THORDON
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Matson's Aloha-Class containership rendering courtesy Matson

COMPAC Ordered For Largest Jones Act Containerships

Thordon Bearings has signed a landmark contract to supply COMPAC seawater-lubricated propeller shaft bearing solutions to two Jones Act containerships under construction at the Aker Philadelphia Shipyard Inc. (APSI) for Matson Navigation Company, Inc., U.S.A.

The order is significant in that it represents the first large containership reference for Thordon and the largest commercial ship propeller shafts to be fitted with COMPAC bearings.

The 3600TEU 'Aloha Class' vessels, the largest Jones Act containerships ever built, will each feature a COMPAC bearing system for a 930mm (37 in) diameter shaft driving an 8.1m (27 ft) diameter fixed pitch propeller.

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Thordon COMPAC Propeller Shaft Bearing With Tapered Keyset

Matt Cox, President and CEO, Matson, said. "These new ships are the future for Hawaii shipping and will bring a new level of efficiency and effectiveness to our service. The substantial investment in new technology underscores Matson's long-term commitment to Hawaii and our desire to serve the islands in the best, most environmentally friendly way into the future."

Craig Carter, Thordon Bearings' Head of Marketing and Customer Services, said: "The COMPAC solution is very much in keeping with Matson's environmental and sustainability objectives. As with all its vessels, the Aloha-class will feature a number of environmentally safe technologies, but the addition of seawater-lubricated shaft bearings will reduce even further the impact its operations have on the marine environment. Our COMPAC system obviates completely the risk of non-compliance with US Vessel General Permit stern tube oil to sea interface rules and ensures that the vessels can operate safely, responsibly and legally in US waters."

The U.S. Environmental Protection Agency ruled in December 2013 that vessels over 24m (79 ft) must adopt environmentally acceptable lubricants in all oil-to-sea interfaces before their next drydocking, recommending that seawater lubricated bearings be used in propeller shaft lines.

David Marshall, Thordon Bearings Senior Regional Manager, said: "This order is one of the most important commercial ship contracts we have ever received for the COMPAC solution. Not only does it provide us with a number of significant 'firsts', it shows that liner companies trading in US waters are taking the new VGP rules very seriously. That Matson has become the first liner company to make the switch delivers confidence to the market that seawater-lubrication is the only environmentally and commercially acceptable solution to operational oil pollution."

Each 259m (968 ft) long, DNV GL classed vessel features double hull fuel tanks, a freshwater ballast system and an energy-efficient hull form and a dual-fuel propulsion system future-proofed for conversion to LNG. Main engine output is rated at 38,000kW at 84rev/min to deliver a service speed of 23kts.

Thordon's scope of supply includes COMPAC elastomeric bearings with a tapered keyset, a Thordon Water Quality package, bronze liners and Thor-Coat shaft coating, meeting classification requirements for extended shaft withdrawal periods.

When delivered from the Aker Philadelphia Shipyard in the third and fourth quarters 2018, the Aloha newbuilds will enter service on Matson's West Coast-Hawaii route in anticipation of an increased demand for higher cargo capacity and diversity. NW

Thordon Water Quality Package

20+ Year COMPAC Wear in Canadian Patrol Frigates "Ready, Aye, Ready"

The Royal Canadian Navy (RCN) is no stranger when it comes to using Thordon COMPAC propeller shaft bearings in its vessels. Over two decades ago in May 1992, the RCN (then known as the Canadian Navy) back-fit its lead frigate, *HMCS Halifax*, with Thordon COMPAC. The first of 12 new patrol frigates, the RCN selected *Halifax* as the exemplary ship to set a precedent for her sister ships and represented what the RCN then deemed to be "the most advanced warship in the world".

At 134m (440 ft) in length with a beam of 14.9m (48.9 ft), each of the frigates is capable of speeds of 30 knots plus. Additionally, the frigates are equipped with twin CP propeller systems from Sulzer Escher Wyss. Each of the five-bladed propellers incorporates advanced quieting technology, and each propeller shaft runs on a main and intermediate "A" bracket bearing.

The RCN had outlined a strict set of criteria for the frigates to meet, including having a minimal level of break-away torque, a limited coefficient of friction in clean water, and a low acoustic signature. These two latter requirements, which were not met by the original rubber bearings, triggered the RCN's need to replace them.

