HLAS SINGLE ACTING HYDRAULIC LINEAR ACTUATOR

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Before installation these instructions must be read fully and understood

TABLE OF CONTENTS

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 the EN ISO 9001 international regulation.

1.1.1 Applicable regulations

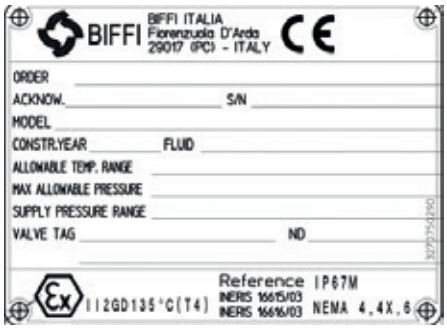
EN ISO 12100-1: 2005: Safety of machinery - Basic notions, general design principles. Part 1 - Basic terminology method.
EN ISO 12100-2: 2005: Safety of machinery - Basic notions, general design principles. Part 2 - Technical principles and specification.

2006/42/EC:	Machinery directive.
97/23/EC:	Directive for pressure equipment (PED).
2006/95/EC:	Directive for low voltage equipment.
2004/108/EC:	Directive for electromagnetic compatibility.
94/9/EC:	Directive and safety instructions for use in hazardous areas.

1.1.2 Terms and conditions

Biffi guarantees that all the items produced, if installed, used and subjected to maintenance, are without material and manufacturing defects and comply with specifications in force. The warranty period is one year, starting from the date of installation by the first user of the product, or eighteen months as of the date of shipment to the first user, depending on which event occurs first.
The warranty does not cover special products or components not covered by warranty in their turn by subcontractors, or materials that were used or installed inappropriately, or which were modified or repaired by unauthorized staff.
If the failure was caused by inappropriate installation, maintenance or use, or by irregular working conditions, the repairs will be charged according to the applicable fees.

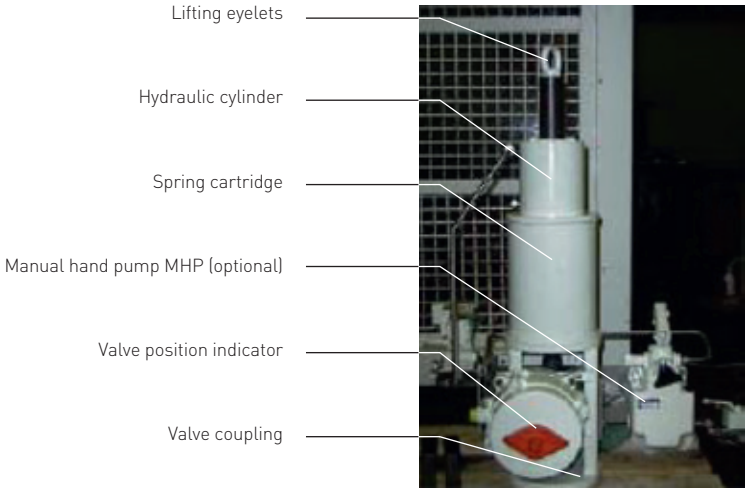
FIGURE 1
Data plate



1.2 Identification plate
It is forbidden to modify the information and marks without previous written authorization by Biffi. The plate fastened on the actuator contains the information shown in figure 1.

1.3 Introducing the actuator
HLAS single acting hydraulic linear actuators are suitable for the operation of linear valves (wedge gate valves, through conduit gate valves) for ON-OFF and modulating heavy-duty service.
The actuator comprises an hydraulic cylinder, a spring cartridge and a mounting pedestal complete with a joint for coupling the valve stem to the actuator output stem. The valve is actuated in opening and closing positions by the actuator hydraulic cylinder in one direction and by the spring unit in the other direction.
The output thrust of the spring unit can be downward or upward according to valve operation requirements (spring to open, spring to close, direct acting valve, reverse acting valve).
The spring return pack incorporates up to four springs, fully encapsulated in a factory welded cartridge: this assures personnel safety and simplifies assembly.
The linear stroke of the valve is adjustable by means of the external mechanical stop for upward position and by the adjustment of the coupling of the valve stem to actuator joint for the downward position.
The actuator pedestal has a flange with threaded holes to fix the actuator to the valve.
Different types of control system can be supplied to meet customers' requirements.
The expected lifetime of the actuator is approximately 30 years.

FIGURE 2
Identification of actuator parts



SELECTION GUIDE

Example:		**HLAS**	**250K**	**135**	**100K**	**300**	**CL**	**MHP**
HLAS	Actuator series							
250K	Max. allowable thrust (N)							
135	Cylinder diameter (mm)							
100K	Spring ending thrust (N)							
300	Stroke (mm)							
CL	Spring action							
MHP	Manual override							

1.4 Technical data

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

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 the order confirmation (section 1.2).
- Check that the actuator is equipped with the fittings as per the 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
Lifting and handling should be carried out 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.
During handling, avoid passing the actuator above personnel.

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 to preserve the area of the 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 closed properly.

If the storage is long-term or outdoor:

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

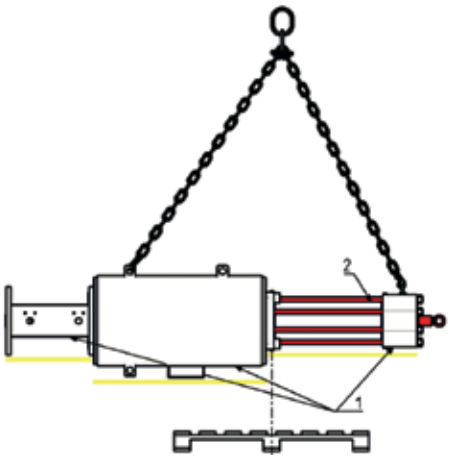
2.4 Actuator assembly on the valve

2.4.1 Types of assembly
The adapter pedestal in fabricated carbon steel is designed specifically for adaptation to any type of valve with provision for local indicator, limit switches and other accessories (on request).
Lift the actuator by safety-hook for chains using the lifting-points (see section 2.2) on the top of actuator for handling, transporting and assembling in vertical position (see figure 3).
For handling, transporting and assembling the actuator in horizontal position by safety-hook for chains, use the lifting-points on the top of cylinder head-flange and on the coupling flange (see figure 4).

FIGURE 3
Lifting points for HLAS actuators

1. Lifting points (obligatory)

FIGURE 4
Positioning by chains



1. Point of support
2. Do not lay the actuator on cylinder tie-rods
3. Do not lay the actuator on accessories (manual hand pump, hydraulic control system etc.)

2.4.2 Assembly procedure

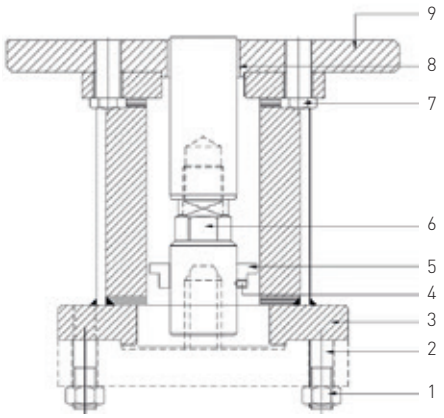
WARNING
Failure to comply with the following procedures may impair product warranty. Installation, commissioning, maintenance and repair works should be carried out by qualified staff.
A non-conforming assembly could be the source of serious accidents.

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

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

1. Check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions (valve stem and flange). Lubricate the valve stem with grease in order to make the assembly easier.
2. Connect a sling to the support point of the actuator and lift it.
   To make assembly easier, the valve stem has to be in a perfect vertical position.
   Note: the eyebolt is sized for the lifting of the actuator only (not actuator+valve). Proper lifting points have to be provided for the valve.
3. Screw the actuator coupling joint onto the valve by rotating the actuator, or screw down the valve stem stroke-ring with Red Loctite 542 and fix the half-bearings. When the threaded holes of the actuator flange correspond with the holes on the valve flange, screw the proper stud bolts. Screw the nuts on the stud bolts and tighten up the valve flange until it is in contact with the actuator flange.
4. Tighten the nuts of the connecting stud bolts evenly with the torque prescribed in table 1. The stud bolts must be made of ASTM A320 L7 steel, the nuts must be made of ASTM A194 grade 2 steel as minimum.

FIGURE 5
Pedestal with threaded coupling joint



PARTS LIST

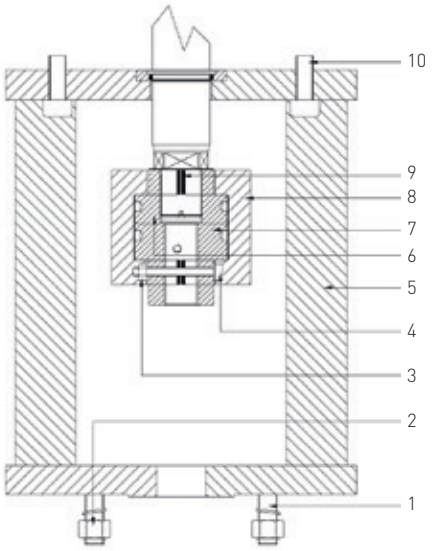
Item	Description
1	Nut
2	Stud bolt
3	Support joint
4	Index
5	Screw
6	Connecting joint
7	Screw
8	Bushing
9	Flange

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

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

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

FIGURE 6
Pedestal with shell coupling joint



PARTS LIST

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

To implement, refer to the following table:

TABLE 1 - 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

2.5 Hydraulic connections

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

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

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

- Deburr the ends of rigid pipes properly
- Clean the interior of pipes properly, 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 hydraulic connections. If necessary, tighten the nuts of the pipe-fittings.

2.6 Electrical connections (if any)

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

2.7 Commissioning

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

Upon actuator commissioning please carry out the following checks:
- Check that paint has not been damaged during transport. If necessary, repair damage to the paint coat.
- Check that the values of hydraulic supply available in the system are compatible with those reported on the actuator's identification plate (figure 1) and on the documentation supplied.
- Check that the feed voltage values of the electric components (solenoid valve coils, microswitches, pressure switches, etc.) are compatible with those reported on the actuator's identification plate (figure 1).
- Check that the setting of the actuator control unit's components (pressure regulator, pressure switches, flow control valves, etc.) meet the plant requirements.
- Carry out all kinds of operations and check their proper execution (section 3.3).
- Check the absence of leakages in the hydraulic connections.
  If necessary, tighten the nuts of the pipe-fittings.
- Check proper operation of all the due signalling (valve position, hydraulic supply pressure etc.)
- Carry out a complete functional test to verify all the operations are executed according to the operating schematic diagram supplied.

