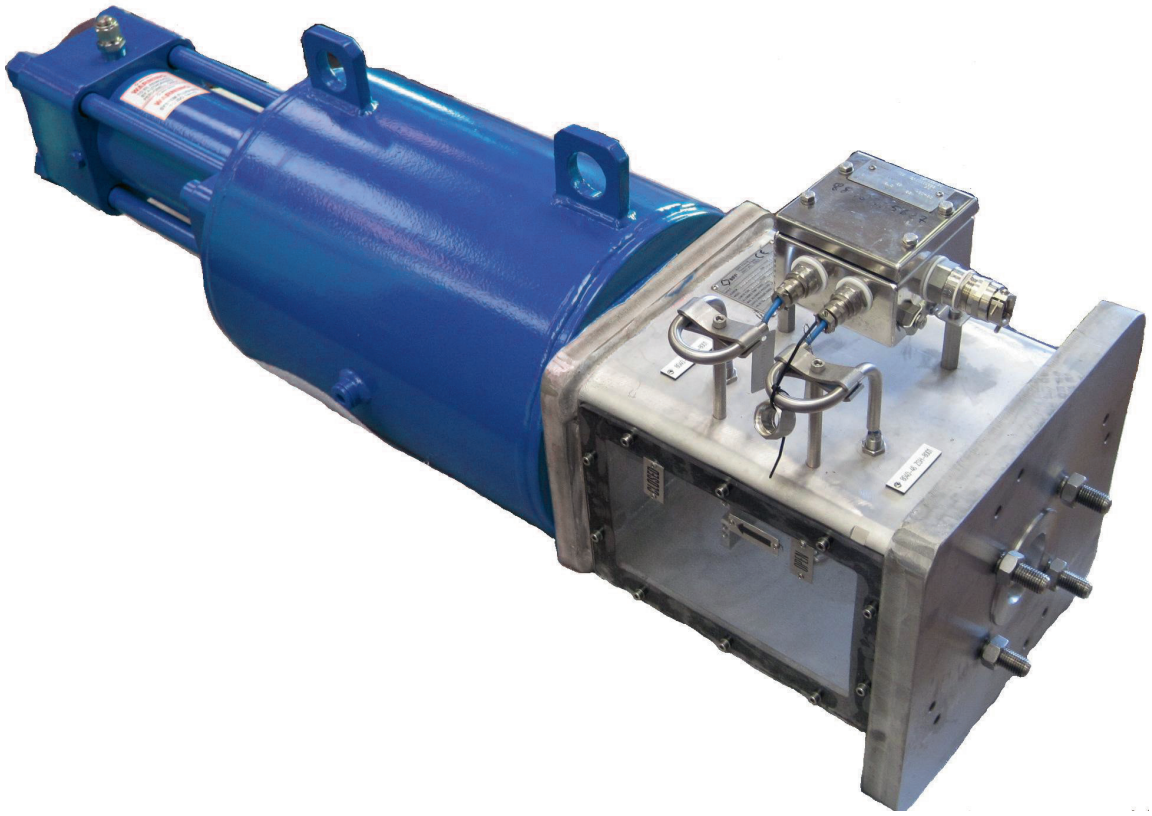
Installation, Operation and Maintenance Manual
MAN 620 Rev. 6
May 2024

Biffi HLAS

Single Acting Spring-Return Hydraulic Linear Actuator



BIFFI

This page is intentionally left blank.

Table of Contents

Section 5: Maintenance

Section 6: Troubleshooting

Section 7: Spare Parts

Section 8: Date Report for Maintenance Operations

NOTICE

Biffi Italia s.r.l. pays the highest attention to collecting and verifying the documentation contained in this IOM (Installation, Operation and Maintenance) manual. However, Biffi Italia s.r.l. is not liable for any mistakes contained in this manual and 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.

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

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.

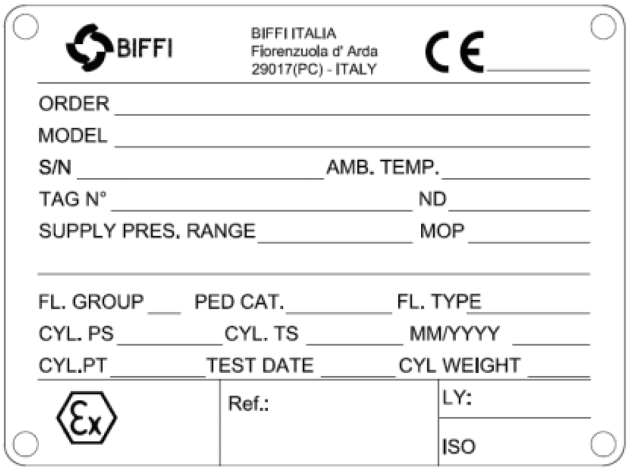
1.2 Identification Plate

⚠ 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



1.3 Introducing the Actuator

HLAS single acting hydraulic linear actuators are suitable for the operation of linear valves (wedge gate valves through conduit gate valves) for ON-OFF and modulating heavy-duty service.

The actuator is made up of a hydraulic cylinder, a spring cartridge and a mounting pedestal complete with a joint for the coupling to the valve stem of actuator output stem. The valve is actuated in opening and in closing position by the actuator hydraulic cylinder in one direction and by the spring unit in the other direction.

The output thrust of spring unit can be downward or upward according to valve operation requirements (spring to open, spring to close, direct-acting valve, reverse-acting valve).

The spring-return pack incorporates up to four springs fully encapsulated in a factory-welded cartridge; this assures safety conditions to personnel and simplifies the assembly.

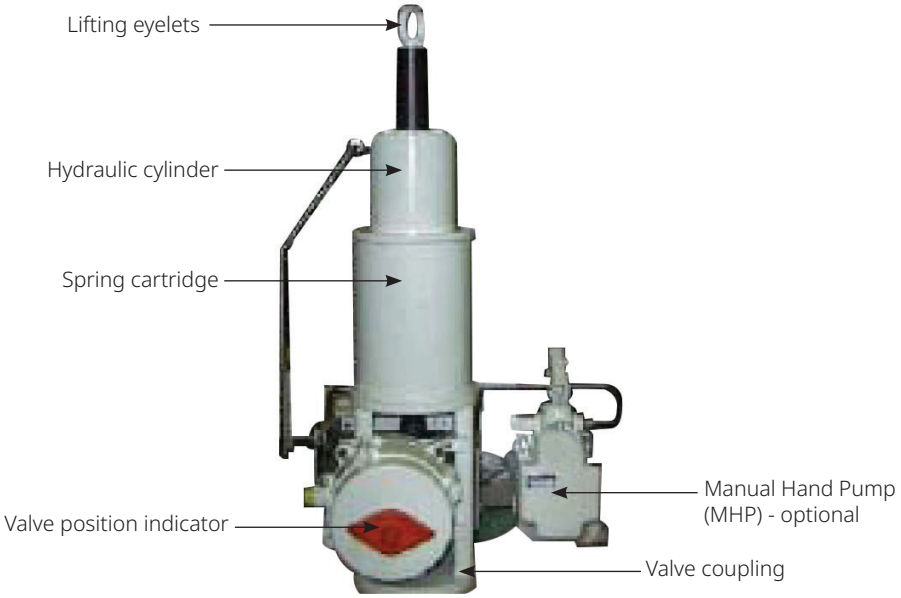
The linear stroke of the valve is adjustable by means of the external mechanical stop for upward position and by the adjustment of the coupling of valve stem to actuator joint for the downward position.

