

Biffi RPD

Double-Acting Pneumatic Actuators



Revision Details

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NOTICE

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

Section 1: General Warnings

NOTE:

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

1.1 Generalities

Biffi Italia s.r.l. actuators are conceived, manufactured and controlled according to the Quality Control System in compliance with EN-ISO 9001 international regulation.

1.1.1 Applicable regulation

UNI EN ISO 12100-1: 2005: **Safety of machinery** – Basic notions, general design principles. Part 1-Basic terminology, method.

UNI 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** (until 18 July 2016)

2014/68/EU from 19 July 2016

2006/95/EC: **Directive for low voltage equipment** (until 19 April 2016)

2014/35/EU from 20 April 2016

2004/108/EC: **Directive for the electromagnetic compatibility** (until 19 April 2016)

2014/30/EU from 20 April 2016

94/9/CE: **Directive and safety instructions for use in hazardous Area**

(until 19 April 2016) 2014/34/EU from 20 April 2016

1.1.2 Terms and conditions

Biffi Italia s.r.l. guarantees that all the items produced are free of defects in workmanship and manufacturing materials and meet relevant current specifications, provided they are installed, used and serviced according to the instructions contained in the present manual. The warranty can last either one year from the date of installation by the initial user of the product, or eighteen months from the date of shipment to the initial user, depending on which event occurs first. All detailed warranty conditions are specified in the documentation forwarded together with the product. This warranty does not cover special products or components not warranted by subcontractors, or materials that were used or installed improperly or were modified or repaired by unauthorized staff. In the event that a fault condition be caused by improper installation, maintenance or use, or by irregular working conditions, the repairs will be charged according to applicable fees.


The warranty and Biffi Italia s.r.l. liability shall lapse in the event that any modification or tampering whatsoever be performed on the actuator.

1.2 Identification Plate

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

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

Figure 1 Data Plate

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

1.3 Introducing the Actuator

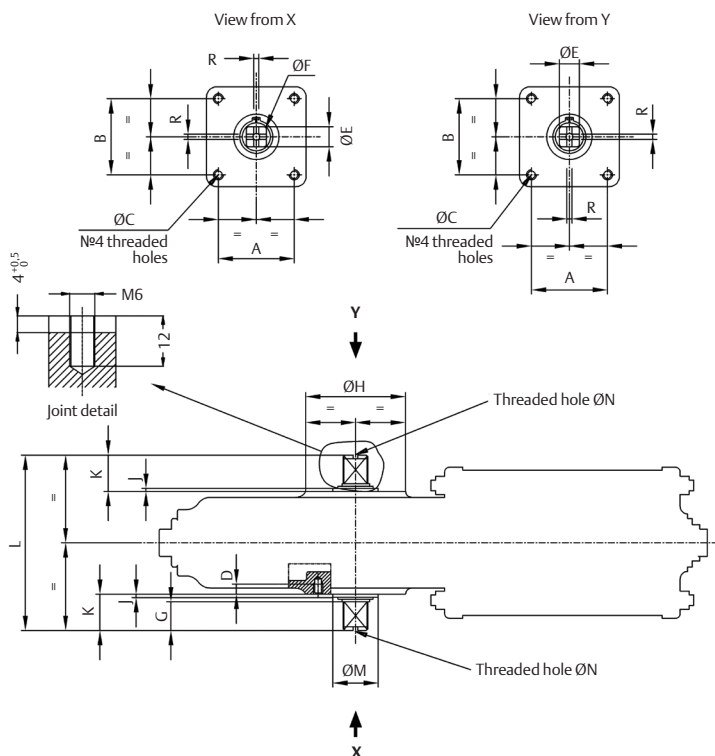
RPD actuators are pneumatic low pressure Spring-Return, suitable for any quarter-turn application such as ball, plug, butterfly valves or dampers, in both ON-OFF and modulating heavy-duty service. The actuator is made up of a rack and pinion mechanism, which transforms the linear movement of the pneumatic cylinder, (on closing or opening), into the rotary movement for the valve operation. An adjustable bronze sliding block supports the transverse force exerted on the rack by its engagement with the pinion. The rack is nitride for ensures the minimal friction. 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 mounting flange is identical on both (upper and lower) faces of the housing; the shaft output drives have the same dimensions but is positioned at 90°. This allows the actuator to be used as spring to close or spring to open without modification.

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.

Actuator manual emergency operation in opposition to the spring action, is performed by rotating the jackscrew by a wrench or by a handwheel (available on request).

Figure 2



Both the actuator flanges can be used for valve coupling or the mounting of ancillary equipment (positioner, limit switch box, etc.).

Table 1.

Actuator Model	A ^{+0.2}	B ^{+0.2}	ØC	D	ØE _{-0.1}	ØF _{-0.5}	G	ØH	K	J	L	ØM _{-0.2}	ØN*	R ^{+0.1}
RP 13-14-15	49,5	49,5	M8	10	16	21	23	66	30	2,7	140	40	M6	4
RP 30	72,1	72,1	M10	12	22	29	25	92	32	2,7	164	50	M6	4
RP 60	88,4	88,4	M12	15	28	37	34	112	42	3,0	204	60	M6	4
RP 120	99,0	99,0	M16	23	37	49	45	132	55	3,0	270	75	M6	4

NOTE:

- All dimensions are in mm.
- Both the actuator flanges can be used for the coupling to the valve or the mounting of ancillary equipments (positioner, limit switch box, etc.).

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 back face (optional), with threaded holes for the assembly of accessories (control panels, air storage tank, etc.).

The expected lifetime of actuator is approximately 25 years.

1.4 Data Sheet

Supply fluid	Air, Nitrogen or sweet gas
Operating temperature	Standard: from -30 °C to +100 °C Optional: from -60 °C to +140 °C
Design pressure	12 bar maximum
Supply pressure	Please refer to technical document: “actuator data sheet”
Output torque	up to 3700 Nm

Section 2: Installation

2.1 Checks Upon Actuator Receipt

- Check that the model, the serial number of the actuator and the technical data reported on the identification plate correspond with those of order confirmation, see 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, refer to Section 3.4 and of micro-switches (if any) refer to Section 3.5.

