

Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk

INSTALLATION AND MAINTENANCE RECOMMENDATIONS FOR 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.

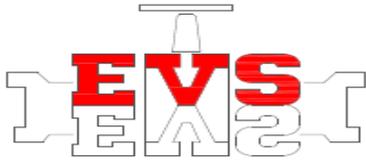
All penstock units are despatched with the doors set in the fully closed condition and the wedges pre-adjusted at the factory for correct operation within the frame and should not be adjusted during installation. Moving the door should be avoided until the penstock unit is securely wedged in to the re-formed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

Prior to grouting we recommend that a feeler gauge test of 0.1mm (0.004") non-acceptance is carried out on the sealing faces. For example, in the case where the soffit seal is distorted it should be 'packed-out' and the feeler gauge tested repeated. At this stage the door should be opened by approximately 100mm and closed to ensure the frame is not distorted.

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.



Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk

Channel Mounted Penstocks

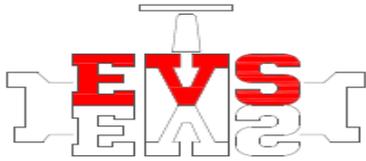
1. Present the penstock unit in its required position with regard to the direction of flow in the pre-formed channel rebates (sides and invert). Ensure that the invert of the frame is flush with final invert of the channel.
2. Locate the penstock unit in its final correct position by setting the frame in the pre-formed rebates using jacks and/or packing pieces to the recommended grout thickness between the frame and concrete rebate.
3. Check for plumb and level in all directions, and if necessary adjust the packing thickness to compensate for irregularities in the civil work.
4. Check the 'Invert to Coping' dimension.
5. Grout in accordance with 'Shuttering and Grouting' in this procedure.

Wall Mounted Penstocks – Expanding 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.
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. The protective coating inside the frame fixing holes may be damaged during the drilling operation. Any damage should be made good immediately after drilling in accordance with the paint specification to prevent corrosion.
5. Blow/remove dust or debris from the drilled holes.
6. 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.
7. Check for plumb and level in all directions and adjust jacks or insert additional packing pieces to compensate for irregularities in the civil work
8. Check seal faces with a feeler gauge for non-acceptance of 0.1mm (0.004") around the full perimeter of the aperture. Adjust the packing only where this tolerance is exceeded and sufficient only to close the gap.
9. Tighten all of the anchor bolts sufficiently to ensure movement of the penstock unit does not occur during grouting. If movement is suspected when tightening the anchor bolts the feeler gauge check and possible adjustment must be repeated.

Wall Mounted Penstocks – Chemical/Resin 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.
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. The protective coating inside the frame fixing holes may be damaged during the drilling operation. Any damage should be made good immediately after drilling in accordance with the paint specification to prevent corrosion.



Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk

4. Blow/remove dust or debris from the drilled holes.
5. Follow the recommendations and instruction provided separately with the chemical/resin anchor bolts.
6. Support the studs in the centre of each mounting hole square to the penstock unit mounting face until the resin is fully cured. If the studs are not kept square then the penstock unit may become 'wedged' by the misaligned studs.
7. Fit washers and nuts to the anchor studs, 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.
8. Check for plumb and level in all directions and adjust jacks or insert additional packing pieces to compensate for irregularities in the civil work.
9. Check seal faces with a feeler gauge for non-acceptance of 0.1mm (0.004") around the full perimeter of the aperture. Adjust the packing only where this tolerance is exceeded and sufficient only to close the gap.
10. Tighten all of the anchor bolts sufficiently to ensure movement of the penstock unit does not occur during grouting. If movement is suspected when tightening the anchor bolts the feeler gauge check and possible adjustment must be repeated.

Notes: Anchor Bolts

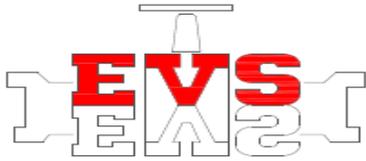
1. The anchor bolts manufactures installation guidelines must be followed for safe application and use of their products.
2. When 'plated' mild steel anchor bolts are used the exposed portion of the bolt a protective coating should be applied to avoid corrosion.

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, and non-acceptance of a 0.01mm (0.004") feeler gauge at the seal faces. 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 wedges.
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 re-check the sealing faces for non-acceptance of a 0.1mm (0.004") feeler gauge.
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.

