



**BIFFI** RPHS SPRING RETURN HYDRAULIC ACTUATOR  
 INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Before installation these instructions must be fully read and understood



*1.1.1 Applicable regulation*  
 EN ISO 12100-1: 2005: Safety of machinery  
 – Basic notions, general design principles.  
 Part 1-Basic terminology, method.  
 EN ISO 12100-2: 2005: Safety of machinery  
 – Basic notions, general design principles.  
 Part 2-Technical principles and specification.  
 2006/42/EC: Machine directive.  
 97/23/EC: Directive for pressure PED  
 equipment.  
 2006/95/EC: Directive for low voltage  
 equipment.  
 2004/108/EC: Directive for the electromagnetic  
 compatibility.  
 94/9/EC: Directive and safety instructions for  
 use in hazardous area.

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**1 GENERAL WARNINGS**

**IMPORTANT**

*The manual is an integral part of the machine. It should be read carefully before carrying out any operation and should be kept for future reference.*

**1.1 Generalities**

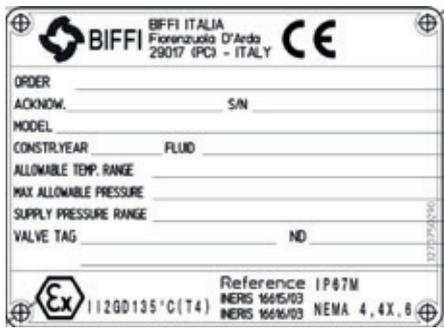
Biffi actuators are conceived, manufactured and controlled according to a Quality Control System in compliance with EN ISO 9001 international regulation.

*1.1.2 Terms and conditions*  
 Biffi 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.

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FIGURE 1  
Data plate



### 1.2 Identification plate

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

The plate fastened on the actuator contains the following information (figure 1).

### 1.3 Introducing the actuator

Series RPHS are hydraulic high-pressure spring return actuators, suitable for any quarter turn application such as ball, plug, butterfly valves or dampers, in both ON-OFF and MODULATING heavy-duty service.

The actuator is made of a rack and pinion mechanism made by alloy steel, which transforms the linear movement of the hydraulic cylinder in one direction, and the linear movement of the spring in the opposite direction, into the rotary movement for the valve operation.

The surfaces of the pinion and rack are treated to guarantee a low friction and a long life.

The spring module incorporates one or two springs in parallel, depending on the model, and it is fully encapsulated to protect persons during actuator disassembling. External travel stops allow precise angular stroke adjustment between 80° and 100°.

Totally enclosed, weatherproof housing, made of nodular cast iron for maximum strength and suitable for use in hostile environments.

The actuator is assembled onto the valve by connecting the actuator-housing flange to the valve flange by a spool piece and the actuator shaft to the valve stem by a stem extension.

The mounting flange, on the housing top, can be utilized for the assembly of limit switches, position transmitter, positioner etc., which are actuated by the actuator output shaft.

The actuator housing is provided, on the front face and in the rear face (optional), with threaded holes for the assembly of accessories (control panels, air storage tank, etc.).

The expected lifetime of actuator is approximately 30 years.

### 1.4 Data sheet

Supply fluid	Hydraulic oil or fire-resistant fluids
Operating temperature	Standard: from -30°C to +100°C Optional: from -60° to +140°C
Supply pressure	Design pressure of the cylinder 220 barg
Max. operating torque	Up to 2600 Nm

FIGURE 2  
Identification of actuator parts



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### 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

##### IMPORTANT

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 and 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

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 with oil, grease or protection disc, the valve coupling area.
- Periodically operate the actuator (section 3.3).

#### 2.4 Actuator assembly on the valve

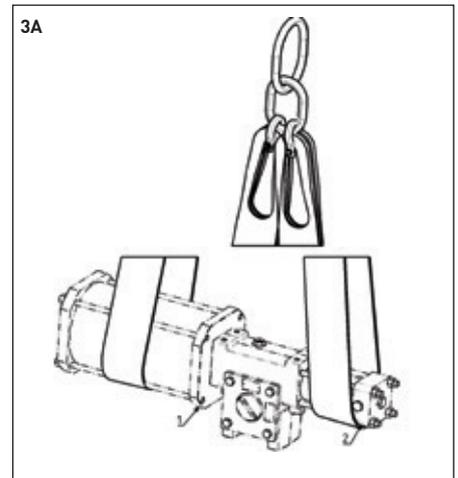
##### 2.4.1 Types of assembly

For coupling to the valve, the housing is provided with a flange with threaded holes according to Biffi standard tables (see figure 4). The number, dimensions and diameter of the holes are made in accordance with ISO 5211. The actuator is provided with a spool piece and a stem extension for coupling to the valve. The assembly position of the actuator, with reference to the valve, must comply with the plant requirements (cylinder axis parallel or perpendicular to the pipeline axis).

