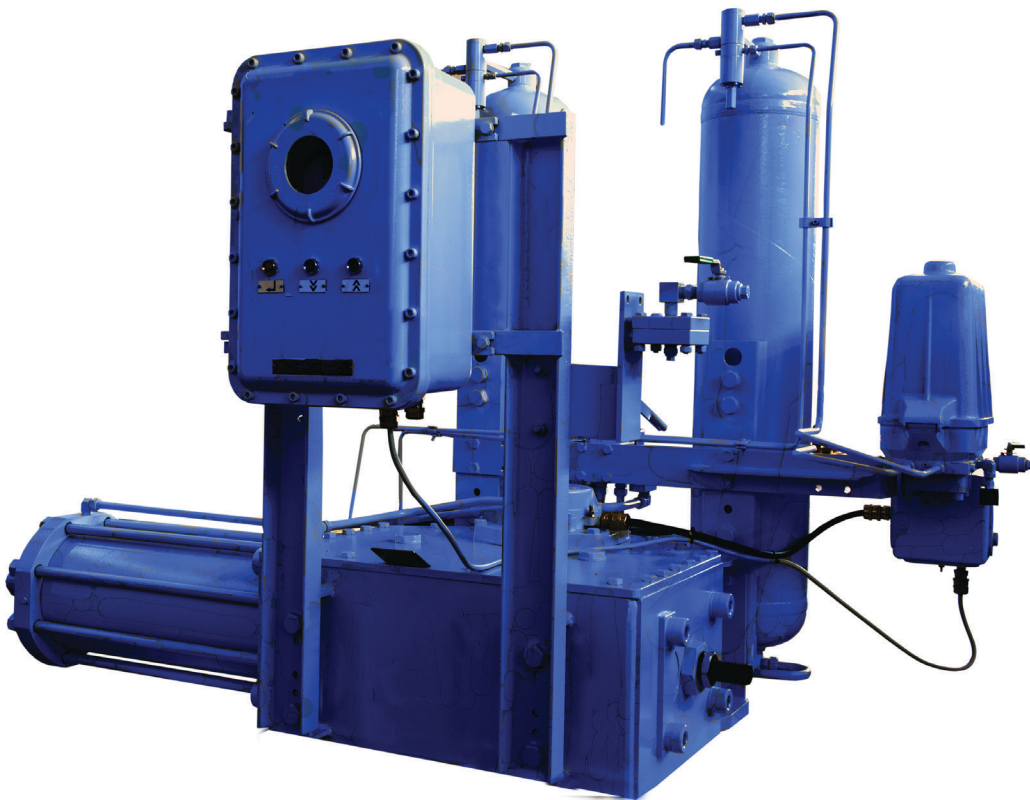


# Biffi GPO-EAC

## Gas-Hydraulic Actuator



**Revision Details**

Rev.	Date	Description	Prepared	Approved
1	September 2020	General update (migration to new template)		
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**NOTICE**

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

## Section 1: General Warnings

**NOTICE**

The manual is an integral part of the machine, it should be carefully read before carrying out any operation and it should be kept for future references.

### 1.1 Generalities

Biffi 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:	<b>Safety of machinery – General principles for design – Risk assessment and risk reduction</b>
2006/42/EC:	<b>Machine directive</b>
2014/68/EU:	<b>Directive for pressure PED equipment</b>
2014/35/EU:	<b>Directive for low voltage equipment</b>
2014/30/EU:	<b>Directive for the electromagnetic compatibility</b>
2014/34/EU:	<b>Directive and safety instructions for use in hazardous area</b>
TR TS 004/2011	<b>Customs Union Technical Regulation (For safety of low voltage equipment)</b>
TR TS 010/2011	<b>Customs Union Technical Regulation (For safety of equipment and machines)</b>
TR TS 012/2011	<b>Customs Union Technical Regulation (For safety of equipment operated in explosive atmosphere)</b>
TR TS 020/2011	<b>Customs Union Technical Regulation (Electromagnetic Compatibility of Technical Products)</b>
TR TS 032/2013	<b>Customs Union Technical Regulation (For safety of Excess Pressure Equipment)</b>

## 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

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**

		CE	
Order _____			
ACTUATOR Model _____			
ACTUATOR S/N _____		MM/YYYY	
ACTUATOR TAG N° _____		ND _____	
Supply Press.Range _____		MOP _____	
Amb.Temp. _____			
CYLINDER FI.Type _____		FI.Group _____	PED Cat. _____
CYLINDER TS _____		Test Date _____	
CYLINDER PS _____		PT _____	Cyl.Weight _____
		Ref.: _____	WARNING: Potential Electrostatic Charging Hazard See Instructions

## 1.3 Introducing the Actuator

The gas hydraulic GPO actuator is designed and used for the operation of quarter-turn valves (ball valves and plug valves) installed on gas transportation lines, in compressor stations and everywhere a high pressure gas supply is available.

The GPO actuator (Figure 2) is composed of one or two double action hydraulic cylinders that, pressurized, determines the linear motion of the piston contained in it.

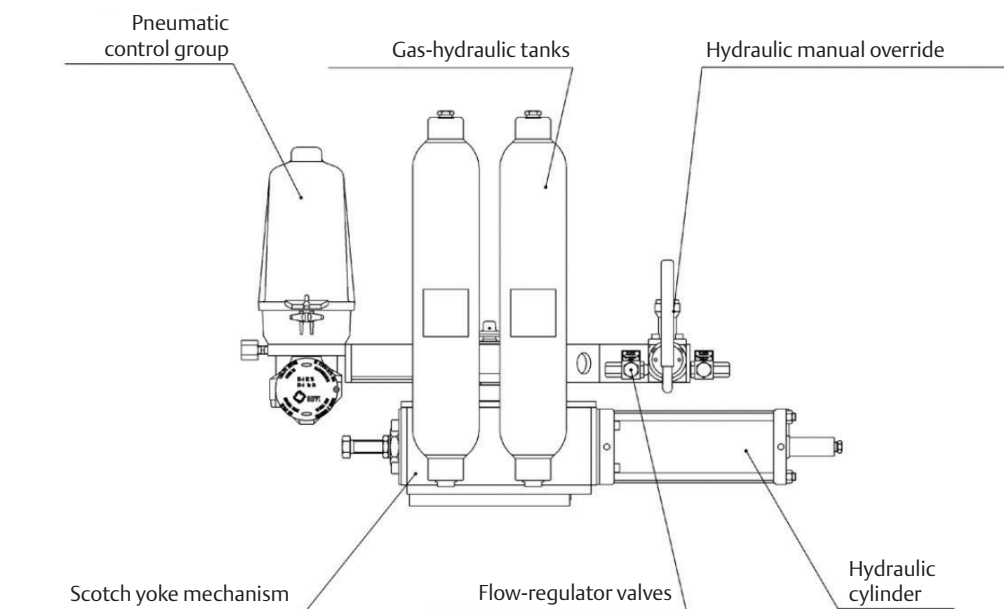
The linear motion of the piston is transformed into rotation by a scotch yoke mechanism.

Gas sampled by the line, pressurizes oil contained in one of the two gas-hydraulic tanks and then the one of the cylinder determining the drive of the actuator.

A peculiar feature of GPO actuator is its great flexibility of use obtained by the choice of a manufacturing solution easy, solid and without parts in motion.

The expected lifetime of actuator is approximately 25 years .

**Figure 2 Identification of Actuator Parts**



## 1.4 Data Sheet

Supply fluid	Natural gas / nitrogen /air
Operating temperature	Standard: from -20 °C to +80 °C Optional: from -60 °C to +80 °C
Supply pressure	Standard: ranging from 7 to 100 bar. Optional: minimum pressures starting from 3,5 bar, maximum pressure up to 160 bar. For higher gas supply pressure, a pressure regulator is foreseen.

## 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 micro-switches (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

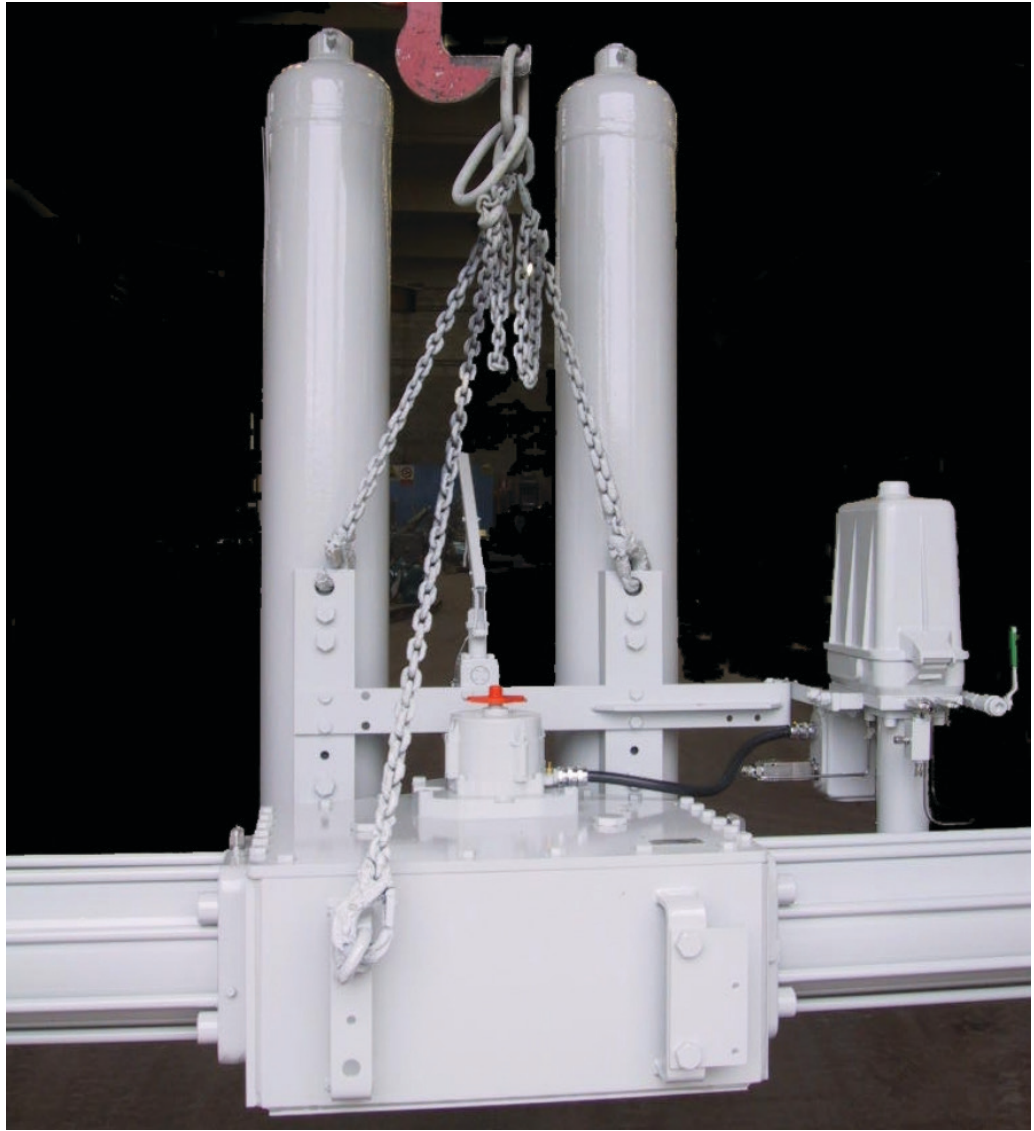
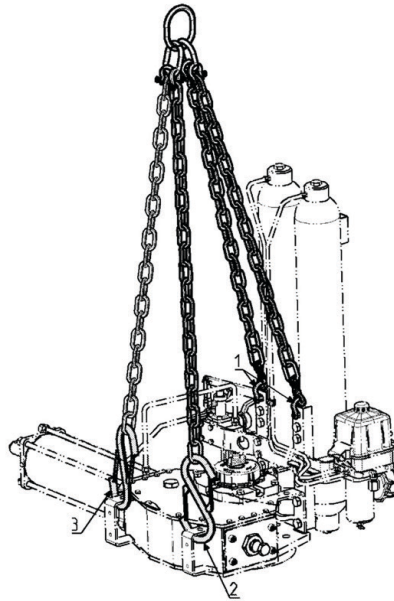


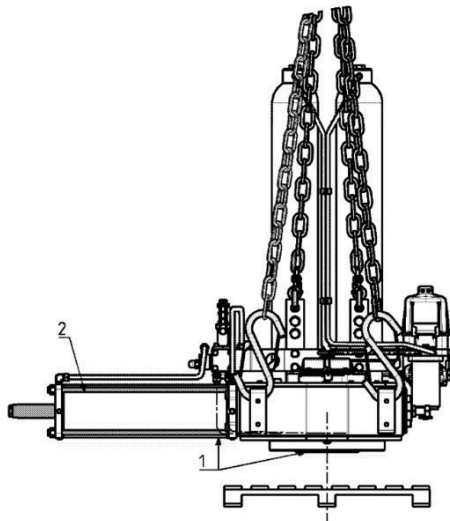
Figure 4 Lifting Points



1, 2 = Lifting points (obligatory)

3 = Balancing point

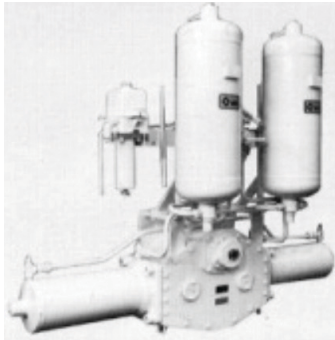
Figure 5 Lifting Points



1 = Point of support

2 = Don't lay the actuator on tie-rods

Figure 6



GPO suitable for mounting on valve with horizontal stem.

