

Penstock & Valve Specialists

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INSTALLATION AND MAINTENANCE RECOMMENDATIONS FOR EVS180 PENSTOCKS

Please read the following notes prior to commencing installation of the penstock(s) and if in doubt contact Express Valve Services Limited.

Handling and Storage

Penstocks should be stored in the 'vertical' position wherever possible, provided this can be achieved safely. In situations where penstocks are stored horizontally, particular care should be taken to avoid introducing twist or distortions to the frame.

If chains or slings are to be used for handling purposes the frame should be protected from damage with cloth sacking or similar material. Never use hooks unless eyebolts are fitted.

Sealing Performance

The leakage performance from an installed penstock is critically dependent upon the quality of installation. In view of this we strongly recommend specialist installation engineers experienced in installations of this type.

BS 7775:2005, Penstocks for use in water and other liquid flow applications specifies the following leakage allowances;

The following table specifies allowable leakage rates in litres/minute of seal perimeter for heads up to and including 6 metres. For heads in excess of 6 metres refer to the above British Standard or contact Express Valve Services Limited.

Seal Type	On-Seat Head	Off-Seat Head
Rigid	1.25l/(min.m)	2.5l/(min.m)
Resilient	0.5l/(min.m)	0.5l/(min.m)

These installation guidelines apply to Express Valve Services Limited standard penstock product range using competent, trained personnel working with suitable equipment under safe site conditions to carry out the work, and the installation will take place on concrete having a minimum strength of 25 N/mm².

Due to civil work tolerances mounting of the penstock unit must be effected by grouting between the wall and frame without contact between the frame and wall avoiding distortion. Attempts to seal between the frame and wall using mastic or resilient compounds may result in leakage. Grouting between the frame and wall is the preferred option.

All penstock units are despatched with the doors set in the fully closed condition and pre-adjusted at the factory for correct operation and should not be adjusted during installation. Moving the door should be avoided until the penstock unit is securely wedged into the re-formed channel rebates or bolted to the wall.

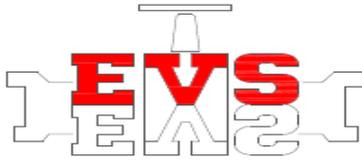
Pressure from any locating jacks must be spread evenly using timber. Avoid point or concentrated loading to any part of the frame, and never apply jacking loads to the door.

Installation Sequence

Penstock installation avoiding distortion and consequent leakage can be achieved using the following recommendations.

Wall Mounted Penstocks – Mechanical Anchor Bolts

1. Present the penstock unit into its required position ensuring the frame invert is flush with the 'civils' invert. In this position check the 'Invert to Coping' dimension. Support the penstock from a crane or along the whole length of the frame bottom cross member.



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2. Using the penstock frame as a template drill all holes to the diameter and depth specified for the anchor bolts to be used.
3. During the drilling cycle anchor bolts may be inserted into the top two holes to prevent movement of the penstock unit, place packing/jacking pieces local to the bolts to the recommended grout thickness. Tighten the anchor bolts sufficiently to hold the packing/jacking pieces in position.
4. Blow/remove dust or debris from the drilled holes.
5. Insert the remaining anchor bolts, place packing pieces or jacks of the required grout thickness as close as possible to the fixing. Tighten the anchor bolt sufficiently to 'nip' the packing piece or jack.
6. Check for plumb and level in all directions and adjust jacks or insert additional packing pieces to compensate for irregularities in the civil work
7. Tighten all of the anchor bolts sufficiently to ensure movement of the penstock unit does not occur during grouting.

1. Notes: Anchor Bolts

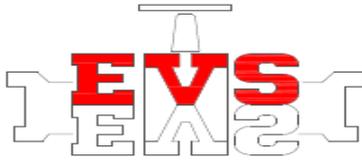
1. The anchor bolts manufactures installation guidelines must be followed for safe application and use of their products.
2. When 'plated' mild steel anchor bolts are used apply a protective coating to the exposed portion of the bolt to avoid corrosion.

Shuttering and Grouting

1. Shutter up around the external profile of the frame and the internal aperture using timber faced with a thin neoprene type sponge material to ensure a good, clean seal without undue pressure
2. Check again for plumb and levels. If correct mix and pour a fluid grout in proportions of 50 Kg of Ordinary Portland Cement, 50 Kg of silver sand and one small tub (0.227 Kg) of Conbex or equivalent non-shrink additive between the penstock frame and wall or pre-formed rebates. Avoid the use of vibrating equipment during grouting which may disturb the factory settings of the penstock.
3. Leave the installation undisturbed for the duration of the grout curing cycle as recommended by the Conbex or equivalent additive manufacturer. When the grout is fully cured, check that the anchor bolts are still tight in sequence (i.e. when one bolt has been checked follow on with the bolt diagonally or diametrically opposite).
4. If all anchor bolts are tight then remove the shuttering and generally clean up and remove any excess grout or debris from the penstock. Pay particular attention to the sealing faces to ensure they are not damaged to minimise leakage.
5. If 'excessive' tightening of any of the anchor bolts was required during the above checking procedure check the sealing faces.
6. Exposed portions of plated steel anchor bolts should be painted on completion of the installation.
7. Do not cut off protruding threads on chemical anchor studs when fitted.

