoprene rubber, with Mobilgrease™ 33 if the seals are in fluorosilicone rubber). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully, and lubricate it with protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective 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 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 placed.
5. Screw the new sealing washer onto the stop screw until it touches the nut (25).
6. Assemble the washer (51) onto the sealing washer.

5.2.1.1.2 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 locknut (25).

NOTICE

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

Figure 47. ALGAS General Drawing

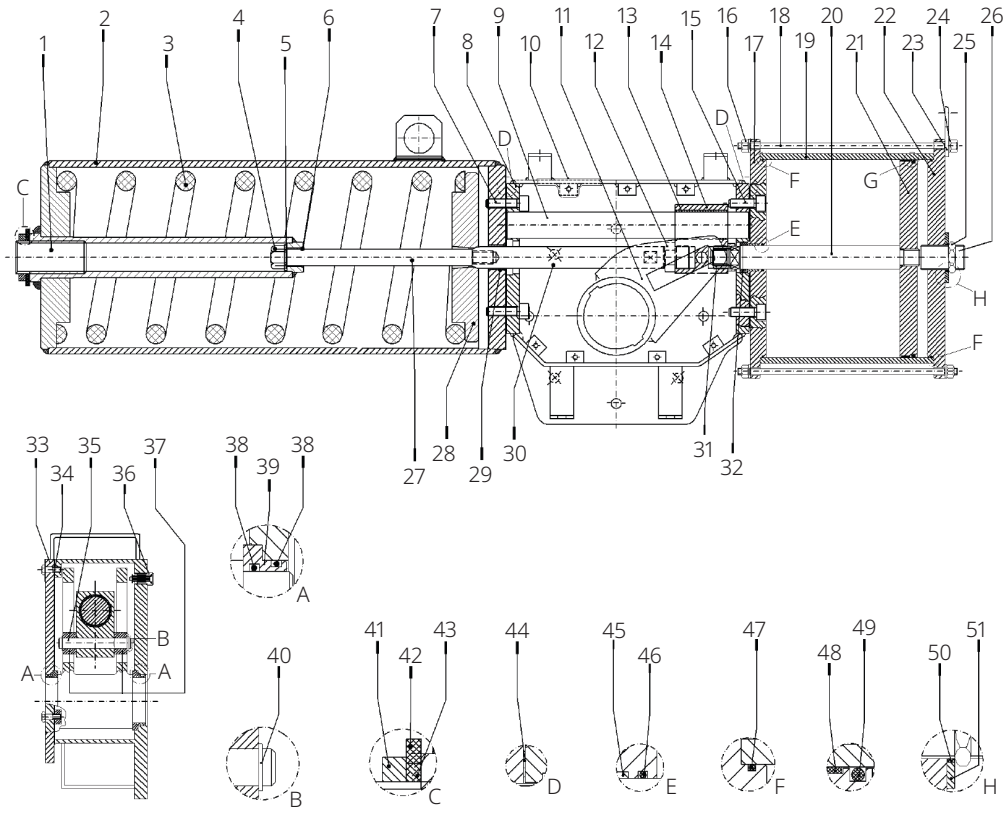


Table 20. Item Description

Item	Description
1	Stop setting screw
2	Spring container
3	Spring
4	Nut
5	Shoulder washer
6	Rod bushing
7	Screw
8	Housing
9	Guide bar
10	Cover gasket
11	Yoke
12	Plug
13	Bushing
14	Guide block
15	Screw
16	Nut
17	Head flange
18	Tie rod

Table 21. Item Description (Continued)

Item	Description
19	Cylinder tube
20	Piston rod
21	Piston
22	End flange
23	Lifting eyelet
24	Spring washer
25	Nut
26	Stop setting screw
27	Guide rod
28	Spring thrust flange
29	Rod bushing
30	Container rod
31	Adaptor bush
32	Washer
33	Cover
34	Screw
35	Guide block pin
36	Vent valve
37	Sliding block
38	O-ring
39	Yoke bushing
40	Retainer ring
41	Nut
42	Washer
43	Sealing washer
44	Gasket
45	Piston rod bushing
46	O-ring
47	O-ring
48	Guide sliding ring for piston
49	O-ring
50	Sealing washer
51	Washer
52*	Washer
53*	Washer
54*	Washer
55*	Washer
56*	Washer
57*	Washer

NOTE:
* Optional items applicable to actuators with Fiberglide® (self-lubricating bearings).

5.2.2 ALGAS MHP

5.2.2.1 Replacement of Cylinder Seals

Refer to Figure 48.

1. Measure the protrusion of the stop screw (26) with reference to the end flange (22) surface, to be able to easily restore the setting of the actuator mechanical stops, once the maintenance procedures have been completed.
2. Remove the hydraulic cylinder from the pneumatic cylinder end flange by unloosing the screws (26).
3. Remove the nuts (16) and the washers (24) from the tie rods (18) at the end flange (22) side.
4. Slide off the end flange (22) and the tube (19).
5. Remove the screws (2) and the cover (1).
6. Unscrew the piston rod (20) threaded end from the adaptor bush (31) of guide block (14).
7. Slide off the piston rod (20) from the head flange (17).
8. Disassemble the head flange (17) from the mechanism housing (8) by removing the screws (15) only if the gasket (36) is damaged and needs to be replaced.

5.2.2.1.1 Seals Replacement

Prior to reassembly, check that the actuator components are in good condition and clean. Lubricate all the surfaces of the parts that move in contact with other components, using the recommended grease. If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully, and lubricate it with a protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective grease film (Molykote 2003 or Lubcon Turmoplex LTA 2 if seals are in NBR/Viton or neoprene rubber, with Mobilgrease 33 if the seals are in fluorosilicon rubber).

1. Replace the O-rings (39-40) of the head flange (17).
2. Replace the O-ring (42) and the guide sliding ring (41) of the piston (21).
3. Replace the O-rings (40-43) of the end flange (22).

5.2.2.1.2 Reassembly

1. Assemble the new gasket (36) after cleaning the surfaces of housing (8) and head flange (17) which are in contact.
2. Assemble the head flange (17), replace the washers (37) if damaged and tighten the screws (15) to the recommended torque.
3. Lubricate the piston rod (20) surface with a protective grease film and introduce it into the head flange hole, take care not to damage the O-ring (39). Carefully clean the threaded end of the piston rod (20) and the threaded hole of the adaptor bush (30) of guide block (14). Spreads some sealant LOCTITE® 452, or equivalent, on the rod threaded end and screw into the adaptor bush (31) threaded hole and tighten.
4. 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 damaged the piston O-ring (42) and the head flange O-ring (40).
5. Assemble the end flange by centring it on the inside diameter of the tube, taking care not to damage the O-ring (40).
6. Assemble the washers (24) and the nuts (16) onto the tie rods (18). Tighten the nuts to the recommended torque, alternating between opposite corners.
7. Replace the gasket (25) if damaged and reassemble the hydraulic cylinder.
8. Apply a generous coating of grease to the contact surfaces of the yoke (11) and the bushings (34), the yoke grooves, the sliding blocks (5), and the guide bar (9).
9. Assemble the new gasket (10) after cleaning the surfaces of the housing (8) and cover (1).
10. Lubricate the O-ring (32) with protective oil or grease.
11. Assemble the cover (1) and the screws (2). Tighten the screws to the recommended torque.
12. Carry out a few actuator operations to check that its movement is regular and that there is no air leakage through the seals.

NOTICE

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

Figure 48. ALGAS with MHP General Drawing

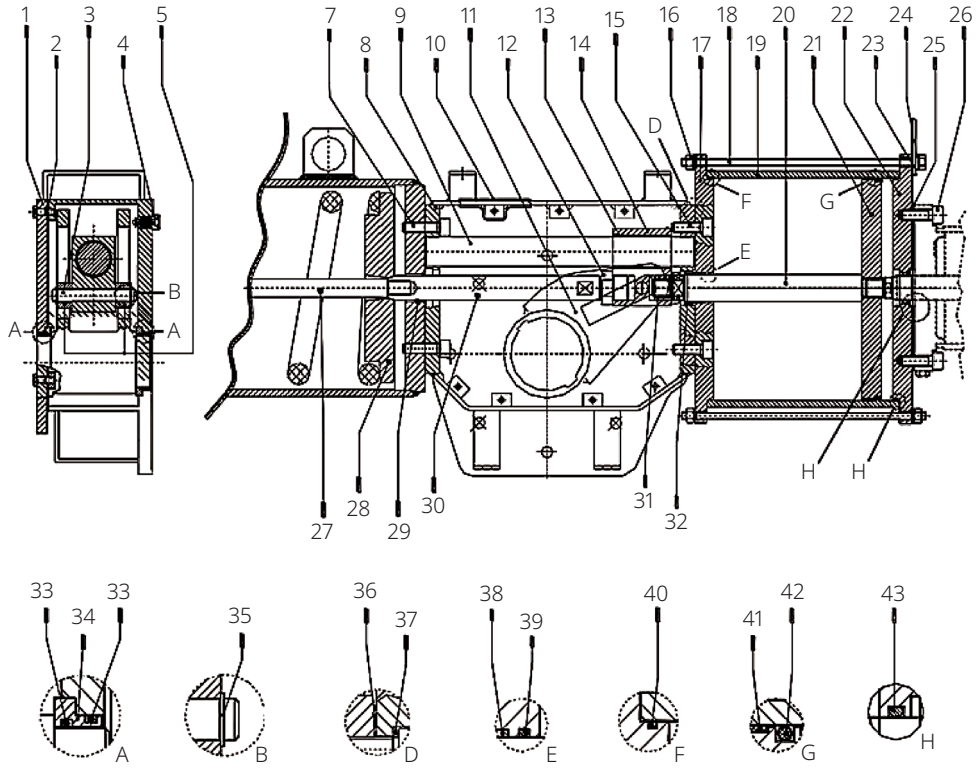


Table 22. Item Description

Item	Description
1	Cover
2	Screw
3	Guide block pin
4	Vent valve
5	Sliding block
6	Screw
7	Screw
8	Housing
9	Guide bar
10	Cover gasket
11	Yoke
12	Plug
13	Bushing
14	Guide block
15	Screw
16	Nut
17	Head flange
18	Tie rod

Table 23. Item Description (Continued)

Item	Description
19	Cylinder tube
20	Piston rod
21	Piston
22	End flange
23	Lifting eyelet
24	Spring washer
25	Gasket
26	Screw
27	Nut
28	Nut
29	Stopper bush
30	Container rod
31	Adaptor bush
32	Washer
33	O-ring
34	Yoke bushing
35	Retainer ring
36	Gasket
37	Washer
38	Piston rod bushing
39	O-ring
40	O-ring
41	Guide sliding ring for piston
42	O-ring
43	O-ring

5.2.2.2 Replacement of Hydraulic Cylinder Seals

If there are leaks in the hydraulic 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 sectional drawing and adopting the following procedures:

1. Remove the nuts (16) and the washers (15) from the tie rods (10) at the end flange (13) side.
2. Slide off the end flange and the tube (12).
3. Slide off the piston rod from the head flange (2).

5.2.2.2.1 Seals Replacement

Prior to reassembly, check that the actuator components are in good condition and clean. Lubricate all the surfaces of the parts, that move in contact with other components, with recommended grease (Molykote 2003 or Lubcon Turmoplex LTA 2 if seals are NBR/Viton or neoprene rubber, with Mobilgrease 33 if the seals are in fluorosilicone rubber). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully, and lubricate it with protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective grease film.

