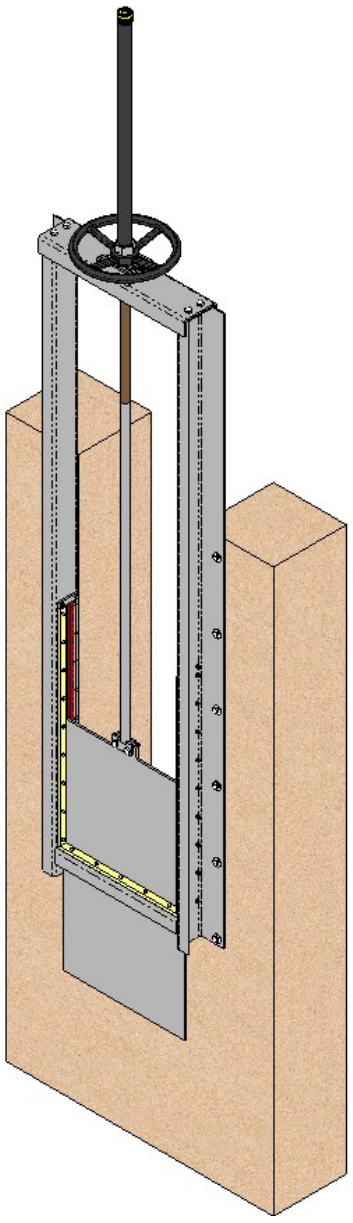
10/04/2013

INSTRUCTIONS AND MAINTENANCE MANUAL

SERIES: RE



ASSEMBLY

APPLICATION OF EUROPEAN DIRECTIVES

See document of European Directives applicable to **CMO Valves.**

The **RE** penstock complies with the Directive on Equipment and Protective Systems for Potentially Explosive Atmospheres. In these cases the logo will appear in the identification label. This label shows the exact classification of the zone in which the penstock can be used. The user is responsible for its use in any other zone.

HANDLING

Pay special attention to the following points when handling the equipment:

- **SAFETY WARNING**: Before handling the penstock, check that the crane to be used is capable of bearing its weight.
- Do not lift the penstock or hold it by the actuator. Lifting the penstock by the actuator can lead to operating problems as it is not designed to withstand the penstock's weight.
- When lifting the penstock, take care not to damage the sealing joints, as this may lead to leakage during the operation of the penstock.
- To prevent damage, especially to the anticorrosive protection, it is recommended to use soft straps to lift the CMO overflow penstocks. These straps must be secured around the side profiles in the upper part of the body.
- If the equipment is packed in wooden boxes, these must be provided with clearly marked holding areas where the slings will be placed when securing them. In the event that two or more penstocks are packed together, separation and securing elements must be provided between them to prevent possible movements, knocks and friction during transport. When storing two or more penstocks in the same box you must ensure they are correctly supported to prevent deformations. In the case of dispatch by sea we recommend the use of vacuum bags inside the boxes to protect the equipment from contact with sea water.
- Pay special attention to maintaining the correct levelling of the penstocks during loading and unloading as well as during transport to prevent deformations in the equipment. For this purpose we recommend the use of mounts or trestles.

INSTALLATION

In order to avoid personal injury and other types of damage (to the facilities, the penstock, etc.), we recommend following these instructions:

- The staff responsible for the installation or operation of the equipment must be qualified and trained.
- Use suitable Personal Protective Equipment (PPE) (gloves, safety boots, goggles, etc.).
- Shut off all lines which affect the penstock and put up a warning sign to inform about the work being carried out.
- Completely isolate the penstock from the whole process. Empty the channel.
- Drain all the fluid from the channel through the penstock.
- Use non-electric hand tools during installation and maintenance, in accordance with **EN13463-1 (15)**.

Before installation, inspect the penstock to ensure no damage has occurred during transport or storage. Make sure that the side profiles and inside of the penstock body and, in particular, the seal area are clean. Inspect the wall intended for installation of the penstock, making sure it is clean and flat.

The **RE** penstock can be used as unidirectional or bidirectional:

- When **bidirectional**, the fluid may come in either direction.
- When **unidirectional**, the fluid always comes in the same direction.

