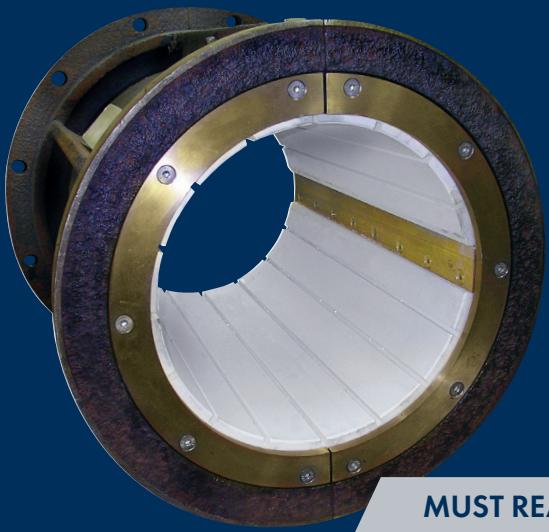
For Successful Installation & Operation of

THORDON SXL

Water-Lubricated Turbine Guide Bearings for Hydro Turbines



MUST READ CONTENTS

SXL BEARINGS

The information in this document has been prepared based upon Thordon Bearings Inc. experience and best practices developed over many years in designing and installing hydro turbine main guide bearings.

The information provided here is a general guideline for the installation and operation of SXL Turbine Guide Bearings (TGB).

Detailed technical information can be found in the Thordon Elastomeric Bearings Engineering Manual version 2022.1 in conjunction with Thordon's Bearing Sizing Calculation Program.

If there are any questions regarding this document, please contact the authorized Thordon Bearings Inc. distributor in your area. A list of global distributors can be found at:

www.ThordonBearings.com

SXL TURBINE GUIDE BEARINGS SPECIFICATION

1. General

The bearing wear surface is Thordon SXL, a non-metallic, homogeneous, elastomeric polymer alloy. Special lubricants are included in the material formulation to reduce start-up friction and eliminate stick-slip, providing a low coefficient of friction. A mechanical means of anti-rotation should be fitted.

2. Arrangement

Interference fitting is the recommended method for fitting the TGB. To achieve this, the bearing shall have a minimum wall thickness to permit interference fitting as specified by the Thordon Bearing Sizing Calculation Program.

The bearings are split and may be comprised of single or multiple bearing segments.

Alternatively, a bonded installation is also possible. Typically, the SXL bearing is bonded with TG-75 into a split housing, with the I.D. finished machined after bonding.

3. Axial Retention

All bearings must be fitted with mechanical means for limiting axial movement. Most commonly, this will be a shoulder in the bore at the bottom and also for the Radial Segmented Seal housing at the top of the bearing carrier/housing. Alternatively, a split circular, bolted retaining ring may be used at the bottom of the bearing carrier/housing.

4. Shaft Liner/Shaft Sleeve (if required)

The shaft in way of the bearing should have a cylindrical, smooth continuous non-corroding surface. Welded layers, split welded-on liners, or split bolted liners can be used. A shaft liner is to be used, made from a good quality stainless steel or equivalent material with minimum thickness requirements.

Ideally, surface finish should be 0.4 micrometres (16 microinches) Ra; up to 1.6 micrometres (63 microinches) Ra can perform satisfactorily.

Please contact Thordon Bearings for other liner material options.

5. Cooling Water

The minimum water flow rate for SXL Turbine Guide Bearings is 0.3 litres per minute per millimetre (2 US gal. per minute per inch) of shaft diameter.

The recommended method of supplying water to the bearings is with a dedicated pump to each TGB, however other methods are acceptable provided that the minimum water flow requirements are met.

The lubrication water should be as cool as possible and water above 40°C (104°F) is to be avoided. Use of water, already heated, from previous cooling duty is not to be used.

The recommended water supply piping arrangement shall include a flow meter indicating low flow that is connected to an alarm in the control room. The low flow alarm should be set at the calculated minimum water flow required for the bearings.

Cooling/lubrication water shall normally be supplied at the top of the TGB so that it flows over the full length of the TGB, before exiting near the runner.