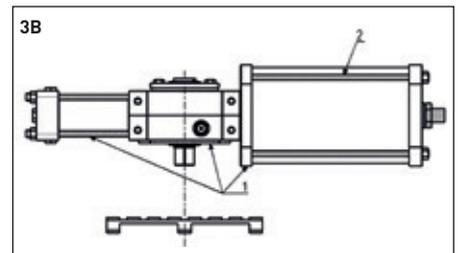
##### IMPORTANT

To fix the actuator to the valve flange must be used the stud bolts and nuts supplied by Biffi!  
In case the actuator is supplied without stud bolts and nuts the following materials must be used as a minimum:  
ASTM A 193 grade L7 for stud bolts  
ASTM A 194 grade 4 for nuts

FIGURE 3A, 3B  
Lifting points for RPHS actuators



1, 2 = Lifting points (obligatory)



1 = Point of support (lifting points)  
2 = Do not lay the actuator on tie rods

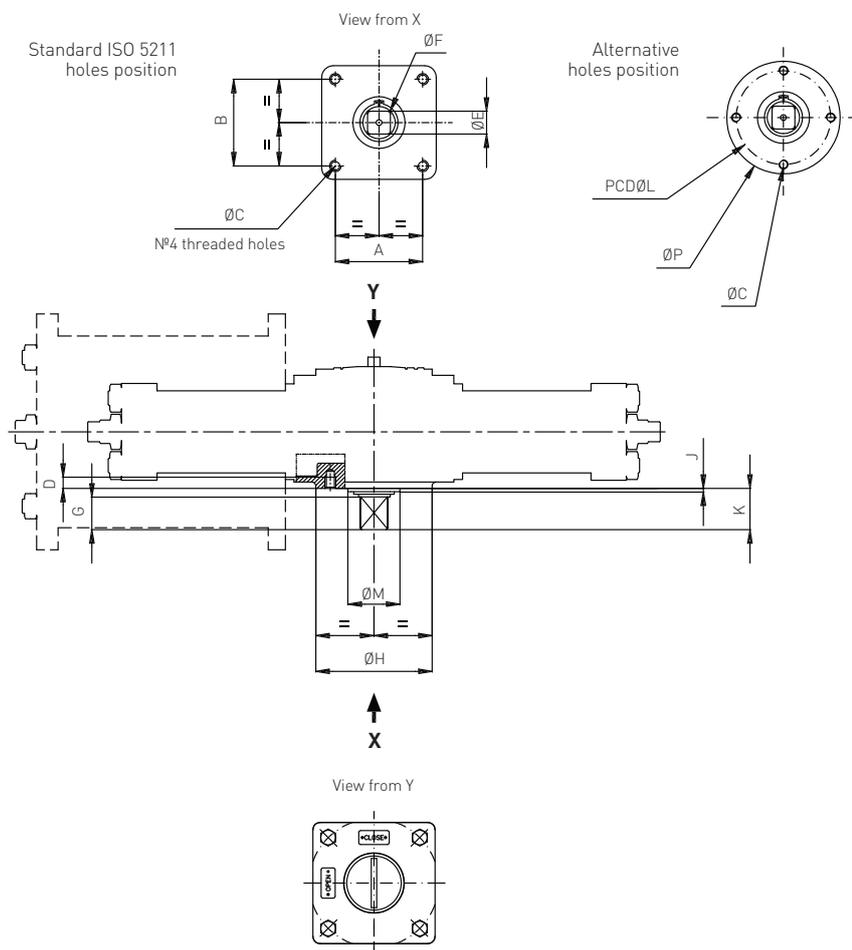
##### WARNING

Do not lay the actuator on tie rods of cylinder /s and do not lay the actuator on accessories (manual hand pump, manual jackscrew, hydraulic control group etc.)

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FIGURE 4  
Coupling dimensions for RPHD/RPHS hydraulic actuators



Actuator shown in closed position

### DIMENSIONS (mm)

Actuator model	A ± 0.2	B ± 0.2	ØC	D	ØE	ØF	G	ØH	K	J	ØL	ØM	ØP
RPHD - 10	49.5	49.5	M8	10	16	21	23	66	30	3	70	40	90
RPHS - 10	49.5	49.5	M8	10	16	21	23	66	30	3	70	40	90
RPHD - 20	72.1	72.1	M10	12	22	29	25	92	32	3	102	50	125
RPHS - 20	72.1	72.1	M10	12	22	29	25	92	32	3	102	50	125
RPHD - 40	88.4	88.4	M12	15	28	37	34	112	42	3	125	60	150
RPHS - 40	88.4	88.4	M12	15	28	37	34	112	42	3	125	60	150
RPHD - 80	99.0	99.0	M16	23	37	49	45	132	55	3	140	75	175
RPHS - 80	99.0	99.0	M16	23	37	49	45	132	55	3	140	75	175

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### 2.4.2 Assembly procedure

#### IMPORTANT

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:

#### IMPORTANT

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 1.

