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WHITE PAPER

Improving Reliability at Inlet Works

Practical approaches to reducing actuator failures and improving asset reliability.

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Executive Summary

At wastewater treatment works, actuated inlet penstocks represent one of the most critical mechanical assets. The failure of either the penstock or its actuator can create a single point of failure for the entire works, as they control the flow entering the treatment process.

Maintaining these assets extends beyond the actuator itself. In many cases, the greatest reliability challenges occur at the mechanical interface between the actuator and the penstock spindle, where wear, lubrication and environmental protection all play a significant role in long-term performance.

Understanding these failure mechanisms and adopting appropriate maintenance strategies can help reduce unplanned outages while extending asset life.

> “The failure of either the penstock or its actuator can create a single point of failure for the entire works.”

Single point of failure

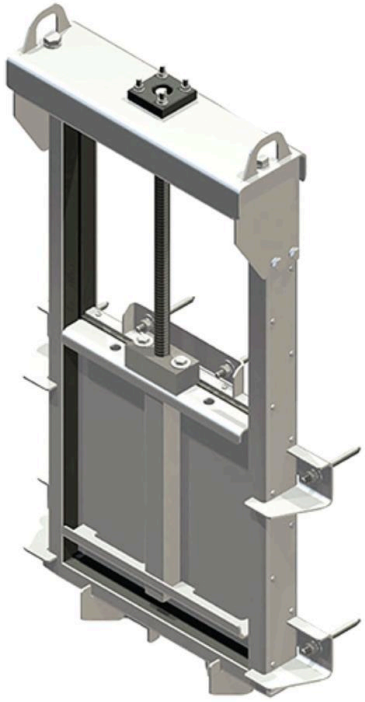
Penstocks and actuators control the flow into the treatmentprocess.

Wear is inevitable

Drivenuts are designed to wear and have a finite operational life.

Simple maintenance

Good lubrication and sealing extend life and improve reliability.



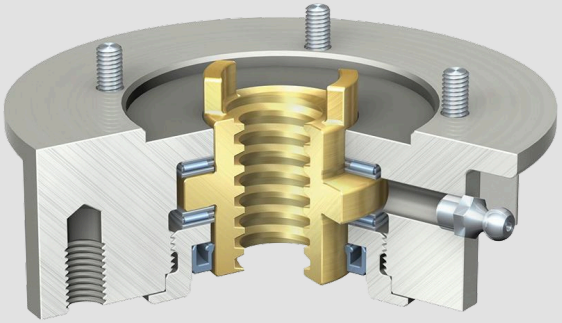
Importance of the Thrust Base

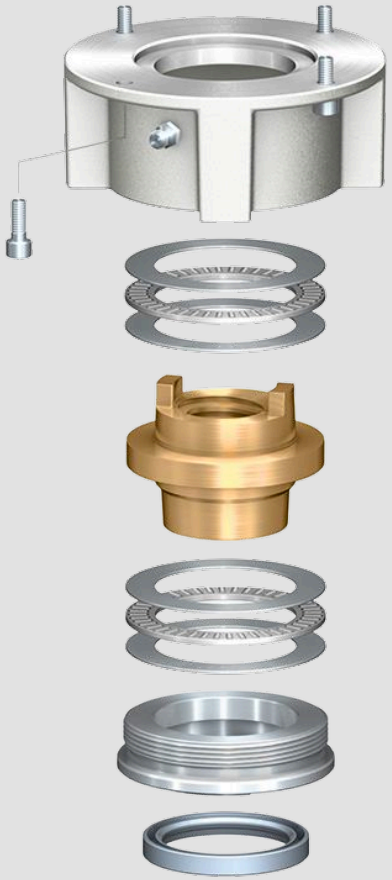
The connection between an electric actuator and a rising-spindle penstock is made through the thrust base.

Although designs differ between manufacturers, the assembly typically contains a housing, bearings, drive sleeve, retaining ring, grease seal, lubrication point and drivenut.

The drivenut is machined to suit the individual penstock spindle and works in conjunction with the thrust bearings to transfer the actuator's output into linear movement.

> These components are the primary wear elements within the assembly and are therefore critical to reliable operation."



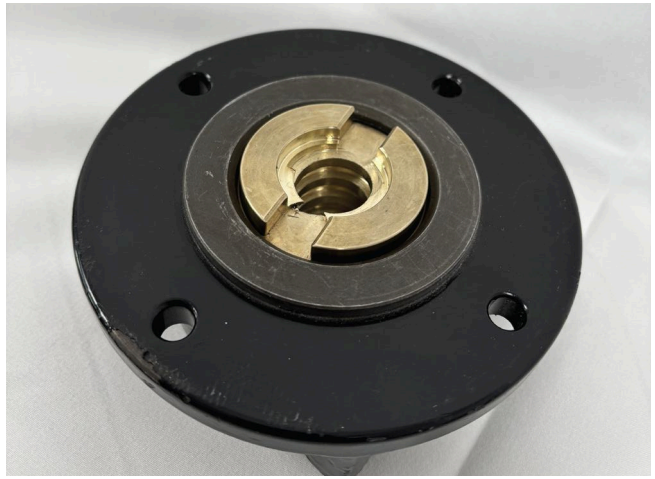


Typical thrust base:
> housing
> bearings
> drive sleeve
> retaining ring and grease seal
> lubrication point.