6. Clean Water

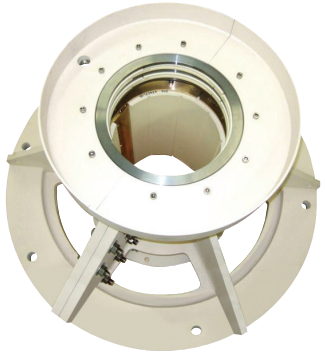
Typically, the removal of abrasives between two operating surfaces will prolong the wear life in most mechanical systems. If the turbine is supplied by water containing sand or other abrasives, it is recommended to remove such abrasives to minimize bearing wear. If clean water is not possible, then other considerations should be made = please contact Thordon Bearings.

The removal of abrasives can be accomplished by many methods. The method chosen should ideally remove suspended solids with a specific gravity of 1.2 or higher and greater than 100 (0.004") microns.

Thordon Bearings Inc. offers a Water Quality Package (WQP) to supply a steady flow of conditioned water to the bearings and seals.

7. Shaft Seals

A Radial Segmented Seal (RSS) is recommended, however other water-lubricated seal options can be used.



INSTALLATION

The recommended method for fitting SXL bearings is to install using an interference fit. To ensure that the force generated to hold the bearings is sufficient, the dimensions of the machined bearing should be verified against the design dimensions for the installation.

The bearings can be installed with either freezing or cooling, e.g. use of ice water. During installation, it is recommended to leave axial gaps between the bearing segments and the bottom retaining rings. The lower part of the bearing can be shimmed with dissolvable shims. With multiple bearing segments, the grooves in the bearings should be aligned, with care taken at the machining stage.

Bearing Care – Installation to Delivery

Once the SXL bearing has been installed in the turbine, it should be protected from:

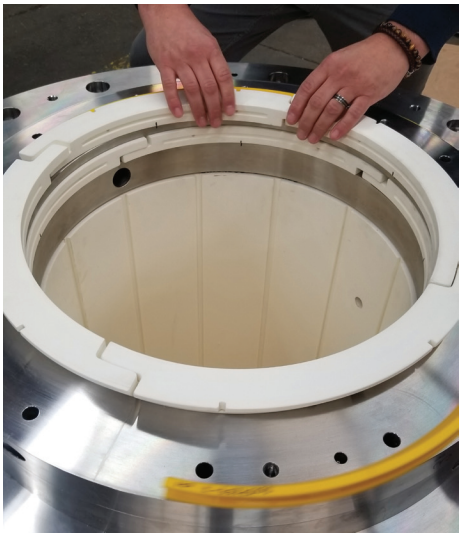
1. **Debris** – the bearing should be protected against debris entering the bearing such as sandblasting material, paint, weld slag, etc.
2. **Heat** – the bearing should be protected from temperatures in excess of 50°C (122°F), especially from the heat of welding.
3. **Chemical attack** – the bearing should be protected from any chemicals.
4. **Corrosion** – adjacent metal parts should be protected from corrosion as the corrosion particles could enter the bearing and cause premature wear. Stainless Steel housings are recommended.

MAINTENANCE

Shaft surface roughness should be maintained at less than 1.6 micrometres (63 microinches) Ra to prevent accelerated bearing wear.

Shafts and liners in way of the bearings must be kept clean and smooth.

Bearing Measurements – Bearing wear down or clearances are to be recorded periodically as part of best maintenance practices.



STORAGE

Long-term exposure to sun (ultraviolet radiation) may cause the surface of the bearing material to undergo a colour change. However, once the surface layer is removed, the underlying material will be the original colour and still maintain its physical properties.

Testing and experience indicate that Thordon SXL bearings can be stored for 20 years or longer if stored in controlled environmental conditions.

The following steps will extend the life of the bearing in storage:

1. Store out of direct sunlight protected from weather, preferably in warehouse or similar.
2. If possible, wrap the bearing in plastic wrapping or similar.
3. Store at ambient temperature. Avoid high humidity and temperatures above 40°C (104°F).
4. Avoid contact with solvents.
5. Store tubular material on one end to minimize product deformation.

THORDON

THORDON BEARINGS INC.

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3225 Mainway, Burlington, ON L7M 1A6 Canada
Tel: +1.905.335.1440 Fax: +1.905.335.4033

www.ThordonBearings.com