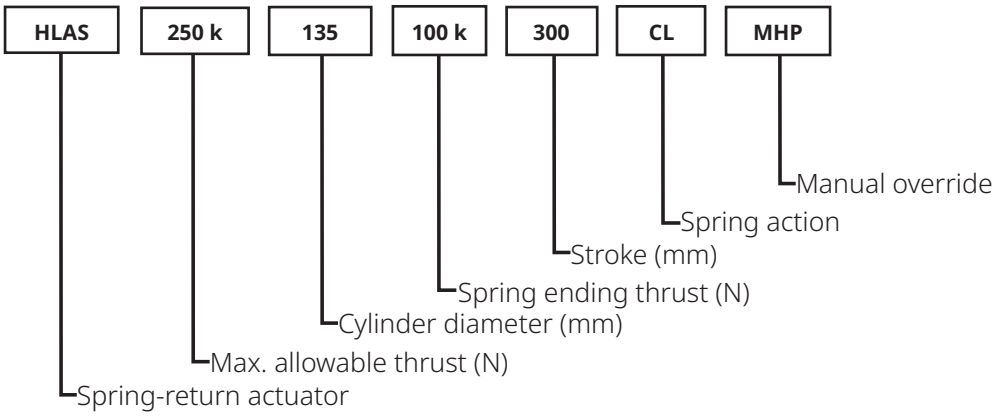
The actuator pedestal has a flange with threaded holes to fix the actuator to the valve.

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

The expected lifetime of actuator is approximately 25 years.

Figure 2. Identification of Actuator Parts





1.4 Data Sheet

Supply fluid	Mineral oil or synthetic fluids
Operating temperature	Standard: from -30 to +100 °C Optional: from -60 to +140 °C
Applications	Gate, Globe valves

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

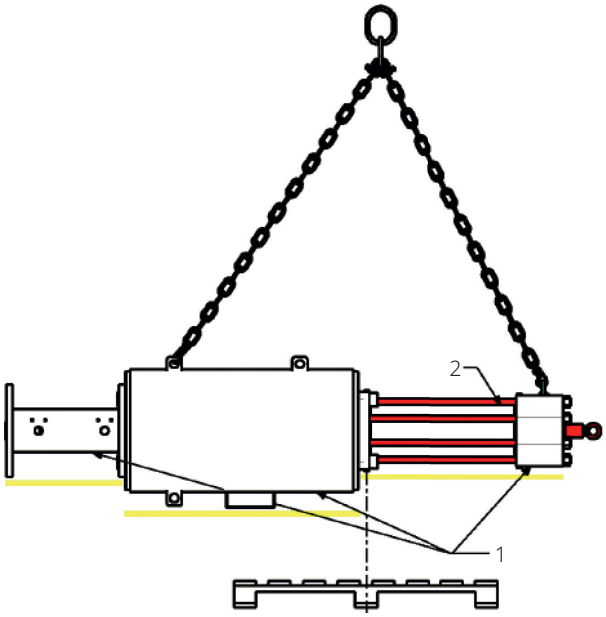
The fastening points are appropriate for the lifting of the actuator alone and not for the valve + actuator assembly. Avoid that during the handling, the actuator passes above the staff. The actuator should be handled with appropriate lifting means. The weight of the actuator is reported on the delivery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

Figure 3. Lifting Points for HLAS Actuators

1 = LIFTING POINTS (OBLIGATORY)

Figure 4. Positioning By Chains

1 = POINT OF SUPPORT



⚠ WARNING

2 = do not lay the actuator on tie rods of cylinder
3 = do not lay the actuator on accessories (manual hand pump, hydraulic control system, etc.)

2.3 Storage

If the actuator needs storage before installation, follow these steps:

- Place it on a wood surface in order not to degrade 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 hydraulic 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

The adapter pedestal in fabricated carbon steel is specifically designed for adaptation to any type of valve with provision for local indicator, limit switches and other accessories (on request).

Lift the actuator by safety hook for chains using the lifting points (see Section 2.2) on the top of actuator for handling, transporting and assembling in vertical position (see Figure 3). For handling, transporting and assembling the actuator in horizontal position by safety hook for chains, use the lifting points on the top of cylinder head flange and on coupling flange (see Figure 4).

2.4.2 Assembly Procedure

⚠ WARNING

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

A. To assemble the actuator onto the valve by bracket with threaded joint, proceed as follows:

Figure 5. Pedestal With Threaded Coupling Joint

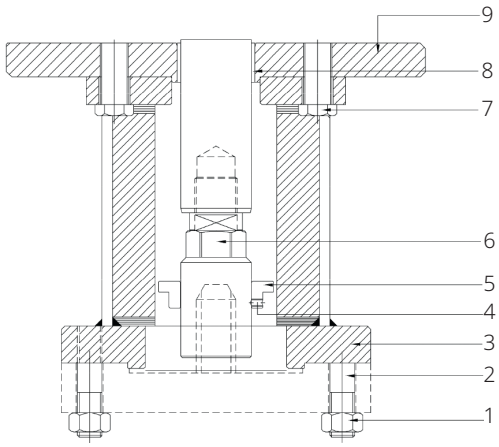


Table 1. Parts List

Item	Description
1	Nut
2	Stud bolt
3	Support joint
4	Index
5	Screw
6	Connecting joint
7	Screw
8	Bushing
9	Flange

1. Check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions (valve stem and flange). Lubricate the valve stem with grease in order to make the assembly easier.
2. Connect a sling to the support point of the actuator and lift it. To make the assembly easier, the valve stem has to be in perfect vertical position.

NOTICE

The eyebolt is sized for the lifting of the actuator only (NOT ACTUATOR+VALVE). Proper lifting points have to be foreseen for the valve.

3. Screw the actuator coupling joint onto the valve by rotating the actuator or screw down the valve stem stroke ring with Red LOCTITE® 542 and fix the half bearings. When the threaded holes of the actuator flange are in correspondence with the holes on the valve flange, screw the proper stud bolts. Screw the nuts on the stud bolts and tighten up the valve flange that is in contact with the actuator flange.
4. Tighten the nuts of the connecting stud bolts evenly with the torque prescribed in the table. The stud bolts must be made of ASTM A320 L7 steel, the nuts must be made of ASTM A194 grade 2 steel as minimum.