Sealant Application (Sikabond or Equivalent)

1. Concrete Wall Surface Check – The concrete wall surface shall be inspected prior to commencing installation of the penstock. The concrete construction shall be flat, level and plumb and in accordance with the ACI 117-06 standard. If necessary, use non-shrink grout in order to meet the specified standard. The concrete wall surface shall be dry (to enable the construction sealant cures effectively). If necessary the wall can be dried with a blowtorch or a hot air fan.
2. Pre-Installation of the Penstock – Place the penstock against the wall and line up with the opening. The slide shall be in the fully closed position. Drill and install an anchor bolt on each side of the penstock. After installing the first anchor bolt, and prior to drilling the hole on the other side ensure the penstock frame is perfectly levelled.



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3. Construction Sealant Application (Sikabond or Equivalent) – Remove the penstock from the wall (first remove the nuts from the anchor bolts). Apply construction sealant all around the perimeter of the frame.
4. Sikabond (200ml/m) or equivalent construction sealant shall be used. Be sure not to get sealant on the seals, guides or stem this may cause leakage or damage. Re-install the penstock on the wall and tighten both anchor bolts.
5. Final Installation of the Penstock – Drill and install the remainder of the anchor bolts.

CAUTION: If the penstock is not completely in contact with the wall, do not over tighten the anchor bolts. Over tightening may bend or distort the frame. If the wall flatness and levelness is in accordance with the specified standards the construction sealant will fill the remaining void

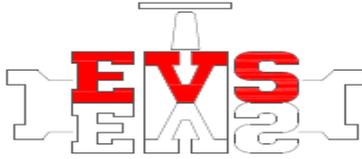
Apply construction sealant around the penstock frame in order to fill any existing gaps between the wall and frame (this is only for aesthetics). Wipe away the excess sealant to leave a smooth finish.

Operating Equipment

1. Whenever possible penstocks and their respective operating equipment are despatched fully assembled. However, units despatched in separate sections are clearly marked with an identification code.
2. Rising stem applications may require the stem to be removed for transportation and in these cases the nut block will be attached to the stem using the torque reaction pin.
3. Manufacturers of proprietary operators (e.g. electric actuators, gearboxes, hydraulic and pneumatic cylinders etc.) provide Installation, Maintenance and Operating Instructions for their equipment.
4. Express Valve Services Limited recommend the use of installation engineers experienced in commissioning operating equipment where electric actuators, hydraulic or pneumatic cylinders are involved. Damage can be caused to the penstock and operating equipment as a result of incorrect setting of limit and torque switches, control valves etc.
5. The following guidelines cover the installation of stems, guide brackets, coping brackets, pillars etc. but excludes equipment referred to in Item 3 above. Refer to the equipment manufacturers documentation for detailed instructions.
6. If the stem has been removed from the penstock for transportation remove the nut block from the end of the stem. Retain the torque reaction pin (rising stem applications) and place the nut block in the housing on top of the penstock door. Carefully fit the stem into the nut block and replace the torque reaction pin (rising stem applications).
7. Attach extension stem(s) if appropriate and support the stem vertically and in line with the centre line of the penstock door nut pocket. Use the stem to mark out the positions for guide bracket(s), coping bracket(s) etc. as appropriate. Longer lengths of rising stems may be supplied in two or more sections for handling or material availability and require coupling(s). In these cases ensure that spacing between guide brackets is sufficient to accommodate the full 'travel' of the coupling(s) for the opening depth of the penstock aperture. We recommend that these items are mounted in order from penstock to operating level.
8. Fix and grout the guide bracket(s), coping bracket(s) etc. to the 'civils' as described previously for the type of anchor bolts specified.
9. Note, that the pillar should be set to provide correct vertical alignment of the stem support at the top of the pillar **before** fitting and tightening the fasteners/anchor bolts through the pillar base flange. This will ensure that the clearances in the pillar base flange do not create misalignment of the stem.
10. On completion of the above procedure check that the operating equipment in vertical alignment. Fit the means of operation, e.g. handwheel, gearbox, actuator etc. as appropriate.
11. Stems/extension stems fitted to twin stem penstocks must be in vertical alignment with the penstock door and remote operating equipment. The cross shaft connecting the two stems must be horizontal and at right angles to the vertical stems.

Operation

1. Clean the penstock to remove excess grout before opening the penstock for the first time. With the door fully open check all sliding surfaces including the invert and remove any debris.



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2. Apply the appropriate grease for the duty to the operating screw thread, nut and metallic seals when fitted.
3. Securely 'prop' the door when work is carried out with the penstock in the open condition.
4. Provided the installation procedure has been implemented by competent engineers experienced in the type of work leakage performance should be within the requirements of BS 7775: 2005.
5. If excessive leakage occurs the most likely explanations are:-
 - The penstock frame has been distorted during installation,
 - The door and/or wedging devices have been moved prior to completion of the installation,
 - There is grout of debris between the sealing faces or at the invert seal,
 - The seals have been scored or damaged,
 - The limit or torque switches have not been set correctly,
 - Misalignment of the operating equipment

Do not attempt to solve leakage problems by using excessive force to close the penstock door, this may result in permanent damage to the equipment. Manual input effort is limited to a maximum of 250N on the crank handle, tee key or handwheel rim in accordance with BS 7775. If in doubt contact Express Valve Services Limited.

