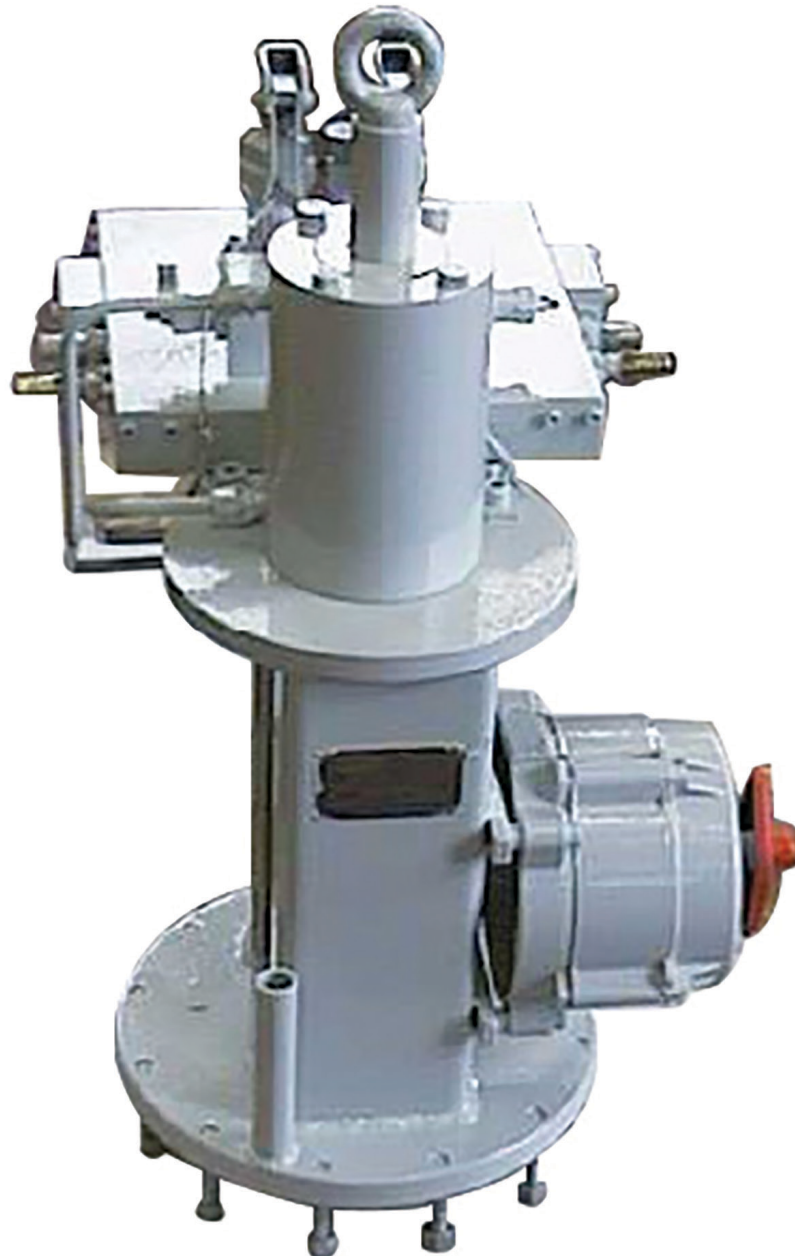


# Biffi HLA

## Double-Acting Hydraulic Linear Actuator



**Revision Details**

Rev.	Date	Description	Prepared	Checked	Approved
5	March 2022	General update (Migration to new template)			
4	February 2019	Updated data plate	Sassi	Orefici	Vigliano
3	April 2016	Updated applicable regulation (chapter 1.1.1)	Ermanni	Orefici	Vigliano
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1	June 2010	General update	Ermanni	Stoto	Vigliano
0	May 1999	Document release	Lazzarini	Aliani	Ziveri

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## NOTICE

Biffi Italia s.r.l. pays the highest attention to collecting and verifying the documentation contained in this 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. 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 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 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 (Figure 1).

**Figure 1** Data plate

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

## 1.3 Introducing the Actuator

HLA double-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 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 that is pressurized in one or in the other direction.

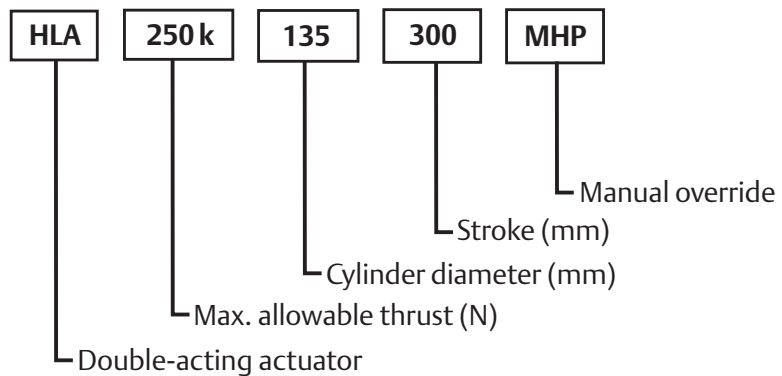
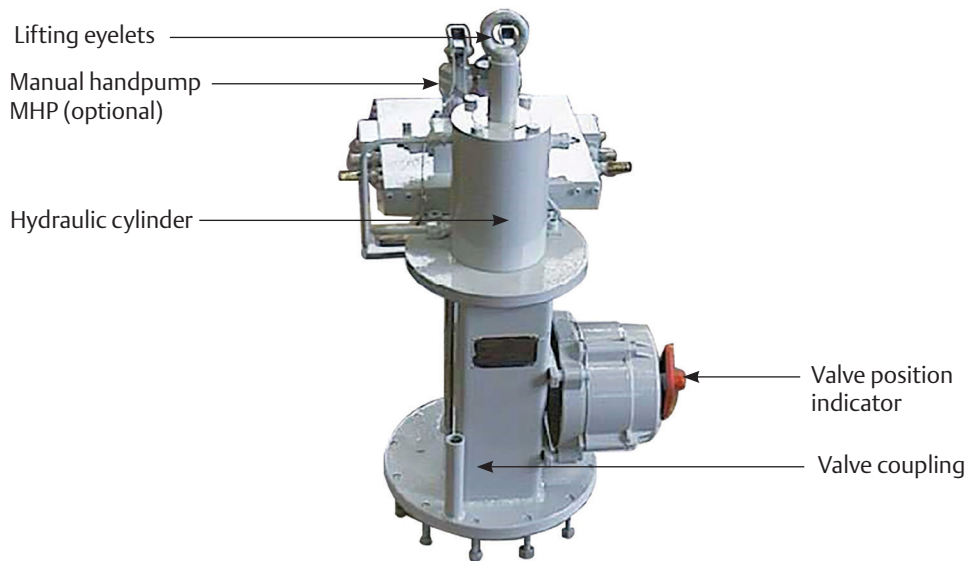
The linear stroke of the valve is adjustable by means of the external mechanical stop for upward position and by the adjustment of the coupling of valve stem to actuator joint for the downward position.

