Over fifty years ago, ship owners and managers made the conversion from seawater lubricated lignum vitae (a self-lubricating wood) to oil lubricated white metal stern tube bearings. Concern over the continued supply of quality lignum vitae, and improvements in lip shaft sealing technology, facilitated this development. As the majority of commercial ocean-going ships operate with a propulsion system using a propeller shaft supported by oil lubricated metal bearings with the oil contained in the stern tube by forward and aft shaft seals, stern tube oil pollution has become a concern. According to seal manufacturers, the seal must leak (aft-into the sea or forward-into the ships bilge) at the shaft/seal interface in order for the seal to function properly. As well, simple fishing net or rope caught on a ships rotating shaft can also damage the aft seal allowing stern tube oil to flow out into the sea.

Using a proven, available technology, there is an alternative to an oil lubricated sealed system that completely eliminates stern tube oil pollution and the risks associated with it. A Thordon seawater-lubricated COMPAC bearing system uses seawater as the lubrication medium in place of oil. The seawater is taken from the sea, pumped through COMPAC elastomeric polymer shaft bearings and returns to the sea. No stern tube oil is needed.

STOP (STERN TUBE OIL POLLUTION)

During the last few decades, the pollution of the world’s oceans has become a matter of increasing international concerns. Zero tolerance for any kind of ship source pollution is now becoming the norm and international regulations are becoming more and more stringent.

Violations of international, national and local environment laws are resulting in numerous penalties - criminal (such as large fines or jail terms), civil and judicial or administrative (such as loss of government contracts or permits). These penalties can be applicable to any company or individual such as the master, the chief engineer, the owner, the operator, the charterer of the ship and the Classification Society.

The safest way for today’s ship owners and managers to ensure there is no risk of environmental violations is to completely eliminate stern tube oil pollution by using COMPAC bearings lubricated with seawater. With over 30 years of bearing experience using the proven principles of seawater lubrication, Thordon’s COMPAC stern tube bearing system is a simple, reliable and oil-free system.
PIONEERS IN SEAWATER LUBRICATED BEARING TECHNOLOGY

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GOOD FOR THE SEA. GOOD FOR BUSINESS. GOOD FOR LIFE.

To demonstrate to commercial ship owners that modern seawater lubricated propeller shaft bearing systems do offer wear life predictability, reduced operating costs and elimination of stern tube oil pollution risks, Thordon Bearings has introduced a 15 year bearing wear life guarantee for its COMPAC seawater lubricated stern tube bearings. Elastomeric polymer COMPAC stern tube bearings, lubricated by a consistent supply of conditioned water from Thordon’s integrated Water Quality Package, ensure long, predictable wear life and completely eliminate stern tube oil as a potential pollution source.
The Thordon COMPAC stern tube bearing system includes:
- COMPAC elastomeric polymer stern tube bearings (with bearing carriers when appropriate)
- Thordon Water Quality Package
- Shaft liners
- Thor-Coat shaft coating
- Seawater lubricated forward seal (Thordon can supply if requested)

COMPAC Elastomeric Polymer Stern Tube Bearings

The bearing wear surface is Thordon COMPAC, a non-metallic, elastomeric polymer alloy. To reduce start-up friction and eliminate stick-slip, COMPAC’s formulation includes special lubricants to provide 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 smooth, while the upper half of the bearing incorporates grooves for flow of the water lubricant/coolant. COMPAC bearings are approved by all major Classification Societies. The L/D ratio for COMPAC can be as low as 2:1 for the bearing adjacent to the propeller and 1:1 for all others depending upon the load and operational requirements. If the bearings are to be aligned, and resin chocked into position, they should be installed in a metal carrier. A Thordon tapered keyset can be provided to allow the bearing to be removed for inspection or replacement without removing the shaft. The COMPAC bearing is split and the key is comprised of two parts sliding on a taper – a fixed section and a removable sliding section.

Thordon Water Quality Package

A steady supply of seawater with the significant abrasives removed is an important element in ensuring long, predictable, bearing wear life. With this factor in mind, Thordon has developed a self-contained supply, conditioning and monitoring package to ensure that an adequate supply of clean water is consistently being delivered to both the forward seal and the bearings.

The Thordon Water Quality Package is designed to supply seawater to the stern tube bearings for lubrication and cooling at a minimum flow rate of 0.15 litres/minute/mm (1 US gallon/minute/inch) of shaft diameter and to condition seawater from the water supply by removing suspended solids greater than 50 microns (0.002”) with a specific gravity of 1.2 or higher. Seawater is sourced directly from the ship’s sea bay, or alternately, from a suitable existing onboard supply.

