DESCENDING GATE

GISERIES

03/12/2014

Bottom shaft descending gate with 3 or 4 side sealing

- Descending gate which turns on a horizontal shaft located at the bottom of the channel.
- Stopboard design with side wheels, to guide the stopboard throughout its run.
- Option of 3 or 4 side sealing.
- Design of rectangular or square penstock.
- Various sealing materials available.
- Designed to install embedded in concrete or mounted on walls with chemical or expansion anchors.

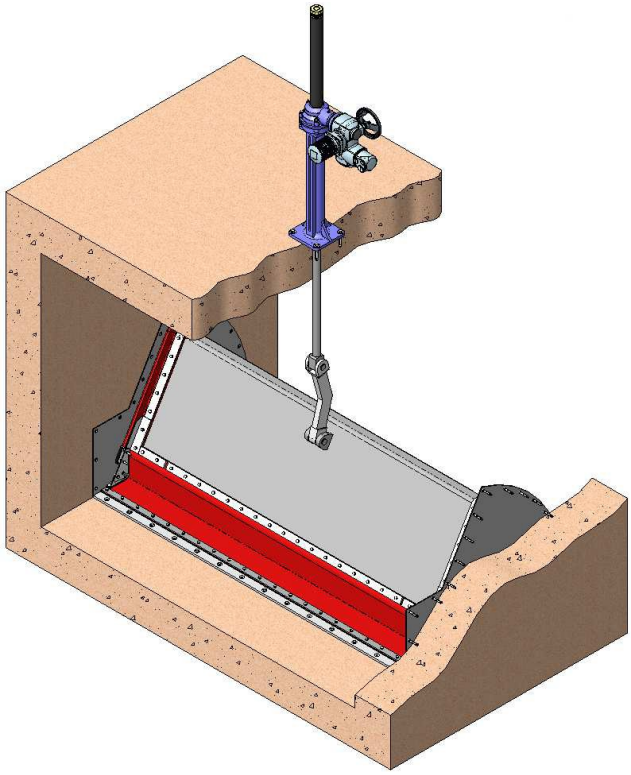


fig. 1

General applications:

- The **GI** descending gate is designed to be installed in channels or in orifices in walls. The channel or orifice can be rectangular or square, and this penstock can have a 3-side or 4-side sealing.
  It is suitable to work with clean liquids or loaded with solids. Used mainly in:
  - Water treatment plants
  - Irrigation
  - Hydroelectric power stations
  - Conduits

Sizes:

- From 500 x 500 up to 3000 x 3000 (larger sizes to order). Check with CMO for the general dimensions of a specific **GI** descending gate.

Working (ΔP):

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

Civil engineering work:

- One assembly system is supported on the concrete and secured with expansion anchors. In this case it is essential that both the base and the walls are completely smooth. The walls where the penstock is to be installed must be level and the base completely horizontal.
- Another assembly system is embedded in the concrete. This option ensures there is no protrusion in the channel, to which end a series of housings is required in the civil engineering work for the installation of the penstock.

Watertight integrity:

- The watertight integrity of **GI** descending gates complies with that set out in regulation DIN 19569, class 5 of leaks.

APPLICATION OF EUROPEAN DIRECTIVES

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

Quality dossier:

- The watertight integrity of the seat area is measured with gauges.
- Material and testing certificates can be supplied on request.

Advantages of CMO "GI Model"

GI descending gates are designed to handle liquids. Its main elements are the side guide plates (used for side seal), the rotation point mounts (used for the movement of the gate), and the stopboard, which is fitted with a 3 or 4 side seal.

The most characteristic aspect of these penstocks is the rotation point located at the bottom of the channel. This rotation point comprises several mounts with their corresponding shafts and self-lubricating bushing, thus avoiding having to lubricate these shafts. In order to operate the penstock, there is also an actuator system which can be electrical, hydraulic, manual, etc.

CMO's **GI** penstocks can have different designs; in one of the options the components are secured to the civil engineering work using expansion or chemical anchors. In another option these components are embedded in the concrete. There is also the option of combining both types of design in the same penstock, i.e., some parts of the body embedded in concrete and other parts secured by expansion or chemical anchors.

These penstocks are designed in accordance with the requirements of each project, taking into account dimensions, pressures, type of civil engineering work, etc.

The construction of the descending gate stopboard is mechanically welded and is fitted with guide wheels on both sides. The purpose of these wheels is to guide the stopboard throughout its run, maintaining the same distance between the stopboard and the side guide plates at all times. This will ensure that the seals always have the same torque, guaranteeing watertight integrity whatever the degree of opening of the penstock.

As mentioned previously, the penstock may have a 3 or 4 side sealing, although the seals will always be located on the stopboard. The side and top seals (the top seal is optional, only in the case of 4-side sealing) are attached to the stopboard and close against the stainless steel plates located in the civil engineering work. On the other hand, the bottom seal is made up of elastomer skirting, which is attached to the stopboard and to the bottom seal plate of the base of the civil engineering work.