Designed to Wear

In most installations, a stainless steel rising spindle operates through a phosphor bronze drivenut. The drivenut is intentionally manufactured from a softer material, acting as a sacrificial component that protects the more difficult and costly-to-replace spindle. Consequently, wear is an expected part of its service life rather than an indication of defective operation.

Over time, thread wear can lead to slipping or, in severe cases, complete failure of the threaded engagement. Recognising that the drivenut has a finite operational life is an important aspect of maintenance planning.



Why phosphor bronze?

The drivenut is intentionally manufactured from a softer material, acting as a sacrificial component that protects the more difficult and costly-to-replace spindle.

Water Ingress & Bearing Flange

Thread wear is only one potential cause of failure. The thrust bearings are equally vulnerable if water is allowed to enter the assembly. Damaged or incomplete cover tubes, particularly where end caps are missing, can allow rainwater to wash lubricant from the drivenut and bearings, accelerating deterioration.

Increasing operating torque may provide an early indication of these problems. Higher operating loads can result from bearing degradation or increased friction within the drivenut assembly, highlighting the importance of regular inspection before failures develop.

What it should look like.

Common failures.

Water ingress removes lubrication and rapidly accelerates bearing failure.

Extending Service Life

Although drivenut wear cannot be eliminated, several straightforward maintenance practices can help reduce wear rates and improve reliability. These include accurate machining during installation, maintaining effective lubrication of both the spindle and drivenut threads, preventing the ingress of water and dirt, optimising actuator movement where appropriate, and ensuring the penstock itself remains in good mechanical condition to minimise operating torque.

Where appropriate, extending the length of the drivenut increases thread engagement, distributing wear over a greater surface area and extending operational life compared with a standard-length component.

Reduce wear on the drivenut
Use a thrust base with an extended coupling to spread the wear over for threads and extend operational lifetime.

Machine accurately
Ensure precise machining at installation.

Lubricate
Keep the spindle and drivenut well lubricated.

Keep water out
Maintain cover seal and tubes to prevent ingress.

Maintain penstock
Keep the penstock in good condition to minimise torque.

Monitor torque
Increasing torque may indicate developing problems.

Simple maintenance significantly extends service life and reduces unplanned outages.

Lubrication remains fundamental

Lubrication is one of the simplest yet most important maintenance activities. However, lubricating the thrust bearings does not generally lubricate the rising spindle itself. Accessing the penstock spindle normally requires removal of the cover tube before grease can be applied directly to the thread.

Where regular maintenance cannot be guaranteed, or where cover tubes are difficult to remove safely, automatic lubrication systems offer an alternative. With suitable modification of the drivenut, lubrication can be supplied simultaneously to both the thrust bearings and the spindle thread.

Lubricate driveshaft/spindle

Lubricate thrust bearings

01

Thrust bearings
Ensure regular lubrication to ensure smooth operation.

02

Drivenut thread
Consider lubricating the penstock spindle thread.

03

Spindle
Lubricating the bearings does not automatically lubricate the spindle.

04

Auto lubrication
Automatic lubricating systems can supply grease to both the thrust bearings and the spindle where appropriate.

Protecting the Assembly

The cover tube performs a vital protective function by preventing dirt, grit and rainwater from reaching the spindle and thrust base.

Where plastic cover tubes are used, exposure to sunlight can limit service life, making routine inspection important. Replacing damaged cover tubes helps preserve lubrication and protects the drivenut and bearings from premature deterioration. AUMA can supply Plexiglass or steel cover tubes to replace the plastic ones often supplied by the penstock supplier.

> “Replacing damaged cover tubes protects the entire assembly.”

Focusing Maintenance Where It Matters

Modern electric actuators generally require relatively little routine maintenance. Instead, inspection should concentrate on the associated mechanical components.

Routine checks should include confirming the condition of the cover tube, verifying lubrication of both spindle and thrust bearings, monitoring drivenut wear, and reviewing actuator fault logs for repeated torque trips that may indicate developing problems with the penstock seat, seals or spindle.

Maintenance intervals should reflect the duty of the asset rather than relying solely on fixed schedules, as operating conditions vary significantly between installations. Holding a pre-machined replacement drivenut can also reduce downtime when replacement becomes necessary.