## 2.2.1 Instruction for Transport with Gas-Hydraulic Tanks in Horizontal Position

### NOTICE

The GPO actuators have to be maintained always with the gas-hydraulic tanks in vertical position, in order to avoid that the hydraulic oil flows out through the pneumatic pipes and the control group.

The presence of oil in the pneumatic control group can be dangerous for the possibility of fouling by presence of dust or sand.

This could compromise the correct operation of control valves.

Additionally the loss of part of the hydraulic oil from the gas-hydraulic tank compromises the correct functioning of GPO actuator.

If the actuator, for reason of transport dimensions, must be boxed in horizontal position it is mandatory to isolate the oil inside of the gas-hydraulic tanks to avoid losses.

The pneumatic pipes must be removed and their-ends must to be protected by plastic plugs, to avoid ingress of dirtiness.

They have also to be fixed by proper adhesive tape, to avoid damages during the transport.

### ⚠ WARNING

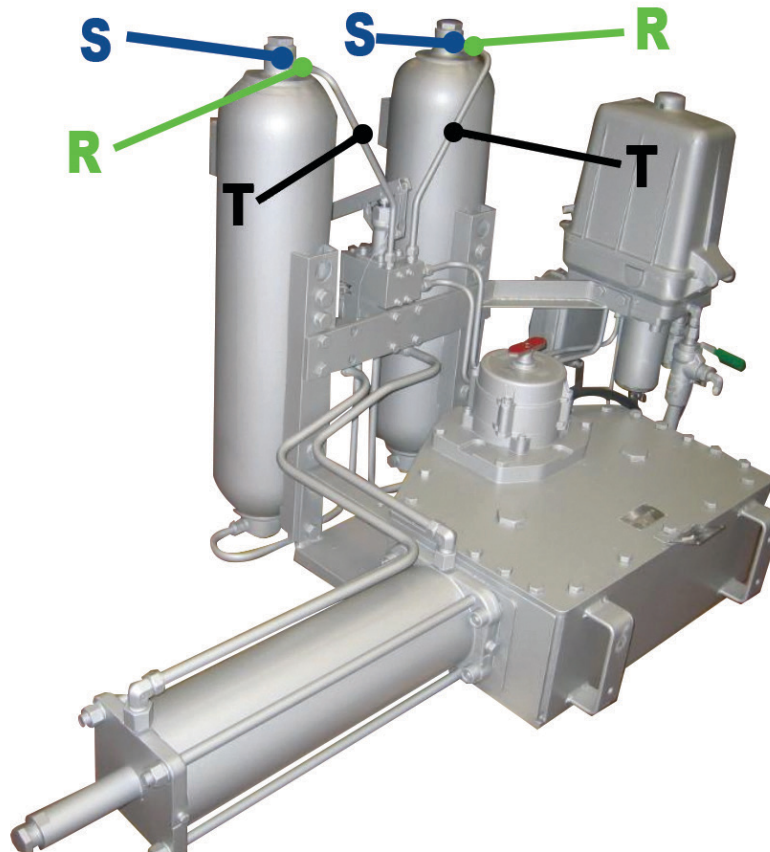
For the transport of actuator with gas-hydraulic tanks with horizontal axis, the packing has to foresee a proper support for the tanks.

If the necessity of horizontal transport is known at the order date, Biffi Italia s.r.l. can provide two ball type isolation valves at the inlet of the bottles. In this case it's very easy to isolate the oil bottles, simply closing the stop valves before the boxing.

The correct procedure for the transport of GPO actuator with gas-hydraulic tanks in horizontal position is the following (see Figure 7).

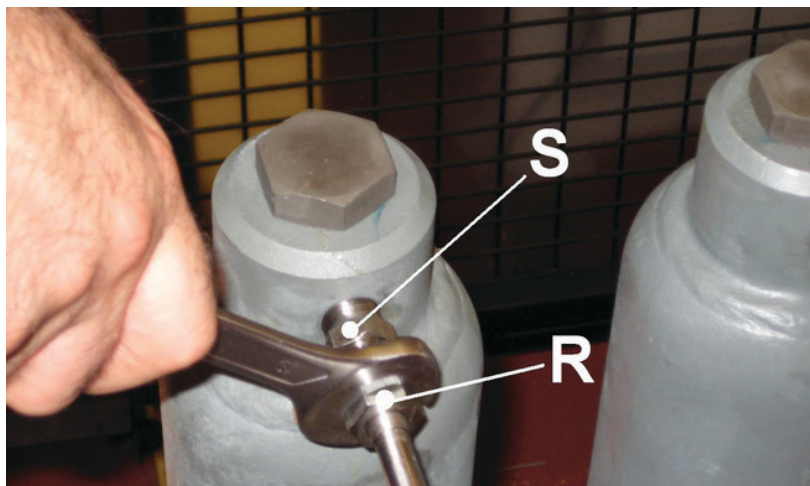
Disassembly for shipping:

Figure 7



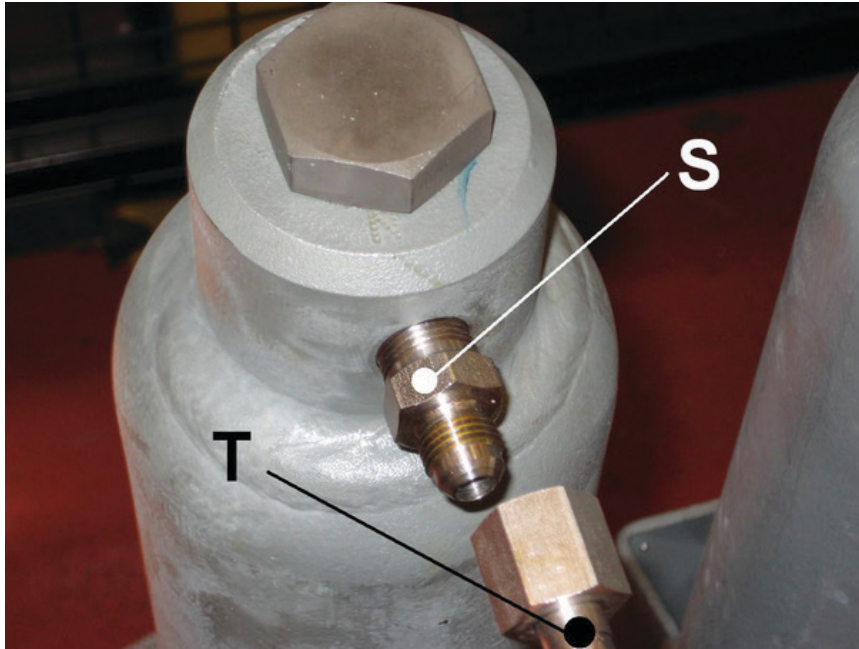
- Unloose the nuts of the compression fittings R on pneumatic connections nipple S (Figure 8).

Figure 8



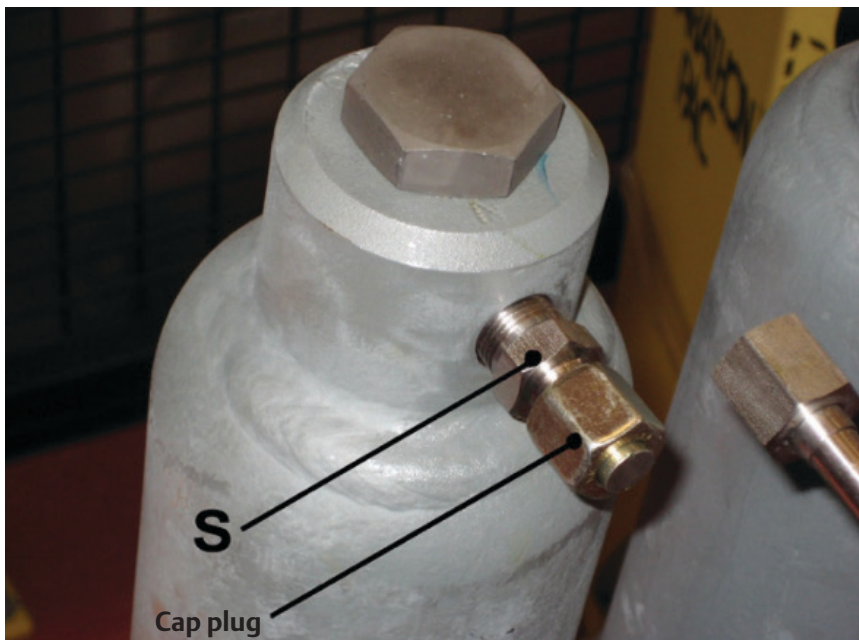
- Remove pneumatic tubes T from connection nipple S (Figure 9).

Figure 9



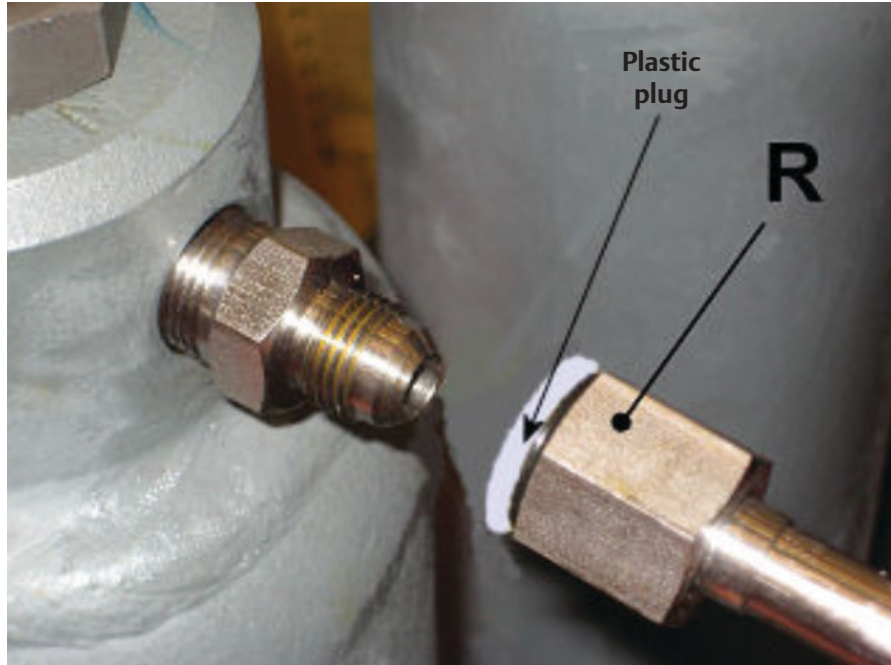
- Plug the connection nipple S with proper cap plugs (Figure 10).

Figure 10



- Plug the pneumatic pipe ends with plastic plugs for fittings (Figure 11).

**Figure 11**



**Re-assembly before “start-up” of actuator:**

- Remove protection plugs from compression fittings R and connections S.
- Connect pneumatic tubes T to connections S.

**NOTICE**

Check that the ferrule inside the conical seat of the fitting is aligned with the axis of the pneumatic tube end and the connection nipple.

- Tighten the nuts of the compression fittings R to pneumatic connections S.

**NOTICE**

After tightening the nuts of pneumatic connections it must be performed a pneumatic test to check possible leakages.

