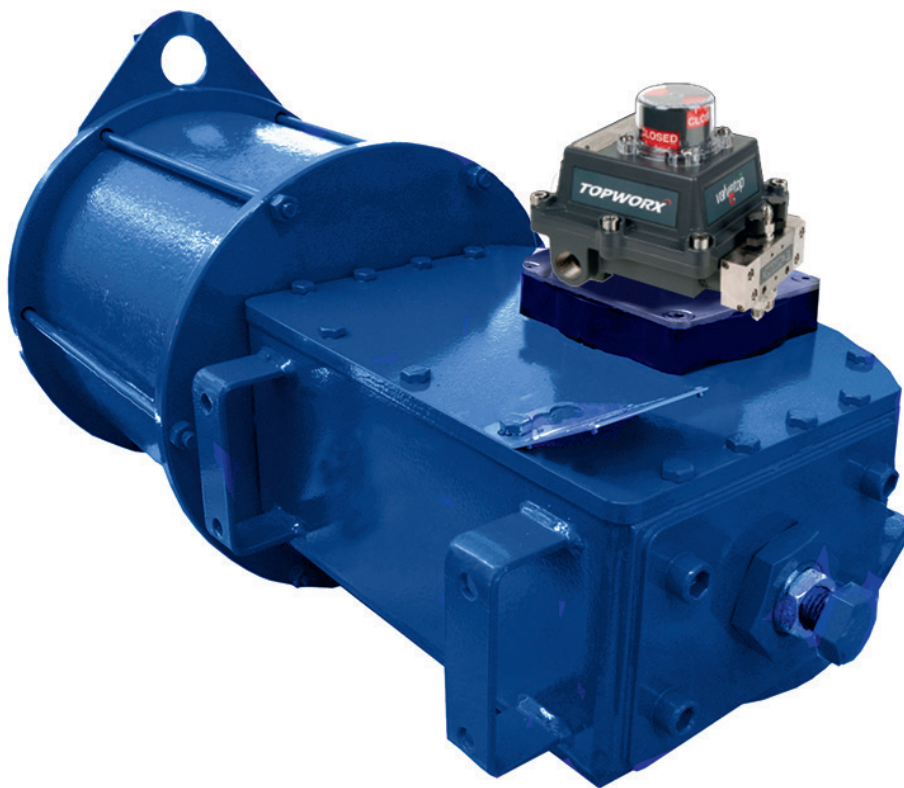


# Biffi ALGA

## Double-Acting Pneumatic Actuator



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Date Report for Maintenance Operations.....68

**NOTICE**

Biffi Italia s.r.l. pays the highest attention to collecting and verifying the documentation contained in this Installation, Operation and Maintenance (IOM) Manual. However, Biffi Italia s.r.l. is not liable for any mistakes contained in this manual for damage or accidents due to the use of the latter. The information contained is of exclusive reserved ownership of Biffi Italia s.r.l. and may be modified without prior notice. All rights reserved.

## 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 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 PED equipment

**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

#### 1.1.2 Terms and Conditions

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

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




## 1.2 Identification Plate

### **⚠ WARNING**

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

The plate fastened on the actuator contains the following information (Figure1).

**Figure 1. Data Plate**

 <b>BIFFI</b>		Manufacturer: BIFFI ITALIA Strada Biffi, 165 29017 Fiorenzuola D'ARDA (PC) - ITALY	
Order _____			
Model _____			
ACTUATOR	S/N _____	MM/YYYY _____	
	ACTAG N° _____	ND _____	
Supply Press.Range _____		MOP _____	
Amb.Temp. _____			
CYLINDER	Fl.Type _____	Fl.Group _____	PED Cat. _____
	TS _____	Test Date _____	_____
PS _____	PT _____	Cyl.Weight _____	
		Ref: _____	WARNING: Potential Electrostatic Charging Hazard See Instructions

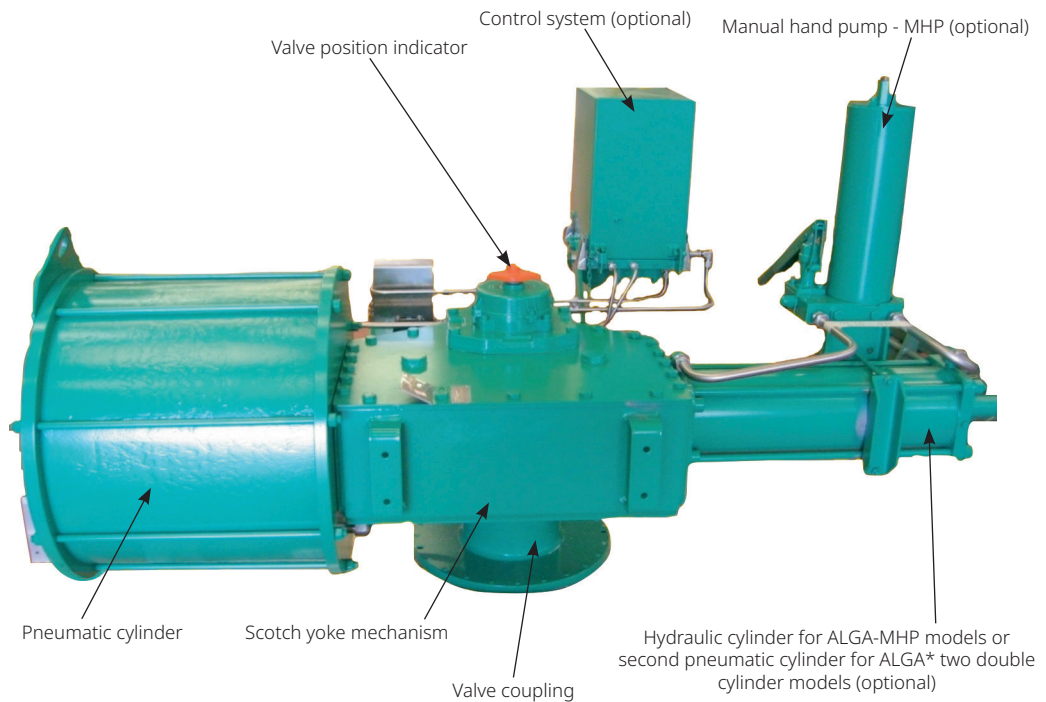
## 1.3 Introducing the Actuator

The ALGA actuators was engineered and is manufactured to provide maximum torque output with minimum supply pressure. ALGA actuators are suitable for the operation of any quarter turn operation such of ball, plug, butterfly valves or dampers, in both on/off and modulating heavy duty service.

The actuator (see Figure 2) is made up of a weatherproof scotch yoke mechanism transforming the linear movement of the pneumatic cylinder (on closing or opening) into the rotary movement, which is necessary for operation. The angular stroke of the yoke is adjustable between 82° and 98° by means of the external mechanical stops screwed into the left wall of the mechanism housing and into the end flange of the pneumatic cylinder. The cover of the scotch yoke mechanism is arranged for the assembly of the required accessories (positioner, signalling limit switches, position transducer, 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 the internal hole of which is machined (by Biffi or at customer's care), according to the shape and dimensions of the valve stem. Biffi can supply different types of control system following customers requirements.

The expected lifetime of actuator is approximately 25 years .

**Figure 2. Identification of Actuator Parts**



NOTE:  
\* C or S canted or symmetric

## 1.4 Data Sheet

Supply fluid	Air, nitrogen or sweet gas, special version available for sour gas
Operating temperature	Standard: from -30 to +100 °C Optional: from -60 to +200 °C
Supply pressure	Please refer to technical document: "actuator data sheet"
Output torque	Up to 750000 Nm (higher value with special version)

## Section 2: Installation

### 2.1 Checks Upon Actuator Receipt

- Check that the model, the serial number of the actuator and the technical data reported on the identification plate correspond with those of order confirmation (Section 1.2).
- Check if the actuator is equipped with the fittings as provided for by order confirmation.
- Check if the actuator was not damaged during transportation. If necessary renovate the painting according to the specification reported on the order confirmation.
- If the actuator is received already assembled with the valve, its settings have already been made at the factory.
- If the actuator is delivered separately from the valve, it is necessary to check, and if required, to adjust, the settings of the mechanical stops (Section 3.4) and of microswitches (if any) (Section 3.5).

### 2.2 Actuator Handling

#### NOTICE

The lifting and handling should be made by qualified staff and in compliance with the laws and provisions in force.

#### ⚠ WARNING

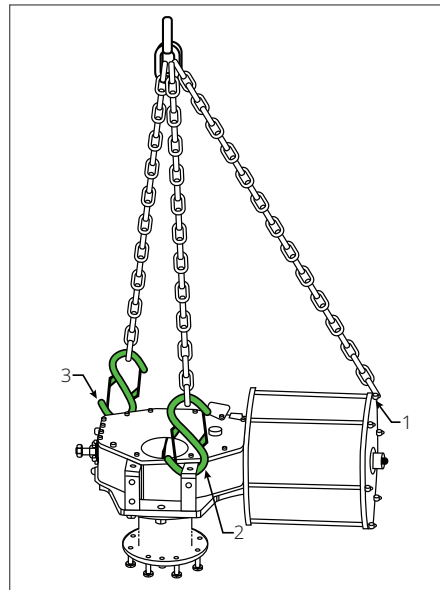
The fastening points are appropriate for the lifting of the actuator alone and not for the valve + actuator assembly. While handling the actuator, avoid passing it above the staff. The actuator should be handled with appropriate lifting means. The weight of the actuator is reported on the delivery bill.

When lifting and moving the actuator, use only hooks fitted with safety latch, like the one shown in Figure 3.

**Figure 3. Example of Hook with Safety Latch**

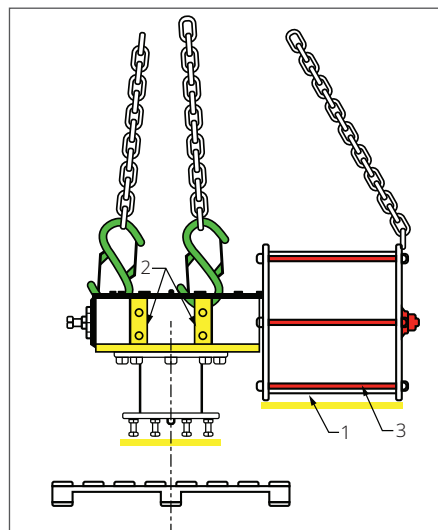


**Figure 4. Lifting Points for ALGA/ALGA-MHP/ALGA-MSJ Actuators (1)**



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

**Figure 5. Lifting Points for ALGA/ALGA-MHP/ALGA-MSJ Actuators (2)**



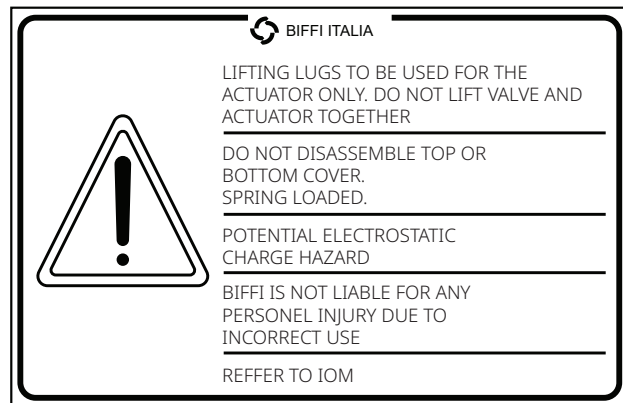
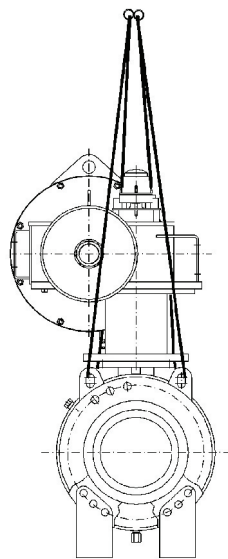
1 = Point of support  
 2 = Supports for lateral positioning  
 3 = Do not lay the actuator on tie-rods of cylinder/s and do not lay the actuator on accessories (manual hand pump, manual jackscrew, pneumatic control group, etc.)

- When lifting unbalanced loads, use ropes of different lengths or chains with adjustable length.
- Always check the conditions of all lifting equipment used and discard it if not in perfect working order.
- Do not knot or twist the ropes so as not to reduce the lifting capacity or produce torsional effects on the load being lifted.
- Exercise 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 shifting sideways in an uncontrolled manner.
- Use slings of such length that the angles of the leg from vertical are as narrow as possible ( $\alpha_{MAX} < 20^\circ$ ).
- During handling, do not transport the suspended actuator above staff members in charge of the operation.

### **⚠ WARNING**

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

**Figure 6. Lifting Warning Label**



### **⚠ 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 wrong lifting operations.

## 2.3 Storage

If the actuator needs storage before installation follow these steps:

- Place it on a wood surface in order not to deteriorate the area of the valve coupling.
- Make sure that plastic plugs are present on the pneumatic and electrical connections (if present).
- Check that the cover of the control group and of the limit switch box (if any) are properly closed.

If the storage is long-term or outdoor:

- Keep the actuator protected from direct weather conditions.
- Replace plastic plugs of pneumatic and electrical connections (if any) with metal plugs that guarantee perfect tightness.
- Coat the valve coupling area with oil, grease or protection disc.
- Periodically operate the actuator (Section 3.3).

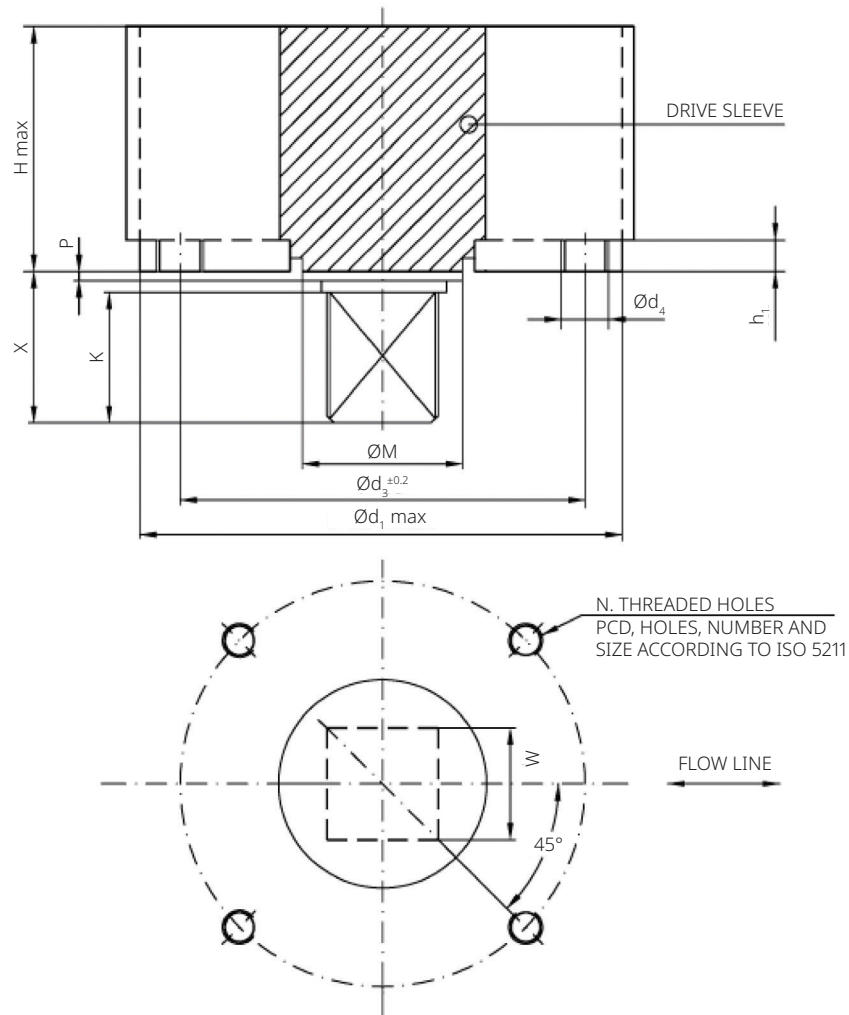
## 2.4 Actuator Assembly on the Valve

### 2.4.1 Types of Assembly

For coupling to the valve, the housing is provided with a flange with threaded holes according to Biffi standard tables (Tables 1 to 7. Please refer to the plant for additional details). 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 centreline in order to allow an easier assembly of an intermediate flange, when required. This intermediate flange (or spool-piece) can be supplied when the valve flange can not directly match the actuator flange in its "standard" configuration. For the biggest actuator models, the actuator flange can be machined in accordance with the valve flange dimensions.