Typically mounted on an "A" strut away from the hull, it is almost impossible to mask noises emanating from squeals or vibration and, therefore, a bearing with a very low coefficient of friction is required. COMPAC elastomeric polymer shaft bearings, designed mainly for blue water operations, excels in this standard due to its characteristically low coefficient of friction. Furthermore, COMPAC performs well due to its self-lubricating property. For these reasons, COMPAC was selected to replace the originally specified bearings for the *Halifax's* propeller shafts.

During various testing, sea trials, and sound range runs, data revealed that all rubber bearing related sound and operational problems were eliminated with COMPAC. Additionally, COMPAC's coefficient of friction is only ¼ that of rubber, so it is capable of a lower start up, thereby avoiding stick-slip and squealing. The results were so impressive that RCN identified COMPAC as the material to be installed in 11 of *Halifax's* sister ships. And, to this day, *HMCS Halifax* is still reaping these benefits. Interestingly enough, it is doing so on the same COMPAC bearings that were originally installed in the

Canadian Navy Patrol Frigates installed with Thordon COMPAC Bearings

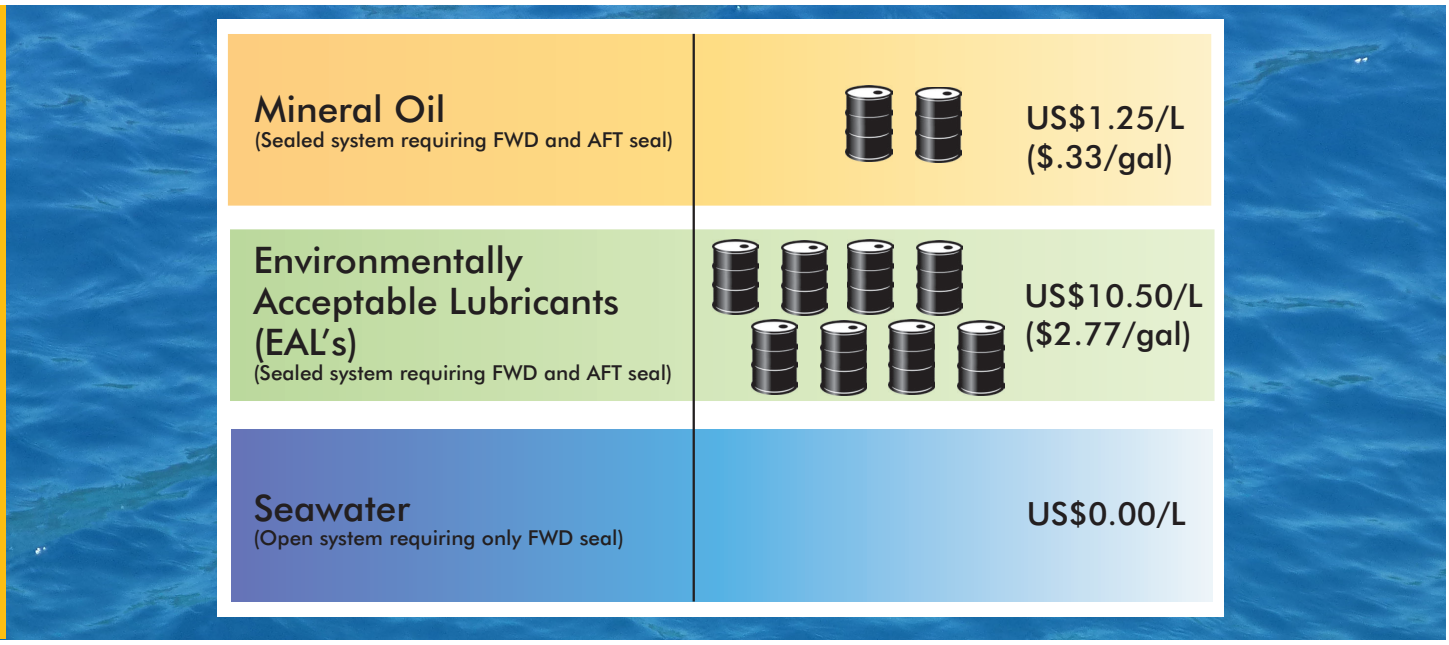
conversion over twenty years ago, as they have not needed to be replaced due to bearing wear. Likewise, all the other 11 RCN vessel bearings are exhibiting similar wear life patterns to *HMCS Halifax*.

