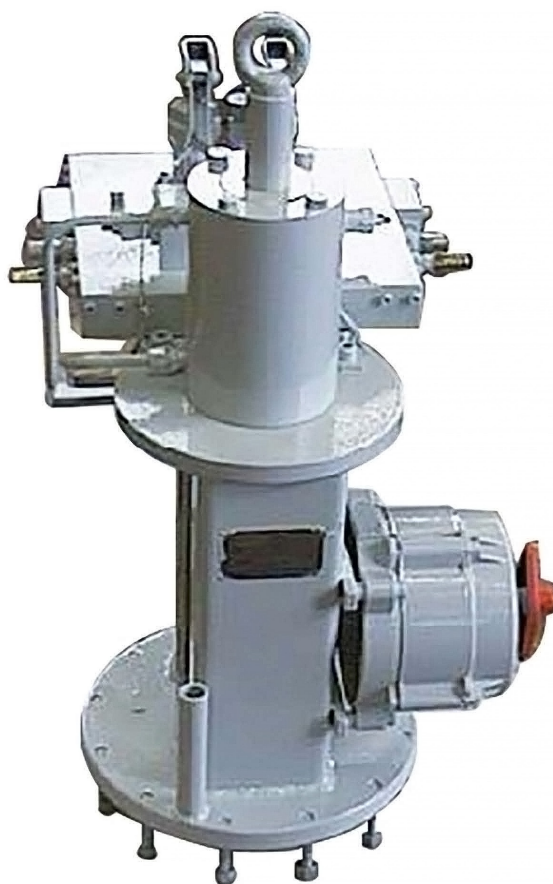


Biffi HLRA

Hydraulic Double-Acting Linear Actuator



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NOTICE

Biffi Italia has taken every care in collecting and verifying the documentation contained in this instruction and operating manual. Nevertheless, Biffi Italia does not provide any guarantees for this instruction manual. Biffi Italia will not be responsible for any mistakes contained in it or for any damage either accidental or due to the use of this manual. The information herein contained is reserved property of Biffi Italia and is subject to being modified without notice.

Section 1: General Warnings

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 Electrostatic Charge

An electrostatic charge risk is present on the actuator surface; in case of cleaning, use only antistatic cloth; in case of maintenance, avoid all rubbing/frictions that could electrostatically charge the equipment.

1.1.2 Noise Emission

The verification of the noise of the actuated valve is at valve maker care. Biffi points out that the actuator's noise can be considered negligible since it is an equipment for regular on-off or intermittent use.

If the integral quick exhaust valve is present, we recommend using ear PPE (Personal Protective Equipment) to avoid any possible acoustic discomfort.






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

		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 Description of the Actuator

The line of Double-Acting Hydraulic Linear Actuators, has been designed and produced by Biffi mainly to satisfy specific needs present on plants. For the above reason, the Biffi production of the above linear actuators, even based on a fixed criteria of design, is normally done job by job to adapt the actuator to the different parameters and thrust/stroke of valves.

Features

- Electroless nickel plated and polished cylinder for corrosion resistance and minimum friction.
- Hard chromium plated stainless steel piston rod for corrosion resistance and minimum friction.
- Teflon type piston rod seals and piston seals for low hysteresis and high sensitivity preventing sticking problems. Piston seal is (A-Q seal) type (zero leakages).
- Piston rod supported by bushing made of bronze with sinterized Teflon to provide minimal friction and extended service life.
- Stroke adjustment with mechanical travel stop in one direction.
- Adapter spool in fabricated carbon steel, specifically designed for adaptation to any type of valve with provision for local indicator, limit switches and other accessories (on request).

Section 2: Installation

2.1 Checks upon Actuator Receipt

Checks to be carried out on receiving the actuator:

1. If the actuator arrived already assembled onto the valve, the settings of the mechanical stops and of the microswitches (if existing) has already been made by the person who assembled the actuator onto the valve.
2. If the actuator arrived separated from the valve, the settings of the mechanical stops and of the microswitches (if existing) must be checked, and if necessary, carried out while assembling the actuator onto the valve.
3. Check if the actuator has not been damaged during transport. If necessary, repair all damages to the paint-coat, etc.
4. Check if the model, the serial number of the actuator and the performance data written on the data-plate are in accordance with those described on the order acknowledgement, test certificate and delivery note.
5. Check if the fitted accessories comply with those listed in the order acknowledgement and the delivery note.