- Check cover tube integrity
- Verify spindle grease
- Lubricate thrust bearings
- Monitor drivenut wear
- Review actuator fault log
- Plan for replacement parts

Maintenance intervals should reflect:

- The duty of the asset
- Operating conditions
- Asset management data

Using Operational Data More Effectively

Many modern electric actuators incorporate asset management functions that record operating history and fault events.

These systems can provide early indication that actuator servicing is required, while repeated torque trips may highlight emerging issues within the penstock itself. Using operational data in this way allows maintenance activities to be targeted according to asset condition, supporting a more preventative approach.

Torque events
Repeated torque trips may indicate issues with the penstock or spindle.

Trend analysis
Identify patterns before failures occur.

Plan proactively
Scheudle maintenance based on actual usage and condition.

Condition-based maintenance reduces unplanned outages and optimises asset performance.

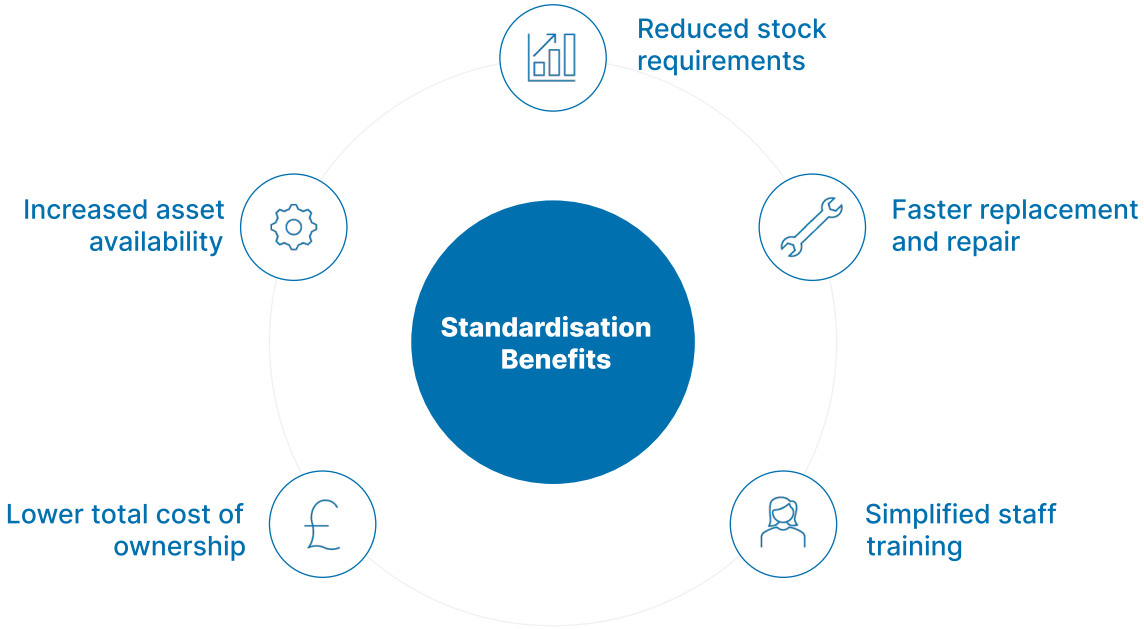
Standardisation Can Simplify Asset Management

Alongside effective maintenance, standardising actuator assets can improve operational efficiency across treatment sites.

A common actuator platform can reduce the number of spare units and replacement parts required, simplify installation and retrofit activities, minimise training requirements and improve availability by allowing standard units to be held in stock.

Compatibility with multiple control options, variable speed settings and standard mounting arrangements can also simplify replacement of existing equipment while reducing downtime.

Standardisation offers the opportunity to introduce more consistent maintenance practices for operators managing large asset portfolios while improving responsiveness when replacement is required.



01	Maintain the mechanical interface	Regularly inspect and maintain the thrust base and spindle.
02	Keep water out	Ensure cover tubes and seals are intact and effective.
03	Lubricate effectively	Lubricate both the spindle thread and thrust bearings.
04	Review and analyse	Use actuator data to identify issues early.
05	Standardise where possible	Use common components to simplify maintenance.

Conclusion

Reliable operation of inlet penstocks is fundamental to the performance of wastewater treatment works. Although the actuator often attracts attention, experience shows that the greatest maintenance priorities frequently lie within the mechanical interface between the actuator and the penstock.

Recognising the drivenut as a sacrificial component, maintaining effective lubrication, protecting the assembly from water ingress and monitoring operational data can all contribute to extending service life and reducing the likelihood of unplanned failures.

Combined with a considered approach to asset standardisation, these practical maintenance measures can help improve availability, reduce downtime and support more effective management of critical inlet works infrastructure.

> “Maintaining the mechanical interface is often more important than maintaining the actuator itself.”

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