Whether the penstock is bidirectional or unidirectional, and in this case favourable or unfavourable, CMO manufactures them with a single design. Their specific sealing profile ensures these penstocks work correctly in any of the aforementioned situations.

ASPECTS TO BE CONSIDERED DURING ASSEMBLY

RE series overflow penstocks have a specific design in order to regulate the fluid level in the channel. The position of the gate can be vertically adjusted; placing the gate in a lower position will allow overflow above it, thus obtaining less fluid level on the other side of the gate. Given the design, it must be ensured that there is groove for the gate to move up and down freely. For this reason, the most common location for this type of penstock is usually at the end of a channel, supported on the wall and secured with chemical or expansion anchors (fig. 1), although, as can be seen in fig. 2, there is also another assembly option.

Secured to the wall (standard)

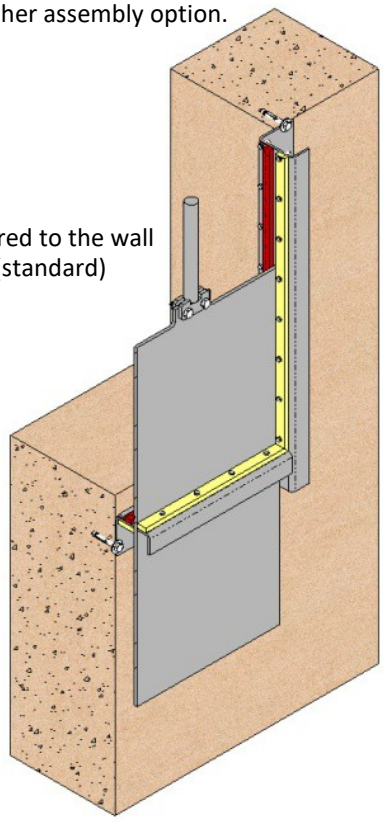


fig. 1

Embedded in the channel

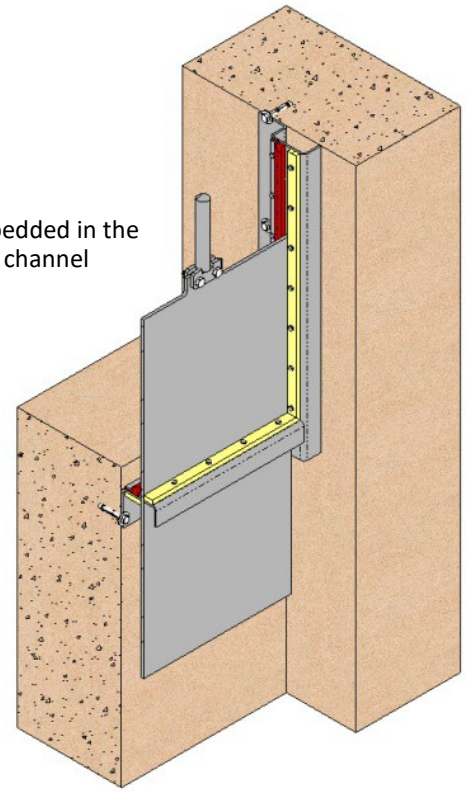


fig. 2

Whatever the fastening option, the lower and side profiles are always secured with chemical or expansion anchors. Carry out the following steps to assemble the penstock:

- It is important that the concrete support faces are smooth and level.

-Place the penstock in completely closed position (i.e. in the upper position) in the wall, ensuring it coincides with the gap in the channel. To do this, position the top side of the body's lower profile 50 mm below the base of the channel, meaning that the upper edge of the gate is aligned with the base of the channel when the penstock is completely open (gate in lower position), therefore providing continuous passage.

- Using the holes of the body of the penstock as a guide, make the boreholes necessary in the wall for the chemical or expansion anchors.

- Remove the penstock from the wall and apply sealing paste such as SIKAFLEX-11FC or similar in order to prevent leakages between the body and the wall.

- Return the penstock to its location above the sealing paste and introduce the chemical or expansion anchors. These anchorings must also be suitable for the operating conditions and their measurements must be in accordance with the approved plans.

- Once all the chemical or expansion anchors are in place, carry out the initial tightening with low torque and then, once all the anchors have been slightly tightened, carry out the final crosswise tightening. Finally tighten using a flat rule supported on the body, tightening the chemical or expansion anchors. Do not secure too firmly as this may result in loss of shape in the penstock; stop tightening as soon as the body begins to lose shape. The final torque must be correct in accordance with the applicable standard.