1. Replace the O-rings (3) of the head flange (2).
2. Replace the O-ring (3) of the end flange (13).

For replacement of piston rod seal ring (4) and of the O-ring (5), proceed as follows:

1. Remove the existing PTFE (Polytetrafluoroethylene) seal ring (4) and the O-ring (5) from their groove.
2. Clean the groove carefully and lubricate it with a protective grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective grease film.
4. Assemble the new PTFE seal ring (4) into the flange groove, on the rubber O-ring (5), by bending it: take care that the bending radius is as large as possible to avoid damaging the seal. Then, enlarge the seal ring with your fingers to restore its round shape: pay attention not to utilize any tools, which can damage the seal ring.

To replace the piston seal ring (9) and the O-ring (19), proceed as follows:

1. Remove the existing PTFE seal ring (9) and the O-ring (19) from their groove.
2. Clean the groove carefully and lubricate it with a protective grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective grease film.
4. Assemble the new PTFE seal ring (9) onto its rubber O-ring (19) by inserting one side into the groove and then gently expanding it with your fingers to fit it fully into place. Ensure that the ring is uniformly expanded without using tools that could cause damage. The elastic memory of the PTFE material allows the seal ring to shrink back to its original dimensions after a short time.

If the O-ring (17) has to be replaced, measure the protrusion of the stop screw (11) with reference to the end flange (13) surface, to easily restore the setting of the actuator mechanical stop in the correct previous valve position, once the maintenance procedures have been completed.

1. Loosen the stop setting screw cover (14) and unscrew the stop screw (11).
2. Remove the O-ring (17) from the stop screw (11). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the sealing washer works.
3. Screw the new sealing onto the stop screw until it touches the stop setting screw cover (14).
4. Screw the stop screw into the threaded hole of the end flange until it reaches its original position (the same protrusion with reference to the flange surface).
5. Check that the O-ring (17) is inside the groove into the end flange and in contact with the groove bottom surface.

5.2.2.2.2 Cylinder Reassembly

1. Assemble the new gasket (25, Figure 48) after cleaning the surfaces of pneumatic cylinder end flange (22, Figure 48) and head flange (2) which are in contact.
2. Assemble the head flange and tighten the screws (26, Figure 48) to the recommended torque.
3. Clean and lubricate the surface of the piston rod (6), especially the bevel, with a protective film of grease. Insert the rod into the head flange hole, ensuring the PTFE seal ring (4) is not damaged. The bevel on the piston rod should smoothly expand the seal ring during insertion.
4. Carefully clean the inside of the tube (12) and inspect the entire surface, especially the bevels, to ensure there is no damage. Apply a protective film of grease to the inner surface of the tube and the bevels at both ends.
5. Slide the tube onto the piston, ensuring that the PTFE seal ring (9) is not damaged. The bevel of the tube must smoothly compress the seal ring. Also, take care not to damage the head flange O-ring (3).
6. Assemble the end flange (13) by centering it on the inside diameter of the tube, taking care not to damage the O-ring (3).
7. Assemble the washers (15) and nuts (item 16) onto the tie rods (10). Tighten the nuts to the recommended torque, alternating between opposite corners.

NOTICE

After maintenance operations, carry out a few actuator operations (5 to 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 49. Cylinder

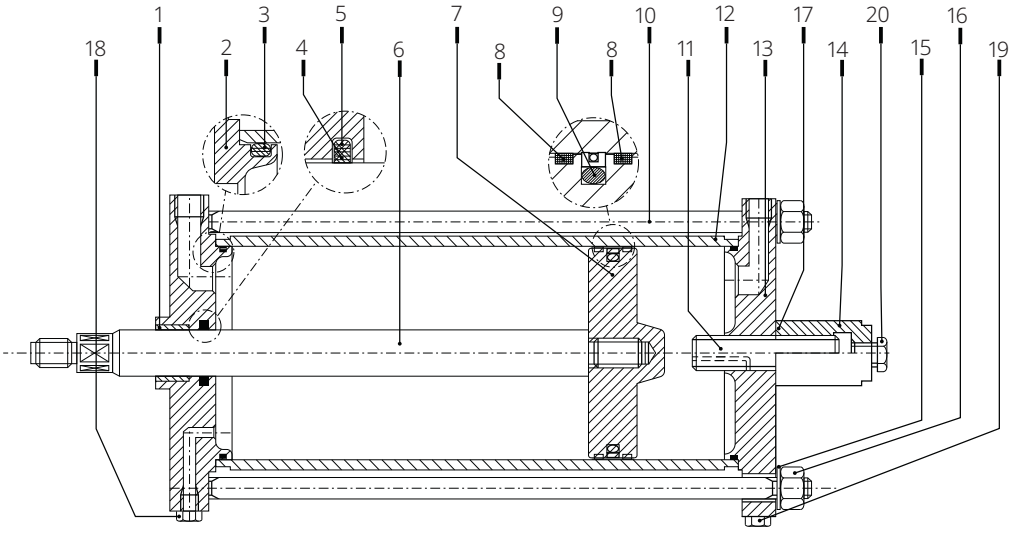


Table 24. Item Description

Item	Quantity	Description	Material
1	1	Piston rod bushing	Steel + Bronze + PTFE
2	1	Head flange	Carbon steel
3	2	O-ring	* NBR
4	1	Piston rod seal ring	* PTFE + Graphite
5	1	O-ring	* NBR
6	1	Piston rod	Alloy steel
7	1	Piston	Nickel plated carbon steel
8	2	Guide sliding ring for piston	* PTFE + Graphite
9	1	Piston seal ring	* PTFE + NBR
10	4	Tie rod	Alloy steel ASTM A320 Grade L7
11	1	Stop setting screw	Alloy steel
12	1	Cylinder tube	Nickel plated carbon steel
13	1	End flange	Carbon steel
14	1	Stop setting screw cover	Carbon steel or refer to the scope of supply
15	4	Spring washer	Carbon steel
16	4	Nut	Carbon steel ASTM A194 Grade 7
17	1	O-ring	* NBR
18	6	Plug	Carbon steel
19	1	Plug	Carbon steel
20	1	Plug	Carbon steel

NOTE:
* Recommended spare parts

5.2.2.3 MHP Hydraulic Manual Override Maintenance and Troubleshooting

5.2.2.4 Operation

Refer to Figure 50.

The “MHP” hydraulic manual override is utilized, in connection with the actuator hydraulic cylinder, for the manual operation of the actuators.

5.2.2.5 Manual Operation

The hand-operated directional control valve (D) must be in its "MANUAL" control position for the operation (opening or closing) to be performed.

Actuate the hand pump (P).

The relief valve (R) prevents the oil pressure generated by the hand pump from exceeding the set value, protecting the valve and the actuator from damage.

⚠ WARNING

At the end of hydraulic manual control, close the stop valve 351 to stop the valve position. To allow the automatic control, open the stop valve 351 and bring the distributor lever in the “automatic control” position.

5.2.2.6 Remote Operation

To enable the pneumatic operation of the actuator, the hand-operated directional control valve (D) must be in its “REMOTE” control position, with the valve lever in its central position as indicated on the instruction plate.

The exceeding oil volume, corresponding to the hydraulic cylinder piston rod, flows into the oil tank (OT).

The relief valve (395) prevents the oil pressure in the hydraulic cylinder from exceeding a set value.

5.2.2.7 Checking the Oil Level in the Oil Tank

Refer to Figure 51.

During the actuator operation, the oil tank must be closed (not in connection with the atmosphere) to avoid cavitation.

When checking the oil level in the tank, it is necessary to proceed as follows:

- Move the actuator to the safe position with the spring uncompressed.
- Unscrew the dipstick (1).
- Check that the oil level in the tank (4) is in correspondence with the “maximum level” notch of the dipstick. If not, refill to maximum level.
- Screw and tighten the dipstick.

NOTICE

For refill, use oil of the same brand as the one in the hydraulic manual override tank.

Table 25. Hydraulic Oil List by Biffi for Refilling in Different Working Conditions

Standard Temperature Conditions (-30 to +85 °C)	
Producer	ENI®
Name	Arnica 22
Viscosity at 40 °C	20.9 mm^2/s
Viscosity at 100 °C	4.73 mm^2/s
Viscosity index ASTM	153
Flash point	192 °C
Pour point	-42 °C
Specific weight (at 15 °C)	0.857 Kg/l
Equivalent oils:	Use an equivalent or better product in compliance with the oil proposed in the actual scope of supply by Biffi. Your oil supplier can verify and propose an alternative product at your responsibility.
Low Temperature Conditions (Until -46 °C):	
Manufactured Name	Shell AeroShell® Fluid 41
Viscosity at -54 °C	2300 cST
Viscosity at -40 °C	491 cST
Viscosity at 40 °C	14.1 cST
Viscosity at 100 °C	5,30 cST
Viscosity index (ISO 2909)	>200
Flash point	105 °C
Pour point	<-60 °C
Specific weight	0.87 kg/dm^3
(or equivalent)	
Low Temperature Conditions (Until -60 °C)	
Manufactured Name	* SYNTESIS * SYNTRASS-CS 500
Viscosity at -60 °C	580 cST
Viscosity at -30 °C	39 cST
Viscosity at 20 °C	5.8 cST
Viscosity at 50 °C	2.1 cST
Flash point	152 °C
Pour point	-68 °C
Specific weight	0.897 kg/dm^3
(or equivalent)	

NOTE:
* Refer to Fiorenzuola plant to receive a quotation for this oil.

5.2.2.8 Maintenance for MHP

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 provide the proper safety conditions for the staff.

The hydraulic unit has been designed to work for long period in the most severe conditions, without the need for maintenance.

It is, however, advisable to periodically check that:

- With the hand pump manual override, the actuator operates the valve properly both in opening and in closing.
- There are no leakage in the hydraulic connections. Tighten the nuts of the pipe fittings if necessary.
- The hydraulic oil is in good condition. If necessary, every 3 years, change the oil in the oil tank by removing the plug (27) to drain all the oil and by pouring the new oil into the tank through the hole of the dipstick.

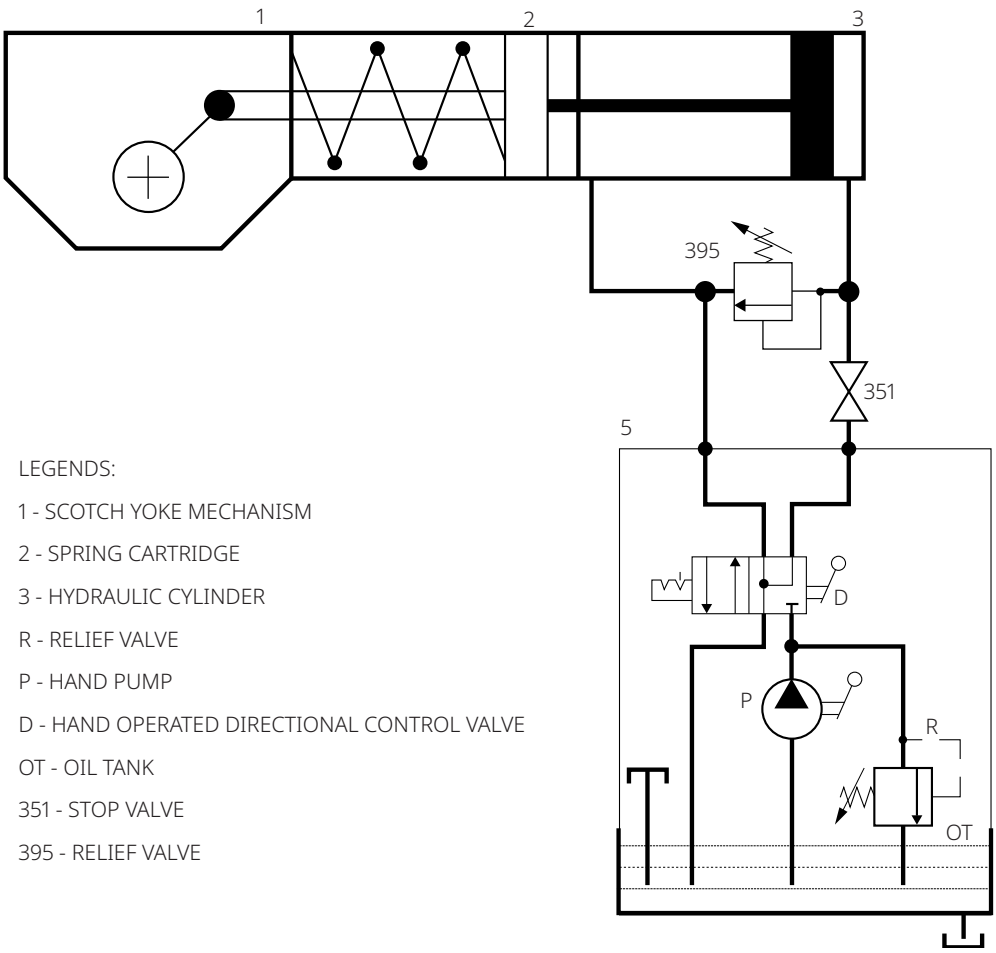
If dirt or sludge is found in the oil drained from the tank, disassemble the oil tank tube by unscrewing the two cap nuts (2) before refilling the tank with new oil. Clean the internal surfaces of the tank, and if necessary, replace the O-ring (21) of the tank.

