UNIDIRECTIONAL or BIDIRECTIONAL COFFERDAM GATE

- Gate for clean liquids or loaded with solids.
- Design of square or rectangular gate.
- Option of unidirectional or bidirectional.
- Various seat materials available.
- Common design to embed in the sides of the channel or in walls using chemical or expansion anchors.

Fig. 1

General applications:

- The cofferdam gate is designed to work in open channels or in orifices in walls, and has a 3-sided seal (base and sides) or a 4-sided seal (base, sides and lintel **fig. 1**).

It is suitable to work with clean liquids or loaded with solids. Used mainly in:

- Water treatment plants
- Irrigation
- Hydroelectric power stations
- Conduits

Sizes:

- All dimensions can be manufactured in accordance with customer's needs. Check with CMO for the general dimensions of a specific **gate**.

Working (ΔP):

- The maximum working pressure adapts to the needs of the customer in every project. These gates are designed to comply with working conditions in the place of installation.

Building work:

- The standard installation for **CMO AT** cofferdam gates is to build pockets in the channel in order to introduce the frame and secure it to the channel by cementing. It can also be designed to be secured to the wall through chemical or expansion anchors. The boreholes necessary to secure to the concrete are made when assembling, using the frame of the penstock as a guide. These gates can be manufactured to order in line with customer requirements.

Sealtight integrity.

- The sealtight integrity of the **AT** channel gates complies with that set out in regulation DIN 19569, class 5 of leaks.

COFFERDAM GATE AT SERIES

Directives:

- 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**, for information on categories and zones please contact CMO Technical-Sales Department.

Quality dossier:

- The sealtight integrity of the seat area is measured with gauges.
- Material and testing certificates can be supplied to order.

Advantages of CMO "AT Model"

AT channel penstocks are designed to handle liquids. The main elements of the **ATs** are the frame or body, which is fitted with a gate which moves up and down, and has a 3-sided (lower and sides) or 4-sided (lower, sides and lintel) sealing system in order to prevent leakages.
CMO standard **ATs** are designed for the body to be embedded, thus ensuring there is no obstruction in the channel passage. It therefore provides entirely continuous passage and prevents residue from building up when the gate is not installed.

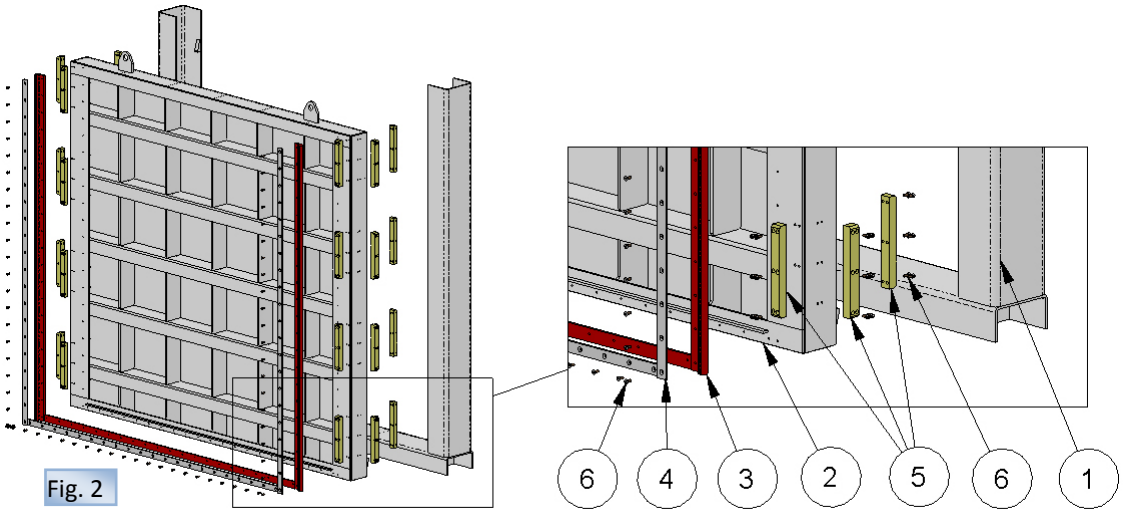


Fig. 2

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 1

DESIGN CHARACTERISTICS

1- BODY

The standard body or frame (**fig. 3**) is mechanically welded. Constructed with foldable profiles to prevent any loss of shape and also increase robustness. The side profiles have a groove throughout the length (in order to slide the gate), obtained by way of two folds (without welding), thus ensuring the body will not have any leaks.