2.2 Actuator Handling

NOTICE

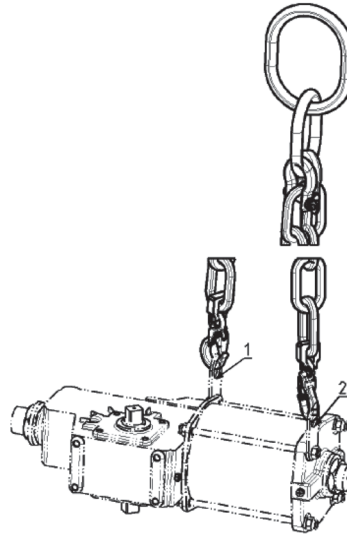
The lifting and handling should be made by qualified staff and in compliance with the laws and provisions in force.

WARNING

The fastening points are appropriate for the lifting of the actuator alone and not for the valve + actuator assembly. Avoid that during the handling, the actuator passes above the staff. The actuator should be handled with appropriate lifting means. The weight of the actuator is reported on the delivery bill.

For a correct lifting procedure, please refer to following Figure.

Figure 3



1 and 2 = Lifting eyelets

2.3 Storage

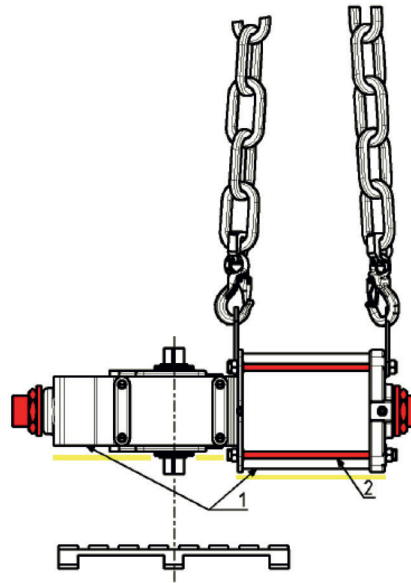
If the actuator needs storage, before installation follow these steps:

- 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 protection of the control system 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, refer to Section 3.3.

Figure 4



- 1 = Points of support
2 = Don't lay the actuator on the tie rods

⚠ WARNING

Don't lay the actuator on accessories (manual handpump, manual jackscrew, pneumatic control system, etc.).

2.4 Actuator Assembly on the Valve

2.4.1 Types of Assembly

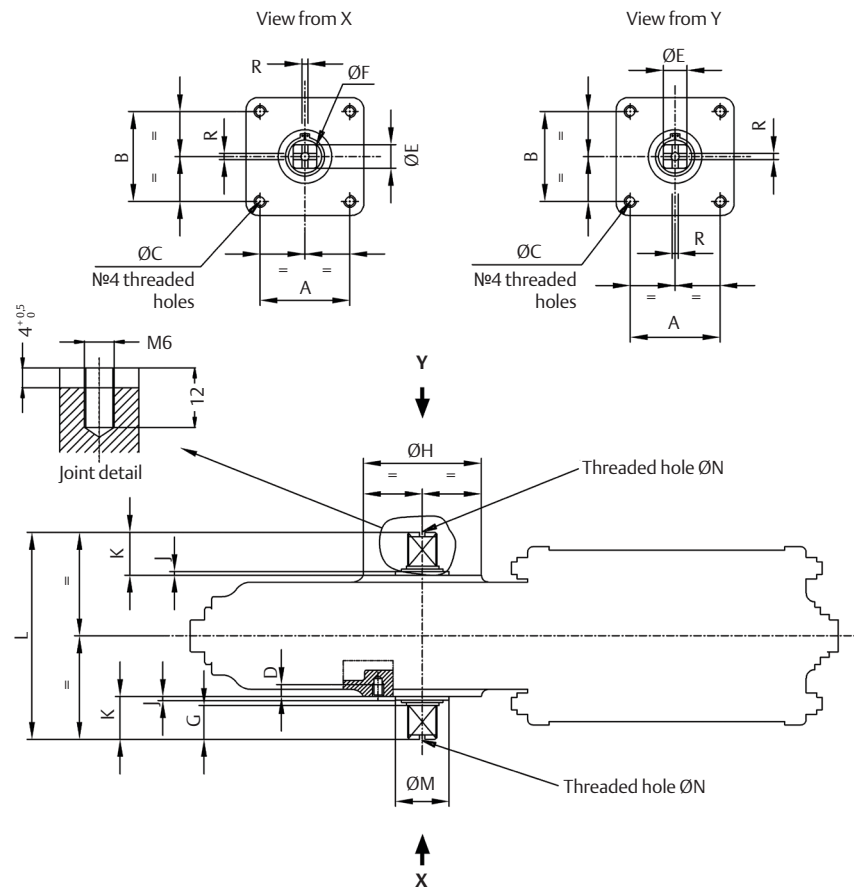
For coupling to the valve, the housing is provided with a flange with threaded holes according to Biffi standard tables (TN1182 attached). The number, dimensions and diameter of the holes are made in accordance with ISO 5211. The actuator is provided with a spool piece and a stem extension for coupling 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).

NOTICE

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 5



Both the actuator flanges can be used for valve coupling or the mounting of ancillary equipment (positioner, limit switch box, etc.).

Table 2.

Actuator Model	A ^{±0.2}	B ^{±0.2}	ØC	D	ØE _{0.1}	ØF _{0.5}	G	ØH	K	J	L	ØM _{0.2}	ØN*	R ^{+0.1}
RP 13-14-15	49,5	49,5	M8	10	16	21	23	66	30	2,7	140	40	M6	4
RP 30	72,1	72,1	M10	12	22	29	25	92	32	2,7	164	50	M6	4
RP 60	88,4	88,4	M12	15	28	37	34	112	42	3,0	204	60	M6	4
RP 120	99,0	99,0	M16	23	37	49	45	132	55	3,0	270	75	M6	4

NOTE:

- All dimensions are in mm.
- Both the actuator flanges can be used for the coupling to the valve or the mounting of ancillary equipments (positioner, limit switch box, etc.).

2.4.2 Assembly Procedure

NOTICE

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

⚠ WARNING

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

For actuator assembly on the valve:

NOTICE

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

- Operate the actuator so that it reaches the matching valve position, see Section 3.3.
- Lubricate valve stem with oil or grease.
- Properly clean and remove grease from valve coupling flange surfaces.
- Connect, if supplied separately, the stem extension onto the valve stem and fasten it with the special fastening pins.
- Lift the actuator using the special lifting points, see 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, see Section 3.4.
- Fasten threaded connections. Please refer to Table 3.