Whenever the penstock is fitted with a manual actuator, the stem protection hood is independent from the handwheel attachment nut, meaning the hood can be dismounted without having to release the

entire handwheel. This advantage allows regular maintenance operations to be carried out, such as lubricating the stem, etc,

CMO penstock stems are made from 18/8 stainless steel, whilst the operation handwheel is made from GJS-500 nodular cast iron. This material is highly resistant to bangs, making it more long-lasting than commonly used cast iron wheels.

The yoke has a compact design with the bronze actuator nut protected in a sealed, lubricated box. This makes it possible to move the penstock with a key, even without the handwheel (in other manufacturers' products this is not possible).

In the case of pneumatic actuators, the top and bottom covers are made from GJS-400 nodular cast iron or aluminium. This characteristic is essential in pneumatic actuators. The pneumatic cylinder seals are commercial products and can be purchased worldwide., meaning it is not necessary to contact CMO every time parts are required.

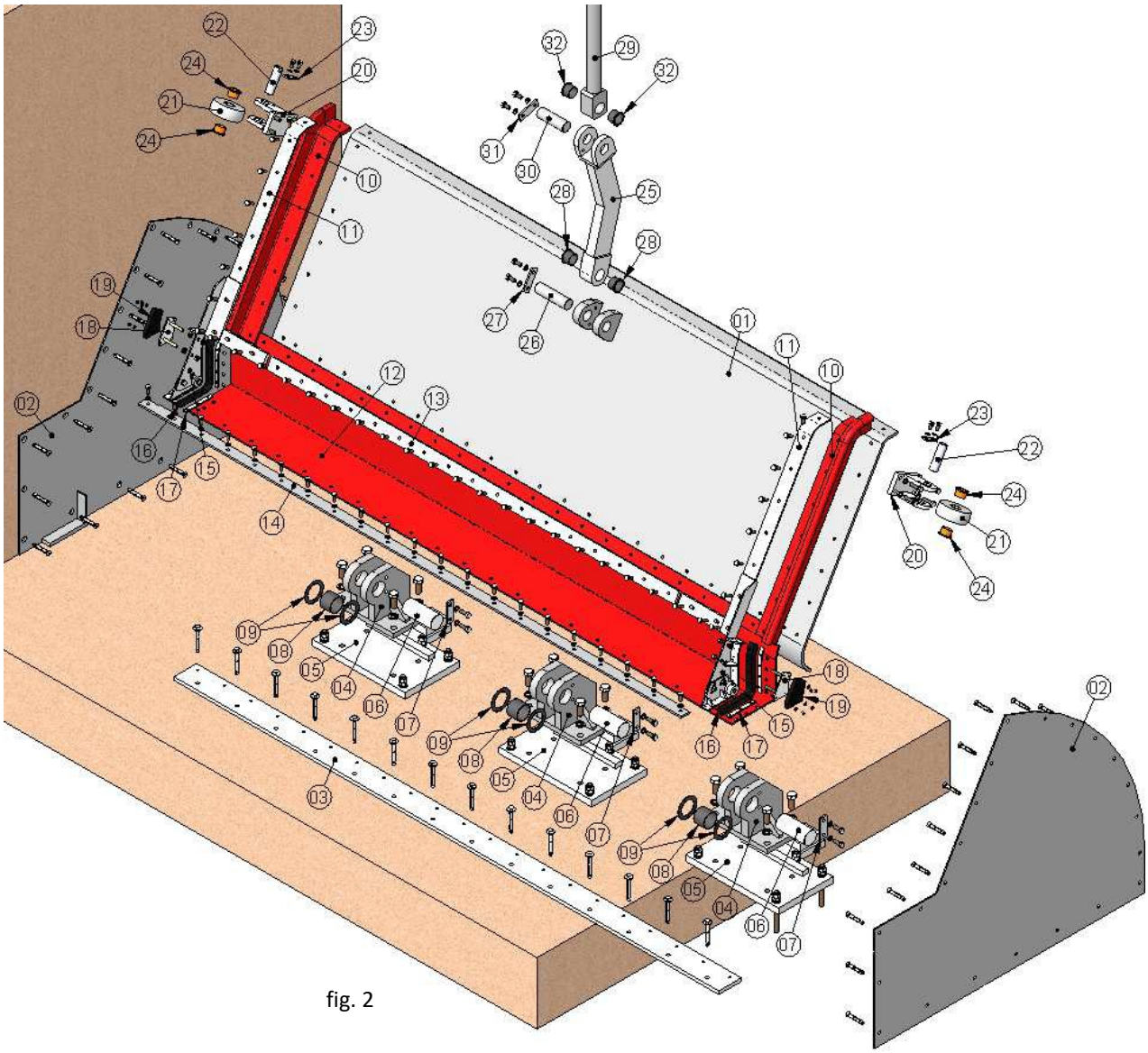


fig. 2

POS	DESCRIPTION	POS	DESCRIPTION	POS	DESCRIPTION
01	STOPBOARD	12	BOTTOM SEAL	23	NON-TURN PLATE
02	SIDE GUIDE PLATE	13	BOTTOM SEAL FLANGE	24	GUIDE WHEEL BUSHING
03	BOTTOM SEALING ANCHOR PLATE	14	BASE SEAL FLANGE	25	ACTUATOR LEVER
04	ROTATION MOUNT PIECE	15	SIDE SEALING FOOT PIECE	26	PULL STOPBOARD PIN
05	TURN MOUNT BASEPLATE	16	BOTTOM CORNER SEAL	27	NON-TURN PLATE
06	ROTATION PIN	17	BOTTOM CORNER SEAL FLANGE	28	LEVER BUSHING
07	NON-TURN PLATE	18	SEAL PLUG MOUNT	29	STEM/SPINDLE
08	ROTATION BUSHING	19	SEAL PLUG	30	PULL LEVER PIN
09	ROTATION STOPPER WASHER	20	GUIDE WHEEL MOUNT	31	NON-TURN PLATE
10	SIDE SEAL	21	GUIDE WHEEL	32	SPINDLE BUSHING
11	SIDE SEAL FLANGE	22	GUIDE WHEEL PIN	33	SCREWS AND BOLTS

Table 1

DESIGN CHARACTERISTICS

1- BODY

In this type of penstock the body is made up of two side guides, with one secured on each side of the channel of the civil engineering work (fig. 3). These are smooth plates with a small welded profile on each plate (fig. 4) in order to guarantee the side sealing of the lower part of the penstock. These guide plates are positioned in their location on site, with the stopboard being used to adjust the penstock exactly to the civil engineering work, since the guide wheels and seals allow a certain margin of adjustment. Operating in this way facilitates the assembly process and ensures the penstock adapts better to the civil engineering work.