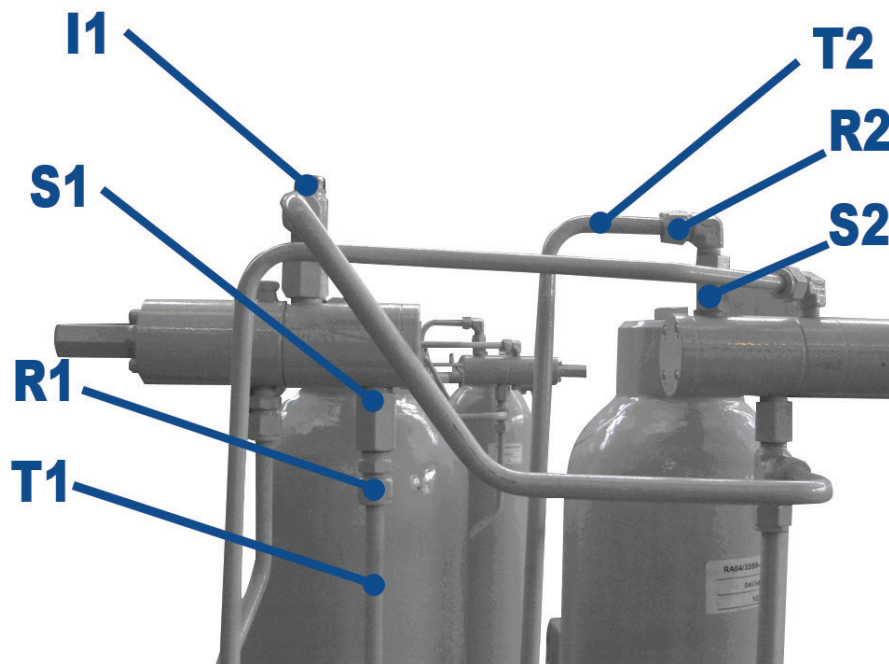
**When torque limiting devices are furnished , proceeded as follow :**

(See Figure 12)

**Disassembly for shipping :**

- Remove tubes (T1 and T2) on connections S1, S2 by unloosing the nuts of the compression fittings R.

**Figure 12**



- Plug the torque limiting switch with proper cap plugs on S connections.
- Plug the pipe ends with suitable plugs for fittings (R1-R2 connections).

**Re-assembly before “start-up” of actuator:**

- Remove protection plugs on S and R connections.
- Reassemble the fittings R for tubes (T) on connections S.
- Assemble exhaust pole on the actuator, and connect tube to connection I-1 (if foreseen).

## 2.2.2 Procedure to Follow If Oil Leaks from the Tanks into the Pneumatic Valves

### NOTICE

If the actuator tanks are kept in horizontal axis by mistake, and the oil inside them enters into the pneumatic connection pipes and in the control pneumatic valves, it is necessary to wash with dry air (high flow, low pressure) the interior of valves and pipes: connect an air or a dry nitrogen supply to the threaded hole of actuator supply and disconnect the pipes that connect the support plate of control valves to the tanks. Then operate the valves so that the air flow removes oil, air should go out from the ends of the pipes so to clean properly also their interior. This operation should be made as soon as possible after the inconvenience of oil spill.

#### Checking of the oil level of the bottles (also see Section 5.1.1)

The correct oil level can be verified by means of the oil dipsticks mounted on the top of each bottle. To do this correctly, we must equalize the oil level of the two bottles:

- Bring the actuator to the middle of the stroke (45° degrees rotation)
- Rotate the oil distributor to the equalizing position
- Wait some minutes, so as the oil can reach for gravity the same level in the two bottles
- Rotate again the hydraulic distributor to the position corresponding to the gas powered operation

After this operation, bring the actuator to the end of the stroke (fully closed or fully open position) and check, after the gas has been exhausted, the level of the oil by unscrewing the dipstick. Check that the oil level correspond to the minimum level line, for the tank wich was pressurized and to the max level line, for the tank which was to exhaust.

I.E. If the actuator is in the closed position, the closing bottle (normally on the left side) must have the oil at minimum level line; the opening bottle must have the oil at maximum level line. If the levels are lower than the dipstick lines, add some oil, after checking type and grade of the oil to be used.

## 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 pneumatic and electrical connections (if present).
- Check that the cover of the control group and of the limit switch box (if any) are properly closed.

If the storage is long-term or outdoor:

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

## 2.4 Actuator Assembly on the Valve

### 2.4.1 Types of Assembly

For coupling to the valve, the housing is provided with a flange with threaded holes according to Biffi standard tables (SCN6200 SCN6201). The number, dimensions and diameter of the holes are made in accordance with ISO 5211, but for actuator models 0.3 to 6 the holes are drilled on the centreline in order to allow an easier assembly of an intermediate flange, when required. This intermediate flange (or spool-piece) can be supplied when the valve flange can not directly match the actuator flange in its “standard” configuration. For the biggest actuator models, the actuator flange can be machined in accordance with the valve flange dimensions.

The yoke has bored with keyways for coupling to the valve stem, the dimensions of which are according to Biffi standard tables SCN6200 and SCN6201.

Figure 13

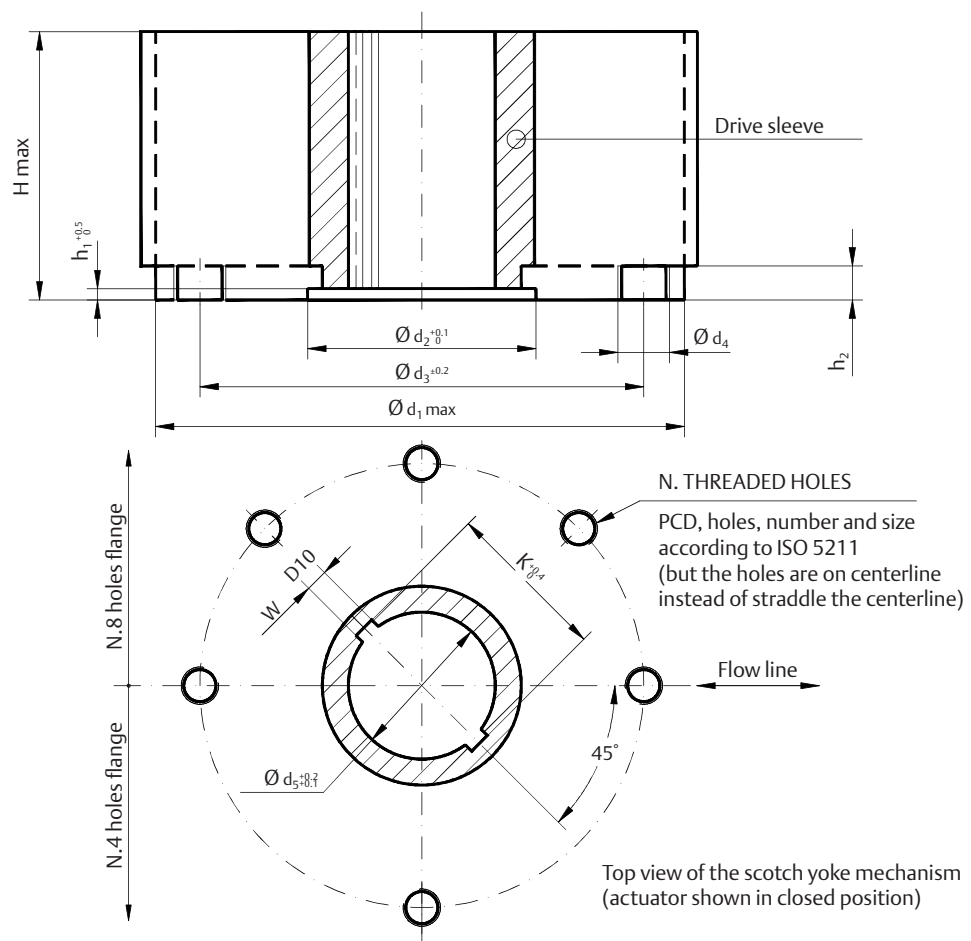


Table 1.

Dimensions in millimeters

Actuator model	$\text{Ø } d_1$	$\text{Ø } d_2$	$\text{Ø } d_3$	$\text{Ø } d_4$	N	$h_1$	$h_2$	H max	$\text{Ø } d_5$	W	K
0.3	240	93	165	M20	4	5	17	127	70	12	75.6
0.9	310	112	254	M16	8	5	19	150	86	14	93.6
1.5	360	144	298	M20	8	6	19	190	112	18	119.0
3	430	195	356	M30	8	9	23	200	157	25	167.8
6	520	250	406	M36	8	14	29	260	200	28	212.8

Figure 14

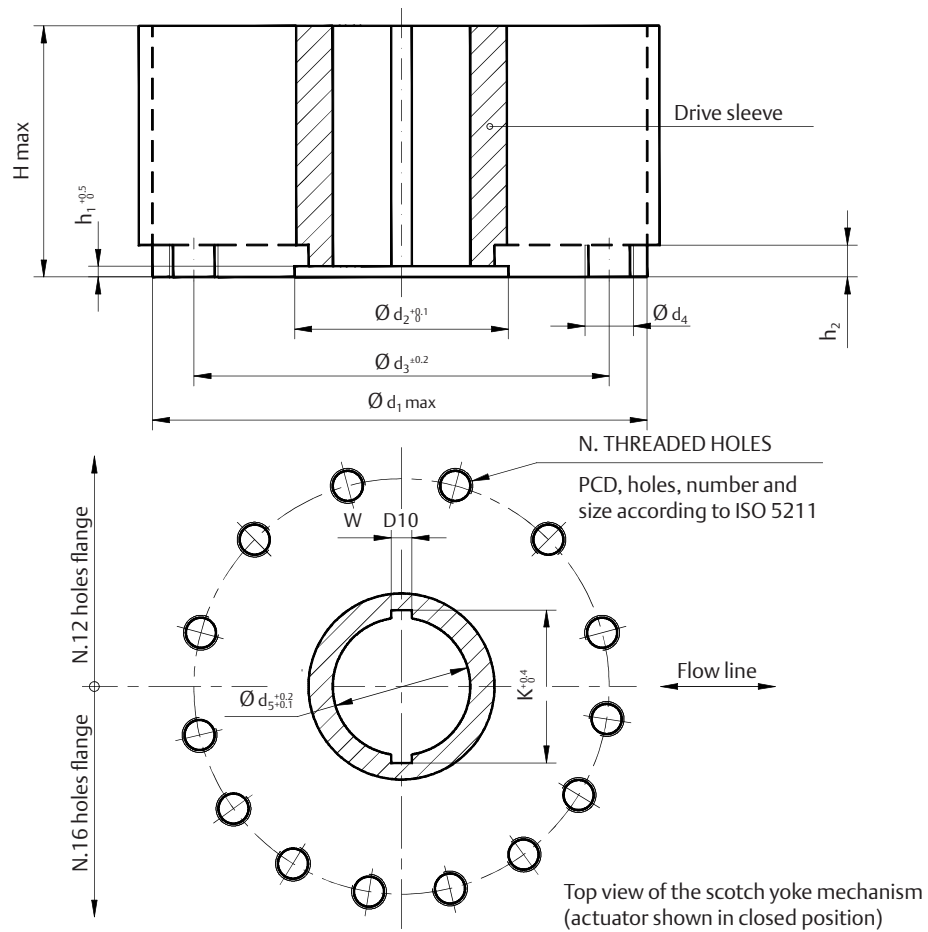


Table 2.

Dimensions in millimeters

Actuator model	Ø d <sub>1</sub>	Ø d <sub>2</sub>	Ø d <sub>3</sub>	Ø d <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ø d <sub>5</sub>	W	K
14	580	250	483	M36	12	10	29	340	175	45	195.8
18	680	290	603	M36	16	12	32	350	200	45	220.8
32	780	290	603	M36	16	12	32	400	220	50	242.8
35	780	315	603	M36	16	11	32	400	240	50	242.8
42	840	310	603	M36	16	12	32	400	220	50	242.8