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

<b>Supply fluid</b>	Mineral oil or synthetic fluids
<b>Operating temperature</b>	Standard: from -30 °C to +100 °C Optional: from -60 °C to +140 °C
<b>Applications</b>	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 that the actuator is equipped with the fittings as provided for by order confirmation.
- Check that 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

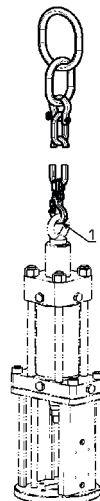
The lifting and handling should be made by qualified staff and in compliance with the laws and provisions in force.

#### ⚠ 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.

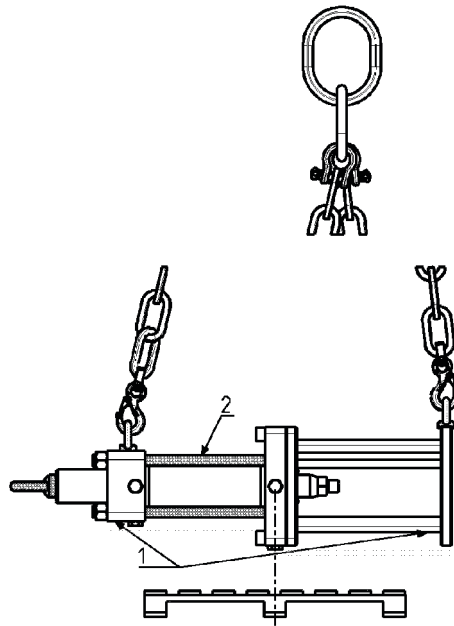
**Figure 3** Lifting points for HLA actuators

1 = Lifting points (obligatory)

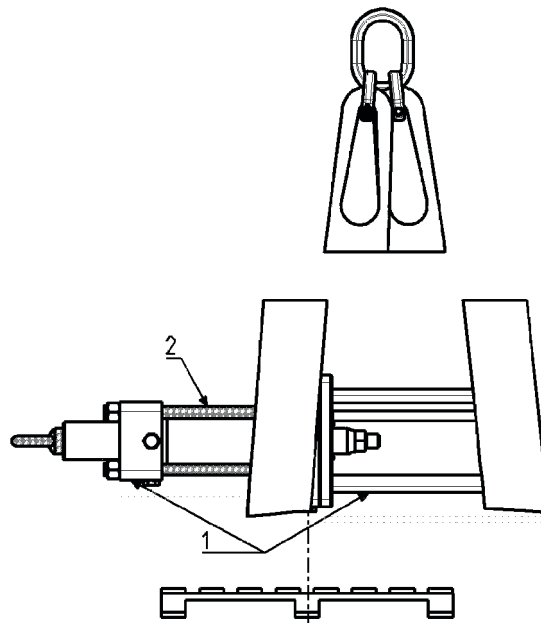


**Figure 4 Positioning by chains**

1 = point of support



**Figure 5 Positioning by slings**



**⚠ WARNING**

- 2 = don't lay the actuator on tie rods of cylinder
- 3 = don't lay the actuator on accessories (manual handpump, 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 deteriorate the area of valve coupling.
- Make sure that plastic plugs are present on the hydraulic 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 Figures 4 and 5).

### 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.

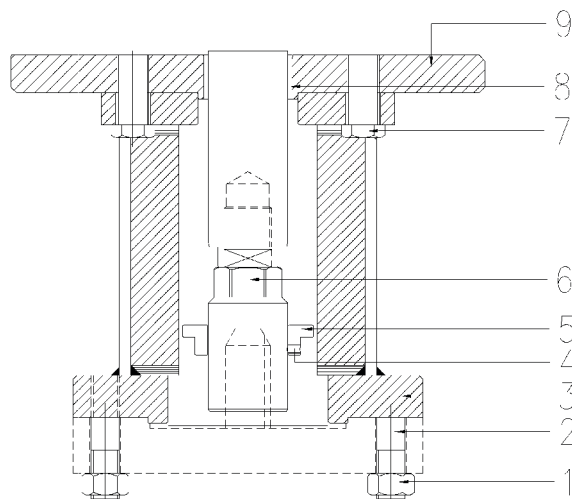
For actuator assembly on the valve:

#### **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 6 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.

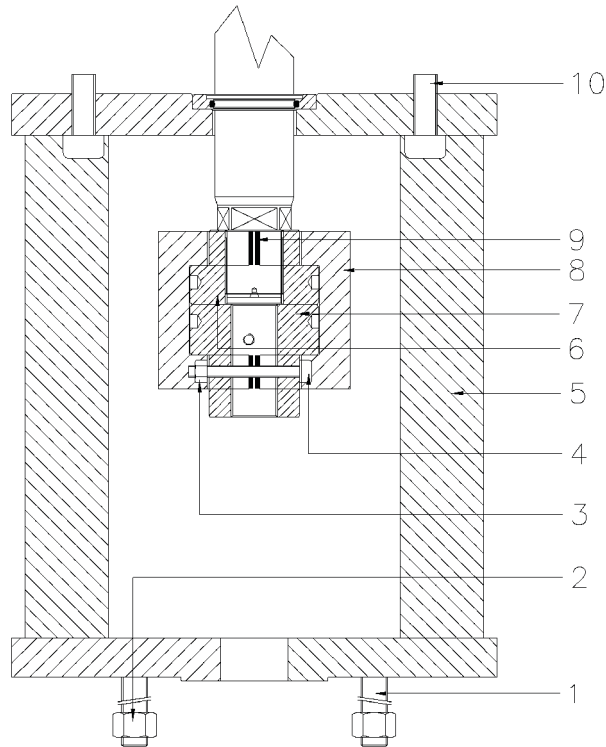
**NOTICE**

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 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 7 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 allow 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.