The bearing wear chart shows the wear measurement on a typical Canadian frigate that was fitted with COMPAC. Originally installed in 1992, the vessel's 600.0mm (23.62 in) diameter bearing yielded measurements showing a total wear of 2.60mm (0.102 in). The RCN limits the maximum allowable wear on bearings to 4.00mm (0.16 in). If the data is extrapolated to 2015, the COMPAC fitted on this particular vessel is estimated to have worn approximately 2.76mm (0.11 in) in a total 23 years of service.

Scott Groves, Marine Business Development Manager at Thordon Bearings, is pleased by these results. "One of the unique properties of COMPAC is its exceptional wear life. Bearing wear data has been collected for several ships with shaft diameters over 600.0mm (23.62 in) that have been operating with the COMPAC bearing system for more than 10 years, and results indicate that they are expected to last over 20 years. At this rate of wear, we are exceeding these expectations by not only years but decades."

While the reasons for choosing COMPAC propeller shaft bearings were not driven by its wear life, it is one of the more pronounced and remarkable outcomes of using it.

Water, Water Everywhere



Cost Comparison Chart of Stern Tube Lubricants

Exorbitantly priced propeller shaft bio-lubricants may have been approved by authorities such as the US EPA, but seawater can do the job for a fraction of the lifetime costs, argues Thordon Bearings.

In recent years, a number of new lubricant types have sprung up on the marine market, primarily aimed at vessels utilising oil-lubricated propeller shaft bearing systems. Described in the trade as bio-lubricants, or 'environmentally acceptable lubricants' (EALs), these reportedly eco-friendly – albeit most definitely expensive – lube types are intended to replace the mineral oils typically used in shaft bearing systems, to assist ship and boat operators in complying with increasingly strict environmental regulations.

According to New York-based analyst Environmental Research Consulting, the amount of lube oil polluting the ocean as a result of stern tube leaks, on a global basis, can range from 4.6 million to 28.6 million litres annually. Not only is this environmentally unacceptable, but it constitutes a tremendous waste of money on the shipowners' and operators' part.

In contrast, the new EALs, which incorporate vegetable oils, synthetic esters and polyalkylene glycols into the mix, are reported to be far less harmful to the environment – to the extent that the US Environmental Protection Agency (EPA) has given them the green light. The EPA's Vessel General Permit (VGP), which was formally introduced in December 2013, specifies that vessels of 24m loa and over must switch from mineral oils to EALs before their next drydocking period. Vessels with seals that are non-EAL compliant face the expense of seal replacement, while those that continue to use conventional mineral oil-based lubes will have to ensure that their seal systems are protected by 'double barrier' configurations, which could likewise call for a system overhaul.

Seawater solution

The real cost drain, however, becomes apparent when one skims through the pricing of these EALs. According to manufacturer Thordon Bearings, a litre of EAL will set you back US$10.50, in comparison to a typical mineral oil cost of US$1.25/litre. Thordon claims that even the cheaper EALs are roughly priced seven times more than mineral oils. Given Environmental Research Consulting's estimate that the average offshore supply vessel (OSV), passenger ferry, tug and standby vessel guzzles two litres of stern tube lubricant daily, the cost implications become obvious – especially for vessel sectors already struggling to develop methods to cut vessel fuel costs and comply with stringent emissions regulations.

For Craig Carter, director of marketing and customer service at Thordon Bearings, the adoption of EALs is like "paying for the very air we breathe", in comparison to using a more natural 'bio-lubricant', in the form of seawater. "When you take into account the amount of lubricant that is leaked into the oceans each year and needs to be replaced, the cost to the shipowner is simply

staggering," he says, "and this is without adding any monetary penalties incurred by way of environmental fines."