The body has at least the same height as the gate, thus ensuring proper sealing.

The standard body is designed to be concreted inside the channel gaps, meaning no screws are required to secure the body, thus ensuring that there is no protrusion and passage is entirely continuous. When the channel is constructed and does not have the necessary holes to mount already concreted, the body can be secured using chemical or expansion anchors, in which case it must be remembered that the channel passage is slightly narrower.

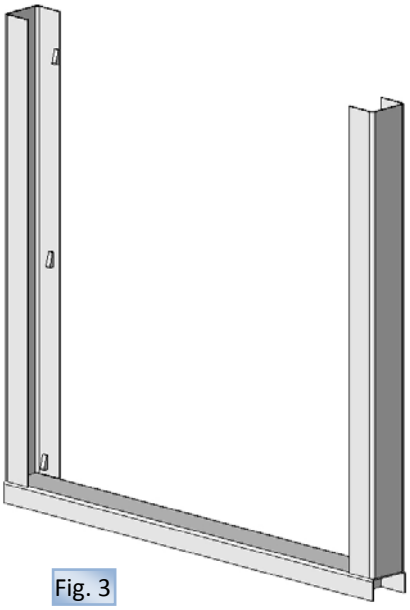


Fig. 3

There is also the option of mounting it supported on the wall using chemical or expansion anchors, meaning no type of building work is required. As the body is designed in line with the dimensions of the wall orifice, there are no protrusions and passage is entirely continuous. When the wall orifice is at ground level, the penstock can be mounted with the base embedded in the concrete or screwed down using chemical or expansion anchors, in which case it must be remembered that the channel passage is slightly narrower.

The bodies can be square or rectangular.

The material used is usually stainless steel AISI304 or AISI316, although carbon steel S275JR can also be used. In accordance with the conditions the penstock will be subject to, there are other special materials available to order, such as AISI316Ti, Duplex, 254SMO, Uranus B6, Aluminium, etc. As a rule, iron or carbon steel penstocks are painted with an anti-corrosive protection of 80 microns of EPOXY (colour RAL 5015), although other types of anti-corrosive protections are also available.

2 - GATE

The gate manufacture material is usually the same as that used for the body, although it can also be supplied to order with other materials or combinations.

In accordance with the dimensions of the penstock, reinforcements are commonly welded to the gate (as shown in **fig. 4**) in order to achieve the necessary rigidity. Two lifting lugs are welded to the top of the gate in order to extract it or introduce it in the frame, with the longitudinal movement opening or closing the gate. The gate is fitted with three sealing joints, two on the sides and one on the bottom (3-sided) and two on the sides, one on the bottom and one on the lintel (4 sides).

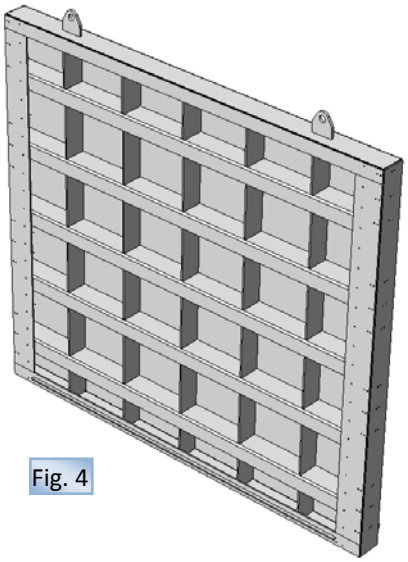


Fig. 4

3- SEAT

The standard seal in this type of penstock comprises smooth rubber rims which are secured to the gate using stainless steel flanges. The sealtight integrity complies with that set out in regulation **DIN** 19569, class 5 of leaks.
Depending on the work application, the following options can be chosen from:

- UNIDIRECTIONAL:

This is the most common, and is used when the fluid always comes in the same direction. The sealing joints are located on the upstream face of the gate, thus ensuring that the thrust of the fluid pressurises the seal against the body and guarantees sealtight integrity (**fig. 5**).