## NOTICE

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 L7 for screws or tie rods and ASTM A194 gr. 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 and connections appropriate as for 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 sending through them plenty of the supply fluid used in the system.
- 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 leakages from hydraulic connections. If necessary, tighten the nuts of the pipe-fittings.

## 2.6 Electrical Connections (if Any)

### WARNING

Use components appropriate as for 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 cable 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 damages to paint coat.
- 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.

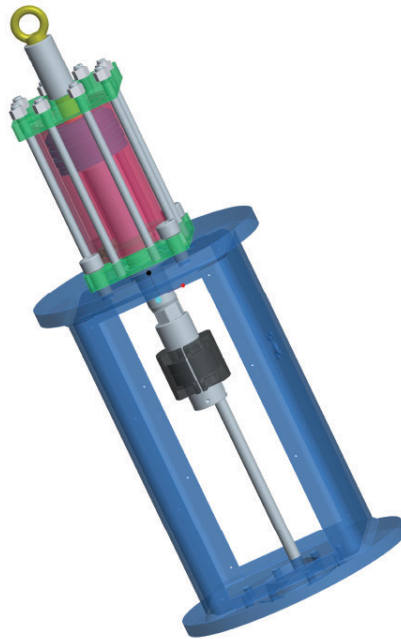
## Section 3: Operation and Use

### 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.

**Figure 8**



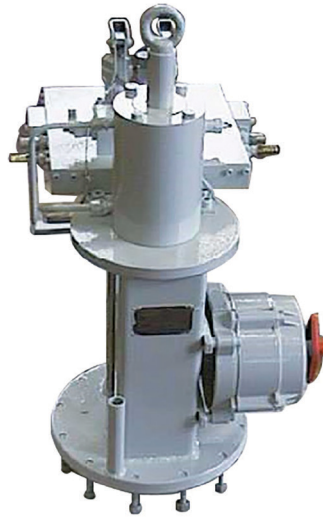
For local or remote operations, please refer to technical documentation furnished with actuators.

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 9** Double-acting function with jackscrew manual override MHP

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## 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.

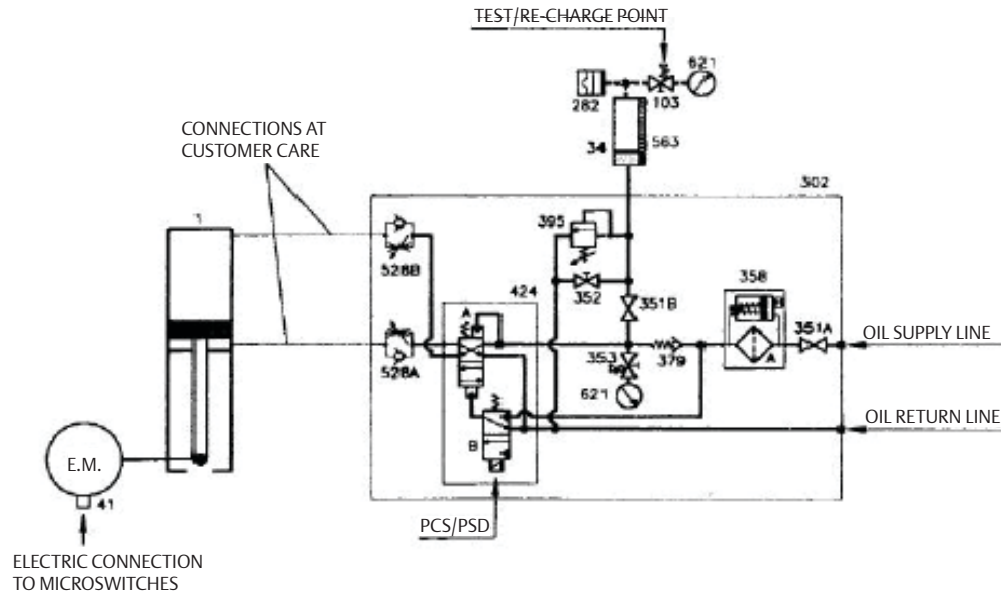
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The HLA actuators can have an emergency manual override in addition to the local and/or remote control system which controls the oil supplied by a power pack for the “normal” actuator operation.

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, Figure 23. 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 10** Example of control schematics for double-acting HLA actuator



Electric remote control to open  
Energize permanently the solenoid valve 424A.  
The opening time is adjustable by the flow regulator 528B.

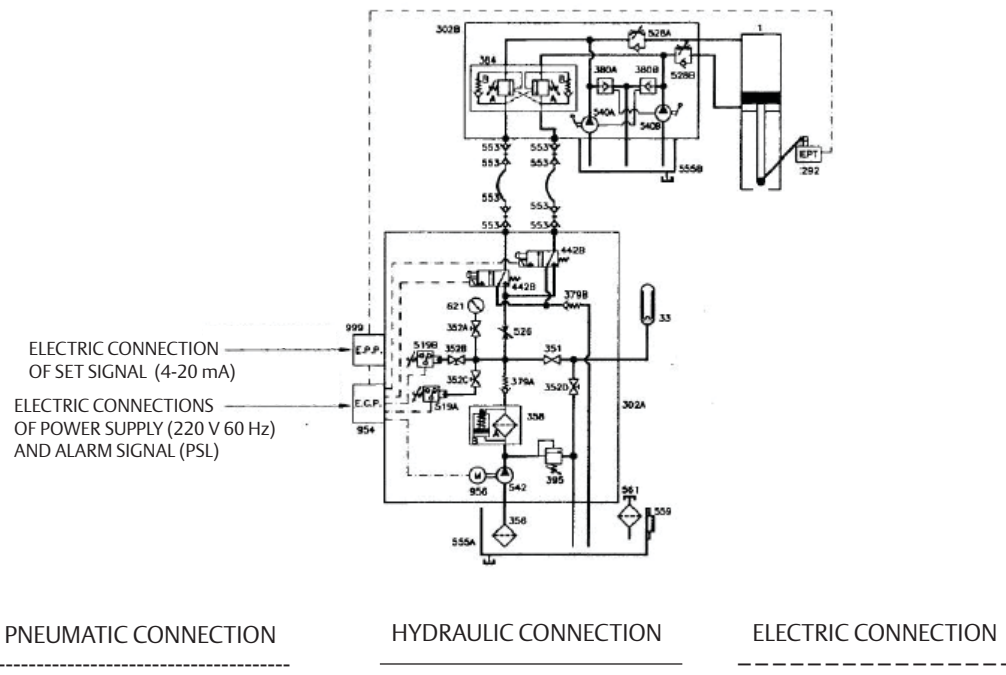
Electric remote control to close  
De-energize the solenoid valve 424A.  
The closing time is adjustable by the flow regulator 528A.