B. To assemble the actuator onto the valve by bracket with shell joint, perform the following operations:

Figure 6. Pedestal With Shell Coupling Joint

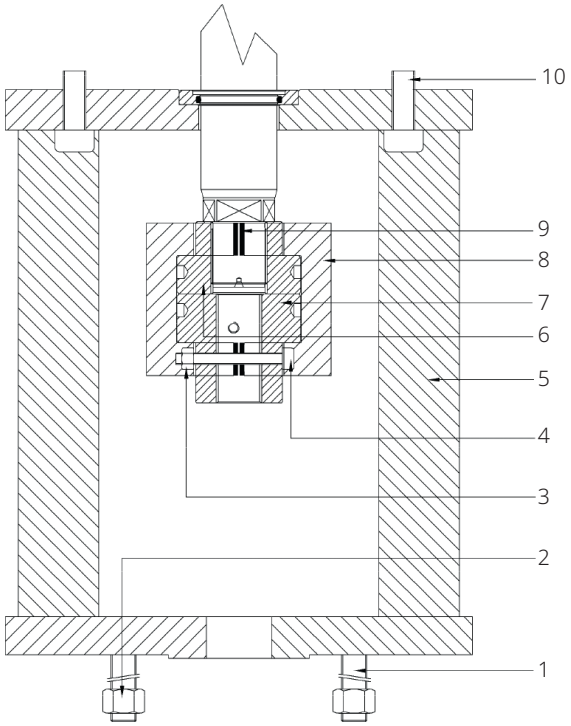


Table 2. Parts List

Item	Description
1	Stud bolt
2	Nut
3	Nut
4	Screw
5	Pedestal
6	Actuator joint
7	Stem valve joint
8	Shell joint
9	Spacer
10	Screw

1. Check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions (valve stem and flange). Lubricate the valve stem with grease in order to make the assembly easier.
2. To make the assembly easier, the valve stem has to be in perfect vertical position.
3. Disassemble the two halves of actuator pedestal shell joint (item 8) by unscrewing the retaining screws (item 4), therefore, disassemble the valve stem joint (item 7).
4. Lift the actuator by utilizing the proper lifting eyelets and unscrew the nuts and the stud bolts from the actuator pedestal.
5. Assemble the actuator onto the valve and arrange it in its correct vertical position proper to connection between valve stem and actuator cylinder rod.
6. Screw the valve stem joint (item 7) on valve stem up to reach the proper position which allows the reassembly of the two halves of shell joint (item 8), tighten the joint fastening screws (item 4).
7. Screw the stud bolts (item 1) into the actuator pedestal flange and screw the nuts on the stud bolts.
8. Tighten according to the nut (item 2) size torque requirements.

To operate, refer to following table:

Table 3. 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 3 were calculated considering the materials ASTM A320 Grade L7 for screws or tie rods and ASTM A194 Grade 2H for the nuts.

2.5 Hydraulic Connections

⚠ WARNING

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

NOTICE

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

⚠ WARNING

Use motor fluid with purity degree ISO 4406 17/14 or NAS 1638 Class 8 (AS4059 Class 4B-F). For special applications, the lower contamination degree is required. Please refer to the documentation supplied.

- Properly deburr the ends of rigid pipes.
- Properly clean the interior of pipes by sending plenty of the supply fluid used in the system through them.
- Mold 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 leakage from hydraulic connections. If necessary, tighten the nuts of the pipe-fittings.

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 as per CEI 64-8 regulation should be complied with (same as IEC 60364).

Remove plastic plugs from cables entries.

- Screw the cable glands firmly.
- 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.

2.7 Commissioning

⚠ WARNING

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 damaged during transport. If necessary, repair the damage to the paint coating.
- Check that the values of hydraulic supply available in the system are compatible with those reported on the identification plate of the actuator (Figure 1) and on the documentation supplied.
- Check 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).
- Check that the setting of the components of the actuator control unit (pressure regulator, pressure switches, flow control valves, etc.) meet the plant requirements.
- Carry out all kinds of operations and check their proper execution (Section 3.3).
- Check the absence of leakages in the hydraulic connections. If necessary, tighten the nuts of the pipe-fittings.
- Check proper operation of all the due signalling (valve position, hydraulic supply pressure, etc.).
- Make a complete functional test in order to verify all the operations are executed according to operating schematic diagram supplied.

Section 3: Operation and Use

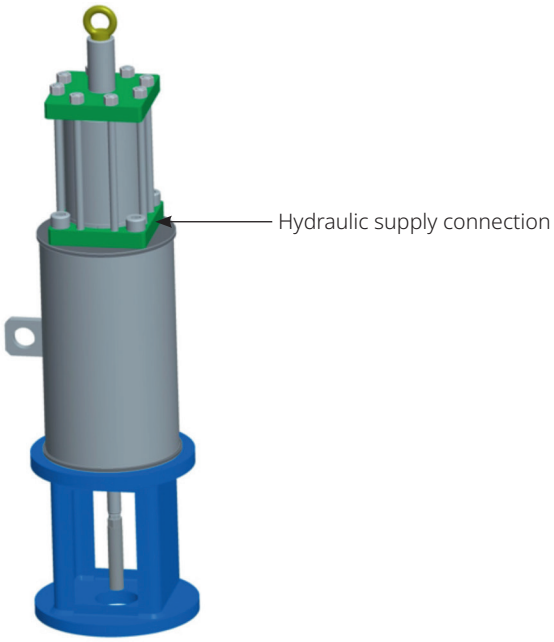
3.1 Operation Description

The supply fluid pressurizes the hydraulic cylinder chamber relevant to the operation to carry out (opening or closing) (see following pages).

This pressure starts the linear motion of the piston and the consequent motion of the valve stem that is coupled.

The spring action operates the valve stem in the opposite direction (fail-safe position).

Figure 7.



For local or remote operations, please refer to technical documentation furnished with actuators.

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

NOTICE

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

Figure 8. Single Acting Function With Jackscrw Manual Override MHP

3.2 Residual Risks

⚠ WARNING

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

3.3 Operations

(refer to specific document: operating diagram furnished).