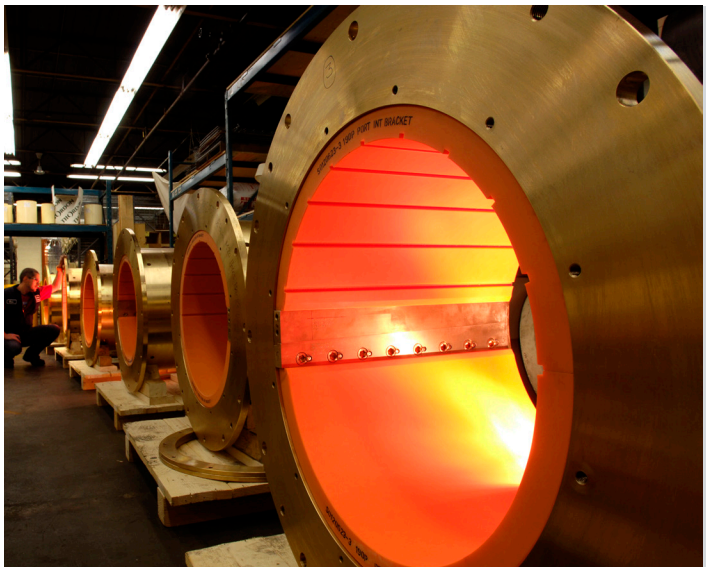
Of course, Thordon Bearings is keen to promote its seawater-lubricated COMPAC propeller shaft solution as an alternative to systems reliant on lube oils, but Carter believes that the economies involved tell their own story. "Installing the COMPAC system is probably going to cost you 25% more upfront than installing a lube-based system,but you're going to realise a lot of long-term savings." Not least of these is the budget allocated to the regular purchase of lube oils, which become redundant when investing in a seawater-utilising system.

The COMPAC system incorporates non-metallic bearings (fashioned instead from elastomeric polymer) and a corrosion-protected shaft and, in most striking contrast to conventional propeller shaft bearing systems, ditches the aft seal, retaining only the forward, so that water passing through the system and flows back into the sea. Carter identifies this feature as presenting another cost advantage, in removing the need for aft seal maintenance and replacement; the common problem of seal wear is largely caused by contact with debris in seawater (including sections of rope and fishing line).

To ward off seawater-induced corrosion, the shaft is fitted with bronze liners and, between these, Thordon Bearings applies its Thor-Coat brand of protective paint; the epoxy is manufactured in-house, and is on its fourth generation at present. The COMPAC system is also fitted with a Water Quality Package containing centrifugal separators, to remove abrasives in the water, for added protection and a pump to ensure constant water flow. "As a result, we're able to offer a 15-year life guarantee for the system," says Carter. "Our first installations were on Princess Cruises vessels in1998, and the company's feedback shows it has managed to reduce operating expenses, with no lubes to purchase and no aft seal to maintain."

Any size of vessel

Similar installations have been arranged for naval vessels in Sweden, Germany and the Netherlands, as well as for the US Coast Guard, to the point that the COMPAC system is now fitted on 2,000 vessels worldwide. "The system can be scaled to suit any vessel size," Carter adds. "There is a particular benefit for the commercial passenger sector, which can't afford to be seen to be leaking lubes." To date, boatbuilders specialising in small-to-medium sized vessels have been more open to the COMPAC concept, Carter explains, primarily because they are more experienced in fulfilling custom orders; attempts to crack South East Asia's shipbuilding



Thordon Bearings' COMPAC bearings in bronze carriers

sector have been more difficult due to that region's reliance on vessel standardisation. "When yards are producing 40 ships per order, they're a lot more reluctant to change," he says. However, he believes this conservative attitude may change in future, and Thordon Bearings is currently in negotiations with some large shipbuilders in Korea, with a view to potential COMPAC orders.

Oddly, the EPA ruling on EALs also seems to tacitly suggest that stern tube leakage is a 'given', as if little can be done to address the vulnerability of the typical seal. Taken at face value, the ruling might also suggest that leaking bio-lubricants into the sea is of little or no consequence. On a performance level, Carter has heard from ship owners stating their reservations about EALs' ability to do the job; he comments: "Biodegradable oils deteriorate when mixed with water, and the inevitable result is that the lubricating capabilities will be adversely affected. While strides have been taken by many EAL manufacturers to combat this issue, the technology has certainly been introduced to the market in a hurry and not thoroughly tested, so there are no guarantees about their longevity."