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.

2.3 Storage

The actuators leave the factory in excellent working conditions and with an excellent finish (these conditions are guaranteed by an individual inspection certificate); in order to maintain these characteristics until the actuator is installed on the plant, it is necessary to observe a few rules and take appropriate measures during the storage period.

1. Make sure that plugs are fitted in the oil connections and in the cable entries. The plastic plugs which close the inlets do not have a weatherproof function, but are only a means of protection against the entry of foreign matter during transport. If long-term storage is necessary and especially if the storage is outdoor, the plastic protection plugs must be replaced by metal plugs, which guarantee a complete weatherproof protection.
2. If the actuators are supplied separately from the valves, they must be placed in a wooden pallet to protect the coupling flange to the valve. In case of long-term storage, the coupling parts (flange, drive sleeve, insert bush) must be coated with protective oil or grease. If possible, blank off the flange with a protection disk.
3. In case of long-term storage, it is advisable to keep the actuators in a dry place or to provide at least some means of weather protection. If possible, it is also advisable to periodically operate the actuator with filtered, dehydrated and lubricated air; after such operations, all the threaded connections of the actuator and the valves of the control panel (if existing) should be carefully plugged.

2.4 Assembling the Actuator Onto the Valve

To assemble the actuator onto the valve proceed as follows:

1. Check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions (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 easier the assembly, the valve stem has to be in perfect vertical position.

NOTICE

The eyebolt is sized for the lifting of the only actuator (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 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.

Table 1.

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

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.

Section 3: Operation and Use

3.1 Setting of the Linear Stroke

The setting of the open valve position is performed by adjusting the travel stop screw that is screwed into the end flange of the hydraulic cylinder.

For the adjustment of the travel stop screw in the end flange of the hydraulic cylinder, proceed as follows:

1. Unscrew through plug from the cylinder end flange.
2. If the actuator linear stroke is stopped before reaching the end position (fully open), unscrew the stop screw by turning it counterclockwise with an Allen wrench until the valve reaches the correct position.
3. If the actuator linear stroke is stopped beyond the end position (fully open), screw the stop screw by turning it clockwise until the valve reaches the correct position.
4. Screw through plug into the cylinder end flange.

Figure 2. Travel Stop Screw Screwed into the End Flange of Hydraulic Cylinder

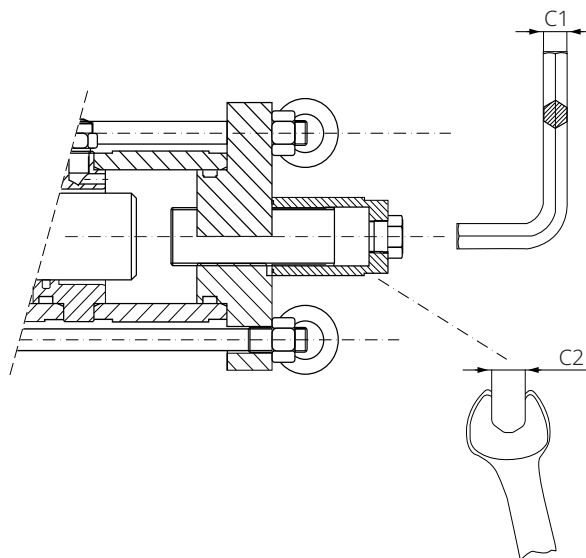


Table 2.

Hydraulic Cylinder Diameter	Wrench C1 (mm)	Wrench C2 (mm)
From 50 to 95	17	46
From 110 to 135	17	55

3.2 Preparation for Start-Up

Refer to Section 2.