Periodically, visually check that the external components of the hydraulic unit are in good condition and check the paint-work. If some areas are damaged, repair the paint-work according to the applicable specification.

In case of a malfunction of any hydraulic unit part, disassemble it using the attached sectional drawings as reference. Clean the components, replace any damaged parts (if applicable), and replace the seals if necessary. Reassemble the unit, taking care not to damage the seals.

Perform several operations to ensure that the hydraulic unit functions properly with both pneumatic and manual operations, and check for any leaks.

Figure 50. (MAN686-A) ALGAS with MHP General Arrangement



LEGENDS:

1 - SCOTCH YOKE MECHANISM

2 - SPRING CARTRIDGE

3 - HYDRAULIC CYLINDER

R - RELIEF VALVE

P - HAND PUMP

D - HAND OPERATED DIRECTIONAL CONTROL VALVE

OT - OIL TANK

351 - STOP VALVE

395 - RELIEF VALVE

PNEUMATIC CONNECTION

ELECTRIC CONNECTION

Figure 51. Hydraulic Manual Hand Pump

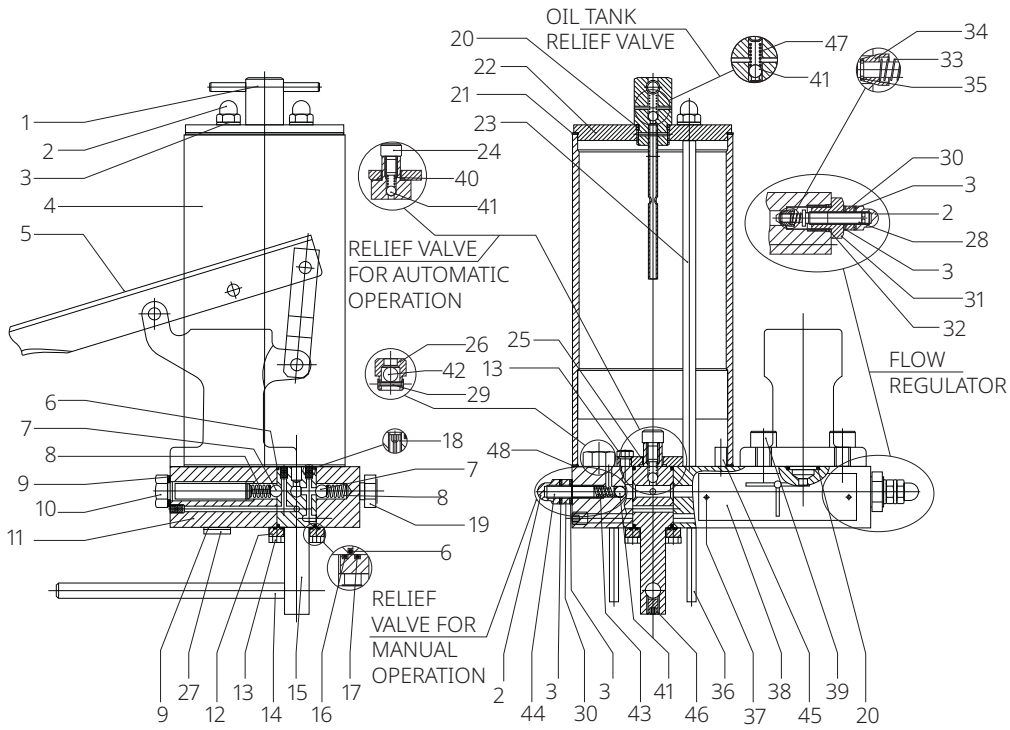


Table 26. Item Description

Item	Quantity	Description	Material
1	1	Dipstick	Carbon steel + Aluminum
2	5	Cap nut	Carbon steel
3	8	Washer	Carbon steel + Rubber
4	1	Hydraulic tank	Carbon steel
5	1	Hand pump	Refer to Table 48
6	2	O-ring	* Fluorosilicone rubber
7	2	Ball	Stainless steel
8	2	Spring	Spring steel
9	2	Washer	Carbon steel + Rubber
10	1	Screw	Carbon steel
11	1	Plate	Carbon steel
12	1	Flange	Aluminum
13	8	Screw	Carbon steel
14	1	Lever	Carbon steel
15	1	Distributor	Stainless steel
16	1	O-ring	* Fluorosilicone rubber
17	1	O-ring	* Fluorosilicone rubber
18	1	Nozzle	Carbon steel
19	2	Screw	Carbon steel
20	3	O-ring	* Fluorosilicone rubber
21	1	Tank gasket	* Fiber
22	1	Tank cover	Carbon steel
23	2	Tie rod	Carbon steel
24	1	Screw	Carbon steel

NOTE:
* Recommended spare parts

Table 27. Item Description (Continued)

Item	Quantity	Description	Material
25	1	Flange	Aluminum
26	2	Check valve body	Carbon steel
27	1	Plug	Carbon steel
28	2	Flow control valve setting screw	Stainless steel
29	2	Spring pin	Stainless steel
30	3	Nut	Carbon steel
31	2	Flange	Carbon steel
32	2	O-ring	* Fluorosilicone rubber
33	2	Spring	Spring steel
34	2	Plug	Stainless steel
35	2	Retainer ring	Spring steel
36	2	Spring pin	Carbon steel
37	2	Rivet	Aluminum
38	1	Operation instruction plate	Stainless steel
39	4	Screw	Carbon steel
40	1	Spring	Stainless steel
41	3	Ball	Stainless steel
42	2	Ball	Stainless steel
43	1	Spring	Spring steel
44	1	Relief valve setting screw	Stainless steel
45	3	Spring pin	Carbon steel
46	1	Screw	Alloy steel
47	1	Spring	Stainless steel
48	1	Tank gasket	* Polyurethane

NOTE:
* Recommended spare parts

5.2.3 ALGAS MHW Actuator

5.2.3.1 Replacement of Cylinder Seals

1. Measure the protrusion of the stop screw (52) with reference to the protection tube (51) surface, to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed. Disassemble the manual override from the pneumatic cylinder end flange by unscrewing the fastening screws (61), as described in following pages.
2. Remove the washer (51) and the sealing washer (50).
3. Unscrew the nuts (16) from the tie rods (18) on the side of the end flange. They must be gradually unscrewed simultaneously.
4. Slide off the end flange (22) and the tube (19).

5.2.3.1.1 Seals Replacement

Prior to reassembly, check if the actuator components are in good condition and clean. Lubricate all the surfaces of the parts, that move in contact with other components, by recommended grease (Molykote 2003 or Lubcon Turmoplex LTA 2 if seals are NBR/Viton or neoprene rubber, with Mobilgrease 33 if the seals are in fluorosilicone rubber). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with a protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective 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).

5.2.3.1.2 Reassembly

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 (57) and the O-ring (59) are in contact with the end flange (22) surface.
6. Reassemble the manual override. Tighten the screws (61) to fix protection tube.

NOTICE

After maintenance operations, carry out a few actuator operations (5 to 10 full actuator movements) 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 52. ALGAS-MHW Spring-Return Pneumatic Actuator

NOTE: IF STOP SETTING SCREW IS REQUIRED, REFER TO ITEMS 62 AND 63.

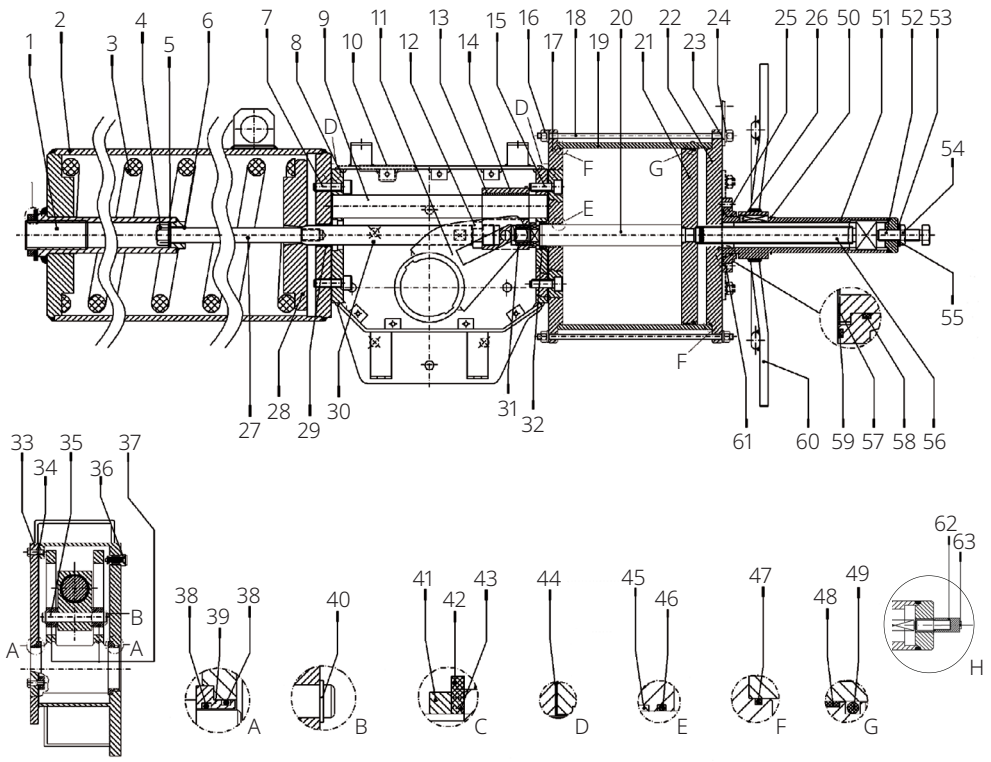


Table 28. Item Description

Item	Description	Item	Description	Item	Description
1	Stop setting screw	22	End flange	43	Sealing washer
2	Spring container	23	Lifting eyelet	44	Gasket
3	Spring	24	Spring washer	45	Piston rod bushing
4	Nut	25	Flange	46	O-ring
5	Shoulder washer	26	Key	47	O-ring
6	Rod bushing	27	Guide rod	48	Guide sliding ring for piston
7	Screw	28	Spring thrust flange	49	O-ring
8	Housing	29	Rod bushing	50	Retainer ring
9	Guide bar	30	Container rod	51	Protection tube
10	Cover gasket	31	Adaptor bush	52	Stop setting screw
11	Yoke	32	Washer	53	Washer
12	Plug	33	Cover	54	Nut
13	Bushing	34	Screw	55	Sealing washer
14	Guide block	35	Guide block pin	56	Jackscrew
15	Screw	36	Vent valve	57	Thrust bearing washer
16	Nut	37	Sliding block	58	O-ring
17	Head flange	38	O-ring	59	O-ring
18	Tie rod	39	Yoke bushing	60	Handwheel
19	Cylinder tube	40	Retainer ring	61	Screw
20	Piston rod	41	Nut	62	Stop setting screw cover
21	Piston	42	Washer	63	Plug

NOTE:
* Recommended spare parts

5.2.3.2 Replacement of the Seals of Manual Override “MHW”

NOTICE

Before any operation, you must keep the actuator in release position to allow the air and spring stroke.