The yoke has bored with keyways for coupling to the valve stem, the dimensions of which are according to Biffi standard tables (Tables 1 to 7. Please refer to the plant for additional details).

**Figure 7. Coupling Dimensions - Model 0.1**



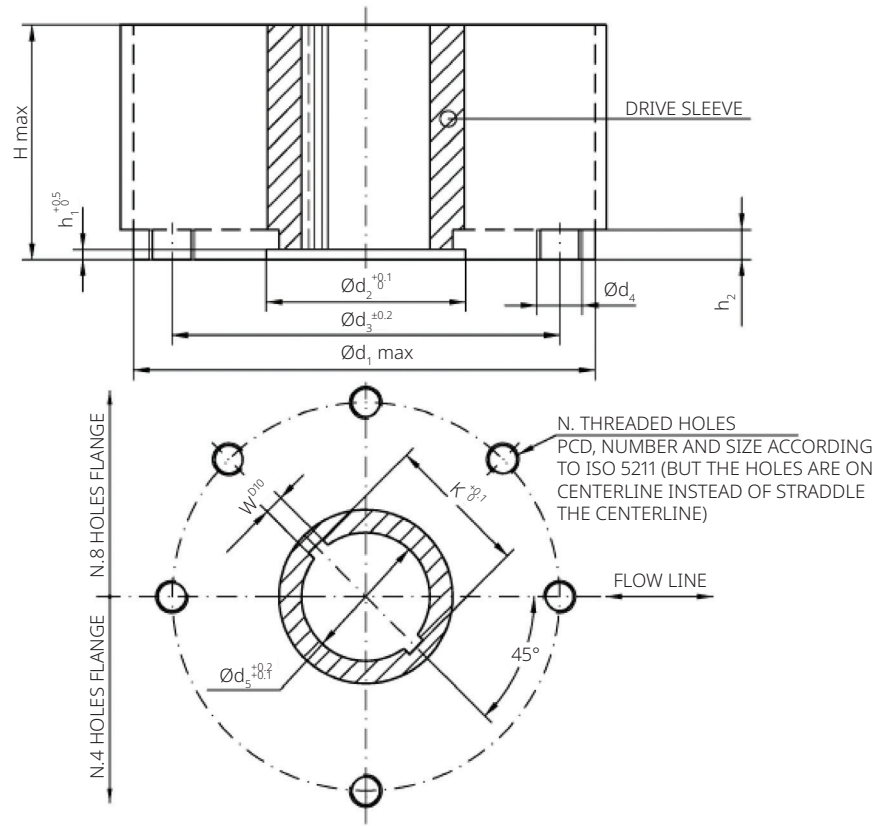
TOP VIEW OF THE SCOTCH YOKE MECHANISM (ACTUATOR SHOWN IN CLOSED POSITION)

**Table 1. Coupling Dimensions - Model 0.1**

Actuator Model	Ød <sub>1</sub>	Ød <sub>3</sub>	Ød <sub>4</sub>	ØM	N	P	h <sub>1</sub>	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 8. Coupling Dimensions - Models 0.3 to 6**



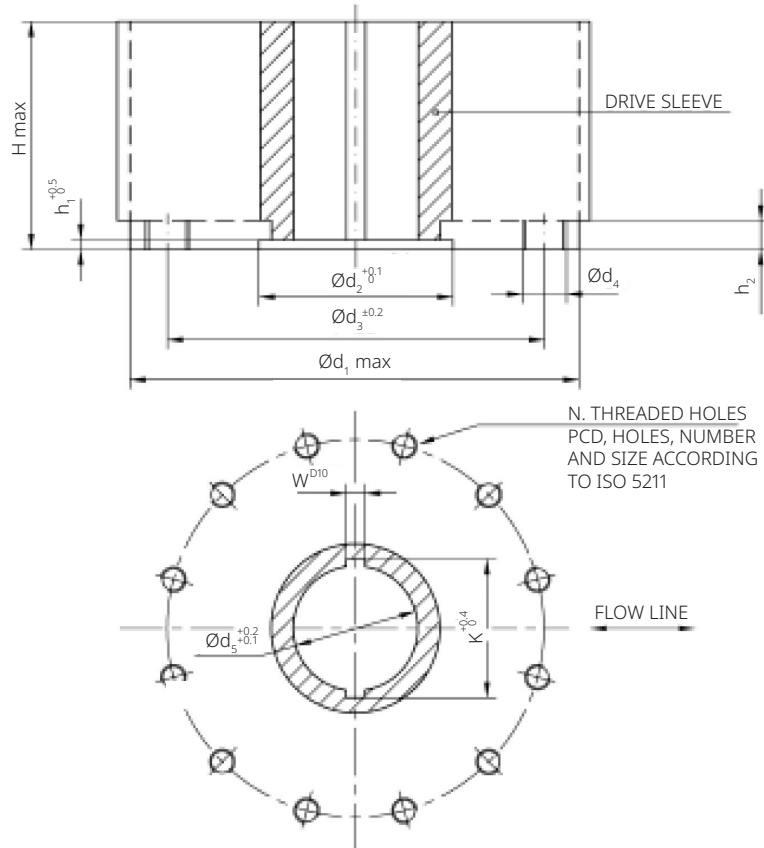
TOP VIEW OF THE SCOTCH YOKE MECHANISM (ACTUATOR SHOWN IN CLOSED POSITION)

**Table 2. Coupling Dimensions - Models 0.3 to 6**

Actuator Model	Ød <sub>1</sub>	Ød <sub>2</sub>	Ød <sub>3</sub>	Ød <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ød <sub>5</sub>	W	K
0.3	240	93	165	M20	4	5	17	127	70	12	75.6
0.9	310	112	254	M16	8	5	19	150	86	14	93.6
1.5	360	144	298	M20	8	6	19	190	112	18	119.0
3	430	195	365	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 9. Coupling Dimensions - Model 14**



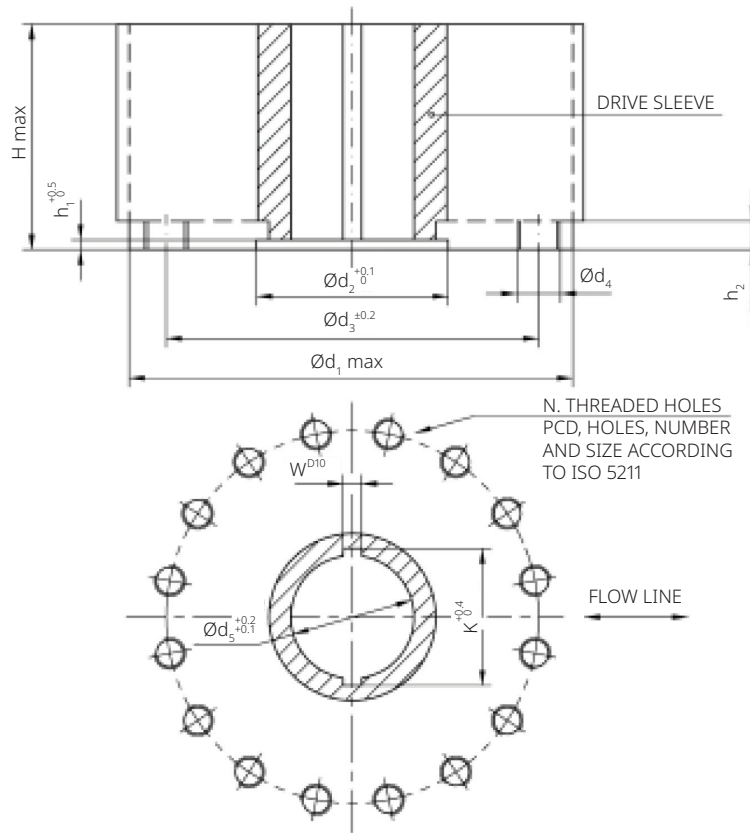
TOP VIEW OF THE SCOTCH YOKE MECHANISM (ACTUATOR SHOWN IN CLOSED POSITION)

**Table 3. Coupling Dimensions - Model 14**

Actuator Model	Ød <sub>1</sub>	Ød <sub>2</sub>	Ød <sub>3</sub>	Ød <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ød <sub>5</sub>	W	K
14	580	250	483	M36	12	10	29	340	175	45	195.8

**NOTE:**  
All dimensions are in millimeters.

**Figure 10. Coupling Dimensions - Models 18 to 42**



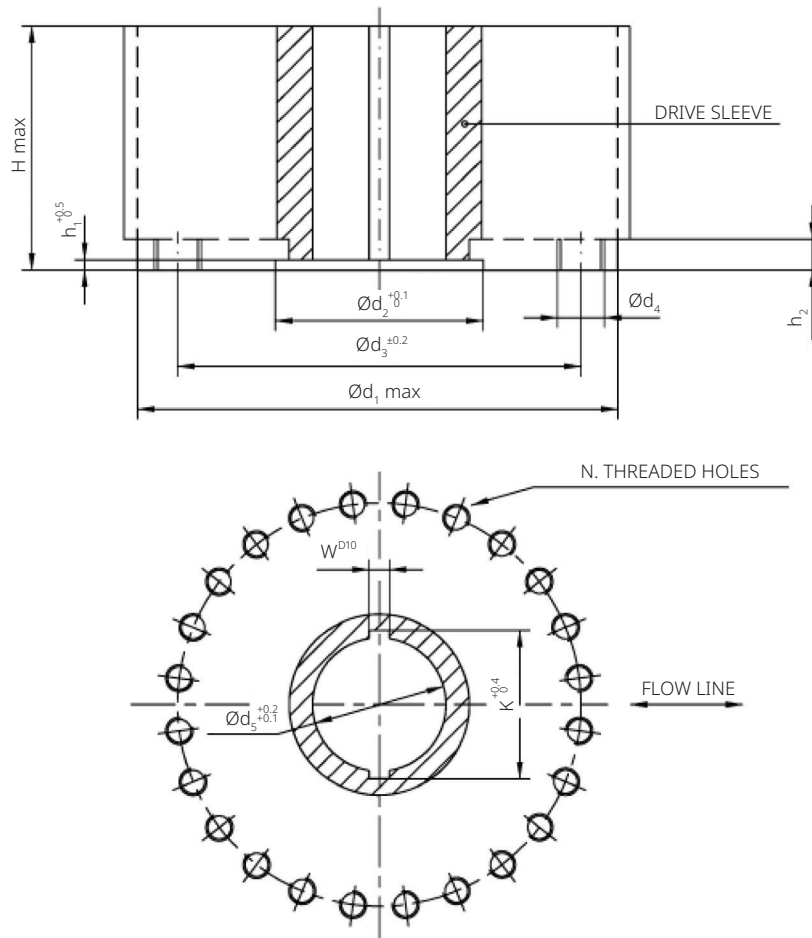
TOP VIEW OF THE SCOTCH YOKE MECHANISM (ACTUATOR SHOWN IN CLOSED POSITION)

**Table 4. Coupling Dimensions - Models 18 to 42**

Actuator Model	$\text{Ø}d_1$	$\text{Ø}d_2$	$\text{Ø}d_3$	$\text{Ø}d_4$	N	$h_1$	$h_2$	H max	$\text{Ø}d_5$	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
35	780	315	603	M36	16	12	32	400	240	56	264.8
42	840	310	603	M36	16	12	32	400	220	50	242.8

**NOTE:**  
All dimensions are in millimeters.

Figure 11. Coupling Dimensions - Models 50 and 60



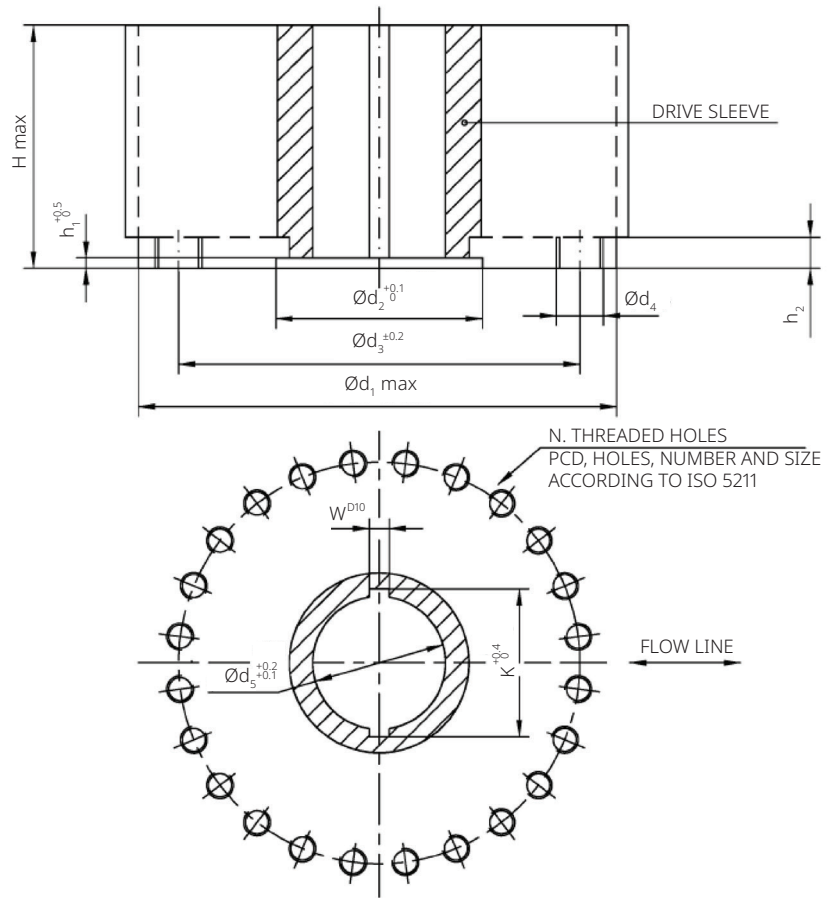
TOP VIEW OF THE SCOTCH YOKE MECHANISM (ACTUATOR SHOWN IN CLOSED POSITION)

