1.1 Preparation and Preservation for Shipment

All penstocks are properly packed in order to protect that are subject to deterioration during transportation and storage on site. In particular, the following precautions should be taken:

1. The penstocks must be packed with the plastic wrapper in closed position.
2. The type of packing must be defined in the Customer's Order and shall be appropriate to ensure safe transportation to final destination and eventual conservation before installation.

1.2 Handling Requirement

1. The lifting of these penstocks has to be carried out using in the lifting point located at the penstocks and at respecting the carrying limits. The handling must be carried out on pallets, protecting the machined surfaces to avoid any damage.
2. The transportation of all material must be carried out safety and following the local safety regulations.

1.3 Storage and Preservation before Installation

In case the penstocks have to be stored before installation, the storage has to be carried out in a controlled way, and to be performed in accordance with the following criteria:

1. The penstocks have to be stored in a closed, clean and dry storage room.
2. The gate must be in the closed position. If possible keep the original protection.
3. Periodical checks have to be carried out in the storage area to verify that the above mentioned conditions are maintained.

NOTE

Storage in an open area for a limited period can be considered only in case the penstocks have appropriate packing.

Do not place consignment packages directly on the ground and stack the penstocks.

Do not expose consignment packages to the weather or directly to the sun.

Check the packaging every two months.

CAUTION

- For penstock handling and/or lifting, the lifting equipment must be sized and selected while taking into account the penstock weight indicated in the shop drawing. Lifting and handling must be made only by qualified personnel.
- Caution must be taken during the handling to avoid that this equipment passes over the workers or over any other place where a possible fall could cause damage. In any case, the local safety regulations must be respected.

2.1 Preparation before Installation

Before the penstocks are put into operational service, the gate should be raised and any foreign matter carefully removed from the sealing/guide faces and the invert area. The screwed stem and lifting nut assembly should then be thoroughly greased prior to operation.

The penstock can be raised or lowered into their desired opening position by actuating the actuator; it is recommended that the penstocks be operated at least once every three (3) months.

The penstock must be operated using the actuator supplied with each unit, severe damage can result to the screwed stem, lifting nut assembly and sealing faces when non-standard actuators are used.

Should it be necessary to remove the penstock for any reason, it should be noted that, when fitted, the torque limit switches will require re-setting after re-installation.

1. Carefully remove the penstock from the shipping plastic wrapper avoiding any damage to the penstock.

2. Confirm that the materials of construction listed are appropriate for the service intended and are as specified.

3. Define the preferred mounting orientation with the respect of system pressure. Please refer to the acknowledged provided shop drawing.

> ⚠ **NOTE** See the actuator user manual for actuator preparation.

2.2 Installation Instructions

The frame and gate assembly must be kept together as one unit to provide the most rigid structure to avoid distortion/damage during installation. If the penstock is damaged in anyway during installation the degree of sealing and ease of operation will be directly affected.

Installation of wall mounted Penstock

The penstock frame must be set plumb and straight regardless of the condition of the vertical concrete wall on which it is to be fixed. The following procedure must be followed to ensure the door and frame are aligned and the sealing efficiency attained.

1. Secure all anchor bolts in position using the penstock frame as a template. Check carefully to ensure the size, projection, vertical and horizontal alignments are correct. EXTREME CARE must be taken in this initial procedure since bolts which are incorrectly set will cause warping and therefore excess leakage. DO NOT FORCE THE PENSTOCK ONTO MISALIGNED BOLTS.

2. Fit the backing nuts and washers to the anchor bolts. Hang the penstock loosely in position and adjust the backing nuts to correctly align it. Fit the locking nuts and washers and finger tighten them. If a top seal is fitted ensure the seal is pressing against the gate, if necessary adjust the intermediate across rail anchor bolts. Again check the penstock to ensure it is parallel, plumb and all seals are pressing against the gate, before tightening the locking nuts.

3. NON-SHRINK grout must be placed in the void behind the penstock frame and extension frame above the opening, taking special care around the penstock's sealing periphery.

4. Every possible care must be taken to ensure that the door faces are neither scratched nor damaged in any way and no grout comes in contact with the penstock seals. If by chance this does happen, clean in area thoroughly with fresh clean water. Failure to do so may result in serious damage to the sealing surfaces.

Installation of channel mounted Penstock

The penstock frame must be set plumb and straight, hence for the designed sealing and operation efficiency the following procedure is recommended:

1. Present the penstock into its required position in the pre-prepared rebates. Pack under the invert until flush with the channel floor.
2. Pack between the penstock frame and channel rebates carefully, checking frame is plumb and straight in all directions.
3. Box up the frame and channel rebates, ensuring not to disturb the penstock. Recheck for alignment and position.
4. Using a non-shrink grout, fill the voids between the penstock frame and rebates.
5. Every possible care must be taken to ensure that the door faces are neither scratched nor damaged in any way and that no grout comes in contact with the penstock seals. If by chance this does happen, clean the area thoroughly with fresh clean water. Failure to do so may result in serious damage to the sealing surfaces.

2.3 Operation Instruction

After the penstock has been installed, check the following prior to operation:

1. Check all assemblies and mounting hardware for proper tightness. Check gate guides and seals for foreign matter and clean as necessary.
2. Open the penstock gate to the fully open position. The operation should be easy and unlabored, IF NOT, check for binding or other causes by reviewing the installation procedures.
3. Clean all dirt, concrete splatter, grout and other foreign material from the sealing surfaces and the flush bottom seat.
4. The penstock is fitted with Polyethylene bearing/guiding strips which require NO lubrication. To do so will attract dirt and grill which will accelerate wear, thus reducing sealing efficiency.
5. Close penstock gate completely and check for proper closure and alignment.
6. Cycle the gate from fully closed to fully open several times to ensure proper installation, alignment and operation.

NOTE DO NOT APPLY EXCESS FORCE TO THE HANDWHEEL

Be extremely careful when closing the gate to ensure excessive force is not applied to the stem. The stem under compressive load is the weakest link and can buckle if excessive force is applied.

3.0 Maintenance

Esareka Penstock is designed to minimize maintenance throughout the duty life span. Nevertheless, minor maintenance is needed.

For Non-Rising stem penstock, the grease needed to apply on to the stem thread at the penstock annually whereas rising stem penstock, the grease is apply on to the Headstock/ pedestal stem thread located at ground level. When apply the grease, the door gate should fully closed.

4.0 Troubleshooting

	Fault	Action
1	Door gate fail to open, Stem was not rotating	1. Check the penstock opening to identify any object obstruct the door closing/ opening. 2. Check the penstock seal guide clearance. 3. Remove any object if needed
2	Door gate fail to open, Stem was rotating	1. Check the entire connection between the door, stem, bush and muff coupler.
3	Unacceptable leakage rate at fully close position	1. Ensure the gate door is fully close. 2. Check to identify any leakage from between the penstock frame and the concreate/ grout surface.

WARNING

All Troubleshooting should carried out by trained person only.
Do not operated any maintenance when the reservoir was filled up with water.