



CONSTRUCCIONES
METÁLICAS
DE OBTURACIÓN, S.L.

CMO



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MANAGEMENT
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COFFERDAM GATE

AT SERIES

19/04/2013

INSTRUCTIONS AND MAINTENANCE MANUAL

SERIES: AT



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ASSEMBLY

THE AT PENSTOCK COMPLIES WITH THE FOLLOWING:

Machinery Directive: **DIR 2006/42/EC (MACHINERY)**.

Pressure Equipment Directive: **DIR 97/23/EC (PED) ART.3, P.3.**

Potentially Explosive Atmospheres Directive (optional): **DIR 94/9/EC (ATEX) CAT.3 ZONE 2 and 22 GD.**

The **AT** 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.
- 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 cofferdam gates. These straps must be secured around the side profiles in the upper part of the body, or in the lifting lugs in the top of the gate.
- 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 harm 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 conduit or channel.
- Drain all the fluid from the conduit or 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.



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Make sure that the inside of the penstock body side profiles and, in particular, the seal area are clean. Inspect the wall or channel space intended for installation of the penstock, making sure it is clean and flat.

The AT penstock can be unidirectional or bidirectional:

- When **bidirectional**, the fluid may come in either direction.
- When **unidirectional**, the fluid always comes in the same direction. It is necessary to define whether it is favourable or unfavourable:
 - If it is favourable, the direction of the fluid pressurises the gate seal against the body.
 - If it is unfavourable, the fluid direction tends to separate the seal located in the wall gate; in this case the design of the penstock is identical to bidirectional.

ASPECTS TO BE CONSIDERED DURING ASSEMBLY

Channel assembly

The most common system is to concrete these penstocks (**fig. 1**), although there are other assembly options, as seen in **fig. 2 and 3**.

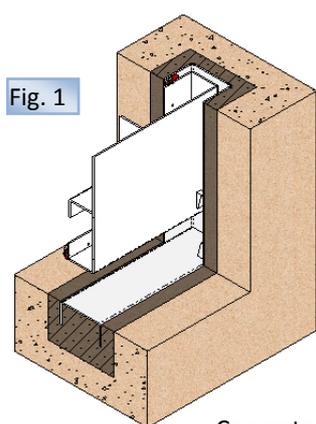


Fig. 1

Concreted
sides and base

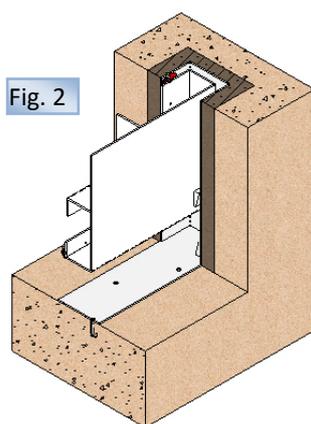


Fig. 2

Flat base and
concreted sides

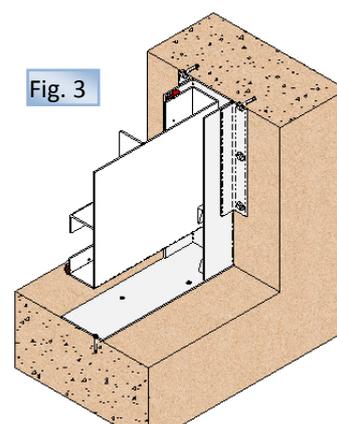


Fig. 3

Flat sides and
base

- Proceed as follows to mount the concreted penstock (fig.1):
 - After ensuring that the holes of the channel are clean and of sufficient size, proceed to position the penstock in these holes. In this process it is particularly important that the seal joint in the gate is on the downstream side (in the case of unidirectional only).
 - Once the penstock is positioned in the holes, align it horizontally with regards to the channel and vertically make sure that the base of the penstock is level with the channel. In this manner, there are no protrusions in the channel, achieving entirely continuous passage.
 - After correctly levelling the penstock, carry out the second stage of concreting, which involves filling in the channel holes, ensuring there is no protrusion in the channel.