Cast Iron Penstocks – Soffit Seal Improvements

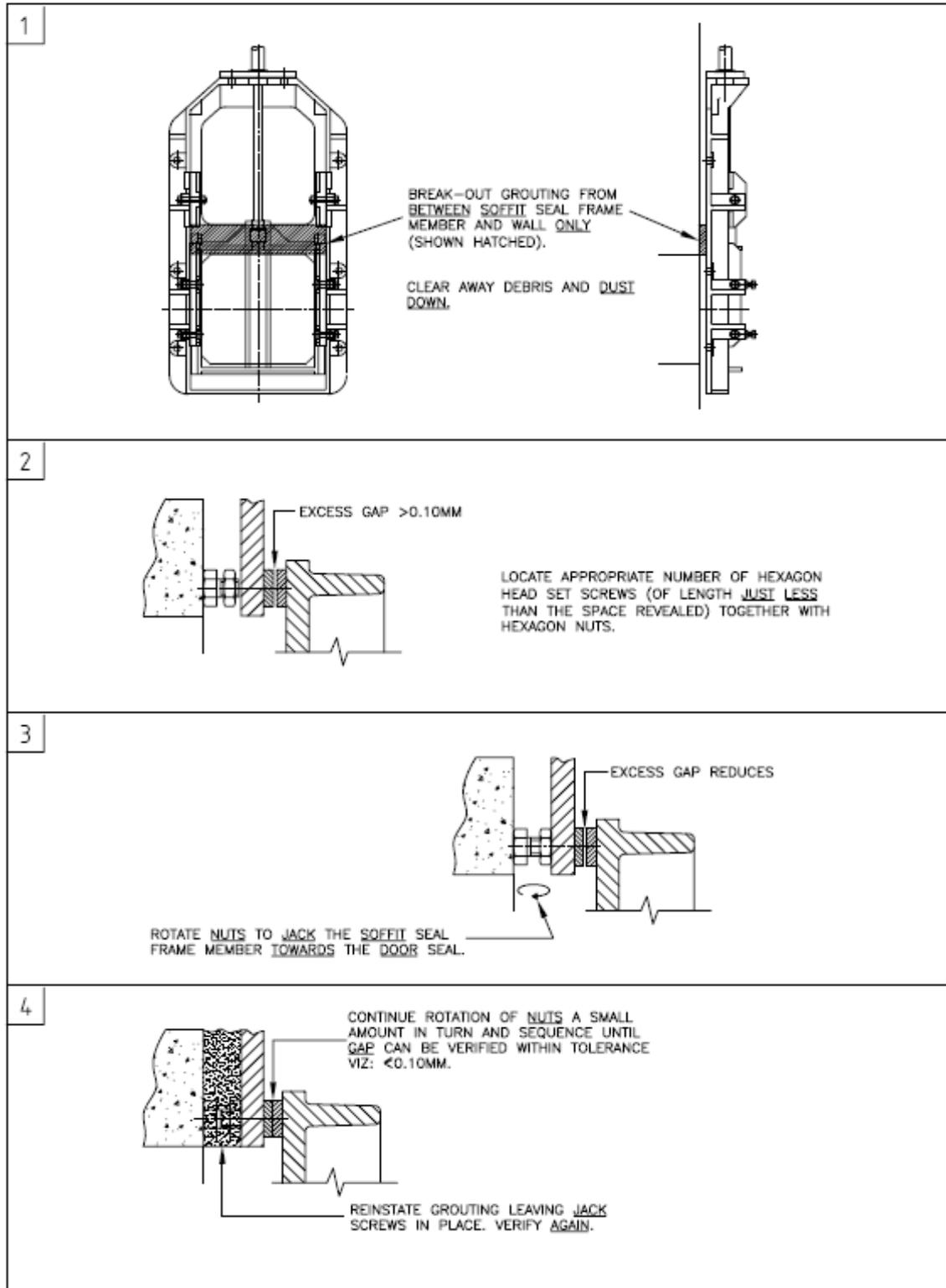
Provided the recommended installation procedure is adopted satisfactory sealing performance should be achieved. However, in the event of leakage through the soffit sealing face the seal performance can be improved implementing the procedure illustrated in Figure 1 below.

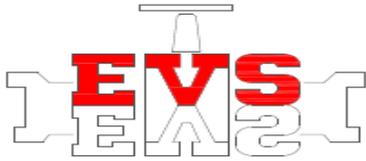


Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk





Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk

1. 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.

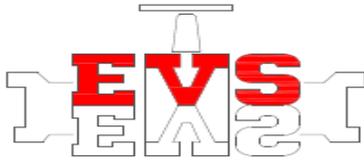
Maintenance Schedule – Penstock Unit

Frequency of maintenance is dependent on the frequency of use and operating duty, in view of this the following recommendations must be considered as minimum requirements.

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.

Cast Iron Penstocks

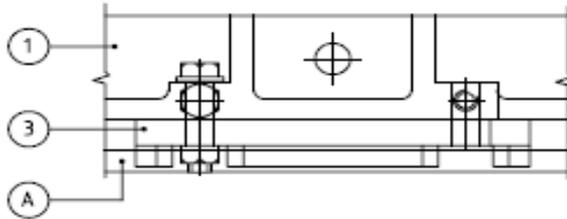
Wedges are pre-adjusted at the factory to satisfy a feeler gauge of 0.1mm (0.004") non-acceptance on the sealing faces prior to despatch. Depending on frequency of operation and service conditions wear on contact surfaces may occur resulting in a requirement to adjust the wedges. Figure 2 below illustrates operation and recommended procedure.