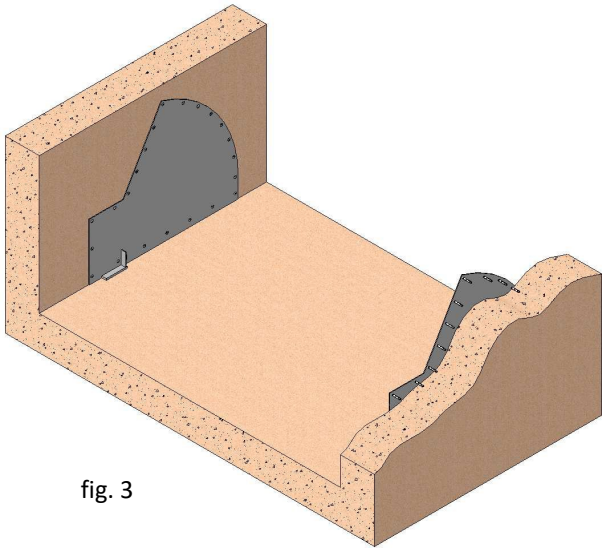


fig. 3

The surface covered by the side guide plates is at least the complete run of the stopboard.

The body can be designed in different ways; one of the options is supported on the civil engineering work and secured with countersunk expansion anchors. This type of design does not require any type of box in the civil engineering work, although it must be taken into account that the channel passage decreases slightly. Another possibility is to design a body to embed in the civil engineering work housings. The latter case avoids this slight decrease in the channel passage, although, on the other hand, it requires the installation of boxes in the civil engineering work before assembling the penstock; however, once mounted, it ensures there is no protrusion in the channel, thus guaranteeing complete, continuous passage.

As the body is designed in line with the type and size of the channel, the most suitable design is chosen for each specific project.

The materials commonly used are stainless steel AISI304 or AISI316 and carbon steel S275JR. In any case, the elastomer seals are always seated on a stainless steel surface; in consequence, when choosing the option of S275JR carbon steel body, stainless steel rims will be welded to ensure the seals fit correctly and thus guarantee watertight integrity at all times.

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, carbon steel penstock components 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.

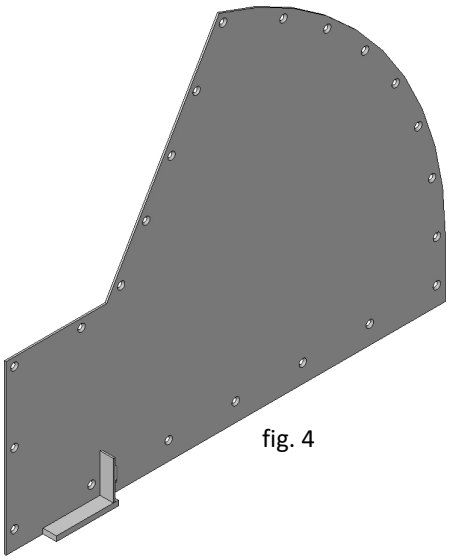


fig. 4

2 - STOPBOARD

The stopboard is mechanically welded, manufactured in one single piece. Made with folded metal plate reinforced with horizontal and vertical ribs for rigidity. The lower section of the stopboard is fitted with housings for the rotation point shafts. The amount and size of these housings is defined in line with the size of the penstock and the pressure worked with.