3.3 Start-Up and Commissioning

WARNING

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

Upon actuator commissioning, please carry out the following checks:

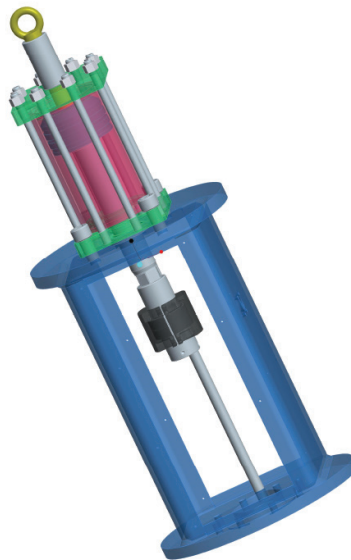
- Check that paint is not damaged during transport; if necessary, repair the damages to paint coat.
- Check that the values of hydraulic supply available in the system are compatible with those reported on the identification plate of the actuator (Figure 1) and on the documentation supplied.
- Check 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 3.6).
- 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.

3.4 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 3.



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.

3.5 Residual Risks

⚠ WARNING

The actuator has parts under pressure.

Use due caution.

Use individual protections provided for by the laws and provisions in force.

3.6 Operations

Refer to specific document: operating diagram furnished.

Section 4: Operational Tests and Inspections

NOTICE

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

Section 5: Maintenance

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.

5.1 Routine Maintenance

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:

HLRA actuators have been designed to work for long periods in the severest conditions with no need for maintenance.

1. Check if the actuator operates the valve correctly and with the required operating times. If the actuator operation is very infrequent, carry out a few opening and closing operations with all the existing controls (remote control, local control, emergency controls, etc.), if this is allowed by the conditions of the plant.
2. Check if the signals to the remote control desk are correct. Check if the supply pressure value is within the required range.
3. Check if the external components of the actuator are in good conditions.
4. Check all the paint-coat of the actuator. If some areas are damaged, repair the paint-coat according to the applicable specification.
5. Check if there are no leakages in the hydraulic connections. If necessary, tighten the nuts of the pipe fittings.

5.2 Special Maintenance

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 attached sectional drawing and adopting the following procedures.

5.2.1 Replacement of Cylinder Seals

1. Unscrew the plug (28) from the cylinder end flange.
2. Measure the distance of the stop screw (23) with reference to the end flange (13) surface, 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 (23) by turning it counterclockwise with an Allen wrench until the screw is completely withdrawn inside the end flange threaded hole.
4. Unscrew the nuts (25) from the tie rods (7) they must be gradually unscrewed all at the same time.
5. Slide off the end flange (13), the upper cylinder tube (22), the intermediate flange (11) and the lower cylinder tube (18).
6. If the piston rod seal ring (3) needs to be replaced, remove the screw (17). Unscrew the piston rod (19) threaded end from the adaptor bush (16). Slide off the piston rod (19) from the head flange (1).
7. Disassemble the head flange.

5.2.2 Seals Replacement

Prior to reassembly, check if the actuator components are in good condition and clean. Lubricate all the surface 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 (5) and the back-up ring (4) of the flanges (1) (11).
2. Replace the scraper (2) into the head flange.

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

1. Remove the existing Teflon 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 Teflon seal ring (3) into the flange groove, inside its rubber O-ring, by bending it. The bending radius is as large as possible make sure to avoid damaging the seal. Then enlarge the seal ring with your fingers to restore its round shape, pay attention not to utilize any tools which can damage the seal ring.

To replace the piston seal ring (9) proceed as follows:

1. Remove the existing Teflon seal ring (9) 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 (9) 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.

To replace the piston rod seal rings (12) proceed as follows:

1. Remove the existing Teflon seal ring (12) 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 (12) into the flange groove, inside its rubber O-ring by bending it, take care since the bending radius is as large as possible to avoid damaged 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.