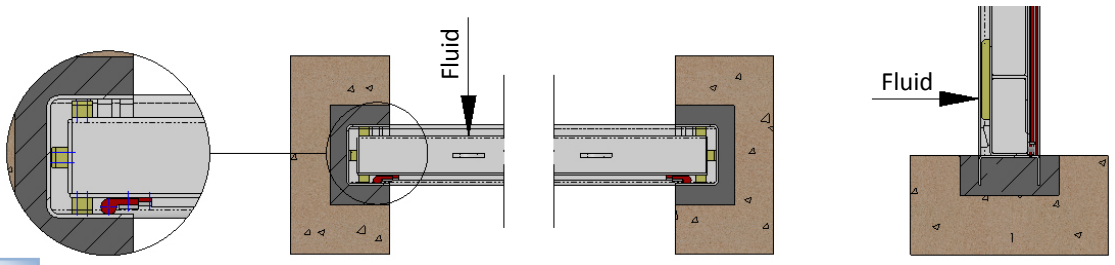


Fig. 5

PLAN VIEW (side seals detail)

SIDE VIEW
(Lower seal detail)

- BIDIRECTIONAL:

This type of seal is used when the fluid can come in either direction. The sealing joints are located on the same side as the unidirectional, whilst the side seal takes the shape of a double musical note, thus ensuring that the thrust of the fluid, whatever its direction, always pressurises the seal against the body to guarantee sealtight integrity (**fig.6**).

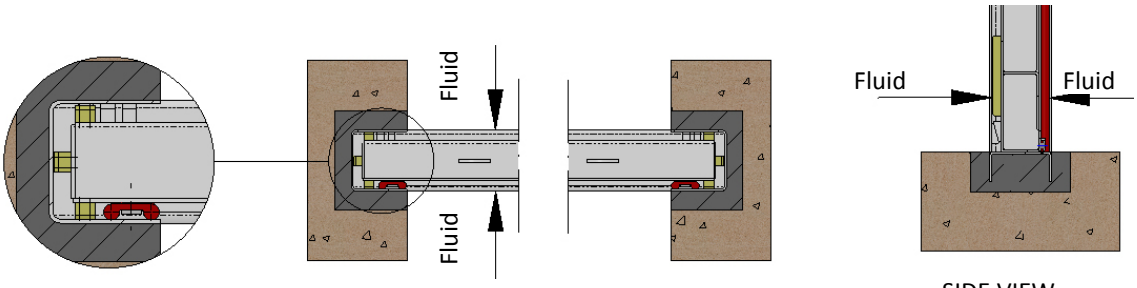


Fig. 6

PLAN VIEW (side seals detail)

SIDE VIEW
(lower seal detail)

Although the standard sealtight joint is EPDM, there are other types of materials in order to choose the most suitable, in accordance with the work applications for the penstock (work temperature, fluid type, etc). The characteristics of the most common ones are described here, and they are also summarised below in **table 2**:

Sealtight materials

EPDM

Recommended for temperatures below 90°C*, providing the penstock with 100% sealtight integrity. Application: Water and acids.

NITRILE

Used in fluids containing fats or oils at temperatures no higher than 90°C*. It provides the penstock with 100% sealtight integrity.

VITON

Suitable for corrosive applications and high temperatures of up to 190ºC and peaks of 210ºC. It provides the penstock with 100% sealtight integrity.

SILICONE

Used mainly in the food industry and for pharmaceutical products with temperatures no higher than 200°C. It provides the penstock with 100% sealtight integrity.

PTFE

Suitable for corrosive applications and pH between 2 and 12. It does not provide the penstock with 100% sealtight integrity. Estimated leakage: 0.5% of the channel flow.

NATURAL RUBBER

This can be used in multiple applications at temperatures below 90°C with abrasive products, providing the penstock with 100% sealtight integrity. Application: fluids in general.

***Note:** In some applications other types of rubber are used, such as: hypalon, butyl, etc. Please contact CMO if you require one of these materials.