Figure 15

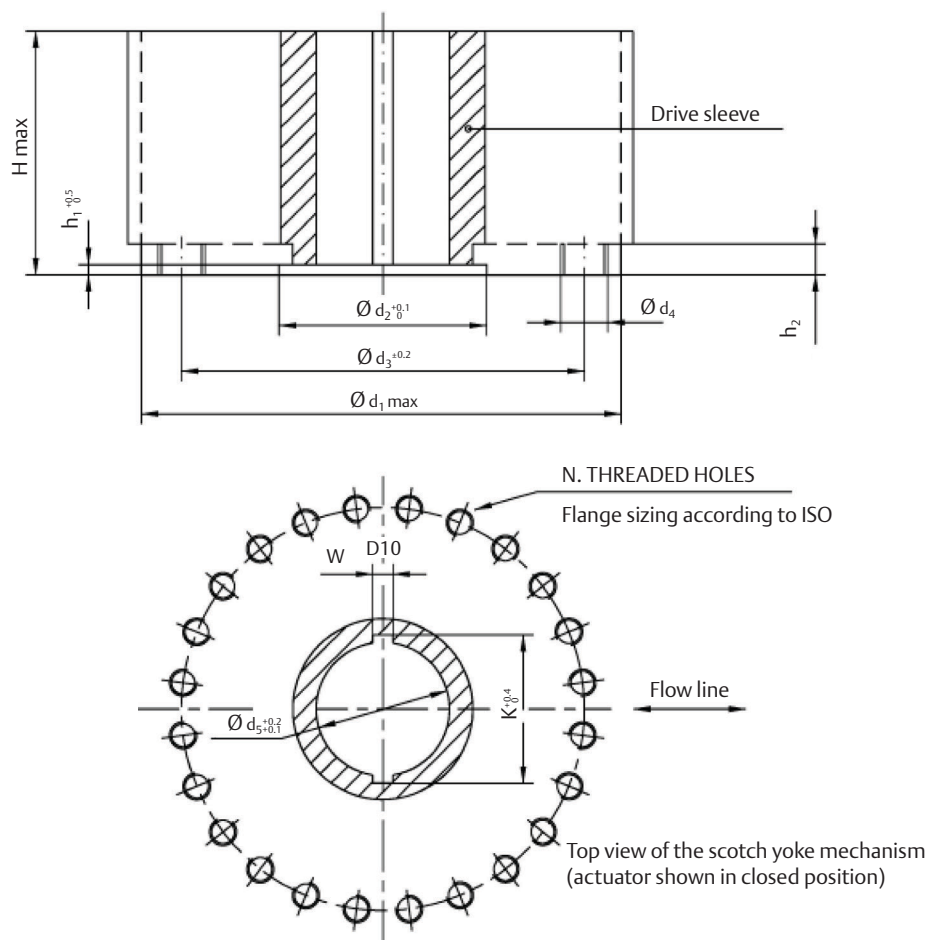


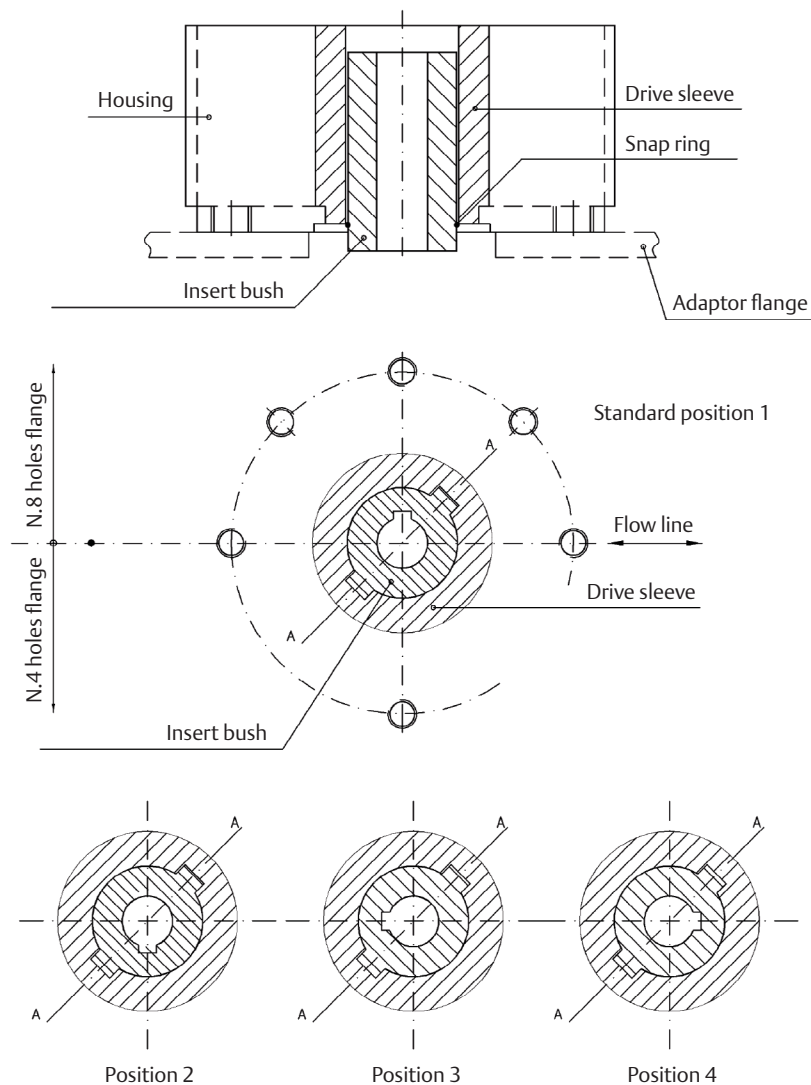
Table 3.

Dimensions in millimeters

Actuator model	Ø d <sub>1</sub>	Ø d <sub>2</sub>	Ø d <sub>3</sub>	Ø d <sub>4</sub>	N	h <sub>1</sub>	h <sub>2</sub>	H max	Ø d <sub>5</sub>	W	K
50	800	315	698	M36	24	10	32	430	240	56	264.8
60	840	315	698	M36	24	10	32	430	240	56	264.8

If required, for the standard models size 0.3 to 6, Biffi can supply an insert bush with un-machined bore in accordance with Biffi standard table SCN6202 enclosed (see following pages). On request the insert bush bore can be machined by Biffi to couple the valve stem. The particular execution of the flange and bushing allow the actuator to be rotated by 90° in 4 different positions according to the Figure 16.

**Figure 16** Insert Bush + Intermediate Coupling Flange



**Table 4.**

Position 2	Position 3	Position 4
Rotate insert-bush 180° around vertical-standard position (1)	Rotate insert-bush 180° around axis A-A, from position (2)	Rotate insert-bush 180° around axis A-A, from position (1)
<b>Insert bush turned upside down</b>		

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

## 2.4.2 Assembly Procedure

### NOTICE

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

### WARNING

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

For actuator assembly on the valve:

### NOTICE

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

- Operate the actuator so that it reaches the position matching valve position (Section 3.3).
- Lubricate valve stem with oil or grease.
- Properly clean and remove grease from coupling flange surfaces.
- Connect, if supplied separately, the adjustment insert to valve stem and fasten it with the special fastening pins.
- Lift the actuator using the special lifting points (Section 2.2).
- Install the actuator so that valve stem inserts in the coupling area. This coupling should be made without forcing.
- Fasten the two parts with the threaded connections (screws, tie rods, nuts). If holes of coupling flanges are not aligned, adequately operate the actuator if necessary move the mechanical stops backwards (Section 3.4).
- Fasten threaded connections. Please refer to Table 5.

**Table 5. 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 5 were calculated considering the materials ASTM A320 L7 for screws or tie rods and ASTM A194 gr.2H for the nuts.

## 2.5 Pneumatic Connections

### WARNING

Check that the values of pneumatic 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.

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

## 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.

### **NOTICE**

#### **Safety provisions:**

**2006/95/EC:** Directive for low voltage equipment (until 19 April 2016) 2014/35/EU from 20 April 2016

**2004/108/EC:** Directive for the electromagnetic compatibility (until 19 April 2016) 2014/30/EU from 20 April 2016

**94/9/CE:** Directive and safety instructions for use in hazardous Area (until 19 April 2016) 2014/34/EU from 20 April 2016

Remove plastic plugs from cables entries

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

**Figure 17 Junction Box**



## 2.7 Commissioning

### NOTICE

Check that values of electrical supply to the control group (if foreseen) are compatible with those on the plate on the junction box (Figure 17).

### ⚠ 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 the values of pneumatic supply available in the system are compatible with those reported on the identification plate of the actuator (Figure 1).
- Check that electrical values of supply to the control group comply with the ones reported on junction box (Figure 17).
- Check the absence of leakages in the hydraulic connections.
- Check that paint is not be damaged during transport, if necessary repair the damages to paint coat.
- Carry out all kinds of operations and check their proper execution (Section 3.3).
- Check the absence of leakages in pneumatic connections.
- Check proper operation of all the due signalling.
- Check oil level in gas-hydraulic tanks (Section 5.1.1).

## Section 3: Operation and Use

### 3.1 Operation Description

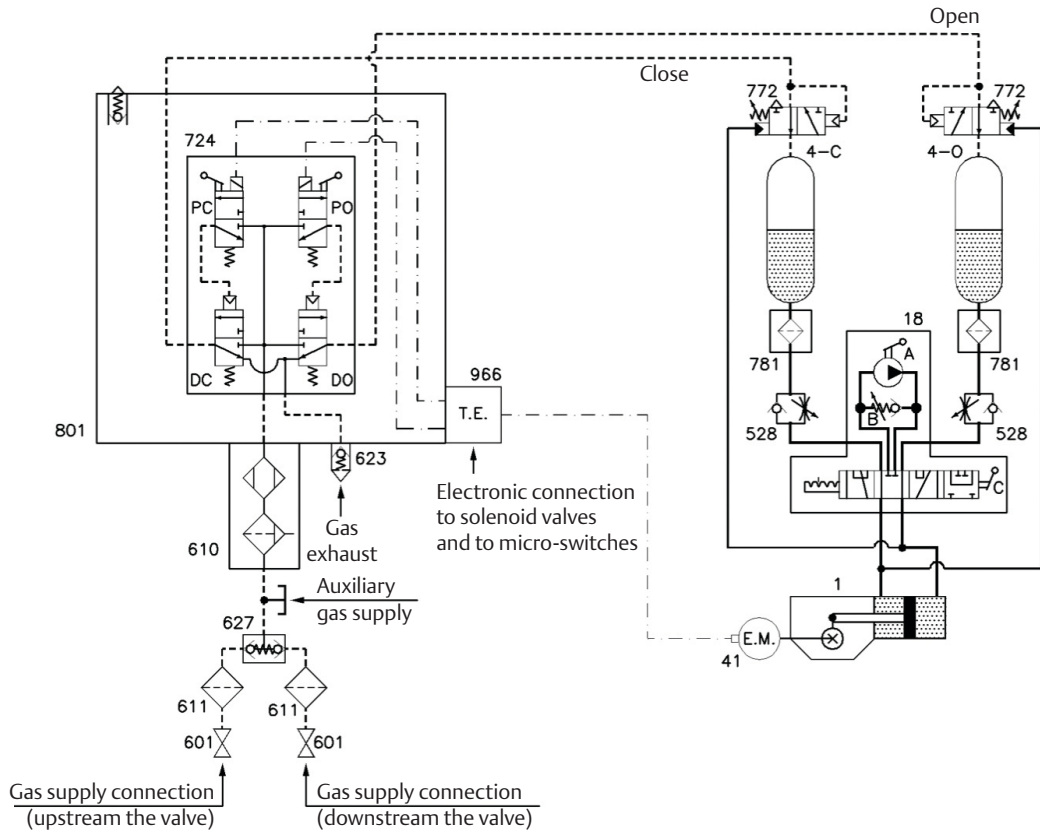
The supply gas pressurizes oil contained in the gas-hydraulic tank relevant to the operation to carry out (opening or closing) (Figure 18).

Oil, (Figure 20), arrives to the manual hydraulic control group and pressurizes a chamber of the cylinder: this starts the linear motion of the piston and the consequent rotation motion of the scotch yoke, to which the valve stem is coupled.

Oil, discharged from the chamber of the cylinder, flows in the second tank going through the manual hydraulic control group and the flow control valve placed under it, that regulates the operation time being carried out (Section 3.6).

When the operation is over, the pressurized gas exhausted, is discharged through the valves placed in the control group. This allows having the actuator not in pressure except during the execution of the operation.

Figure 18 Operating Diagram



Pneumatic connection

Hydraulic connection

Electric connection

**Electric remote control to open and to close**

Energize solenoid valve 724-P0 to open or 724-PC to close the actuator during all the valve stroke. Solenoid valves must be de-energized at the end of the actuator operation.

**Local control to open and to close**

Press lever on valve 724-P0 to open or 724-PC to close.

**Manual operation**

Select by the valve 18-C the opening or closing operation and actuate the handpump 18-A.

Note: the directional control valve 18-C must be in "automatic"- position to allow the operation with gas supply.

**Torque limiting device**

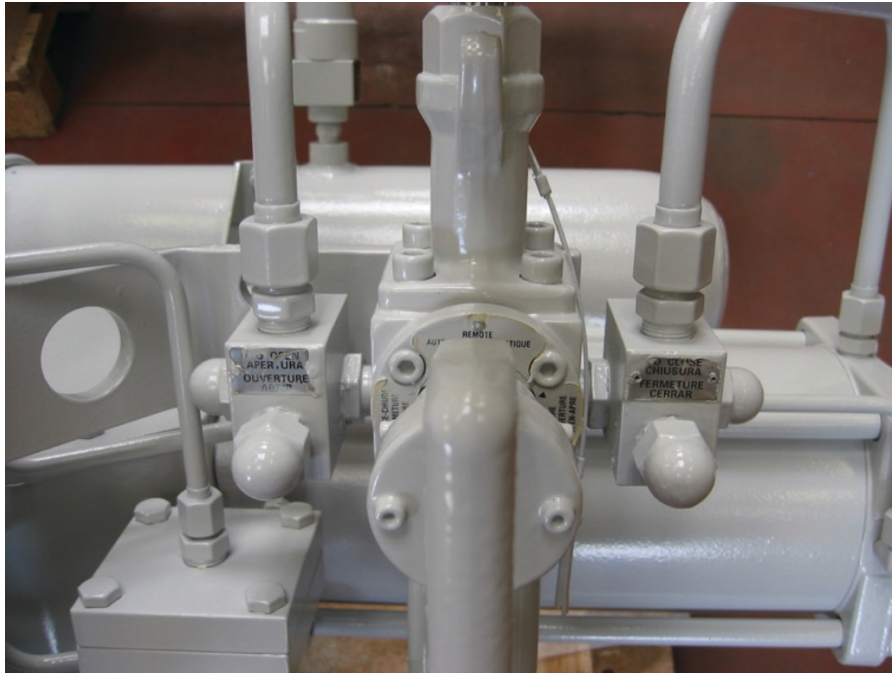
When the actuator output torque exceeds the set value. The torque limiting switch 772 stops the gas flow to the relevant gas-hydraulic tank 4 and the enclosed gas is exhausted.