The screwing values in table 1 were calculated considering the materials ASTM A320 grade L7 for screws or tie rods and ASTM A194 grade 2H for the nuts.

**TABLE 1 - NUTS TIGHTENING TORQUE**

Threading	Tightening torque (Nm)
M8	20
M10	40
M12	70
M16	160

### 2.5 Hydraulic connections

#### IMPORTANT

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

#### WARNING

The connections should be made by qualified staff. Use pipes and connections appropriate as for type, material and dimensions. 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 burr the ends of rigid pipes if present.
- 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 functional diagram.
- Check the absence of leakages from hydraulic connections.

#### IMPORTANT

For the characteristics of the motor fluid please refer to the documentation supplied.

### 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 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.

### 2.7 Commissioning

#### WARNING

Installation, commissioning and maintenance and repair works should be made by qualified staff. Any calibration relative to functional aspects of the actuator are preset at the factory. Before any modifications please contact Biffi.

Upon actuator commissioning please carry out the following checks:

- 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 the power voltage of electrical components complies with the one reported on the documentation supplied.
- Check the absence of leakages in the cylinder and in hydraulic connections.
- Check that paint is intact and in case renovate it according to the specification on order confirmation.
- Carry out all kinds of operations and check their proper execution (section 3.3). Check the proper operation of all the warnings.

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### 3 OPERATION AND USE

#### 3.1 Operation description

The oil supply 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 rotation motion of the rack and pinion mechanism, to which the valve stem is coupled, in one direction. The operation in the opposite direction is made by the linear movement generated from the spring releasing.

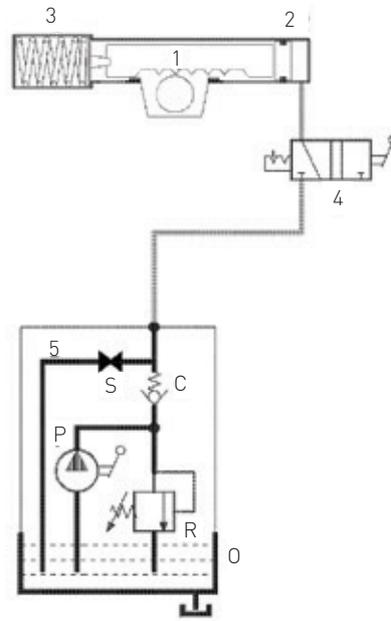
For local or remote operations, please refer to section 3.3.1, 3.3.2, 3.3.3 and 3.3.4 and prior to technical documentation furnished with actuators.

Typical schematics for various applications are following for information only: in these schematics, actuator operation in local is performed by the optional hydraulic manual override. Actuator operation in remote shall be performed operating the hydraulic manual selector (figure 6, item 4) by control signal from control room.

The power and control systems are supplied on specific customer demand (refer to specific documentation furnished).

FIGURE 6  
Hydraulic manual override for RPHS actuators

Local control suitable also for remote oil supply for spring return actuators



- 1 Rack and pinion mechanism
- 2 Hydraulic cylinder
- 3 Spring cartridge
- 4 Hydraulic manual selector
- 5 Hydraulic manual override
- S Stop valve
- C Check valve
- P Hand pump
- R Relief valve
- O Oil tank

FIGURE 5  
Hydraulic manual override (optional)



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### 3.2 Residual risks

#### WARNING

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

The operations are carried out sending the proper signal through the control system in compliance with customer specifications.

Please refer to the functional diagram and specific documentation supplied.

### 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 angular stroke at both extreme valve position (fully open and fully closed), except when this is required by the valve operation (e.g. metal seated butterfly valves).

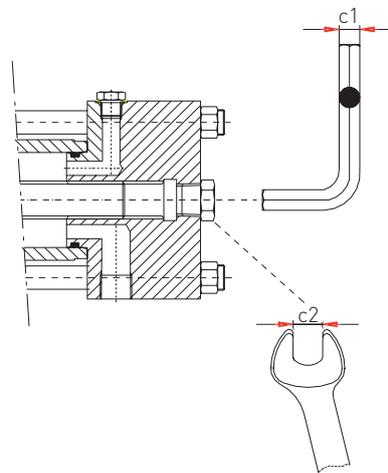
The setting of the open valve position is performed by adjusting the travel stop screw on the end flange of the spring container.