SEAT/SEALS		
Material	**Max. Temp. (ºC)**	**Applications**
EPDM (E)	90*	Non-mineral oils, water and acids.
Nitrile (N)	90*	Hydrocarbons, oils and greases
Viton (V)	200	Hydrocarbons and solvents
Silicone (S)	200	Food products
PTFE (T)	250	Resistant to corrosion
Natural Rubber	90	Abrasive products

Table 2

NOTE: More details and other materials available to order.
***➔ EPDM and Nitrile: possible up to max temp 120°C on request.**

ACCESSORIES AND OPTIONS

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

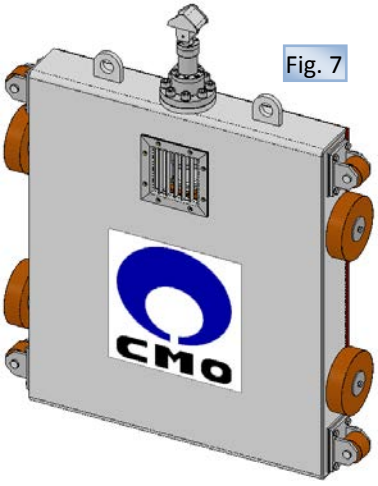


Fig. 7

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. 7**).

By-pass

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

-Allows the passage of a controlled amount of water or ecological flow.

Opening and closing is carried out manually from the top section.

Hoist beam (fig. 8 and 9)

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 bypass closes. Passage closed.