Table 5. Coupling Dimensions - Models 50 and 60

Actuator Model	$\varnothing d_1$	$\varnothing d_2$	$\varnothing d_3$	$\varnothing d_4$	N	$h_1$	$h_2$	H max	$\varnothing d_5$	W	K
50	800	315	698	M36	24	10	32	430	240	56	264.8
60	840	315	698	M36	24	10	32	430	240	56	264.8

**NOTE:**  
All dimensions are in millimeters.

**Figure 12. Coupling Dimensions - Models 65 and 80**



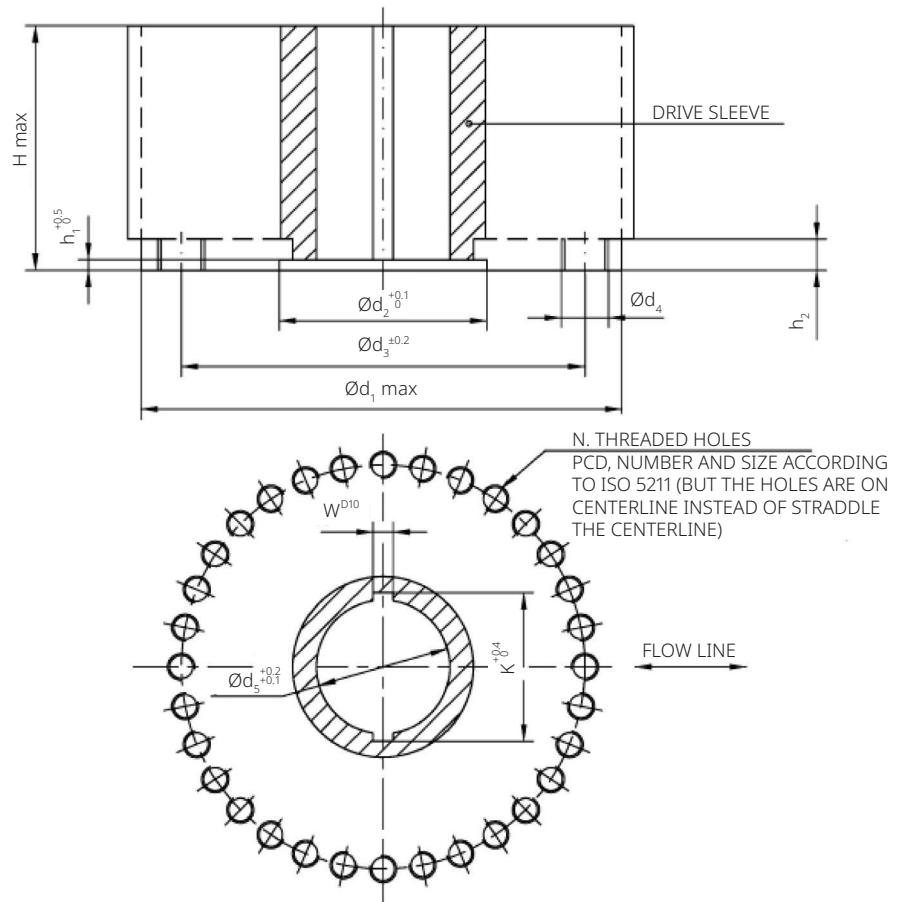
TOP VIEW OF THE SCOTCH YOKE MECHANISM (ACTUATOR SHOWN IN CLOSED POSITION)

**Table 6. Coupling Dimensions - Models 65 and 80**

Actuator Model	Ød <sub>1</sub>	Ød <sub>2</sub>	Ød <sub>3</sub>	Ød <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ød <sub>5</sub>	W	K
65	910	370	813	M42	24	12	37	540	280	46	327.4
80	900	370	813	M42	24	12	37	540	280	46	327.4

**NOTE:**  
All dimensions are in millimeters.

Figure 13. Coupling Dimensions - Model 100



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

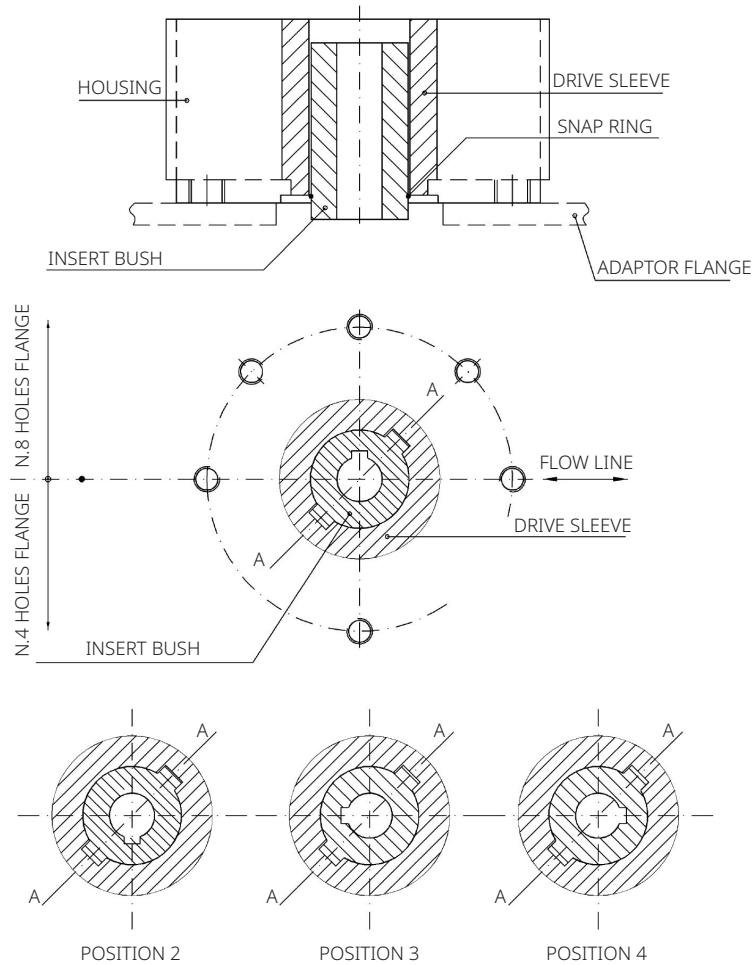
Table 7. Coupling Dimensions - Model 100

Actuator Model	Ød <sub>1</sub>	Ød <sub>2</sub>	Ød <sub>3</sub>	Ød <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ød <sub>5</sub>	W	K
100	1200	450	1042	M42	32	8	57	600	300	70	328.8

**NOTE:**  
All dimensions are in millimeters.

If required, for the standard models size 0.3 to 6, Biffi can supply an insert bush with an unmachined bore in accordance with Biffi standard table SCN6202. On request, the insert bush bore can be machined by Biffi to couple the valve stem, provided its dimensions match the maximum stem acceptance of the bush according to Figure 14. The particular execution of the flange and bushing allow the actuator to be rotated by 90° in 4 different positions according to Figure 14.

**Figure 14. Insert Bush + Intermediate Coupling Flange**



**Table 8. Insert Bush Position**

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 biggest actuator models, the bore of the yoke can be machined according to the dimensions of valve stem.

## 2.4.2 Assembly Procedure

### NOTICE

Failure to comply with the following procedures may void product warranty.

### WARNING

Installation, commissioning and maintenance and repair works should be carried out by qualified staff. A non-conforming assembly could be the source of serious accidents.

For actuator assembly on the valve:

### NOTICE

Check that the assembly position, as shown on the documentation, complies with system's geometry. Check the consistency of the parts of actuator-valve coupling.

- Operate the actuator so that it reaches the position matching valve position (Section 3.3).
- Lubricate valve stem with oil or grease.
- Properly clean and remove grease from coupling flange surfaces.
- Connect, if supplied separately, the adjustment insert to valve stem and fasten it with the special fastening pins.
- Lift the actuator using the special lifting points (Section 2.2).
- Install the actuator so that valve stem inserts in the coupling area. This coupling should be made without forcing.
- Fasten the two parts with the threaded connections (screws, tie rods, nuts). If holes of coupling flanges are not aligned, adequately operate the actuator if necessary move the mechanical stops backwards (Section 3.4).
- Fasten threaded connections. Please refer to Table 9.

**Table 9. Nuts Tightening Torque**

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

The screwing values in Table 9 were calculated considering the materials ASTM A320 Grade L7 for screws or tie rods and ASTM A194 Grade 2H for the nuts.

## 2.5 Pneumatic Connections

### WARNING

Check if the values of pneumatic supply available are compatible with those reported on the identification plate of the actuator.

The connections should be made by qualified staff. Use pipes and connections appropriate as per type, material and dimensions.

- Properly de-burr the ends of rigid pipes.
- Properly clean the interior of pipes sending through them plenty of the supply fluid used in the system.
- Mould and fasten the connection pipes so that no irregular strains at entries or loosening of threaded connections occur.
- Make the connections according to the operating diagram.
- Check the absence of leakages from pneumatic connections.

### NOTICE

If it is necessary to mount components not in Biffi scope of supply, please check the accessories mounting hole details in the documents TN 1028 (for metric dimension) or TN 1028U (for imperial dimension).

## 2.6 Electrical Connections (If Any)

### **⚠ WARNING**

Use components appropriate as per type, material and dimensions. The connections should be made by qualified staff. Before carrying out any operation, cut line power off.

#### **Safety provisions:**

<b>2006/95/EC:</b>	Directive for low voltage equipment (until 19 April 2016) 2014/35/EU from 20 April 2016
<b>2004/108/EC:</b>	Directive for the electromagnetic compatibility (until 19 April 2016) 2014/30/EU from 20 April 2016
<b>94/9/CE:</b>	Directive and safety instructions for use in hazardous Area (until 19 April 2016) 2014/34/EU from 20 April 2016

Remove plastic plugs from cables entries:

- Screw firmly the cable glands.
- Introduce connection cables.
- Make the connections in compliance with applicable wiring diagrams on the documentation supplied.
- Screw the cable gland.
- Replace the plastic plugs of unused entries with metal plugs.

**Figure 15. Junction Box on Control Group (If Foreseen)**



## 2.7 Commissioning

### WARNING

Check to see if the values of electrical supply to the control group (if foreseen) are compatible with those on the plate on the junction box (Figure 15). Installation, commissioning and maintenance and repair works should be made by qualified staff.

Upon actuator commissioning please carry out the following checks:

- Check that paint is not be damaged during transport, if necessary repair the damages to paint coat.
- Check if the pressure and quality of the gas supply (filtering degree, dehydration) are as prescribed. Make sure that the feed voltage values of the electric components (solenoid valve coils, microswitches, pressure switches, etc.) are compatible with those reported on the identification plate of the actuator (Figure 1).
- Ensure that the setting of the components of the actuator control unit (pressure regulator, pressure switches, flow control valves, etc.) meet the plant requirements.
- Conduct all kinds of operations and check if they were properly executed (Section 3.3).
- Check the pneumatic connections for leakages. If necessary, tighten the nuts of the pipe-fittings.
- Check proper operation of all the due signalling (valve position, gas supply pressure, etc.).
- Make a complete functional test in order to verify that all the operations are executed according to operating schematic diagram supplied.

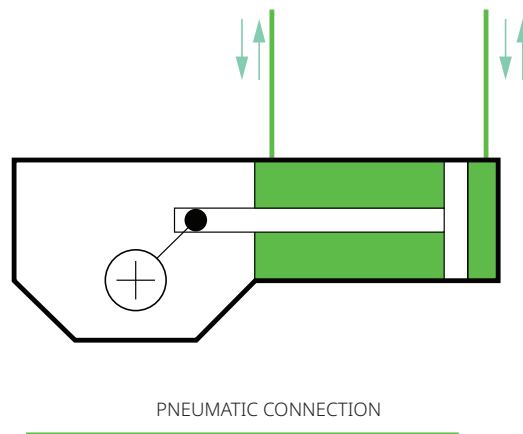
## Section 3: Operation and Use

### 3.1 Operation Description

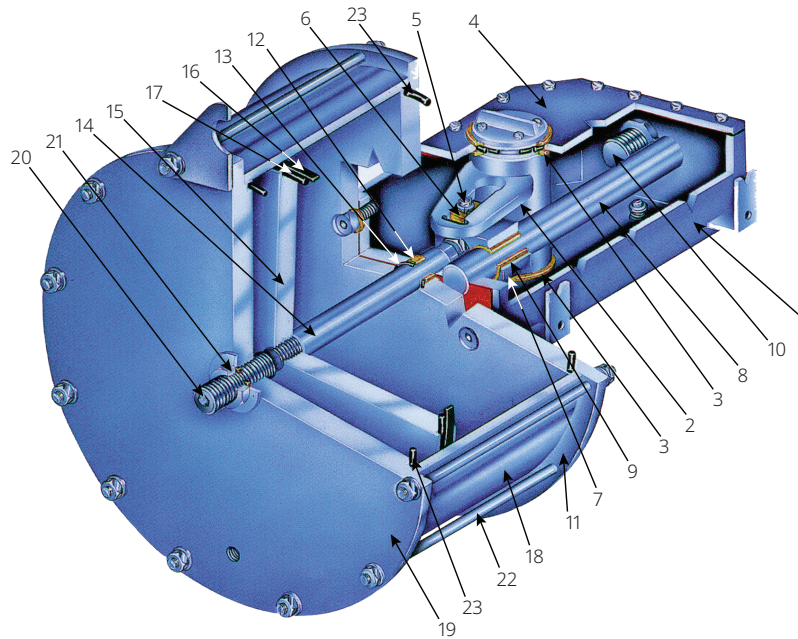
In the normal operating situation, the ALGA actuator is fed by pressurized gas which flows into the relevant cylinder chamber (for example opening). The cylinder piston stroke causes the actuator operation and the consequent valve movement to the operational position requested (in this case to the "open" position).

Upon a demand, the closing chamber the cylinder is fed by pressurized gas and at the same time the gas is discharged from the open chamber into the return line: the actuator performs the closing operation driven by the piston movement, and the valve moves from the open position to the close (safety-related) position.

**Figure 16. Cylinder Chamber Open/Close Action**



**Figure 17. ALGA Actuator Parts**



**Table 10. Parts List**

Item	Name
1	Housing
2	Yoke
3	Yoke bushing
4	Cover
5	Guide block pin
6	Sliding block
7	Guide block
8	Guide bar
9	Guide block bushing
10	Travel stop screw
11	Cylinder head flange
12	Piston rod bushing
13	Piston rod seal ring
14	Piston rod
15	Piston
16	Piston guide sliding ring
17	Piston seal ring
18	Cylinder tube
19	End flange
20	Travel stop screw
21	Sealing washer
22	Tie rod

For local or remote operations, please refer for information only to Figures 18 to 23 and prior to technical documentation furnished with actuators.