The guide wheels for side guiding are located in the side faces.

The stopboard in **GI** penstocks is fitted with guide wheels on both sides; the purpose of these wheels is to guide the stopboard throughout its run, maintaining the same distance between the stopboard and the side guide plates at all times. This will ensure that the seals always have the same torque, guaranteeing watertight integrity whatever the degree of opening of the penstock.

Both the guide wheel bushing and the rotation point bushing are self-lubricating, in order to avoid having to lubricate these shafts.

The side seals are secured on both sides of the stopboard using stainless steel flanges, whilst the end of elastomer skirting is secured to the lower part and the other end is secured to the bottom seal plate of the base of the civil engineering work. In the case of a penstock with seal on 4 sides, the stopboard will house another seal bolted down with a flange in the top section.

A series of boreholes are made in the vertical ribs of the stopboard, which are designed to lift the stopboard and make it easier to assemble the penstock.

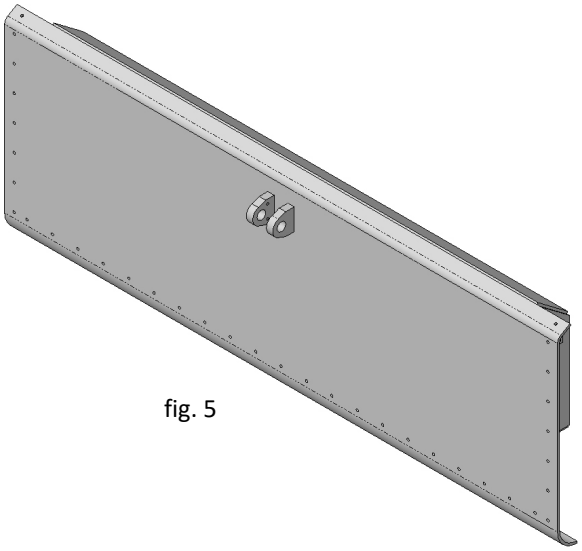


fig. 5

The stopboard 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.

3- SEAT

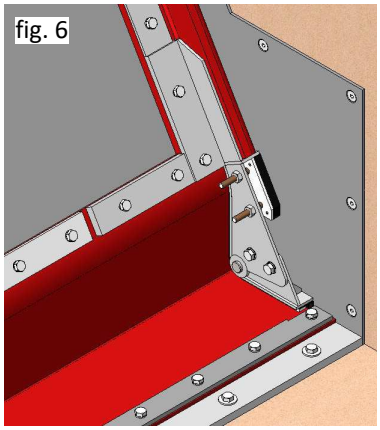


fig. 6

In this type of penstock the bottom sealing (fig. 6) is elastomer skirting, one end of which is attached to the stopboard, with the other end attached to the bottom sealing plate of the base of the civil engineering work. On the other hand, the side sealings (fig. 7) are seals which are secured to the sides of the stopboard and fit on the side guide plates located on each side of the channel. Whenever a penstock with a 4 side sealing is required, the fourth sealing will be in the top part of the stopboard, using a seal profile which fits on a stainless steel plate located in the top part of the orifice in the civil engineering work.

All seals, both the different profiles and the skirting, are attached to the stopboard using stainless steel flanges and stainless steel nuts and bolts, which can be reused several times.

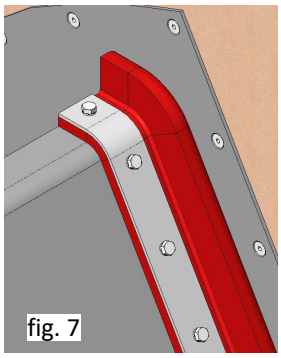


fig. 7

As mentioned throughout this document, this type of gates can be with a 3 or 4 side sealing. The peculiarity of the 3-side sealing is that when the fluid reaches the maximum height of the stopboard, this will begin to overflow over the stopboard, meaning the maximum working load will be equal to the height of the stopboard. These sealings are made in the bottom and in the sides.

On the other hand, penstocks with a 4-side sealing will have an additional sealing in the top section, meaning that, when the penstock is completely closed, the fluid will not overflow above the stopboard, making it possible to work with water loads greater than the height of the stopboard.

Adjustable seal foot pieces are fitted on both sides of the bottom of the stopboard (fig. 6). This zone requires a high degree of precision since the elastomer skirting must close with the side guide plate (body); for this reason the stopboard is fitted with adjustable foot pieces to provide a certain margin during assembly and perfectly adapt the sealing.

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

Watertight seal materials

EPDM

Recommended for temperatures below 90°C*, providing the penstock with 100% watertight 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% watertight integrity.

VITON

Suitable for corrosive applications and high temperatures of up to 190°C continuously and peaks of 210°C. It provides the penstock with 100% watertight 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% watertight integrity.