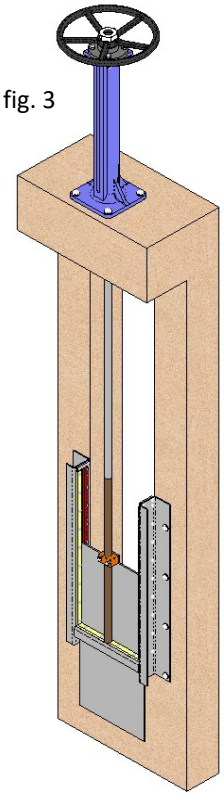
This procedure can be used for both wall mounted penstocks (fig. 1) and for penstocks embedded in the channel (fig. 2).
The following points should be taken into account after installing the penstock:

- The equipment must be firmly secured to the wall or channel.
- As regards scaffolding, ladders and other auxiliary elements to be used during assembly, follow the safety recommendations indicated in this dossier.
- Once the equipment has been assembled, make sure that there are no elements which can interfere with the gate movement.
- Make the relevant connections (electrical, pneumatic, hydraulic) in the equipment's actuator system following the instructions and wiring diagrams supplied with it.
- The assembly of the equipment must be coordinated with the site's control and safety staff and no modifications are permitted in the equipment's external indication elements (limit switches, positioners, etc.).
- When operating the equipment, follow the safety recommendations indicated in this dossier.

ASSEMBLY POSITIONS

This type of penstock is mounted in vertical walls in which there is a square or rectangular orifice (fig. 3), or at the end of an open channel (fig. 4). It is important to ensure that there is sufficient space in the base for the gate to move up and down freely.

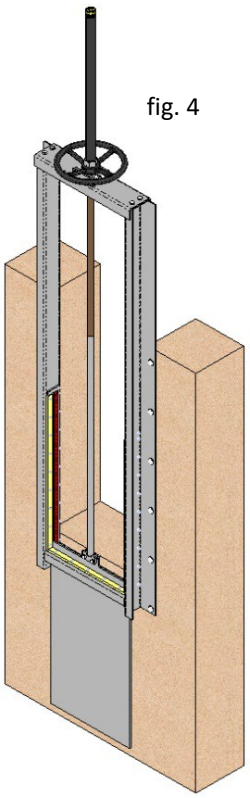
fig. 3



The penstock position is always vertical.

Once the penstock has been installed, check that all the screws and nuts have been correctly tightened and that the whole penstock operation system has been correctly adjusted (electrical connections, pneumatic connections, instruments, etc).
All CMO penstocks are tested at its facilities, although the penstock may have become damaged during handling or transport. Once the penstock is installed, it is very important to check that there is no leakage when fluid load is applied to the penstock.

fig. 4



Once the penstock is in place, check the electrical or pneumatic connections. If the penstock has electrical accessories or you are in an ATEX zone, earth connections must be made before operating it. If you are in an ATEX zone, check the continuity between the different elements of the penstock (EN 12266-2, annex B, points B.2.2.2. and B.2.3.1.). Check the earth connection of the penstock.

ACTUATOR

HANDWHEEL (rising stem, non-rising stem and gearbox)

In order to operate the penstock: turn the handwheel clockwise to close or anti-clockwise to open. It is possible to stop the handwheel from turning at any degree of opening of the penstock; this will maintain its position since the actuator is self-locking.

CHAINWHEEL

To operate the penstock, pull one of the chain's vertical drops, taking into account that sealing is carried out when the wheel turns clockwise. It is possible to stop pulling the chain at any degree of opening of the penstock; the gate will maintain its position since the actuator is self-locking.

LEVER

First loosen the position locking clamp located on the yoke. Once it is unlocked, lower the lever to open or raise it to close. Lock the lever again to finish the operation. This actuator also allows the possibility of locking at any degree of opening.

PNEUMATIC (double and single acting)

CMO pneumatic actuators are designed to be connected to a pneumatic grid of between 6 kg/cm² and 10 kg/cm².

The pressurised air used for the pneumatic actuator must be dry and correctly filtered and lubricated.