5.2.3 Reassembly

1. Assemble the head flange (1), on pedestal (15).
2. Lubricate the piston rod (19) surface, with a protective oil or grease film and introduce it into the head flange hole, taking care not to damage the piston seal ring (3). Carefully clean the threaded end of the piston rod (19) 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 (18) 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 damaged the Teflon seal ring (9): the tube bevel has to smoothly compress the seal ring; take care also not to damage the head flange O-ring (5).
4. Before reassembling the intermediate flange (11), lubricate the upper piston rod (21) with a protective oil or grease film.
5. Assemble the intermediate flange (11) take care not damage the seal ring (12) and the O-ring (5). Assemble the upper cylinder tube and the end flange by centering it on the inside diameter of the tube.
6. Assemble the nuts (25) onto the tie rods (7). Tighten the nuts to the recommended torque, alternating between opposite corners.
7. Screw the stop screw (23) by turning it clockwise with an Allen wrench until it reaches its original position (the same distance with reference to the end flange surface).
8. Screw the plug (28) into the cylinder end flange.

NOTICE

After maintenance operations, carry out a few actuator operations to check that its movement is regular and that there is no oil leakage through the seals.

Figure 4. HLRA Double-Acting Hydraulic Linear Actuator

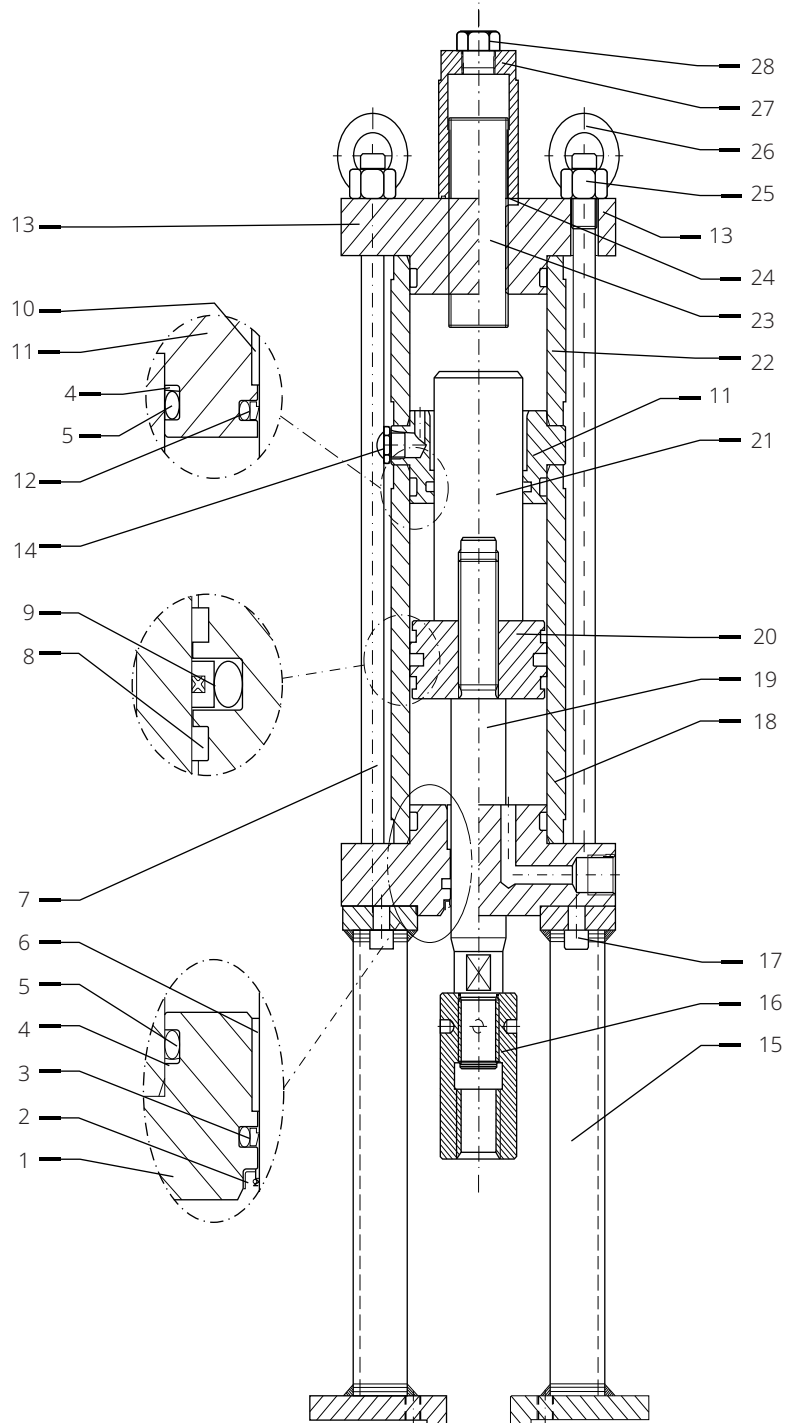


Table 3. Parts List

Item	Description	Material
1	Cylinder lower flange	Carbon steel ASTM A 283 Gr. D
2	Scraper ring	* Teflon + nitrile rubber
3	Piston rod seal ring	* Teflon + nitrile rubber
4	Back-up ring	* Nitrile rubber
5	O-ring	* Nitrile rubber
6	Piston rod bushing	Steel + bronze + teflon
7	Tie rod	Stainless steel ASTM A564 TP630
8	Piston guide sliding ring	* Teflon + graphite
9	Piston seal ring	* Teflon + nitrile rubber
10	Bushing	Steel + bronze + teflon
11	Intermediate flange	Carbon steel ASTM A 283 Gr. D
12	Seal ring	* Teflon + nitrile rubber
13	Cylinder upper flange	Carbon steel ASTM A 283 Gr. D
14	Dust excluder	Stainless steel AISI 316
15	Pedestal	Carbon steel ASTM A 283 Gr. D
16	Connecting joint	Alloy steel AISI SAE 9840
17	Screw	Alloy steel ASTM A193 B7
18	Lower cylinder tube	Carbon steel (Nickel plated) API 5LX Gr. X52