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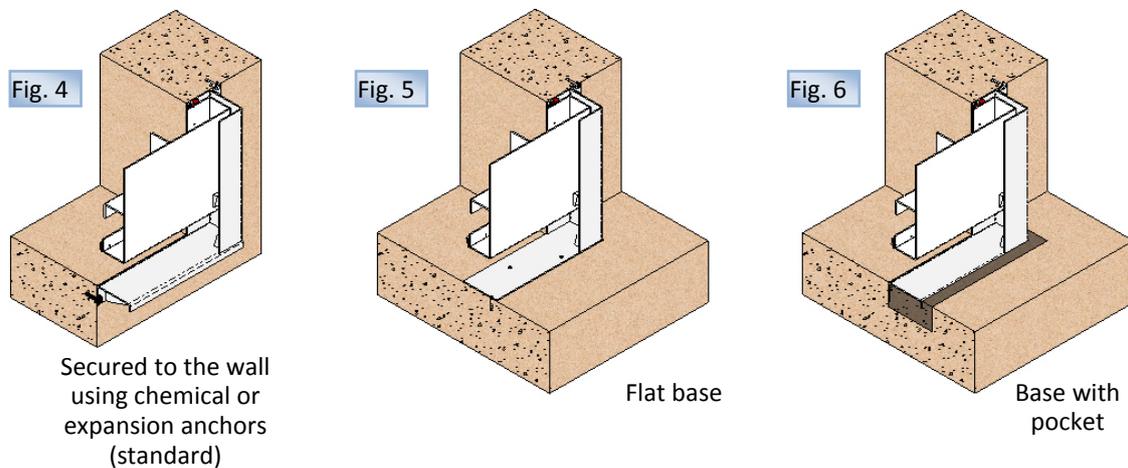
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- Proceed as follows to mount the penstock using chemical or expansion anchors (fig. 3):
 - Begin by placing the penstock in the channel in the required location. In this case it is also particularly important for the gate seals to be on the downstream side (in unidirectional only).
 - Using the holes of the body of the penstock as a guide, make the boreholes necessary in the channel for the chemical or expansion anchors.
 - Remove the penstock and apply sealing paste such as SIKAFLEX-11FC or similar in order to prevent leakages between the body and the channel.
 - 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. The final torque must be correct in accordance with the applicable standard.

Wall assembly

Another way to assemble these penstocks is supported on the wall and secured with expansion or chemical anchors (**fig. 4**), although there are also other assembly options (**fig. 5 and 6**).

Whatever the fastening option, the upper and side profiles (in 4-sided seal) are always secured with chemical or expansion anchors; for this reason it is very important that the wall is completely flat, otherwise the body could become deformed and suffer irreparable damage when starting to tighten the anchors. It is therefore recommended to use a flat rule when screwing down the body. Support the rule on the body and begin to tighten the chemical or expansion anchors, and stop tightening as soon as the body begins to lose shape.



- Proceed as follows to mount the penstock using chemical or expansion anchors (fig. 4):
 - The concrete surface where the frame is mounted must be smooth and level.
 - Start by placing the body on the wall, ensuring the passage of the penstock coincides with the wall orifice.
 - 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 frame and apply sealing paste such as SIKAFLEX-11FC or similar in order to prevent leakages between the body and the wall.
- Return the frame 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. Tighten using a flat ruler, avoiding overtightening which may cause loss of shape of the penstock. The final torque must be correct in accordance with the applicable standard.

This procedure can also be used for flush base penstocks (**fig. 5**).

- Proceed as follows to mount the penstock with the base embedded in the concrete (**fig.6**):
 - The building work must include a pocket in the ground, which should be clean and of sufficient size.
 - Position the penstock in the pocket and align it with regards to the wall orifice, ensuring that the base of the penstock is level with the building work, thus meaning there is no protrusion in the base and guaranteeing entirely continuous passage.
 - Keeping the penstock in this position, make the boreholes necessary for the upper and side profiles, using the holes of the body of the penstock as a guide.
 - Remove the penstock and apply sealing paste such as SIKAFLEX-11FC or similar where the penstock is to be located on the wall, in order to prevent leakages between the body and the wall.
 - Return the penstock to its location above the sealing paste and screw down with chemical or expansion anchors using the usual procedure, namely with the help of a flat rule, screwing crosswise and without excessive force.
 - After correctly securing the upper and side profiles, proceed with the second layer of cementing. This involves filling the base pocket with concrete, ensuring there is no protrusion in the passage of the fluid.

