

THORDON

THORDON BEARINGS INC.



Grand Princess, Equipped with COMPAC bearings, Installed in 1998

**COMPAC OPEN SEAWATER LUBRICATED
PROPELLER SHAFT BEARING SYSTEM
FOR CRUISE SHIPS**

COMPAC FOR LIFE

SEAWATER LUBRICATION IS **FREE**

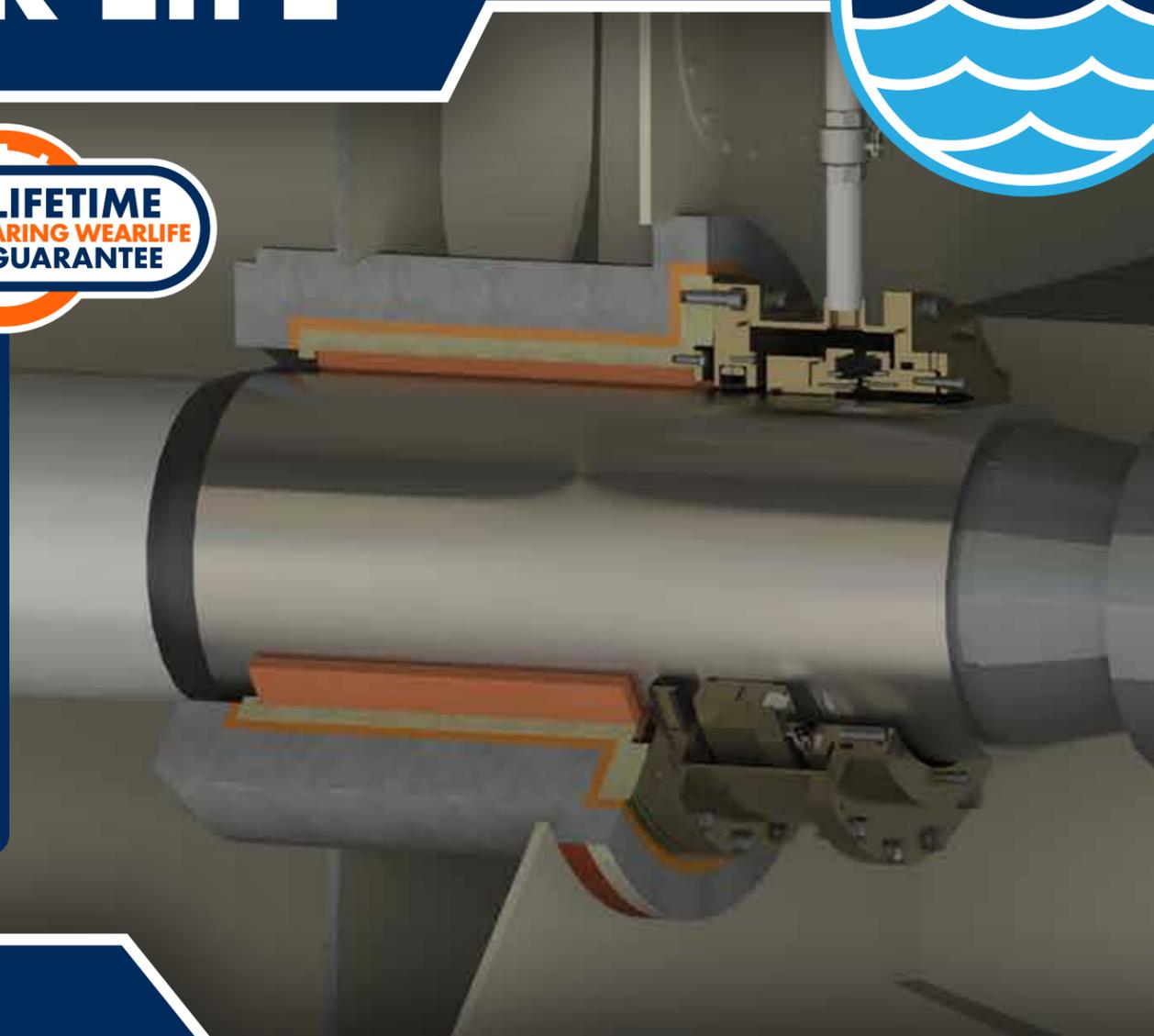


Benefits of Water Lubricated Propeller Shafts Compared to Podded Propulsion

In 20+ Years History, the 46 Ocean-Going Cruise Ships that are Equipped with Thordon **COMPAC** Seawater Lubricated Propeller Shaft Bearing System:

- have never had a cruise cancellation nor had to revise an itinerary due to shaftline/bearing problems
- have extremely low or zero maintenance costs
- do not use oil lubrication, so there is zero risk of polluting our oceans and seas
- are easier for pilots and masters to manoeuvre as steering decisions are intuitive
- are easily repaired in most shipyards around the world

LIFETIME BEARING WEARLIFE GUARANTEE



Thordon COMPAC Water Lubricated Propeller Shaft Bearing Clearance

(Avg. Clearance of Port & Starboard)



Ship Owner Benefits

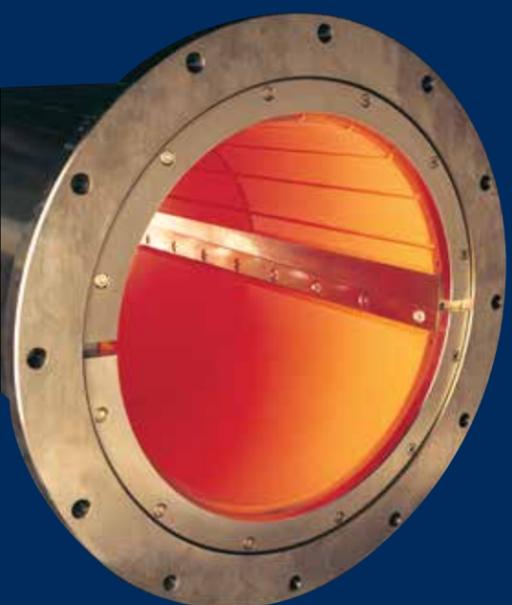
- Proven reliability on over 2000 ship references
- Lowest operating costs
- Virtually maintenance-free
- Elimination of shaft and pod seal issues
- Zero environmental impact as no oil is used
- Compliance with US VIDA and Polar Code regulations

Compliant Operation

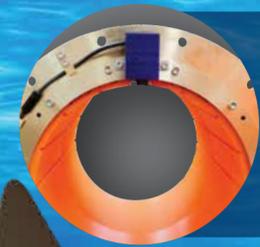
Extended shaft withdrawal notations are approved for all class societies with the exception of NK and KR (as they don't have these notations). This allows the propeller shaft for open water lubricated systems to remain in place if monitoring conditions are met. Extended shaft withdrawal notations ensure technical equivalence of the COMPAC system with oil lubricated propeller shaft systems. Thordon's COMPAC system assures ship owners/operators that there will be no environmental violations resulting from stern tube oil leakage and meets both US VIDA and Polar Code regulations guaranteeing zero risk of pollution.

Reliable Operation with Lowest OPEX

The use of an open seawater lubricated propeller shaft bearing system on cruise ships can permanently eliminate operational and accidental oil emissions from a vessel's propulsion system. An open propeller shaft bearing system lubricated entirely by seawater is the only truly sustainable solution for ship owners that want to meet all future ship emission regulations, while significantly reducing their OPEX and ensuring reliable, safe operation for the life of the vessel.

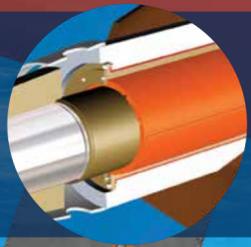


COMPAC OPEN SEAWATER LUBRICATED PROPELLER SHAFT BEARING SYSTEM



Thordon Bearing Condition Monitoring System

- The Thordon Bearing Condition Monitoring System allows wear measurements from inside the ship by pushing a button, supporting the Classification Societies' requirements.