1. Measure the protrusion of the stop screw (52) with reference to the surface of the protection tube (51) end flange, to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed.
2. Loosen the locknut (54) and unscrew the stop screw (54) until it is removed from the end flange of protection tube (51) together with the nut (54), washer (53) and sealing washer (55).
3. Rotate the handwheel (60) clockwise to move the jackscrew (56) backwards until it hits the end flange of the protection tube.
4. Disassemble the manual override from the pneumatic cylinder end flange by unscrewing the fastening screws (61).
5. Disassemble the retainer ring (50) and remove the handwheel (60).
6. Disassemble the flange (25) from the protection tube (51).
7. Remove the O-rings (58 and 59) from their grooves in the flange. Carefully clean the grooves and lubricate them with protective grease film. Assemble the new O-rings into their grooves and lubricate them.
8. Assemble the flange (25), the handwheel (60) and the retainer ring (50) onto the protection tube (51).
9. Fasten the manual override to the pneumatic cylinder end flange with the proper screw.
10. Remove the sealing washer (55) from the stop screw (52). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the sealing washer works. Screw the new sealing onto the stop screw until it touches the nut (54).
11. Assemble the washer (53) onto the sealing washer (55). Screw the stop screw into the threaded hole of the end flange of the protection tube until it hits the jackscrew (56) of the manual override.
12. Actuate the manual override by rotating the handwheel counterclockwise until it is possible to screw the stop screw (52) and until it reaches its previous position related to fully open valve position (the same protrusion with reference to the surface of the protection tube end flange as before the disassembly).
13. Check if the sealing washer (55) and the washer (53) are in contact with the end flange surface.
14. Tighten the locknut (54).

5.2.3.3 Replacement of the Seals of Reduced-Manual Override "MRHW"

NOTICE

Before any operation, you must keep the actuator in release position to allow the air and spring stroke.

1. Measure the protrusion of the stop screw (19) with reference to the surface of the protection tube (6) end flange, to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed.
2. Loosen the locknut (20) and unscrew the stop screw (19) until it is removed from the end flange of protection tube (6) together with the nut (20), washer (34) and sealing washer (35).
3. Rotate the handwheel (7) clockwise to move the jackscrew (18) backwards until it hits the end flange of protection tube.
4. Disassemble the manual override from the pneumatic cylinder end flange by unscrewing the fastening screws (36).
5. Disassemble the screw (31), which fastens the reduction unit to the spacer bracket (5).
6. Move the reduction unit along the protection tube (6) until the key (13) is accessible. Remove the key from the protection tube. Move the spacer bracket (5) along the protection tube (6) until the O-ring (4) is accessible.
7. Remove the O-rings (1 and 4) from their grooves. Carefully clean the grooves and lubricate them with protective grease film. Assemble the new O-rings into their grooves and lubricate them.
8. Move the spacer bracket along the protection tube up to reach its working position. Assemble the key (13). Move the reduction unit to its working position and fasten it to the spacer bracket (5) by the screws (31).
9. Remove the sealing washer (35) from the stop screw (19). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the sealing washer works. Screw the new sealing onto the stop screw until it touches the nut (20).
10. Assemble the washer (34) onto the sealing washer (35). Screw the stop screw into the threaded hole of the end flange of the protection tube until it hits the jackscrew (18) of manual override.
11. Actuate the manual override by rotating the handwheel counterclockwise until it is possible to screw the stop screw (19) and until it reaches its previous position related to fully open valve position (the same protrusion with reference to the surface of the protection tube end flange as before the disassembly).
12. Check that the sealing washer (35) and the washer (34) are in contact with the end flange surface.
13. Tighten the locknut (20).

NOTICE

After maintenance operations, carry out a few actuator operations (5 to 10 full actuator movements) 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 53. Mechanical Manual Override "MRHW" Worm Gear Reduction Unit

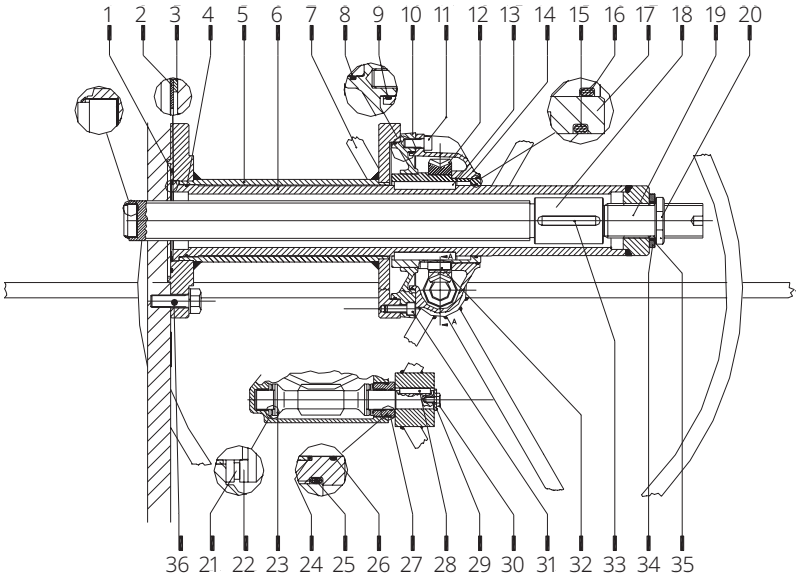


Table 29. Item Description

Item	Quantity	Description	Material	Equivalence to USA Standards
1	1	O-ring	* NBR	-
2	1	Thrust bearing washer	Alloy steel	AISI SAE 9840
3	1	Sliding washer	Bronze	ASTM B427 Alloy 908
4	1	O-ring	* NBR	-
5	1	Spacer bracket	Carbon steel	ASTM A106 Grade B + ASTM A283 Grade D
6	1	Protection tube	Carbon steel	API 5LX Grade X52 (C<0.2%) + ASTM A283 Grade D
7	1	Handwheel	Carbon steel	API 5L Grade B
8	1	O-ring	* NBR	-
9	1	O-ring	* NBR	-
10	1	Worm gear box lower body	Aluminium	ASTM B85-73 Alloy S12B
11	3	Screw	Carbon steel	AISI SAE 1040
12	1	Worm wheel	Bronze	ASTM B527 Alloy 908
13	2	Key	Alloy steel	AISI SAE 9840
14	1	Worm gear box upper body	Aluminium	ASTM B85-73 Alloy S12B
15	1	O-ring	* NBR	-

NOTE:
* Recommended spare parts

Table 30. Item Description (Continued)

Item	Quantity	Description	Material	Equivalence to USA Standards
16	1	O-ring	* NBR	-
17	1	Drive sleeve	Carbon steel	API 5LX Grade X52
18	1	Jackscrew	Alloy steel + Bronze	AISI SAE 9840 + ASTM B427 Alloy 908
19	1	Stop setting screw	Carbon steel	AISI SAE 1040
20	1	Nut	Carbon steel	ASTM A194 Grade 2
21	2	Axial needle bearing	Alloy steel	AISI SAE 9840
22	4	Thrust bearing washer	Alloy steel	AISI SAE 9840
23	1	Worm screw	Alloy steel	AISI SAE 9840
24	2	Bushing	Steel + Bronze + PTFE	-
25	1	O-ring	* NBR	-
26	1	O-ring	* NBR	-
27	1	Ring nut	Carbon steel	AISI SAE 1040
28	1	Key	Carbon steel	AISI SAE 1040
29	1	Washer	Carbon steel	AISI SAE 1040
30	1	Screw	Stainless steel	AISI 304
31	4	Screw	Carbon steel	AISI SAE 1040
32	2	Key	Carbon steel	AISI SAE 1040
33	2	Key	Carbon steel	AISI SAE 1040
34	1	Washer	Carbon steel	AISI SAE 1040
35	1	Sealing washer	* Polyvinyl Chloride (PVC)	-
36	1	Screw	Carbon steel	AISI SAE 1040

NOTE:
* Recommended spare parts

Figure 54. Mechanical Manual Override "MRHW" Bevel Gear Reduction Unit

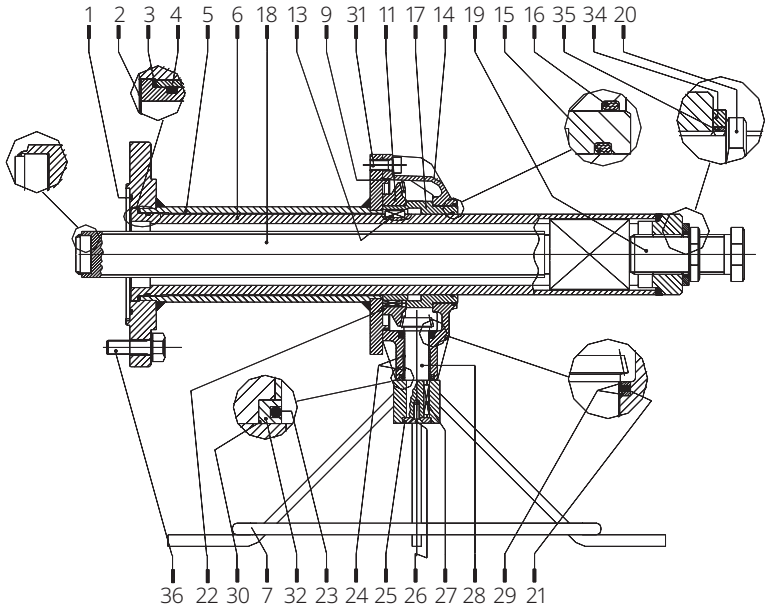


Table 31. Item Description

Item	Quantity	Description	Material	Equivalence to USA Standards
1	1	O-ring	* NBR	-
2	1	Thrust bearing washer	Alloy steel	AISI SAE 9840
3	1	Sliding washer	Bronze	ASTM B427 Alloy 908
4	1	O-ring	* NBR	-
5	1	Spacer bracket	Carbon steel	ASTM A106 Grade B + ASTM A283 Grade D
6	1	Protection tube	Carbon steel	API 5LX Grade X52 (C<0.2%) + ASTM A283 Grade D
7	1	Handwheel	Carbon steel	API 5L Grade B
9	1	O-ring	* NBR	-
11	1	Bevel drive gear	Alloy steel	AISI SAE 9840
13	4	Key	Carbon steel	AISI SAE 1040
14	1	Gear box	Aluminium	ASTM B85-73 Alloy S12B
15	1	O-ring	* NBR	-

NOTE:
* Recommended spare parts

Table 32. Item Description (Continued)

Item	Quantity	Description	Material	Equivalence to USA Standards
16	1	O-ring	* NBR	-
17	1	Drive sleeve	* Carbon steel	API 5LX Grade X52
18	1	Jackscrew	Alloy steel + Bronze	AISI SAE 9840 + ASTM B427 Alloy 908
19	1	Stop setting screw	Carbon steel	AISI SAE 1040
20	1	Nut	Carbon steel	ASTM A194 Grade 2
21	1	Axial needle bearing	Alloy steel	AISI SAE 9840
22	1	Thrust bearing washer	Alloy steel	AISI SAE 9840
23	1	O-ring	* NBR	-
24	2	Bushing	Steel + Bronze +PTFE	-
25	1	Washer	Carbon steel	AISI SAE 1040
26	1	Screw	Carbon steel	AISI SAE 1040
27	1	Key	Alloy steel	AISI SAE 9840
28	1	Bevel pinion	Alloy steel	AISI SAE 9840
29	2	Axial bearing washer	Alloy steel	AISI SAE 9840
30	1	O-ring	* NBR	-
31	4	Screw	Alloy steel	ASTM A320 L7
32	1	Bushing	Stainless steel	AISI 340
34	1	Washer	Carbon steel	AISI SAE 1040
35	1	Sealing washer	PVC	-
36	1	Screw	Carbon steel	AISI SAE 9840

NOTE:
* Recommended spare parts

5.2.4 ALGAS-QA (with Stop Setting Screw Cover) Actuator

5.2.4.1 Replacement of Cylinder Seals

Refer to Figure 55 for sectional drawing.