Typical schematics for various applications are follow attached for information only, the function described are furnished only on specific customer demand. For all the relevant information, please refer to the specific technical documentation supplied with the actuators.

**Figure 18. On/Off Service: Four Way Control Valve**

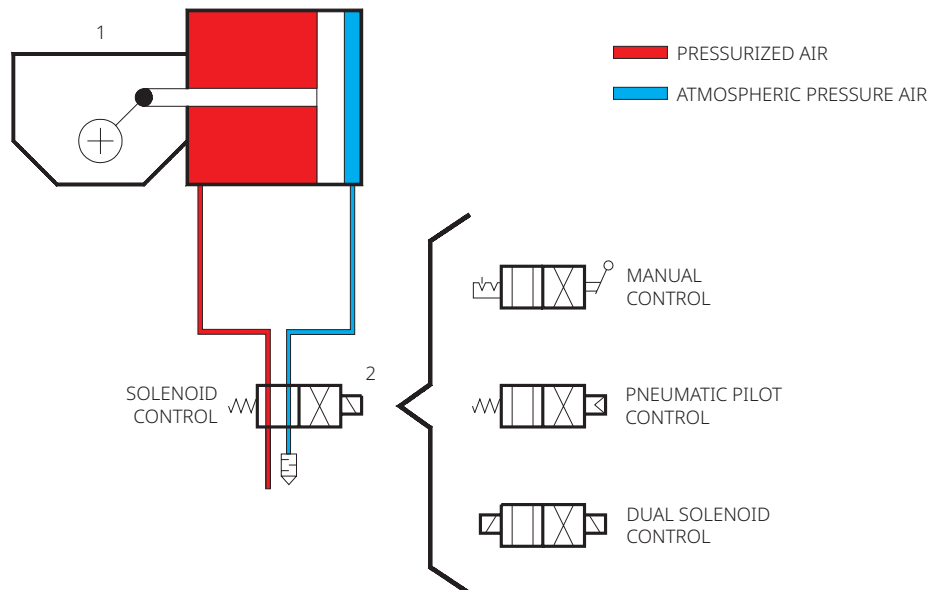
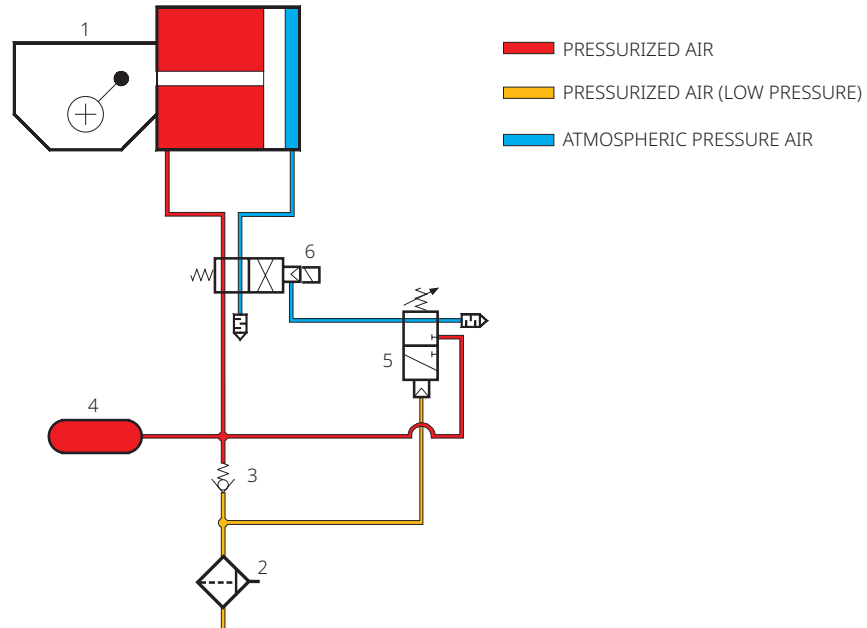


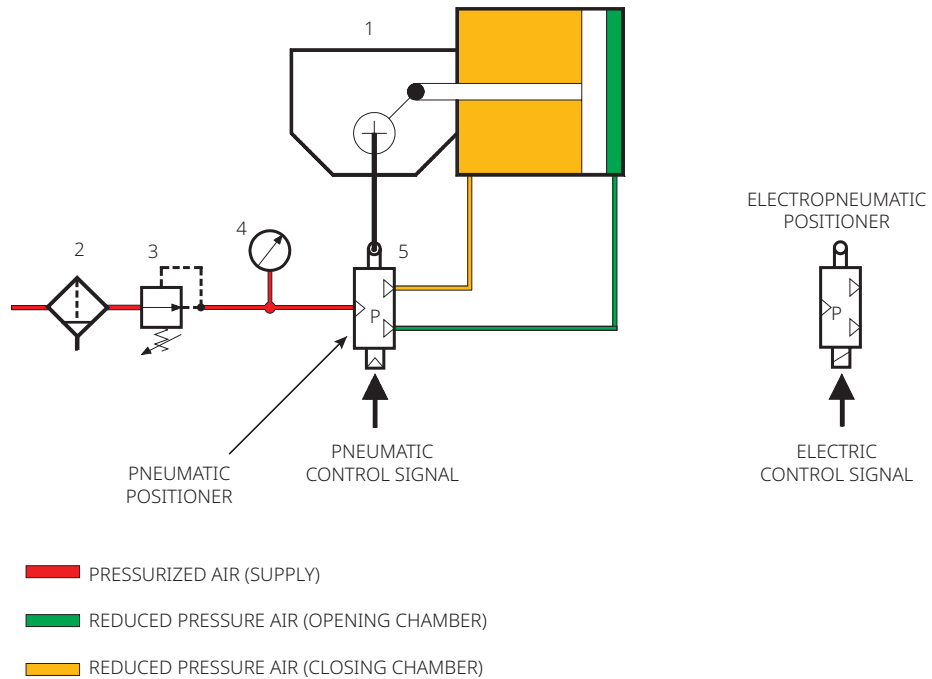
Figure 18 shows the simplest on/off control. The gas supply pressure is applied to one side of the cylinder and exhausted from the opposite side. When the control valve (2) is actuated the connection of supply and exhaust to the cylinder chambers are reversed. The control valve can have many types of actuating devices (solenoid, manual control, pneumatic pilot, spring, etc.). The spring-return control valves allow 'fail-safe' operation.

**Figure 19. On/Off Service: Air Fail Safe Aystem**

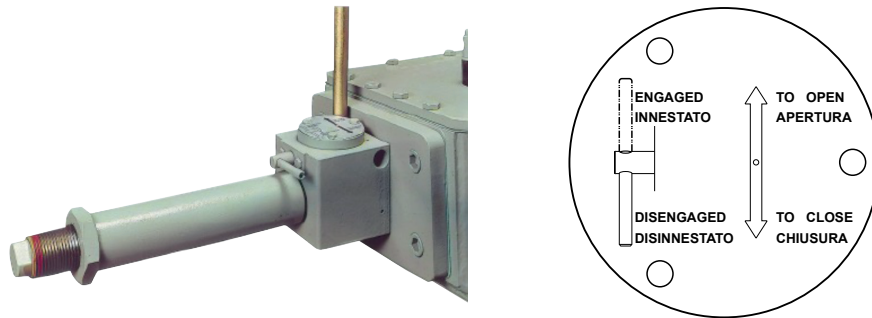


The system allows 'fail-safe' operation when the pressure in the gas supply line drops below a set value. Figure 19 shows the actuator in the 'fail-safe' condition. When the gas supply pressure drops below the pressure switch (5) set point, the pneumatic supply to the solenoid valve (6) pilot is exhausted and the actuator moves to the 'fail-safe' position by using the gas stored in the tank (4). The tank is connected to the gas supply through the check valve (3).

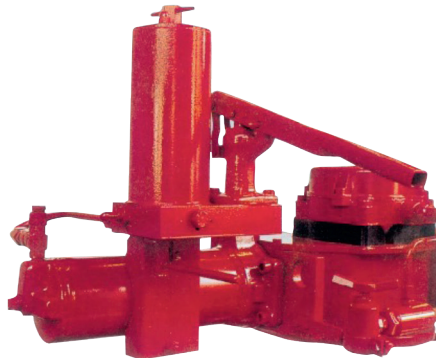
**Figure 20. Modulating Service**



When modulating control is required as a function of a pneumatic or electric control signal, a positioned (5) is used, which controls the supply to the actuator cylinder to keep the valve in the required angular position. The positioner has a mechanical linkage to the actuator for a feedback of the valve position.

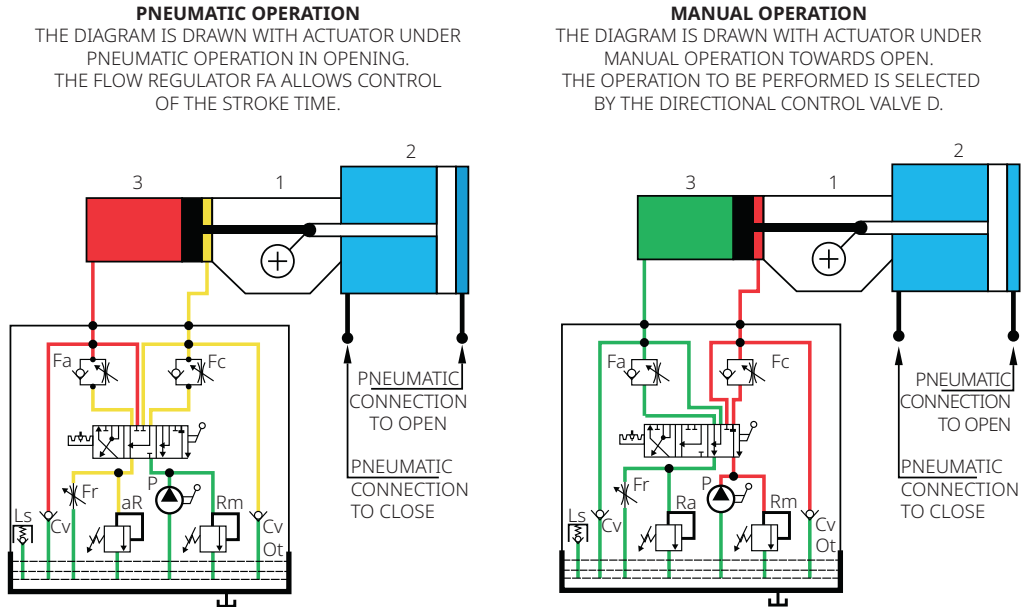
**Figure 21. Emergency Manual Override**

For models up to three, the MHW-MSJ jackscrew manual override can be provided. The jackscrew end of the override is screwed into the guide block and it is installed on the actuator's left side. A bronze split screw nut is mounted inside the body. The manual operator has a declutch system, the screw nut is engaged with the jackscrew by turning the engagement lever. The body of the screw container is rotated manually by rotating a lever (for MSJ models) or a handwheel (for MHW models) once the screw nut is engaged with the jackscrew. Refer to the actuator's label shown in Figure 21.

**Figure 22. MHP Hydraulic Manual Override**

The MHP hydraulic manual override is used to manually operate the actuator in lack of air supply. It also allows to accurately adjust the actuator operating times independently in opening and in closing, by way of the hydraulic regulators which work on the oil flow from one chamber to the other of the hydraulic cylinder during pneumatic operation. Moreover, it permits a smooth angular speed all along the stroke. During manual operation, the flow regulators are by-passed to make the force on the hand pump lever easy. The MHP unit consists of a hydraulic cylinder mounted directly on the actuator. The piston rod end is screwed into the guide block. The compact hydraulic control unit consists of a hand pump, directional control valve, oil tank, relief valve and two unidirectional flow regulators. The directional control valve has three operating positions: "remote": the actuator is operated by pneumatic supply; "to open": the actuator operation is opening by hand pump. On request, the hydraulic manual override type MHP2 (double hand pump version) can be supplied which allows the remote control to automatically override manual operation.

**Figure 23. Manual Override Operational Description**



- |                               |  |
|-------------------------------|--|
| 1 = SCOTCH YOKE MECHANISM     | Ra = RELIEF VALVE FOR AUTOMATIC OPERATION              |
| 2 = PNEUMATIC CYLINDER        | Rm = RELIEF VALVE FOR MANUAL OPERATION                 |
| 3 = HYDRAULIC CYLINDER        | P = HAND PUMP  |
| 4 = HYDRAULIC MANUAL OVERRIDE | D = HAND OPERATED DIRECTIONAL CONTROL VALVE            |
| ■ = HIGH PRESSURE OIL         | Fa = UNIDIRECTIONAL FLOW REGULATOR (OPENING OPERATION) |
| ■ = INTERMEDIATE PRESSURE OIL | Fc = UNIDIRECTIONAL FLOW REGULATOR (CLOSING OPERATION) |
| ■ = LOW PRESSURE OIL          | Fr = BIDIRECTIONAL FLOW REGULATOR                      |
| ■ = PRESSURIZED AIR           | Cv = CHECK VALVE                                       |
| ■ = ATMOSPHERIC PRESSURE AIR  | Ot = OIL TANK  |
|                               | Ls = LEVEL STICK WITH RELIEF VALVE                     |

## 3.2 Residual Risks

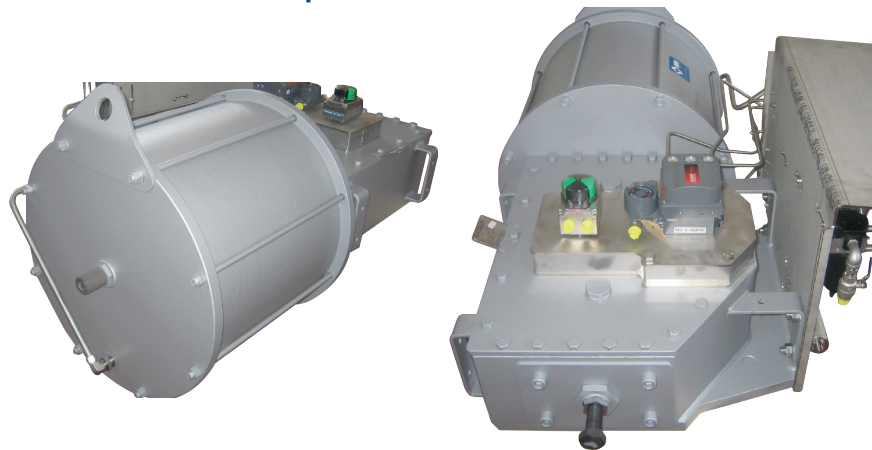
### **⚠ WARNING**

It is recommended to pipe exhaust gas. The actuator has parts under pressure. Exercise due caution. Use individual protections provided for by the laws and provisions in force.

## 3.3 Calibration of the Angular Stroke

The angular stroke of the yoke can be adjusted between 82° to 98° ( $\pm 4^\circ$  with respect to the nominal positions of complete opening and closing) by means the mechanical stops screwed into the left side of the housing (open valve) and into the end flange of the pneumatic cylinder (closing) (Figure 24).

