

Stern Tube Conversions Reduce Pollution Risk



Peter R Cresswell converted from oil lubricated propeller shaft bearings to a complete seawater lubricated COMPAC bearing system in 2010

The conversion from sealed oil lubricated bearings to open water lubricated bearings on the bulk carrier *Peter R Cresswell* demonstrates the way owners of existing ships are solving oil pollution leakage issues.

A growing number of owners of existing ships are coming to realize that the environmental and maintenance benefits offered by switching to water lubricated stern tube bearings are as important to existing ship owners as they are to these building new vessels.

In 2011, new US Environmental Protection Agency National Pollutant Discharge Elimination System (NPDES) rules specifically targeted oil lubrication discharges from stern tubes. The new requirements carry extensive civil and criminal penalties for violations, including the threat of jail. In Europe, meanwhile, the 2007 European Union Maritime Policy specifies the elimination of all vessel discharges into the marine environment by 2020.

Leakage from an oil lubricated stern tube does not necessarily mean negligence. Currently, the majority of commercial ocean-going ships operate with a propulsion system using a propeller shaft supported by oil lubricated metal bearings with oil contained in the stern tube by forward and aft shaft seals. According to

seal manufacturers, the seal must leak (aft-into the sea or forward-into the ship's bilge) at the shaft/seal interface to function properly. Simple fishing nets or rope caught on a ship's rotating shaft can damage the aft seal, allowing stern tube oil to flow out into the sea. According to seal repairers, this occurs on a frequent basis.

While Deepwater Horizon may be dominating the environmental landscape, it might be worth considering that a typical ocean-going ship's stern tubes contains 1500L (396 US gal.) of oil. Even a conservative stern tube leakage rate of 6L (1.6 US gal.)/day as set by Lloyds Register Class Society Seal Type Approvals from a world fleet of around 45,000 vessels could add up to 'normal' operational stern tube oil pollution of over 80 million litres (20 million US gal.) annually.

Oil and water

One of the owners most recently persuaded of the benefits of water lubricated bearings include Algoma Central Corp. During the recent St. Lawrence Seaway freeze, Algoma took the opportunity to convert stern tube bearings on board the bulk carrier *Peter R Cresswell* to the COMPAC water lubricated system delivered by Thordon Bearings Inc. The conversion included a Water



Seawater lubricated propeller shaft COMPAC bearing replacing metal bearing lubricated with oil

Quality Package (designed to ensure that abrasives are removed from the seawater and to provide a consistent flow of water to the bearings), Thor-Coat shaft coating (to ensure the mild steel shaft stays free of corrosion), installation of bronze shaft liners (to operate in way of the bearings), and Thordon COMPAC propeller shaft bearings.

Scott Groves, Thordon Bearings Area Manager Canada/Western USA, said that the conversion process involved the removal of the shaft, existing oil lubricated bearings and oil header tank. The installation included bronze shaft liners, Thor-Coat shaft coating, fitting COMPAC bearings, Thordon Water Quality Package and a new forward shaft seal.

Using the COMPAC system, seawater is taken from the sea, pumped through elastomeric polymer shaft bearings and returned to the sea. No stern tube oil is needed. New materials and designs of non-metallic bearings now offer performance similar to metal shaft bearings with a life expectancy of 15 to 20 years, said Mr. Groves. The 30,735 dwt self-unloading ship, built in 1982, was converted at Canada's Seaway Marine & Industrial Shipyard, as part of a 12 week overhaul project involving five year survey and hull work.

Al Davies, Director of Operations, said that *Peter R Cresswell's* oil lubricated stern tube bearings had

become increasingly problematic. "The whole environmental issue became a source of grief with Transport Canada. As a company we are part of a collective programme to introduce green marine policies, extending across emissions, ballast water management, grey and black water discharges. It's pretty clear that the end game will be no discharges allowed at all, and we



Peter R Cresswell dry-docking March 2010

have bought into a process that is externally audited by Lloyd's Register. The initiative with water lubricated stern tube bearings is an example of that commitment. If anyone asks what we've done for the environment; well, we can say this."

"Essentially, there came a point when the ship's stern tube bearing was getting tired and we knew that the tail shaft had to come out anyway. With Thordon half an hour away and the yard 10 minutes down the road, it seemed like a good opportunity to take another look at this solution. We already had experience of what Thordon could do on the ship *Quebecois*, where 10 years ago we replaced the bearing system because of reports that lignum vitae would not be available anymore. We knew that the COMPAC system worked, and the closed system meant that we had the lead time to order the liners."