This type of actuator does not require any adjustment, due to the fact that the pneumatic cylinder is designed for the exact stroke required by the penstock.

HYDRAULIC (double and single acting)

CMO hydraulic actuators are designed to work at a standard pressure of 135 kg/cm² (other pressures can be used in accordance with needs).

This type of actuator does not require any adjustment, due to the fact that the hydraulic cylinder is designed for the exact stroke required by the penstock.

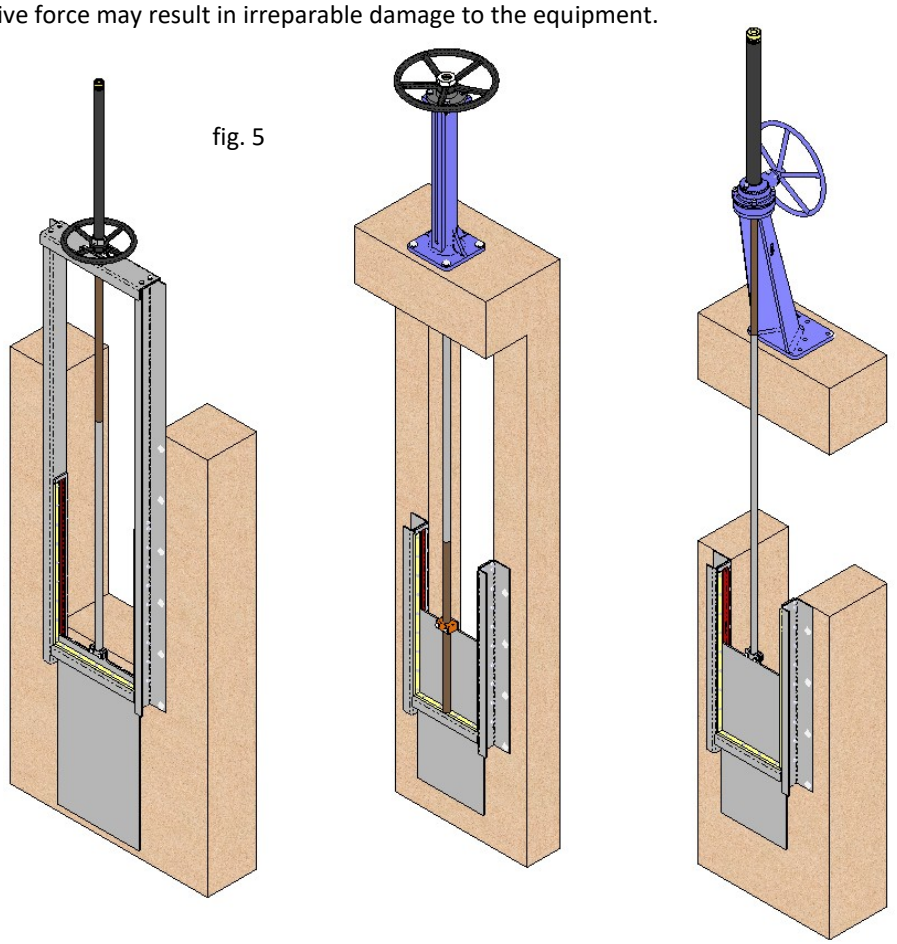
MOTORISED (rising, non-rising stem)

If the penstock is fitted with a motorised actuator, the instructions of the supplier of the electric actuator will be included.

Motorised actuators must have torque limiters and limit switches in order to prevent damage to the equipment.

Manual actuators (wheel, gearbox, lever, etc.) should not be subjected to excessive force (max. 25 kg). Excessive force may result in irreparable damage to the equipment.