1. Measure the protrusion of the stop screw (26) with reference to the end flange (22) surface, 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).

5.2.4.1.1 Seals Replacement

Prior to reassembly, check if the actuator components are in good condition and clean. Lubricate all the surfaces of the parts, that 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 a 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 placed.
5. Screw the new O-rings with the protection covers onto the stop screw until it touches the end flange.

5.2.4.1.2 Cylinder Reassembly

1. Carefully clean the inside of the tube (19) and inspect the entire surface, especially the bevels, to ensure there is no damage. Apply a protective film of grease to the inner surface of the tube and the bevels at both ends. Slide the tube onto the piston, ensuring that the piston O-ring (49) and the head flange O-ring (47) is not damaged.
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 to 10 full actuator movements) 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 55. ALGAS-QA "Quick-Acting" Spring-Return Pneumatic Actuator

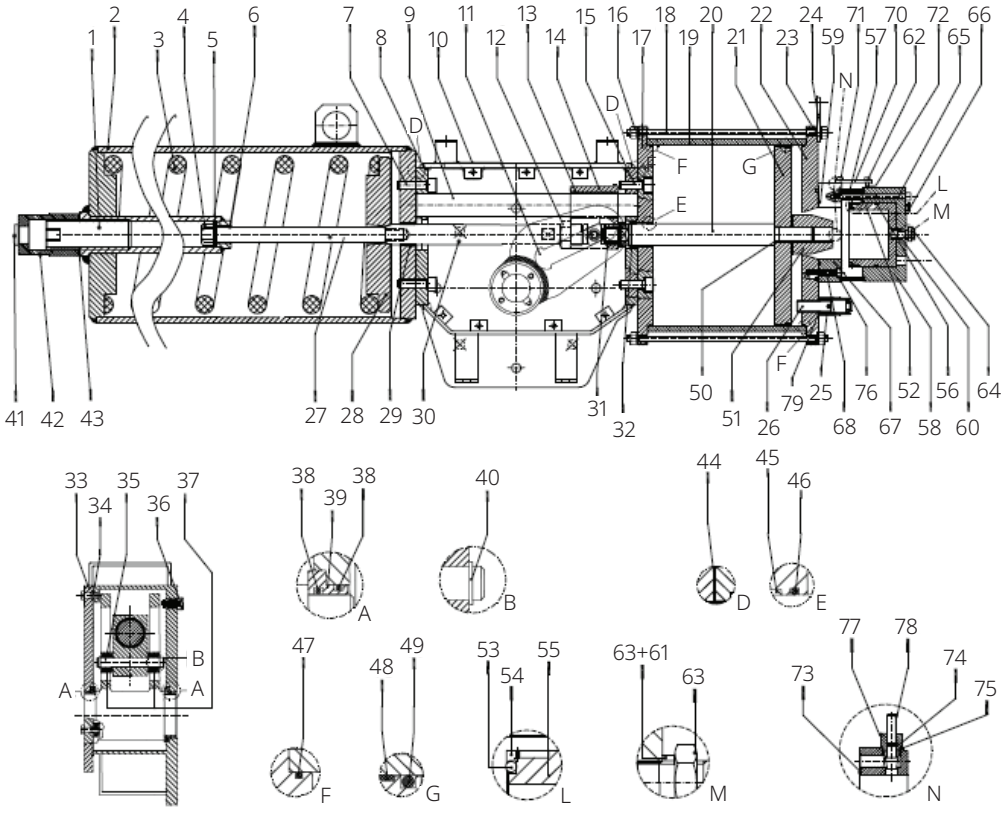


Table 33. Item Description

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		

5.2.5 ALGAS-QA (without Stop Setting Screw Cover) Actuator

5.2.5.1 Replacement of Cylinder Seals

Refer to Figure 56 for sectional drawing.

1. Measure the protrusion of the stop screw (26), with reference to the end flange (22) surface, 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).

5.2.5.1.1 Seals Replacement

Prior to reassembly, check if the actuator components are in good condition and clean. Lubricate all the surfaces of the parts, that move in contact with other components, by recommended grease (AGIP-ENI LCX 2/32 if seals are in NBR/Viton or neoprene rubber, or with Aeroshell Grease 7 if the seals are in fluorosilicon rubber). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with a protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective 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 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 placed.
5. Screw the new O-rings with the protection covers onto the stop screw until it touches the end flange.

5.2.5.1.2 Cylinder Reassembly

1. Carefully clean the inside of the tube (19) and inspect the entire surface, especially the bevels, to ensure there is no damage. Apply a protective film of grease to the inner surface of the tube and the bevels at both ends. Slide the tube onto the piston, ensuring that the piston O-ring (49) and the head flange O-ring (47) is not damaged.
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 to 10 full actuator movements) 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 56. ALGAS-QA "Quick-Acting" Spring-Return Pneumatic Actuator

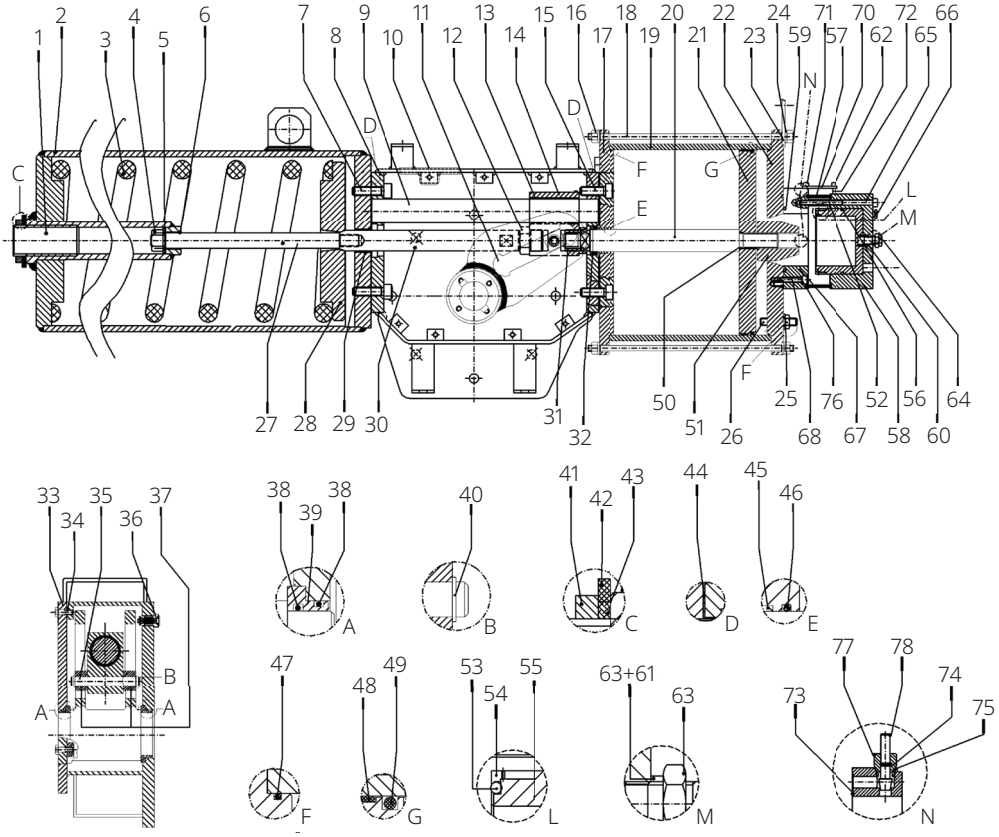


Table 34. Item Description

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

5.2.6 ALGAS with Stop Setting Screw Cover

5.2.6.1 Replacement of Cylinder Seals

Refer to Figure 57.

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 stop setting screw cover (25) and unscrew the stop screw (26) until it is removed from the end flange (22) together with the cover (25), the plug (51) and the O-ring (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).

5.2.6.1.1 Seals Replacement

Prior to reassembly, check if the actuator components are in good condition and clean. Lubricate all the surfaces of the parts, that move in contact with other components, by recommended grease (Molykote 2003 or Lubcon Turmoplex LTA 2 if seals are NBR/Viton or neoprene rubber, with Mobilgrease 33 if the seals are in fluorosilicone rubber). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with a protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective 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-ring (50) from the stop screw cover (25). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the sealing is placed.
5. Screw the new O-rings with the protection covers onto the stop screw until it touches the end flange.