Table 3. Nuts Tightening Torque

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

The screwing values in Table 3 were calculated considering the materials ASTM A320 L7 for screws or tie rods and ASTM A194 gr.2H for the nuts.

2.5 Pneumatic Connections

Connect the actuator to the pneumatic feed line with fittings and pipes in accordance to the plant specifications. They must be sized correctly in order to guarantee the necessary air flow for the operation of the actuator, with pressure drops not exceeding the maximum allowable value.

The shape of the connecting piping must not cause excessive stress to the inlets of the actuator. The piping must be suitably fastened so as not to cause excessive stress or loosening of threaded connections, if the system undergoes strong vibrations.

Every precaution must be taken to ensure that any solid or liquid contaminants which may be present in the pneumatic pipe-work to the actuator are removed to avoid possible damages to the unit or loss of performance. The inside of the pipes used for the connections must be well cleaned before use: wash them with suitable substances and blow through them with air or nitrogen.

The ends of the tubes must be well debarred and cleaned. Once the connections are completed, operate the actuator and check that it functions correctly, that the operation times meet the plant requirements and that there are no leakages in the pneumatic connections.

2.6 Electrical Connections (If Any)

WARNING

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).

Connect the electrical feed, control and signal lines to the actuator, by linking them up with the terminal blocks of the electrical components. In order to do this, the housing covers must be removed without damaging the coupling surfaces, the O-rings or the gaskets. Remove the plugs from the cable entries. For electrical connections use components (cable glands, cables, hoses, conduits) which meet the requirements and codes applicable to the plant specifications (mechanical protection and/or explosion-proof protection). Screw the cable glands tightly into the threaded inlets, so as to guarantee the weatherproof and explosion-proof protection (when applicable). Insert the connection cables into the electrical enclosures through the cable glands, and connect the cable wires to the terminals according to the applicable wiring diagram. If conduits are used, it is advisable to carry out the connection to the electrical enclosures by inserting hoses so as not to cause anomalous stress on the housing cable entries. Replace the plastic plugs of the unused enclosure entries by metal ones, to guarantee perfect weatherproof tightness and to comply with the explosion-proof protection codes (where applicable). Once the connections are completed, check that the controls and signals work properly.

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, except the angular stroke setting because for this setting operation, the actuator must be placed on to the valve (see Section 3.4) Before any modifications please read Biffi Italia s.r.l.

Upon actuator commissioning please carry out the following checks:

- Check that the pressure and quality of the air supply (filtering degree, dehydration) are as prescribed. Check that the feed voltage values of the electrical components (solenoid valve coils, micro-switches, pressure switches, etc.) are as prescribed.
- Check that the actuator controls work properly (remote control, local control, emergency controls, etc.).
- Check that the required remote signals (valve position, air pressure, etc.) are correct.
- Check that the setting of the components of the actuator control unit (pressure regulator, pressure switches, flow control valves, etc.) meet the plant requirements.
- Check there are no leakages in the pneumatic connections. If necessary, tighten the nuts of the pipe fittings.
- Remove all rust and, in accordance with the applicable painting specifications, repair paint-coat that has been damaged during transport, storage or assembly.

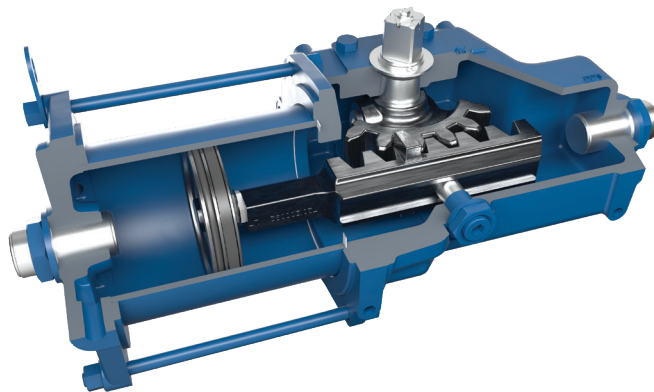
Section 3: Operation and Use

3.1 Operation Description

The air, or supply fluid, pressurizes the cylinder chamber relevant to the operation to carry out (opening or closing).

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 required direction.

Figure 6



For local or remote operations related to the actuator, please refer to technical documentation furnished with delivery actuators (schematics, overall dimensions and parts list).

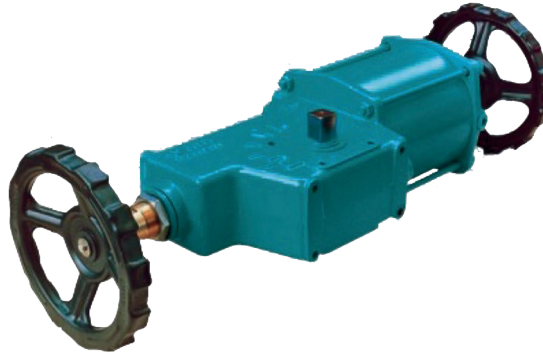
NOTICE

Typical general schematics for various applications are follow attached for information only, various control systems are furnished only at Customer demand.

Manual Override for RPD Double-Acting Pneumatic Actuator

Actuator manual emergency operation is performed by rotating one of the two jackscrews by a wrench or by a handwheel (available on request).

Figure 7



In standard configuration operating the screw mounted in the cylinder end flange results in valve opening while operating the screw mounted in the housing side wall results in the valve closing.

To achieve a required manual manoeuvre, prior to operate the proper jackscrew, the opposite one must be backed off. A lever manual override is available only for small models. Special handwheel with disengagement system are available on demand.