**Figure 24. Mechanical Stops**



In case of an actuator with two cylinders (Figure 25), both mechanical stops are screwed on the end flanges of the cylinders.

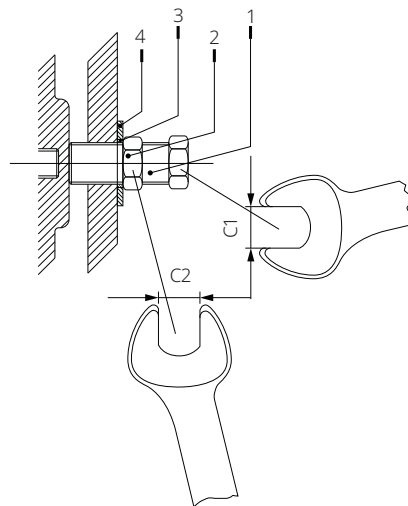
**Figure 25. Actuator with Two Cylinders**



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

- 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).

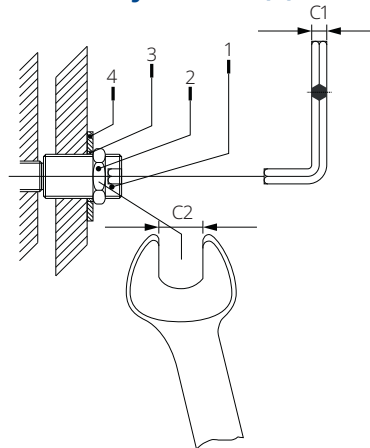
**Figure 26. Travel Stop Screw Adjustment (1)**



**Table 11. Travel Stop Screw Adjustment (1)**

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

**Figure 27. Travel Stop Screw Adjustment (2)**



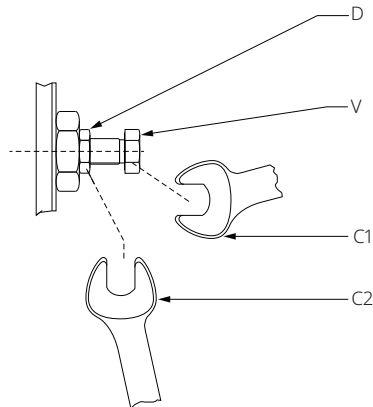
**Table 12. Travel Stop Screw Adjustment (2)**

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

For the adjustment of the mechanical stop screwed into the left side of housing, follow these steps (Figure 26 and 27):

- Loosen the locknut (D) with the specific wrench (C2).
- Adjust the pin (G)/screw (V) with the adequate wrench (C1).
- Turn counterclockwise to increase the angular stroke, turn clockwise to decrease it.
- When the adjustment is over tighten the locknut (D).

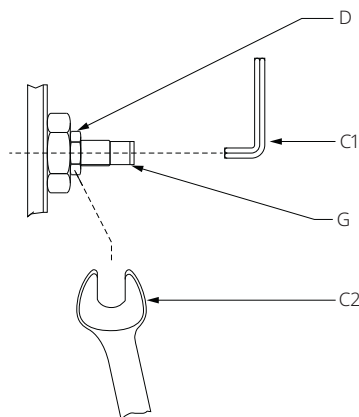
**Figure 28. Mechanical Stop on the Housing (1)**



**Table 13. Mechanical Stop on the Housing (1)**

Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
0.3	30	30
0.9	30	30
1.5	41	41
3	41	41
6	46	46

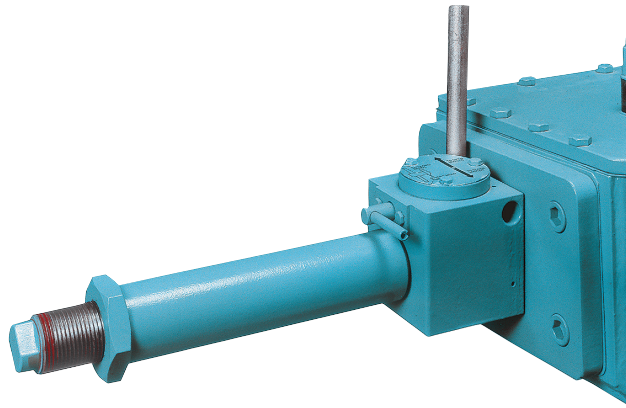
**Figure 29. Mechanical Stop on the Housing (2)**



**Table 14. Mechanical Stop on the Housing (2)**

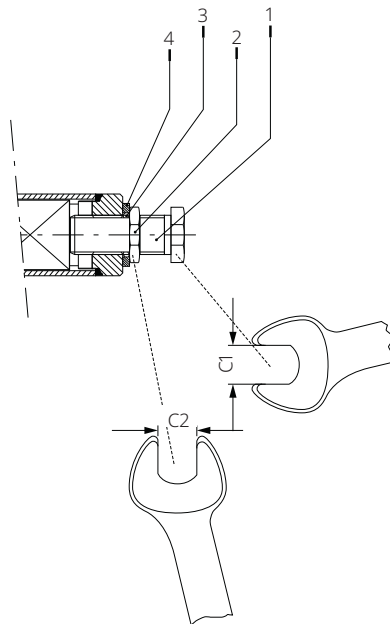
Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
14	17	60
18	17	60
32	17	60
50	17	60

**Figure 30. Manual Jackscrew MSJ**



For the adjustment of the mechanical stop screwed on the end flange of manual override, see Section 7.2 Figure 51: sectional drawing for manual jackscrew MSJ – MHW.

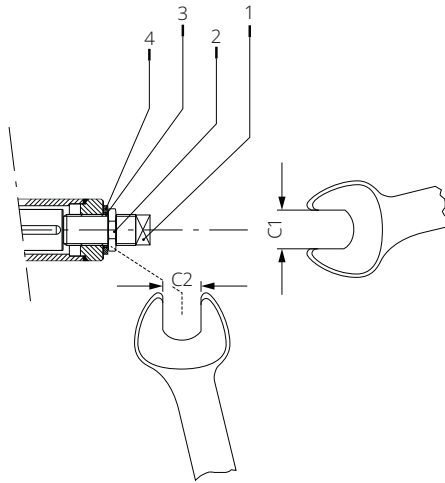
**Figure 31. Mechanical Stop at the End Flange of Manual Override (1)**



**Table 15. Mechanical Stop at the End Flange of Manual Override (1)**

Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
0.3	34	34
0.9	34	34

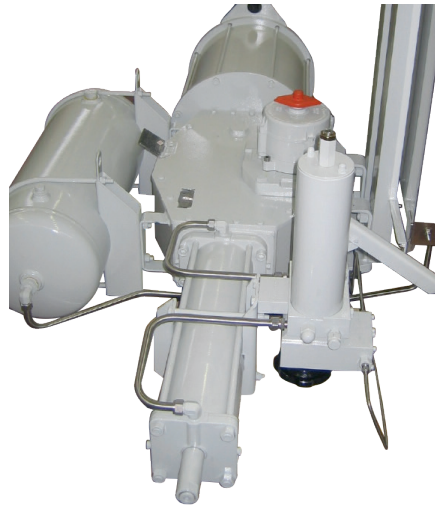
**Figure 32. Mechanical Stop at the End Flange of Manual Override (2)**



**Table 16. Mechanical Stop at the End Flange of Manual Override (2)**

Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
1.5	24	65
3	24	65

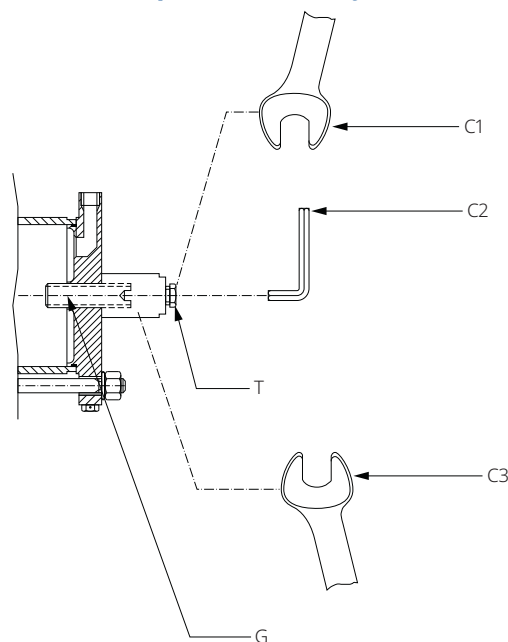
**Figure 33. Mechanical Stop at the End Flange of Manual Override (3)**



For the adjustment of the mechanical stop at the end flange of hydraulic cylinder of MHP, follow these steps (Figure 34):

- Remove with the specific wrench (C1) the plug (T).
- Insert a wrench for Allen keys (C2) in the through hole until reaching the adjustment pin (G).
- Keep the protection cover blocked with the special wrench (C3).
- Turn counterclockwise to increase the angular stroke, turn clockwise to decrease it.
- When the adjustment is over tighten the plug (T).

**Figure 34. Mechanical Stop of the MHP Cylinder**



**Table 17. Mechanical Stop of the MHP Cylinder**

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

## 3.4 Calibration of Microswitches

Refer to Safety Instructions Manual for limit switch box.

### ⚠ WARNING

Refer only to technical documentation related to installed switch-box model.

### 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).

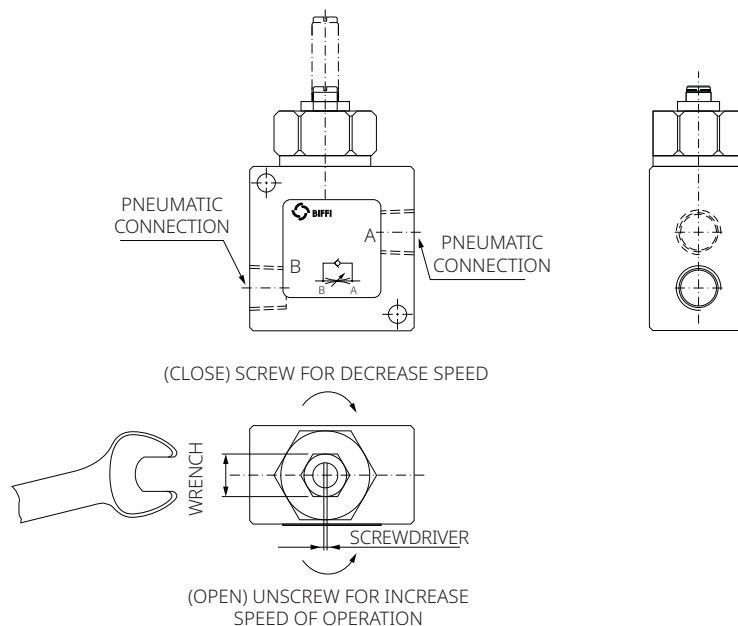
### NOTICE

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.

## 3.5 Calibration of the Operation Time (Biffi Limit Switch Box Only)

The calibration of the operation time is made by Biffi Italia s.r.l. according to customer requirements and to technical data sheet included in technical documentation. If necessary, it's possible to modify or reset the operating time through two-flow regulation valves placed between the control valves enclosure and the pneumatic cylinder (Figure 35).

**Figure 35. Example of Operating Time Adjustment (If Foreseen)**



To carry out the adjustment, use an adequate Allen wrench and follow these steps (Figure 35):

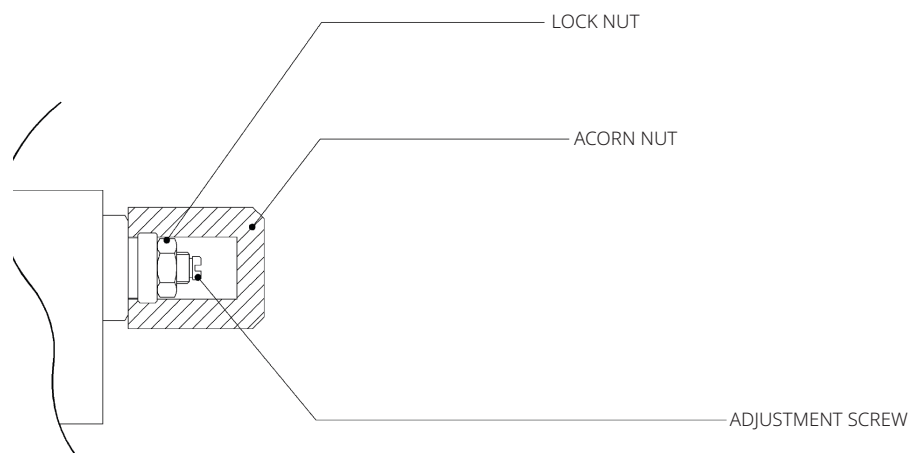
- Loosen the locknut.
- Screw with a screwdriver the setting screw to increase the operation time.
- Unscrew with a screwdriver the setting screw to decrease the operation time.
- After the adjustment is over screw the locknut.

For ALGA actuator models with a manual hand pump, the operating time is adjustable through two regulation valves placed on manual hand pump's body (see Section 7.2, Figure 49: sectional drawing for hydraulic control unit MHP).

To carry out the adjustment, use a suitable Allen wrench and follow these steps (Figure 29):

- Remove the cap nut.
- 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 and put back in place the cap nut.

**Figure 36. Flow Regulators Placed on Manual Hand Pump (Optional - If Foreseen)**



## 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 executing any maintenance operation, it is necessary to close the pneumatic supply line and discharge pressure from the cylinder of the actuator and from the control unit (if foreseen).

## ⚠ WARNING

Installation, commissioning and maintenance and repair works should be carried out by qualified staff.

## 5.1 Periodic Maintenance

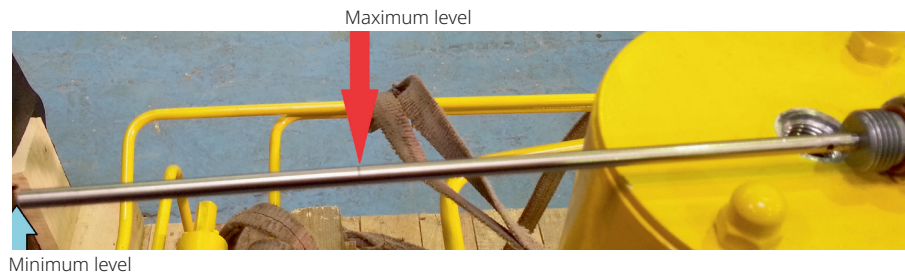
ALGA actuators are designed to operate long-term in heavy-duty operating conditions, without maintenance needs.

## NOTICE

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

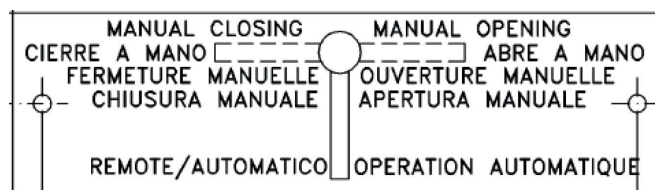
Every 2 years of operation, the following is recommended:

- 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 (refer to specific operating diagram, in technical documentation furnished with actuators).
- Check if there are no hydraulic or pneumatic leakages.
- Check oil level (Figure 37) into the hydraulic control unit (see Section 5.1.1).
- Check if the actuators did not undergo accidental damage with oil leakages found on site (Section 5.1.1).
- Check that improper closing of control-group cover did not produce the presence of condensation on it.
- Check the integrity of worn out parts (gaskets, pads, etc.).
- Replace, if any, the mechanical filter of the supply gas (refer to Section 5.1.2).