- 1 Double-acting hydraulic linear actuator
- 34 Hydraulic accumulator (Piston type)
- 41 Electric microswitches
- 103 Needle valve with drain valve
- 282 Rupture disk
- 302 Panel
- 351 Stop valve
- 352 Needle valve
- 353 Needle valve with drain valve
- 358 Hydraulic filter with visual indicator
  - A - Filter
  - B - Clogging visual indicator
- 379 Check valve
- 395 Relief valve
- 424 5/2 Hydraulic pilot/spring-return solenoid valve
  - A - 5/2 Hydraulic pilot/spring-return valve
  - B - 3/2 N.C. Poppet type solenoid valve
- 528 Undirectional flow regulator (adjustable setting)
- 563 Piston position visual indicator
- 621 Pressure gauge

**NOTE:**

The diagram is drawn with solenoid valves coils not energized.

**Figure 11 Example of control schematics for double-acting HLA actuator with power pack**



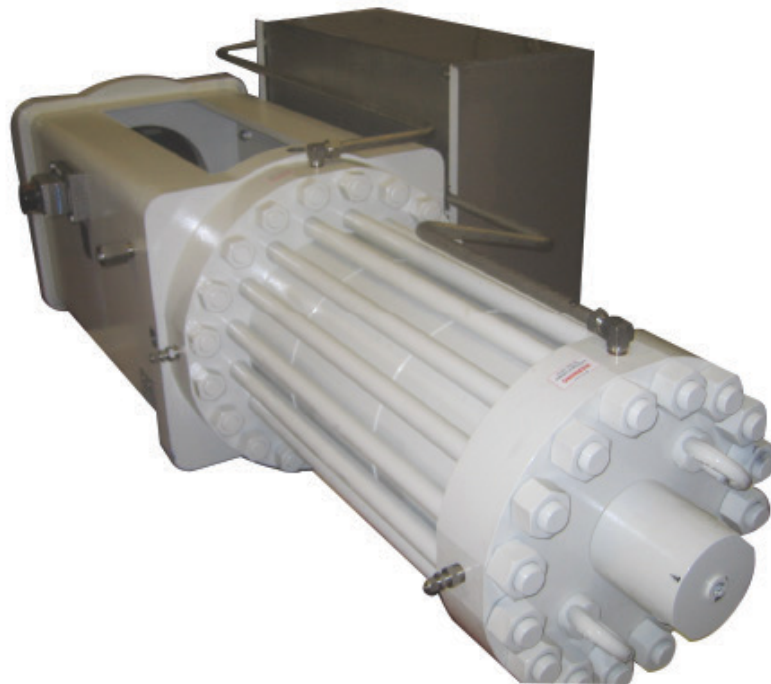
<p><b>Electrohydraulic power unit operation</b> The operation of electric motor 956 which drives the hydraulic pump 542, is controlled by the pressure switch 519A through the electric control panel 954, so as to maintain the oil pressure into the accumulator 33 within the fixed range.</p> <p><b>Regulating service</b> The electronic positioner 999 energizes the solenoid valve 442A or 442B in order to reach the position required by the electric set signal.</p> <p><b>Lock in position</b> When the solenoid valves 442 are not energized, the actuator is locked in position by valve 384.</p> <p><b>Local control</b> In case of set signal failure, actuate the manual override of valve 442B to open or 442A to close during all the valve stroke.</p> <p><b>Emergency manual operation</b> In case of electric supply failure, actuate the handpump 540A to close or 540B to open.</p> <p><b>NOTE:</b> The diagram is drawn with solenoid valves coils not energized.</p>	<p>1 Double-acting pneumatic actuator 33 Hydraulic accumulator (bladder type) 292 Electric position transmitter 302 Panel 351 Stop valve 352 Needle valve 354 Hydraulic filter 358 Hydraulic filter with visual indicator     A - Filter     B - Clogging visual indicator 379 Check valve 380 Pilot-operated check valve 384 Dual pilot-operated relief valve with check valves     A - Pilot-operated relief valve     B - Check valve 395 Relief valve 442 3/2 N.C. Poppet type solenoid valve (test push button) 519 Electric pressure switch (adjustable) 526 Bidirectional flow regulator (adjustable setting) 528 Unidirectional flow regulator (adjustable setting) 540 Handpump 542 Hydraulic rotating pump 553 Quick connector 555 Oil tank 559 Level gauge 561 Oil pouring plug with filter 621 Pressure gauge 954 Electric control panel 956 Electric motor 999 Electronic positioner</p>
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## 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.

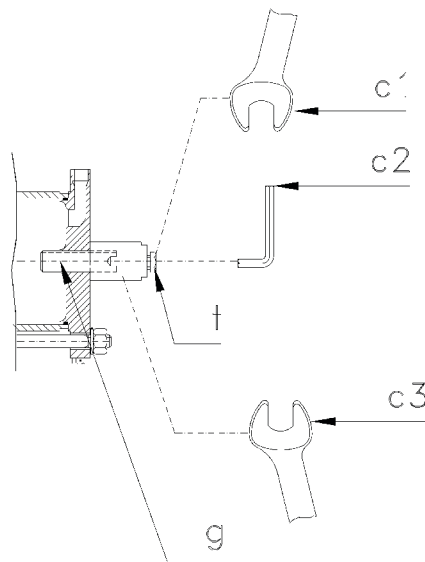
**Figure 12** Mechanical stop



For the adjustment of the mechanical stop on the end flange of cylinder, follow these steps (Figure 13):

- 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 13 Mechanical stop of the cylinder**