Operating Instructions

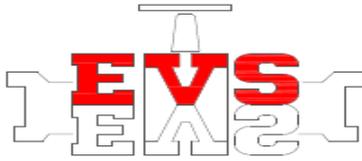
1. Refer to the documentation provided by the manufacturers of proprietary operating equipment covering installation, commissioning, operation and maintenance.
2. Where handwheels are fitted the direction of closing is marked on the handwheel rim. For powered actuation opening and closing directions are marked on the operating unit.
3. If 'tight spots' are encountered during operation of the equipment avoid using excessive force since this may cause damage to the stem and/or nut. In such cases determine the cause and resolve the obstruction to correct operation of the equipment. The risk of potential leakage and operational problems can be reduced by implementation of a maintenance schedule.
4. The working life of the penstock can be prolonged if minimum force is used to fully close the penstock and achieve satisfactory leakage performance.
5. Handwheel diameters and operator sizes will have been determined with the above in mind. Express Valve Services Limited does not advise increasing/changing to larger handwheels to resolve operating problems. Similarly, for powered actuation it is not advisable to alter the settings of torque or limit switches after these have been correctly set during commissioning of the equipment.
6. Operating equipment utilising rising stems should be fitted with protection tubes.

Maintenance – Penstock Unit

Cleaning and Lubrication

EVS 180 penstocks need practically no maintenance. In order to ensure maximum performance of the penstock, the following maintenance inspections shall be carried out periodically and a minimum every 6 months

- Stem and stem nut shall be cleaned and greased. For non-rising stem configurations, the stem may be in contact with water and dirt. Under these conditions, the threads of the stem and/or stem nut may wear, and they shall be checked every 3 months.
- Clean the slide with clean water and remove any deposits, especially on the seals and in the guides.
- Check the seals and make sure they are not damaged. Seals shall be replaced if damaged.
- Seals shall be wet while operating. If the penstock has not been used for a long period of time under dry conditions, the seals shall be wetted with clean water before operating the penstock. Operating the slide with dry seals may damage the seals. Additionally, more torque may be required to operate the penstock.



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Maintenance Schedule - Operating Equipment

Refer to the documentation provided by the manufacturers of proprietary operating equipment covering maintenance.

If maintenance is required with the door open the door must be securely 'propped' to prevent the risk of the door falling and causing injury or damage.

Non-Rising Stems

Non-rising stem penstock units require special consideration regarding maintenance due to exposure of the 'working' parts (screw thread and nut) to the media and accessibility for maintenance to be carried out effectively.

In cases where the media level is above the aperture grit and debris may contaminate the screw thread on the stem and in the nut. This condition when applied to penstocks in constant use may result in accelerated wear of the nut block threads. Excessively worn threads in the nut block may be unable to support the weight of the door resulting in the door falling without warning.

1. Every Three Months

- Clean the threads of the stem and nut by 'hosing down' with clean water,
- Apply grease suitable for the duty to the stem screw thread and nut.

2. Every Twelve Months

- Remove the nut block from the penstock door and thoroughly check for signs of wear in the screw threads. Frequent operation of the penstock in an abrasive (grit for example) media may require inspection periods to be reduced for the reasons explained above.

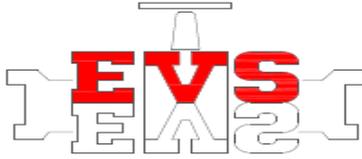
Rising Stems

1. Every Six Months

- Remove the stem protection tube,
- With the penstock door fully raised clean and replace grease on the stem screw thread and yoke/drive sleeve.
- Replace stem protection tube.

2. Every Twelve Months

- Remove the stem protection tube,
- With the penstock door fully closed remove the yoke/drive sleeve and check the screw thread for signs of wear. Refer to the manufacturers maintenance instructions for access to the drive sleeves for propriety operators (electric actuators, gearboxes etc.).
- Replace the yoke/drive sleeve if excessive wear is evident in the screw threads for the reasons explained above.
- Apply grease to the yoke/drive sleeve and re-assemble.
- Raise the penstock door and apply grease to the stem screw threads.
- Replace the stem protection tube.
- Operate the penstock for several cycles.



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Recommended Lubricants

- For general lubrication purposes under normal operating conditions we recommend Shell Alvania R2 (or equivalent) for greasing stem screw threads, nut block threads, yoke/drive sleeves and thrust housings.
- For high duty or aggressive effluent applications we recommend Rocol Tuflube Allweather grease for lubricating stem and nut block screw threads.
- For seawater applications we recommend Rocol RB1200 or Rocol Tuflube Allweather grease for lubricating stem and nut block screw threads.
- For potable water applications we recommend using Rocol MX22 or Rocol MX66 grease.