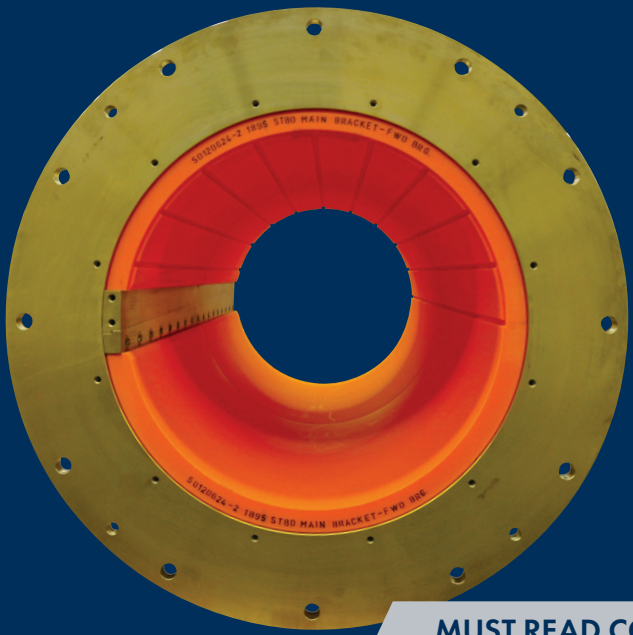
For Successful Installation & Operation of

THORDON COMPAC

Seawater Lubricated Propeller Shaft Bearings



MUST READ CONTENTS

COMPAC BEARINGS

The information in this document has been prepared based upon Thordon Bearings experience and best practices developed over many years in designing and installing seawater lubricated propeller shaft bearings.

The information provided here is a general guideline for the installation and operation of COMPAC bearings.

Detailed technical information can be found in the Thordon Marine Bearing Installation Manual in conjunction with the Thordon Bearing Sizing Calculation Program.

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

www.ThordonBearings.com

COMPAC PROPELLER SHAFT BEARING SPECIFICATION

DESIGN

1. General

The bearing wear surface is Thordon COMPAC, a non-metallic, elastomeric polymer alloy. Special lubricants are included in the formulation to reduce start-up friction and eliminate stick-slip, providing a low coefficient of friction. To promote early formation of a hydrodynamic film between the shaft and bearing, the lower (loaded) portion of the bearing is without grooves, while the upper half of the bearing incorporates axial grooves for enhanced flow of the water lubricant/coolant. Since angular orientation of the bearing is important, mechanical means of anti-rotation should be fitted.

2. Arrangement

Interference fitting is the recommended method for fitting the propeller shaft bearings. 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 bearing may be a solid tube or split and may comprise of single or multiple axial bearing segments.

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 one end and a circular, bolted retaining ring at the other.

4. Shaft Liner (if required)

The shaft in way of the bearing should have a cylindrical, smooth continuous non-corroding surface. If a shaft liner is to be used, the liner shall meet Classification Society (or applicable quality standard) requirements. Where deemed beneficial to reduce the risk of damage because of calcareous deposits, Inconel® 625 (or equivalent) should be used as the liner material.

Ideally, the surface finish should be 0.8 micro-metres (32 micro-inches) Ra; up to 1.6 micro-metres (63 micro-inches) Ra can perform satisfactorily.

Aluminum bronzes are not recommended as a shaft liner material. Please contact Thordon Bearings for other options.

5. Corrosion Protection

If the shafting is made from a ferrous material, then the sections of the shaft exposed to seawater shall be suitably protected from corrosion. The shaft coating shall be applied in accordance with the manufacturer's recommendations with care to be taken to ensure the integrity of the coating where it meets the shaft liners.

6. Cooling Seawater

The minimum water flow rate for COMPAC bearings is 0.15 litres per minute per millimetre (1 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 shaft line, however other methods are acceptable provided that the minimum water flow requirements are met.

The lubrication water should be as cool as possible. Ambient seawater is preferable. Water already heated from previous cooling duty, is not recommended.

If available, onboard sources of non-salt lubrication water may be used for cooling water. See Maintenance section (below) for more details.

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

Cooling/lubrication water shall normally be supplied at the forward end of the stern tube so that it flows over the full length of the forward bearing through the stern tube, then over the full length of the aft bearing before exiting outboard.

For strut bearings, where water flow is provided by the movement of the vessel through the water, fairwaters and rope guards should include design features to encourage water flow into and out of the bearing – see link for further information:

https://thordonbearings.com/docs/default-source/marine/documents/technical-notice-rope-guards-streaming-cap-clearances.pdf

Pumped water flow may also be an option for strut bearing lubrication.

7. Clean Seawater

Typically, the removal of abrasives between two operating surfaces will prolong the wear life in most mechanical systems. If the vessel is to operate in waters containing sand or other abrasives, it is recommended to remove such abrasives to minimize bearing wear.

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.

8. Seals

A face or lip seal is recommended, however other water lubricated seal options can be used.

INSTALLATION

The recommended method for fitting COMPAC 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 dry ice or liquid nitrogen. During installation, it is recommended to leave axial gaps between the bearing segments and the retaining rings. The gaps will reduce as the chilled bearing returns to ambient, due to thermal expansion of the bearing material. The lower (loaded) part of the bearing I.D. is smooth, and the upper half of the bearing has grooves. With multiple bearing segments, the grooves in the bearings should be aligned.