A flow alarm is incorporated to alert the operator to any low water flow condition to the bearings. The Thordon Water Quality Package is designed to operate on a stand-alone basis, or can be fully integrated into the ship’s control and monitoring systems to allow operation in an unmanned machinery space.

Shaft Liners

Since bearing “clearance” is the sum of both bearing wear, and wear of the shaft liner, a high quality shaft liner is an important component of a COMPAC bearing system. Thordon Bearings recommends shaft liners made from a good quality centrifugally cast bronze, stainless steel or Inconel alloys. Weld clad inconel or others acceptable to Classification Society Rules are also possible.

Thor-Coat Shaft Coating

In a COMPAC seawater lubricated bearing system, clean seawater is used as the lubricant. Where the shaft is exposed to salt water, the shaft must be protected by a corrosion-resistant coating. Thor-Coat is a modified epoxy coating having enhanced flexibility and no woven fabric component. Thor-Coat is designed to provide 10 year or greater integrity – potentially eliminating the need for the 5 year shaft withdrawal and inspection. Easily applied to a thickness of 2mm, (0.079”) on the shaft, Thor-Coat is a one-coat product.

Forward Seal

Thordon recommends a face seal or lip seal for use with the COMPAC seawater lubricated stern tube bearing system. Thordon’s new Sea Thigor mechanical face seal is a recommended option for shaft diameters up to 400mm (15.75”). A separate detailed brochure on the Thordon Sea Thigor seal is available.
**COMPAC Seawater Lubricated Stern Tube Bearing System**

The Thordon COMPAC Stern Tube Bearing System includes:
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COMPA

Seawater Lubricated Stern Tube Bearing System

Thor-Coat Shaft Coating
- Thordon's tough new modified epoxy coating, designed to provide 10 year integrity against corrosion

Thordon Water Quality Package
- A Thordon Water Quality Package delivers a consistent supply of conditioned water to both the FWD seal and all bearings. A separate detailed brochure on the Thordon Water Quality Package is available

AFT COMPAC Bearing System
- COMPAC bearing in bronze carrier with retaining ring
- Thordon recommended shaft liner in way of the bearings
- No AFT seal required

COMPAC Single Tapered Key Design
- COMPAC split bearing with a single tapered key allows bearings to be withdrawn, inspected and re-installed in a matter of hours with the shaft in place

FWD COMPAC Bearing System
- COMPAC bearing in bronze carrier
- Thordon recommended shaft liner in way of the bearings
- Face type FWD shaft seal shown here
**Zero Pollution Risk**

The COMPAC seawater lubricated stern tube bearing system eliminates stern tube oil, as the lubricant is the sea water. There is no AFT seal, no storage of oil, no sampling of oil, no disposal of stern tube oil and no worry of ingressing seawater contaminating the oil. Expensive, multiple chamber AFT seals designed to ‘trap’ oil leakage and drain it inboard for further processing and disposal are not required. Thordon’s COMPAC system ensures ship owners/operators that there will be no environmental violations resulting from stern tube oil leakage.

**Lower Life Cycle Costs**

COMPAC seawater lubricated stern tube bearings typically may mean a higher up-front cost initially than comparable oil lubricated white metal stern tube bearings due to the need for bronze shaft liners and corrosion resistance.
**Ship Owner Benefits**

**15 Year COMPAC Stern Tube Bearing Wear Life Guarantee**

In newbuild applications, the ship owner must clearly specify the complete COMPAC system (including Thordon Water Quality Package, Thor-Coat and approved shaft liners) to the ship yard in order to qualify for the 15 year wear life guarantee. The Thordon COMPAC Stern Tube Bearing System is guaranteed to meet Classification Society stern tube bearing wear specifications for 15 years or Thordon Bearings Inc. will supply new bearings free of charge. The guarantee is limited to the supply of replacement bearings delivered to the ship. It does not include replacement of any other Thordon supplied components nor any drydocking or installation costs. A copy of the specification is available from Thordon Bearings Inc.

The bearing guarantee is available for commercial newbuild vessels with shaft diameters of 300mm (12") or greater and COMPAC bearings enclosed in stern tubes. Standard operating parameters as specified by Thordon Bearings (for example – system maintenance, minimum water flows, etc.) must be provided and maintained by the ship owner. The guarantee is limited to the owner of the ship. Full details of the 15 year guarantee are available from Thordon Bearings Inc.

*The guarantee is subject to prior approval by Thordon Bearings Inc. and limited to the supply of replacement bearing(s).*

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**Proven Long Bearing Wear Life**

Bearings wear data has been recorded for several ships with shaft diameters over 500mm (20") that have been operating with the COMPAC bearing system for at least 5 years. Results have shown the bearings are expected to last 15 to 20 years as pointed out in the charts for two major cruise line operators.
protection of the shaft. However, with the elimination of aft seal maintenance and stern tube oil costs, the up-front costs are recouped with lower in-service costs. Based on existing user experience of COMPAC seawater lubricated propeller shaft bearings, overall life cycle costs have been reduced compared to oil systems for these ship owners.