3 OPERATION AND USE

3.1 Operation description

The supply fluid pressurizes the hydraulic-cylinder chamber relevant to the operation to be carried out (opening or closing) (see following pages).
This pressure starts the linear motion of the piston and the consequent motion of the valve stem that is coupled.
The spring action operates the valve stem in the opposite direction (fail safe position).
For local or remote operations, please refer to the technical documentation furnished with the actuators.
The power and control systems are supplied on specific customer demand.
For all the relevant information please refer to the specific documentation supplied.

3.2 Residual risks

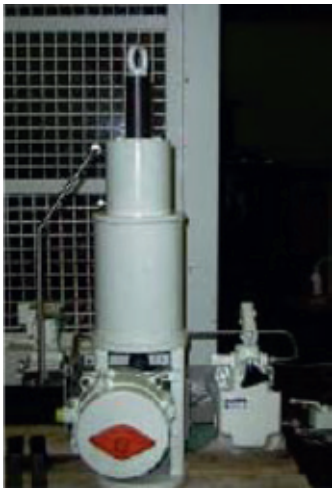
WARNING
The actuator has parts under pressure.
Use due caution.
Use individual protections provided for by the laws and provisions in force.

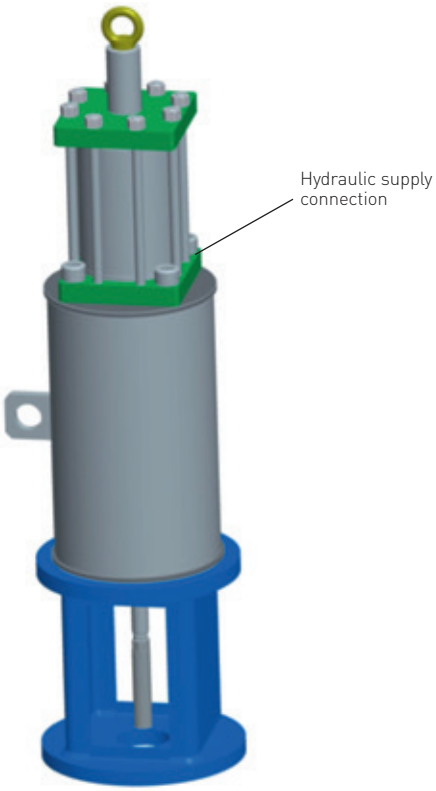
3.3 Operations

Refer to specific document: operating diagram (provided).

3.3.1 Emergency manual operation (MHP)
Refer to the applicable control schematic in the documentation supplied.
The HLAS actuators can have an emergency manual override in addition to the local and/or remote control system which controls the oil supplied by a power pack for 'normal' actuator operation.
The emergency manual override is mounted on the actuator, and consists of an hydraulic manual override and an hydraulic manual selector to choose the actuator 'normal operation', with oil supply from a power pack, or 'emergency manual operation'. For nominal pressure up to 105 bar, the manual override is similar to section 7.2 figure 23. For nominal pressure above 105 bar the manual override will be OMFB for carbon steel material, or dedicated model engineered for stainless steel material.

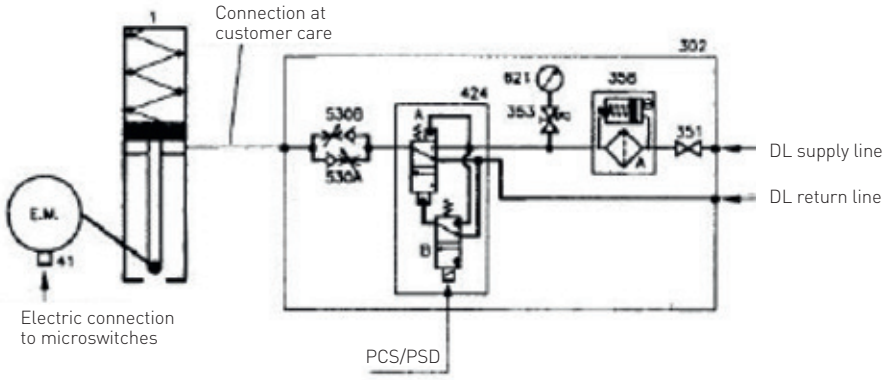
FIGURE 7
Single acting function with jackscrew manual override MHP





3.3.2 Remote control operations

FIGURE 8
Example of control schematics for spring-to-close HLAS actuator



Electric remote control to open
Energize the solenoid valve 424B permanently. The opening time is adjustable by the flow regulator 530A.

Electric remote control to close
De-energize the solenoid valve 424B. The closing time is adjustable by the flow regulator 530B.

NOTE
The diagram shows the solenoid valve coil not energized.

PARTS LIST

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

3.4 Calibration of the angular stroke
It is important that the mechanical stops of the actuator (and not those of the valve) stop the linear stroke at both extreme valve positions (fully open and fully closed), except when this is required by the valve operation.
The setting of the open/closed valve position (upward position) is performed by adjusting the travel stop screw into the end flange of the hydraulic cylinder and by adjustment of the coupling of the valve stem to actuator joint for the downward position.

For the adjustment of the mechanical stop on the end flange of cylinder, follow these steps (refer to figure 10):
- Remove the plug (t) with the specific wrench (c1).
- Insert a wrench for Allen keys (c2) in the through hole until you reach the adjustment pin (g).
- Keep the protection cover blocked with the special wrench (c3).
- If the actuator angular stroke is stopped before reaching the upward position (fully open or closed), unscrew the adjusting screw by turning it anticlockwise with a proper wrench, until the valve reaches the right position.
- If the actuator angular stroke is stopped beyond the upward position (fully open or closed valve), screw the stop screw by turning it clockwise until the valve reaches the right position.
- When the adjustment is complete, tighten the plug (t).

FIGURE 9
Mechanical stop on cylinder end flange

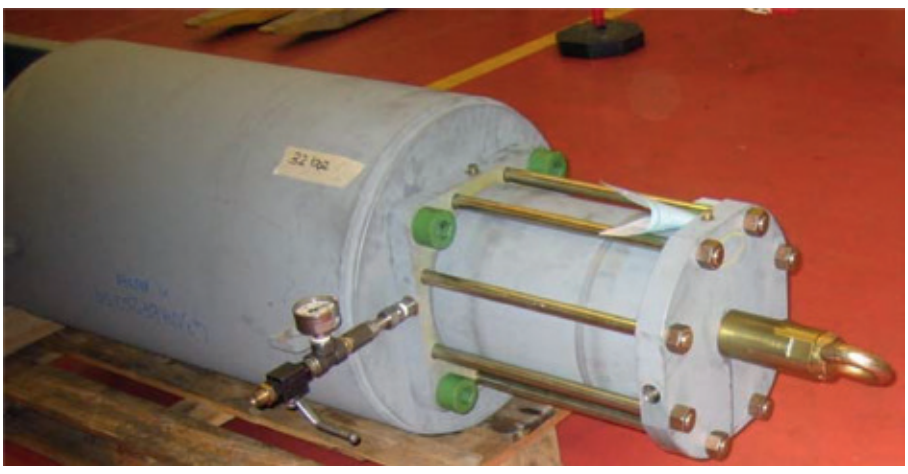
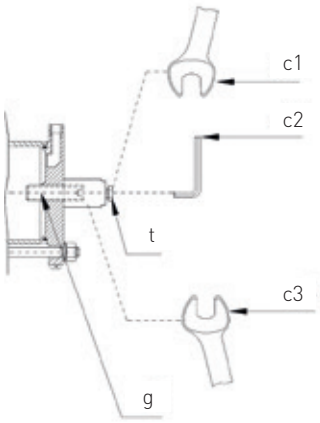
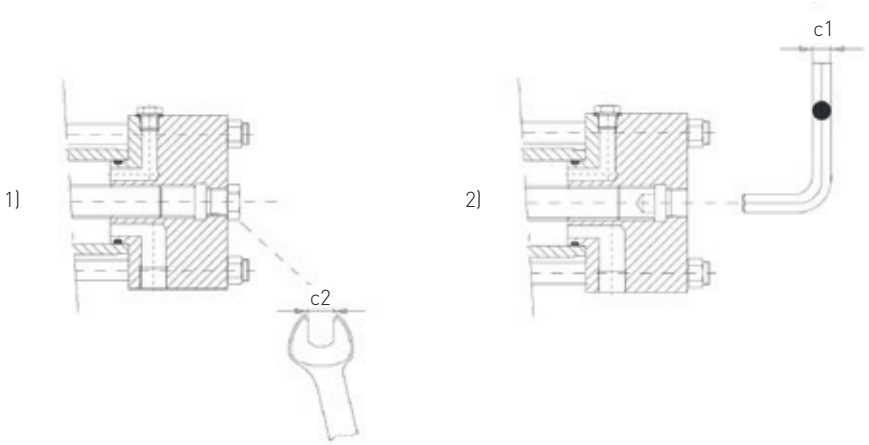


FIGURE 10
Mechanical stop of the cylinder



Hydraulic cylinder size	Wrench c1 (mm)	Wrench c2 (mm)	Wrench c3 (mm)
075	22	10	36
100	22	10	36
135	22	10	36
175	22	14	46
200	27	14	46
235	27	17	65
280	27	17	65
300	36	17	110

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



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.

3.5.1 Westlock 2200 Series Quantum - ATEX certified

EPSILON 08 ATEX 2370X
Ex d IIB +H2 T* Tamb -*°C to +*°C
Ex tD A21 IP6X T*°C Tamb -*°C to +*°C
Flat cover -20°C to +85°C (T4); -20°C to +75°C (T5); -20°C to +60°C (T6)
Beacon cover -30°C to +85°C (T4); -30°C to +75°C (T5); -30°C to +60°C (T6)
Environmental parameters: 80 kPa (0.8 bar) to 110 kPa (1.1 bar). Air with normal oxygen content, typically 21%.