The EPA has approved seawater lubricated propeller shaft systems as being in compliance with VGP requirements (in fact they recommend it), while Lloyd's Register and BV have amended its rules on shaft withdrawal timeframes for water lubricated shaftlines, partly in response to queries from COMPAC customers, Carter reveals. NW

COSCO Places Significant Amount of Orders for COMPAC Bearing Systems

4 AHTS Vessels equipped with COMPAC bearings will be constructed at Dalian Shipyard, China

China's COSCO has returned to Thordon Bearings with orders for 17 seawater-lubricated COMPAC Propeller Shaft Bearing Systems, making COSCO the Canadian company's largest user to-date.

Thordon Bearings, the pioneer in advanced seawater lubricated propeller shaft bearing systems, will supply COMPAC packages for installation to various merchant and offshore newbuilds under construction at a number of Chinese shipyards.

The scope of supply includes the Thordon Water Quality Package, which provides a constant, clean seawater flow to the bearings in order to extend bearing wear life comparable to oil lubricated bearings.

These recent orders follow the shipowner's successful operational experience of the COMPAC system aboard twelve 32,000 dwt bulk carriers and three 18,500 dwt PCTCs (pure car/truck carriers).

Sam Williams, Thordon's Regional Manager for Asia, said: "The orders from COSCO, a returning customer, is indicative of a changing market. Traditionally, Thordon's core market for propeller shaft bearing systems has been cruise and naval ships, with over 2000 references across these sectors. But whether it's a consequence of more stringent environment legislation, the higher cost of new biodegradable lubricants, or increasing corporate social responsibility, we are seeing a marked increase in the number of quotes for seawater lubricated propeller shaft bearing systems from owners of merchant and offshore tonnage."

COMPAC packages for COSCO will be delivered to China's Guangzhou Shipyard International (GSI) for installation in a 90,000 dwt semi-submersible heavy transport vessel and three 50,000 dwt bulk carriers. Huang Pu Wenchong Shipbuilding will receive COMPAC systems for three 50,000 dwt semi-submersibles and four 36,000 dwt bulk carriers.

Other orders include those for four AHTS vessels under construction at Dalian; a 2D seismic vessel and a 28,000 dwt heavy-lift ship at Shanghai Shipyard; two bulk carriers at the Shanghaiguan Shipyard; and a 12,800 dwt bitumen tanker contracted to Qingshan.
"We are seeing more and more Chinese shipyards specifying the COMPAC system in their standard designs now. Unlike the oil-lubricated variety, a water-lubricated propeller shaft does not require an aft seal making it quicker and less complicated to install, while reducing operating costs," said Williams.

COMPAC systems and Water Quality packages will be delivered to the shipyards throughout 2015 and 2016.

No wear for RiverTough after more than 20,000 hours in abrasive Alaskan waters

After nine years of operation in the harsh, abrasive waters of Alaska's Yukon River, aboard Inland Barge Service's push boat Ramona, Thordon Bearings' RiverTough water-lubricated tail-shaft bearing system has emerged completely free of wear and tear.

The exceptional performance of the RiverTough bearings in waters renowned for their high content of gritty glacial silt came to light when the 16m (52.5ft) workboat's cracked struts underwent repair in dry-dock.

Charles Hnilicka, the owner of Inland Barge Service Inc, said: "In the spring of 2011 we were doing some hot work on one of the struts and decided to change the bearing since everything was apart. We didn't have to and could have reinstalled the original bearing after the hot work, but we had a spare set.

"When we took it out, the RiverTough bearing and sleeves had no appreciable wear and tear, which was amazing considering the environment in which the Ramona operates."

The 1971-built push boat provides an invaluable service delivering freight and consumer goods to communities along the Yukon River and its tributaries.

These shallow waters, usually only navigable between May and October, are fed by rain and glacial melt containing highly abrasive silt and ground rocks, called glacial till, that can severely damage other propeller shaft systems.

Since 2003, when Inland Barges Services replaced the single-screw Ramona's rubber bearings, Thordon's polymer system has undertaken over 2000 hours of operation per year in some very abrasive environments.