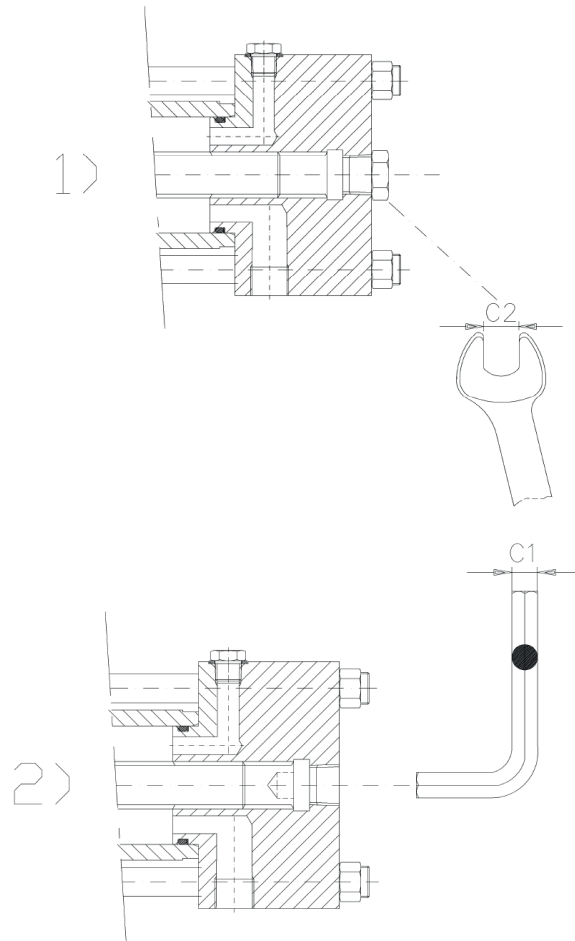


**Table 4.**

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 14



## 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.

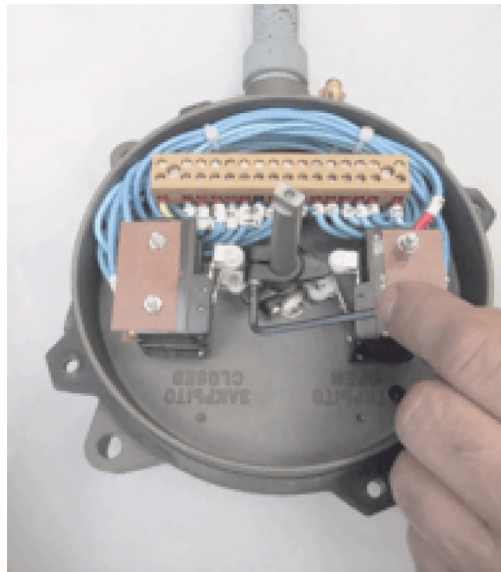
Microswitches are placed inside a special box (Figure 15).

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

- Unscrew the fastening screws of the cover (Figure 15).
- 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 16).
- 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 17).
- Tighten the screws.

**Figure 15** Microswitches box



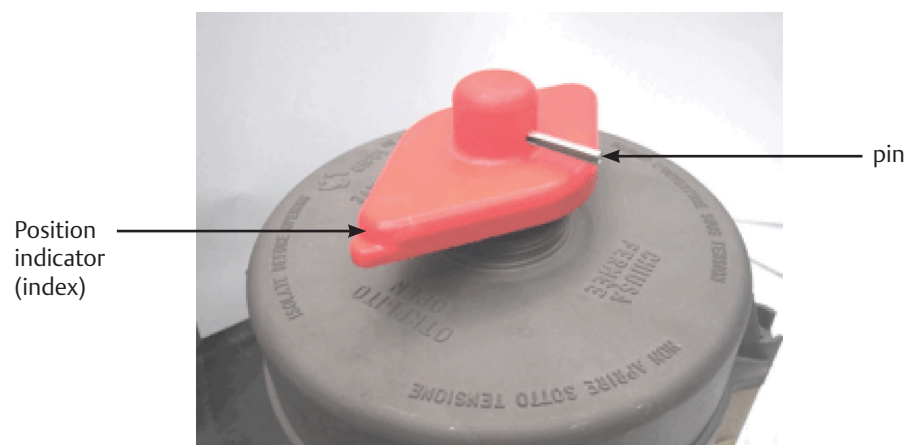
**Figure 16** Cam adjustment

If the index (Figure 17) 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

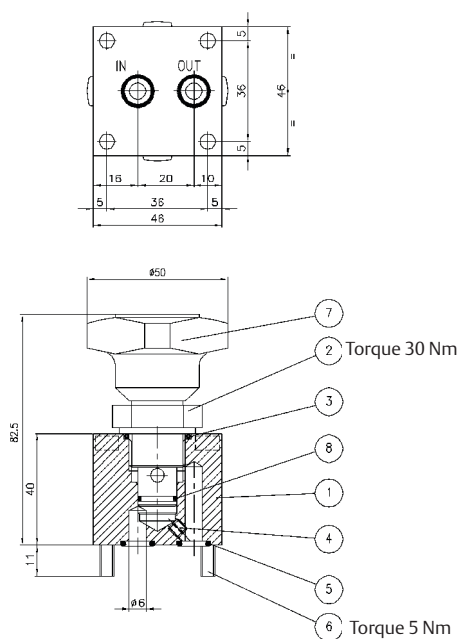
End of stroke microswitches should be operated before the stop of the stroke of the actuator due to mechanical stops. Adjust the relative cams properly.

**Figure 17** 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 18 Adjustment of operating time by flow-regulator valve**



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

**Table 5.**

POS	QTY	Denomination	Material	Type or Drawing
8	1	OR + 2BK (included in cartridge pos. 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 pos. 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 actuator must be checked with regular intervals of time, as described in the Safety Manual.

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

### 5.1 Periodic Maintenance

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

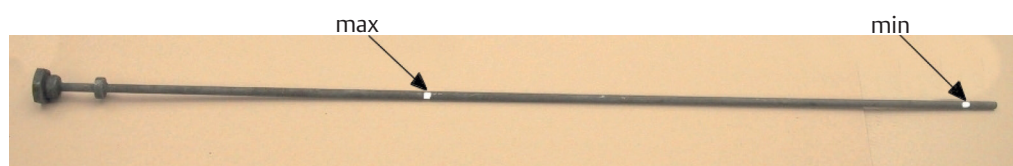
### **NOTICE**

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.