The setting of the closed valve position is performed by adjusting the travel stop screw, which is on the right side of the actuator (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 (see figure 7A):

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

FIGURE 7A  
Mechanical stop of the cylinder



#### Travel stop screw screwed on the end flange of spring container

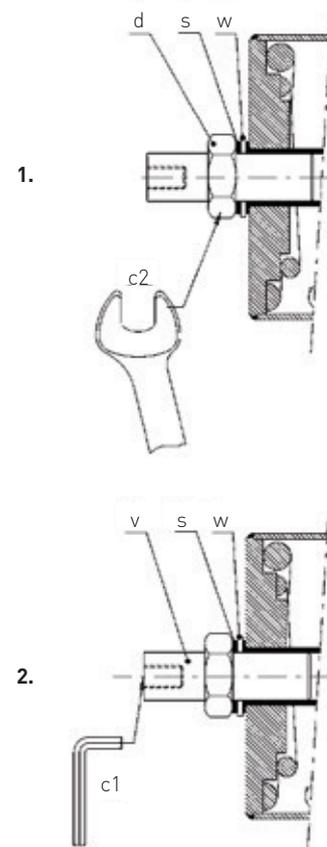
For the adjustment of the travel stop screw proceed as follows (see figure 7B):

1. Loosen the lock nut "d".
2. If the actuator angular stroke is stopped before reaching the end position, unscrew the stop screw "v" by turning it anticlockwise until the valve reaches the correct position.
3. If the stop-screw is too hard to be operated, reduce or remove the cylinder pressure, in order to move the mechanism far from the screw. Operate the setting-screw and then pressurize again the cylinder to reach end position.
4. If the actuator angular stroke is stopped beyond the end position, screw the stop screw by turning it clockwise until the valve reaches the correct position.
5. Tighten the lock nut, after having correctly placed the threaded seal washer "s" and "w".

To operate the adjustments refer to followings tables.

Hydraulic cylinder diameter	Wrench c1 (mm)	Wrench c2 (mm)
28 - 40	8	22
45 - 60	12	27
70 - 175	14	36
200 - 235	22	36

FIGURE 7B



Spring container size	Wrench c1 (mm)	Wrench c2 (mm)
010	8	24
020	8	24
040	13	41
080	15	46

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### 3.5 Calibration of microswitches (with safety instructions for limit switch box)

If the actuator is delivered separately from the valve, it is necessary to check, and, if required, to adjust, the settings of the position signalling microswitches.

#### **IMPORTANT**

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

#### **WARNING**

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

#### **IMPORTANT**

*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.*

#### **WARNING**

*Do not open when energized or when an explosive atmosphere is present.*

#### **WARNING**

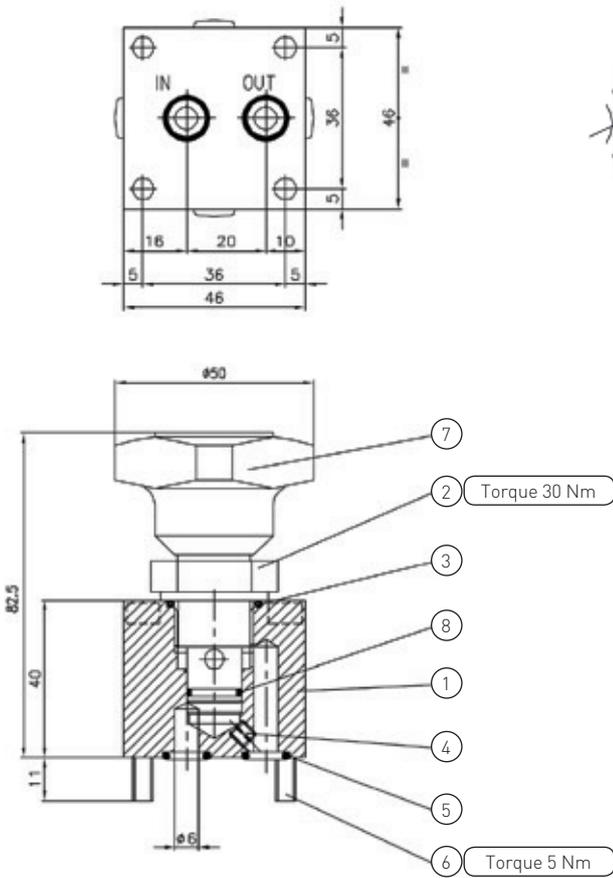
*Electrostatic hazard, clean only with damp cloth.*

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FIGURE 17

Adjustment of operating time by flow-regulator valve (please refer to specific operating diagram, item 526-530)



### 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 ISO 4466 (25 μ abs.)	
Seals in MFQ (fluoro-silicone)	

### PARTS LIST

Item	Qty	Name	Material	Type or drawing
1	1	Body	AISI 316	49.144.031
2	1	Cartridge	AISI 316	FT 2267/2-14-hFQSV
3*	1	O-ring	MFQ-70Sh	OR 2-116
4	1	Screw	A4-70	M5x5 UNI 5923
5	2	O-ring	MFQ-70Sh	OR 5-612
6	4	Screw	A4-70	VCTEI M5x45 UNI 5931
7	1	Handwheel	11S (2011)	29.102.378
8*	1	OR+2BK	MFQ-6Sh+PTFE	OR2-013 + 2BK

\* included in cartridge item 2

### 3.6 Calibration of the operating time (optional - if foreseen)

The calibration of the operation time is made according to customer requirements and to technical data-sheet included in technical documentation. If necessary it's possible to modify or reset the operating time through two flow regulation valves (optional) placed on inlets of hydraulic cylinder (see figure 17 and the applicable operating diagram).