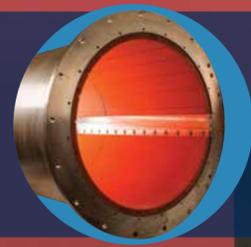
COMPAC Bearings

- The bearing wear surface is Thordon COMPAC, a non-metallic, elastomeric polymer alloy
- The COMPAC bearing has no grooves on the lower half of the bearing to promote early formation of a hydrodynamic film between shaft and bearing, comparable to oil
- Thordon recommends bronze shaft liners in way of the bearing



ThorShield Shaft Coating System

- Thordon's tough modified epoxy coating, ThorShield, is designed to provide integrity against shaft corrosion



COMPAC with Tapered Key Design Option

- COMPAC can be supplied in flanged bronze carriers. The COMPAC bearing is supplied split with a tapered keyset that allows bearing to be withdrawn, inspected and re-installed in a matter of hours with the shaft in place



BlueWater Seal

- An axial lip seal with Safe Return to Port (SRTP) capability that will deliver reliable performance and value to the shipowner with the low friction RENFORM main sealing ring



SeaThigor Mechanical Face Seal

- The SeaThigor seal is a maintenance-free high-performance seal manufactured for long wear life and reduced maintenance costs.
- The Safe Return to Port Emergency seal allows the shaft to continue to turn while the emergency seal is engaged.



Thordon Water Quality Package

- A Thordon Water Quality Package delivers a consistent supply of conditioned water to the fwd seal and all bearings to ensure long predictable bearing wear life.

Proven Performance in Cruising

"One anti-pollution measure that has proved its worth is Carnival's choice of Thordon water-lubricated sterntube bearings, which are, in my opinion, one of the best investments any operator can make, Mr. Joly said. As well as eliminating pollution risks, they have proven themselves to be so robust, it's likely they will outlast many of the vessels."

– Chris Joly, Principal Manager of Marine Engineering, Carnival Corporation (U.K.)

"It's a no-brainer! A seawater lubricated shaft means there is less to worry about."

– Andy Wright, Fleet Operations Director, Technical Operations, Holland America Group, Serving Princess Cruises

"When we first entered the cruise market with Viking Star, we opted for water lubricated propulsion as a cost-effective means of reducing the impact of our operations on the marine environment. The COMPAC system has proven itself both commercially and operationally."

– Richard Goodwin, Vice President, Engineering, Viking Ocean Cruises (U.K.)

"EPA recommends that all newbuild vessel operators endeavour to use seawater-based systems for their stern tube lubrication to eliminate the discharge of oil from these interfaces to the aquatic environment."

– Section 2.2.9; 2013 Vessel General Permit (VGP), Effective Dec. 19, 2013 (U.S.A.)

"Thordon's products are proven and reliable with an exceptional lifetime, and of course seawater is limitless and without cost. This substantially reduces the risk of failures compared to other propulsion solutions and therefore increases ship availability and protects its earning potential over its lifetime. Operating costs are minimal and the risk of pollution of the seas is eliminated completely."

– Richard Vie, former Vice-President, Technical Development and Quality Assurance – Shipbuilding, Carnival Corporation (U.K.)

CUSTOMER FOCUSED TO QUICKLY MEET YOUR NEEDS

Quick and Responsive Service

It takes quality products to be globally successful in the water-lubricated bearing and shaft seal industry. It also takes great service to keep customers coming back.

Thordon Bearings Inc. is geared to respond quickly to supply high performance seal and bearing solutions. Our products arrive quickly, fit right and last!

Extensive Distribution Network

Thordon Bearings has an extensive distribution network of more than 75 distributors in 100 countries to supply and service our global customer base. Non-standard requests are met with responsive design, quick machining and speedy delivery.

Application Engineering

Thordon engineers work closely with customers to provide innovative bearing and shaft seal system designs and solutions. Global installation and technical support is available for those cases where specific application engineering is required.

Manufacturing Quality

Thordon Bearings Inc. is a family-owned company with manufacturing and new product development facilities in Burlington, Ontario, Canada. In addition, we operate a new leading edge manufacturing plant in Slupsk, Poland.

We manufacture to ISO 9001 Quality System requirements. Contact us for our installation references.

High Performance Bearings and Seals; Industry-Leading Service

Thordon Bearings is an industry leader in the design, manufacture, supply and installation of high performance, pollution-free, shaft seal and bearing systems.

Your Authorized Thordon Distributor

THORDON
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