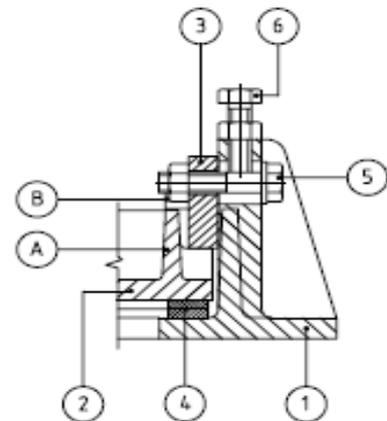
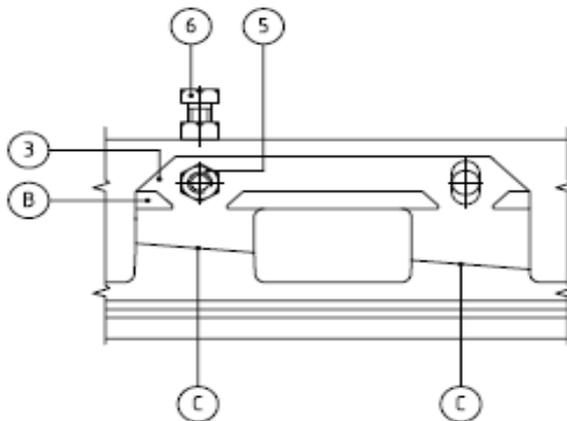
Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
 Units 18/19 The Wallows Industrial Estate
 Dudley Road, Brierley Hill
 West Midlands, DY5 1HR

Tel: 01384 263872
 Fax: 01384 480148
 e-mail: sales@expressvalves.co.uk



ITEM	DESCRIPTION	COMP	DESCRIPTION
1	FRAME	A	GUIDE RIB
2	DOOR	B	GUIDE FLANGE
3	WEDGE/GUIDE	C	WEDGE FACE
4	SEAL FACES		
5	WEDGE BOLT		
6	WEDGE ADJUSTER		



OPERATION OF PENSTOCK WEDGES (SUPA)

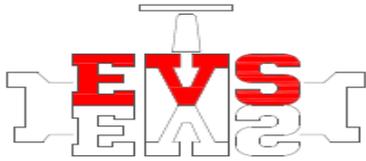
The seal faces (4) are brought together at the point of closure by the wedging action between the wedges (3) and the door (2).

The wedges (3) are clamped to frame (1) by means of wedge bolts (5) and the adjuster (6) prevents the wedge bolts being disturbed from the set point.

The adjusters are not intended to provide any compensation for door distortion in the frame nor entrapment of debris or other obstruction of door movement.

INSTRUCTIONS FOR SETTING PENSTOCK WEDGES (SUPA)

1. Position door (2) 50mm from SHUT.
2. Loosen bolts (5) and unscrew adjuster (6) well away from bolts.
3. Press wedges (3) into frame as far as possible and tighten bolts (5) sufficiently only to hold wedges in place.
4. Close door to the SHUT position to automatically set wedges at the optimum position.
DO NOT CLOSE THE DOOR TOO FAR.
5. Fully tighten bolts (5).
6. Screw adjusters (6) in until they contact the wedge bolts firmly, but do not over-tighten.
7. Secure adjusters with lock nut where supplied.
8. Open door and check operation.



EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk

Penstock & Valve Specialists

1. If penstock(s) are unused for a lengthy period since commissioning the following maintenance checks should be completed prior to commencing operations:-
 - Raise the penstock door and remove debris from the sealing faces, door guide grooves and invert areas,
 - Check to ensure sealing faces on the frame and door are not damaged,
 - Apply grease suitable for the duty to the sealing faces, wedging surfaces, stem screw thread and nut.
 - Operate the penstock from fully closed to fully open several times.
2. Every Three Months
 - Operate penstock(s) through at least one full cycle,
 - If the penstock(s) is located in a situation where debris can collect clean the unit by hosing down
 - If operational procedures permit remove old grease and replace as Item 1 above. Rising stem screw threads can be lubricated at operating level without serious disruption to operations.
3. Every Six Months
 - Check the equipment for signs of wear or damage, with particular attention to the sealing faces if operation procedures allow access to the penstock unit. The effect of normal wear on the sealing faces can be corrected by minor adjustments to the wedging system.
 - Visually check the equipment for signs of corrosion or damage to the paint system and repair as required.
 - Check and adjust the tightness of fasteners that are accessible including the anchor bolts.
 - Check for signs of leakage between the penstock frame and civils, make good any faults.

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. Replace the nut block if necessary.



Penstock & Valve Specialists

EXPRESS VALVE SERVICES LIMITED
Units 18/19 The Wallows Industrial Estate
Dudley Road, Brierley Hill
West Midlands, DY5 1HR

Tel: 01384 263872
Fax: 01384 480148
e-mail: sales@expressvalves.co.uk

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.

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.