To carry out the adjustment, operate the hand-wheel (turn clockwise the hand-wheel to increase the operating time or turn the hand-wheel counter-clockwise to decrease the operation time).

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### 4 OPERATIONAL TESTS AND INSPECTIONS

#### IMPORTANT

To ensure the guaranteed SIL Level, according to IEC 61508, the functionality of actuator must be checked with regular intervals of time, as described following.

For safety related applications, the following test operation has to be performed:

- 1) Full stroke of actuator once a year.
- 2) Partial stroking test at least every six months (if applicable, please refer to operating diagram and operate accordingly).
- 3) Visual inspection-checks, according to section 5.1, but with a frequency of once a year.

For standard applications please refer to section 5.1.

### 5 MAINTENANCE

#### IMPORTANT

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

#### WARNING

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

#### 5.1 Periodic maintenance

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

#### IMPORTANT

Periodicity and regularity of inspections is particularly influenced by specific environmental and working conditions.

#### WARNING

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 all the paint-coat of the actuator. If some areas are damaged, repair the paint-coat according to the applicable specification.
- Check there are no hydraulic leakages. If necessary tighten the nuts of the pipe-fittings.

TABLE 2

Features of hydraulic oil	
Producer	AGIP
Name	ARNICA 22
Viscosity at 40°C	22 cSt
Viscosity at 100°C	5.2 cSt
Viscosity index ASTM	175
Flammability point	192°C
Sliding point	-39°C
Specific weight	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

- Check the actuators did not undergo accidental damage with oil leakages found on site (section 4.1.1).
- 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.
- Check oil level into the hydraulic manual override (see specific customer documentation furnished with actuators).

#### IMPORTANT

For refill use oil of the same brand as the one in the tanks.

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### 5.2 Extraordinary 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 following general sectional drawing and adopting the following procedures.

#### 5.2.1 Replacement of cylinder seals (refer to figure 18)

#### WARNING

*Before carrying out any maintenance operation, it is necessary to close the hydraulic feed line and exhaust the pressure from the actuator cylinder and from the control unit, to ensure safety of maintenance staff.*

#### IMPORTANT

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

*Before carrying out any operation, cut power off from the electrical line.*

1. Unscrew the plug (30) from the cylinder end flange.
2. Measure the distance from the stop screw (45) to the end flange (33) 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 (45) by turning it anticlockwise with an Allen wrench until the screw is completely withdrawn inside the end flange threaded hole, to let the spring loosen.

#### WARNING

*Before disassembling the cylinder, make sure the above operation of spring release is done.*

4. Unscrew the nuts (17) from the tie rods (28): they must be gradually unscrewed all at the same time, to recover the spring pre-setting.
5. Slide off the end flange (33) and the tube (13).
6. Remove the piston (14) from the tube (13).

#### Seals replacement

If the O-ring/seals must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with protective oil or grease film. Assemble the new O-ring/seals into its groove and lubricate it with a protective oil or grease film.

1. Replace the O-ring (29) of the end flange (33).

To replace the piston seal ring (16) proceed as follows:

1. Remove the existing PTFE seal ring (16) with its O-ring from their groove.
2. Clean the groove carefully and lubricate it with a protective oil or grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.
4. Assemble the new PTFE seal ring (16) on its rubber O-ring by introducing one side of it into the groove, then enlarge it with your fingers so as to fit it into the groove: take care to enlarge it uniformly without any tools which could possibly damage it. The elastic memory of the kind of PTFE the seal ring is made of allows the ring to shrink back to its previous dimension after a short time.

#### Reassemble

Prior to reassemble check that the actuator components are in good conditions and clean. Lubricate all the surfaces of the parts, which move in contact with other components, by recommended grease.

1. Carefully clean the inside of the tube (13) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate with a protective oil or grease film the tube internal surface and the bevels at the ends. Slide the tube onto the piston taking care not to damage the PTFE seal ring (16): the tube bevel has to smoothly compress the seal ring; take care also not to damage the end flange O-ring (29).
2. Assemble the end flange by centring it on the inside diameter of the tube, taking care not to damage the O-ring (29).
3. Assemble the nuts (17) onto the tie rods (28). Tighten the nuts to the recommended torque, alternating between opposite corners.
4. Restore a generous coating of grease on the contact surfaces of the pinion and rack.
5. Assemble the new O-rings (32-27) after cleaning the surfaces of the housing (11) and cover (22)
6. Lubricate with protective oil or grease the O-rings (32-27).
7. Assemble the cover (22) and the screws (23). Tighten the screws to the recommended torque.
8. Screw the stop screw (45) by turning it clockwise with an Allen wrench until it reaches its original position (the same distance with reference to the end flange surface).
9. Screw the plug (30) into the cylinder end flange.