Figure 8

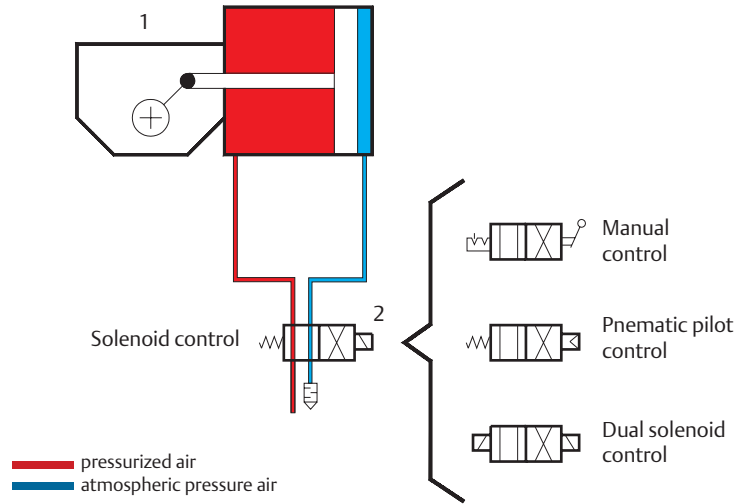


Declutching manual handwheel override (refer to Section 7.2, Figure 19, Table 11)

ON-OFF service: four way control valve

The diagram shows the simplest On-Off control. The gas supply pressure is applied to one side of the cylinder and exhausted from the opposite side. When the control valve (2) is actuated the connections of supply and exhaust to the cylinder chambers are reversed. The control valve can have many types of actuating devices (solenoid, manual control, pneumatic pilot, spring, etc.). The spring return control valves allow "fail safe" operation.

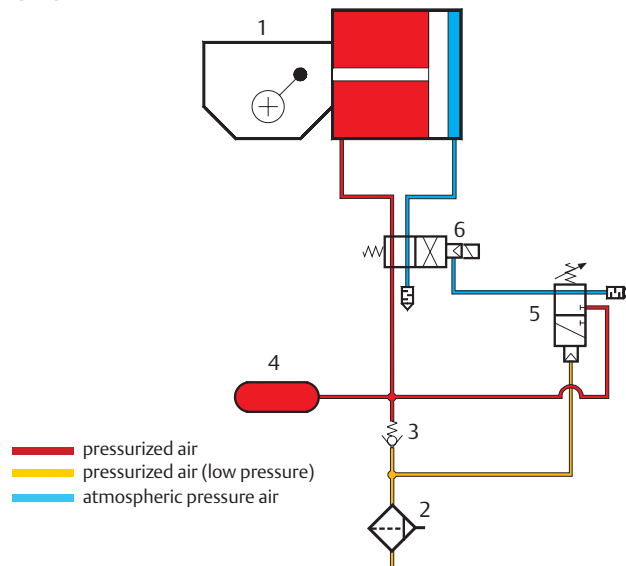
Figure 9



ON-OFF service: Air Fail Safe System

This system allows "fail safe" operation when the pressure in the gas supply line drops below a set value. The diagram shows the actuator (1) in the "fail safe" condition. When the gas supply pressure drops below the pressure switch (5) set point, the pneumatic supply to the solenoid valve (6) pilot is exhausted and the actuator moves to the "fail safe" position by using the gas stored in the tank (4). The tank is connected to the gas supply through the check valve (3).

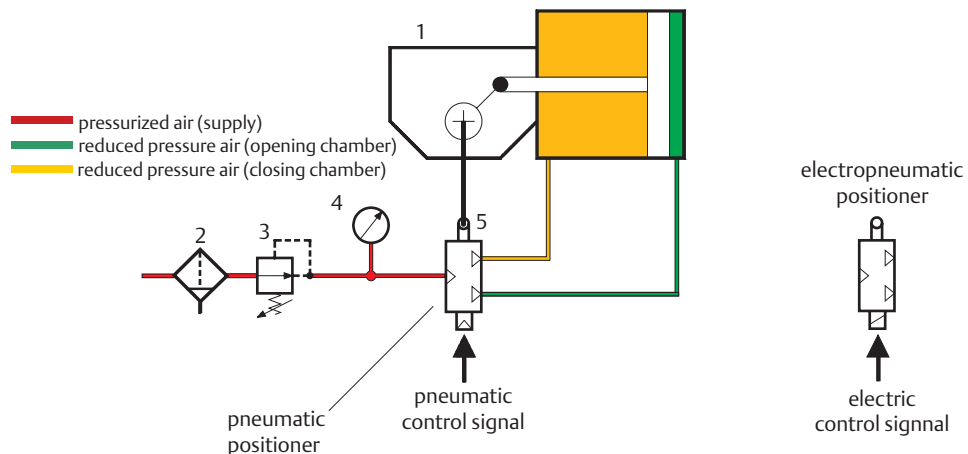
Figure 10



Modulating service

When modulating control is required as a function of a pneumatic or electric control signal, a positioner (5) is used, which controls the supply to the actuator cylinder to keep the valve in the required angular position. The positioner has a mechanical linkage to the actuator, for a feedback of the valve position.

Figure 11



3.2 Residual Risks

⚠ WARNING

The actuator has parts under pressure. Use the due caution. 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 angular stroke is performed by adjusting the travel stop screws of the cylinder end flange and of the housing wall.

The setting of the open valve position is performed by adjusting the travel stop screw on the left side of the actuator (screwed in the housing wall for spring to close actuators or in the cylinder end flange for spring to open actuators).

The setting of the closed valve position is performed by adjusting the travel stop screw on the right side of the actuator (screwed in the cylinder end flange for spring to close actuators or in the housing wall for spring to open actuators).

For the adjustment of the travel stop screws proceed as follows:

(please refer to Figures 12 and 13 on following page)

1. Loosen the lock nut with wrench C2
2. If the actuator angular stroke is stopped before reaching the end position (fully open or closed), unscrew with wrench C1 the travel stop screw by turning it anticlockwise, until the valve reaches the right position. When unscrewing the travel stop screw, keep the lock nut still with a wrench so that the sealing washer does not withdraw together with the travel stop screw
3. Tighten the lock nut refer to Table 4 to avoid accidental unscrewing of the lock-nut)
4. 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 right position
5. Tighten the lock nut (refer to Table 4 to avoid accidental unscrewing of the lock-nut)

Table 4.