The 2200 certification is compliant against the following standards	
EN 60079-0 : 2006	Electrical apparatus for explosive gas atmospheres – Part 0 - General requirements
EN 60079-1 : 2007	Electrical apparatus for explosive gas atmospheres – Part 1 - Flameproof enclosures 'd'
EN 61241-0 : 2006	Electrical apparatus for use in the presence of combustible dust – Part 0 - General requirements
EN 61241-1 : 2006	Electrical apparatus for use in the presence of combustible dust – Part 1 - Protection by enclosures 'tD'

3.5.1.1 Product description
The 2200 series valve control monitor provides two methods of end of travel indication by the means of mechanical switches, inductive proximity sensors or proximity switches and an external visual indicator.
For applications that require position feed back, ancillary components such as a 4-20 mA current signal transmitter or a resistive signal feed back can be installed.
To allow this product to be used with network communication bus protocols, the 2200 series enclosure can house various network modules.
The 2200 series enclosure comprises of a two parts, a cover and housing. The cover has three variations, flat cover, standard beacon cover or a high cover to suit different applications. The housing can offer up to two integral solenoid coils and upto three of the following conduit entries; M20 x 1.5p, M25 x 1.5p, ½"-14 NPT or ¾"-14 NPT cable entries for connection to an external power source via appropriate ATEX certified cable glands.

Note: before installation of this product, please ensure that the product and its certification is suitable for the intended application. This product uses various 'O'-ring material and an Eastar Copolyester visual indicator.

If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.
Installation of any cable entry devices, conduit entry devices or blanking devices shall not compromise the degree of ingress protection level IP6X for use in the presence of combustible dusts.
The unit has an ingress protection of IP66/67 and therefore any conduit device fitted must maintain this.

Note: these products have been certified with a cable entry temperature rise of 4°C. Ensure that this is taken into consideration when selecting suitable cabling for the ambient temperature in which the product is to be used.

Note: these products are not intended to be assembled directly to process pipe work etc that is heated or cooled to temperatures outside of the range as indicated above.

3.5.1.2 Mounting instructions

1) Attach the mounting bracket and adaptor (if required) to the Quantum housing and shaft with the fasteners provided with the mounting kit.
2) To ensure that the 2200 series Quantum is mounted correctly, it may necessary to stroke the actuator to the fully closed position.

WARNING
Before stroking the actuator to the fully closed position, please ensure that the process is safe to do so.

3) With the actuator in the correct position, attach the 2200 series Quantum / bracket to the actuator using the hardware provided in the mounting kit.
4) To release the cover, loosen the cover retaining screws. Twist the cover approx 45° and lift up. See figure 11.
5) To set the switches, lift the bottom cam and turn until the switch has activated and then release. The spring will push the cam back onto the splined shaft.

WARNING
Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft.

6) Stroke the actuator to the opposite end of travel. Set the top cam by pushing down and turning the cam until the switch is activated.

WARNING
Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft.

7) Stroke the actuator from one end of stroke to the other several times to check the switch operation. If the switches require adjustment, repeat steps 5) to 7).

3.5.1.3 Field wiring and installation

WARNING
The 2200 series should always be handled with care when the cover is removed and wired to electrical power source.

Note: *before electrical installation, please read and follow the wiring diagram located inside the cover. The electrical ratings can be found on the product I.D label.*

1) Field wiring must be carried out in accordance with site, local and national electrical codes / requirements. This includes special attention to earth bond to the aluminium enclosure using the internal and external earth points provided.
2) Installation of this product shall be carried out by competent personnel in accordance with the applicable code of practice such as EN 60079-14.
3) The 2200 control monitor housing can offer up to three of the following conduit entries; M20 x 1.5p, M25 x 1.5p, ½"- 14 NPT or ¾"- 14 NPT. These entries are detailed on the product I.D label found on the product cover. Please see figure 13 for conduit positions.

FIGURE 11

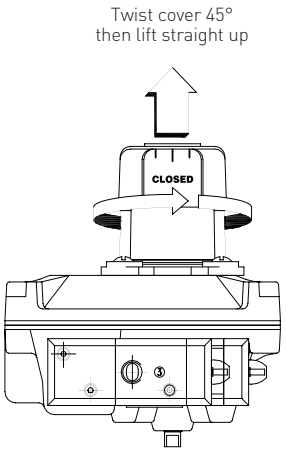


FIGURE 12

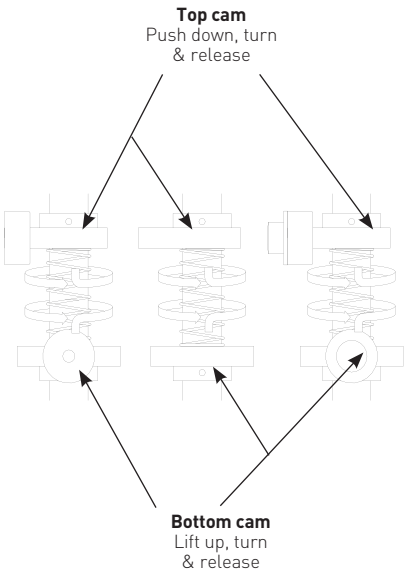
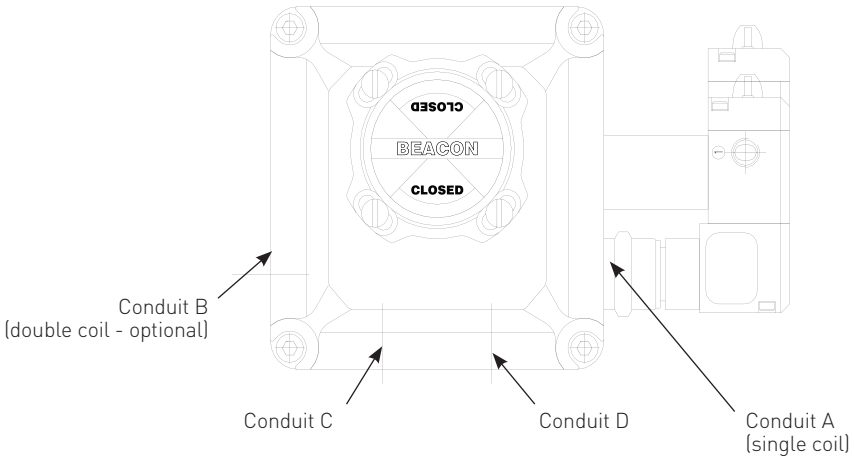


FIGURE 13



4) The certification applies to equipment without cable glands. When mounting the flameproof enclosure in the hazardous area, only suitably rated IP66/67 ATEX certified flameproof glands must be used.
5) All unused cable entries must be plugged with a suitably rated IP66/67 ATEX certified blanking devices.
6) The first two digits of the Westlock nomenclature signifies the series with the third digit defining whether the product has a visual beacon or not. The table below details the applicable ambient ranges:

Series code	Cover type	T class	Ambient range
224*	Beacon	T6 (80°C)	-30°C to +60°C
224*	Beacon	T5 (95°C)	-30°C to +75°C
224*	Beacon	T4 (130°C)	-30°C to +85°C
226*	Flat	T6 (80°C)	-20°C to +60°C
226*	Flat	T5 (95°C)	-20°C to +75°C
226*	Flat	T4 (130°C)	-20°C to +85°C

7) The forth digit designates the switch / sensor type. The following table details the most common switch / sensor types together with their electrical ratings.

Series code/Switch designation		Electrical rating
22*5	Mechanical (SPDT)	15 A - 125 or 250 V AC; 0.5 A - 125 V DC; 0.25 A - 250 V DC
22*6	Mechanical (DPDT)	10 A - 125 or 250 V AC; 10 A - 28 V DC; 0.2 A - 125 V DC
22*7	Inductive proximity sensors	
22*9	Magnum ratings	3 A - 120 V AC; 1.5 A - 240 V AC or 2 A - 24 V DC

NOTE: *The series code signifies the maximum electrical rating of the product, suitable overloading protection must be provided to prevent these values being exceeded.*

8) The 2200 series valve position monitor has the option for position feedback by the means of a resistive signal (RS) or current signal (CS).
   The RS transmitter electrical ratings are – 1 k ohms (standard) or 5 k ohms (optional). See I.O.M TECH-084.
   The CS transmitter electrical ratings are – current loop 4-20 mA at 18 to 24 V DC. See I.O.M TECHUK-301
9) The 2200 series valve control monitor has the ability to connect to bus networks via Netpak modules. With the Netpak options it may be possible to assemble other switches within the enclosure (depending on enclosure cover variation).

9.1) Netpak electrical parameters.

Netpak option	Electrical parameters	I.O.M.
AS-I Actuator Sensor Interface	24 V DC, 140 mA MAX	TECH-316
Device Net	24 V DC, 105 mA MAX	TECH-309
Modbus	24 V DC, 85 mA MAX	TECH-214
Profibus DP	24 V DC, 120 mA MAX	TECH-326
Foundation Fieldbus	9-32 V DC, 34 mA MAX	TECH-485

10) Digit 10 of the Westlock nomenclature signifies the coil voltage with the following voltage and type available, 24, 48, 110 and 240 V AC or V DC.
11) Before replace the enclosure cover, ensure that both of the housing and cover flange surfaces are clean and undamaged. Tighten the cover screws hand tight using a standard 6 mm A/F Allen key ensuring there are no gaps.

3.5.1.4 Product repair and service

1) Inspection of this product shall be carried out by suitably trained personnel in accordance with the applicable code of practice such as EN 60079-17.
2) In the event of any repairs that may be required such tasks must be carried out by suitably trained / competent personnel in accordance with the applicable code of practice such as EN 60079-19.
3) The certification of this product has been approved based on the material of construction as per the drawings listed in the schedule within this certificate. Any replacement parts that are not made in accordance to the listed drawing will invalidate the approval / certification.
4) Replacement parts must be purchased through Westlock Controls UK Ltd or via an approved Westlock Controls distributor.

3.5.2 Westlock 2600 Series - ATEX certified

ITS 11 ATEX 17438X
Ex d IIC Gb T* Tamb -*°C to +*°C
Ex tb IIIC Db T*°C Tamb -*°C to +*°C IP6X
Ambient variation: -60°C to +110°C (T4/T130°C); -60°C to +85°C (T5/T95°C);
-60°C to +65°C (T6/T80°C)
Environmental parameters: 80 kPa (0.8 bar) to 110 kPa (1.1 bar). Air with normal oxygen content, typically 21%.

The 2600 certification is compliant against the following standards	
EN 60079-0 : 2011 (Ed 6)	Electrical apparatus for explosive gas atmospheres – Part 0 - General requirements
EN 60079-1 : 2007	Electrical apparatus for explosive gas atmospheres – Part 1 - Flameproof enclosures 'd'
EN 60079-31 : 2009	Electrical apparatus for use in the presence of combustible dust – Part 31 - Protection by enclosure 't'

3.5.2.1 Product description
The 2600 series valve control monitor provides two methods of end of travel indication by the means of mechanical switches, inductive proximity sensors or proximity switches and an external visual indicator.
For applications that require position feed back, ancillary components such as a 4-20 mA current signal transmitter or a resistive signal feed back can be installed.
The 2600 series enclosure is available in two materials; cast aluminium or 316 stainless steel. The enclosure construction comprises of a housing with a screwed cover.
The housing has the option of upto three cable entries for connection to an external power source via appropriate ATEX certified cable glands: M20 x 1.5p, M25 x 1.5p, ½" - 14 NPT or ¾" - 14 NPT.