5.2.6.1.2 Cylinder Reassembly

1. Carefully clean the inside of the tube (19) and inspect the entire surface, especially the bevels, to ensure there is no damage. Apply a protective film of grease to the inner surface of the tube and the bevels at both ends. Slide the tube onto the piston, ensuring that the piston O-ring (49) and the head flange O-ring (47) is not damaged.
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 to 10 full actuator movements) 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 57. ALGAS Spring-Return Pneumatic Actuator

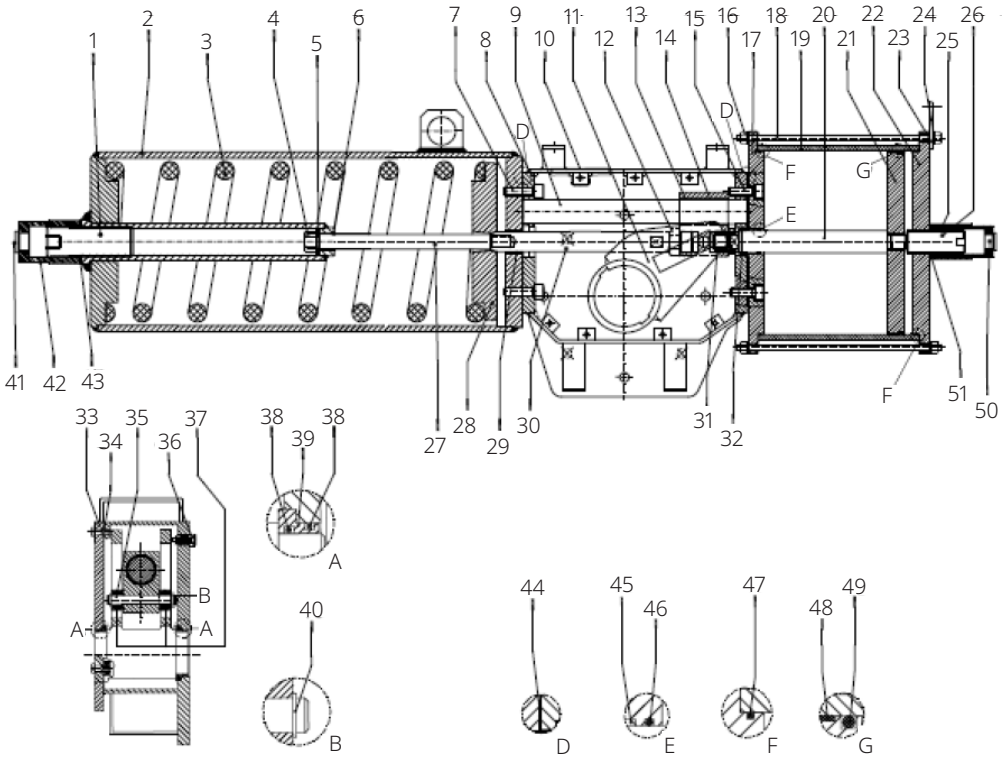


Table 35. Item Description

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

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 is 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 relubrication:

ENI MU/EP/2 * and **

To be used in standard temperature conditions:	-30 to +85 °C
NLGI (National Lubricating Grease Institute) consistency:	2
Worked penetration:	280 dmm
ASTM Dropping Point:	185 °C
Base oil viscosity at 40 °C:	160 mm^2/s
ISO Classification:	L-X-BCHB 2
DIN 51 825:	KP2K - 20
Equivalent to:	Use an equivalent or better product in compliance with the grease proposed in the actual scope of supply by Biffi. Your grease supplier can verify and propose an alternative product at your responsibility.

Mobilgrease 33 or Equivalent **

To be used in low temperature conditions:	-60 to +100 °C

Notes:

* If the service is not special (i.e., oxygen, hydrogen or other mentioned during the offer stage).

** Use an equivalent or better product in compliance with the grease proposed in the actual scope of supply by Biffi. Your grease supplier can verify and propose an alternative product at your responsibility.

5.4 Dismantling and Tear Down

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 releasing. It moves the actuator and consequently the valve, in its fail-safe position.

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

Lift the actuator using the proper lifting points, see Sections 2.2 to 3.5.

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

NOTICE

The tear down 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 appropriate waste collection sites, as provided by the laws and provisions in force.

Section 6: Troubleshooting

6.1 Failure or Breakdown Research

Table 36. Troubleshooting

Event	Possible Cause	Remedy
Actuator does not work	Lack of power supply	Provide the air supply
	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
	Low supply pressure	Restore the pressure working condition (Section 3.8)
	Clogged filter	Clean or replace the cartridge
	Failure of the control group	Call Biffi Italia s.r.l. customer service
Actuator too slow	Low supply pressure	Restore the pressure working condition (Section 3.8)
	Wrong calibration of flow regulator valves	Restore (Section 3.7)
	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 (Section 3.8)
	Bad functioning of booster/quick exhaust valve	Call Biffi Italia s.r.l. customer service
	Wrong calibration of flow regulator valves	Restore (Section 3.7)
Leakages on hydraulic 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 (Section 3.8)
	Wrong warning of microswitches	Restore (Section 3.9)
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 Replacement Procedure

Figure 58. Scotch Yoke Mechanism (Base Model - Applicable To All Models)

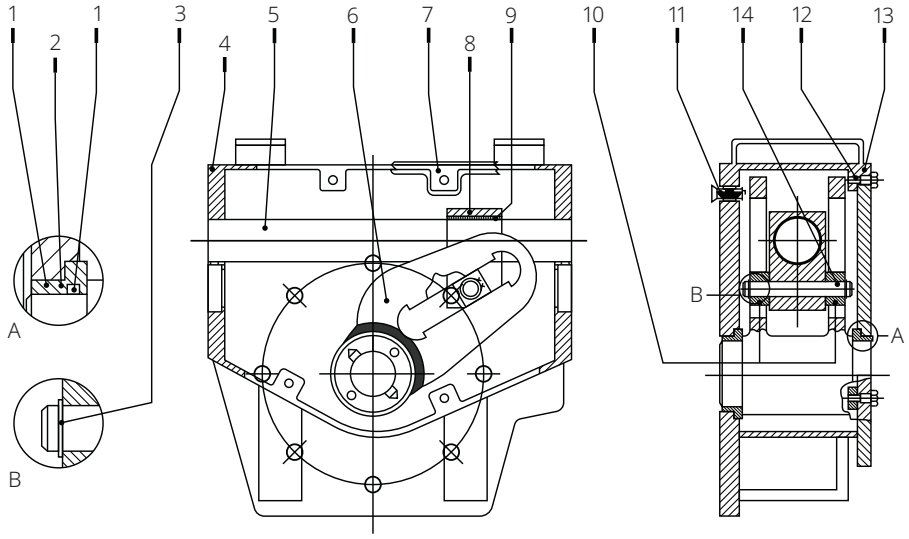


Table 37. Item Description

Item	Quantity	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	* Styrene Butadiene Rubber (SBR) + Cellulose + Fillers
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

NOTE:
* Recommended spare parts
Cycles performed by actuator in a 25 years expected lifetime - the minimum performed cycles are guarantied by Biffi based on service conditions listed:
- All the valve required torques have to be lower than actuator max operating torque (design torque).
- The ratio between valve required running torque and actuator max operating torque (design torque) has to be >1.5.
- The actuator mechanism has to be lubricated in accordance witn indication given on this IOM.

NOTICE

For special scotch yoke mechanism version or heavy-duty service application, refer to Fiorenzuola plant.

Figure 59. ALGAS MHW with Screw Protection

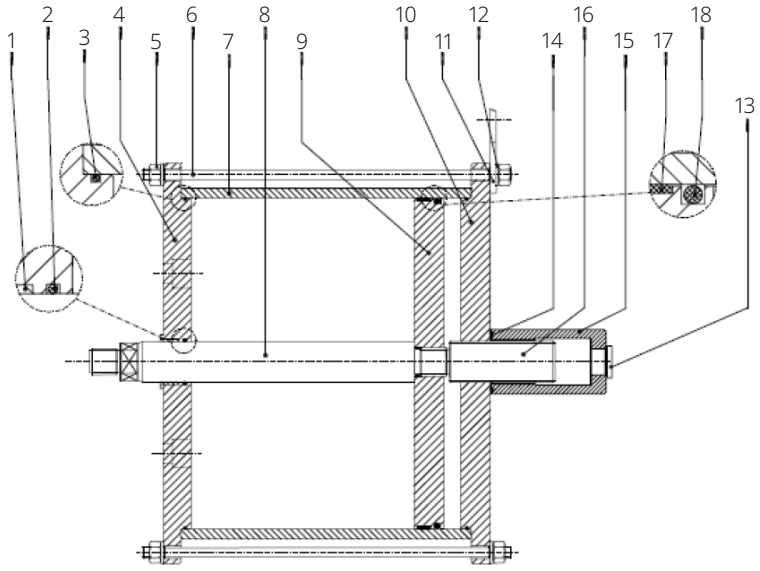


Table 38. Item Description

Item	Quantity	Description	Material
1	1	Piston rod bushing	Steel + Bronze + PTFE
2	1	O-ring	* Viton
3	2	O-ring	* Viton
4	1	Head flange	Carbon steel
5	8	Nut	Carbon steel
6	4	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	8	Spring washer	Carbon steel
13	1	Plug with Viton gasket	Stainless steel + Viton
14	1	O-ring	* NBR
15	1	Stop setting screw cover	Carbon steel or refer to the scope of supply
16	1	Stop setting screw	Carbon steel
17	1	Guide sliding ring for piston	* PTFE + Graphite
18	1	O-ring	* Viton

NOTE:
* Recommended spare parts

Figure 60. ALGAS-QA with Screw Protection

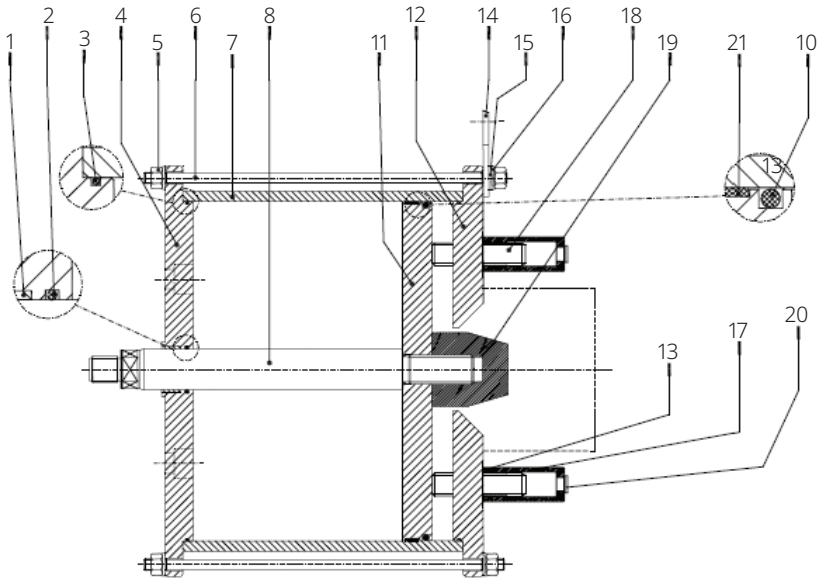


Table 39. Item Description

Item	Quantity	Description	Material
1	1	Piston rod bushing	Steel + Bronze + PTFE
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
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	* PTFE + Graphite

NOTE:
* Recommended spare parts

Figure 61. ALGAS-QA without Screw Protection

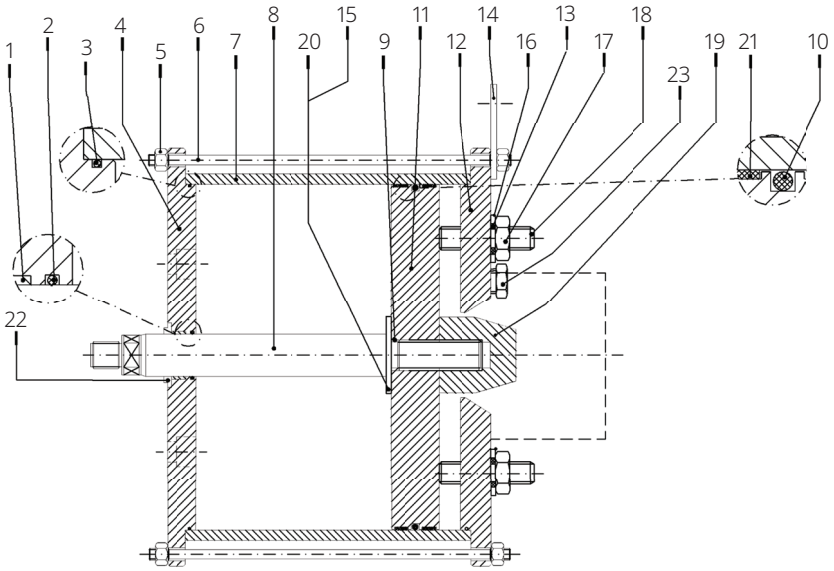


Table 40. Item Description

Item	Quantity	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	32	Nut	Alloy steel ASTM A194 Grade 7
6	16	Tie rod	Alloy steel ASTM A320 Grade L7
7	1	Cylinder tube	Nickel plated carbon steel
8	1	Piston rod	Alloy steel
9	1	O-ring	* NBR
10	1	O-ring	* NBR
11	1	Piston	Carbon steel
12	1	End flange	Carbon steel
13	2	Sealing washer	PVC
14	1	Lifting eyelet	Carbon steel
15	1	O-ring	* NBR
16	2	Washer	Carbon steel
17	2	Nut	Carbon steel
18	2	Stop setting screw	Alloy steel
19	1	Damper	Aluminium
20	1	Washer	Carbon steel
21	2	Piston seal ring	* PTFE + Graphite
22	1	Centering washer	Alloy steel
23	1	Plug	Carbon steel