Actuator Model	Thread	Wrench C2 (mm)	Torque (Nm)
RPD 15	M30X2	41	150
RPD 30	M40X2	50	350
RPD 60	M45X2	55	500
RPD 120	M50X2	60	800

Figure 12

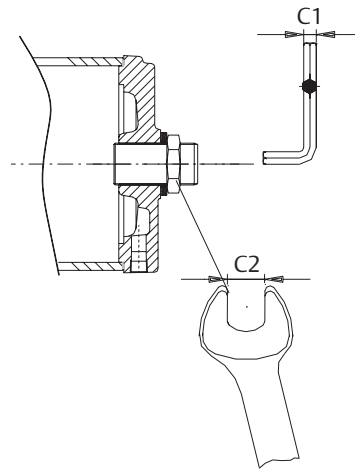


Table 5. Without Jackscrew Manual Override

Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
RPD 15	17	41
RPD 30	17	50
RPD 60	17	55
RPD 120	17	60

Figure 13

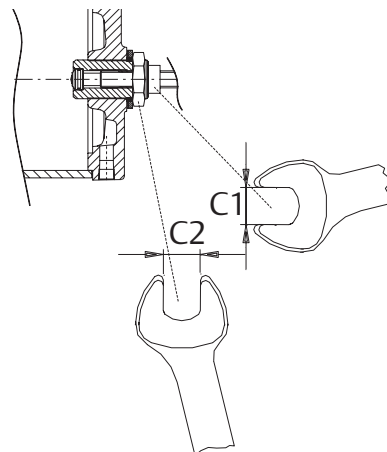


Table 6. With Jackscrew Manual Override

Actuator Model	Wrench C1 (mm)	Wrench C2 (mm)
RPD 15	24	41
RPD 30	32	50
RPD 60	36	55
RPD 120	36	60

3.5 Calibration of Micro-switches (If Foreseen)

(Refer to Safety Instructions Manual for limit switch box)

WARNING

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

NOTICE

For mounting interface dimension of the Limit Switch box on the cover of the actuator, please refer to TN1163V (for metric dimension) or TN1163VU (for imperial dimension).

NOTICE

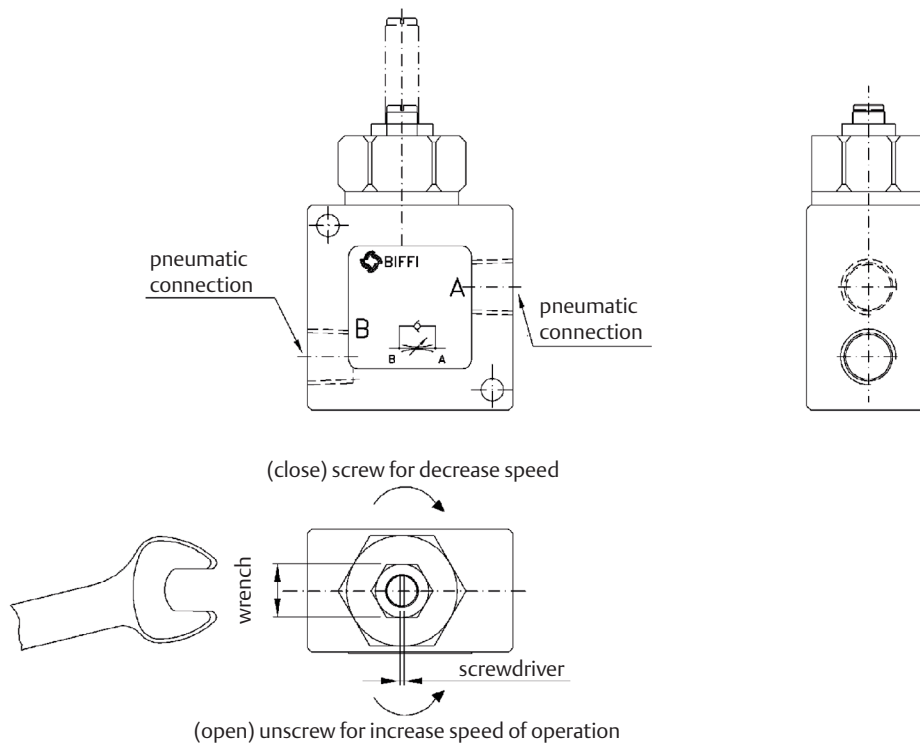
Operate only the micro-switch corresponding to the direction of operation being carried out, as clearly reported on the micro-switch. End of stroke microswitches should be operated before the stop of the stroke of the actuator due to mechanical stops. Adjust the relative cams properly.

3.6 Calibration of the Operation Time

(If required)

The calibration of the operation time is made by Biffi Italia s.r.l. according to customer requirements and to technical data-sheet included in technical documentation. If necessary and required from Customer, it should be possible to modify or reset the operating time through flow regulator valves that check the flow quantity on pneumatic supply, refer to Figure 14.

Figure 14 Example: Adjustment of Operating Time by Flow Regulator Valve



Section 4: Operational Tests and Inspections

NOTICE

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

Section 5: Maintenance

NOTICE

Before executing any maintenance operation, it is necessary to close the pneumatic feed line and discharge pressure from the actuator and from the control unit (if foreseen any) to ensure the safety of maintenance staff.

⚠ WARNING

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

5.1 Periodic Maintenance

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

NOTICE

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

Anyway every 2 years of operation the following is recommended:

- Check that the actuator operates the valve correctly and with the required operating times. If the actuator operation is very infrequent, carry out a few opening and closing operations with all the existing controls (remote control, local control, emergency controls, etc.), if this is allowed by the conditions of the plant.
- Check 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 pneumatic leakages. If necessary tighten the nuts of the pipe-fittings.
- Check the integrity of worn out parts (gaskets, pads etc.).
- If there is an air 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 air. If the filter is made of cellulose, it must be replaced when clogged.

5.2 Extraordinary Maintenance

If there are leaks on RPD actuator 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 follow general sectional drawing and adopting the following procedures.

5.2.1 Replacement of Cylinder Seals

(refer to Table 7)

NOTICE

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

WARNING

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.

Replacement of cylinder seals

(see sectional drawing, Figure 15)

1. Measure the protrusion of the stop screw (30) with reference to the end flange (4) surface, so as to be able to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed.
2. Loosen the lock nut (10) and unscrew the stop screw (30) together with the nut (10), the washer (28) and the sealing washer (17).
3. Remove the nuts (25) from the tie rods (14) at the end flange (4) side.
4. Slide off the end flange (4) and the tube (13). Take care not to damage the plane surfaces of the tube ends.