Anyway 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 19) into the hydraulic manual handpump, 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 19** Level measuring stick



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

(refer to Section 7.2, Figure 24)

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 “MAX LEVEL” notch of the dipstick.
4. By leaving the dipstick unscrewed, move the actuator by the pneumatic control or by the handpump 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 single 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. Features of hydraulic oil suggested by Biffi Italia s.r.l. for refilling in different working conditions**

<b>Standard temperature conditions (-30 °C/+85 °C):</b>	
Producer	AGIP
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:	SHELL TELLUS PLUS 22 CHEVRON HYDRAULIC OIL AW ISO 22 MOBIL DTE22 EXXON UNIVIS N22 EQUIVIS ZS22 BP ENERGOL HLP-HM22 CASTROL DYSPIIN AWS22
<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	SYNTESSIS
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>

## 5.2 Extraordinary Maintenance

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

### NOTICE

Anyway, contact Biffi Italia customer care.

### 5.2.1 Lubrication of Mechanism

For normal duty, the HLA 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 31, Figure 20) from pedestal with coupling joint.

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

**Table 7.**

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

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.

## 5.2.2 Replacement of Cylinder Seals

(refer to Figure 20)

### 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.

1. Unscrew the adjusting screw cover (for low pressure cylinder) or the protection plug (12) (for high pressure cylinder) from the cylinder end flange.
2. Measure the distance of the stop screw (2) with reference to the end flange surface (6), 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 (2) by turning it anticlockwise with an Allen wrench until the screw is completely withdrawn inside the end flange threaded hole.
4. Unscrew the nuts (9) from the tie rods (8); they must be gradually unscrewed all at the same time.
5. Slide off the end flange (6) and the tube (7).
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 (20) to be replaced, remove the screw (10) and the flange (5). Unscrew the piston rod (3) threaded end from the adaptor bush. Slide off the piston rod (3) from the head flange (5).
7. Disassemble the head flange.

### 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 (16) of the head flange (5).
2. Replace the back-up ring (19) of the end flange (6).
3. Replace the scraper (23) into the pedestal flange (22) placed under the head flange.

To replace the piston rod seal rings (20), proceed as follows:

1. Remove the existing Teflon seal ring (20) 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 Teflon seal ring (20) 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 Teflon 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 Teflon 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 Teflon the seal ring is made of allows the ring to shrink back to its previous dimension after a short time.

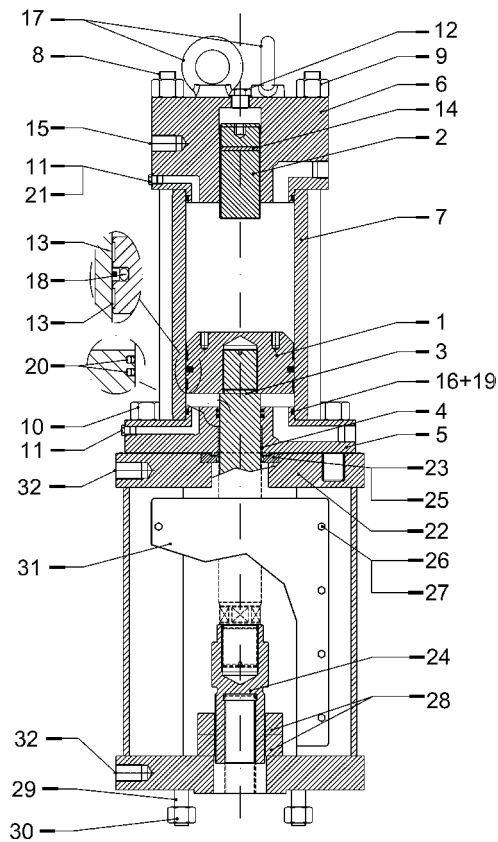
### Reassembly

1. Assemble the head flange (5), replace the washers if damaged.
2. Lubricate the piston rod (3) surface with a protective oil or grease film and introduce it into the head flange hole, taking care not to damage the O-ring (16). Carefully clean the threaded end of the piston rod (3) 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 (7) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate the tube internal surface and the bevels at the ends with a protective oil or grease film. Slide the tube onto the piston taking care not to damage the Teflon seal ring (18); the tube bevel has to smoothly compress the seal ring; take care also not to damage the head flange O-ring (16).
4. Assemble the end flange by centering it on the inside diameter of the tube, taking care not to damage the O-ring (16).
5. Assemble the nuts (9) onto the tie rods (8). Tighten the nuts to the recommended torque, alternating between opposite corners.
6. Screw the stop screw (2) 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. Screw the plug (12) into the cylinder end flange.

## NOTICE

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

**Figure 20** Double-acting hydraulic linear actuator sectional drawing



**Table 8.** Parts list

Item	Qty	Description	Item	Qty	Description
1	1	Piston	17	2	Eyebolt
2	1	Stop setting screw	18	1	Piston seal ring
3	1	Piston rod	19	2	Back-up ring
4	1	Piston rod bushing	20	2	Piston rod seal ring
5	1	Head flange	21	5	Washer
6	1	End flange	22	1	Pedestal
7	1	Cylinder tube	23	1	Scraper ring flange
8	8	Tie rod	24	1	Shell joint
9	8	Nut	25	1	Scraper ring
10	4	Screw	26	16	Screw
11	5	Plug	27	16	Washer
12	1	Plug	28	2	Nut
13	2	Guide sliding ring for piston	29	4	Stud bolt
14	1	Friction bar	30	4	Nut
15	1	Dowel	31	2	Plate
16	2	O-ring	32	2	Dowel

## 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.

### NOTICE

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 9.

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 control system	Call Biffi Italia s.r.l. Customer Service
Actuator too slow	Clogged filter	Clean or replace the cartridge
	Low supply pressure	Restore (Section 1.4)
	Wrong calibration of flow regulator valves	Restore (Section 3.6)
Actuator too fast	Wear of the valve	Replace
	High supply pressure	Restore (Section 1.4)
Leakages on hydraulic or pneumatic circuits	Wrong calibration of flow regulator valves	Restore (Section 3.6)
	Deterioration and/or damage to gaskets	Call Biffi Italia s.r.l. Customer Service
Incorrect position of the valve	Wrong adjustment of mechanical stops	Restore (Section 3.4)
	Wrong warning of microswitches	Restore (Section 3.5)
Hydraulic manual pump does not work	Handle positioned on remote control	Position the handle on the indication of the operation to make
	Leakages on the check valve of the hydraulic control group	Call Biffi Italia s.r.l. Customer Service
Incorrect position of the valve	Wrong adjustment of mechanical stops	Reset (Section 3.4)
	Wrong warning of microswitches	Reset (Section 3.5)