NOTE:
* Recommended spare parts

Figure 62. ALGAS and ALGAS MHP without Screw Protection

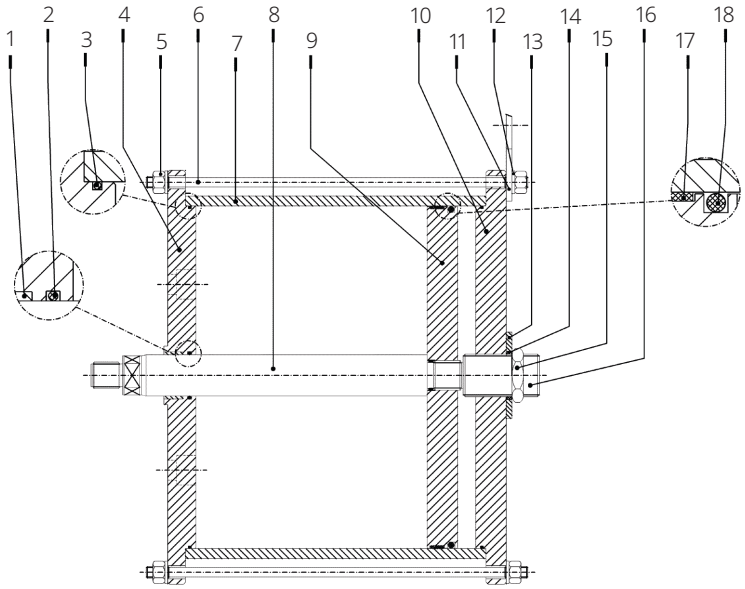


Table 41. Item Description

Item	Quantity	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

NOTE:
* Recommended spare parts

Figure 63. All Configurations without Screw Protection

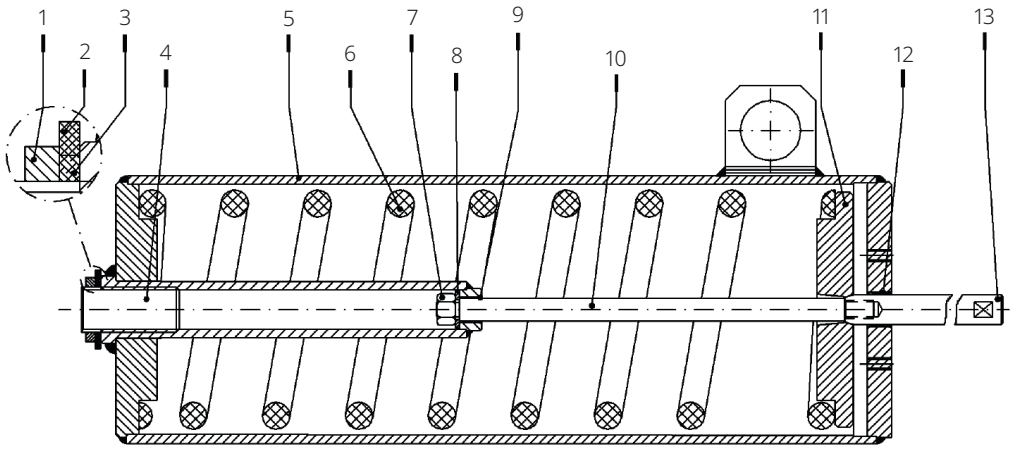


Table 42. Item Description

Item	Quantity	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)

NOTE:
* Recommended spare parts

Figure 64. Spring Cartridge with Setting Screw Protection

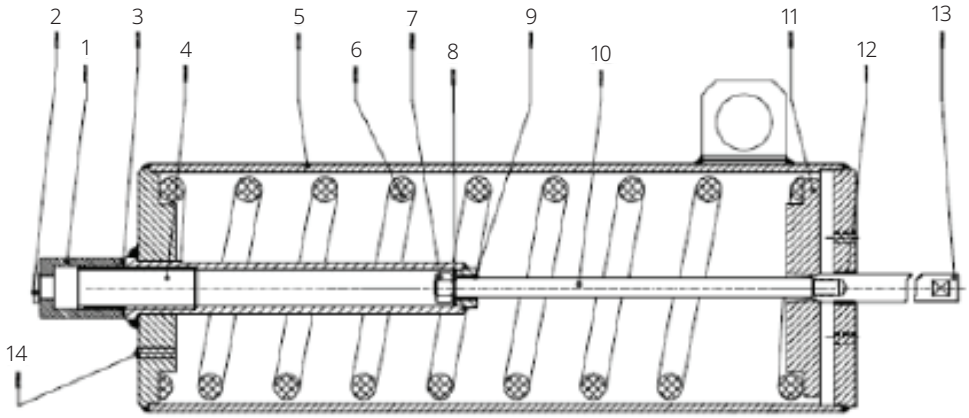
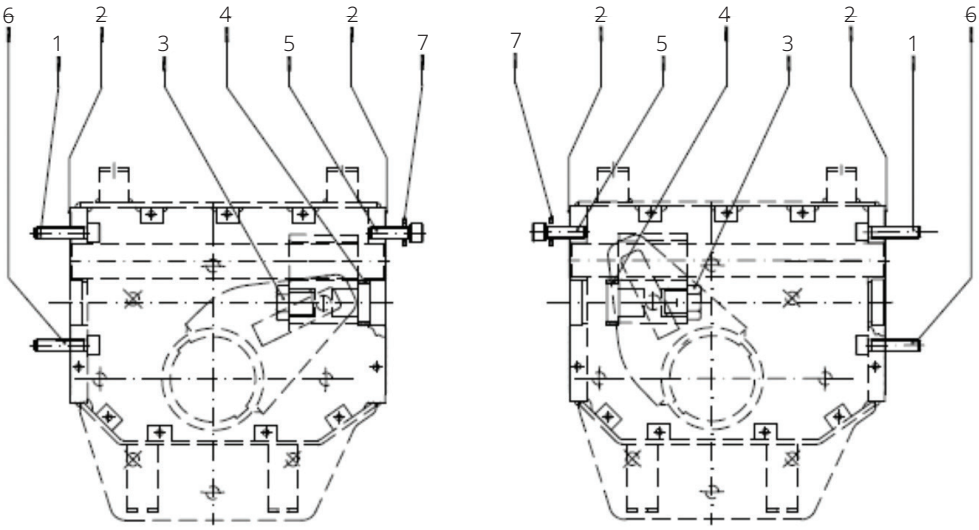


Table 43. Item Description

Item	Quantity	Description	Material
1	1	Stop setting screw cover	Carbon steel
2	1	Plug with gasket	Stainless steel + Viton
3	1	O-ring	* NBR
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 + 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)
14	1	Plug	Stainless steel + Viton

NOTE:
* Recommended spare parts

Figure 65. All Configurations - Assembly Kit



SPRING TO CLOSE ASSEMBLY SPRING TO OPEN ASSEMBLY

Table 44. Item Description

Item	Quantity	Description	Material
1	4	Screw	Alloy steel
2	2	Gasket	* SBR + Cellulose + fillers
3	1	Plug	Carbon steel
4	1	Washer	* Carbon steel
5	4	Screw	Alloy steel
6	4	Screw	Alloy steel
7	4	Washer	Copper