Seals replacement

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 (AGIP-ENI LCX 2/32 if seals are in NBR/Viton or Neoprene rubber, or with Aeroshell Grease 7 if the seals are in Fluorosilicon rubber). If the O-ring must be replaced, remove the existing one from its groove, clean the groove carefully and lubricate it with protective grease film.

Assemble the new O-ring into its groove and lubricate it with a protective oil film.

1. Replace the O-ring (24) and the piston guide sliding ring (20).
2. Remove the existing gaskets (7) from their seats in the housing (1) and in the end flange (4). Carefully clean the seats and the plane surfaces, at the tube ends, which are in contact with the gaskets.

If the sealing washer (17) must be replaced, measure the protrusion of the stop screw (30) with reference to the end flange surface (4), so as to be able to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed.

1. Loosen the lock nut (10) and remove the travel stop screw (30) together with the nut (10), the washer (28) and the sealing washer (17).
2. Remove the sealing washer from the travel stop screw. Carefully clean and lubricate the travel stop screw thread and the surface of the end flange area, where the sealing washer is.
3. Screw the new sealing washer onto the travel stop until it is in contact with the nut (10). Assemble the washer (28) onto the sealing washer (17).
4. Screw the travel stop screw into the threaded hole of the end flange until it reaches its original position (the same protrusion with reference to the flange surface).
5. Check that the sealing washer (17) and the washer (28) are in contact with the flange surface.
6. Tighten the lock nut (10).

Reassemble

1. Assemble the new cylinder gaskets (7) on its seat on the housing and on the end flange (4).
2. Carefully clean the inside of the tube (13) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate the inside surface of the tube and the bevels at the ends. Slide the cylinder tube onto the piston taking care not to damage the piston O-ring (24).
3. Assemble the end flange (4) centring it on the tube (13). Assemble the nuts (25) onto the tie rods (14). Tighten the nuts to the recommended torque (see table), alternating between opposite corners.

Replacement of mechanism seals

(see sectional drawing, Figure 15)

To replace the O-Rings of the shaft (6) proceed as follows:

1. Remove the retainer ring (21).
2. Disassemble the shoulder washer (8). Remove the existing O-Ring (23) from its groove. Clean the groove and the shaft carefully and lubricate it with protective oil film.
3. Assemble the new O-Ring into its groove and lubricate it with protective oil or a grease film. Assemble the shoulder washer (8). Assemble the retainer ring (21).
4. If the sealing washer (17) has to be replaced, measure the protrusion of the stop screw (30) with reference to the housing (1) surface, so as to be able to easily restore the setting of the actuator mechanical stop, once the maintenance procedures have been completed.
5. Loosen the lock nut (10) and remove the stop screw (30) together with the nut (10), the washer (28) and the sealing washer (17). Remove the sealing washer (17) from the stop screw (30). Carefully clean and lubricate the stop screw thread and the surface on the housing area, where the sealing washer is.
6. Screw the new sealing washer onto the stop screw until it is in contact with the nut (10). Assemble the washer (28) onto the sealing washer (17).

7. Screw the stop screw into the threaded hole of the housing until it reaches its original position (the same protrusion with reference to the housing surface). Check that the sealing washer (17) and the washer (28) are in contact with the housing surface. Tighten the lock nut (10).
8. If the sealing washer (18) has to be replaced, measure the protrusion of the thrust bearing screw (15) with reference to the housing (1) surface, so as to be able to easily restore the setting of the position of the thrust bearing sliding block with reference to the rack once the maintenance procedures have been completed.
9. Loosen the lock nut (26) and remove the screw (15) together with the sliding block (19), the nut (26), the washer (27) and the sealing washer (18). Remove the sealing washer (18) from the screw (15). Carefully clean and lubricate the screw thread and the surface of the housing area, where the sealing washer is.
10. Screw the new sealing washer onto the screw until it is in contact with the nut (15). Assemble the washer (27) onto the sealing washer (18).
11. Screw the thrust bearing screw (15), complete with the sliding block (19), into the threaded hole of the housing until it reaches its original position (the same protrusion with reference to the housing surface).
12. Check that the sealing washer (18) and the washer (27) are in contact with the housing surface. Tighten the lock nut (26).

NOTICE

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

Figure 15

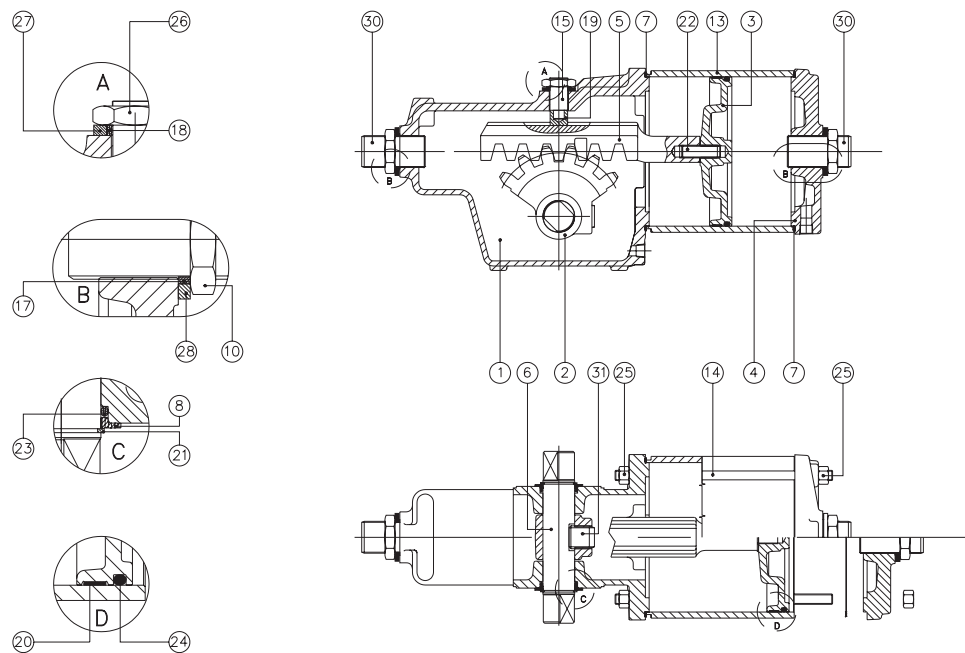


Table 7.