**Figure 37. Level Measuring Stick**

## 5.1.1 Check and Restore Oil Level in the Hydraulic Manual Override

Operate the distributor lever to “closing manual operation”.

**Figure 38. Local or Remote Manual Operator Setting**

Move the actuator into his “fail to close” position.

Unscrew the dipstick (1).

Check that the oil level into the tank (4) is in correspondence of the “MAXIMUM LEVEL” notch of the dipstick.

Screw and tighten the dipstick.

If necessary, substitute or add the oil, proceeding as follow:

- Remove the dipstick (1) from the tank cover (22).
- Unscrew the plug (27) and the washer (9) to drain all the oil.
- If some dirt or/and sludge is found in the oil drained from the tank, before filling with new oil in the tank, disassemble the oil tank tube, by unscrewing the two cap nuts (2), and clean the internal surfaces of the tank. If necessary, substitute the gaskets (21) of the tank.
- Replace the plug (27) and the washer (9) into the plate (11) and tighten.
- Pour the new oil into the tank through the dipstick hole (1) on the cover (22).
- Replace the dipstick (1).
- Add oil (refer to Table 18) if in the tank the oil level is BELOW THE MINIMUM (Figure 37: minimum level is in correspondence to the end of dipstick) until it reaches the optimal (MAXIMUM) oil level.
- Operate the distributor lever to “Remote” position.

**NOTICE**

For refill use oil of the same brand as previous, refer to related technical documentation.

**Table 18. Hydraulic Oil List by Biffi Italia s.r.l. for Refilling in Different Working Conditions**

<b>Standard Temperature Conditions (-30 to +85 °C):</b>	
Producer	ENI
Name	Arnica 22
Viscosity at 40 °C	20.9 mm <sup>2</sup> /s
Viscosity at 100 °C	4.73 mm <sup>2</sup> /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 Fiorenzuola. Your oil supplier can verify and propose an alternative product at your responsibility.
<b>Low Temperature Conditions (Until -46 °C):</b>	
Manufactured	Shell®
Name	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 (or equivalent)	0.87 kg/dm <sup>3</sup>
<b>Low Temperature Conditions (Until -60 °C):</b>	
Manufactured	*SYNTESIS
Name	*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 (or equivalent)	0.897 kg/dm <sup>3</sup>

**NOTE:**

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

## 5.1.2 Gas Supply Dehydrating Filter Maintenance (If Foreseen)

The gas supply filter is fitted with a mechanical filter and a drain valve to discharge periodically the water generated by the condensation of the humidity inside the gas supply.

### NOTICE

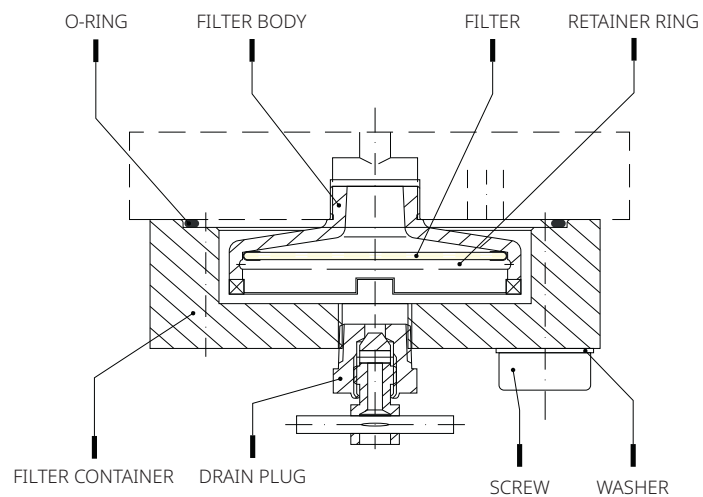
During the routine maintenance, it is recommended to check and clean the mechanical filter and replace it in case of heavy dirty conditions.

To disassemble the filter proceed as follow:

- A. Close the stop valve at the inlet of pressure supply line;
- B. Discharge the pressure from the drain valve;
- C. Remove the lower enclosure screws;
- D. Remove the mechanical filter;
- E. Clean or replace the filter;

Reinstall all parts carefully paying attention to avoid any damage to the O-ring.

**Figure 39. Mechanical Filter System**

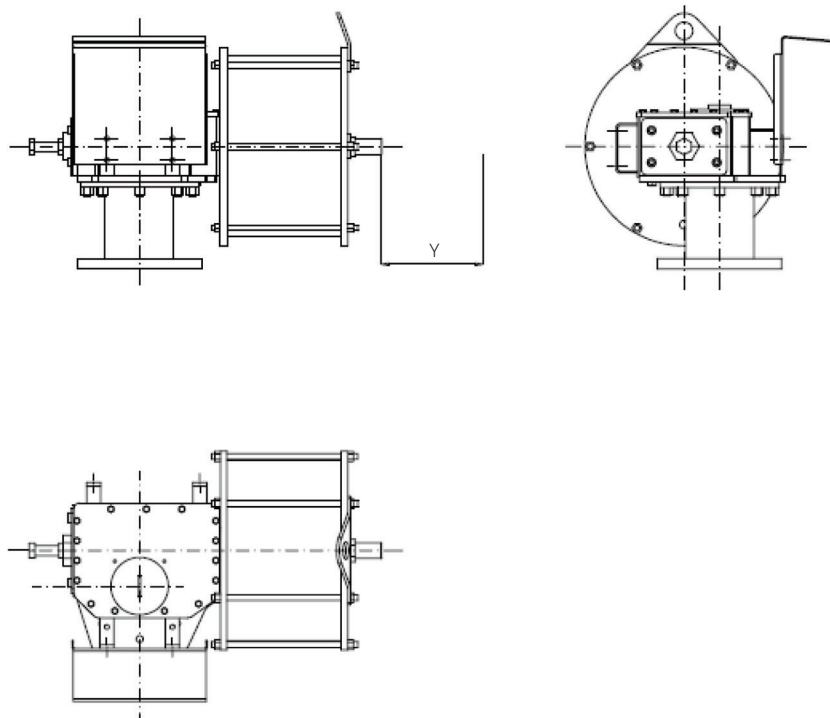


## 5.2 Extraordinary Maintenance

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

### 5.2.1 Replacement of Cylinder Seals

**Figure 40. Double-Acting Actuator (Space Limit for Replacement)**



**Table 19.**

Model Size	Dimension "Y" (mm)
0.1	300
0.3	350
0.9	450
1.5	600
3	300
6	800
14	800
18	900
32 to 42	1000
50 to 60	1200
65 to 55	1200
80	1400

**⚠ WARNING**

Before executing any maintenance operation, it is necessary to intercept the supply line and discharge pressure from the cylinder of the actuator.

If the actuator can be operated, it is essential to take it to fail-safe position, otherwise the actuator should be disassembled from the valve and follow these steps:

1. Remove the nuts (16) and the washers (24) from the tie rods (18) at the end flange (22) side.
2. Slide off the end flange (22) and the tube (19).
3. Remove the screw (2) and the cover (1).
4. Unscrew the piston rod (20) threaded end from the adaptor bush (30) of guide block (14).
5. Slide off the piston rod (20) from the head flange (17).
6. Disassemble the head flange (17) from the mechanism housing (8) by removing the screw (15) only if the gasket (36) has to be replaced due to damage.

### 5.2.1.1 Seals Replacement

Prior to reassemble, check that the actuator components are in good condition and clean. Lubricate all the surfaces of the parts which move in contact with other components, by recommended grease (Molykote® 2003 or Lubcon Turmoplex LTA 2 if seals are in Nitrile Butadiene Rubber (NBR)/Viton or neoprene rubber, or with Mobilgrease® 33 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 protective grease film. Assemble the new O-ring into its groove and lubricate it with a protective grease film.

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). Replace the O-ring (40) of the end flange (22).

If the sealing washer (43) has to be replaced, 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 in the closed valve position, once the maintenance procedures have been completed.

1. Loosen the lock nut (25) and unscrew the stop screw (26) until it is removed together with the nut (25), the washer (44) and the sealing washer (43).
2. Remove the sealing washer (43) 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 works.
3. Screw the new sealing onto the stop screw until it touches the nut (25).
4. Assemble the washer (44) onto the sealing washer (43).
5. 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).
6. Check that the sealing washer (43) and the washer (44) are in contact with the flange surface.
7. Tighten the lock nut (25).

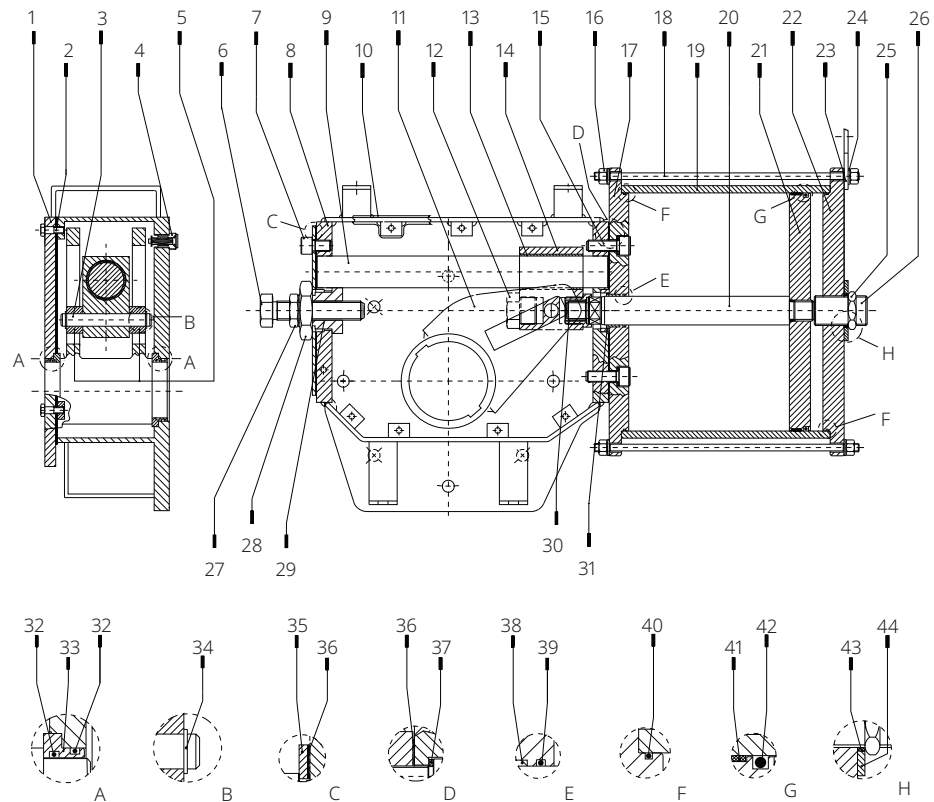
### 5.2.1.2 Reassemble

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, tighten the screws (15) to the recommended torque.
3. Lubricate the piston rod (20) surface with a protective oil film and introduce it into the head flange hole, taking 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). Spread some sealant LOCTITE® 452, or equivalent, on the rod threaded end and screw into the adaptor bush (30) 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 damage 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. Restore a generous coating of grease on the contact surfaces of the yoke (11) and the bushing (33), on the yoke grooves, on the sliding block (5), on guide bar (9).
8. Assemble the new gasket (10) after cleaning the surfaces of the housing (8) and cover (1).
9. Lubricate with protective oil the O-ring (32).
10. Assemble the cover (1) and the screw (2). Tighten the screws to the recommended torque.
11. 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) 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 41. ALGA Double-Acting Pneumatic Actuator**



**Table 20. Parts List**

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

### Replacement of hydraulic cylinder seals (see Figure 41) only for ALGA-MHP hydraulic handpump manual override

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 (item 16) and the washers (item 15) from the tie rods (item 10) at the end flange (item 13) side.
2. Slide off the end flange and the tube (item 12).
3. Remove the screws (item 2, Figure 41) and the cover (item 1, Figure 41).
4. Unscrew the piston rod (item 6) threaded end from the adaptor bush (item 30, Figure 41) of guide block (item 14, Figure 41).
5. Slide off the piston rod from the head flange (item 2).
6. Disassemble the head flange from the mechanism housing (item 8, Figure 41) by removing the screws (item 7, Figure 41) only if the gasket (item 36, Figure 41) has to be replaced due to damage.

#### 5.2.1.3 Seals Replacement

Prior to reassemble, check that the actuator components are in good condition and clean. Lubricate all the surfaces of the parts which move in contact with other components, by recommended grease (Molykote 2003 or Lubcon Turmoplex LTA 2 if seals are in Nitrile Butadiene Rubber (NBR)/Viton or neoprene rubber, or with Mobilgrease 33 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 protective oil film. Assemble the new O-ring into its groove and lubricate it with a protective oil 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 seal ring (4) and the O-ring (5) from their groove.
2. Clean the groove carefully and lubricate it with a protective oil film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil 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 so as 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 oil film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil film.
4. Assemble the new PTFE seal ring (9) on its rubber O-ring (19) by introducing one side of it into the groove and then enlarge it with your fingers so as to introduce it into the groove: take care to enlarge it uniformly without any tools which could possibly damage it. The elastic memory of the kind of PTFE type the seal ring is made of allows the ring to shrink back to its previous dimension 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, so as to be able to easily restore the setting of the actuator mechanical stop in the open valve position, once the maintenance procedures have been completed.

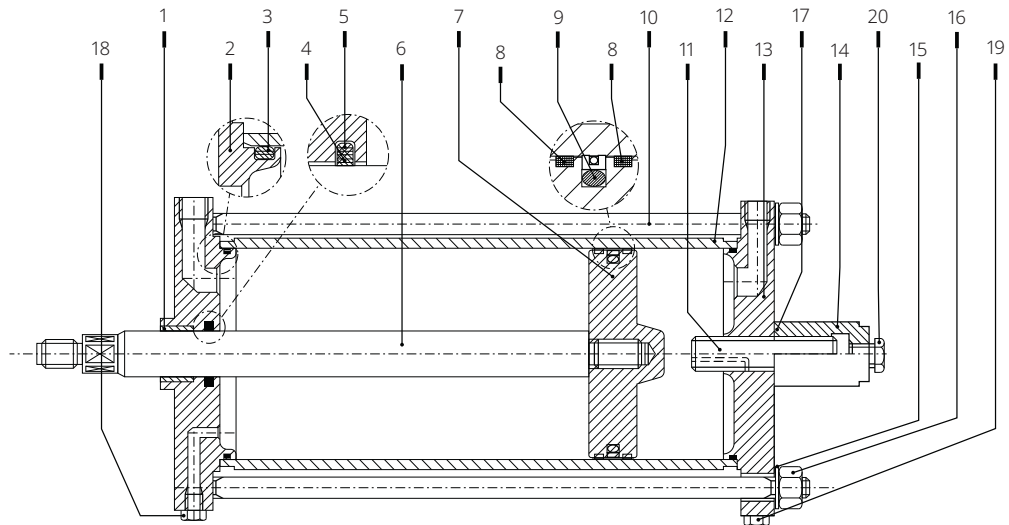
5. Loosen the stop setting screw cover (14) and unscrew the stop screw (11).
6. Remove the O-ring (17) from the stop screw (11). Carefully clean and lubricate the stop screw thread and the surface of the end flange area, on which the O-ring works.
7. Screw the new O-ring onto the stop screw until it touches the cover (14).
8. 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).
9. Check that the O-ring (17) is inside the groove into the end flange and in contact with the groove bottom surface.