19	Lower piston rod	Stainless steel (Chromium plated) ASTM A564-TP 630
20	Piston	Carbon steel ASTM A 283 Gr. D
21	Upper piston rod	Stainless steel (Chromium plated) ASTM A564-TP 630
22	Upper cylinder tube	Carbon steel (Nickel plated) API 5LX Gr. X52
23	Travel stop screw	Stainless steel ASTM A193 B8M
24	O-ring	* Nitrile rubber
25	Nut	Stainless steel ASTM A194 8M
26	Eyebolt	Carbon steel AISI SAE 1040
27	Travel stop screw cover	Carbon steel ASTM A283 Gr. D
28	Plug	Carbon steel AISI SAE 1040

NOTE:

* Recommended spare parts

5.3 Extraordinary Maintenance

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

NOTICE

Anyway, contact Biffi Italia customer care.

5.3.1 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 (if present) from pedestal with coupling joint.

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

Table 4.

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 ² /s	Density:	966 kg/m ³ at 15 °C
ISO Classification:	L-X-BCHB 2	Flash point:	>215 °C (COC) (Based on synthetic oil)
DIN 51 825:	KP2K - 20	Dropping point:	260 °C (ASTM D-566)
Equivalent to:	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.

5.4 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 work site.

WARNING

Before disassembling the actuator, it is necessary to close the hydraulic 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 different waste collection sites, as provided for by the laws and provisions in force.

Section 6: Troubleshooting

6.1 Failure or Breakdown Research

Table 5.

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 the correct sizing pressure
	Wrong calibration of flow regulator valves	Verify the flow regulator setting (if present)
Actuator too fast	Wear of the valve	Replace
	High supply pressure	Restore the correct sizing pressure
Leakages on hydraulic or pneumatic circuits	Wrong calibration of flow regulator valves	Verify the flow regulator setting (if present)
	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 3.1)
	Wrong warning of microswitches	Verify the limit switches setting (if present)
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 3.1)
	Wrong warning of microswitches	Verify the limit switches setting (if present)

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 5. HLRA Double-Acting Hydraulic Linear Actuator