Note: before installation of this product, please ensure that the product and its certification is suitable for the intended application. This product uses various 'O'-ring material and an Eastar Copolyester visual indicator.
If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.
Installation of any cable entry devices, conduit entry devices or blanking devices shall not compromise the degree of ingress protection level IP6X for use in the presence of combustible dusts.
The unit has an ingress protection of IP66/67 and therefore any conduit device fitted must maintain this.

Note: these products have been certified with a cable entry temperature rise of 4°C. Ensure that this is taken into consideration when selecting suitable cabling for the ambient temperature in which the product is to be used.

Note: these products are not intended to be assembled directly to process pipe work etc that is heated or cooled to temperatures outside of the range as indicated above.

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

WARNING
Electrostatic hazard, clean only with damp cloth.

3.5.2.2 Mounting instructions
1) Attach a mounting bracket to the housing base with the M8 fasteners provided with the mounting bracket. Install shaft adaptor / coupler, as appropriate to either the actuator pinion or Accutrak shaft.
2) To ensure that the 2600 series Accutrak is mounted correctly, it may necessary to stroke the actuator to the fully closed position.

WARNING
Before stroking the actuator to the fully closed position, please ensure that the process is safe to do so.

3) With the actuator in the correct position, attach the 2600 series Accutrak / bracket to the actuator using the hardware provided in the mounting kit.
4) Unscrew the cover (figure 11) and keep in a safe place. Ensure that the Jack screw (M4 socket head cap screw) remains in the housing (figure 12).
5) To set the switches, lift the bottom cam and turn until the switch has activated and then release. The spring will push the cam back onto the splined shaft (figure 13).

WARNING
Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft.

6) Stroke the actuator to the opposite end of travel. Set the top cam by pushing down and turning the cam until the switch is activated.

WARNING
Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft.

7) Stroke the actuator from one end of stroke to the other several times to check the switch operation. If the switches require adjustment, repeat steps 5) to 7).
8) Beacon setting – if fitted. Loosen the beacon fixing screw, see figures 11 and 12, rotate beacon window (outer beacon) to indicate appropriate open or closed text as corresponding to actuator position.
9) Tighten beacon fixing screw sufficiently to prevent movement of window.

3.5.2.3 Field wiring and installation

WARNING
The 2600 series should always be handled with care when the cover is removed and wired to electrical power source.

Note: *before electrical installation, please read and follow the wiring diagram located inside the cover. The electrical ratings can be found on the product I.D label.*

1) Field wiring must be carried out in accordance with site, local and national electrical codes / requirements. This includes special attention to earth bond to the aluminium enclosure using the internal and external earth points provided.
2) Installation of this product shall be carried out by competent personnel in accordance with the applicable code of practice such as EN 60079-14.
3) The 2600 control monitor housing can offer up to three of the following conduit entries; M20 x 1.5p, M25 x 1.5p, ½"- 14 NPT or ¾"- 14 NPT. These entries are detailed on the product I.D label found on the product cover. Please see figure 17 for conduit positions.

FIGURE 14
Standard enclosure

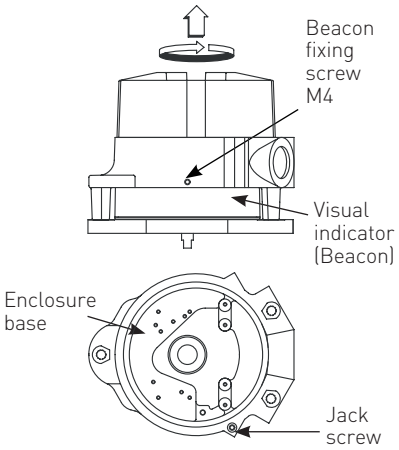


FIGURE 15
Alternative enclosure

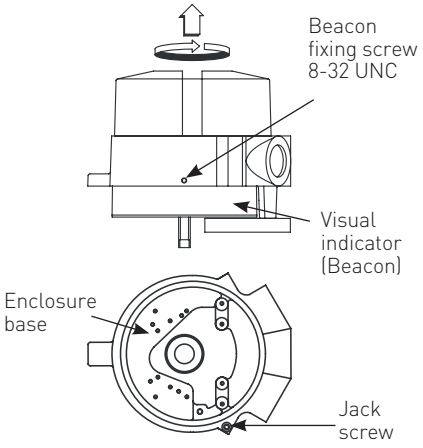


FIGURE 16

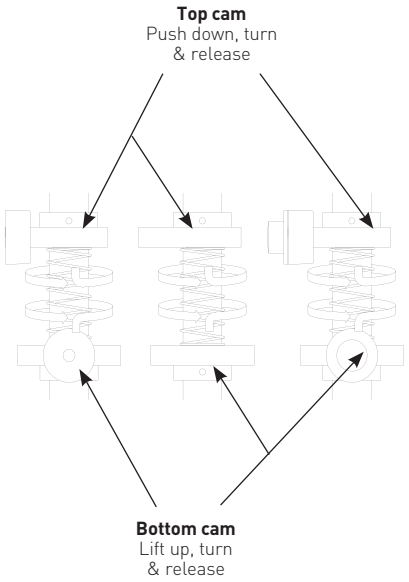
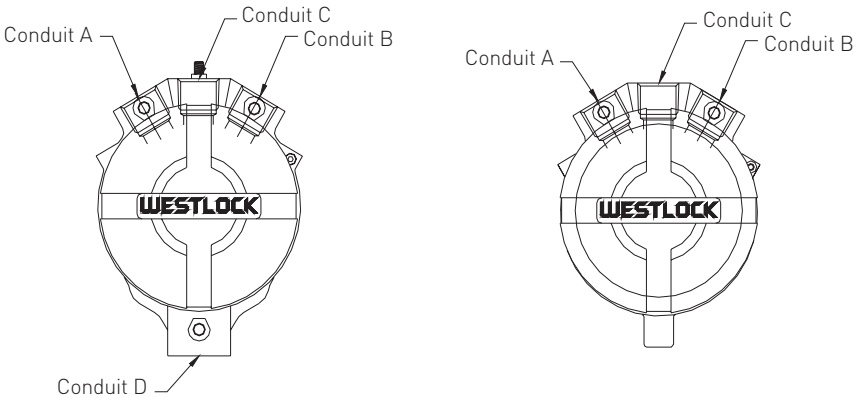


FIGURE 17
2600 conduit designations (alternative enclosure)



4) The certification applies to equipment without cable glands. When mounting the flameproof enclosure in the hazardous area, only suitably rated IP66/67 ATEX certified flameproof glands must be used.
5) All unused cable entries must be plugged with a suitably rated IP66/67 ATEX certified blanking devices.
6) Thread adaptors shall satisfy the requirements of the specific type of protection.
7) The first two digits of the Westlock nomenclature signifies the series with the third digit defining whether the product has a visual beacon or not. The table below details the applicable ambient ranges:

Series code	Cover type	T class	Ambient range
264*	Beacon	T6 (80°C)	-60°C to +65°C
264*	Beacon	T5 (95°C)	-60°C to +80°C
264*	Beacon	T4 (130°C)	-60°C to +110°C
266*	No beacon	T6 (80°C)	-60°C to +65°C
266*	No beacon	T5 (95°C)	-60°C to +80°C
266*	No beacon	T4 (130°C)	-60°C to +110°C

8) The forth digit designates the switch / sensor type. The following table details the most common switch / sensor types together with their electrical ratings.

Series code/Switch designation		Electrical rating
26*5	Mechanical (SPDT)	15 A - 125 or 250 V AC; 0.5 A - 125 V DC; 0.25 A - 250 V DC
26*6	Mechanical (DPDT)	10 A - 125 or 250 V AC; 10 A - 28 V DC; 0.2 A - 125 V DC
26*7	Inductive proximity sensors	
26*9	Magnum ratings	3 A - 120 V AC; 1.5 A - 240 V AC or 2 A - 24 V DC

NOTE: The series code signifies the maximum electrical rating of the product, suitable overloading protection must be provided to prevent these values being exceeded.

9) The 2600 series valve position monitor has the option for position feedback by the means of a resistive signal (RS) or current signal (CS).
   The RS transmitter electrical ratings are – 1 k ohms (standard) or 5 k ohms (optional). See I.O.M TECH-084.
   The CS transmitter electrical ratings are – current loop 4-20 mA at 18 to 24 V DC. See I.O.M TECHUK-301
10) Before replacing the enclosure cover, ensure that both of the housing and cover threads are clean and undamaged. Screw the cover onto the housing ensuring that it is not cross threaded and turns freely. Continue tightening the cover until metal to metal condition is achieved between the bottom edge of the cover and the housing surface.
    Lock the cover as follows:
    Using a 3mm A/F Allen key / wrench, rotate the Jack screw in an anti-clockwise direction until sufficient pressure has been applied to the bottom edge of the cover to prevent the cover from being removed by hand.

3.5.2.4 Product repair and service

1) Inspection of this product shall be carried out by suitably trained personnel in accordance with the applicable code of practice such as EN 60079-17.
2) In the event of any repairs that may be required such tasks must be carried out by suitably trained / competent personnel in accordance with the applicable code of practice such as EN 60079-19.
3) The certification of this product has been approved based on the material of construction as per the drawings listed in the schedule within this certificate. Any replacement parts that are not made in accordance to the listed drawing will invalidate the approval / certification.
4) Replacement parts must be purchased through Westlock Controls UK Ltd or via an approved Westlock Controls distributor.