PTFE

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

NATURAL RUBBER

This can be used in multiple applications at temperatures below 90°C, with abrasive products, and it provides the penstock with 100% watertight 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	**Temp. Max. (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 to order.**

4- ACTUATOR SHAFT

As mentioned above, these penstocks can be fitted with different types of actuator, with the actuator shaft varying in line with each type.

Whenever the penstock is operated by pulling on the stopboard, the shaft may be a smooth spindle or threaded stem secured to the stopboard. On the other hand, when the penstock is operated by applying torque at the stopboard rotation point, the shaft will be a smooth spindle with cotter pins to transmit the rotation torque to the stopboard.

In any case, the actuator shaft of CMO's **GI** descending gates will always be made from stainless steel. This characteristic makes it highly resistant and provides excellent properties against corrosion.

If the penstock is fitted with a stem actuator, a hood is supplied to protect the stem from contact with dust and dirt whilst also keeping it lubricated.

5- ACTUATORS

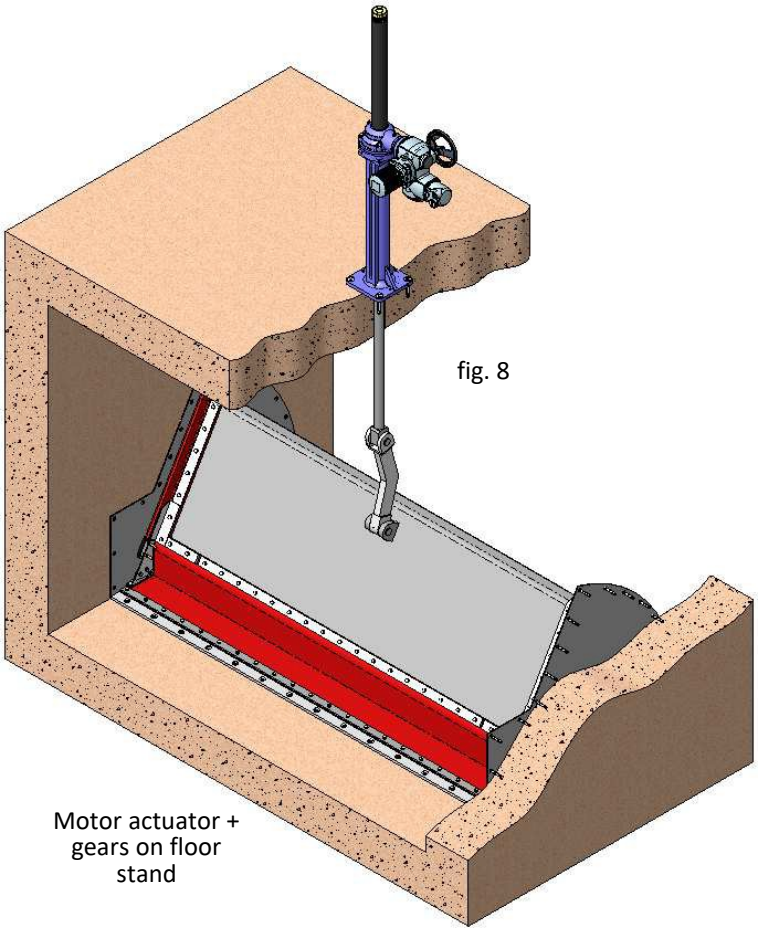


fig. 8

Motor actuator + gears on floor stand

GI descending gates can be designed with different actuator systems.

Choosing the type of actuator is dependent, amongst other aspects, on the civil engineering work where the penstock is to be installed. For example, if the penstock is to be mounted in a covered channel, the actuator could be positioned on the top of the roof and the penstock actuated with a spindle or stem which crosses through the roof and is secured to the central part of the stopboard (fig. 8 and fig. 9).

If the penstock is installed in an open channel which does not have a roof, an actuator made up of two hydraulic cylinders could be installed; these would be secured to the side walls of the channel and actuate the penstock by pulling on both ends of the stopboard (fig. 11).

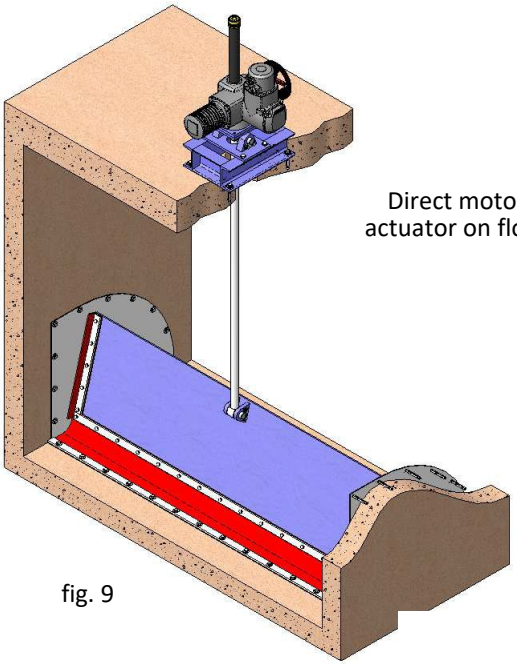
Whenever there is a dry chamber parallel to the channel, a linear hydraulic cylinder could be installed to prevent the actuator from interfering with the passage of the fluid; in this case a lever system would exercise rotational torque on an actuator shaft which, using cotter pins, would transmit this torque to the rotation point of the stopboard (fig. 10).