C. Once the gate is in place, the hoist beam should be extracted and either stored away or left ready for use.

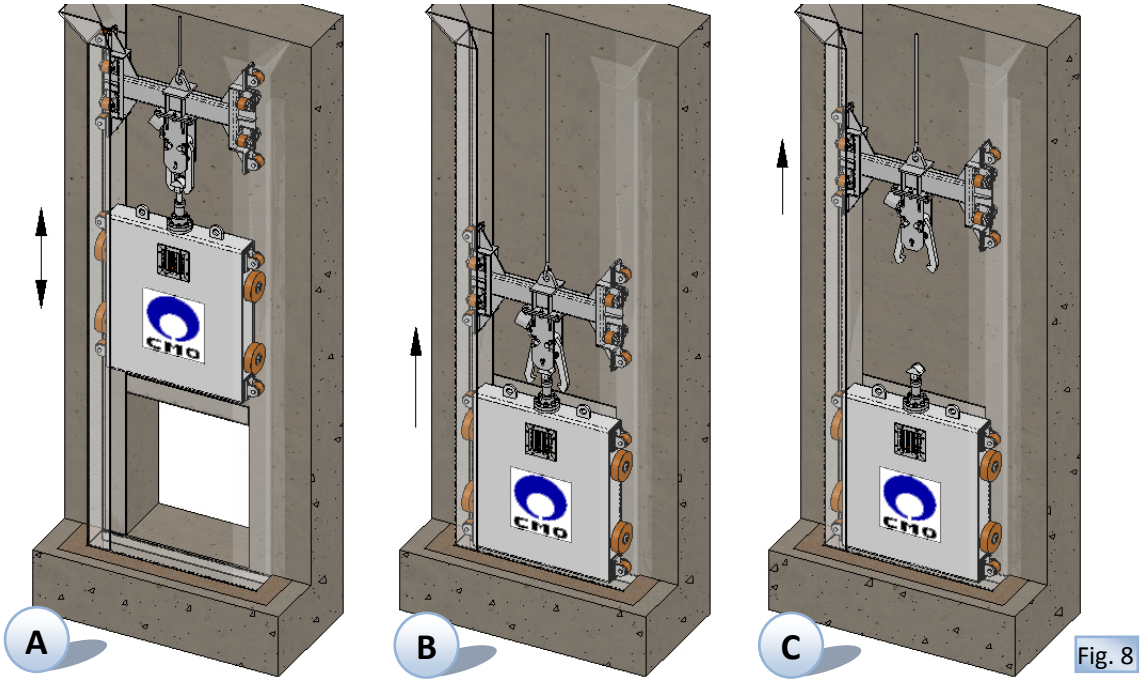


Fig. 8

D. To lift the cofferdam 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. Passage open.

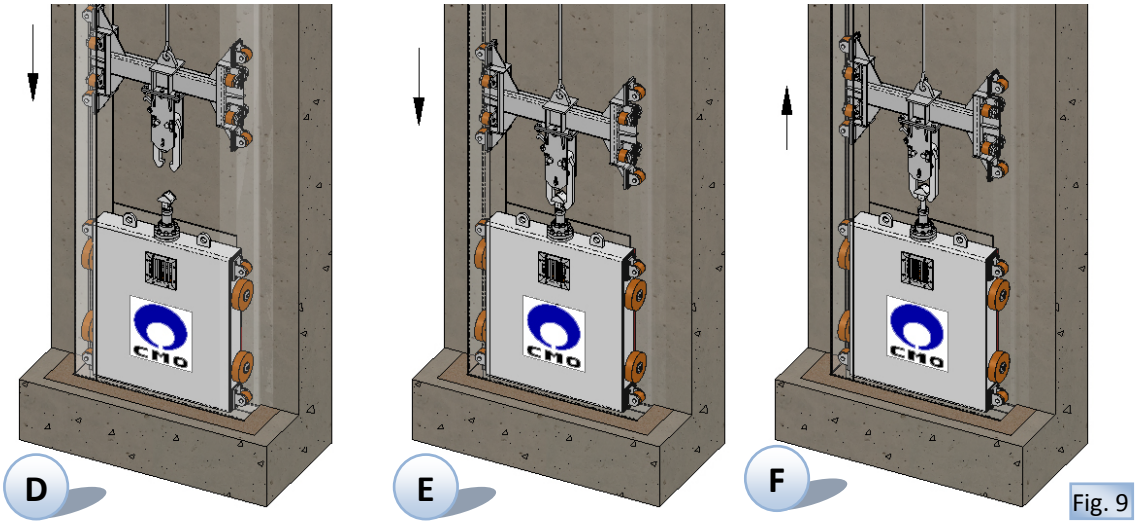


Fig. 9

- 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.

- Modular penstocks (fig. 10):
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.
It is often used in places in which access with large-sized valves is limited due to the building work involved.

- Mechanical locking device:
Allows the gate to be mechanically locked in a position.

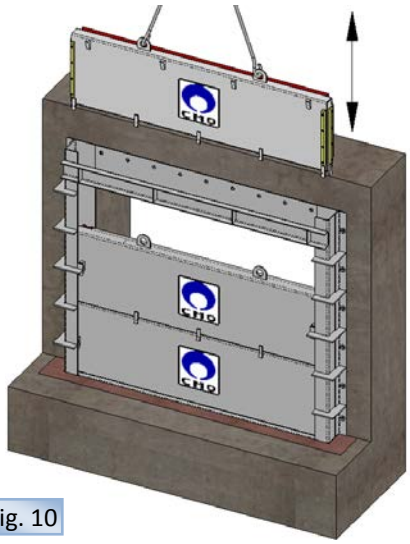


Fig. 10

GENERAL DIMENSIONS

In order to define an **AT** cofferdam gate, we need to know the width and height of the channel or conduit, the fluid direction and the fluid load on each side of the gate. It is also necessary to know the height of the floor (**Hs**) and whether it is a 3-sided seal (**fig. 11**) or 4-sided seal (**fig. 12**).
The levels A and B will be used to refer to the width and height variables, whilst the designation mode will be **A x B** (**Width x Height**). The dimensions are as indicated for each project. These penstocks may be square or rectangular, meaning they do not need to have the same width (**A**) and height (**B**).
Below is a description of each level (**fig. 11 and 12**).
- Level **A**: This is used to define the width of the channel (fig 11) or conduit (fig. 12).
- Level **B**: This is used to define the height of the gate (fig 11) or conduit (fig. 12).
- Level **Hs**: This is used to define the height from the orifice base to the floor.
- Level **Haf**: This is used to define the favourable fluid load (when the fluid direction pressurises the seal in the penstock against the wall or pocket), the Haf level defines the maximum fluid level measured from the base of the orifice.
- Level **Had**: This is used to define the unfavourable fluid load (when the fluid direction tends to separate the seal in the wall or pocket gate), the Had level defines the maximum fluid level measured from the base of the orifice.