3.3.1 Emergency Manual Operation (MHP)

⚠ WARNING

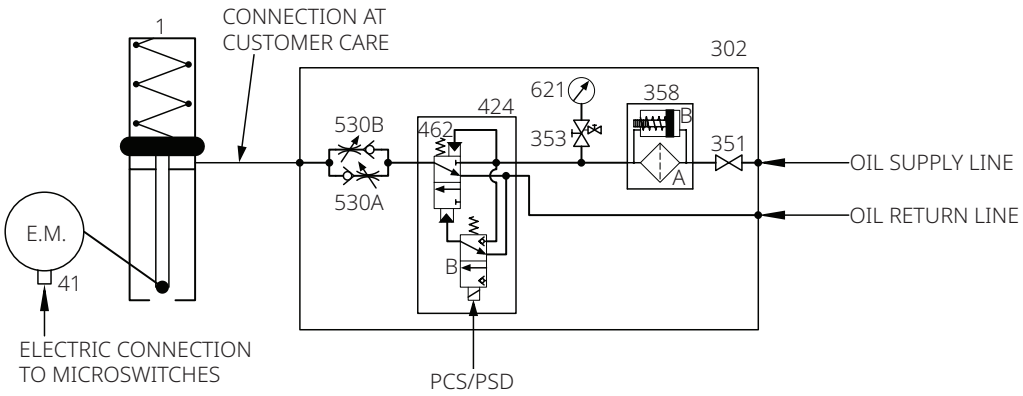
Refer to applicable control schematic in supplied documentation.

The HLAS actuators can have an emergency manual override in addition to the local and/or remote control system, which controls the oil supplied by a power pack for the “normal” actuator operation.

The emergency manual override mounted on the actuator consists of a hydraulic manual override and a hydraulic manual selector to choose the actuator “Normal operation” with oil supply from a power pack, or the “Emergency manual operation”. For nominal pressure until 105 bar, the manual override is similar to Section 7.2, Figure 21. For nominal pressure upper to 105 bar, the manual override will be OMFB for carbon steel material or dedicated model engineered by Biffi for stainless steel material.

3.3.2 Remote Control Operations

Figure 9. Example of Control Schematics for Spring-To-Close HLAS Actuator



1	Single acting spring-return hydraulic linear actuator
41	Electric microswitches
302	Panel
351	Stop valve - lockable
353	Needle valve with drain valve
358	Hydraulic filter with visual indicator A - Filter B - Clogging visual indicator
424	3/2 N.C. Poppet type solenoid valve A - 3/2 N.C. Hydraulic pilot/spring-return valve B - 3/2 N.C. Poppet type solenoid valve
530	Undirectional flow regulator (adjustable setting)
621	Pressure gauge

NOTE:
The diagram is drawn with solenoid valve coil not energized.

Electric remote control to compress the spring

1. Energize permanently the solenoid valve 424B.
2. The opening time is adjustable by the flow regulator 530A.

Electric remote control to release the spring

1. De-energize the solenoid valve 424B.
2. The closing time is adjustable by the flow regulator 530B.

3.4 Calibration of the Angular Stroke

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

The setting of the open/closed valve position (upward position) is performed by adjusting the travel stop screw into the end flange of the hydraulic cylinder and by the adjustment of the coupling of valve stem to actuator joint for the downward position.

Figure 10. Mechanical Stop on Cylinder End Flange

For the adjustment of the mechanical stop on the end flange of cylinder, follow these steps (Figure 11):

- Remove the plug (T) with the specific wrench (C1).
- 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).
- If the actuator angular stroke is stopped before reaching the upward position (fully open or closed), unscrew the adjusting screw by turning it anticlockwise with a proper wrench, until the valve reaches the right position.
- If the actuator angular stroke is stopped beyond the upward position (fully open or closed valve), screw the stop screw by turning it clockwise until the valve reaches the right position.
- When the adjustment is over, tighten the plug (T).

Figure 11. Mechanical Stop of the Cylinder

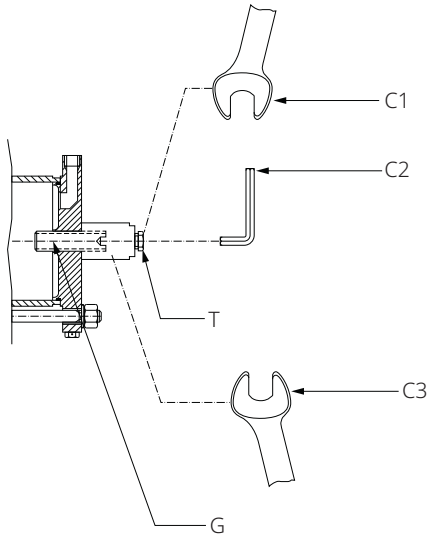
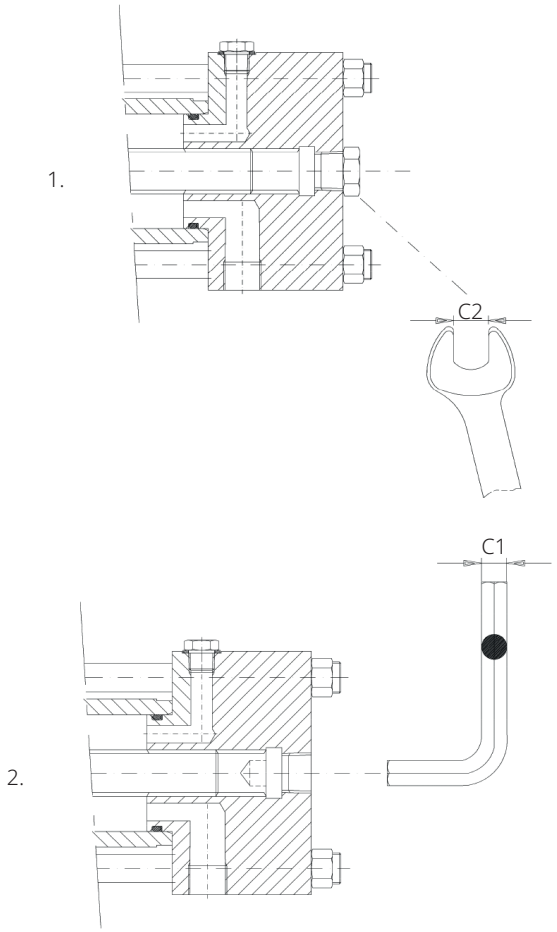


Table 4.

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

For high pressure cylinder models, the mechanical stop is internal (without protection cover). Proceed at the same way: (1) remove the plug and (2) operate the adjusting screw.

Figure 12.



3.5 Calibration of Microswitches (Biffi Limit Switch Box Only)

NOTICE

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

⚠ WARNING

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

Microswitches are placed inside a special box (Figure 13).

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

- Unscrew the fastening screws of the cover (Figure 13).
- 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 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 14).
- 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 15).
- Tighten the screws.