Note: the operating diagram is drawn with solenoid valves coils not energized.

- 1 Double acting gas over oil actuator
- 4 Gas-hydraulic tank
- 18 Hydraulic manual override
  - a - Handpump
  - b - Adjustable relief valve
  - c - Hand operated directional control valve
- 41 Electric micro-switches
- 528 Unidirectional flow regulator (adjustable setting)
- 601 Stop valve
- 610 Gas dehydrating filter/condensate separator
- 611 Mechanical filter
- 623 Dust excluder with check valve
- 627 Higher pressure shuttle valve (double check valve)
- 724 Double 3/2 N.C. solenoid valve with manual override
  - PC - 3/2 N.C. pil. solenoid valve. man. overr. (to close)
  - PO - 3/2 N.C. pil. solenoid valve. man. overr. (to open)
  - DC - 3/2 N.C. pneum. pilot/ spring ret. valve (to close)
  - DO - 3/2 N.C. pneum. pilot/ spring ret. valve (to open)
- 772 Torque limiting switch
- 781 Hydraulic filter
- 801 Control valves enclosure with vent valve
- 966 Terminals enclosure

**Figure 19 Torque Limiting Device**

A pressure reducer or a “torque limiting device” (Biffi patent) can be supplied when the gas supply pressure varies in a wide range and when the actuator output torque must not exceed a fixed value in order not to damage the valve. The pressure reducer limits the output torque of the actuator by reducing the gas supply pressure at a preset value. The torque limiting device consists of 2 valves, one for each gas-over-oil tank, which stop the gas flow coming from the pneumatic control valves of the actuator and exhaust the gas enclosed in the gas-over-oil tanks when the output torque exceeds the preset value. When the gas supply to the actuator is not always available, a storage tank engineered and manufactured according to the applicable code and working conditions is provided. For any particular requirements it is advisable to contact Biffi sales offices, which will provide the most suitable and convenient solutions to the various needs. (Figure 19).

**Figure 20** Flow Regulator Valves

The speed of operation can be adjusted on site by two flow control valves (see Figure 20 and Section 3.6).

## 3.2 Residual Risks

### **⚠ WARNING**

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

## 3.3 Operations

### 3.3.1 Local Pneumatic Operation

### **⚠ WARNING**

Use the proper safety measures to protect from any pressurized gas not piped and from excessive and harmful noise.

---

**Figure 21 Double Solenoid Valve With Manual Control**

- 
- Arrange the distributor to the “Automatic” position (Figure 22).
  - Operate the manual control lever of the double solenoid valve in the control group, relevant to the operation to carry out (opening or closing) (Figure 21).
  - Check the correct operation of the actuator through the visual position indicator.
  - Release the lever to terminate the operation.

### 3.3.2 Local Hydraulic Manual Operation

#### **⚠ WARNING**

Use the proper safety measures to protect from any pressurized gas not piped and from excessive and harmful noise.

---

- Operate the distributor to the “opening” or “closing” position according to the operation to make (Figure 22).
- Operate the manual control lever (Figure 22).
- Check the correct operation of the actuator through the visual position indicator.
- If no other local operation is carried out, operate the distributor to the “Automatic” position (Figure 22).

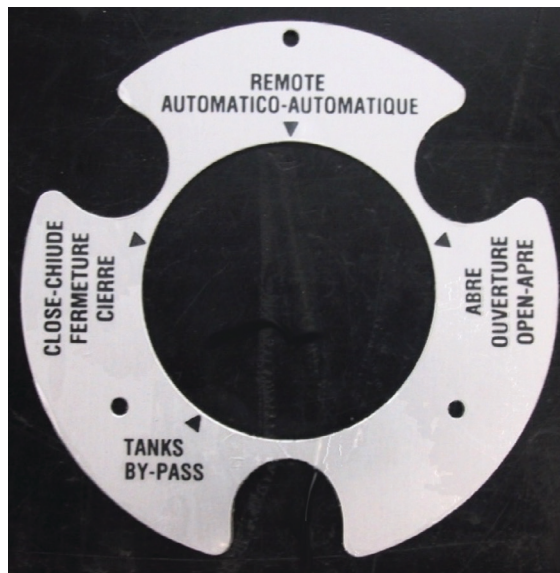
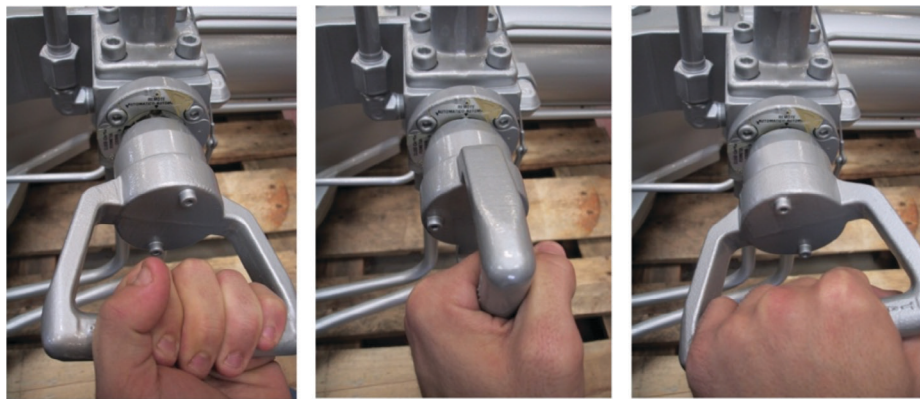
### 3.3.3 Remote Operation

- In case of remote control, arrange the distributor to “Automatic” position (Figure 22), and from the control room send the electric signal corresponding to the operation to carry out (opening or closing).

#### NOTICE

Do not use, to carry out operations, the by-pass position of the distributor.

Figure 22 Distributor in the Three Operation Positions



## 3.4 Calibration of the Angular Stroke

The angular stroke of the yoke can be adjusted between  $82^{\circ} \div 98^{\circ}$  ( $\pm 4^{\circ}$  with respect to the nominal positions of complete opening and closing) by means the mechanical stops screwed into the left side of the housing (open valve) and into the end flange of the pneumatic cylinder (closing) (Figure 23).

**Figure 23 Mechanical Stops**



In case of an actuator with two cylinders (Figure 24), both mechanical stops are screwed on the end flanges of the cylinders.

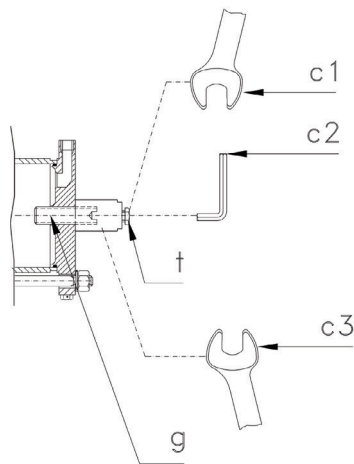
**Figure 24 Actuator with Two Cylinders**



For the adjustment of the mechanical stop on the end flange of cylinder, follow these steps (Figure 25):

- Remove with the specific wrench (c1) the plug (t).
- Insert a wrench for Allen keys (c2) in the through hole until reaching the adjustment pin (g).
- Keep the protection cover blocked with the special wrench (c3).
- Turn counter-clockwise to increase the angular stroke, turn clockwise to decrease it.
- When the adjustment is over tighten the plug (t).

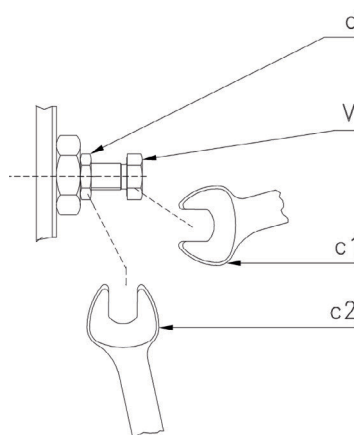
**Figure 25 Mechanical Stop of the Cylinder**

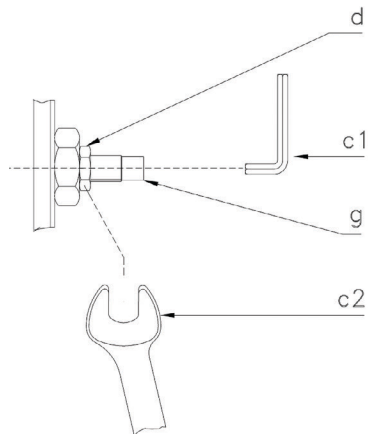


For the adjustment of the mechanical stop screwed into the left side of housing, follow these steps (Figure 26 and 27):

- Loosen the locknut (d) with the specific wrench (c2).
- Adjust the pin (g)/screw (v) with the adequate wrench (c1).
- Turn counter-clockwise to increase the angular stroke, turn clockwise to decrease it.
- When the adjustment is over tighten the locknut (d).

**Figure 26 Mechanical Stop on the Housing**



**Figure 27 Mechanical Stop on the Housing**

## 3.5 Calibration of Micro-switches (If Foreseen)

(Refer to Safety Instructions Manual for limit switch box)

### **⚠ WARNING**

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

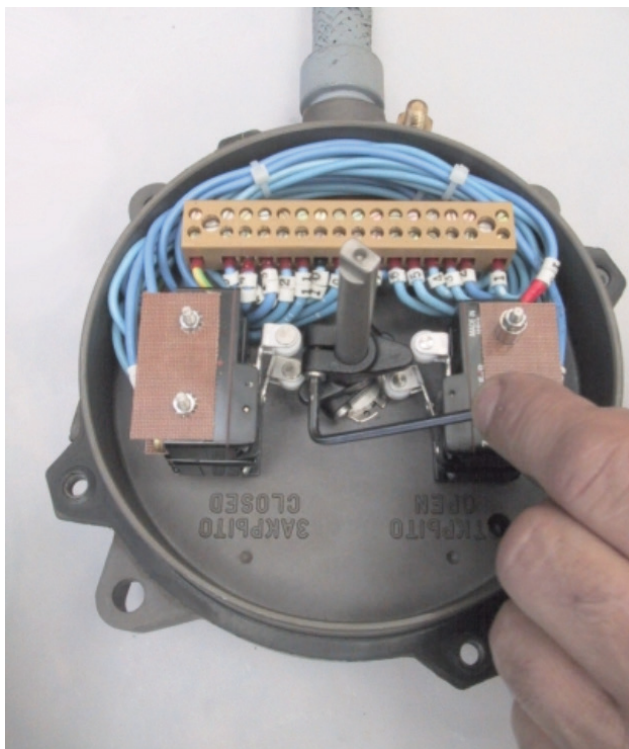
### **NOTICE**

Operate only the micro-switch corresponding to the direction of operation being carried out, as clearly reported on the micro-switch. 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 28 Micro-switches Box



Figure 29 Cam Adjustment



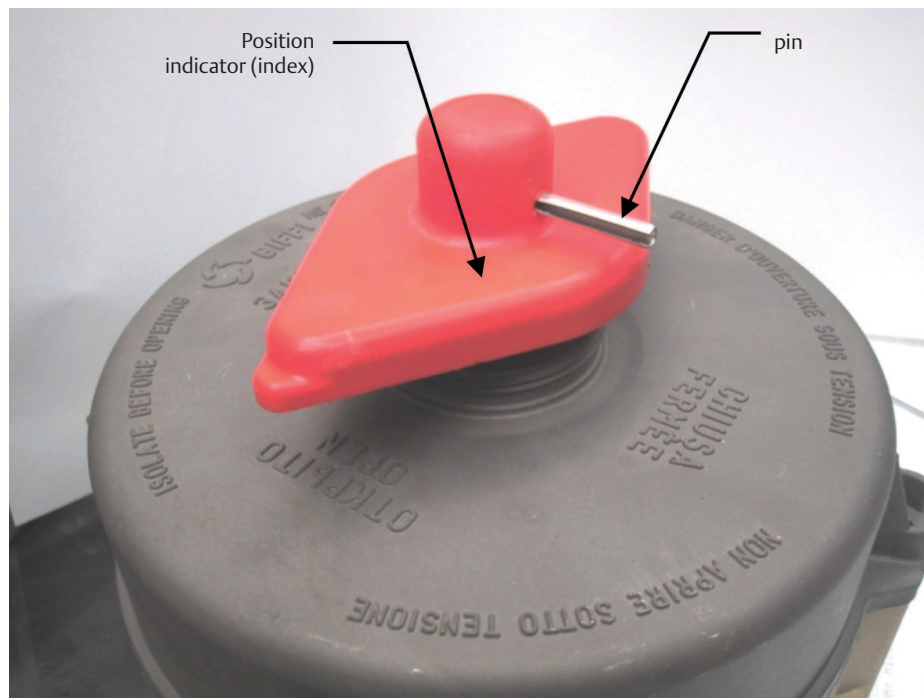
If the index (Figure 30), does not signal the proper position of the valve but is turned by 90°:

- 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 micro-switches should be operated before the stop of the stroke of the actuator due to mechanical stops. Adjust the relative cams properly.