These are specific examples of possible actuators. However, as these valves are designed for each specific project, they can be designed in line with the needs and specifications of the customer. If you require any type of specific actuator, please check with CMO's technical and sales department.

Manual:	**Automatic:**
Handwheel	Electrical actuator
Gears	Pneumatic cylinder
Others (square stem, etc)	Hydraulic cylinder

DESCENDING GATE

GISERIES



Direct motor actuator on floor

fig. 9

Hydraulic cylinder actuator in the rotation shaft

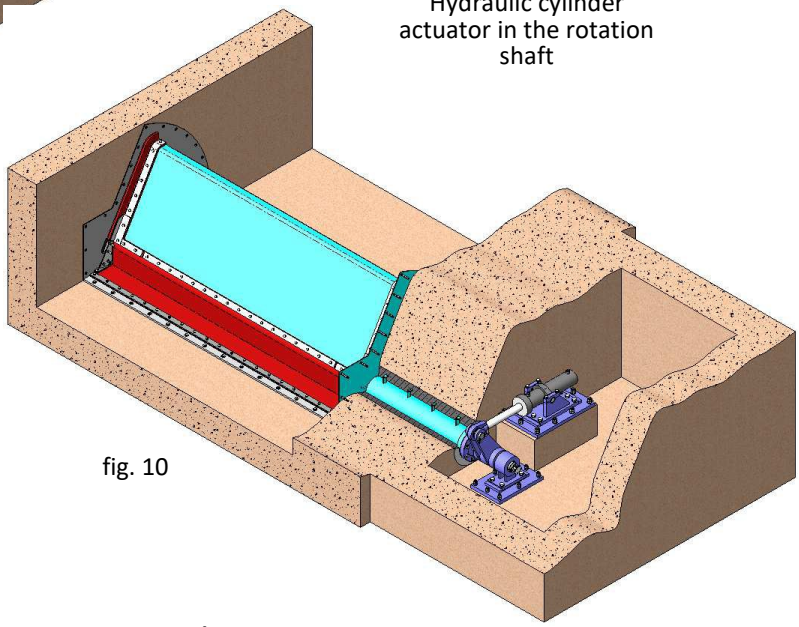
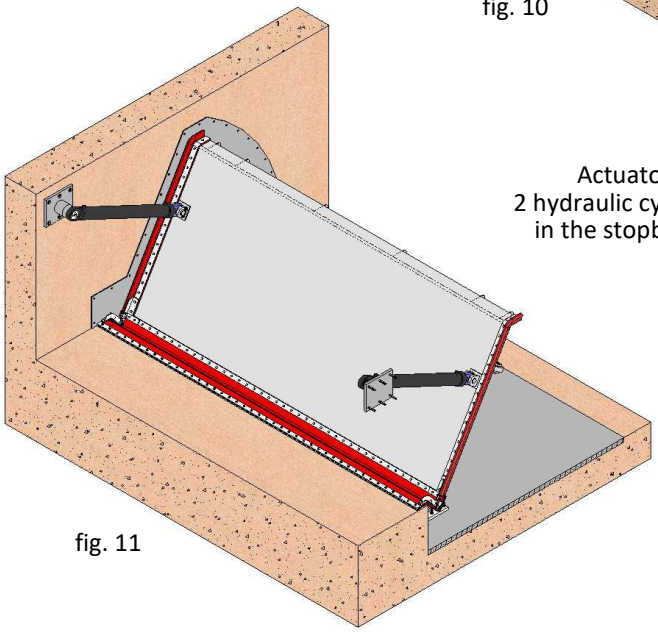


fig. 10



Actuator
2 hydraulic cylinders
in the stopboard

fig. 11

Stem or spindle extensions have also been developed, allowing the actuator to be located far away from the penstock, to suit all needs. Please check with our technicians beforehand.

Wide range of accessories available:
Mechanical stoppers
Locking devices
Emergency manual actuators
Positioners
Limit switches
Proximity detectors
Floor stands (fig. 12)
...

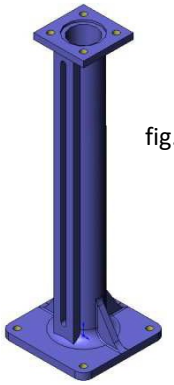


fig. 12

ACCESSORIES AND OPTIONS

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

- Mechanical limit switches, inductive switches and positioners:
Limit switches or inductive detectors are installed to indicate precise penstock position, as well as positioners to indicate continuous position.
- Electrovalves:
For air distribution to pneumatic actuators.
- Connection boxes, wiring and pneumatic piping: Units supplied fully assembled with all the necessary accessories.
- Mechanical stroke limiters (mechanical stops): These allow the stroke to be mechanically adjusted, limiting the gate run.
- Mechanical locking system:
Allows the penstock to be mechanically locked in a set position for long periods.
- Emergency manual actuator (handwheel/gears): Allows manual operation of the penstock in the event of power failure.
- 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.