# Section 7: Layouts

## 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. - Spares Office

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 Replacing Procedure

Figure 21 Pedestal with coupling joint

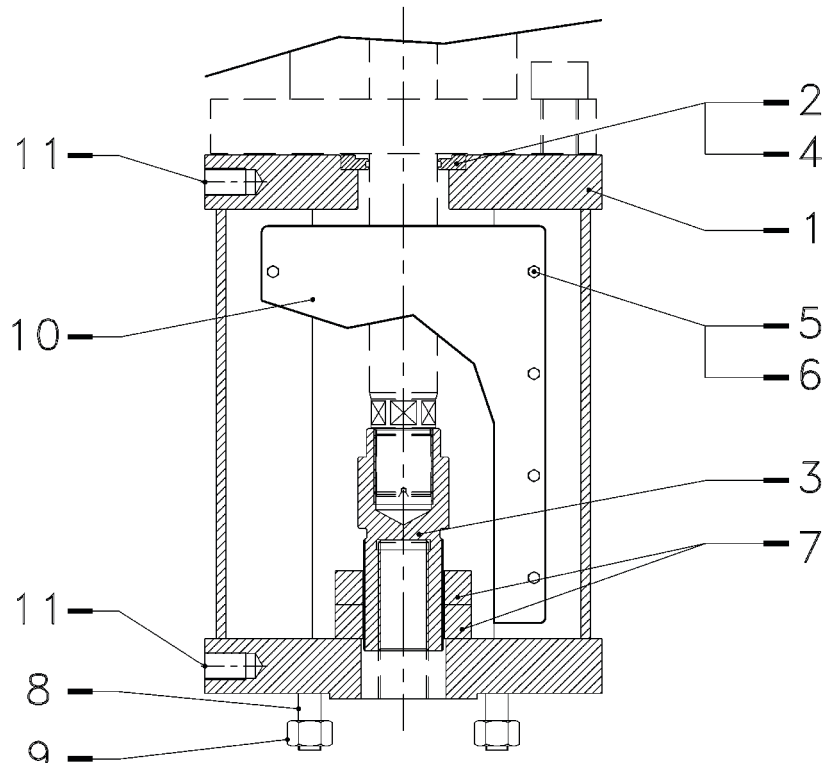


Table 10. Parts list

Item	Qty	Description	Material
1	1	Pedestal	Carbon steel
2	1	Scraper ring flange	Stainless steel
3	1	Shell joint	Alloy steel
4	1	Scraper ring	*NBR rubber
5	16	Screw	Stainless steel
6	16	Washer	Stainless steel
7	2	Nut	Stainless steel
8	4	Stud bolt	Stainless steel
9	4	Nut	Stainless steel
10	2	Plate	Carbon steel
11	2	Dowel	Stainless steel

**NOTE:**

\*recommended spare parts

Figure 22 Hydraulic cylinder

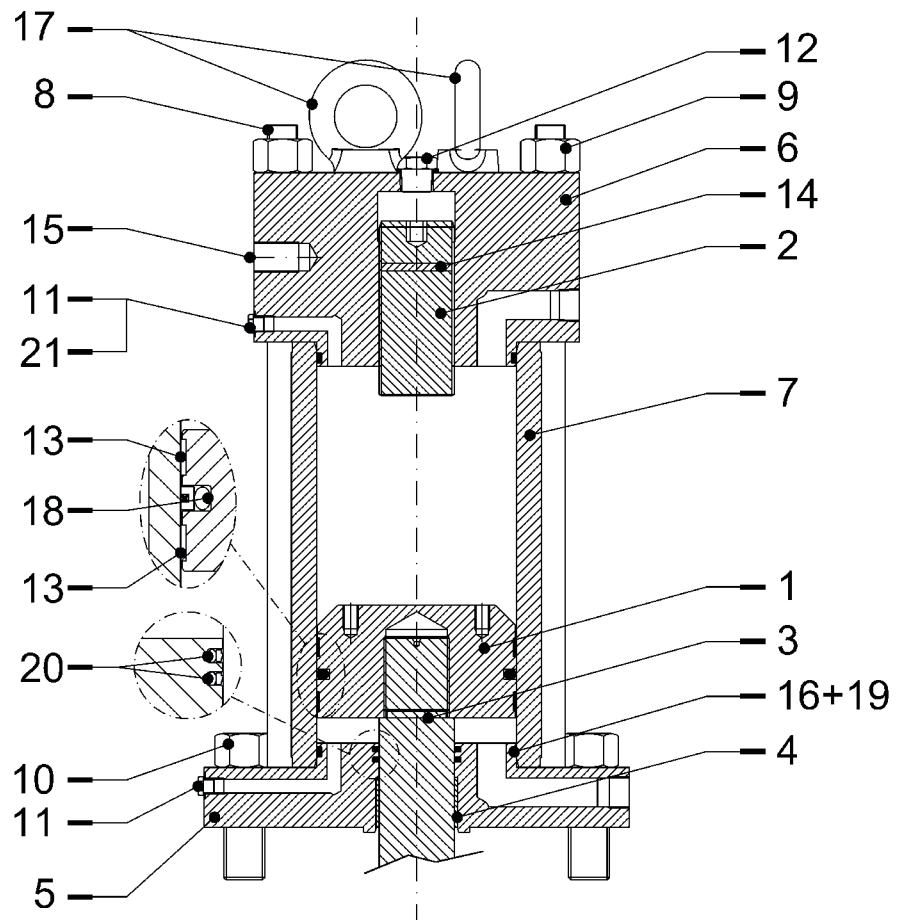


Table 11. Parts list

Item	Qty	Description	Material
1	1	Piston	Carbon steel
2	1	Stop setting screw	Stainless steel
3	1	Piston rod	Stainless steel
4	1	Piston rod bushing	Steel + BZ + Teflon
5	1	Head flange	Carbon steel
6	1	End flange	Carbon steel
7	1	Cylinder tube	Nickel plated carbon steel
8	8	Tie rod	Stainless steel
9	8	Nut	Stainless steel
10	4	Screw	Stainless steel
11	5	Plug	Carbon steel
12	1	Plug	Carbon steel
13	2	Guide sliding ring for piston	*Teflon + graphite
14	1	Friction bar	Nylon
15	1	Dowel	Carbon steel
16	2	O-ring	*NBR
17	2	Eyebolt	Carbon steel
18	1	Piston seal ring	*Teflon + graphite + NBR
19	2	Back-up ring	*NBR
20	2	Piston rod seal ring	*Teflon + graphite + NBR
21	5	Washer	Stainless steel