The concreted penstock can be installed with chemical or expansion anchors; in both cases the following must be taken into account:

- The equipment must be firmly secured to the wall or channel.
- As regards to 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.
- 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.).

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ASSEMBLY POSITIONS

This type of penstock is mounted in open horizontal channels (fig. 7), or in vertical walls (fig. 8), the penstock position must always be vertical.



Fig. 7



Fig. 8

As described above, in unidirectional penstocks it is very important to ensure that the gate seal is on the downwater side (fig. 9); the seal is the red element.

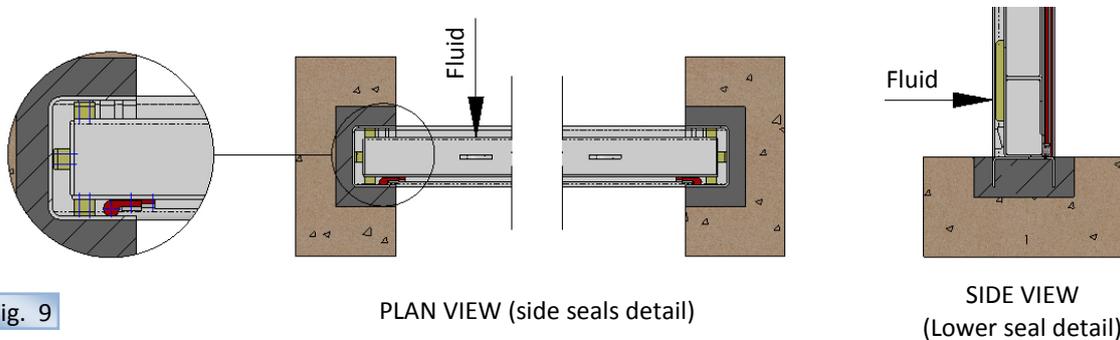


Fig. 9

PLAN VIEW (side seals detail)

SIDE VIEW
(Lower seal detail)

Once the penstock has been installed, check that all the screws and nuts have been correctly tightened. 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.

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.

OPTIONAL

Different options are available to adapt the penstock to specific working conditions such as:

Slide with wheels

The cofferdam gates are supplied with Nylon slides (HD500) as standard.

The slide is designed with a wheel rolling system for large pressures.

This system performs better in large size gates or gates with high water loads (fig. 10).

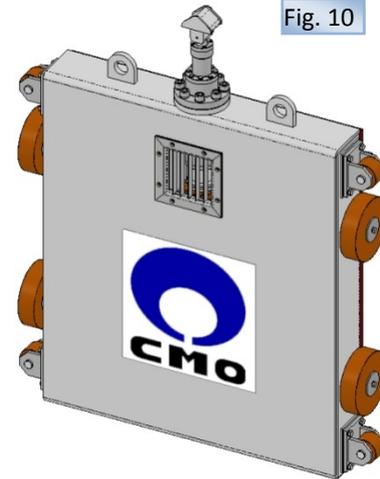


Fig. 10

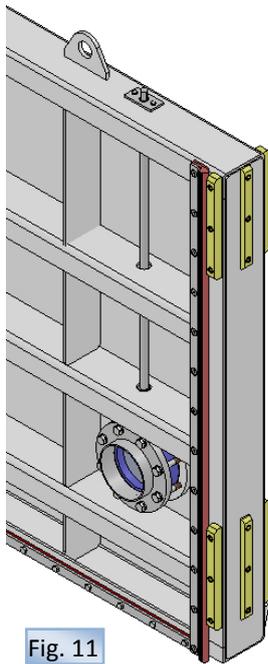


Fig. 11

By-pass (fig. 11):

A bypass system can be mounted for easier opening. With the valve installed, opening the bypass reduces the pressure of the penstock on the seal and makes it easier to open.

-Allow the passage of a controlled amount of water or ecological flow.
Opening and closing is carried out manually from the top section.

- Modular penstocks (fig. 12):

This type of valve can be supplied with modular penstocks. These gates are divided into several sections which fit together and are sealed with rubber seals.