Figure 13. Microswitches box

Figure 14. Cam adjustment

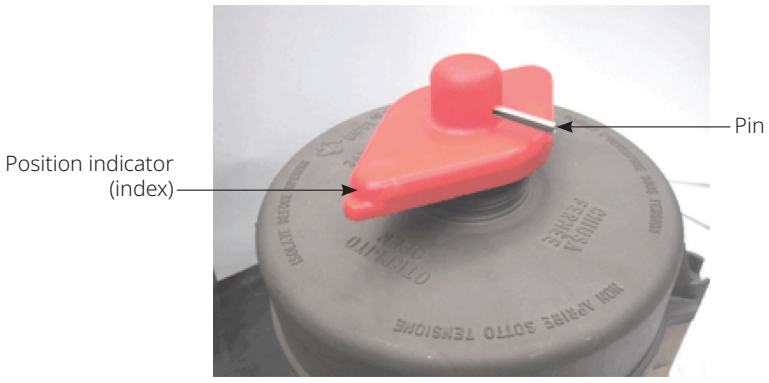
If the index (Figure 15) does not signal the proper position of the valve but is turned by 90°:

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

NOTICE

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

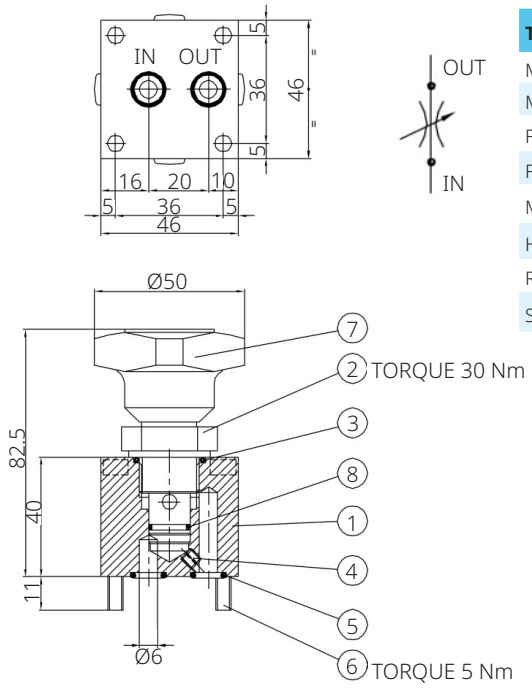
Figure 15. Position Indicator and Pin for Microswitches Box



3.6 Calibration of the Operation Time

For actuator models with control system, it's possible to regulate the speed of actuator operations. 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 regulating valves (optional) placed on inlets of hydraulic cylinder (refer to specific technical documentation furnished with actuator's scope of supply).

Figure 16. Adjustment of Operating Time By Flow-Regulator Valve



Technical features:		
Max. adjusted flow	(1/min.)	10
Max. working pressure	(bar)	250
Fluid viscosity range	(cSt)	5 to 750
Fluid temperature range	(°C)	-45 to +60
Mass	(Kg)	0.70
Hydraulic fluid: mineral oils		
Recommended filtration: 19/15 ISD 4466 (25 µ absolutes)		
Seals in MFQ (Fluorosilicone)		

Table 5.

Poistion	Quantity	Denomination	Material	Type or Drawing
8	1	OR + 2BK (included in cartridge position 2)	MFQ-70Sh+PTFE	OR2-013 + 2BK
7	1	Handwheel	11S (2011)	29.102.378
6	4	Screw	A4-70	VTCEI M5x45 UNI 5931
5	2	O-ring	MFQ-70Sh	OR 5-612
4	1	Screw	A4-70	M5x5 UNI 5923
3	1	O-ring (included in cartridge position 2)	MFQ-70Sh	OR 2-116
2	1	Cartridge	AISI 316	FT 2267/2-14-FQSV
1	1	Body	AISI 316	49.144.031

To carry out the adjustment, operate the handwheel (turn the handwheel clockwise to increase the operating time or turn the handwheel counterclockwise to decrease the operation time).

Section 4: Operational Tests and Inspections

NOTICE

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

Section 5: Maintenance

⚠ WARNING

Before carrying out any maintenance operation, it is necessary to close the hydraulic 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 Periodic Maintenance

HLAS 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. Inspection intervals 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.
- Check that there are no hydraulic leakages. If necessary, tighten the nuts of the pipe-fittings.
- Check oil level (Figure 17) into the hydraulic manual hand pump, if present (see Section 5.1.1).
- Check that the actuators did not undergo accidental damage with oil leakages found on site.
- 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.).
- If there is an oil 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 oil. If the filter is made of cellulose, it must be replaced when clogged.

Figure 17. Level Measuring Stick

5.1.1 Check and Restore Oil Level in the Hydraulic Manual Hand Pump

(refer to Section 7.2, Figure 22)

During the actuator operation, the oil tank has to be closed (not in connection with the atmosphere). Then avoid cavitation; it is necessary to proceed as follows for the checking of oil level into the tank:

1. Unscrew the dipstick (1).
2. Move the actuator into open position.
3. Check that the oil level into the tank (4) is in correspondence of the “MAXIMUM LEVEL” notch of the dipstick.
4. By leaving the dipstick unscrewed, move the actuator by the pneumatic control or by the hand pump, to closed position.
5. Screw and tighten the dipstick.

If it is necessary to substitute or add the oil, proceed as follows:

- 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 (Table 6) if in the tank the level is BELOW MINIMUM.

NOTICE

For refill, use oil of the same brand as the one in the tanks. The cleanliness level for actuator without control system is NAS 8 minimum. For actuator with control system, the cleanliness level is that required by singles components. In any case, Biffi Italia s.r.l. respects the customer requirements to scope of supply. For applicable cleanliness level, refer to document: technical data sheet for actuators.

Table 6. Hydraulic Oil List by Biffi Italia s.r.l. 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 Fiorenzuola. Your oil supplier can verify and propose an alternative product at your responsibility.
Low Temperature Conditions (To -46 °C):	
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^3
Low Temperature Conditions (To -60 °C):	
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^3

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

5.2 Extraordinary Maintenance

In case of need, extraordinary maintenance can be performed on the parts of the actuator.

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 following general sectional drawing and adopting the following procedures.

NOTICE

Anyway, contact Biffi Italia customer care.

5.2.1 Lubrication of Mechanism

For normal duty, the HLAS actuator is lubricated "for life". In case of high load and high frequency of operation, it may be necessary to periodically restore the lubrication; it is advisable to apply a generous coating of grease on the contact surfaces of moving parts. For this operation, it is necessary to disassemble the closing plates (item 4, Figure 19) from pedestal with coupling joint.

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^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 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.

5.2.2 Replacement of Cylinder Seals

(Refer to Figure 18)

⚠ WARNING

Before carrying out any maintenance operation, it is necessary to close the hydraulic feed line and exhaust the pressure from the actuator cylinder and from the control unit to ensure safety of maintenance staff. If the actuator can be operated, it is essential to take it to fail-safe position, with the spring totally extended.