**NOTE:**

\*recommended spare parts

Figure 23 Hydraulic control unit MHP

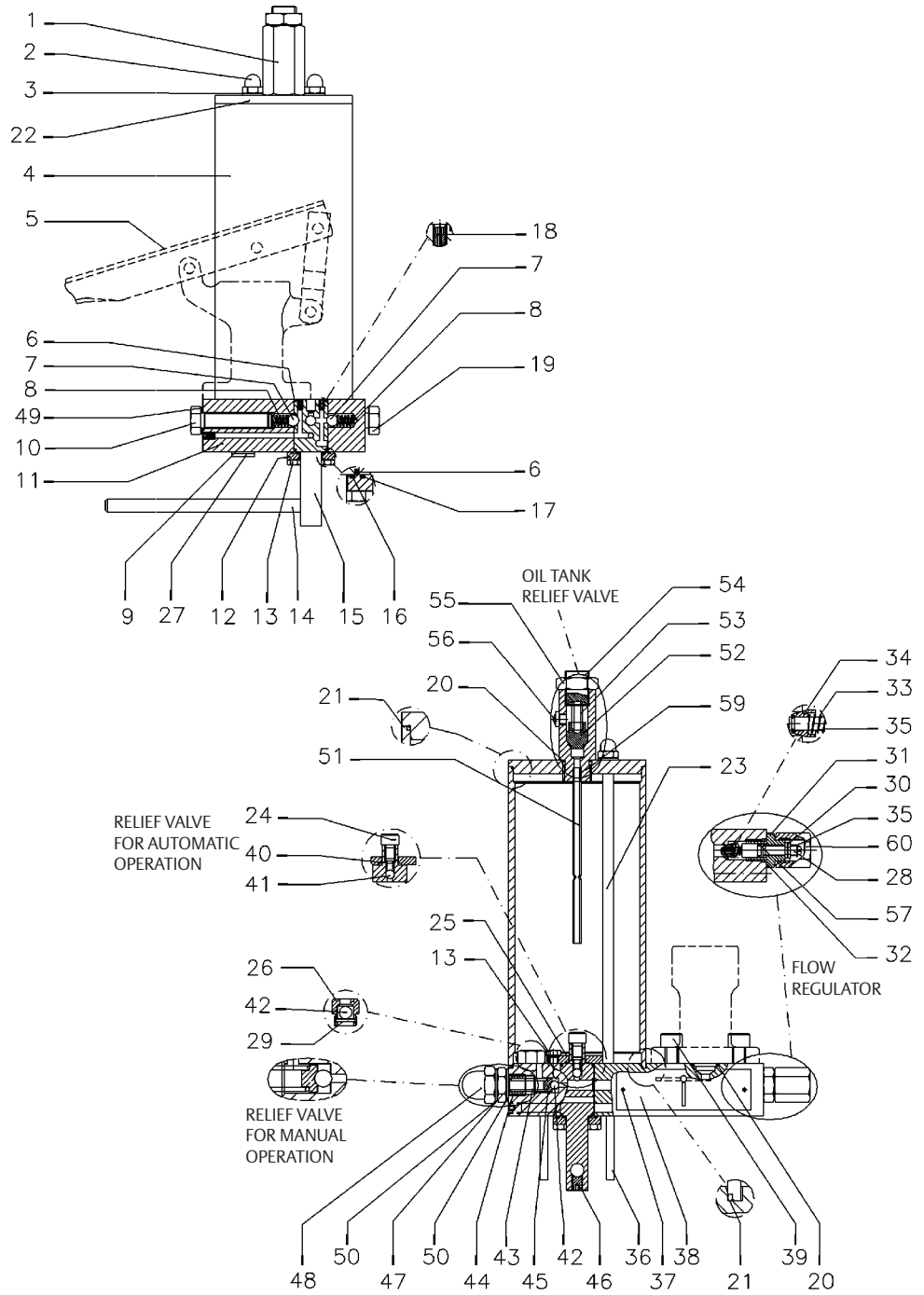
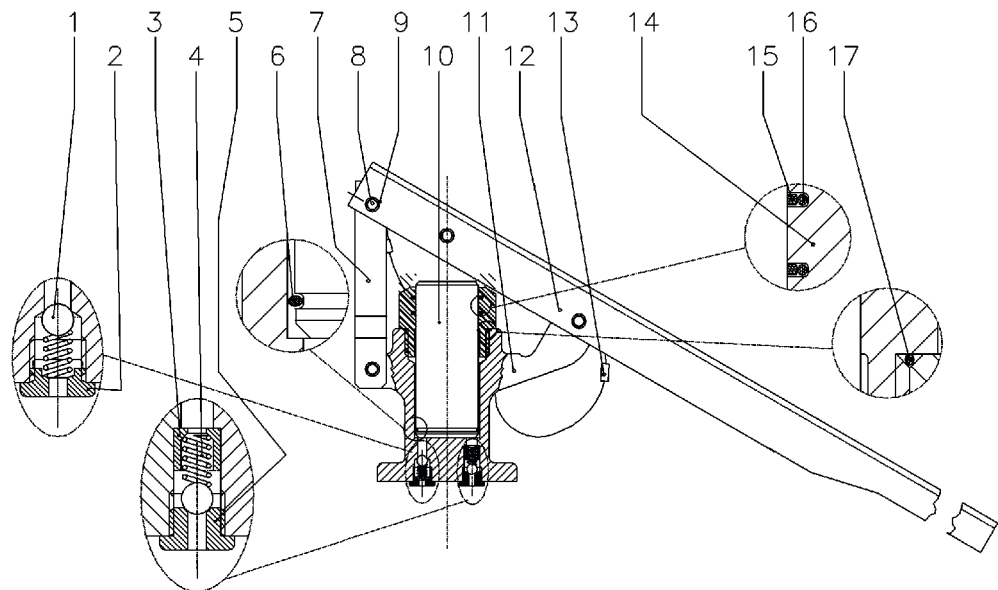


Table 12. Parts list

Item	Qty	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	Handpump	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 24** Hydraulic control unit handpump**Table 13.** Parts list

Item	Qty	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 plate)
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	Teflon + 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).....

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[www.biffi.it](http://www.biffi.it) or contact us at [biffi\\_italia@biffi.it](mailto:biffi_italia@biffi.it)

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