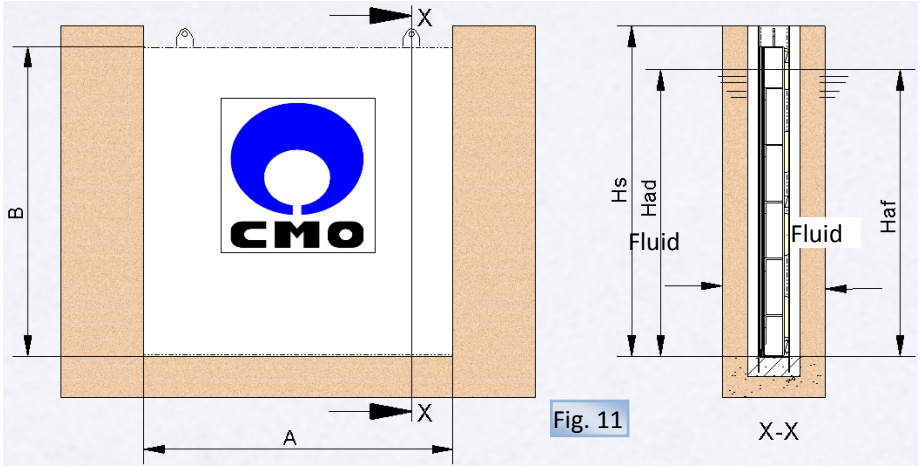


Fig. 11

- Level **Hp**: This is used to define the distance from the base of the penstock through to the upper part of the body. This level must be at least twice the height of the penstock (**B**) plus 105 mm (in order for the penstock to open completely).

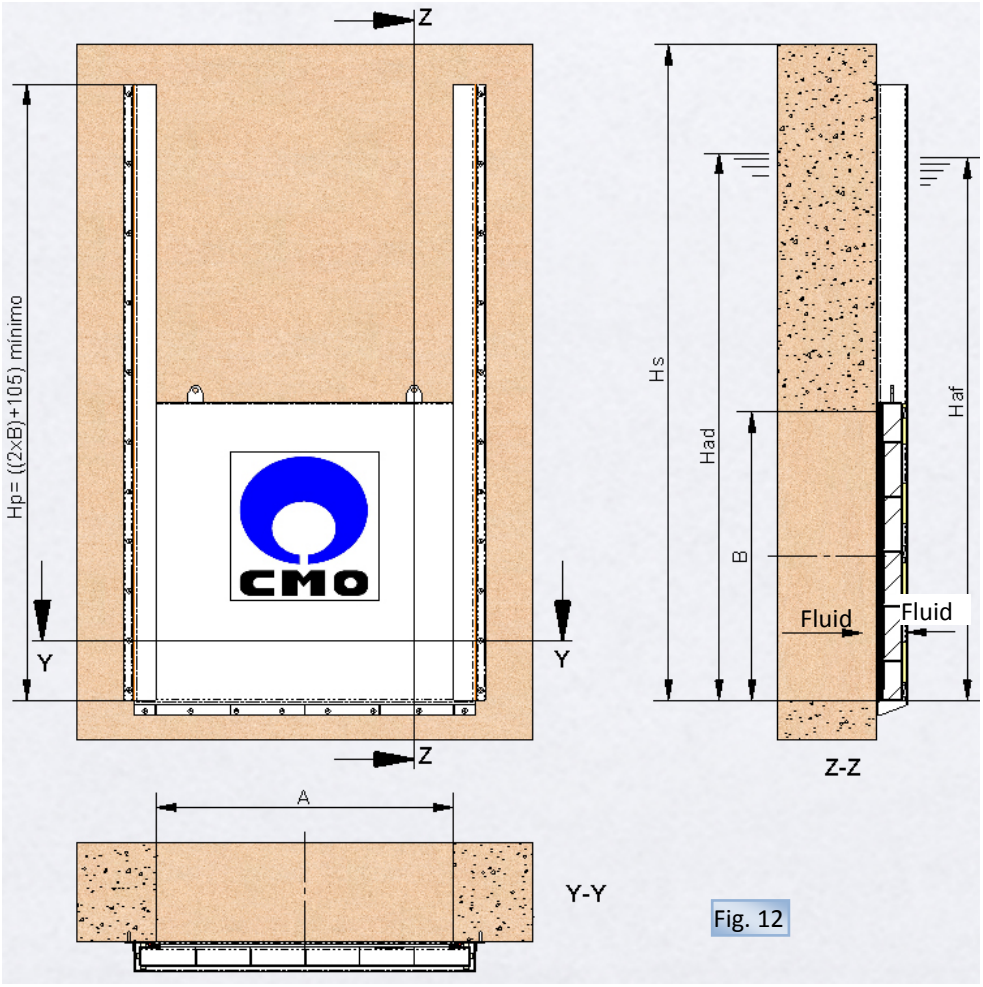
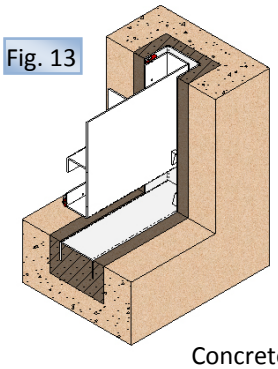