1. Unscrew the adjusting screw cover (for low pressure cylinder) or the protection plug (13) (for high pressure cylinder) from the cylinder end flange.
2. Measure the distance of the stop screw (10) with reference to the end flange surface (12), so as to be able to easily restore the setting of the actuator mechanical stop once the maintenance procedures have been completed.
3. Unscrew the stop screw (10) by turning it anticlockwise with an Allen wrench, until the screw is completely withdrawn inside the end flange threaded hole.
4. Unscrew the nuts (14) from the tie rods (9); they must be gradually unscrewed all at the same time.
5. Slide off the end flange (12) and the tube (11).
6. If the actuator control unit requires the cylinder chamber head flange side to be also filled with oil, and the piston rod seal ring (3) to be replaced, remove the flange (1). Unscrew the piston rod threaded end from the adaptor bush. Slide off the piston rod from the head flange (5).
7. Disassemble the head flange.

5.2.2.1 Seals Replacement

Prior to reassembly, check that the actuator components are in good condition and are clean. Lubricate all the surfaces of the parts, which move in contact with other components, by a 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 (2) of the head flange (1).
2. Replace the back-up ring (4) of the head flange (1).

To replace the piston rod seal rings (3), proceed as follows:

1. Remove the existing Polytetrafluoroethylene (PTFE) seal ring (3) with its O-ring, from their groove.
2. Clean the groove carefully and lubricate it with a protective oil or grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.
4. Assemble the new PTFE seal ring (3) into the flange groove, inside its rubber O-ring, 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 (8), proceed as follows:

1. Remove the existing PTFE seal ring (8) with its O-ring from their groove.
2. Clean the groove carefully and lubricate it with a protective oil or grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.
4. Assemble the new PTFE seal ring (8) on its rubber O-ring by introducing one side of it into the groove, then, enlarge it with your fingers so as to fit 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 the seal ring is made of allows the ring to shrink back to its previous dimension after a short time.

5.2.2.2 Reassembly

1. Assemble the head flange (1), replace the washers, if damaged.
2. Lubricate the piston rod (24) surface with a protective oil or grease film and introduce it into the head flange hole, taking care not to damage the O-ring (3). Carefully clean the threaded end of the piston rod (24) and the threaded hole of the adaptor. Spread some sealant LOCTITE 452, or equivalent, on the rod threaded end and tighten.
3. Carefully clean the inside of the tube (11) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate with a protective oil or grease film, the tube internal surface and the bevels at the ends. Slide the tube onto the piston taking care not to damage the PTFE seal ring (8); the tube bevel has to smoothly compress the seal ring; take care also not to damage the head flange O-ring (2).
4. Assemble the end flange by centering it on the inside diameter of the tube, taking care not to damage the O-ring (2).
5. Assemble the nuts (14) onto the tie rods (9). Tighten the nuts to the recommended torque, alternating between opposite corners.
6. Screw the stop screw (10) by turning it clockwise with an Allen wrench until it reaches its original position (the same distance with reference to the end flange surface).
7. Replace the O-ring (15) under the protection cover.
8. Screw the protection cover (13) into the cylinder end flange.

NOTICE

Carry out a few operations (Section 3) to check if there are no leakages from the gaskets.

Figure 18. Single Acting Spring-Return Hydraulic Linear Actuator Sectional Drawing

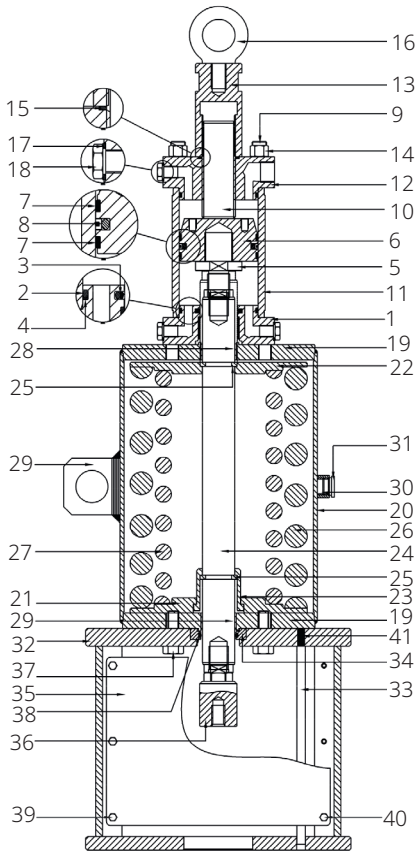


Table 7. Parts List

Item	Description	Item	Description
1	Head flange	22	Lower spring flange
2	O-ring	23	Piston rod guide tube
3	Piston rod seal ring	24	Stem
4	Back-up ring	25	Retainer half ring
5	Joint	26	Spring
6	Piston	27	Spring
7	Guide sliding ring for piston	28	Bush
8	Piston seal ring	29	Lifting eyelet
9	Tie rod	30	Sleeve
10	Stop setting screw	31	Plug
11	Cylinder tube	32	Pedestal
12	End flange	33	Antirotation shaft
13	Stop setting screw cover	34	Scraper ring flange
14	Nut	35	Plate
15	O-ring	36	Actuator joint
16	Eyebolt	37	Screw
17	Washer	38	Scraper ring
18	Plug	39	Washer
19	Closing flange	40	Screw
20	External tube	41	Dowell
21	Upper spring flange		

5.3 Dismantling and Demolition

Before starting the disassembly, a large area should be created around the actuator so as 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 the 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.

If the actuator needs storage before demolition, see Section 2.3.

⚠ WARNING

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

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

Section 6: Troubleshooting

6.1 Failure or Breakdown Research

Table 8.

Event	Possible cause	Remedy
Actuator does not work	Lack of hydraulic supply	Open line stop valve
	Blocked valve	Repair or replace
	Wrong position of the distributor of the hydraulic manual override	Restore correct position
	Failure of the spring	Call Biffi Italia s.r.l. Customer Service
	Failure of the control system	Call Biffi Italia s.r.l. Customer Service
	Clogged filter	Clean or replace the cartridge
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
Incorrect postion of the valve	Wrong adjustment of mechanical stops	Reset (Section 3.4)
	Wrong warning of microswitches	Reset (Section 3.5)

Section 7: Spare Parts

7.1 Spare Parts Order

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

Please send every spare parts request to:

Biffi Italia s.r.l. - 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 acknowledgment
3. Spare parts code
4. Quantity
5. Transport condition
6. Involved people