3.5.3 Westlock 3000 Series - ATEX certified

SIRA 05 ATEX 2242X
II 1 G Ex ia II* T* G*
II 1 D Ex ia IIIC T120°C Da IP6X
* variables based on construction and internal components.
Ta = -20°C to +40°C (plastic enclosure),
Ta = -40°C to +60°C (metal enclosure, subject to limitations of installed devices)

The 3000 certification is compliant against the following standards	
EN 60079-0 : 2009	Explosive atmospheres. Equipment. General requirements
EN 60079-11 : 2007	Electrical apparatus for explosive gas atmospheres – Part 11 - Intrinsically Safe 'i'
EN 60079-26 : 2007	Explosive atmospheres. Equipment with equipment protection level (EPL) Ga
IEC 61241-0 : 2004	Electrical apparatus for use in the presence of combustible dust – General requirements
IEC 61241-11 : 2005	Electrical apparatus for use in the presence of combustible dust – Protection by intrinsic safety 'iD'

3.5.3.1 Product description
The equipment may be used in a CAT 1,2 or 3 environment (internal component dependant) in the presence of flammable gases / vapours and dusts. The apparatus groups cover IIA, IIB and IIC (internal component dependant) with temperature classes of T1 through to T4 or either T5 or T6 internal component dependant. The maximum ambient temperature range is -40 to +60°C (dependant on enclosure material and internal components).
The 3000 series valve position monitor provides end of travel indication by the means of either electrical switch or inductive sensors mounted within the enclosure. These are activated by cams mounted on the rotary shaft.
The 3000 series enclosure construction comprises of a shaft passing through the enclosure base and cover (when fitted with visual beacon). The two part enclosure has an integral gasket seal. The shaft has up to two 'O'ring seals in both the cover and housing bearings. This product is available in three materials, Zytel resin, aluminium or stainless steel 316.
The housing has the option of up to three cable entries (dependant on enclosure material) for connection to an external power source via appropriate ATEX certified cable glands; M20 x 1.5p, M25 x 1.5p, ½"-14NPT, ¾"-14 NPT, PG13.5 or any other suitable thread that can maintain IP6X ingress rating.

Note: before installation of this product, please ensure that the product and its certification is suitable for the intended application.

If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.
Installation of any cable entry devices, conduit entry devices or blanking devices shall not compromise the degree of ingress protection level IP6X for use in the presence of combustible dusts.
The unit has an ingress protection of IP66/67 and therefore any conduit device fitted must maintain this.

WARNING
Electrostatic hazard, clean only with damp cloth.

3.5.3.2 Mounting instructions
1) Attach the mounting bracket and adaptor (if required) to the AccuTrak housing and shaft with the fasteners provided with the mounting kit.
2) To ensure that the AccuTrak is mounted correctly, it may be necessary to stroke the actuator to the fully closed position.

WARNING
Before stroking the actuator to the fully closed position, please ensure that the process is safe to do so.

3) With the actuator in the correct position, attach the Accutrak / bracket to the actuator using the hardware provided in the mounting kit.
4) To release the cover, loosen the cover retaining screws. Twist the cover approx 45° and lift up. See figure 18 below.
5) To set the switches, lift the bottom cam and turn until the switch has activated and then release. The spring will push the cam back onto the splined shaft.

WARNING
Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft.

6) Stroke the actuator to the opposite end of travel. Set the top cam by pushing down and turning the cam until the switch is activated.

WARNING
Before stroking the actuator, please ensure that the process is safe to do so and that all hands are kept away from the moving shaft.

7) Stroke the actuator from one end of stroke to the other several times to check the switch operation. If the switches require adjustment, repeat steps 5) to 7).

3.5.3.3 Field wiring and installation

WARNING
The 3000 series should always be handled with care when the cover is removed.

Note: *before electrical installation, please read and follow the wiring diagram located inside the cover. The electrical ratings can be found on the product I.D label.*

1) Field wiring must be carried out in accordance with site, local and national electrical codes / requirements. This includes special attention to earth bond to the aluminium or stainless steel enclosure using the internal and external earth points provided.
2) Installation of this product shall be carried out by competent personnel in accordance with the applicable code of practice such as EN 60079-14.
3) The certification applies to equipment WITHOUT cable glands. When mounting the enclosure in the hazardous area, only suitably rated IP66/67 or 68 ATEX certified glands MUST BE USED.
4) All unused cable entries MUST be plugged with a suitably rated IP66/67 or 68 ATEX certified blanking devices.
5) The first two digits of the Westlock nomenclature signifies the series with the third digit defining whether the product has a visual beacon or not. The fourth digit identifies the switch / sensor type. The fifth digit details the enclosure material;
R = Resin, A = Aluminium,
S = Stainless steel
The table below details the applicable ambient ranges.

Equipment	Tamb (Ta) range	
Inductive proximity sensor (IFM) type: NS5002	ATEX	(T6) -20°C to +55°C
(PTB 01ATEX2191) (IECEx BVS 06.0003)	(1G)	(T5) -20°C to +60°C
	IEC	-20°C to +60°C
		-25°C to +60°C
Inductive proximity sensor (Turck): sensors type group A (KEMA 02 ATEX 1090X) (IECEx KEM 06.0036X)	-40°C to + *°C (* See certificate ⩽ +60°C)	
Cylindrical inductive sensors (P+F) types NC and NJ (PTB 00ATEX2048X)	-40°C to + *°C (* See certificate ⩽ +60°C)	
Cuboidal inductive sensors (P+F) types NJ and NC (PTB 00ATEX2032X)	-40°C to + *°C (* See certificate ⩽ +60°C)	
SN-sensors (Pepperl + Fuchs) types NJ (PTB 00ATEX2049X)	(T1 – T6) -40°C to +60°C	
Magnum XT90 proximity switch	(T1 – T6) -40°C to +60°C	
V3 microswitches	(T1 – T6) -40°C to +60°C	
CS transmitter	(T1 – T4) -40°C to +60°C	
RS transmitter (Bourns type 3852C)	(T1 – T4) -40°C to +60°C	

FIGURE 18

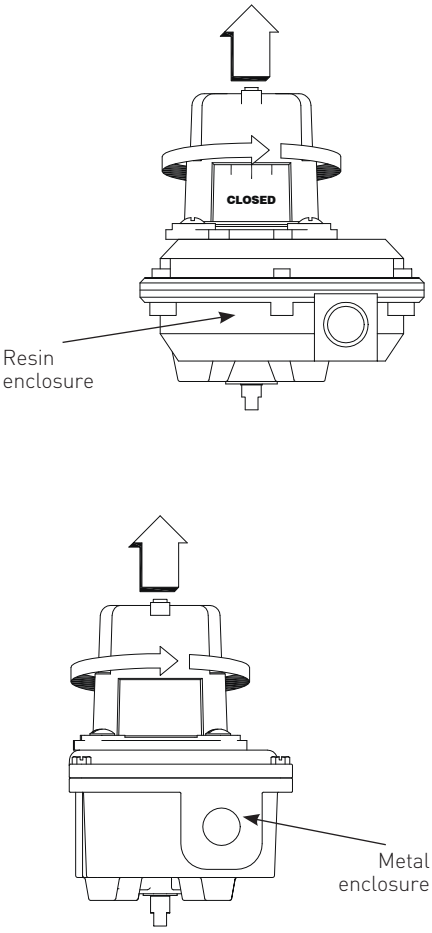
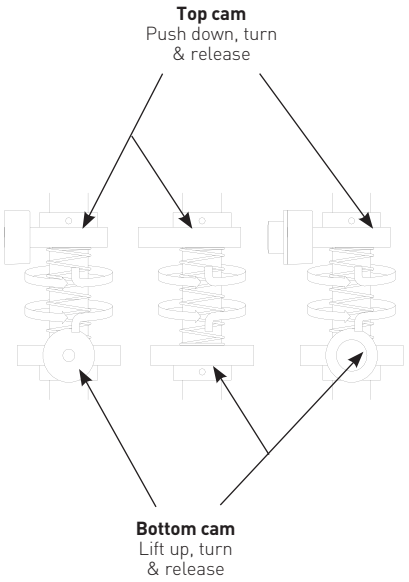


FIGURE 19



NOTES

1. *The working ambient temperature of the enclosures shall be as follows: Resin enclosure: -20 to +40°C Aluminium or stainless steel enclosure: -40 to +60°C*
2. *The maximum upper ambient temperature of the equipment when installed with P&F sensors is dependent on its certificate parameters with regards to 'T' class and barrier type. The maximum upper ambient temperature shall not be considered to be higher than the following limits: Resin enclosure = +40°C Aluminium or stainless steel enclosure = +60°C*
3. *If the CS or RS transmitter is used in conjunction with any switches, sensors or solenoids then the max surface temp for gas and dust shall be shown on the label.*

6) The electrical rating of the internal components are as follows:

Switch type	Electrical rating	Cat. no.
V3 mechanical SPDT gold plated – simple apparatus	Ui = 30 V, Ii = 100 mA, Pi = 1 W, Ci = 10 nF, Li = 10 µH	1
Magnum XT90 proximity switch – simple apparatus	Ui = 30 V, Ii = 100 mA, Pi = 1 W, Ci = 10 nF, Li = 10 µH	1
CS transmitter	Ui = 28 V, Ii = 100 mA, Pi = 0.75 W, Ci = 68.3 nF, Li = 0 µH	1
RS transmitter (Bourns type 3852C)	Ui = 28 V, Ii = 100 mA, Pi = 0.75 W	1
IFM NS5002 (BVS 04 ATEX E153) Ex ia IIB only*	Ui = 15 V, Ii = 50 mA, Pi = 120 mW, Ci = 80 nF, Li = 110 µH	1
Turck sensors (KEMA 02 ATEX 1090X – type group 'A')	Ui = 20 V, Ii = 60 mA, Pi = 200 mW, Ci = 150 nF, Li = 150 µH	1

P&F sensor number	Certificate number	Cat. no.	P&F sensor number	Certificate number	Cat. no.
NJ2-V3-N...	PTB 00ATEX2032X (SUPP 2)	1	NJ2-12GM-N...	PTB 00ATEX2048X (SUPP 1)	1
NCB2-V3-N0...	PTB 00ATEX2032X (SUPP 2)	1	NJ4-12GM-N...	PTB 00ATEX2048X (SUPP 1)	1
			NJ5-18GM-N...	PTB 00ATEX2048X (SUPP 1)	1
NCB1,5-...M...-N0...	PTB 00ATEX2048X (SUPP 1)	1	NJ8-18GM-N...	PTB 00ATEX2048X (SUPP 1)	1
NCB2-12GM...-N0...	PTB 00ATEX2048X (SUPP 1)	1			
NCN4-12GM...-N0...	PTB 00ATEX2048X (SUPP 1)	1	NJ2-11-SN-G...	PTB 00ATEX2049X (SUPP 1)	1
NCB5-18GM...-N0...	PTB 00ATEX2048X (SUPP 1)	1	NJ2-11-SN...	PTB 00ATEX2049X (SUPP 1)	1
NCN8-18GM...-N0...	PTB 00ATEX2048X (SUPP 1)	1	NJ2-12GK-SN...	PTB 00ATEX2049X (SUPP 1)	1
NCB10-30GM...-N0...	PTB 00ATEX2048X (SUPP 1)	1	NJ3-18GK-S1N...	PTB 00ATEX2049X (SUPP 1)	1
NCN15-30GM...-N0...	PTB 00ATEX2048X (SUPP 1)	1	NJ4-12GK-SN...	PTB 00ATEX2049X (SUPP 1)	1
NJ2-11-N...	PTB 00ATEX2048X (SUPP 1)	1	NJ5-18GK-SN...	PTB 00ATEX2049X (SUPP 1)	1
NJ2-11-N-G...	PTB 00ATEX2048X (SUPP 1)	1	NJ5-30GK-S1N...	PTB 00ATEX2049X (SUPP 1)	1
			NJ8-18GK-SN...	PTB 00ATEX2049X (SUPP 1)	1

7) Before replacing the enclosure cover, ensure that both of the housing and cover sealing surfaces are clean and undamaged. Tighten the cover screws hand tight using a suitably sized screwdriver or a metric 8mm A/F spanner / socket.