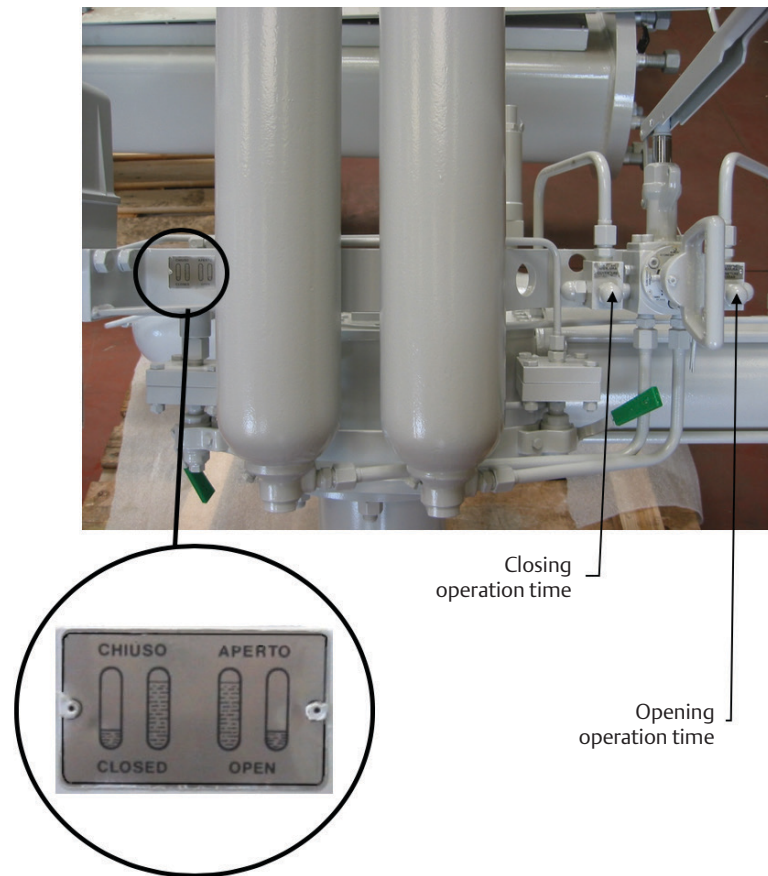
**Figure 30** Position Indicator and Pin for Micro-Switches Box



## 3.6 Calibration of the Operation Time

The calibration of the operation time is made through two flow regulation valves placed next to the hydraulic manual distributor (Figure 31).

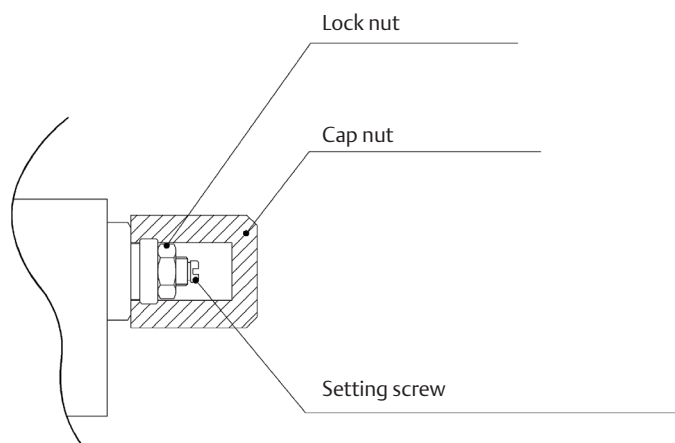
**Figure 31 Adjustment of Operation Time and Oil Levels**



To carry out the adjustment, use an adequate Allen wrench and follow these steps (Figure 32):

- Remove the cap nut.
- Loosen the locknut.
- Screw with a screwdriver the setting screw to increase the operation time.
- Unscrew with a screwdriver the setting screw to decrease the operation time.
- After the adjustment is over screw the locknut and put back in place the cap nut.

**Figure 32 Flow Regulator**



## Section 4: Operational Tests and Inspections

### **NOTICE**

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

---

# Section 5: Maintenance

## NOTICE

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

## ⚠ WARNING

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

## 5.1 Periodic Maintenance

GPO 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 properly operates the valve.
- Check there are no hydraulic or pneumatic leakages.
- Check oil level (Figure 33).
- Check the actuators did not undergo accidental damage with oil leakages found on site (Section 5.1.1).
- Check that improper closing of control-group cover did not produce the presence of condensation on it.
- Check the integrity of worn out parts (gaskets, pads etc.).
- Replace, if any, the filter cartridge of the supply gas.

**Figure 33** Level Measuring Stick



## 5.1.1 Check and Restore Oil Level in the Gas-Hydraulic Tanks

- Bring actuator in position of complete opening or closing.
- Wait for a few minutes before checking.
- Check oil level with the special level sticks placed on top of gas-hydraulic tanks (Figure 33).
- Add oil (Table 6) if in one tanks the level is BELOW MINIMUM and at the same time in the other tank it is BELOW MAXIMUM (Figure 32).

### WARNING

Oil level should not be ABOVE MINIMUM in one tank and at the same time ABOVE MAXIMUM in the other one.

If in one tank level is BELOW MINIMUM and at the same time in the other tank it is ABOVE MAXIMUM or the other way round there is an unbalance of oil levels in the tanks. In this case follow these steps:

- Bring actuator to half angular stroke - 45°.
- Position distributor in “by-pass”.
- Operate the lever of the hydraulic pump to balance the oil levels of two tanks.
- Check that the level is restored with the special measuring sticks.
- Bring distributor back to previous position.

### NOTICE

Do not leave the distributor in the By-pass position. For refill use oil of the same brand as the one in the tanks, refer to related technical documentation.

**Table 6. Features of hydraulic oil suggested by Biffi Italia s.r.l. for refilling in different working condition:**

<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 DYSPIN AWS22
<b>Low temperature conditions (until -46 °C)</b>	
Manufacturer	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	5.3 cST
Viscosity index (ISO 2909)	>200
Flash point	105 °C
Pour point	<-60 °C
Specific weight	0.87 kg/dm <sup>3</sup>
<b>(Or equivalent)</b>	
<b>Low temperature conditions (down to -60 °C)</b>	
Manufacturer	SYNTHESIS
Name	SYNTRASS-CS 500
Viscosity at -60 °C	580 cST
Viscosity at -30 °C	39cST
Viscosity at 20 °C	5.8 cST
Viscosity at 50 °C	2.1 cST
Flash point	152 °C
Pour point	-68 °C
Specific weight	0.897 kg/dm <sup>3</sup>
<b>(Or equivalent)</b>	

## 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 scotch yoke mechanism of the actuator is lubricated "for life". In case of high load and high 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 the yoke and bushings, on the yoke link grooves, on the sliding blocks, on the guide bar. For this operation is necessary to disassemble the mechanism cover. In larger actuators the lubrication can be performed through the inspection holes of cover after removing the plugs.

The following grease is used by Biffi for standard working temperature and suggested for relubrication:

**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)
NLGI consistency:	2	Color:	Buff
Worked penetration:	280 dmm	Physical state:	Semi-solid at ambient temperature
ASTM Dropping Point:	185 °C	Odour:	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

## 5.2.2 Replacing the Seals of the Cylinder

(Section 7.2 - Figure 35: Hydraulic Cylinder)

- Measure the protrusion edge of the setting-screw (11) referred to the surface of the end flange of the cylinder (13), so to easily restore the calibration (Section 3.4) once the maintenance operations are over
- Remove the locking screw protection (14) and unscrew the mechanical stop (11).
- Unscrew the nuts (16) from tie rods (10) on the side of the end flange. Nuts should be progressively unscrewed all together.
- Remove the end flange (13) and the rod (12).
- Remove the O-rings (3) from their seat in the head flange (2).
- Properly clean the slot and lubricate it with protective oil or with a layer of grease.
- Install a new O-ring (3) in the seat and lubricate again.
- Remove the O-ring (19), the tightness ring of the piston (9) and the guide ring (8) from their slots in the piston.
- Properly clean the seat of the guide ring (8) and lubricate it with a lot of grease so that it keeps the ring in its place at the moment in which the rod is put back in place.
- Properly clean the seat of the O-ring (19) and lubricate it with protective oil or with a layer of grease.
- Install a new O-ring (19) and the ring of the piston (9) in their seats and lubricate them again.
- Properly clean the interior of the rod (12) and check accurately the surface is intact.
- Lubricate the internal surface of the rod and the inlet chamfers.
- Insert the rod on the piston of around half its length, paying attention not to damage the O-ring (19). During this operation the guide ring of the piston, passing, removes the grease from the rod surface: so lubrication should be carried out.
- Complete the axial motion of the rod until the head flange (2) of the cylinder is reached paying attention not to damage the O-ring (3).

### NOTICE

Carry out a few operations (Section 3.3) to check there are no leakages from the gaskets.

## 5.3 Dismantling and Demolition

Before starting the disassembly a large area should be created around the actuator so to allow any kind of movement without problems of further risks created by worksite.

### **WARNING**

Before disassembling the actuator it is necessary to close the pneumatic feed line and discharge pressure from the cylinder of the actuator, from the control unit and from the accumulator tank, if present.

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

Lift the actuator using the proper lifting points (see Section 2.2).

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 power supply	Restore it
	Lack of pneumatic supply	Open line interception valve
	Blocked valve	Repair or replace
	Wrong position of the distributor of the manual hydraulic group	Restore correct position
	Failure of the control group	Call Biffi Italia s.r.l. Customer Service
	Unexpected intervention of torque limit-device	Call Biffi Italia s.r.l. Customer Service
Actuator too slow	Low supply pressure	Restore (Section 1.4)
	Wrong calibration of flow regulator valves	Restore (Section 3.6)
	Wear of the valve	Replace
Actuator too fast	High supply pressure	Restore (Section 1.4)
	Wrong calibration of flow regulator valves	Restore (Section 3.6)
Leakages on hydraulic or pneumatic circuits	Deterioration and/or damage to gaskets	Call Biffi Italia s.r.l. Customer Service
Incorrect position of the valve	Wrong adjustment of mechanical stops	Restore (Section 3.4)
	Wrong warning of micro-switches	Restore (Section 3.5)
Hydraulic manual pump does not work	Distributor positioned on AUTOMATIC	Position the distributor on the indication of the operation to make
	Lack of oil in the gas-hydraulic tanks	Restore proper oil levels in the tanks (Section 5.1.1)
	Leakages on the check valve of the hydraulic control group	Call Biffi Italia s.r.l. Customer Service