Fig. 12

FASTENING OPTIONS

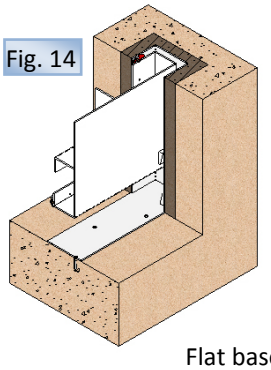
The most common system is to concrete these penstocks (**fig.13**), although, as can be seen in **fig. 14 and 15**, there are other assembly options.

Fig. 13



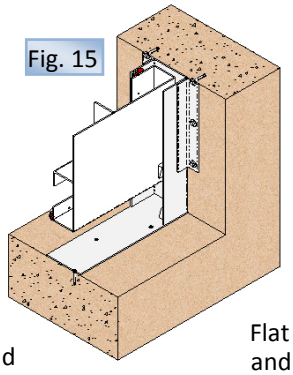
Concreted sides and base

Fig. 14



Flat base and concreted sides

Fig. 15



Flat sides and base

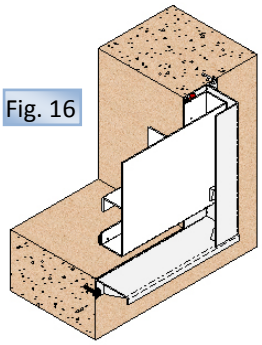
- Position the penstock in the channel holes in order to proceed with concreting (**fig.13**), taking care to ensure that the gate seal is on the downstream side. Once the penstock is positioned in the holes, align it horizontally with regards to the width of the channel and vertically make sure that the base of the penstock is level with the channel, thus guaranteeing that there is no protrusion in the channel and allowing entirely continuous passage.
The second stage of concreting, namely filling the holes, will take place while maintaining this position, ensuring there is no protrusion in the channel.

- In order to install the penstock using chemical or expansion anchors (**fig. 15**), position it in the channel, also taking care to ensure that the gate seal is downstream. Using the holes of the body of the penstock as a guide, make the boreholes 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 and screw down using the chemical or expansion anchors. Take care to screw crosswise and without excessive force, in order to ensure the penstock does not become deformed.

Wall assembly

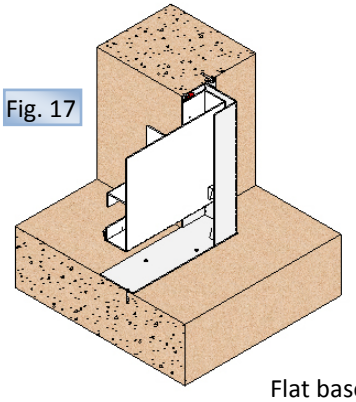
Another way to assemble these penstocks is supported on the wall and secured with expansion or chemical anchors (**fig. 16**), although there are also other assembly options (**fig. 17 and 18**).
Whatever the fastening option, the upper and side profiles (in a 4-sided seal) are always secured with chemical 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.

Fig. 16



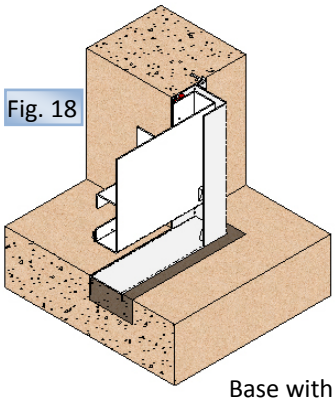
Secured to the wall using chemical or expansion anchors (standard)

Fig. 17



Flat base

Fig. 18



Base with pocket

- Proceed as follows to mount the penstock using chemical or expansion anchors (**fig. 16)** :
  -The concrete surface where the frame is mounted must be smooth and level.
  - Start by placing the body in 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. 17**).

- Proceed as follows to mount the penstock with the base embedded in the concrete **(fig. 18)**:
  -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.