#### IMPORTANT

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

### 5.3 Dismantling and demolition

#### WARNING

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

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

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 work-site.

#### IMPORTANT

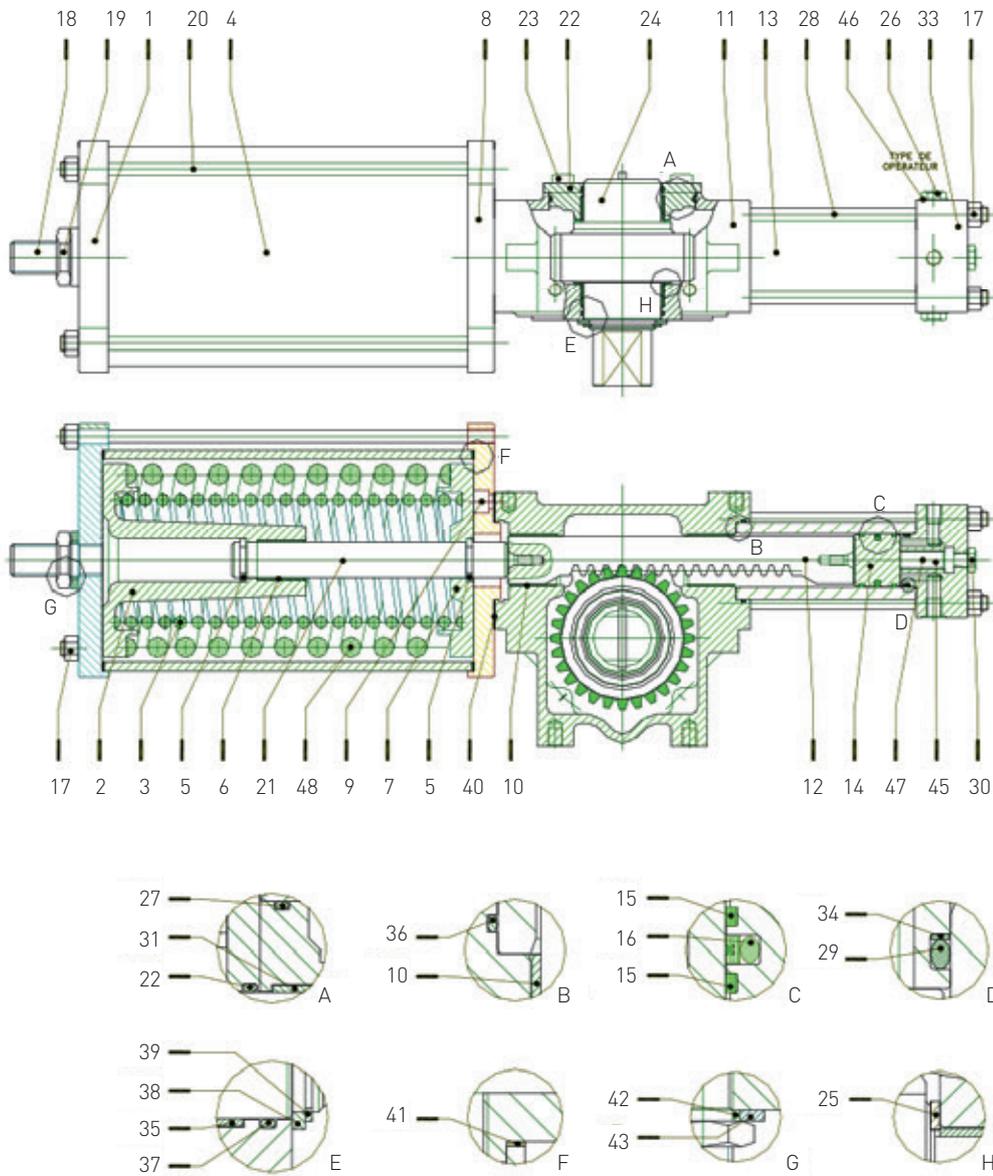
*The demolition of the actuator both concerning any electrical and mechanical parts should be made by specialized staff.*

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.

