



tyco flow control

Checks to be carried out on receipt of the actuator

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

Storage

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

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

air; after such operations, all the threaded connections of the actuator and the valves of the control panel (if present) should be carefully plugged.

Assembling the actuator onto the valve

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).

To assemble the actuator onto the valve proceed as follows:

1. check that the coupling dimensions of the valve flange and stem, or of the relevant extension, meet the actuator coupling dimensions
2. bring the valve in the position related to the actuator spring operation
3. lubricate the valve stem with oil or grease in order to make the assembly easier. Be careful not to pour any of it onto the flange
4. clean the valve flange and remove anything that might prevent a perfect adherence to the actuator flange and especially all traces of grease, since the torque is transmitted by friction
5. assemble the stem extension onto the valve stem
6. bring the actuator to the position caused by the spring operation
7. connect a sling to the support points of the actuator and lift it: make sure the sling is suitable for the actuator weight. When possible, it is easier to assemble the actuator to the valve if the valve stem is in the vertical position. In this case the actuator must be lifted while keeping the flange in the horizontal position
8. clean the actuator flange and remove anything that might prevent a perfect adherence to the valve flange and especially all traces of grease
9. lower the actuator onto the valve so that the shaft output drive enters into the groove of the stem extension. This coupling must take place without forcing and only with the weight of the actuator. When the actuator output shaft and the valve stem are connected, check the holes of the valve flange. If they do not meet with the holes of the spool piece flange or the stud bolts screwed into them, the actuator shaft output drive must be rotated; feed the actuator cylinder with air at the proper pressure or actuate the manual override, if existing, until coupling is possible
10. tighten the nuts of the connecting stud bolts evenly with the torque

prescribed in the table. The stud bolts must be made of ASTM A320 L 7 steel, the nuts must be made of ASTM A194 grade 2 steel

Thread size	Recommended tightening torque (Nm)
M 6	8
M 8	20
M10	40
M12	70
M14	110
M16	160
M20	320
M22	420
M24	550
M27	800
M30	1100

11. if possible, operate the actuator to check that it moves the valve smoothly

Setting 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 positions (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 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:

- loosen the lock nut
- if the actuator angular stroke is stopped before reaching the end position (fully open or closed), unscrew the stop screw by turning it anticlockwise, until the valve reaches the right position. When unscrewing the stop screw, keep the lock nut still with a wrench so that the sealing washer does not withdraw together with the screw
- tighten the lock nut
- if the actuator angular stroke is stopped beyond the end position (fully open or closed), screw the stop screw by turning it clockwise until the valve reaches the right position
- tighten the lock nut

Preparation for start-up

1. 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 pipework 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 deburred 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. Electrical connections

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 explosionproof protection). Screw the cable glands tightly into the threaded inlets, so as to guarantee the weatherproof and explosionproof 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 explosionproof protection codes (where applicable). Once the connections are completed,

check that the controls and signals work properly.

Start-up

During the start-up of the actuator, proceed as follows:

- 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, microswitches, 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 regulators, pressure switches, flow control valves, etc.) meet the plant requirements
- check that 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.

Maintenance

Important: 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 the safety of maintenance staff.

a. Routine maintenance

RPS actuators have been designed to work for long periods in the severest conditions with no need for maintenance. It is, however, advisable to periodically check the actuator as follows:

- 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, local, emergency controls, etc.), if this is allowed by conditions of the plant
- check that the signals to the remote control desk are correct
- check that the air supply pressure value is within the required range
- if there is an air filter on the actuator, bleed the condensed 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

- check that the external components of the actuator are in good conditions
- check all the paint-coat of the actuator. If some areas are damaged, repair the paint-coat according to the applicable specification
- check that there are no leakages in the pneumatic connections. If necessary tighten the nuts of the pipe fittings

b. Special maintenance

If there are air leaks through the seals or a malfunction in the mechanical components, or in case of scheduled preventive maintenance, the actuator must be disassembled and seals must be replaced with reference to the attached sectional drawing and adopting the following procedures:

b1. Replacement of cylinder seals (see sectional drawing)

Disassembly:

- 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
- 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 nuts (25) from the tie rods (14) at the end flange (4) side: they must be gradually unscrewed all at the same time so as to release the thrust of the spring against the flange
- slide off the end flange (4) and the tube (13). The spacer tube (33) must remain in place. Take care not to damage the plane surfaces of the tube ends.