**Controlled Bearing Environment**

Thordon’s Water Quality Package ensures an adequate supply of clean water is consistently being delivered to both the forward seal and the bearings. Lubrication of the bearing is assured and a long predictable bearing wear life is achieved. A controlled supply of clean water allows Thordon to offer a 15 year bearing wear life guarantee.

**Extensive References**

Thordon COMPAC propeller shaft bearing systems are extensively used in over 500 commercial, naval and coast guard applications. Today, commercial ship owners and operators around the world have chosen COMPAC for its pollution-free simplicity and proven reliability. Reference lists and orders of commercial ships equipped with COMPAC seawater lubricated stern tube bearings are available from Thordon Bearings Inc.

**Simple Design for Newbuilds and Conversions**

The COMPAC system was developed from improvements in non-metallic materials and bearing design combined with the proven principles of water lubrication technology and that has existed since the earliest days of shaft driven propellers. The seawater is sourced from the ship’s sea bay, pumped to the forward section of the stern tube just aft of the seal, through the forward and then aft bearings, and returns to the sea.

**Abrasion Resistant**

Due to its elastomeric properties, the Thordon COMPAC bearing tends to deflect and then reject small abrasive particles, allowing them to be flushed through the bearing without becoming embedded.

**Lower Friction Than Oil**

Thordon COMPAC stern tube bearings have been designed to reduce running friction and improve low speed hydrodynamic film development. The lower (loaded) portion of the COMPAC bearing is smooth and the upper half is designed with water grooves for lubrication and cooling. Although start-up friction is initially higher, at rated shaft speeds drag on the rotating shaft resulting from the viscosity of the lubricating fluid is lower with water than with oil, resulting in potential fuel savings.

**Reduced Time in Dock with Single Key Design**

Thordon COMPAC’s unique single tapered key design allows inspection or renewal of the bearings with the shaft in place. Originally developed for Disney Cruise Lines, the split bearing design allows the bearings to be withdrawn, inspected and reinstalled in a few hours.

**Survivability**

If a serious bearing failure occurs with a white metal or reinforced plastic bearing, significant heat is often produced and there can be damage to the shaft as well as the bearing. As the Thordon COMPAC polymer softens at a lower temperature than metallic or other non-metallic bearing materials, excessive amounts of heat are not produced in failure mode and shaft damage is avoided.

**Easily Machined and Fitted**

Thordon COMPAC machines cleanly and produces no airborne machining debris. COMPAC is much lighter than white metal bearings and can be fitted quickly and easily by freezing in liquid nitrogen.
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**Increased Tolerance To Misalignment & Edge Loading**

As a Thordon COMPAC bearing is 50 times more elastic than white metal and 3 times more compliant than other common non-metallic propeller shaft bearings, COMPAC deflects slightly under edge loading. The load is spread, and the localized pressure on the bearing is reduced, eliminating the bearing wiping that often occurs under these conditions.

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Customer Focused To Support Your Immediate And Future Needs

Supply and Service: Geared to provide quick response to customer needs, Thordon Bearings understands the importance of fast delivery and reduced down time. Thordon marine and industrial bearings can be designed, produced to the exact requirements of the customer and shipped quickly.

Distribution: With Thordon bearings specified all around the world, an extensive distribution network has been established in over 70 countries. Inventories of common bearing sizes are stocked by local Thordon Distributors and are backed up by large regional and head office Thordon stocks.

Application Engineering: Thordon Bearing’s engineers work closely with customers to provide innovative bearing system designs that meet or exceed the technical requirements of the application.

Manufacturing: Thordon’s modern polymer processing facility is staffed with experienced and dedicated employees. Bearings up to 2.2 m (86") in diameter have been supplied and bearings up to 1.5 m (60") O.D. can be machined in-house.

Quality: Thordon Bearings Inc. is a Canadian company manufacturing to ISO 9001:2000 Quality System requirements. With over 35 years experience in polymer bearing design, application engineering and manufacturing, Thordon marine and industrial bearings are recognized worldwide for both quality and performance.

Research and Development: Thordon bearings are being continuously tested by our Bearing Test Facility. The Facility evaluates new designs and applications before they are put into service. Ongoing testing not only allows for design refinements, but ensures quality and performance after installation. Our polymer laboratory evaluates new and modified polymers in a continuing quest to improve Thordon bearing performance and searches for new polymer bearing solutions.