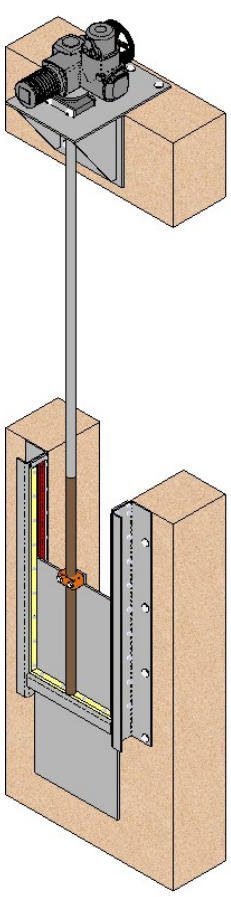
fig. 5



Handwheel with rising stem

Handwheel with NON-rising stem

Handwheel with gearbox



Electric motor actuator

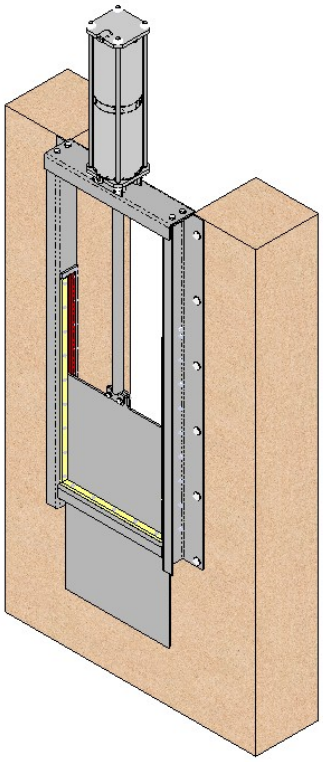
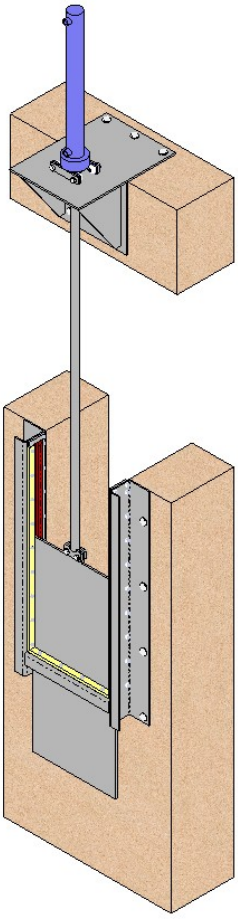


fig. 6

Pneumatic actuator



Hydraulic actuator

The handwheel, chainwheel, gearbox and motor actuators are also available with non-rising stem.

MAINTENANCE

CMO will not be liable if the penstocks suffer any damage due to improper handling or without proper authorisation. The penstocks must not be modified except under express authorisation from CMO. The following instructions should be followed in order to avoid personal injury or material damage when carrying out maintenance tasks:

- The staff responsible for the maintenance or operation of the equipment must be qualified and trained.
- Use suitable Personal Protective Equipment (PPE) (gloves, safety boots, goggles, etc.).
- Shut off all lines which affect the penstock and put up a warning sign to inform about the work being carried out.
- Completely isolate the penstock from the whole process. Empty the channel.
- Drain all the fluid from the channel through the penstock.
- Use non-electric hand tools during maintenance, in accordance with **EN13463-1 (15)**.

The only maintenance required in this type of penstocks is to change the rubber sealing joint. It is recommended to check the sealing joint every 6 months, however its working life will depend on the working conditions of the penstock, such as: pressure, temperature, number of operations, type of fluid and others. These sealing joints are screwed on with flanges; both the flanges and the screws are made of stainless steel, and can be reused several times.

In an ATEX zone, electrostatic charges may be present inside the penstock, which can cause a risk of explosion. The user will be responsible for carrying out the appropriate actions in order to minimise the risks.
The maintenance staff must be informed about the risks of explosion and ATEX training is recommended.

Carry out regular cleaning of the penstock in order to prevent the build-up of dust.
Avoid re-painting the products supplied.

IMPORTANT SAFETY ASPECTS

- In order to work under ideal safety conditions, the magnetic and electrical elements must be in idle mode and the air tanks depressurised. The electrical control cabinets must also be out of service. The maintenance staff must be up to date with the safety regulations and work can only start under orders from the site's safety staff.
- The safety areas must be clearly marked, avoiding the use of auxiliary equipment (ladders, scaffolding, etc.) in levers or moving parts in order to produce the movement of the knife gate.
- In units fitted with spring return actuators, the gate must be mechanically locked and only unlocked when the actuator is pressurised.
- In units fitted with an electric actuator, it is recommended to disconnect it from the mains in order to access the moving parts without any risk.
- Its great importance means you should check that the penstock's shaft has no load before disassembling the actuator system.