3.5.3.4 Product repair and service

1) Inspection of this product shall be carried out by suitably trained personnel in accordance with the applicable code of practice such as EN 60079-17.
2) In the event of any repairs that may be required such tasks must be carried out by suitably trained / competent personnel in accordance with the applicable code of practice such as EN 60079-19.
3) The certification of this product has been approved based on the material of construction as per the drawings listed in the schedule within this certificate. Any replacement parts that are not made in accordance to the listed drawing will invalidate the approval / certification.
4) Replacement parts must be purchased through Westlock Controls UK Ltd or via an approved Westlock Controls distributor.

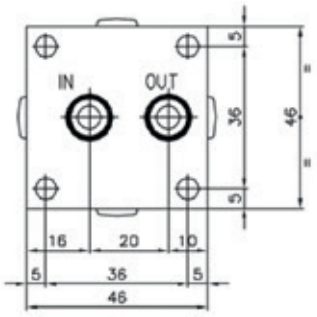
3.6 Calibration of the operation time

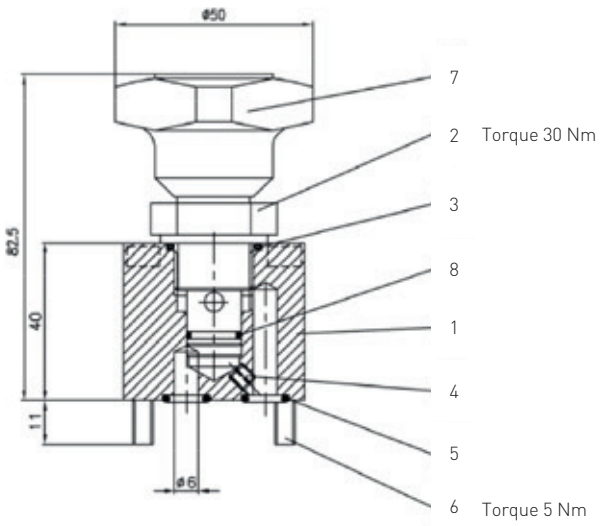
For actuator models with a control system it's possible to regulate the speed of actuator operations. The calibration of the operation time is made according to customer requirements and to the technical data included in the technical documentation. If necessary, it's possible to modify or reset the operating time through two flow regulating valves (optional) placed on the inlets of the hydraulic cylinder (refer to specific technical documentation furnished with the actuator's scope of supply).

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

FIGURE 20

Adjustment of operating time by flow-regulator valve (please refer to specific operating diagram, item 526, 528 or 530)





Torque 30 Nm

Torque 5 Nm

TECHNICAL FEATURES

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

PARTS LIST

Item	Qty	Description	Material	Type of drawing
1	1	Body	AISI 316	49.144.031
2	1	Cartridge	AISI 316	FT 22B7/2-14-FQSV
3*	1	O-ring	MFQ-70Sh	OR 2-116
4	1	Screw	A4-70	M5 x 5 UNI 5923
5	2	O-ring	MFQ-70Sh	OR 5-612
6	4	Screw	A4-70	VTCEI M5 x 45 UNI 5931
7	1	Handwheel	11S (2011)	29.102.378
8*	1	OR + 28K	MFQ-70Sh + PTFE	OR2-013 + 2BK

* Included in cartridge (item 2)

4 OPERATIONAL TESTS AND INSPECTIONS

IMPORTANT
To ensure the guaranteed SIL Level, according to IEC 61508, the functionality of the actuator must be checked at regular intervals, as follows:

For safety related applications, the following test operation has to be performed:
1. Full stroke of actuator once a year.
2. Partial stroke 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

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 the control unit, to ensure safety of maintenance staff.

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

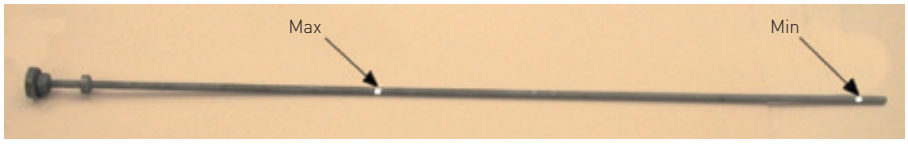
5.1 Periodic maintenance

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

IMPORTANT
Periodicity and regularity of inspections is influenced particularly by specific environmental and working conditions.
Initially, they can be determined experimentally and then improved according to actual maintenance conditions and needs.

Notwithstanding, the following is recommended every 2 years of operation:
- 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 there are no hydraulic leakages. If necessary, tighten the nuts of the pipe-fittings.
- Check oil level (figure 21) into the hydraulic manual hand pump, if present (section 5.1.1)
- Check that the actuators have not suffered accidental damage with oil leakages found on site (section 4.1.1).
- Check that improper closing of the control-group cover did not produce condensation on it.
- Check the integrity of worn out parts (gaskets, pads etc.).
- If there is an oil filter on the actuator, bleed the condense water accumulated in the cup by opening the drain cock. Disassemble the cup periodically and wash it with soap and water. Disassemble the filter. If this contains a sintered cartridge, wash it with nitrate solvent and blow through with oil. If the filter is made of cellulose, it must be replaced when clogged.

FIGURE 21
Level measuring stick



5.1.1 Check and restore oil level in the hydraulic manual hand pump (refer to section 7.2 figure 27).
During actuator operation the oil tank has to be closed (not in connection with the atmosphere). To avoid cavitation it is necessary to proceed as follows for checking the oil level in the tank:

1. Unscrew the dipstick (1).
2. Move the actuator into the open position.
3. Check that the oil level into the tank (4) corresponds with the 'MAX LEVEL' notch of the dipstick.
4. Leaving the dipstick unscrewed, move the actuator, by the pneumatic control or by the hand pump, to the closed position.
5. Screw and tighten the dipstick.

If it's necessary to substitute or add oil, proceed as follows:

- Remove the dipstick (1) from the tank cover (22).
- Unscrew the plug (27) and the washer (9) to drain all the oil.
- If some dirt or/and sludge is found in the oil drained from the tank, before filling with new oil in the tank, disassemble the oil tank tube, by unscrewing the two cap nuts (2) and clean the internal surfaces of the tank. If necessary substitute the tank gaskets (21).
- Replace the plug (27) and the washer (9) into the plate (11) and tighten.
- Pour the new oil into the tank through the dipstick hole (1) on the cover (22).
- Replace the dipstick (1).
- Add oil (table 2) if the level in the tank is BELOW MINIMUM (figure 21).

IMPORTANT
To refill, use oil of the same brand as the one in the tanks.

The cleanliness level for the actuator without a control-system is NAS 8 minimum. For an actuator with a control system, the cleanliness level is that required by individual components. For applicable cleanliness levels, refer to document: technical data-sheet for actuators.

TABLE 2
Features of hydraulic oil suggested for refilling in different working conditions

Standard temperature conditions (-30°C/+85°C)	
Producer	AGIP
Name	ARNICA 22
Viscosity at 40°C	20.9 mm^2/s
Viscosity at 100°C	4.73 mm^2/s
Viscosity index ASTM	153
Flash point	192°C
Pour point	-42°C
Specific weight (at 15°C)	0,857 kg/l
Equivalent oils	SHELL TELLUS PLUS 22
	CHEVRON HYDRAULIC OIL AW ISO 22
	MOBIL DTE22
	EXXON UNIVIS N22
	EQUIVIS ZS22
	BP ENERGOL HLP-HM22
	CASTROL DYSPIN AWS22
Low temperature conditions (down to -46°C)	
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^3
(Or equivalent)	
Low temperature conditions (down to -60°C)	
Manufacturer	SYNTESIS
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^3
(Or equivalent)	

5.2 EXTRAORDINARY MAINTENANCE

When necessary, extraordinary maintenance can be performed on the actuator's parts.

IMPORTANT
If this is necessary, contact customer service.

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 frequency of operation it may be necessary to restore the lubrication periodically: 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 and on the guide bar. For this operation it is necessary to disassemble the mechanism cover. In larger actuators, lubrication can be performed through the cover's inspection holes after removing the plugs.

The following grease is used as standard and suggested for re-lubrication:

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	Odor:	Slight
Base oil viscosity at 40°C:	160 mm²/s	Density:	966 kg/m³ 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)
		Product code:	001A0065
Equivalent to:		Infosafe no.:	ACISO GB/eng/C
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			

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 drawings and adopting the following procedures:

5.2.2 Replacement of cylinder seals (refer to figure 22)

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 the control unit, to ensure safety of maintenance staff.
If the actuator can be operated, it is essential to take it to the fail safe position, with the spring totally extended.

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

Seals replacement (refer to figure 22)
Prior to reassembly check that the actuator components are in good condition and clean. Lubricate all the surfaces of the parts which move in contact with other components, with a recommended grease. If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with a protective oil or grease film. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.
1. Replace the O-ring (2) of the head flange (1).
2. Replace the back-up-ring (4) of the head flange (1).

To replace the piston rod seal rings (3) proceed as follows:
1. Remove the existing PTFE seal ring (3) with its O-ring from their groove.
2. Clean the groove carefully and lubricate it with a protective oil or grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.
4. Assemble the new PTFE seal ring (3) into the flange groove, inside its rubber O-ring, by bending it: take care that the bending radius is as large as possible to avoid damaging the seal. Then enlarge the seal ring with your fingers to restore its round shape: be careful not to utilize any tools which can damage the seal ring.