TYPES OF EXTENSION

When the penstock needs to be operated from a distance, the following different types of actuators can be fitted:

1 - Extension: Floor Stand. This extension is done by coupling an extension to the stem or spindle. The desired extension is achieved by defining the length of the elongation. A floor stand is normally installed to support the actuator.

DESCENDING GATE

GISERIES

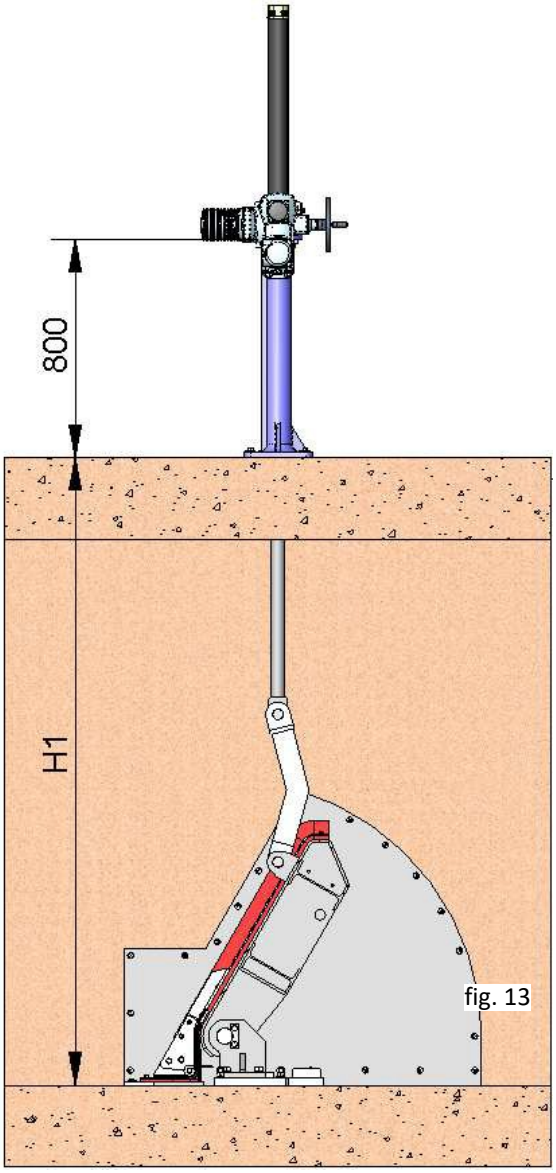


fig. 13

The definition variables are as follows:
H1: Distance from the base of the channel to the floor.

Characteristics:
- Can be coupled to different types of actuator.
- The standard floor stand is 800 mm high (fig. 13). Other floor stand measurements available to order.
- Option of fitting an indicator rule in order to display the degree of opening of the gate.

GENERAL DIMENSIONS

In order to define a **GI** descending gate, it is necessary to know the width and height of the channel where the penstock is to be installed and the fluid load it will have to withstand. It is also necessary to define the height from the floor (Hs) whenever the channel is not open.
Levels A and B are used to refer to the width and height of the penstock variables, whilst the designation mode is A x B (Width x Height). The dimensions range from 500 x 500 up to 3000 x 3000 (larger dimensions to order). 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 of fig. 14:

DESCENDING GATE

G I S E R I E S

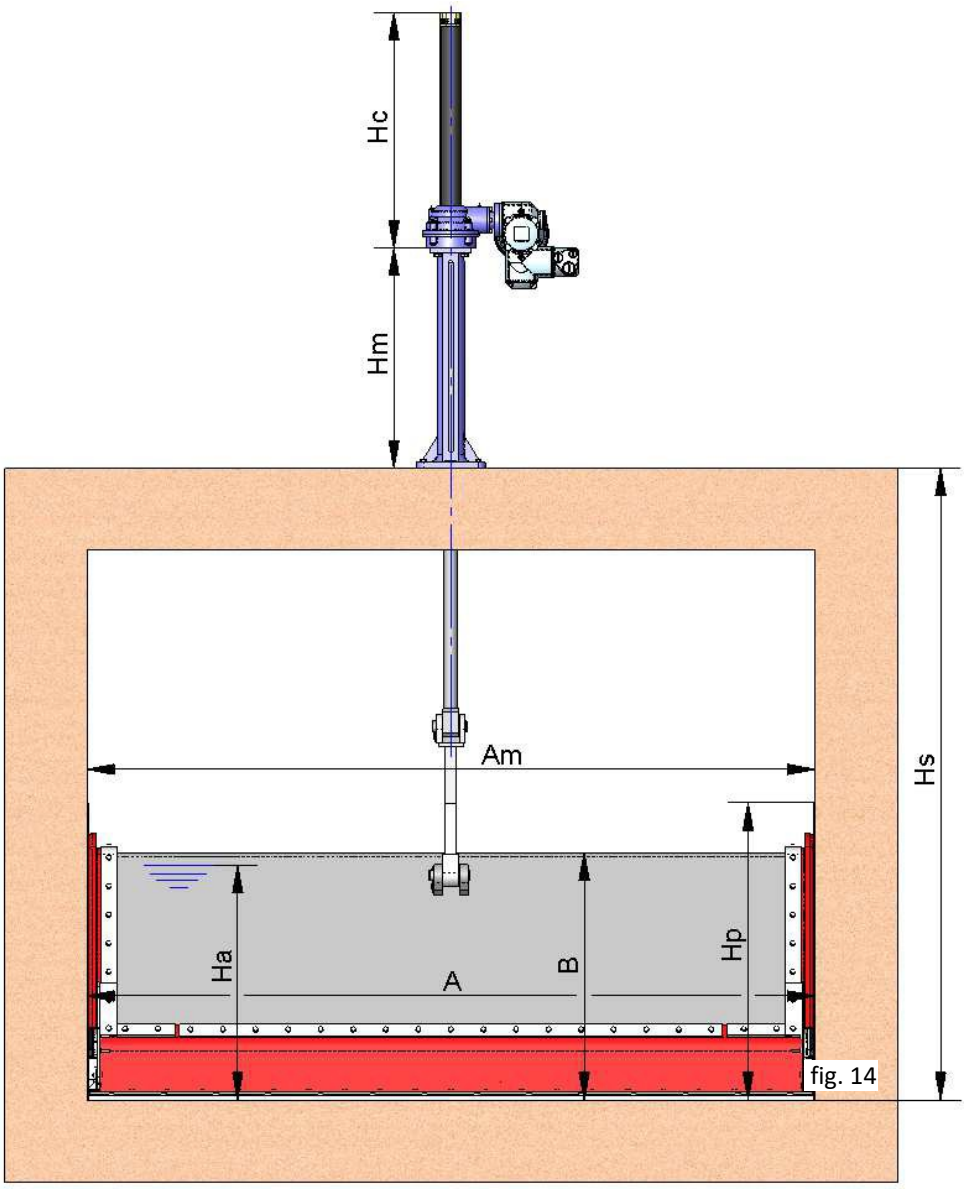


fig. 14

- Level **A**: This is used to define the width of the channel.
- Level **B**: This is used to define the required stopboard height.
- Level **Hs**: This is used to define the height of the channel, or, when a roof is fitted, from the base of the channel to the floor.
- Level **Hm**: This is used to define the distance from the floor to where the actuator is located. This level (Hm) is usually 800 mm, allowing a person to comfortably handle the penstock.
- Level **Hp**: This is used to define the distance from the base of the channel through to the top part of the body.
- Level **Hc**: This is used to define the total height of the actuator. This level varies in line with the type of actuator fitted in the penstock.
- Level **Am**: This is used to define the maximum width covered by the penstock body.
- Level **Ha**: This is used to define the fluid load. This defines the maximum fluid level measured from the base of the channel.

Given the variety of designs of these penstocks and their multiple types of actuator, there may be cases in which other levels are required; the aim has been to represent the most significant and most common levels.

ATTACHMENT OPTIONS

As mentioned, there are several systems to secure these descending penstocks to the civil engineering work.

- One of the attachment options is supported on the civil engineering work and secured with expansion or chemical anchors. This type of design does not require any type of box in the civil engineering work, although it is essential for the base and the walls to be completely smooth. As the different elements of the penstock are attached directly on the concrete, any irregularities in the concrete may be transmitted to the body when tightening the anchors if the cement is not smooth, possibly leading to irreparable damage and harming the operation of the penstock. Before starting to install on the civil engineering work, we recommend using a rule to check that the concrete is flat. The walls where the penstock is to be installed must be level and the base completely horizontal. It must be remembered that the channel passage is slightly reduced when choosing this attachment option.
- Another attachment option is embedded in the housings of the civil engineering work. This design requires boxes to be made in the civil engineering work before assembling the penstock. These housings must have specific dimensions, meaning it is hugely important to respect the dimensions detailed in the penstock diagram. The different elements of the penstock are introduced in these housings and the civil engineering work start bars are welded to the penstock setoffs. To finish, the housings are filled with a second layer of concrete, in order to avoid any protrusion in the channel and ensure total, continuous passage when the stopboard is in open position.
- Another option would be to combine the two aforementioned options, namely some parts embedded in the concrete and others supported on the civil engineering work and secured using expansion or chemical anchors.

This document mentions the different attachment options; please see the instructions and maintenance manual for further details in this regard.

As mentioned, this type of penstock is designed in line with each specific project, so do not hesitate to contact CMO's technical and sales department for any further information you may require on any aspects not envisaged in this manual.