Taking into account the recommendations indicated, below we indicate the maintenance operations carried out in this type of equipment:

REPLACING THE SEALING JOINT

1. Make sure there is absolutely no pressure and fluid in the channel.
2. Loosen the yoke (when present) and the stoppers (7). Remove the gate through the upper part of the body along with the stem or rod in order to change the seal more easily.
3. Loosen and extract the screws (8, 9 and 10) which secure the flanges (4) and the seal (3). Loosening the screws will also release the lower slide (6) which is secured at the bottom of the lower profile; ensure that this does not fall. The front slides do not need to be released (5).
4. Remove the flanges (4) and finally the deteriorated sealing joint (3), then clean the housing.

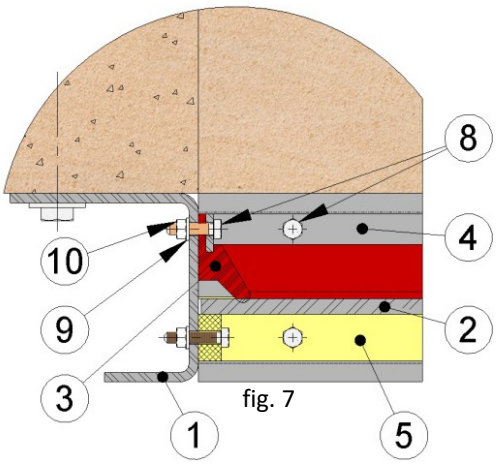
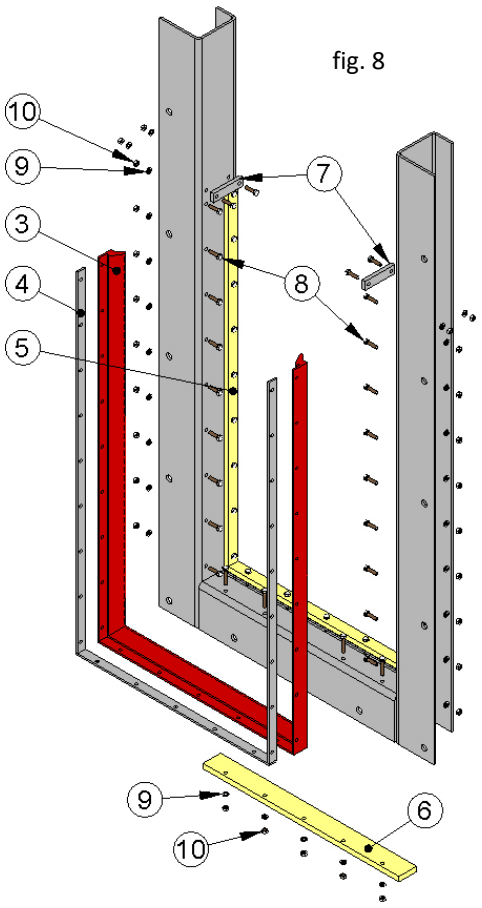


fig. 7

5. Fit a new seal joint (3) impregnated with petroleum jelly, with the same dimensions as the old one.
6. Replace the flanges (4), securing the sealing joint (3) and checking they are correctly assembled, without forgetting to position the lower slide (6), and then screw down.
7. Start to introduce the gate with the rod or stem through the upper part of the body, and carefully allow it to descend. When the gate has descended to the side profiles of the seal (3), mount the start of the seal on the gate as shown in fig. 7. Once the start of the seal (3) is correctly in place, allow the gate to continue descending, checking that the seal is positioned automatically. When the gate touches the lower profile of the seal (3), stop the descent in order to mount the lower profile of the seal (3) on the gate. In this case this will be throughout the width of the penstock, otherwise there is a risk of the lower profile of the seal (3) becoming trapped between the gate and the body.
8. Once the gate has been introduced in the body, re-screw both the yoke and the stoppers (7).
9. Before starting up the installation, carry out several operations to open and close the penstock while empty.

fig. 8



Note: The numbers in brackets refer to fig. 8.