Item	Description
1	Housing
2	Pinion
3	Piston
4	End flange
5	Rack
6	Shaft
7	Cylinder gasket
8	Shoulder washer
10	Nut
13	Cylinder tube
14	Tie rod
15	Thrust bearing screw
17	Sealing washer
18	Sealing washer
19	Sliding block
20	Piston guide sliding ring
21	Retainer ring
22	Screw
23	O-ring
24	O-ring
25	Nut
26	Nut
27	Washer
28	Washer
30	Travel stop screw
31	Screw

5.3 Lubrication of Mechanism

For normal duty the rack and pinion mechanism of the actuator is lubricated "for life".

In case of high load and high frequency of operation it may be necessary to periodically restore lubrication: it is advisable to apply a generous coating of grease on the contact surfaces of moving parts, especially on the surface of the rack in contact with the thrust bearing sliding block and on the teeth of the rack and pinion.

For this operation proceed as follows:

1. Disassemble the actuator from the valve.
2. Measure the protrusion of the stop screw (30) with reference to the end flange surface (4), to be able to easily restore its setting once the maintenance procedures have been completed.
3. Loosen the lock nut and unscrew the stop screw until it is removed.
4. Remove the nuts (25) from the tie rod (14) at the end flange side: they must be gradually unscrewed all at the same time so as to release the thrust of the spring against the flange.
5. Slide off the end flange (4) and the cylinder tube (13).
6. Measure the protrusion of the thrust-bearing screw (15), with reference to the housing surface, so as to be able to restore the right working position of the thrust bearing sliding block with reference to the rack once the maintenance procedures have been completed.
7. Remove from the actuator the complete spring module, the main components of which are the piston (3), the spring (16), the rack spacer rod (12), the spring retainer disk (11) and the rack (5).
8. Remove the spacer tube (33).
9. Lubricate abundantly the teeth of the rack and pinion and the surface of the rack in contact with the thrust bearing sliding block. Use recommended grease.

Prior to reassemble:

1. Check that the actuator components are in good conditions and clean.
2. Substitute the gaskets and the O-Rings if worn or damaged.
3. Assemble all the components, taking care not to damage the seals.

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

Manufacturer:	AGIP
Type:	GR MU/EP2
NLGI grade:	2
Worked preparation (dmm):	280
Drop point ASTM (°C):	185
ISO grade:	X2
Equivalent to:	ESSO BEACON EP2 BP GREASE LTX2 SHELL ALVANIA GREASE R2 ARAL ARALUB HL2 CHEVRON DURALITH GREASE EP2 CHEVRON SPHEEROL AP2 TEXACO MULTIFAK EP2 MOBILPLEX 47 PETROMIN GREASE EP2

For special working conditions and for working temperatures beyond the standard range consult Biffi.

5.4 Dismantling and Demolition

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.

WARNING

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 worksite.

Separate the parts composing the actuator according to their nature (ex. metallic, and plastic materials, fluids etc.) and send them to differentiate waste collection sites, as provided for by the laws and provisions in force.

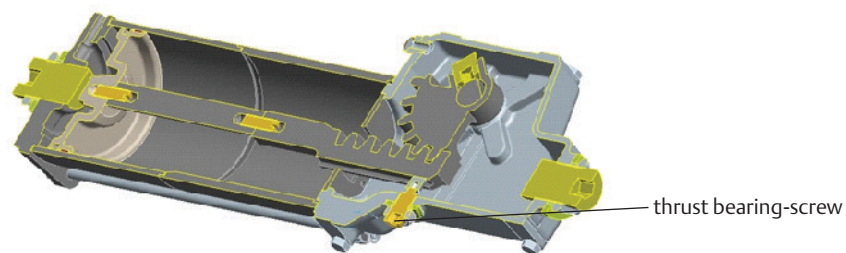
Section 6: Troubleshooting

6.1 Failure or Breakdown Research

Table 8.

Event	Possible cause	Remedy
Actuator does not work	Lack of power supply	Restore it
	Clogged filter	Clean or replace the cartridge
	Blocked valve	Repair or replace
	Failure of the control system	Call Biffi Italia s.r.l. Customer Service
Actuator too slow	Low supply pressure	Restore (Section 1.4)
	Wrong calibration of flow regulator valves	Restore (Section 3.6)
	Wear of the valve	Replace
Actuator too fast	High supply pressure	Restore (Section 1.4)
	Wrong calibration of flow regulator valves	Restore (Section 3.6)
Leakages on hydraulic circuits	Deterioration and/or damage to gaskets	Call Biffi Italia s.r.l. Customer Service
Incorrect position of the valve	Wrong adjustment of mechanical stops	Restore (Section 3.4)
	Wrong warning of micro-switches	Restore (Section 3.5)
Irregular movement of actuator or lower torque value	Wrong adjustment or unscrewing of thrust bearing-screw	See Figure 19

Figure 16



Restore the correct position of thrust bearing-screw, please refer to Figure 16.

Screw the thrust bearing screw (15), complete with the sliding block (19), into the threaded hole of the housing until it reaches the correct original position.

Check that the sealing washer (18) and the washer (27) are in contact with the housing surface. Tighten the lock nut (26).

Section 7: Layouts

7.1 Spare Parts Order

For spare parts order to the relevant Biffi office please make reference to Biffi order confirmation concerning all the supply, and serial number of the actuator, refer to Section 1.2 for any specific spare part for a specific actuator model.