### 5.2.1.4 Reassemble

1. Assemble the new gasket (item 36, Figure 41) after cleaning the surfaces of housing (item 8, Figure 41) and head flange (item 2) which are in contact.
2. Assemble the head flange and tighten the screws (item 7, Figure 41) to the recommended torque.
3. Clean and lubricate the piston rod (item 6) surface, particularly that of the bevel, with a protective oil or grease film and introduce it into the head flange hole, taking care not to damage the PTFE seal ring (item 4): the piston rod bevel has to enlarge smoothly the seal ring.
4. Carefully clean the threaded end of the piston rod and the threaded hole of the adaptor bush (item 30, Figure 41) of guide block (item 14, Figure 41). Spread some sealant LOCTITE 452, or equivalent, on the rod threaded end and screw into the adaptor bush threaded hole and tighten.
5. Carefully clean the inside of the tube (item 12) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate with protective oil film the tube inside surface and the bevels at the ends. Slide the tube onto the piston taking care not to damaged the PTFE seal ring (item 9): the tube bevel has to smoothly compress the seal ring.
6. Take care also not to damage the head flange O-ring (item 3).
7. Assemble the end flange (item 13) by centering it on the inside diameter of the tube, taking care not to damage the O-ring (item 3).
8. Assemble the washers (item 15) and the nuts (item 16) onto the tie rods (item 10). Tighten the nuts to the recommended torque, alternating between opposite corners.
9. Restore a generous coating of grease on the contact surfaces of the yoke (item 11, Figure 41) and the bushings (item 13, Figure 41), on the yoke grooves, on the sliding blocks (item 5, Figure 41), on guide bar (item 9, Figure 41).
10. Assemble the new gasket (item 36, Figure 41) after cleaning the surfaces of the housing (item 8, Figure 41) and cover (item 1, Figure 41)
11. Lubricate with protective oil the O-ring (item 32, Figure 41).
12. Assemble the cover (item 1, Figure 41) and the screws (item 2, Figure 41). Tighten the screws to the recommended torque.

#### 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 42. Cylinder****Table 21. Parts List**

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
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

## 5.3 MHP Hydraulic Manual Override Maintenance and Troubleshooting

### 5.3.1 Operation

Refer to Figures 23 and 43.

The "MHP" hydraulic manual override and speed control unit is utilized, in connection with the actuator hydraulic cylinder, for the manual operation and for the speed control during the pneumatic operation of pneumatic double acting actuators.

### 5.3.2 Manual Operation

Selected by the hand operated directional control valve (D) the operation (opening or closing) to be performed.

Actuate the hand pump (P).

The relief valve (Rm) prevents the oil pressure delivered by the hand pump from exceeding the set value so as not to damage the valve or the actuator.

### 5.3.3 Remote Operation

To allow the actuator pneumatic operation, the hand operated directional control valve (D) has to be in its "REMOTE" control position: valve lever in its central position as shown by the instructions plate.

#### 5.3.3.1 Pneumatic operation

The oil flows from the hydraulic cylinder chamber, rear flange side, via the flow regulator (Fa), the valve (D) and the flow regulator (FC), free flow direction, to the hydraulic cylinder chamber, head flange side.

The exceeding oil volume, corresponding to the hydraulic cylinder piston rod, flows via the flows regulator (Fr) into the oil tank (Ot).

The relief valve (Ra) prevents that the oil pressure, into the hydraulic cylinder, exceeds a set value.

The flow regulator (Fa) allows the setting of the actuator operation speed in opening independently from the actuator speed in closing.

### 5.3.3.2 Pneumatic closing operation

The oil flows from the hydraulic cylinder chamber, head flange side, via the flow regulator (Fc), the valve (D) and the flow regulator (Fa), free flow direction, to the hydraulic cylinder chamber, rear flange side.

The missing oil volume, corresponding to the piston rod of hydraulic cylinder, is sucked from the oil tank via the check valve (Cv).

The flow regulator (Fc) allows the setting of the actuator operation speed in closing, independently from the actuator speed in opening.

### 5.3.4 Setting

#### A) Setting of the actuator operating times (refer to Figure 43)

The setting of actuators operating times in opening and in closing is performed by adjusting the unidirectional flow regulators (items Fa and Fc of operating diagram, Figure 23) assembled into the plate (item 11): into the plate left side the flow regulator for the actuator opening time setting; into the plate right side the flow regulator for the actuator closing time setting.

As the flow regulators are unidirectional type the actuator operating times can be set independently in opening and in closing.

To perform the setting of the flow regulators proceed as follows.

- Unscrew the cap nut (item 2) from the setting screw (item 28).
- Loosen the lock nut (item 30).
- By a screwdriver rotate clockwise the setting screw (item 28) to increase the operating time; rotate counter clockwise to decrease the operating time.
- Check that the operating time is the required one.
- Tighten the lock nut (item 30). During this operation keep the setting screw (item 28) still with a screwdriver.
- Screw the cap nut (item 2) on the setting screw end and tighten so to assure the tightness.

**B) Settings of relief valves (refer to Figure 43)**

The relief valve (item Ra of operating diagram - Figure 23) is set at Biffi factory at a proper value and there is no reason to change the setting on the field.

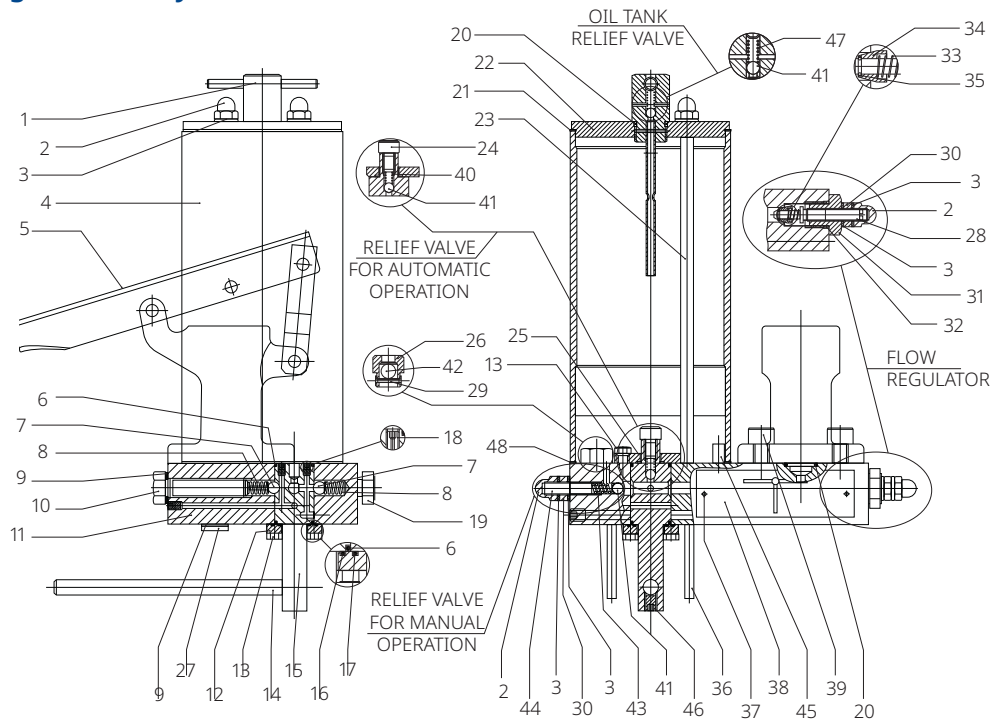
The relief valve (item Ra of operating diagram - Figure 23) is set at Biffi factory at a pressure value at least 20% higher than the pressure required into the hydraulic cylinder, during the manual operation by the handpump, to overcome the valve required torque, in opening and in closing, along all the valve angular stroke.

At the same time the set value is at least 10% lower than the pressure required into the hydraulic cylinder to perform the maximum allowable torque of the actuator and of the valve.

If a setting of the relief valve has to be performed, proceed as follows:

- Unscrew the cap nut (item 2) from the setting screw (item 44).
- Loosen the lock nut (item 30).
- By a male hexagonal wrench rotate clockwise the setting screw (item 44) to increase the pressure setting value; rotate counterclockwise to decrease the pressure set value.
- Check that the pressure set value is the required one.
- Tighten the lock nut (item 30). During this operation keep the setting screw (item 44) still with an hexagonal male wrench.
- Screw the cap nut (item 2) on the setting screw end and tighten so to assure the tightness.

**Figure 43. Hydraulic Control Unit**



**Table 22. Parts List (1)**

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 32
6	2	O-ring	*Fluorosilicon 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	*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	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 23. Parts List (2)**

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	*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	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

## 5.4 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 and on the guide bar.

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

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

### ENI MU/EP/2 \*

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<sup>2</sup>/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 Fiorenzuola. 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 Fiorenzuola. Your grease supplier can verify and propose an alternative product at your responsibility.

## 5.5 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.

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

Lift the actuator using the proper lifting points, see Section 2.2 and 2.3.

If the actuator needs storage before tear down, see Section 2.2.

### **WARNING**

The tear down of the actuator both concerning any electrical and mechanical parts should only 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 the appropriate waste collection sites, as provided for by the laws and provisions in force.

# Section 6: Troubleshooting

## 6.1 Failure or Breakdown Research

**Table 24.**

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

# Section 7: Spare Parts

## 7.1 Spare Parts Order

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

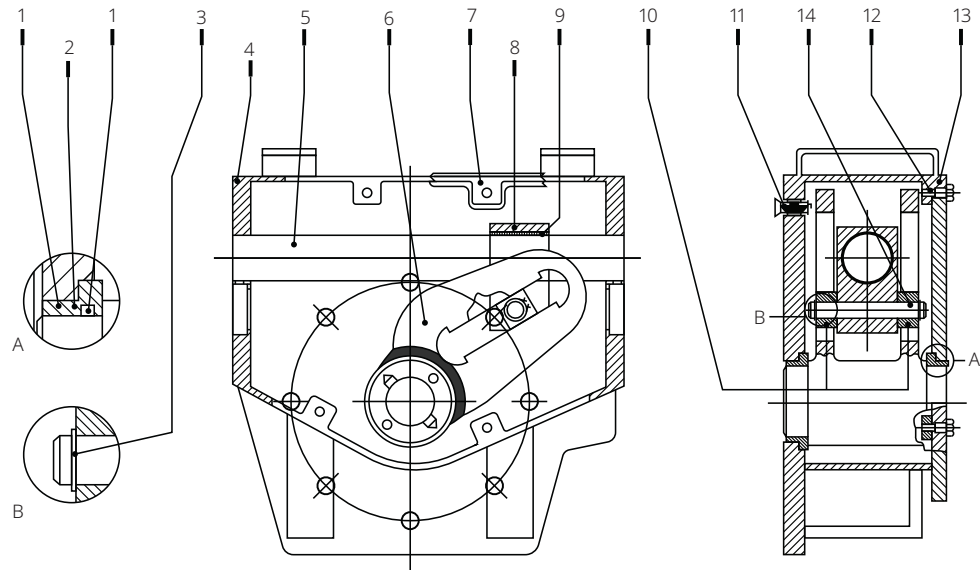
E-mail: [Biffispares@Emerson.com](mailto:Biffispares@Emerson.com)

Please specify:

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

## 7.2 Parts List for Maintenance and Replacement Procedure

**Figure 44. Scotch Yoke Mechanism Standard Version  
(Minimum Performed Cycles\* = 100.000)**



**Table 25. Parts List**

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	*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

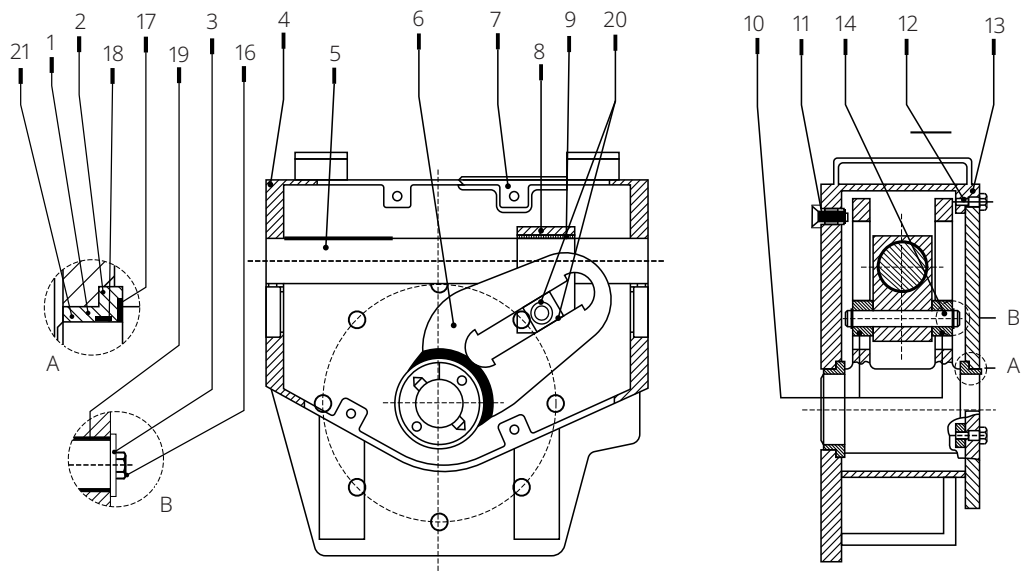
**NOTES:**

\* Recommended spare parts

\*\* Cycles performed by actuator in a 25 years expected lifetime - the minimum performed cycles are guaranteed by Biffi based on service conditions listed:

- All the valve required torques have to be lower than actuator max operating torque (MOT).
- The ratio between valve required running torque and actuator max operating torque (MOT) has to be > 1.5.
- The actuator mechanism has to be lubricated in accordance with indication given on this IOM.