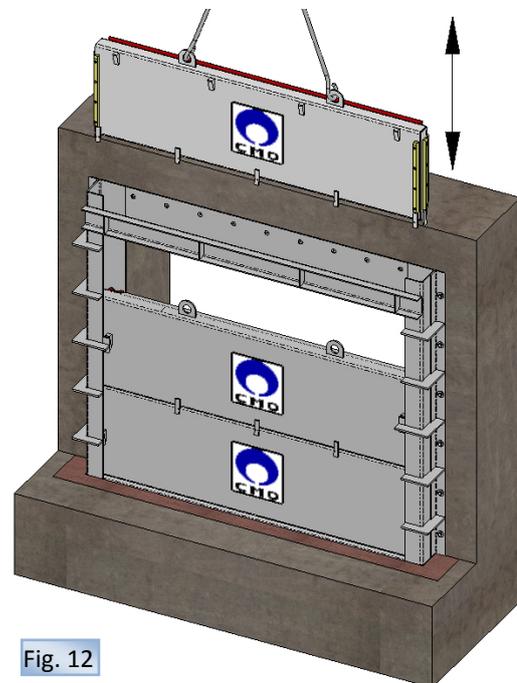


Fig. 12

It is often used in places in which access with large-sized valves is limited due to the building work involved.

- Epoxy Coating:

All carbon steel components and bodies of CMO penstocks are EPOXY coated, giving them great resistance to corrosion and an excellent surface finish. CMO's standard colour is blue RAL-5015.

- Mechanical locking device:

Allows the penstock to be mechanically locked in a position.

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Hoist beam (fig. 13 and 14)

The hoist beam is used to lift or lower cofferdam gates installed in difficult access areas (deep wastewater systems, inlets, etc). It is fitted with a mechanical device which attaches to the gate or releases it. The steps to follow in order to position and extract the gate are:

- A. Lower the gate and the hoist beam guided by the body.
- B. When the gate reaches the bottom, the hoist beam releases it and the conduit remains shut off.
- C. Once the gate is in place, the hoist beam should be extracted and either stored away or left ready for use.

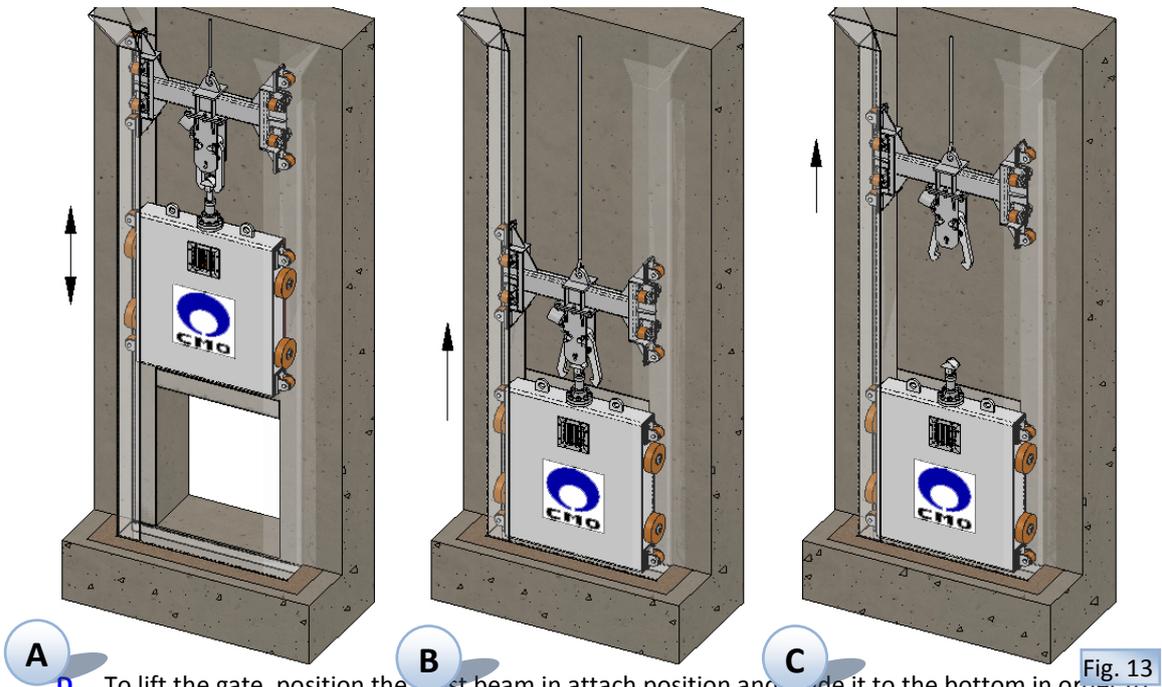


Fig. 13

- D. To lift the gate, position the hoist beam in attach position and guide it to the bottom in order to attach to the gate.
- E. The device attaches to the gate when the hoist beam reaches the bottom.
- F. Lifting starts and the bypass installed in the gate opens to allow the fluid to pass through and so reduce the pressure of the gate on the seal.
- A. Remove the valve, leaving the fluid passage free.