7.2 Parts List for Maintenance and Replacement Procedure

Figure 19. Pedestal With Coupling Joint

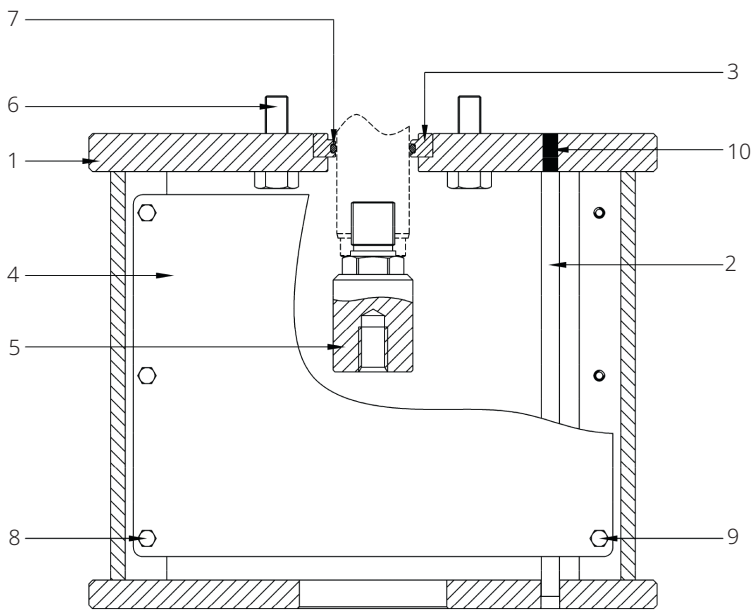


Table 9. Parts List

Item	Quantity	Description	Material
1	1	Pedestal	Carbon steel
2	1	Antirotation shaft	Stainless steel
3	1	Scraper ring flange	Stainless steel
4	1	Plate	Stainless steel
5	1	Actuator joint	Stainless steel
6	4	Screw	Alloy steel
7	1	Scraper ring	Turcon + NBR (Nitrile Butadiene Rubber)
8	6	Washer	Stainless steel
9	6	Screw	Stainless steel
10	1	Dowell	Stainless steel

Figure 20. Spring Cartridge

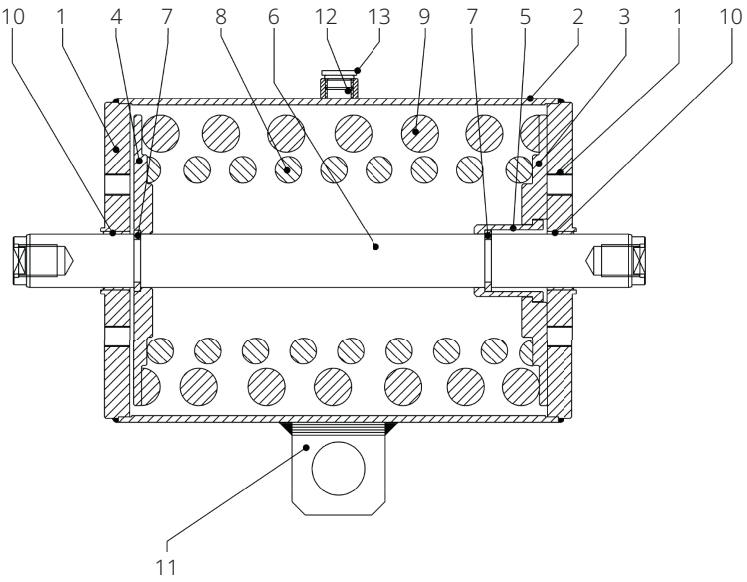


Table 10. Parts List

Item	Quantity	Description	Material
1	2	Closing flange	Carbon steel
2	1	External tube	Carbon steel
3	1	Upper spring flange	Carbon steel
4	1	Lower spring flange	Carbon steel
5	1	Piston rod guide tube	Carbon steel
6	1	Stem	Stainless steel
7	4	Retainer half ring	Stainless steel
8	1	Spring	Alloy steel
9	1	Spring	Alloy steel
10	2	Bush	Carbon steel + Bronze + PTFE
11	1	Lifting eyelet	Carbon steel
12	1	Sleeve	Carbon steel
13	1	Plug	Alloy steel + NBR

Figure 21. Hydraulic Cylinder

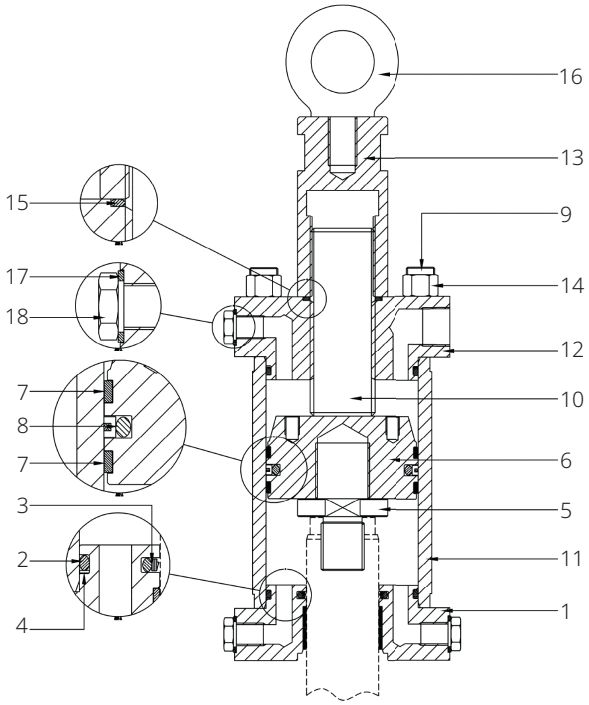


Table 11. Parts List

Item	Quantity	Description	Material
1	1	Head flange	Carbon steel
2	2	O-ring	* NBR
3	2	Piston rod seal ring	PTFE + graphite + NBR
4	2	Back-up ring	* NBR
5	1	Joint	Stainless steel
6	1	Piston	Nickel plated carbon steel
7	2	Guide sliding ring for piston	* PTFE + graphite
8	1	Piston seal ring	* PTFE + graphite + NBR
9	4	Tie rod	Stainless steel
10	1	Stop setting screw	Stainless steel AISI 316
11	1	Cylinder tube	Nickel plated carbon steel
12	1	End flange	Carbon steel
13	1	Stop setting screw cover	Carbon steel
14	4	Nut	Stainless steel
15	1	O-ring	* NBR
16	1	Eyebolt	Carbon steel
17	4	Washer	Stainless steel + NBR
18	4	Plug	Stainless steel