NOTE:
* Recommended spare parts

Figure 66. ALGAS-QA Quick Exhaust Valve

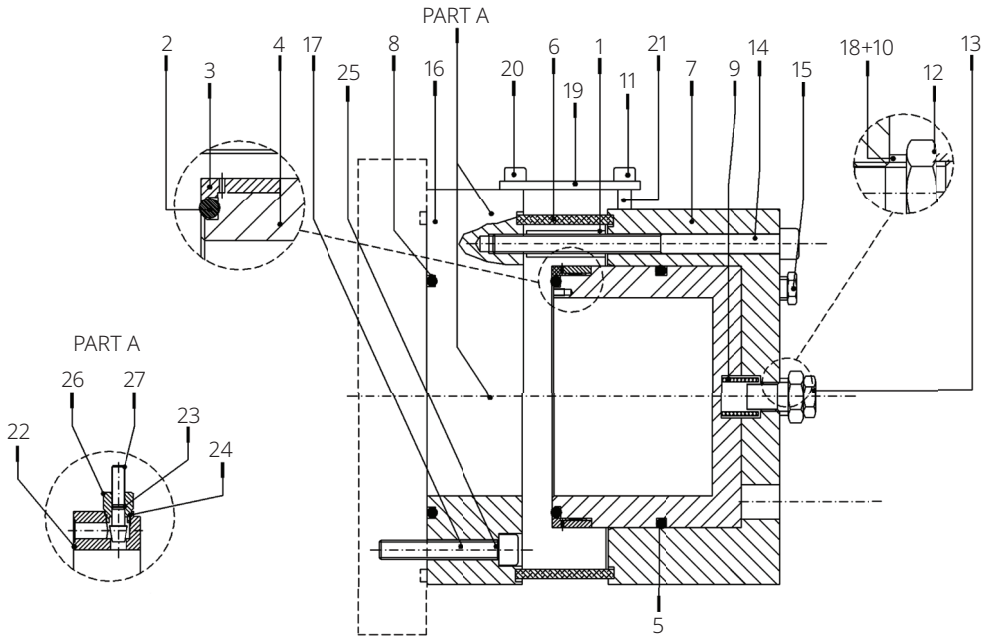


Table 45. Item Description

Item	Quantity	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

Figure 67. Hydraulic Control Unit MHP

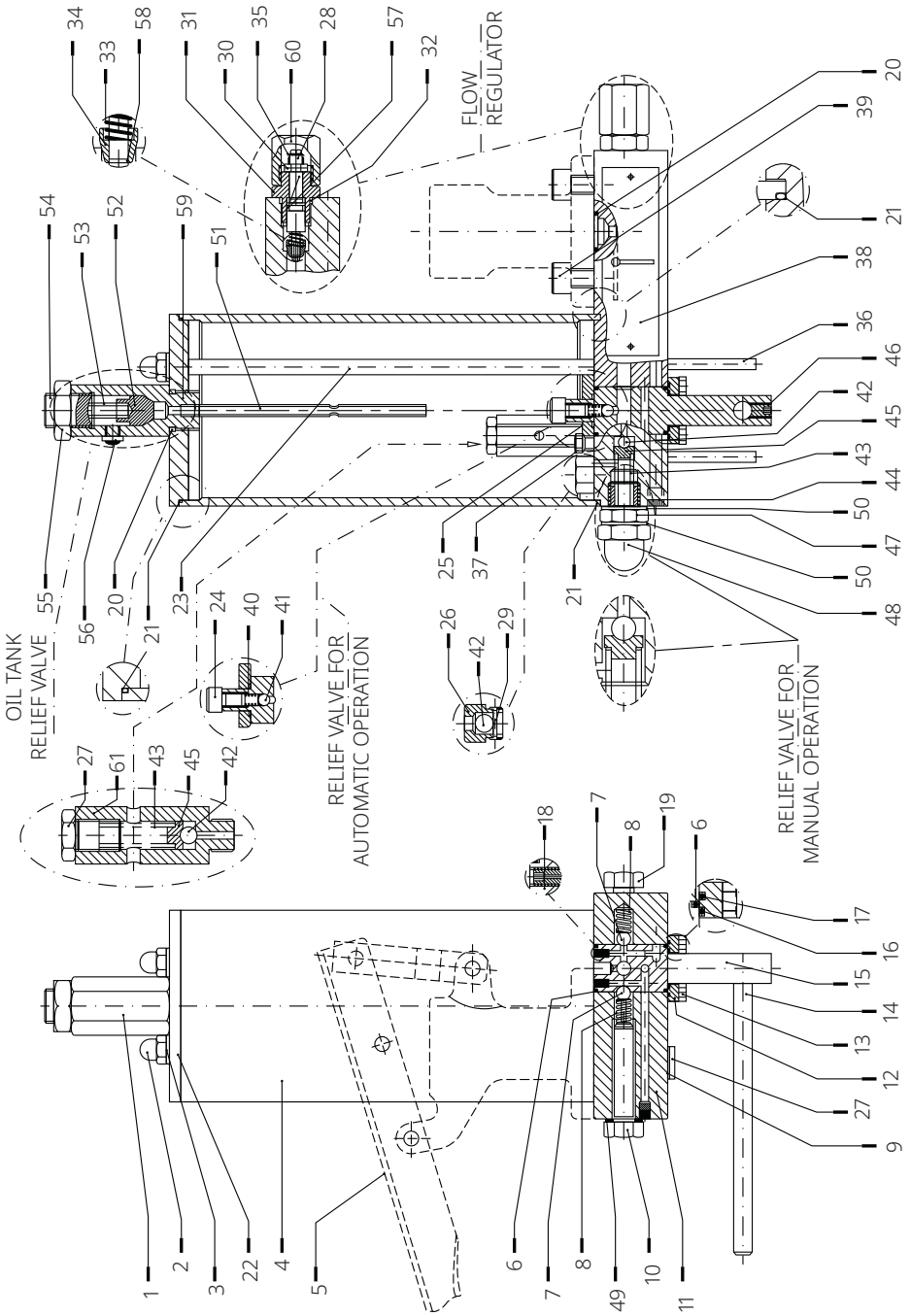


Table 46. Parts List

Item	Quantity	Description	Material
1	1	Dipstick	-
2	2	Cap nut	Carbon steel
3	2	Washer	Carbon steel + rubber
4	1	Hydraulic tank	Carbon steel
5	1	Hand pump	Refer to Table 32
6	2	O-ring	* Fluorosilicon rubber
7	2	Ball	Stainless steel
8	2	Spring	Spring steel
9	1	Washer	Carbon steel + rubber
10	1	Screw	Carbon steel
11	1	Plate	Carbon steel
12	1	Flange	Aluminum
13	4	Screw	Carbon steel
14	1	Lever	Carbon steel
15	1	Distributor	Stainless steel
16	1	O-ring	* Fluorosilicon rubber
17	1	O-ring	* Fluorosilicon rubber
18	1	Nozzle	Carbon steel
19	2	Screw	Carbon steel
20	3	O-ring	* Fluorosilicon rubber
21	2	O-ring	* Fluorosilicon rubber
22	1	Tank cover	Carbon steel
23	2	Tie rod	Carbon steel
24	1	Screw	Carbon steel
25	1	Flange	Aluminum
26	2	Check valve body	Aluminum
27	2	Plug	Carbon steel
28	2	Flow control valve setting screw	Stainless steel
29	2	Spring pin	Stainless steel
30	2	Nut	Carbon steel
31	2	Flange	Carbon steel

NOTE:
* Recommended spare parts

Table 47. Parts List (Continued)

Item	Quantity	Description	Material
3	2	O-ring	* Fluorosilicon rubber
33	2	Spring	Spring steel
34	2	Plug	Stainless steel
35	2	Retainer ring	Spring steel
36	2	Spring pin	Carbon steel
37	4	Screw	Carbon steel
38	1	Operation instruction plate	Stainless steel
39	4	Screw	Carbon steel
40	1	Spring	Stainless steel
41	1	Ball	Stainless steel
42	4	Ball	Stainless steel
43	2	Spring	Spring steel
44	1	Relief valve setting screw	Stainless steel
45	2	Spring pin	Carbon steel
46	1	Screw	Alloy steel
47	1	Spring	Stainless steel
48	1	Nut	Carbon steel
49	1	Washer	Carbon steel + rubber
50	2	Washer	Carbon steel + rubber
51	1	Dipstick	Stainless steel
52	1	Plug + O-ring	*
53	1	Spring	Stainless steel
54	1	Screw	Alloy steel
55	1	Nut	Carbon steel
56	1	Silencer	Brass
57	2	O-ring	* Fluorosilicon rubber
58	2	Retainer ring	Spring steel
59	1	Dipstick body	Aluminum
60	2	Nut	Carbon steel
61	1	Relief valve body	Aluminum

NOTE:
* Recommended spare parts

Figure 68. Hand Pump

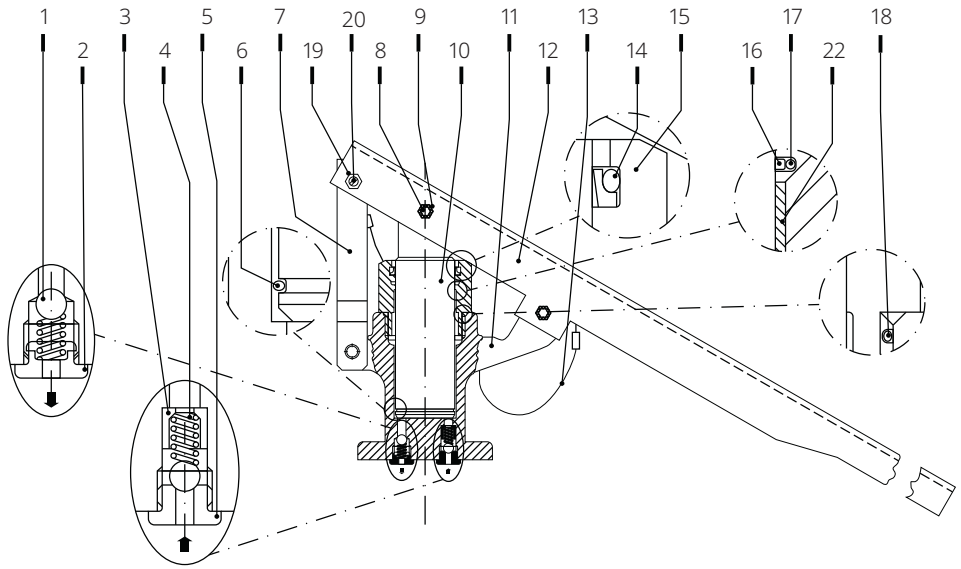


Table 48. Parts List

Item	Quantity	Description	Material
1	2	Ball	Stainless steel
2	1	Delivery valve bush	Carbon steel
3	1	Suction valve bush	Carbon steel
4	2	Spring	Stainless steel
5	1	Suction valve ring	Carbon steel
6	1	Spring retainer ring	Carbon steel
7	1	Fork	Carbon steel
8	2	Pin	Stainless steel
9	4	Retainer ring	Carbon steel
10	1	Rod	Alloy steel
11	1	Body	Carbon steel
12	1	Lever	Carbon steel
13	1	Split pin with rope	Nylon + Carbon steel
14	1	Scraper ring	* PTFE + Fluorosilicon rubber
15	1	Threaded bush	Aluminum
16	2	Rod seal ring	* PTFE + Graphite
17	2	O-ring	* Fluorosilicon rubber
18	1	O-ring	* Fluorosilicon rubber
19	1	Nut	Carbon steel
20	1	Screw	Carbon steel
21	1	Fork	Carbon Steel
22	1	Piston rod bushing	Steel + Bronze + PTFE

NOTE:
* Recommended spare parts

Figure 69. Jackscrew Manual Override MSJ or MHW

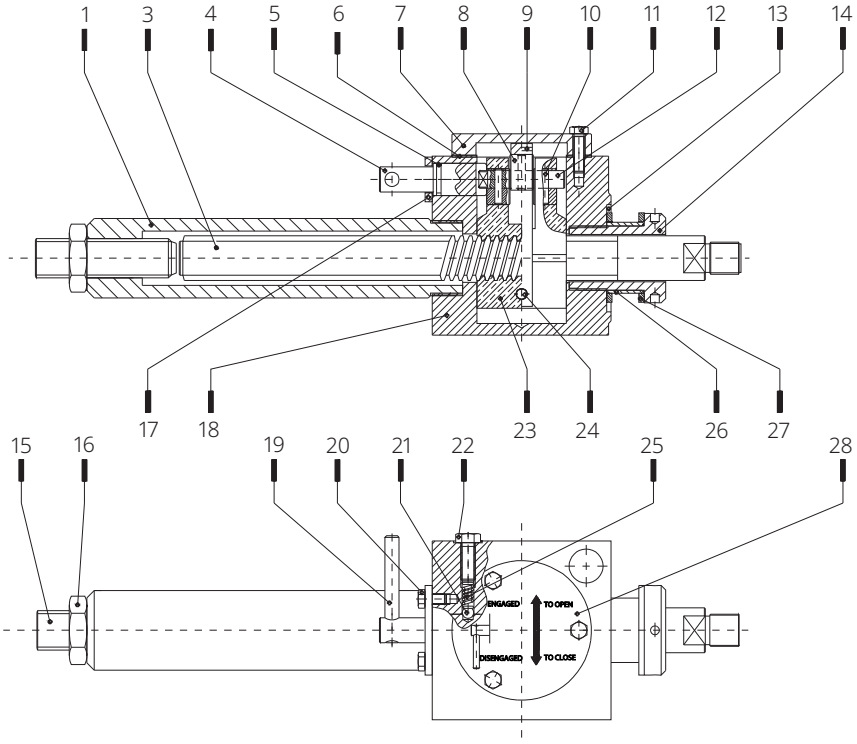


Table 49. Parts List

Item	Quantity	Description	Material	Item	Quantity	Description	Material
1	1	Protection pipe	Carbon steel	15	1	Screw	Carbon steel
2	-	-	-	16	1	Nut	Carbon steel
3	1	Jackscrew	Carbon steel	17	1	Flange	Carbon steel
4	1	Engagement lever pin	Stainless steel	18	1	Body	Carbon steel
5	1	O-ring	* Fluorosilicon rubber	19	1	Spring pin	Spring steel
6	1	Cover gasket	*Fiber	20	2	Screw	Carbon steel
7	1	Cover	Carbon steel	21	1	Ball 1/4 in.	Stainless steel
8	3	Cam	Alloy steel	22	1	Screw	Carbon steel
9	1	Fork	Carbon steel	23	1	Screw nut	Bronze
10	3	Spring pin	Stainless steel	24	1	Pin	Carbon steel
11	3	Screw	Carbon steel	25	1	Spring	Spring steel
12	1	Screw nut operating cam	Alloy steel	26	1	Bush	Bronze
13	1	O-ring	* Fluorosilicon rubber	27	2	Thrust shoulder washer	Bronze
14	1	Thrust nut operating cam	Alloy steel	28	1	Operating instruction plate	Aluminum

NOTE:
* Recommended spare parts

Section 8: Spare Parts

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

Please send all spare parts requests to:

Biffi Italia s.r.l. – Spare Parts and After Sales Department

Tel.: +39 0523-944523

Fax: +39 0523-941885

E-mail: 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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www.biffi.it or contact us at biffi_italia@biffi.it

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