**Figure 45. Scotch Yoke Mechanism Heavy Duty Version (Minimum Performed Cycles\* = 1.00.000)**



**Table 26. Parts List**

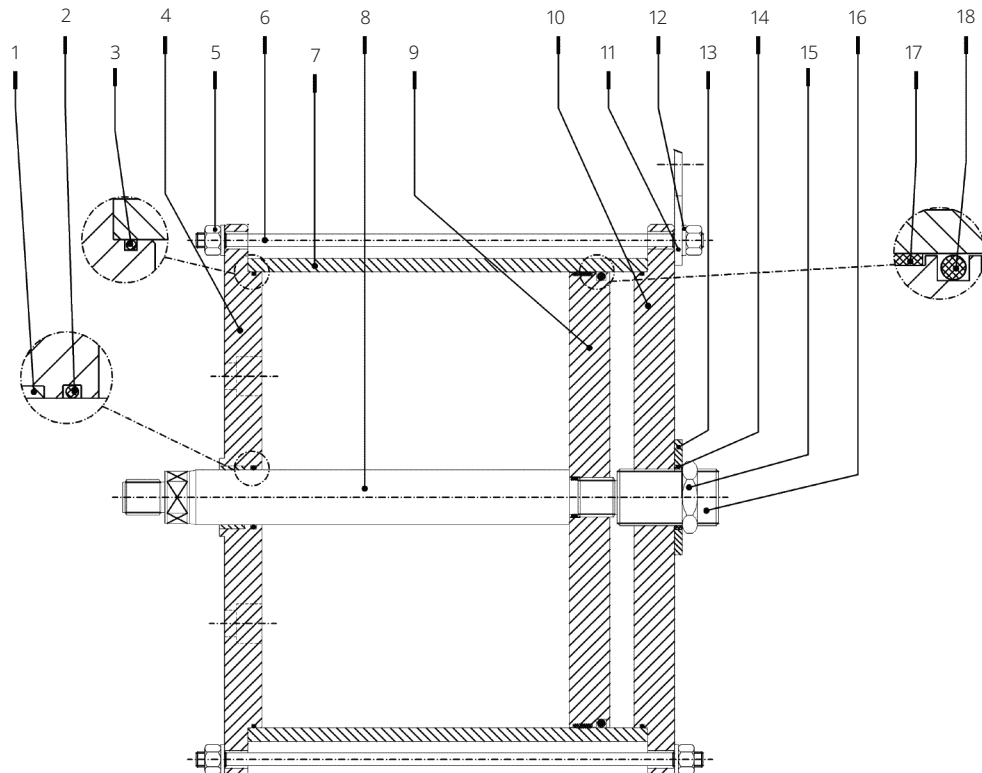
Item	Quantity	Description	Material
1	2	O-ring	*NBR
2	2	Yoke bushing	Carbon steel
3	2	Washer	Stainless steel
4	1	Housing	Carbon steel
5	1	Guide bar	Alloy steel
6	1	Yoke	Carbon steel
7	1	Cover gasket	*SBR + Cellulose + Fillers
8	1	Guide block	Carbon steel
9	1	Bushing	Steel + Fiberglide
10	2	Sliding block	Carbon steel
11	1	Vent valve	*Stainless steel + Fluorosiliconic rubber
12	12	Screw	Carbon steel
13	1	Cover	Carbon steel
14	1	Guide block pin	Alloy steel
15	-	-	-
16	2	Screw	Stainless steel
17	2	Yoke supporter washer	Ertacetal®
18	2	Yoke bushing seat	Steel + Fiberglide®
19	2	Guide block pin bushing	Steel + Fiberglide
20	4	Sliding block seat	Steel + Fiberglide
21	2	O-ring	NBR

**NOTES:**

\* Recommended spare parts

\*\* Cycles performed by actuator in a 25 years expected lifetime - the minimum performed cycles are guaranteed by Biffi based on service conditions listed:

- All the valve required torques have to be lower than actuator max operating torque (MOT).
- The ratio between valve required running torque and actuator max operating torque (MOT) has to be > 1.5.
- The actuator mechanism has to be inspected, lubricated, seals and gaskets have to be replaced after each 200.000 cycles.

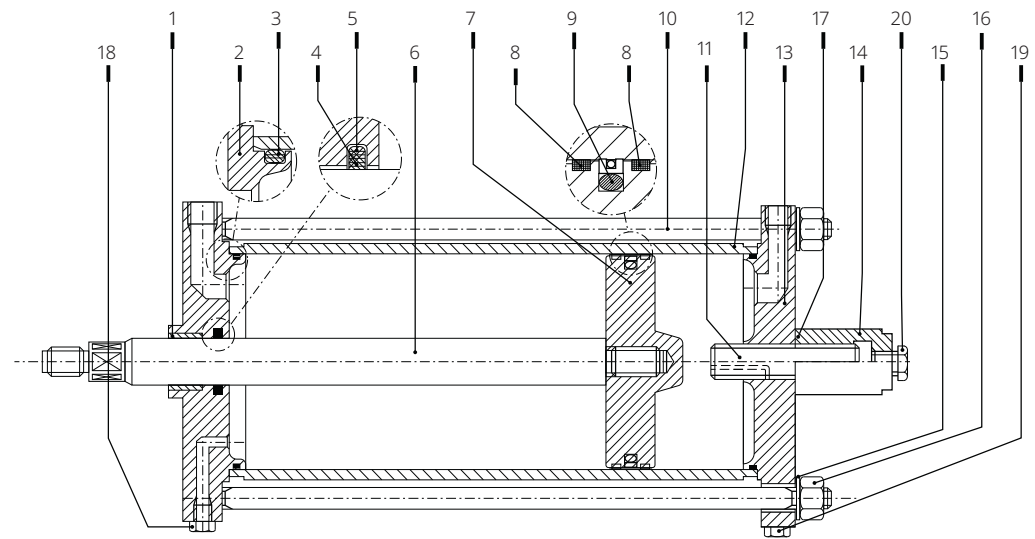
**Figure 46. Pneumatic Cylinder****Table 27. Parts List**

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 47. Hydraulic Cylinder (Optional: Only for ALGA-MHP Hydraulic Handwheel Manual Override)**

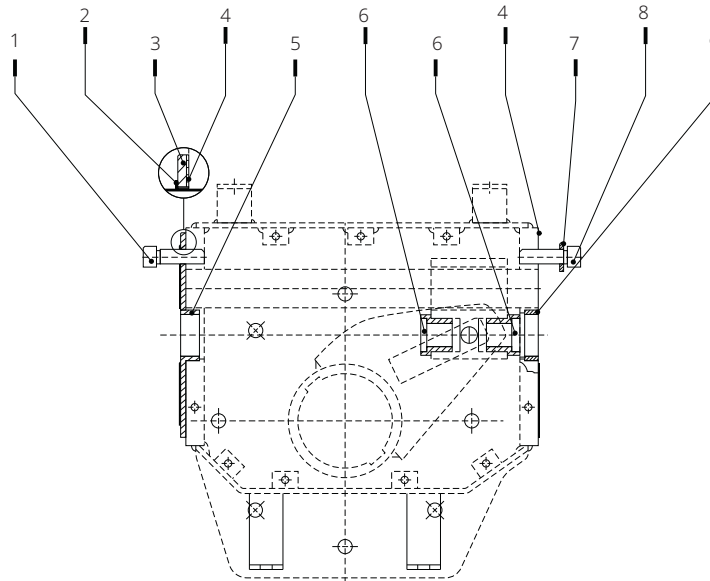


**Table 28. Parts List**

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
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

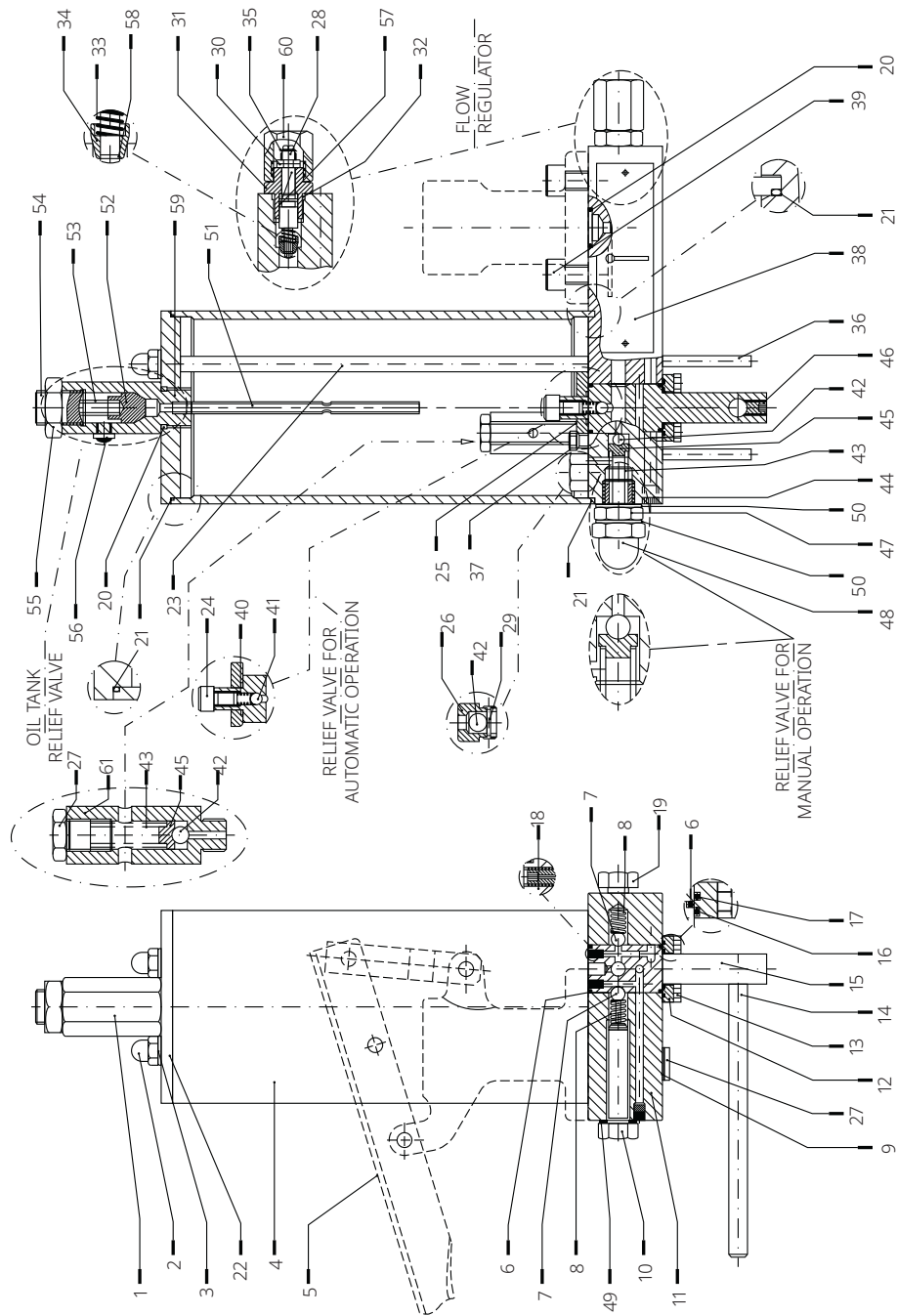
**Figure 48. Assembly Kit****Table 29. Parts List**

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

**NOTE:**

\* Recommended spare parts

Figure 49. Hydraulic Control Unit MHP



**Table 30. Parts List (1)**

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:**

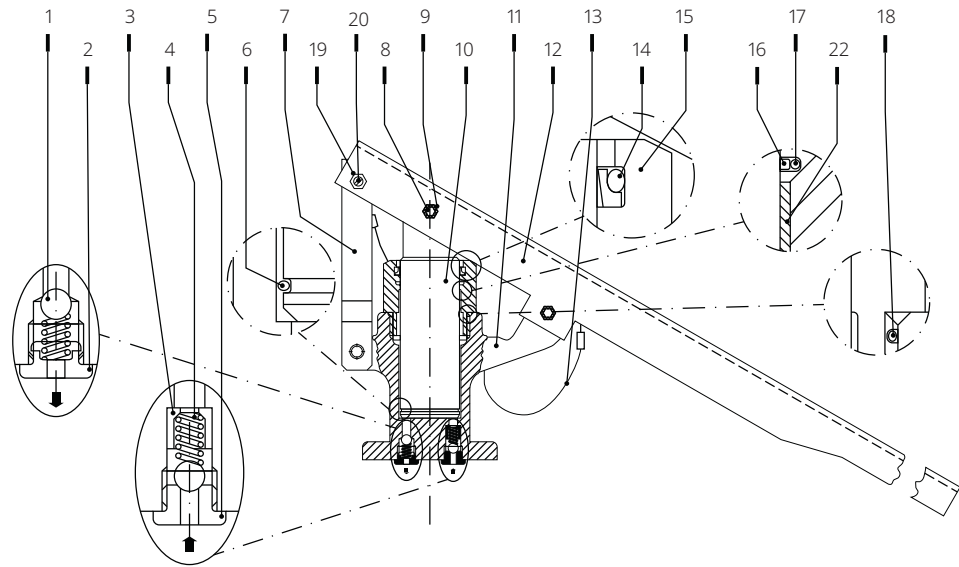
\* Recommended spare parts

**Table 31. Parts List (2)**

Item	Quantity	Description	Material
32	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

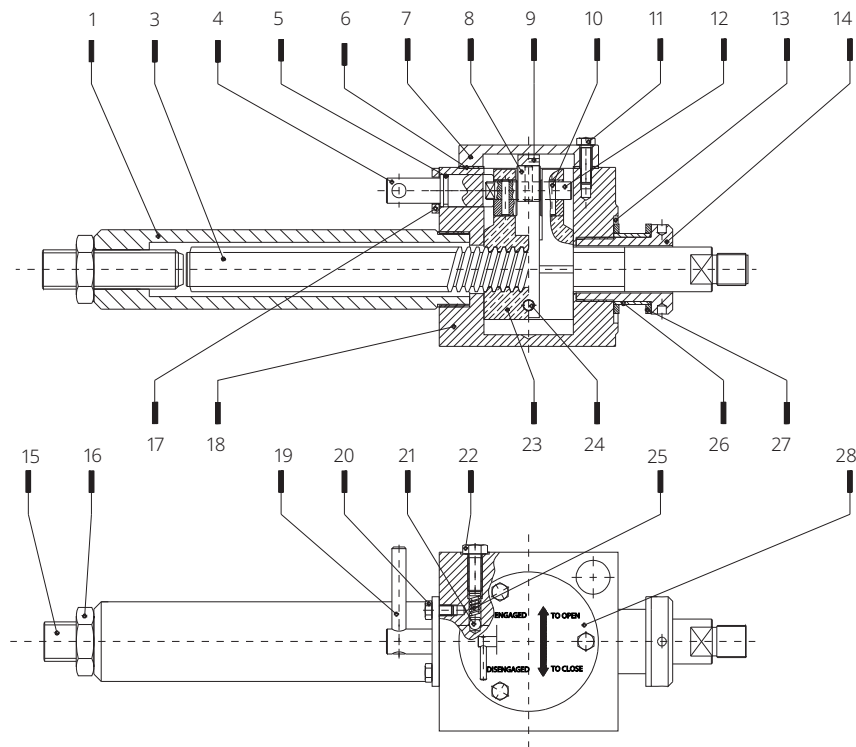
**Figure 50. Hand Pump****Table 32. Parts List**

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 51. Jackscrew Manual Override MSJ or MHW**



**Table 33. 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: 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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