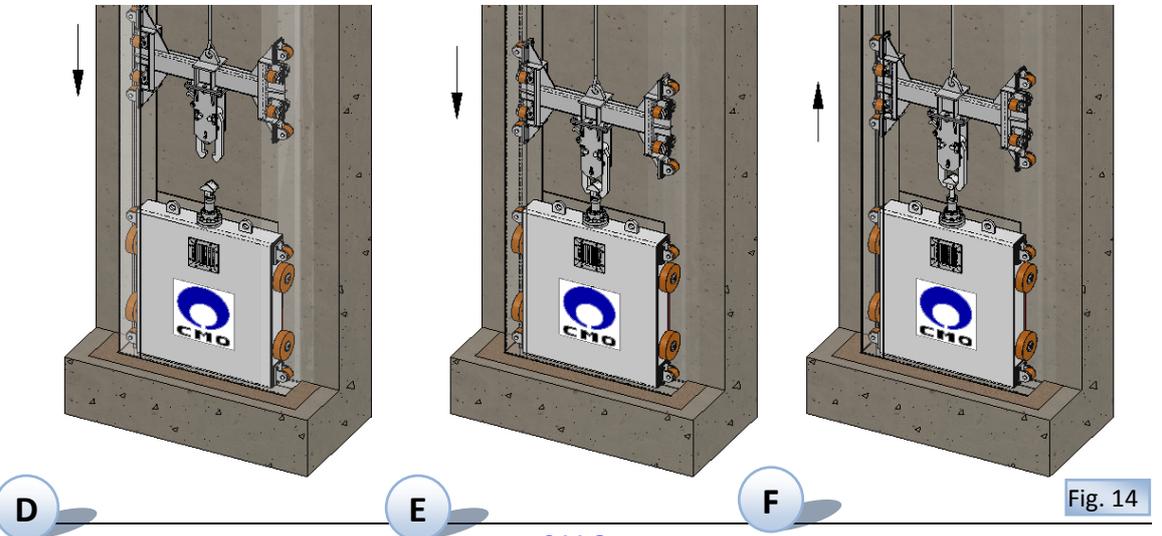


Fig. 14

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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 harm 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 penstock is to change the rubber seal. 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.

Regular cleaning of the penstock to prevent accumulation of dust.

Avoid re-painting the products supplied.

IMPORTANT SAFETY ASPECTS

- In order to work under ideal safety conditions, 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 gate.

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

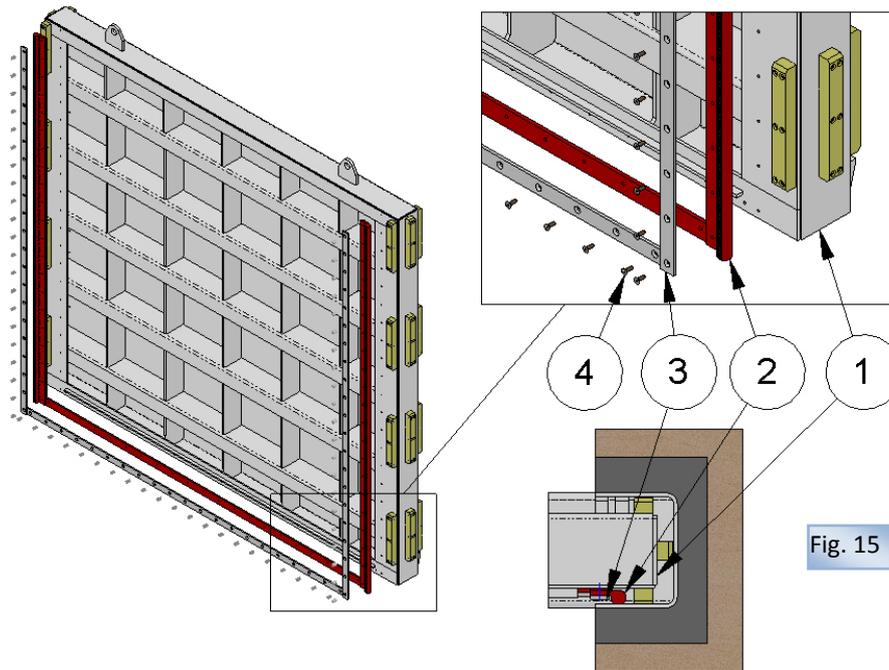
REPLACING THE SEALING JOINT (fig. 15)