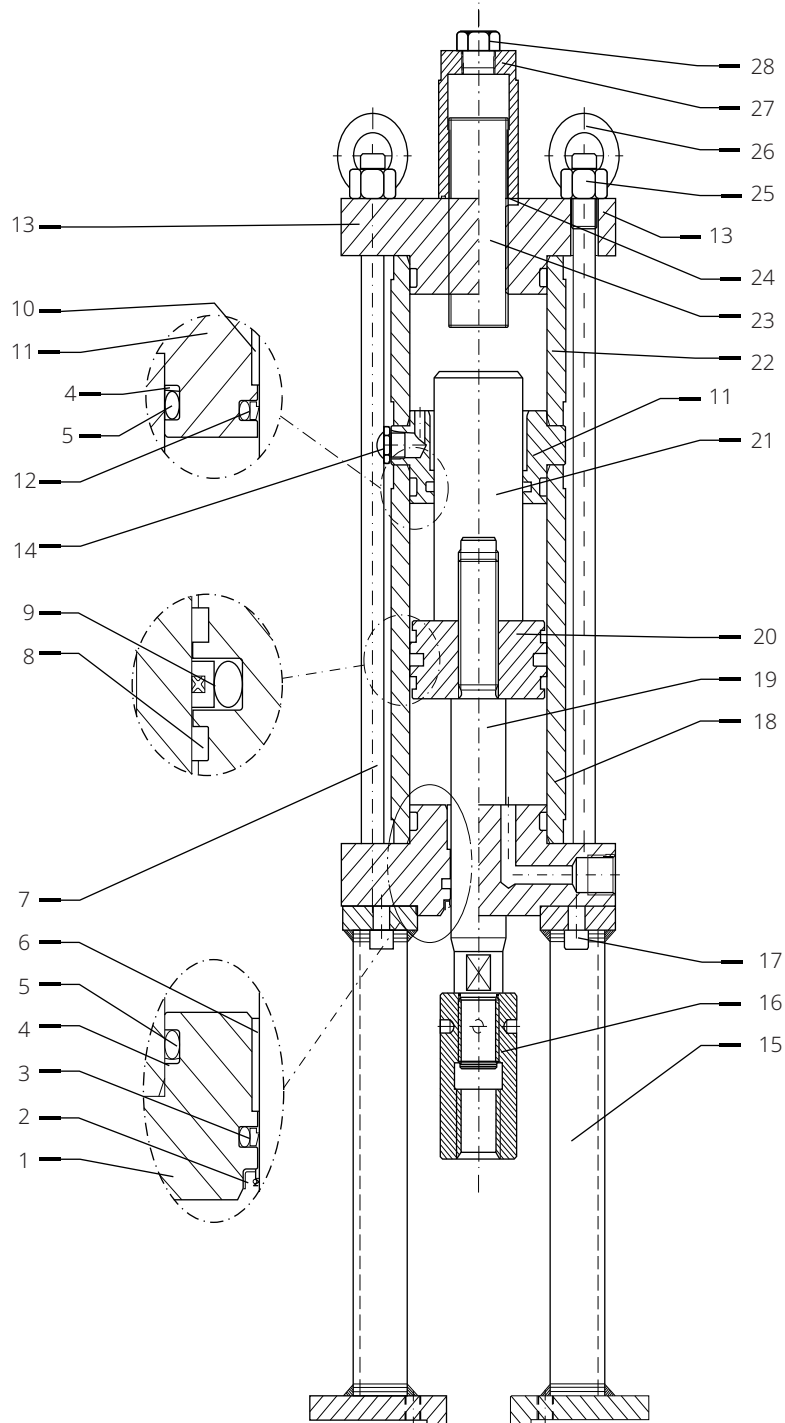


Table 6. Parts List

Item	Description	Material
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3	Piston rod seal ring	* Teflon + nitrile rubber
4	Back-up ring	* Nitrile rubber
5	O-ring	* Nitrile rubber
6	Piston rod bushing	Steel + bronze + teflon
7	Tie rod	Stainless steel ASTM A564 TP630
8	Piston guide sliding ring	* Teflon + graphite
9	Piston seal ring	* Teflon + nitrile rubber
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11	Intermediate flange	Carbon steel ASTM A 283 Gr. D
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14	Dust excluder	Stainless steel AISI 316
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24	O-ring	* Nitrile rubber
25	Nut	Stainless steel ASTM A194 8M
26	Eyebolt	Carbon steel AISI SAE 1040
27	Travel stop screw cover	Carbon steel ASTM A283 Gr. D
28	Plug	Carbon steel AISI SAE 1040

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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