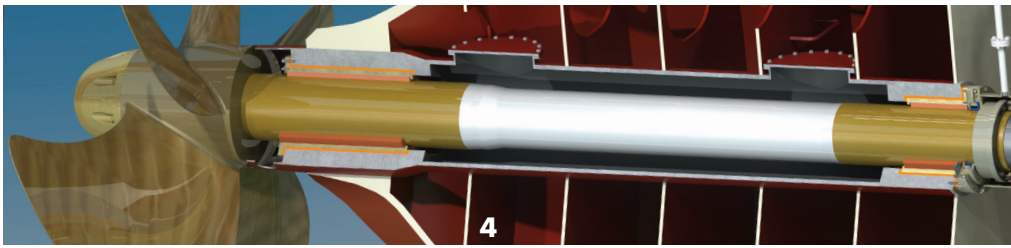
Liquid soap (without particulates) can be used as a lubricant to assist in shaft insertion.

Important: please refer to our Marine Bearing Installation Manual regarding installation and precautions when using a chocking compound.

Bearing Care – Installation to Delivery

Once the COMPAC bearing has been installed in the ship, it should be protected from:

1. **Debris**
   The bearing should be protected against any debris entering while on dock and afloat. The ship's propulsion system should not be tested at dockside or in dry dock basin where large amounts of debris can be stirred up allowing entry into the bearing. This may cause premature bearing wear.
2. **Heat**
   The bearing should be protected from temperatures more than 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.



MAINTENANCE

Marine Growth

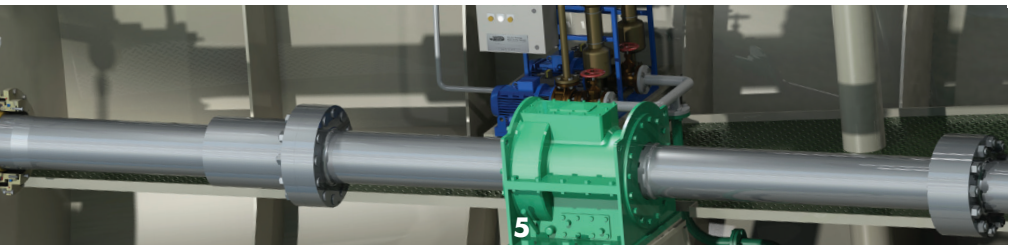
Surfaces exposed to seawater are typically subject to fouling by marine growth (a biological process), calcium carbonate deposits (an electrochemical process) and other shaft deposits (e.g. corrosion by-products).

Fouling (marine growth) tends to be more aggressive in warmer waters than in colder areas. Marine growth can be relatively limited in areas where the water is brackish, there is tidal exchange or where suspended oxygen levels are reduced.

Bearing damage because of deposits on the liner must be reduced or eliminated.

This risk typically applies to vessels that operate 3,000 hours per year or less. Once present, deposits can lead to premature bearing wear, regardless of the bearing and liner materials present. The following mitigating techniques are necessary as best practices:

- Where a vessel is idle for periods lasting longer than two days, good marine practice is to slowly rotate the shaft for 2.5 full revolutions every 1–2 days to dislodge marine growth and calcium carbonate deposits on journal surfaces. When in port and the seawater temperature outside the vessel exceeds 25°C (77°F) it is recommended that shafts are rotated at least daily, if possible.
- Shaft surface roughness should be maintained at less than 1.6 micro-metres (63 micro-inches) Ra to prevent premature bearing wear.
- When alongside, continuous flow of the bearing cooling water will prevent stagnation and further discourage growth on surfaces within the system. For strut bearings experiencing deposits, providing a water feed to the strut bearings that will allow a flow of non-salt water for regular flushing, coupled with shaft turning practices can reduce deposit formation. Non-salt water can be any onboard water source such as air-conditioner condensate or freshwater sources. Apply the non-salt water to sterntube to initially replace the volume of water in the sterntube, followed by a trickle feed to maintain pressure against the sea water.
- In cases of aggressive growth of calcium carbonate deposits, or when shaft turning maintenance is not possible, Inconel® 625 (or equivalent) shaft liners are more able to resist the adherence of calcium carbonate deposits. The best possible outcome is achieved when flushing and routine shaft turning is performed in combination with the use of Inconel® 625 (or equivalent) shaft liners.



Outfitting

- Where a vessel is being outfitted afloat for extended periods, the local water conditions should be better understood to determine what countermeasures, if any, are necessary.
- Some examples of these countermeasures, include a slow continuous supply or periodical flush of the system with fresh water (chlorinated drinking water is OK), or temporarily closing the system apertures to prevent the ingress of the marine organisms and salts.
- Newbuild vessels should have their shaft/liners thoroughly inspected and cleaned before sea-trials, especially after a long period of outfitting while alongside.

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

Bearing Measurements

Bearing wear down or clearances should be recorded at delivery and periodically.

STORAGE

Testing and experience indicate that Thordon COMPAC 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 excessive humidity and temperatures above 40°C (104°F).
4. Avoid contact with solvents.
5. Store tubular material on end to minimize product deformation.

LEAVE NOTHING BEHIND

with a COMPAC Open Seawater Lubricated Propeller Shaft System

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THORDON BEARINGS INC.

Want to learn more about a Seawater System? Contact us today!

info@thordonbearings.com | www.ThordonBearings.com/Seawater

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