1. Remove the gate (1) from the body to make it easier to change the seal.
2. Loosen and extract the screws (4) which secure the flanges (3) and the seal (2).
3. Remove the flanges (3) and finally the deteriorated sealing joint (2), then clean the housing.
4. Fit a new seal joint (2) impregnated with petroleum jelly, with the same dimensions as the old one.
5. Replace the flanges (3), securing the sealing joint (2). It is important that the side and lower seals protrude around five millimetres from the lower part of the gate (1) in order to make the lower seal. Screw them down after checking they are correctly assembled.



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6. Introduce the gate in the body. Before starting up the installation, carry out various operations to open and close the penstock while empty.

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 (°C)	ASTM D-127	60
Viscosity at 100°C	ASTM D-445	5
Penetration 25°C mm./ 10	ASTM D-937	165
Silicone content	None	
Pharmacopeia BP	OK	

Table 1

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 30°C.

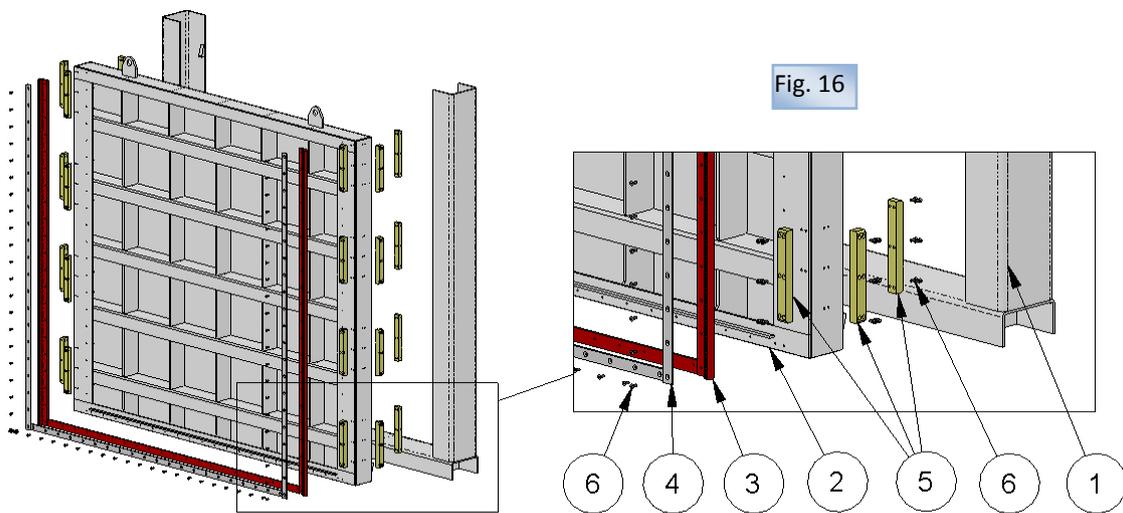
It is not advisable, but if stored outside the penstock must be covered to protect it from heat and direct sunlight, with good ventilation to prevent humidity. The following aspects must be considered for storage purposes:

- The storage place must be dry and undercover.
- 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.

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- 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 difficulty in moving it.
- The equipment must be stored on a flat surface to avoid loss of shape.
- 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



COMPONENTS LIST			
COMPONENT	VERSION S275JR	VERSION AISI304	VERSION AISI316
1- Body	S275JR	AISI304	AISI316
2 - Gate	S275JR	AISI304	AISI316
3- Seal	EPDM	EPDM	EPDM
4 - Flange	AISI304	AISI304	AISI316
5- Slide	HD-500	HD-500	HD-500
6- Screws	A2	A2	A4

Table 2