Note: During the assembly of the new sealing joint it is recommended to apply petroleum jelly to the sealing joint to facilitate the assembly process and the correct operation of the penstock (do not use oil or grease); table 1 below shows details of the petroleum jelly used by CMO:

PETROLEUM JELLY		
Saybolt colour	ASTM D-156	15
Melting point (ºC)	ASTM D-127	60
Viscosity at 100ºC	ASTM D-445	5
Penetration 25ºC mm./ 10	ASTM D-937	165
Silicone content	None	
Pharmacopeia BP	OK	

Table 1

LUBRICATION

It is recommended to lubricate the stem twice a year by removing the protection cap and filling it with grease up to half its volume. In the case of actuator with non-rising stem, apply the grease directly throughout the threaded surface of the stem.

After maintenance in an ATEX zone, it is necessary to check the electrical continuity between the different parts of the penstock, such as the body, gate, stem, etc, Standard EN 12266-2, Annex B, points B.2.2.2. and B.2.3.1.)

PNEUMATIC ACTUATOR MAINTENANCE

The pneumatic cylinders in our penstocks are manufactured and assembled at our premises. The maintenance of these cylinders is simple, if you need to replace any elements or have any questions please check with CMO. Below is an exploded diagram of the pneumatic actuator and a list of the cylinder's components. The top cover and the support cover are made of aluminium, although pneumatic cylinders over Ø200 mm are made of cast iron GJS-400.
The maintenance kit normally includes: the bushing and its sealing joints and the scraper, and, if the customer wishes, the piston is also supplied. The steps to follow to replace these parts are shown below.

1. Place the penstock in open position and shut off the pneumatic circuit pressure.
2. Loosen the cylinder air input connections.
3. The gate must be locked to ensure it does not come down and damage the sealing joints when the piston is released. This can be done by, for example, placing a wooden plug between the slides and the stem lugs.
4. Release and remove the top cover (5), the casing (4) and the tie rods (16).
5. Loosen the nut (14) which connects the piston (3) to the rod (1), and remove the parts. Disassemble the cir-clip (10) and remove the socket (7) with its O-rings (8,9) .
6. Release and remove the support cover (2), in order to remove the scraper (6).
7. Replace the deteriorated parts with new ones and assemble the actuator in the reverse order to that described for disassembly.

PNEUMATIC ACTUATOR		
POS.	DESCRIPTION	MATERIAL
1	ROD	AISI-304
2	SUPPORT COVER	ALUMINIUM
3	PISTON	S275JR + EPDM
4	CASING	ALUMINIUM
5	UPPER COVER	ALUMINIUM
6	SCRAPER	NITRILE
7	BUSHING	NYLON
8	EXTERIOR O-RING	NITRILE
9	INTERIOR O-RING	NITRILE
10	CIR-CLIP	STEEL
11	WASHER	ST ZINC
12	O-RING	NITRILE
13	WASHER	ST ZINC
14	SELF-LOCKING NUT	5.6 ZINC
15	O-RING	NITRILE
16	TIES	F-114 ZINC
17	WASHER	ST ZINC
18	NUT	5.6 ZINC
19	SCREW	5.6 ZINC
20	WASHER	ST ZINC
21	NUT	5.6 ZINC