# 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. - Servizio Assistenza Tecnica Clienti

Tel.: 0523-944523

Fax: 0523-941885

E-mail: Biffispares@Emerson.com

**Please specify:**

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

## 7.2 Parts List for Maintenance and Replacing Procedure

Figure 34 Scotch Yoke Mechanism

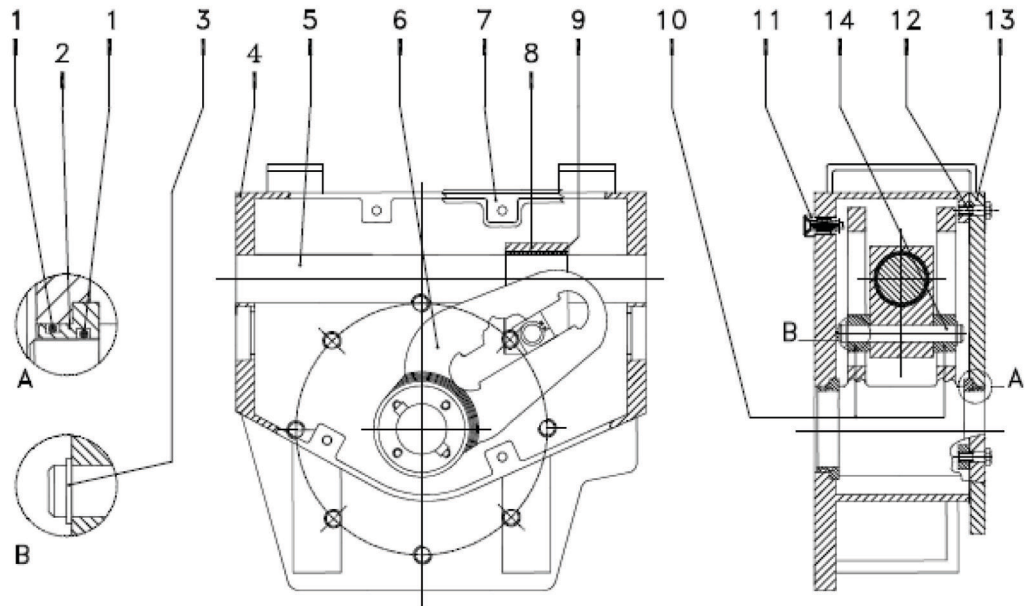


Table 9. Parts List

Item	Qty	Description	Material
1	4	O-ring	* NBR
2	2	Yoke bushing	Bronze
3	2	Retainer ring	Stainless steel
4	1	Housing	Carbon steel
5	1	Guide bar	Alloy steel
6	1	Yoke	Carbon steel
7	1	Cover gasket	* Fiber
8	1	Guide block	Carbon steel
9	1	Bushing	Steel + Bronze + PTFE
10	2	Sliding block	Bronze
11	1	Vent valve	* Stainless steel
12	12	Screw	Carbon steel
13	1	Cover	Carbon steel
14	1	Guide block pin	Alloy steel

**NOTE:**

\* Recommended spare parts

Figure 35 Hydraulic Cylinder

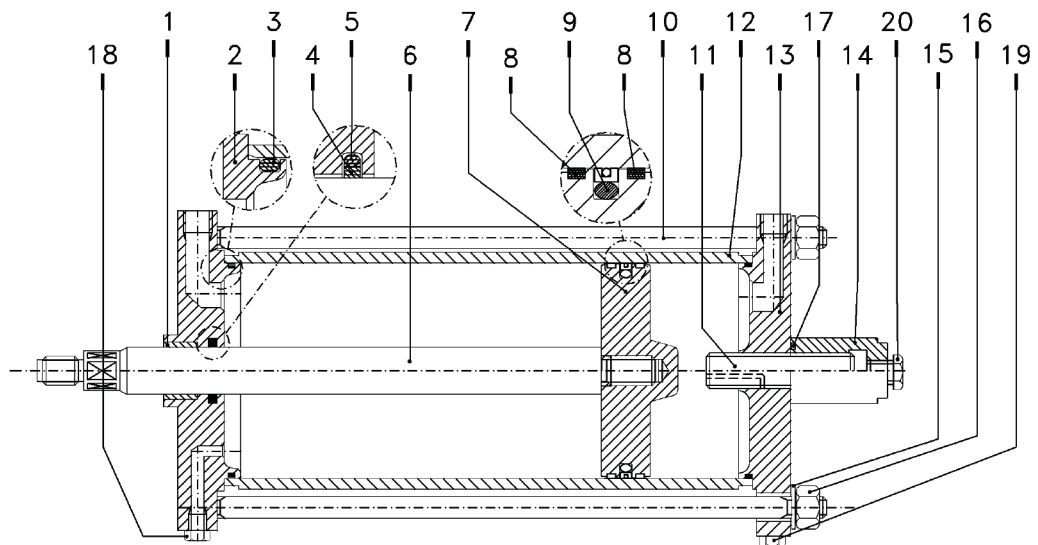


Table 10. Parts List

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

**NOTE:**

\* Recommended spare parts

Figure 36 Assembly Kit

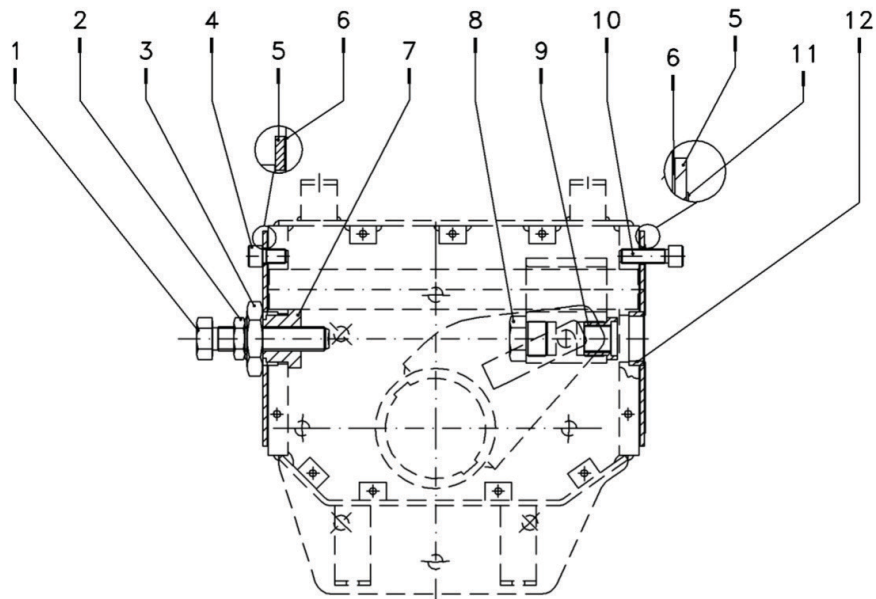


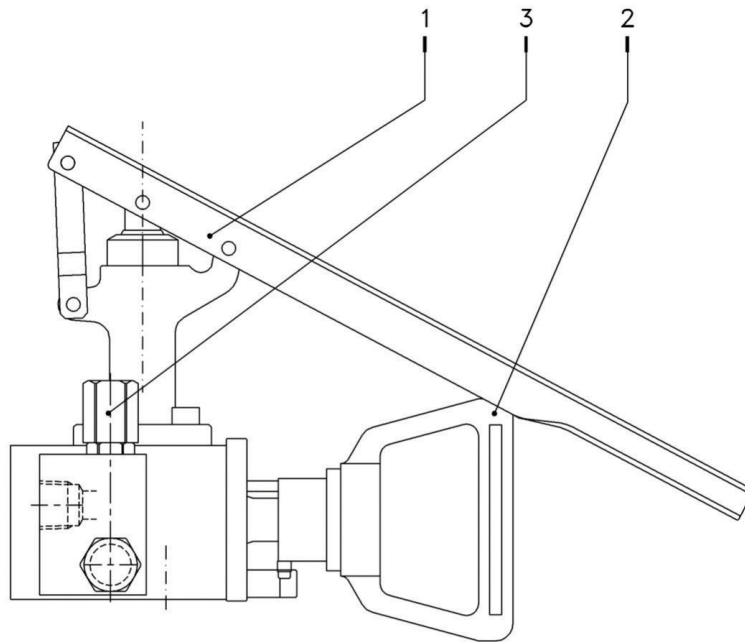
Table 11. Parts List

Item	Qty	Description	Material
1	1	Screw	Alloy steel
2	1	Nut	Carbon steel
3	1	Nut	Carbon steel
4	4	Screw	Alloy steel
5	2	Flange	Carbon steel
6	2	Gasket	* Fiber
7	1	Stopper bush	Alloy steel
8	1	Plug	Alloy steel
9	1	Adaptor bush	Alloy steel
10	4	Screw	Alloy steel
11	1	Gasket	* Fiber
12	1	Washer	Alloy steel

**NOTE:**

\* Recommended spare parts

**Figure 37 Hydraulic Manual Override**



**Table 12. Parts List**

Item	Qty	Description	Material
1	1	Handpump	Carbon steel
2	1	Hand operated directional control valve	Carbon steel
3	2	Hydraulic flow control valve	Carbon steel

Figure 38 Handpump

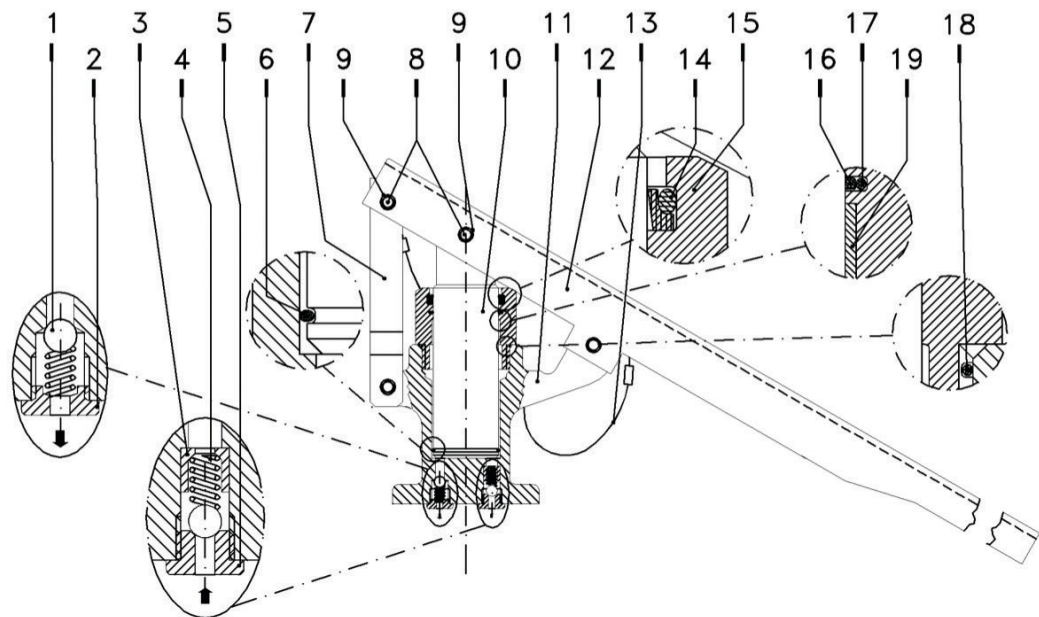


Table 13. Parts List

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 ring	Carbon steel
6	1	Spring retainer ring	Carbon steel
7	1	Fork	Carbon steel
8	2	Pin	Stainless steel
9	4	Retainer ring	Carbon steel
10	1	Rod	Chromium plated alloy steel
11	1	Body	Carbon steel
12	1	Lever	Carbon steel
13	1	Split pin with rope	Nylon + Carbon steel
14	1	Scraper ring	* PTFE + fluorosilicon rubber
15	1	Threaded bush	Aluminium
16	2	Rod seal ring	* PTFE + Graphite
17	2	O-ring	* Nitrile rubber
18	1	O-ring	* Nitrile rubber
19	1	Piston rod bushing	Steel + Bronze + PTFE