"I haven't seen anything like it," said Mr Hnilicka. "When we used rubber bearings we were lucky to get a full operational season out of them before they needed replacing."

Scott Groves, Thordon Bearings' Business Development Manager, said: "We have data from workboats operating on the Mississippi showing typical RiverTough wear rates of 0.075mm to 0.100mm (0.003" to 0.004") in 6000 to 7000 hours of annual use, but this is the first time we have received data from a vessel

Photo courtesy of Inland Barge Service Inc.

Inland Barge Services' push boat Ramona serves communities along Alaska's Yukon River

operating in the high north. The feedback from Inland Barge Services provides clear evidence of RiverTough's superior wear life in very abrasive water conditions. They routinely outlast rubber bearings by a factor of two or more."

Todd Terry, President of Pacific Marine Equipment (PME), Thordon Bearings' Seattle-based distributor, said Inland Barge Service, Inc is among a growing number of workboat and small craft operators to covert from rubber tail-shaft bearings to the RiverTough solution.

"In 2001, we supplied the water-lubricated bearing system to HamiltonJet's Yukon Queen. The vessel ran from 2001 to around 2010 when it was sold and left the river. HamiltonJet reported that the RiverTough bearing worked exceedingly well in this application. Since then, we have supplied Interlake Steamships, Riverway Transport, American Commercial Lines, Ingram Barge Line, Blessey Marine Services and Eckstein Marine."

McAsphalt Marine Transportation is the latest owner to opt for the RiverTough solution and Thordon Bearings will supply water-lubricated bearings and Nickel Chrome Boron-coated stainless steel liners for a twin-screw articulated push barge operating in the Great Lakes waterway system. The bearings will be designed for 365mm (14.4") shaft diameters. NW

COMPAC Wins Top Environmental Award

COMPAC, Thordon Bearings' seawater lubricated propeller shaft bearing system, won the prestigious Tanker Shipping & Trade Environment Award in November 2015 following a verdict that the system allows shipowners to cost-effectively comply with stringent marine pollution rules.

Dr. Karen Purnell, the Managing Director of International Tanker Owners Pollution Federation (ITOPF), who sat on the award judging panel alongside representatives from INTERTANKO, IACS, UK MCA and Scorpio Tankers, said: "It is a challenge to identify opportunities that assist shipowners in meeting environmental standards cost-effectively and that don't end up creating new environmental problems. The COMPAC system meets this challenge and it is for that reason – and the system's simplicity – that we were able to present Thordon Bearings with the award."

Dr. Purnell added that the award-winning COMPAC system will reduce oil seepage into the marine environment and, as such, complements ITOPF's remit.

"Thordon Bearings has an established pedigree and is very transparent about the system's CAPEX and operational cost savings. The COMPAC system is not limited in scope and can be applied to all types of vessels, so has good chance of succeeding," she said.

Clearly delighted with the award, George Morrison, Thordon Bearings' Regional Manager West Europe and Africa, said: "To have won this year's Tanker Shipping & Trade Award is the icing on the cake of a very good year for Thordon Bearings.

"As a result of new regulations and endeavours to strengthen Corporate Social Responsibilities more and more shipowners are eschewing oil lubricated propeller shaft bearings in favour of seawater lubricated propeller shaft systems. We now have over 2000 ships equipped with Thordon's COMPAC with many more on order."

Thordon's COMPAC bearing system prevents the seepage of millions of litres of oil into the world's oceans and reduces ship operating costs associated with aft seals and lubricating oil. Risk of costly emergency aft seal repairs is eliminated, while the higher CAPEX associated with corrosion protection for Thordon systems, are more than offset by lower maintenance and operational costs associated with the oil based system. And there is no risk of pollution. NW

George Morrison, Regional Manager for Thordon Bearings receives the prestigious Tanker Shipping & Trade Environment Award

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THORDON BEARINGS INC.

A Thomson-Gordon Group Company - Innovating since 1911

3225 Mainway, Burlington, Ontario L7M 1A6 Canada
Tel: +1.905.335.1440 Fax: +1.905.335.4033
info@thordonbearings.com
www.ThordonBearings.com

Editor: Charlene Taylor

(Statements made and opinions expressed do not necessarily reflect those of the publishers)

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