Table 2

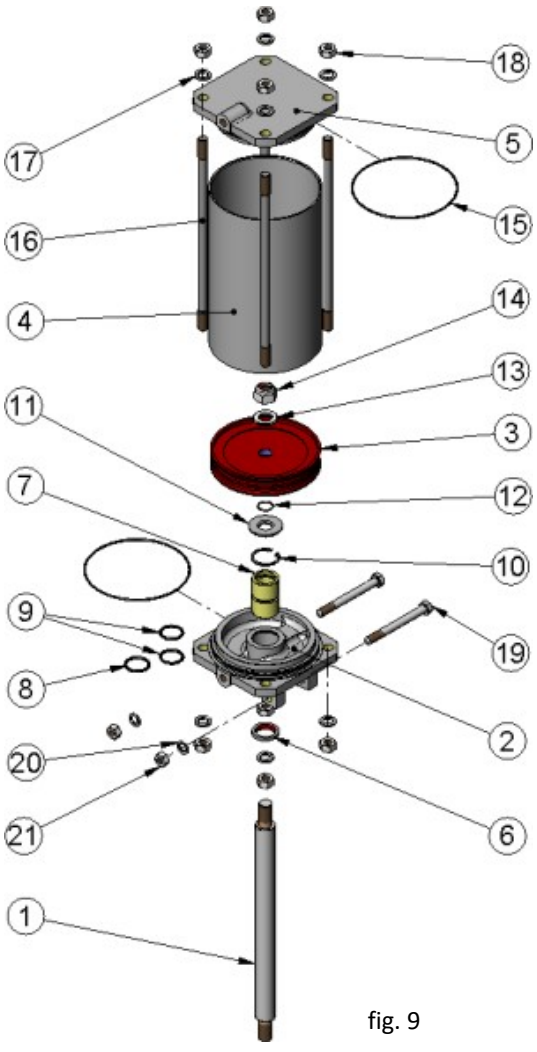


fig. 9

STORAGE

To ensure the penstock is in optimum conditions of use after long periods of storage, it should be stored in a well-ventilated place at temperatures below 30ºC.

It is not advisable, but, if stored outside, the penstock must be covered to protect it from heat and direct sunlight, with good ventilation to prevent humidity. The following aspects must be considered for storage purposes:

- The storage place must be dry and under cover.
- It is not recommended to store the equipment outdoors with direct exposure to adverse weather conditions, such as rain, wind, etc, even when the equipment is packaged.
- This recommendation is even more important in areas with high humidity and saline environments. Wind can carry dust and particles which can come into contact with the penstock's moving parts and this can lead to operating difficulties. The actuator system can also be damaged due to the introduction of particles in the different elements.
  - The equipment must be stored on a flat surface to avoid loss of shape. If the equipment is stored without suitable packaging it is important to keep the penstock's moving parts greased, for this reason it is recommended to carry out regular checks and lubrication.
  - Likewise, if there are any machined surfaces without surface protection, it is important for some form of protection to be applied to prevent the appearance of corrosion.

COMPONENTS LIST (manual penstock with yoke)

POS	DESCRIPTION
1	BODY
2	GATE
3	SEALING JOINT
4	FLANGE SEAL
5	FRONT SLIDE
6	LOWER SLIDE
7	STOPPER
8	STEM
9	STEM STOPPER
10	YOKE
11	ACTUATOR YOKE
12	STEM NUT
13	STOPPER NUT
14	HANDWHEEL
15	HOOD NUT
16	HOOD
17	PROTECTION CAP

Table 3

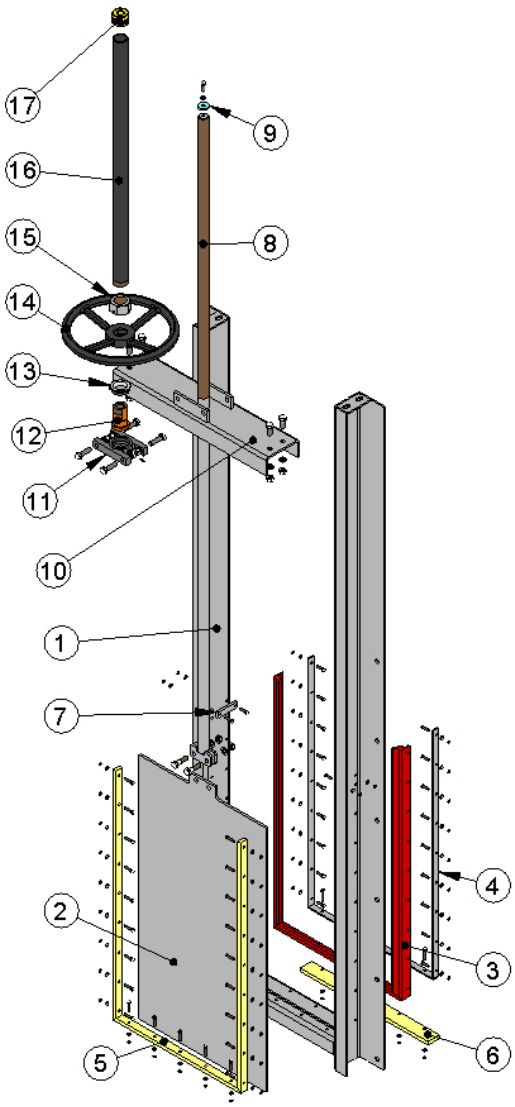


Fig. 10