NOTE:
* Recommended spare parts

Figure 22. Hydraulic Control Unit MHP

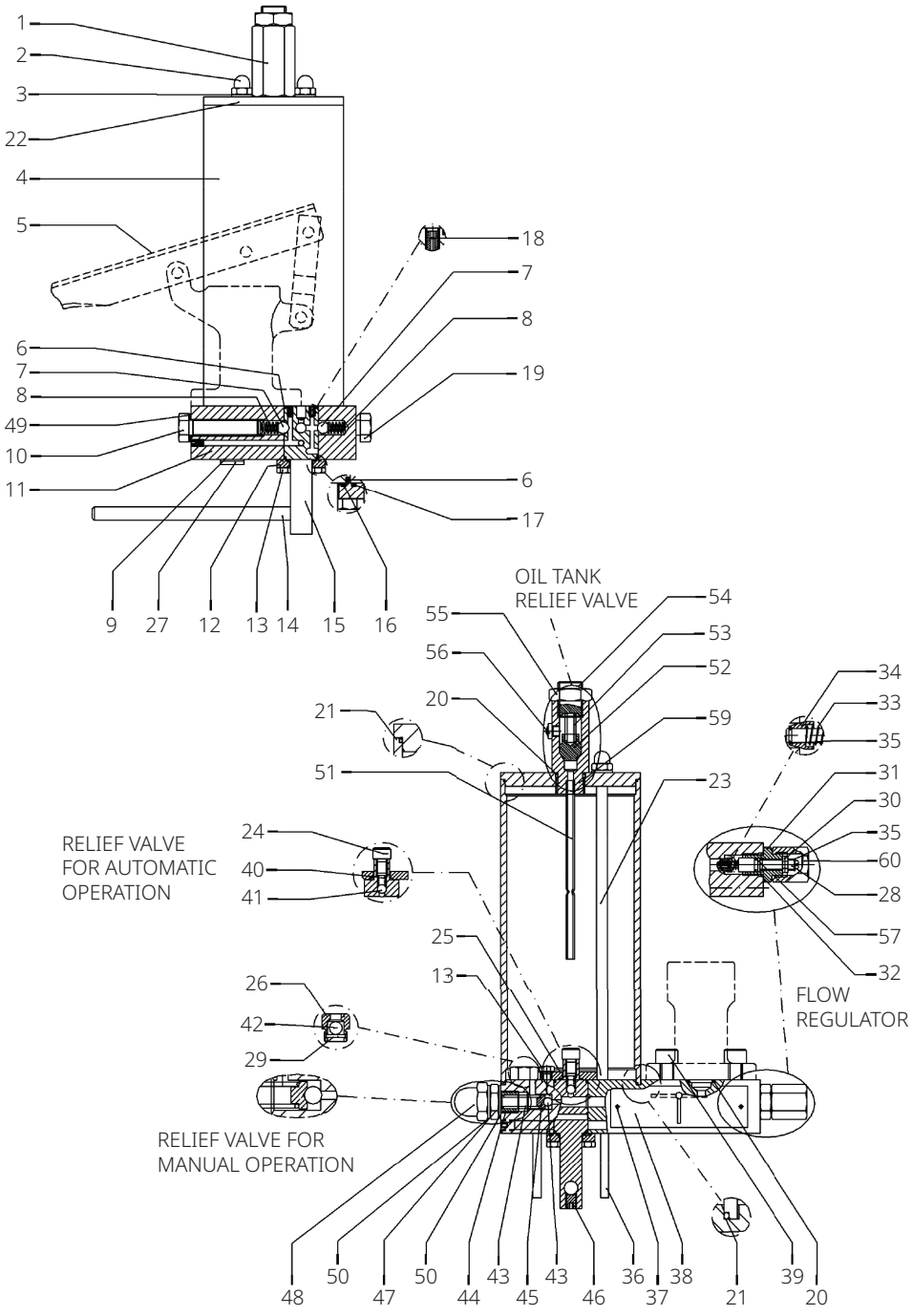


Table 12. Parts List

Item	Quantity	Description	Material
1	1	Dipstick	Carbon steel + Aluminum
2	5	Plug	Carbon steel
3	6	Washer	Copper
4	1	Hydraulic tank	Carbon steel
5	1	Hand pump	See Table 13
6	2	O-ring	* Fluorosilicon rubber
7	2	Ball	Stainless steel
8	2	Spring	Spring steel
9	2	Washer	Copper
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	2	Tank gasket	* Fiber
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	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	Carbon 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	2	Ball	Stainless steel
42	2	Ball	Stainless steel
43	1	Spring	Carbon steel
44	1	Relief valve setting screw	Alloy steel
45	1	Spring pin	Carbon steel
46	1	Screw	Alloy steel
47	1	Spring	Stainless steel
48	1	Ball	Stainless steel

NOTE:
* Recommended spare parts

Figure 23. Hydraulic Control Unit Hand Pump

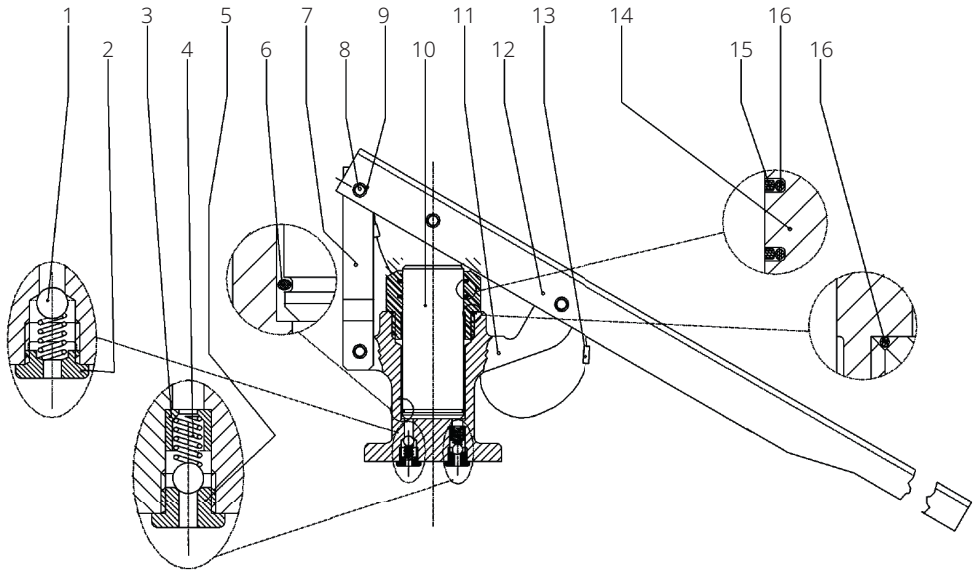


Table 13. Parts List

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 seat	Carbon steel
6	1	Spring retainer ring	Carbon steel
7	1	Fork	Carbon steel
8	3	Pin	Stainless steel
9	6	Retainer ring	Carbon steel
10	1	Rod	Alloy steel (chromium plated)
11	1	Body	Carbon steel
12	1	Lever	Carbon steel
13	1	Split pin with rope	Carbon steel + nylon
14	1	Threaded bush	Aluminum
15	2	Rod seal ring	PTFE + graphite
16	2	O-ring	* Fluorosilicon rubber
17	1	O-ring	* Fluorosilicon rubber

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).....

This page is intentionally left blank.

Biffi Italia s.r.l.
Strada Biffi 165
29017 Fiorenzuola d'Arda (PC)
Italy
T +39 0523 944 411

For complete list of sales and manufacturing sites, please visit www.biffi.it or contact us at biffi_italia@biffi.it

BIFFI