To replace the piston seal ring (8) proceed as follows (refer to figure 22):

1. Remove the existing PTFE seal ring (8) with its O-ring from their groove.
2. Clean the groove carefully and lubricate it with a protective oil or grease film.
3. Assemble the new O-ring into its groove and lubricate it with a protective oil or grease film.
4. Assemble the new PTFE seal ring (8) on its rubber O-ring by introducing one side of it into the groove, then enlarge it with your fingers so as to fit it into the groove: take care to enlarge it uniformly without any tools which could possibly damage it. The elastic memory of the kind of PTFE the seal ring is made of allows the ring to shrink back to its previous dimension after a short time.

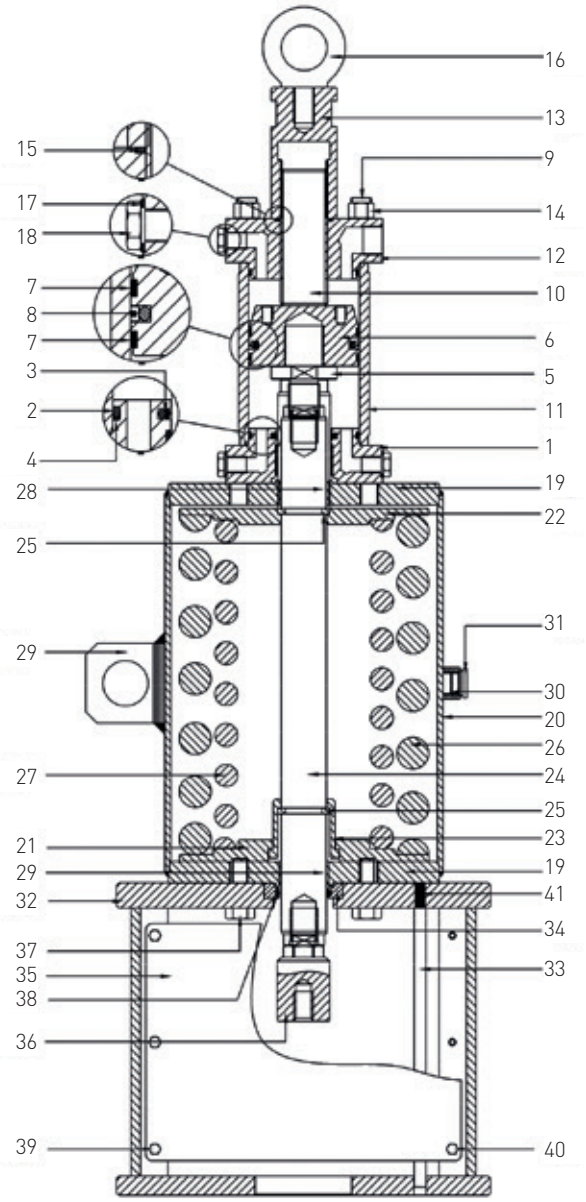
Reassembly

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

IMPORTANT

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

FIGURE 22
Single acting-spring return hydraulic linear actuator



PARTS LIST

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

5.3 Dismantling and disposal

Before starting disassembly, a large area should be created around the actuator to allow movement without further risks created by the work-site.

WARNING

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

If the actuator is still mounted onto the valve, loosen the threaded connections between valve and actuator (screws, tie rods, nuts).
Lift the actuator using the proper lifting points (see section 2.2).
If the actuator needs storage, before demolition (see section 2.3).
The disposal of the actuator concerning both any electrical and mechanical parts should be carried out by specialized staff.
Separate the actuator's parts 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.

6 TROUBLESHOOTING

6.1 Failure or breakdown analysis

Event	Possible cause	Remedy
Actuator does not work	1. Lack of hydraulic supply	1. Open line stop valve
	2. Blocked valve	2. Repair or replace
	3. Wrong position of the distributor of the hydraulic manual override	3. Restore correct position
	4. Failure of the spring	4. Call Biffi Customer Service
	5. Failure of the control system	5. Call Biffi Customer Service
	6. Clogged filter	6. Clean or replace the cartridge
Actuator too slow	1. Low supply pressure	1. Restore (section 1.4)
	2. Wrong calibration of flow regulator valves	2. Restore (section 3.6)
	3. Wear of the valve	3. Replace
Actuator too fast	1. High supply pressure	1. Restore (section 1.4)
	2. Wrong calibration of flow regulator valves	2. Restore (section 3.6)
Leakages on hydraulic or pneumatic circuits	1. Deterioration and/or damage to gaskets	1. Call Biffi Customer Service
Incorrect position of the valve	1. Wrong adjustment of mechanical stops	1. Restore (section 3.4)
	2. Wrong warning of microswitches	2. Restore (section 3.5)
Hydraulic manual pump does not work	1. Handle positioned on remote control	1. Re-position the operation indication handle to manual
	2. Leakages on the check valve of the hydraulic control group	2. Call Biffi Customer Service

7 LAYOUTS

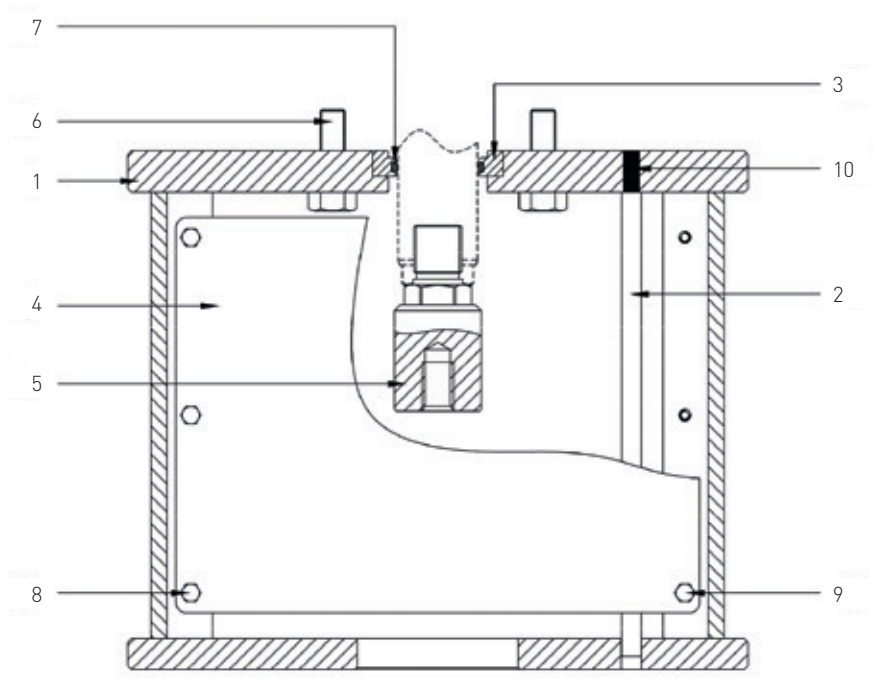
7.1 Spare parts order

For spare parts orders please make reference to the order confirmation concerning all the supply and the 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
Please specify:

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

7.2 Parts list for maintenance and replacement procedure

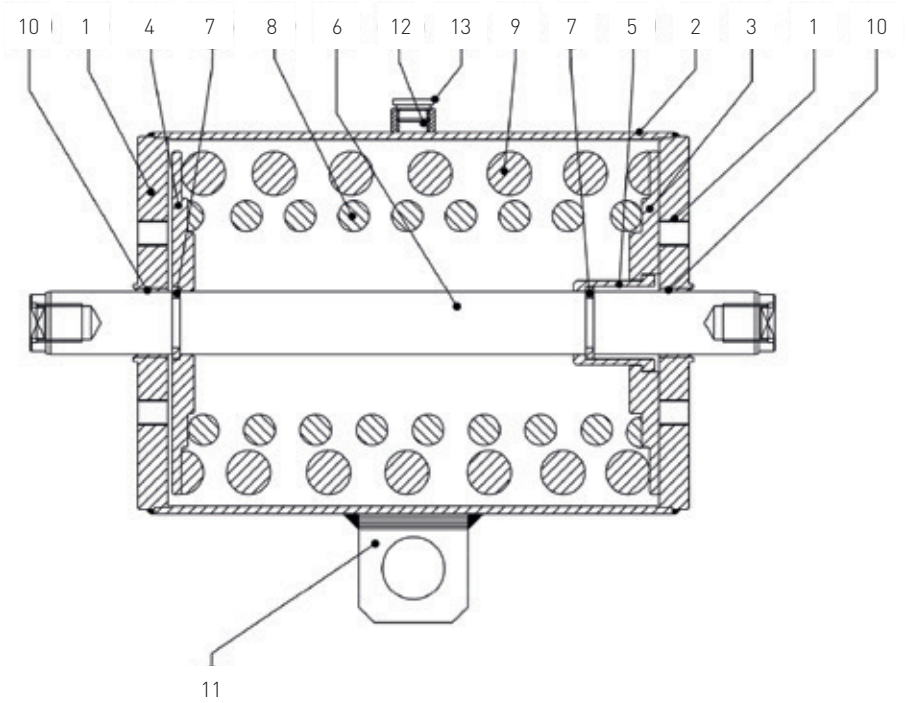
FIGURE 23
Pedestal with coupling joint



PARTS LIST

Item	Qty	Description	Material
1	1	Pedestal	Carbon steel
2	1	Anti-rotation shaft	Stainless steel
3	1	Scraper ring flange	Stainless steel
4	1	Plate	Stainless steel
5	1	Actuator joint	Stainless steel
6	4	Screw	Alloy steel
7	1	Scraper ring	Turcon + NBR
8	6	Washer	Stainless steel
9	6	Screw	Stainless steel
10	1	Dowel	Stainless steel