**NOTE:**

\* Recommended spare parts

Figure 39 Hand Operated Directional Control Valve

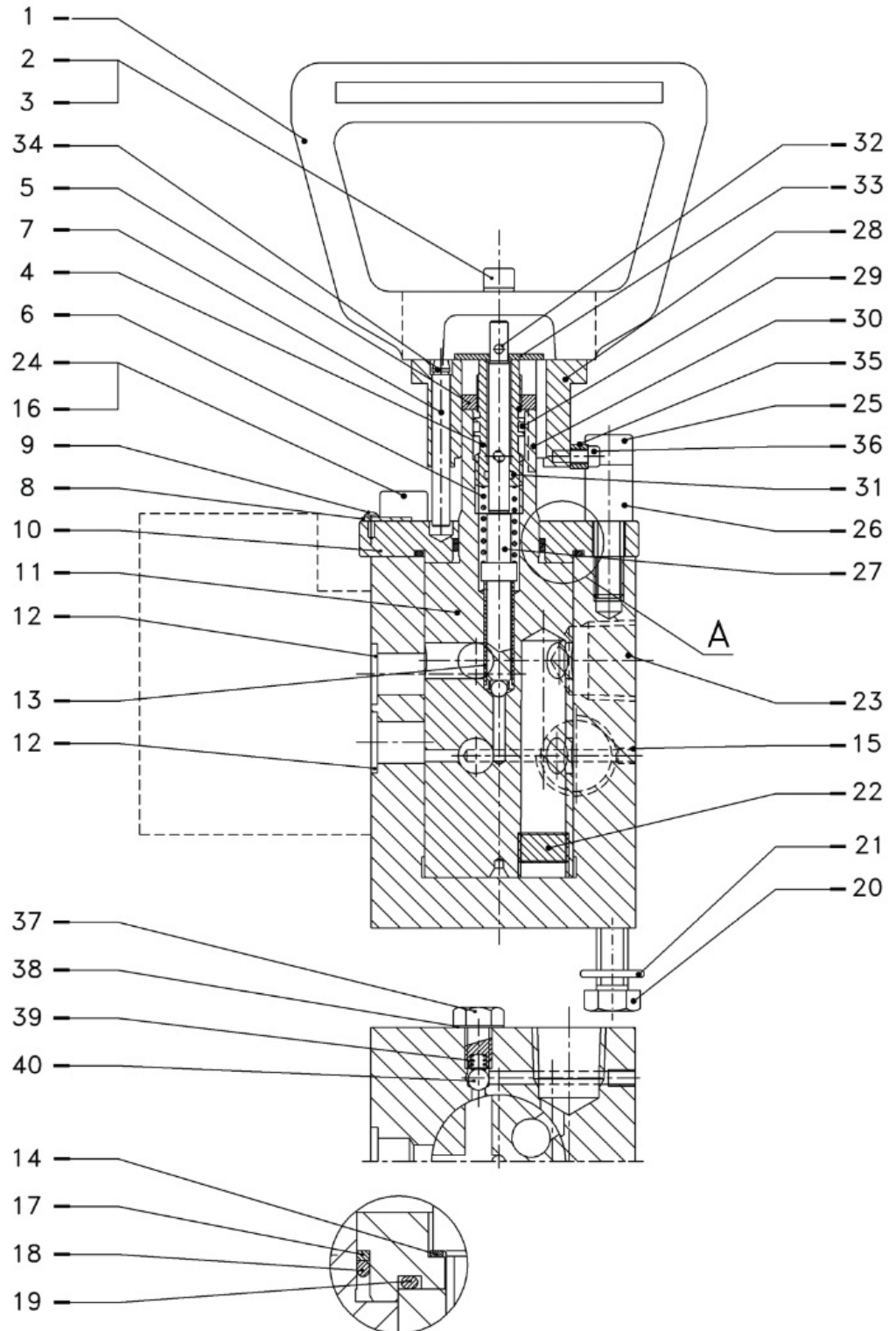


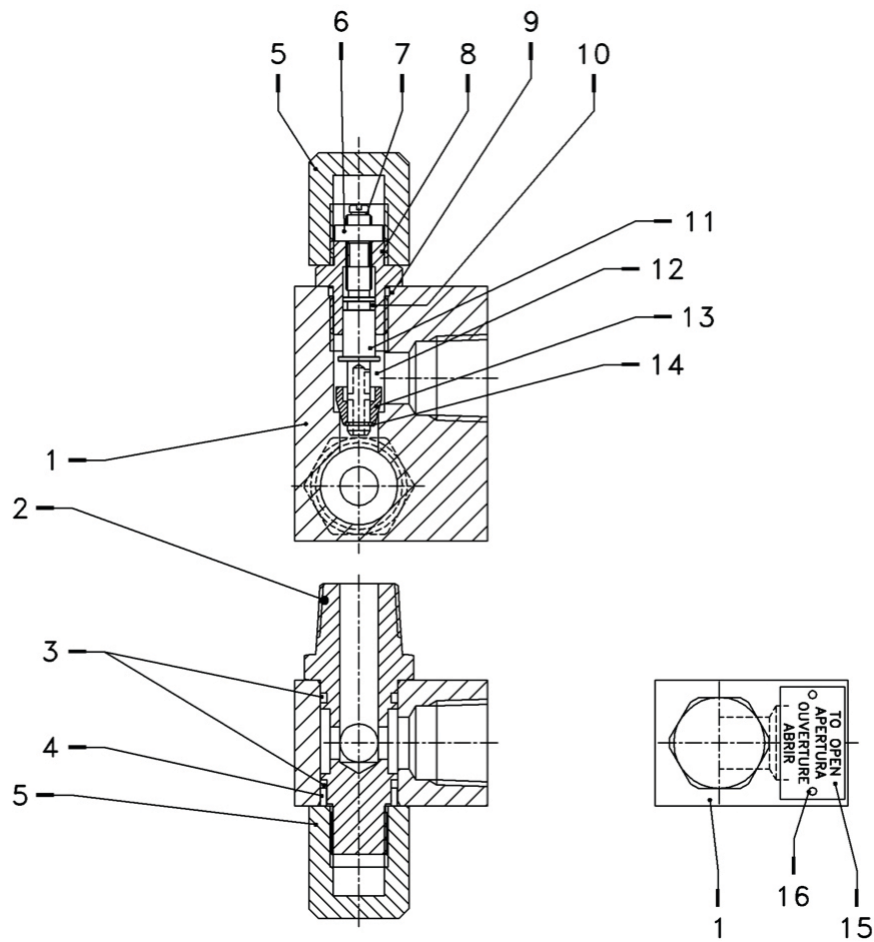
Table 14. Parts List

00Item	Qty	Description	Material
1	1	Handle	Aluminium
2	2	Screw	Carbon steel
3	2	Spring washer	Stainless steel
4	1	Setting screw of relief valve	Bronze
5	1	Lock ring nut	Carbon steel
6	1	Spring	Stainless steel
7	1	Pin	Stainless steel
8	1	Indicator plate	Stainless steel
9	3	Rivet	Aluminium
10	1	Cover	Stainless steel
11	1	Cylindrical distributor	Alloy steel
12	2	O-ring	* NBR rubber
13	1	Strangling ring	Stainless steel
14	1	Back-up ring	* PTFE
15	1	Screw	Stainless steel
16	4	Spring washer	Alloy steel
17	1	Back-up ring	* PTFE
18	1	O-ring	* NBR rubber
19	1	O-ring	* NBR rubber
20	4	Screw	Carbon steel
21	4	Spring washer	Alloy steel
22	2	Screw	Stainless steel
23	1	Body	Carbon steel
24	4	Screw	Carbon steel
25	1	Screw	Carbon steel
26	1	Spacer	Stainless steel
27	1	Operating rod	Stainless steel
28	1	Handle hub	Carbon steel
29	1	O-ring	* NBR rubber
30	1	Key	Stainless steel
31	1	O-ring	* NBR rubber
32	1	Split pin	Stainless steel
33	1	Washer	Stainless steel
34	1	Benzing	Stainless steel
35	2	Spacer	Stainless steel
36	2	Screw	Stainless steel
37	1	Lock ring nut	Carbon steel
38	1	Washer	Stainless steel
39	1	Spring	Stainless steel
40	1	Ball	Stainless steel

**NOTE:**

\* Recommended spare parts

**Figure 40 Hydraulic Flow Control Valve**



**Table 15. Parts List**

Item	Qty	Description	Material
1	1	Body	Carbon steel
2	1	Body	Carbon steel
3	1	O-ring	* NBR rubber
4	1	Seal ring	* PTFE + graphite
5	2	Nut	Carbon steel
6	1	Nut	Carbon steel
7	1	Retainer ring	Spring steel
8	1	Flow control valve flange	Carbon steel
9	1	O-ring	* NBR rubber
10	1	O-ring	* NBR rubber
11	1	Flow control valve setting screw	Stainless steel
12	1	Spring	Spring steel
13	1	Plug	Stainless steel
14	1	Retainer ring	Spring steel
15	2	Data plate	Stainless steel
16	4	Rivet	Aluminium

**NOTE:**

\* Recommended spare parts

Figure 41 Gas-Hydraulic Tank

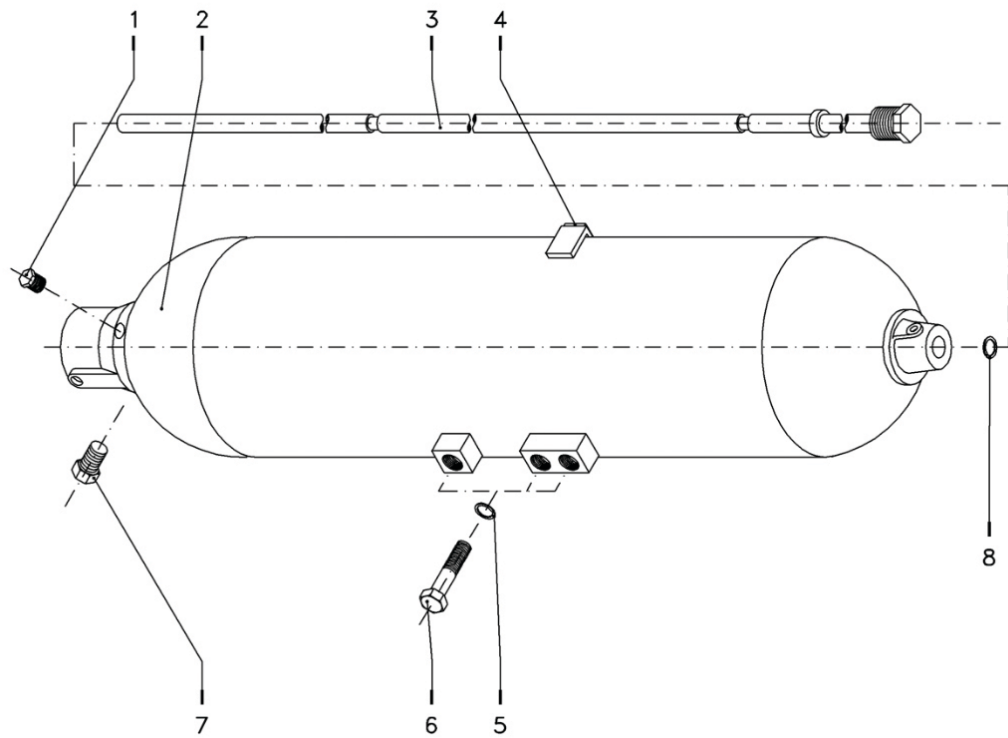


Table 16. Parts List

Item	Qty	Description	Material
1	1	Plug	Carbon steel
2	1	Tank	Carbon steel
3	1	Level stik	Carbon steel
4	1	Plate	Carbon steel
5	3	Spring washer	Carbon steel
6	3	Screw	Carbon steel
7	1	Plug	Carbon steel
8	1	O-ring	* NBR

**NOTE:**

\* Recommended spare parts

# Section 8: Gas-Hydraulic Tanks

## 8.1 Installation, User and Maintenance Manual

1. The tank is supplied internally painted on specific demand of the customer and of the manufacturer of the oil-pneumatic driven actuator on which it will be installed. The tank is supplied as per project drawing, without any accessory, as for example: filters, valves, safety valves, gaskets, circulating fluids, etc.
2. After the tank is tested and marked CE, it is forbidden for anyone to make any modification or any variation to the manufacturing features that may alter in some way its safety requirements.
3. If provided for, any inspection openings placed on the tank coat, will be closed with ASTM A105 threaded forged steel plugs adequately sealed before the final hydraulic test. These plugs will be removed only to allow any internal inspections of the tank scheduled every 10 years as of the date of first installation. Openings will be closed again with the same mode as provided for by the first paragraph of Section 1.3.
4. The transportation of tanks marked CE from manufacturer to user, is made in lots of around 5/100 parts according to their capacity, they will be transported with palletized metallic containers paying attention to avoiding shocks that may damage the nozzles and any threaded supports as well as the structural parts of the tank.
5. The user shall check that internal paint is not damaged, and in case renovate it according to the specification supplied.
6. The threads of nozzles and of any threaded supports will be protected for transportation and for the next phase of external sandblasting for painting preparation, with adequate PVC plastic plugs easy to remove and recycle after use.
7. It is forbidden to expose the tanks to heat sources > 100 °C if there is no adequate protective coating.
8. Specialized firms in compliance with the regulations in force should dispose of the tank.

Figure 42

SERIAL NUMBER N° DI FABBRICA		
VOLUME LITRES VOLUME LITRI	WEIGHT PESO	
DRAWING N° N° DI DISEGNO		
DESIGN PRESSURE PRESSIONE DI PROGETTO		
MAX ALLOWABLE PRESSURE PRESSIONE MAX AMMISSIBILE		
HYDRAULIC TEST PRESSURE PRESSIONE PROVA IDRAULICA		
ALLOWABLE TEMPERATURE TEMPERATURA AMMISSIBILE		
FLUID FLUIDO	YEAR OF BUILT ANNO DI COSTR.	
ORDER n° n° ORDINE	ITEM POSIZIONE	
NOTIFIED BODY ENTE NOTIFICATO	CE	
METALFLANGE MARNATESE S.R.L. V.le Kennedy,653 MARNATE-VA-ITALY		

### Technical data

Supply fluid	Natural gas / nitrogen / air
Operating temperature	from -29 °C to +100 °C
Maximum supply pressure	100 bar

# Section 9: Date Report for Maintenance Operations

Last maintenance operation date:

(in factory, on delivery):

..... exec. by : .....

..... exec. by : .....

..... exec. by : .....

Next maintenance operation date:

..... exec. by : .....

..... exec. by : .....

..... exec. by : .....

Start-up date:

..... (in factory, on delivery) .....

..... (on plant) .....

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