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FIGURE 18  
RPHS spring return hydraulic actuator



### PARTS LIST

Item	Description	Item	Description	Item	Description
1	End spring flange	17	Nut	33	End flange
2	Spring guide flange	18	Adjusting screw	34	Back-up ring
3	Spring	19	Nut	35	Bushing
4	Spring cartridge tube	20	Tie rod	36	O-ring
5	Retainer ring	21	Spring guide rod	37	O-ring
6	Bushing	22	Cover	38	Spigot ring
7	Spring thrust flange	23	Screw	39	Retainer ring
8	Head spring flange	24	Pinion	40	Spring cartridge gasket
9	Screw	25	Shoulder washer	41	Gasket
10	Bushing	26	Plug	42	Sealing washer
11	Housing	27	O-ring	43	Washer
12	Rack	28	Tie rod	44	Shoulder washer
13	Cylinder tube	29	O-ring	45	Stop setting screw
14	Piston	30	Vent valve	46	Washer
15	Guide sliding piston ring	31	Bushing	47	Friction bar
16	Piston seal ring	32	O-ring		

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## INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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### 6 TROUBLESHOOTING

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#### 6.1 Failure or breakdown research

Event	Possible cause	Remedy
Actuator does not work	<ol style="list-style-type: none"><li>1. Lack of power supply</li><li>2. Lack of hydraulic supply</li><li>3. Blocked valve</li><li>4. Wrong position of the distributor of the manual hydraulic group</li><li>5. Failure of the control group</li><li>6. Low supply pressure</li></ol>	<ol style="list-style-type: none"><li>1. Restore it</li><li>2. Open line interception valve</li><li>3. Repair or replace</li><li>4. Restore correct position</li><li>5. Call Biffi Customer Service</li><li>6. Restore (section 1.4)</li></ol>
Actuator too slow	<ol style="list-style-type: none"><li>1. Low supply pressure</li><li>2. Wrong calibration of flow regulator valves</li><li>3. Wear of the valve</li></ol>	<ol style="list-style-type: none"><li>1. Restore (section 1.4)</li><li>2. Restore (section 3.6)</li><li>3. Replace</li></ol>
Actuator too fast	<ol style="list-style-type: none"><li>1. High supply pressure</li><li>2. Wrong calibration of flow regulator valves</li></ol>	<ol style="list-style-type: none"><li>1. Restore (section 1.4)</li><li>2. Restore (section 3.6)</li></ol>
Leakages on hydraulic circuits	<ol style="list-style-type: none"><li>1. Deterioration and/or damage to gaskets</li></ol>	<ol style="list-style-type: none"><li>1. Call Biffi Customer Service</li></ol>
Incorrect position of the valve	<ol style="list-style-type: none"><li>1. Wrong adjustment of mechanical stops</li><li>2. Wrong warning of microswitches</li></ol>	<ol style="list-style-type: none"><li>1. Restore (section 3.4)</li><li>2. Restore (section 3.5)</li></ol>
Hydraulic manual pump does not work	<ol style="list-style-type: none"><li>1. Handle positioned on remote control</li><li>2. Leakages on the check valve of the hydraulic control group</li></ol>	<ol style="list-style-type: none"><li>1. Re-position the operation indication handle to manual</li><li>2. Call Biffi Customer Service</li></ol>

### 7 LAYOUTS

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#### 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  
E-mail: [spareservice@biffi.it](mailto:spareservice@biffi.it)

Please specify:

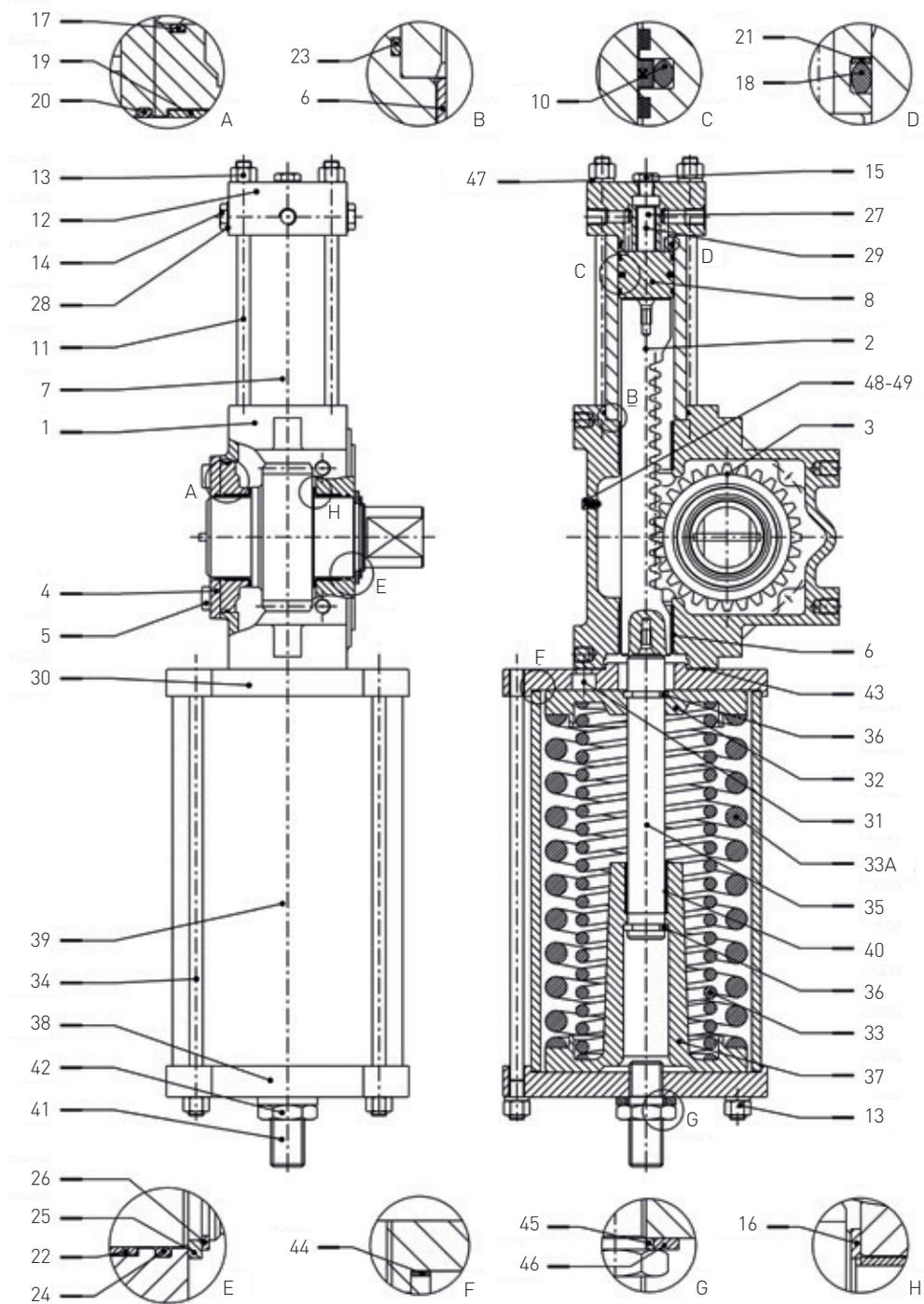
1. Actuator model
2. Biffi acknowledgement
3. Spare parts code
4. Quantity
5. Transport condition
6. Involved people

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### 7.2 Parts list for maintenance and replacing procedure

FIGURE 19  
Rack and pinion mechanism RPHS spring return hydraulic actuator



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### PARTS LIST - RPHS SPRING RETURN HYDRAULIC ACTUATOR

Item	Q.ty	Description	Material
1	1	Housing	Nodular cast iron
2	1	Rack	Alloy steel
3	1	Pinion	Alloy steel
4	1	Cover	Carbon steel
5	4	Screw	Alloy steel
6	2	Bushing	Fe + Bz + PTFE
7	1	Cylinder tube	Nickel-plated carbon steel
8	1	Piston	Carbon steel
10*	1	Piston seal ring	PTFE + graphite + NBR
11	4	Tie rod	Alloy steel
12	1	End flange	Carbon steel
13	8	Nut	Carbon steel
14	2	Plug	Stainless steel
15	1	Plug	Stainless steel
16*	2	Shoulder washer	Ertacetal
17*	1	O-ring	NBR
18*	1	O-ring	NBR
19	1	Bushing	Fe + Bz + PTFE
20*	1	O-ring	NBR
21*	1	Back-up ring	NBR
22	1	Bushing	Fe + Bz + PTFE
23*	1	O-ring	NBR
24*	1	O-ring	NBR
25	1	Spigot ring	Nylon
26	1	Retainer ring	Stainless steel
27	1	Stop setting screw	Carbon steel
28	2	Washer	Copper
29	1	Friction bar	Nylon
30	1	Head spring flange	Carbon steel
31	4	Screw	Alloy steel
32	1	Spring thrust flange	Carbon steel
33	1	Spring	Alloy steel
33A	1	Spring	Alloy steel
34	4	Tie rod	Alloy steel
35	1	Spring guide rod	Alloy steel
36	4	Retainer ring	Stainless steel
37	1	Spring guide flange	Nodular cast iron
38	1	End spring flange	Carbon steel
39	1	Spring cartridge tube	Carbon steel
40	1	Bushing	Fe + Bz + PTFE
41	1	Adjusting screw	Alloy steel
42	1	Nut	Carbon steel
43*	1	Spring cartridge gasket	NBR
44*	2	Gasket	NBR
45*	1	Sealing washer	PVC
46	1	Washer	Stainless steel
47	4	Lifting eyelet	Carbon steel
48	1	Vent valve	Stainless steel
49*	1	Washer	PVC

\* Recommended spare parts

# BIFFI RPHS SPRING RETURN HYDRAULIC ACTUATOR INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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## 8 DATE REPORT FOR MAINTENANCE OPERATIONS

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### 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): .....



Biffi reserves the right to change product designs and specifications without notice.

### Biffi Italia S.r.L.

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