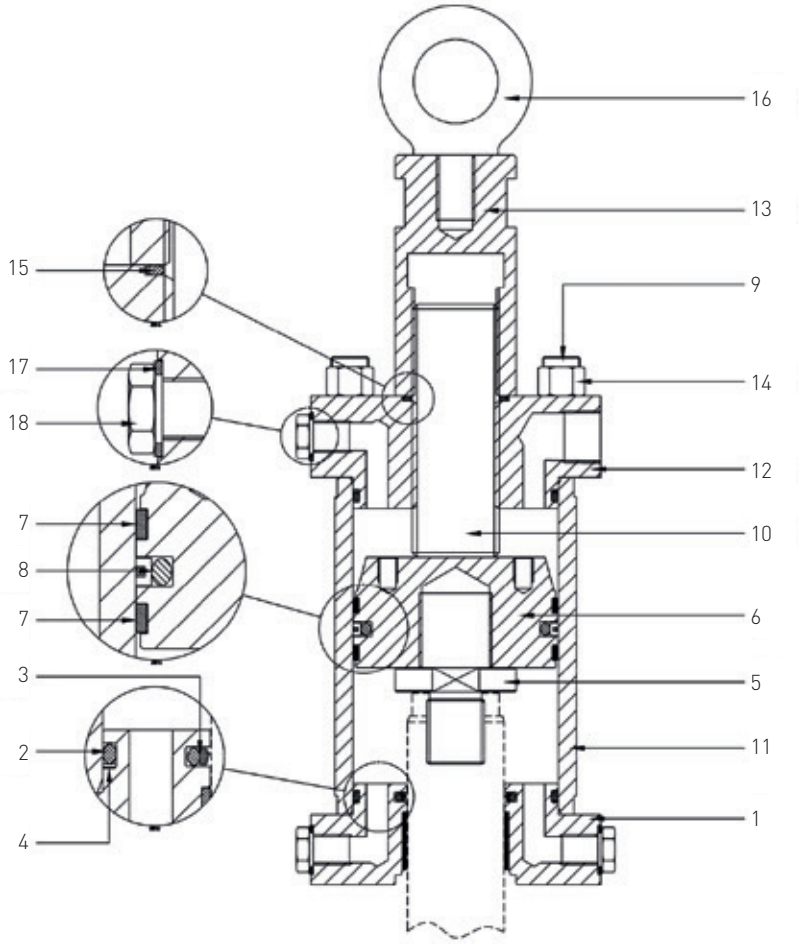
FIGURE 24
Spring cartridge



PARTS LIST

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

FIGURE 25
Hydraulic cylinder

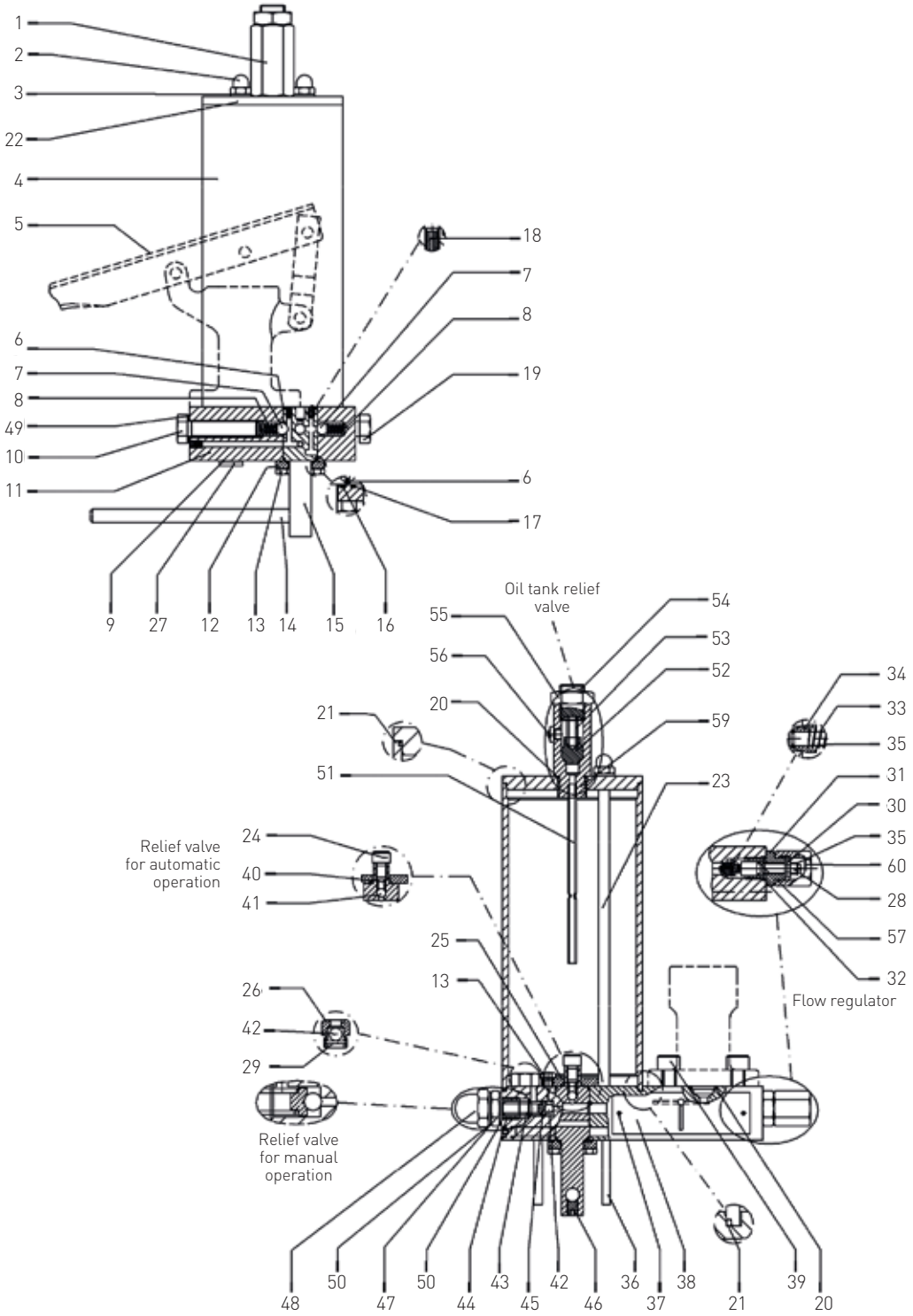


PARTS LIST

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

* Recommended spare parts

FIGURE 26
Hydraulic control unit MHP

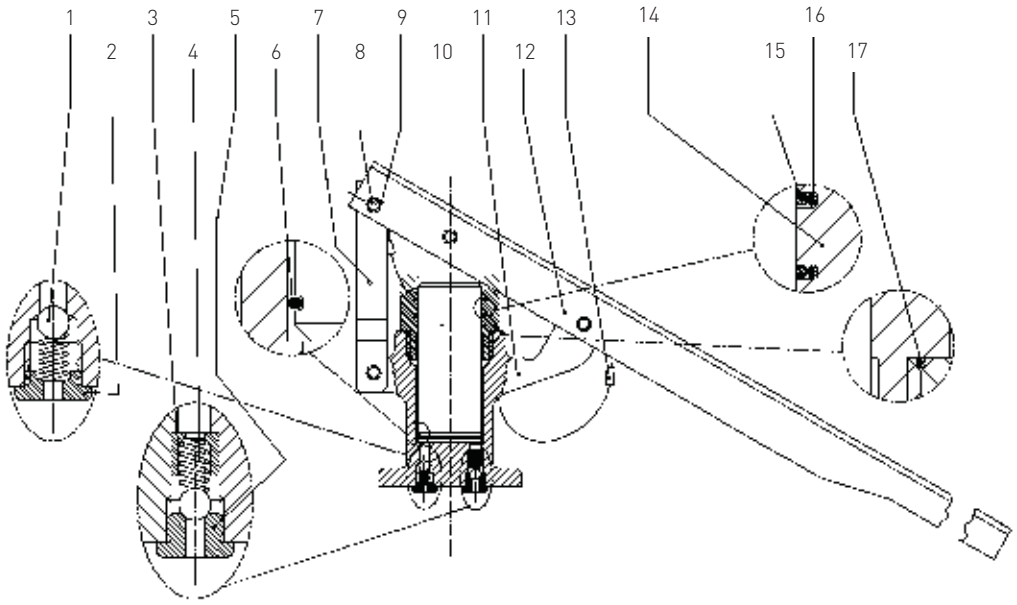


PARTS LIST - HYDRAULIC CONTROL UNIT MHP

Item	Qty	Description	Material
1	1	Dipstick	Carbon steel + aluminum
2	5	Plug	Carbon steel
3	6	Washer	Copper
4	1	Hydraulic tank	Carbon steel
5	1	Hand pump	See figure 27
6*	2	O-ring	Fluorosilicon rubber
7	2	Ball	Stainless steel
8	2	Spring	Spring steel
9	2	Washer	Copper
10	1	Screw	Carbon steel
11	1	Plate	Carbon steel
12	1	Flange	Aluminum
13	8	Screw	Carbon steel
14	1	Lever	Carbon steel
15	1	Distributor	Stainless steel
16*	1	O-ring	Fluorosilicon rubber
17*	1	O-ring	Fluorosilicon rubber
18	1	Nozzle	Carbon steel
19	2	Screw	Carbon steel
20*	3	O-ring	Fluorosilicon rubber
21*	2	Tank gasket	Fiber
22	1	Tank cover	Carbon steel
23	2	Tie rod	Carbon steel
24	1	Screw	Carbon steel
25	1	Flange	Aluminum
26	2	Check valve body	Carbon steel
27	1	Plug	Carbon steel
28	2	Flow control valve setting screw	Stainless steel
29	2	Spring pin	Stainless steel
30	3	Nut	Carbon steel
31	2	Flange	Carbon steel
32*	2	O-ring	Fluorosilicon rubber
33	2	Spring	Spring steel
34	2	Plug	Stainless steel
35	2	Retainer ring	Carbon steel
36	2	Spring pin	Carbon steel
37	2	Rivet	Aluminum
38	1	Operation instruction plate	Stainless steel
39	4	Screw	Carbon steel
40	1	Spring	Stainless steel
41	2	Ball	Stainless steel
42	2	Ball	Stainless steel
43	1	Spring	Carbon steel
44	1	Relief valve setting screw	Alloy steel
45	1	Spring pin	Carbon steel
46	1	Screw	Alloy steel
47	1	Spring	Stainless steel
48	1	Ball	Stainless steel

* Recommended spare parts

FIGURE 27
Hydraulic control unit, hand pump



PARTS LIST

Item	Qty	Description	Material
1	2	Ball	Stainless steel
2	1	Delivery valve bush	Carbon steel
3	1	Suction valve bush	Carbon steel
4	2	Spring	Stainless steel
5	1	Suction valve seat	Carbon steel
6	1	Spring retainer ring	Carbon steel
7	1	Fork	Carbon steel
8	3	Pin	Stainless steel
9	6	Retainer ring	Carbon steel
10	1	Rod	Alloy steel (chromium plated)
11	1	Body	Carbon steel
12	1	Lever	Carbon steel
13	1	Split pin with rope	Carbon steel + nylon
14	1	Threaded bush	Aluminum
15	2	Rod seal ring	PTFE + graphite
16*	2	O-ring	Fluorosilicon rubber
17*	1	O-ring	Fluorosilicon rubber

* Recommended spare parts

8 DATE REPORT FOR MAINTENANCE OPERATIONS

Last maintenance operation date:

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

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

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

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

Next maintenance operation date:

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

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

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

Start-up date:

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

(on plant): .....