Seals replacement

Prior to reassembly 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 a recommended grease (see paragraph b3). 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.

- Replace the O-ring (24) and the piston guide sliding ring (20).
- Remove the existing gasket (7) from its seat in the end flange (4).
- Carefully clean the seat of the gasket in the end flange (4) and the plane surface of the tube end (13), which is in contact with the gasket (7).
- Carefully clean the ends of the cylinder tube (13) and of the spacer tube (33), which must fit together, to remove any trace of the sealant which assures tightness.
- Remove the sealing washer (17) from the stop screw (30). Carefully clean and

lubricate the stop screw thread and the surface of the end flange area, where the sealing washer is.

- 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).

Reassembly:

- assemble the new cylinder gasket (7) into its seat on the end flange (4)
- carefully clean the inside of the cylinder tube (13) and check that the entire surface, particularly that of the bevels, is not damaged. Lubricate with protective oil the inside of the tube, the bevels and the plane surface at the end flange side
- spread some sealant LOCTITE 510, or equivalent, on the cylinder tube end (13), which is connected to the spacer tube (33)
- slide the cylinder tube (13) onto the piston taking care not to damage the piston O-ring (24)
- assemble the end flange (4) centering 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
- screw the 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)
- check that the sealing washer (17) and the washer (28) are in contact with the flange surface
- tighten the lock nut (10).

b2. Replacement of mechanism seals

(see sectional drawing)

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

- remove the retainer ring (21)
- 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 or a grease film
- 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).

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:

- 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

- 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)
- 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).

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:

- 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
- 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)
- 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)
- check that the sealing washer (18) and the washer (27) are in contact with the housing surface
- tighten the lock nut (26).

b3. 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:

- disassemble the actuator from the valve
- measure the protrusion of the stop screw (30) with reference to the end flange surface (4), so as to be able to easily restore its setting once the maintenance procedures have been completed
- loosen the lock nut and unscrew the stop screw until it is removed

- remove the nuts (25) from the tie rods (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
 - slide off the end flange (4) and the cylinder tube (13)
 - 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
 - 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)
 - remove the spacer tube (33)
 - lubricate abundantly the teeth of the rack and pinion and the surface of the rack in contact with the thrust bearing sliding block. Use a recommended grease.
- Prior to reassembly:
- check that the actuator components are in good conditions and clean
 - substitute the gaskets and the O-rings if worn or damaged
 - 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:

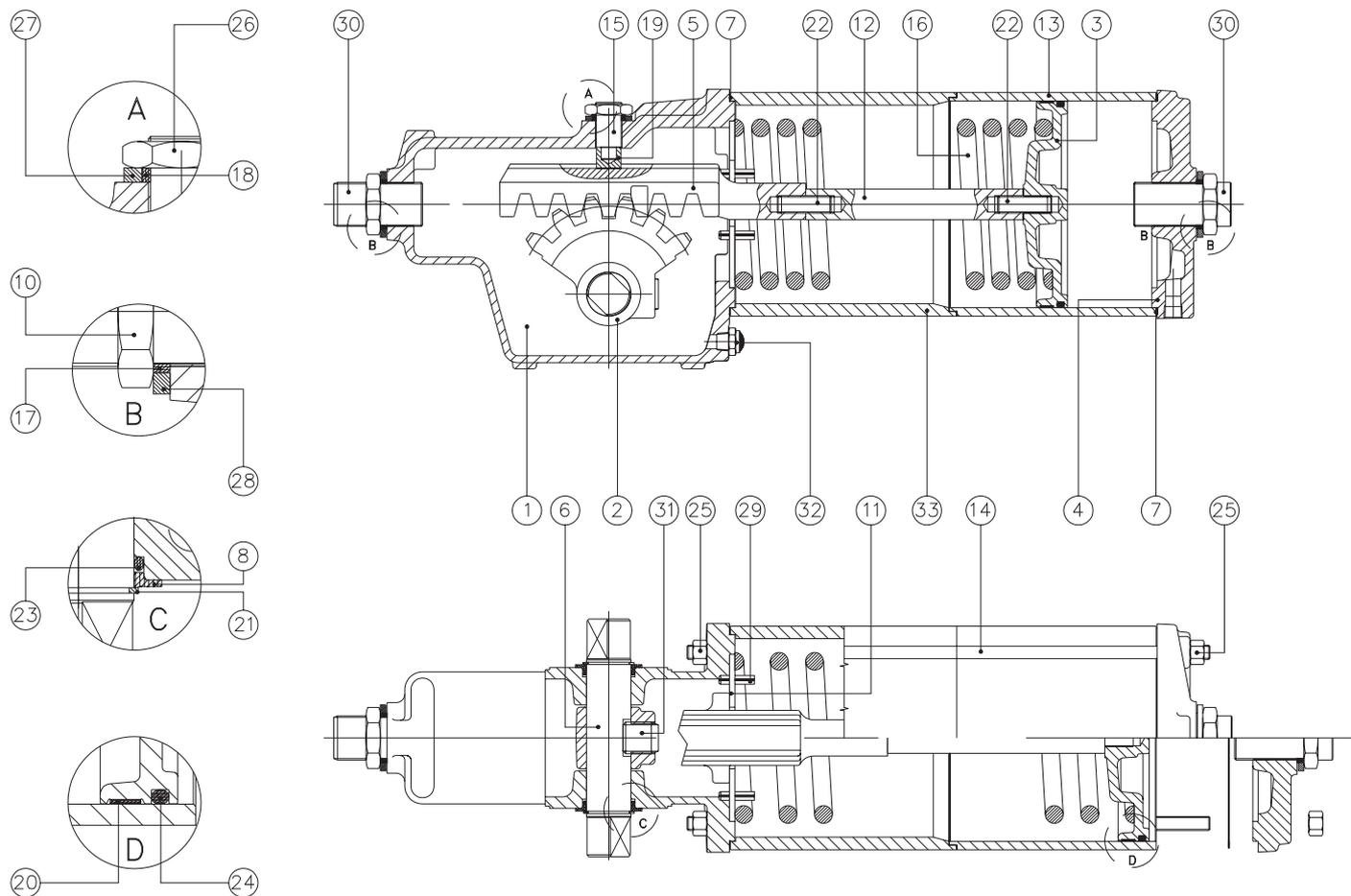
Manufacturer	: AGIP
Type	: GR MU/EPI
NLGI grade	: 1
Worked penetration (dmm)	: 325
Drop point ASTM (°C)	: 185
ISO grade	: X1

Equivalent greases:

ESSO BEACON EP1
BP LTX 1
SHELL ALVANIA GREASE R1

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

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



RPS spring return pneumatic actuator

Item	Name	Item	Name	Item	Name
1.	Housing	13.	Cylinder tube	24.	O - ring
2.	Pinion	14.	Tie rod	25.	Nut
3.	Piston	15.	Thrust bearing screw	26.	Nut
4.	End flange	16.	Spring	27.	Washer
5.	Rack	17.	Sealing washer	28.	Washer
6.	Shaft	18.	Sealing washer	29.	Spring pin
7.	Cylinder gasket	19.	Thrust bearing sliding block	30.	Travel stop screw
8.	Shoulder washer	20.	Piston guide sliding ring	31.	Screw
10.	Nut	21.	Retainer ring	32.	Vent plug
11.	Spring retainer disk	22.	Screw	33.	Spacer tube
12.	Rack spacer rod	23.	O - ring		

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