Please send every spare parts request to:

Biffi Italia s.r.l. - Servizio Assistenza Tecnica Clienti

Tel.: 0523-944523

Fax: 0523-941885

e-mail: Biffispares@Emerson.com

Please specify:

1. actuator model
2. Biffi acknowledgement
3. spare parts code
4. quantity
5. transport condition
6. involved people

7.2 Parts List for Maintenance and Replacing Procedure

Figure 17 Double-Acting Pneumatic Actuator

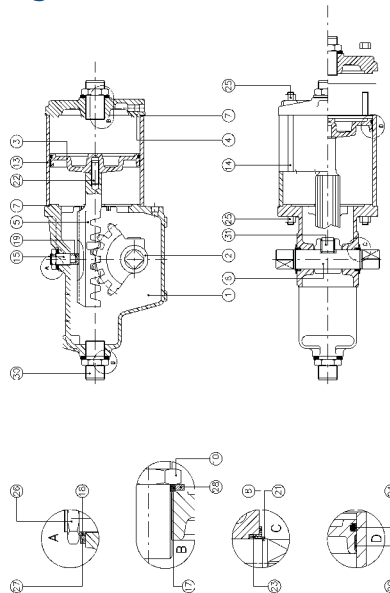


Table 9. Parts list

Item	Qty	Description	Material
1	1	Housing	Nodular cast iron
2	1	Pinion	Nodular cast iron
3	1	Piston	Carbon steel
4	1	End flange	Carbon steel
5	1	Rack	Nodular cast iron
6	1	Shaft	Alloy steel
7	2	Cylinder gasket	*NBR rubber
8	2	Shoulder washer	*Nylon
10	2	Nut	Carbon steel
13	1	Cylinder tube	Nickel plated carbon steel
14	4	Tie rod	Alloy steel
15	1	Thrust bearing screw	Alloy steel
17	2	Seal washer	*PVC
18	1	Seal washer	*PVC
19	1	Thrust bearing sliding block	Bronze
20	1	Piston sliding ring	*Teflon + graphite
21	2	Retainer ring	*Spring steel
22	1	Screw	Alloy steel
23	2	O-ring	*NBR rubber
24	1	O-ring	*NBR rubber
25	8	Nut	Carbon steel
26	1	Nut	Carbon steel
27	1	Washer	Carbon steel
28	2	Washer	Carbon steel
30	2	Stop setting screw	Carbon steel
31	1	Screw	Alloy steel

NOTE:

* Recommended spare parts

Figure 18 Double-Acting Pneumatic Actuator with Manual Jackscrew

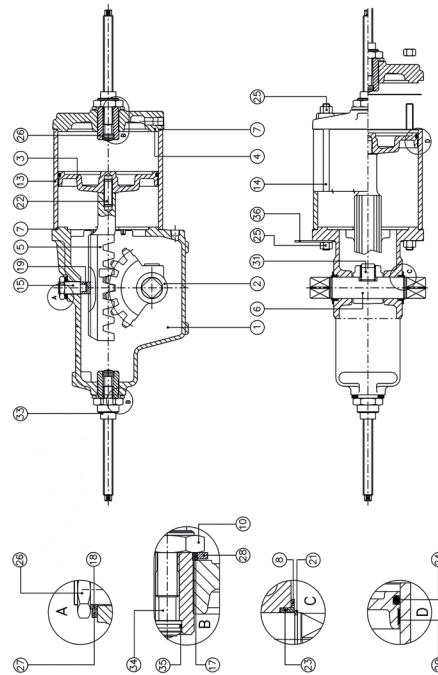


Table 10. Parts list

Item	Qty	Description	Material
1	1	Housing	Nodular cast iron
2	1	Pinion	Nodular cast iron
3	1	Piston	Carbon steel
4	1	End flange	Carbon steel
5	1	Rack	Nodular cast iron
6	1	Shaft	Nickel plated carbon steel
7	2	Cylinder gasket	*NBR rubber
8	2	Shoulder washer	*Nylon
10	2	Nut	Carbon steel
13	1	Cylinder tube	Nickel plated carbon steel
14	4	Tie rod	Alloy steel
15	1	Thrust bearing screw	Alloy steel
17	2	Sealing washer	*PVC
18	1	Sealing washer	*PVC
19	1	Sliding block	Bronze
20	1	Piston guide sliding ring	*Teflon + graphite
21	2	Retainer ring	*Stainless steel
22	1	Screw	Alloy steel
23	2	O-ring	*NBR rubber
24	1	O-ring	*NBR rubber
25	8	Nut	Carbon steel
26	1	Nut	Carbon steel
27	1	Washer	Carbon steel
28	2	Washer	Carbon steel
31	1	Screw	Alloy steel
33	2	Stop setting screw	Bronze
34	2	Manual override jackscrew	Stainless steel
35	2	O-ring	*NBR rubber
36	2	Lifting eyelet	Carbon steel

NOTE:

* Recommended spare parts

Figure 19 Declutchable Manual Override

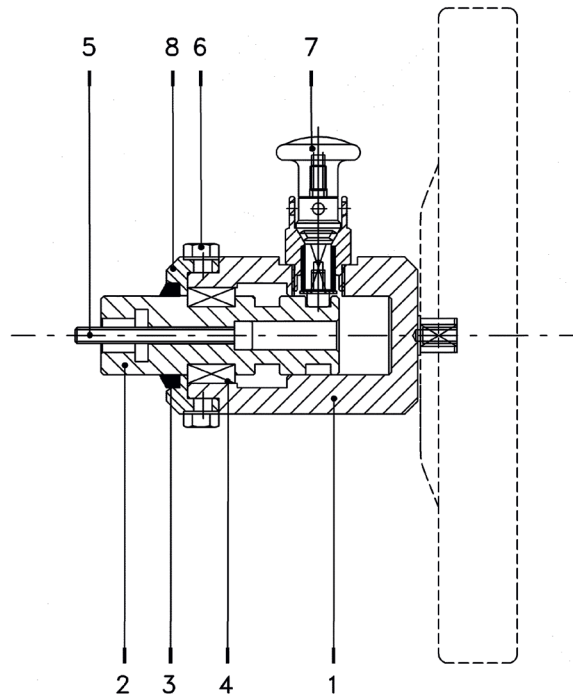


Table 11. Parts list

Item	Qty	Description	Material
1	1	External body	Carbon steel
2	1	Internal body	Carbon steel
3	1	Scrape ring	*Rubber
4	2	Flap	Carbon steel
5	1	Screw	Stainless steel
6	2	Screw	Stainless steel
7	1	Valve lock-unlock	*Viton
8	1	Seat scrape ring	Carbon steel

NOTE:

* Recommended spare parts

Section 8: Date Report for Maintenance Operations

Last maintenance operation date: (in factory, on delivery):
..... exec. by :
..... exec. by :
..... exec. by :

Next maintenance operation date: exec. by :
..... exec. by :
..... exec. by :

Start-up date: (in factory, on delivery)
..... (on plant)

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