Mr. Davies added that selecting bio-degradeable oils did not offer a viable solution. "Bio-degradeables are considered a discharge because of the sheen they leave. Even using those products,



Thordon Water Quality Package provides a controlled environment and removes abrasives from the water improving bearing wearlife and ensure a constant flow of water

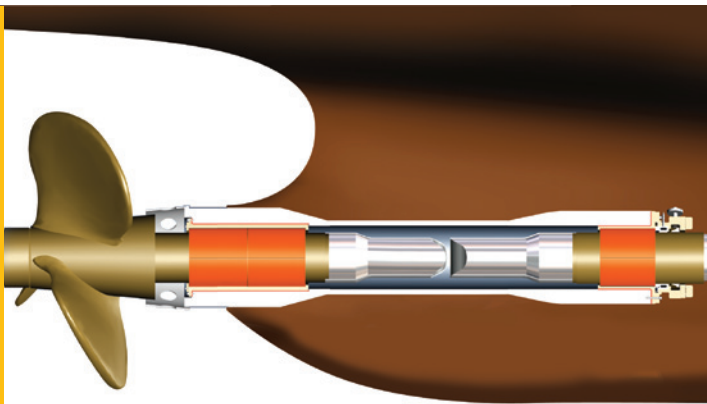
we would be required to notify Transport Canada if there was a discharge and they could stop the boat with no knowing of when they would let you go. The presumption is that you're guilty right off the bat." "Of course, one significant difference with using elastomer bearings is that the mild steel propeller shaft requires corrosion protection from seawater," Mr. Groves acknowledged. "This may mean a higher up-front cost for the water lubricated stern tube bearing system, but the elimination of aft seal maintenance means that the up-front costs are recouped in lower in-service costs along with no aft seal damage worries, no stern tube oil costs and no oil pollution risk (fines)."

Mr. Groves explained some of the key considerations owners should address when contemplating stern tube bearing conversion to water. Questions that needed answers straightaway included whether the new arrangement would actually fit in the space provided. This

requires a review of the existing shafting and sterntube arrangement drawings, if available.



Thordon Thor-Coat shaft coating protects against corrosion



COMPAC Seawater Lubricated Stern Tube Bearing System

The planning required to convert a vessel includes a review of the existing oil system to determine what modifications are required, if any, to fit a water lubricated system.

Owners may also have to accept planning for conversion well ahead of any expected docking. "The longest lead-time items for such projects are the shaft liners," said Mr. Groves. "The number of foundries that can manufacture centrifugally cast single piece liners is limited and there is normally a 6 to 8 week lead-time to obtain these castings."

Mr. Davies said, "Thordon performed all of the measurements and clearances on *Peter R Cresswell* without any issues, LR approved all of the drawings within the envisaged timeline. Since going back into operation in March, the ship's performance has been going well." Even so, Mr. Groves said that, increasingly, owners of older tonnage were seeing the switch to water lubricated bearings as a maintenance, as well as a green issue. The shallow waters of the St. Lawrence Seaway placed restrictions on navigation, with high potential for vessels to run aground, damage their blade tip and their oil lubricated shaft seals.

"The amount of manoeuvring in confined water can bring ships close to the bottom," said Mr. Davies. "Mud, debris, obstructions and ice conditions, and even rogue nets, can cause blade damage and subsequent seal failures."

"The water lubricated bearings available today from Thordon offer the same lifespan as an oil lubricated solution, but owners avoid the prospect of having to be tugged into port in the case of an oil leak," said Mr. Groves. "That means both expense and lost revenue due to downtime are avoided."

Encouraged by the results on board the *Peter R Cresswell*, Mr. Davies said Algoma was considering a new conversion project, this time involving the 1967-vintage gearless bulk carrier *Tim S Dool*. Other ships were also being considered for conversion.

"We will evaluate every ship due into drydock to see if the conversion is appropriate," he said. "Those decisions will be based on the expected longevity of the ship, and on planning well in advance. But this will surely be part of this year's winter budgetary considerations."

There are over 600 ships equipped with COMPAC water lubricated stern tube bearings, with the first ship converted from oil to water in 1998. Conversions have been on the upswing with four completed in the past six months, including two VLCC's operating out of US waters, a Canadian icebreaker and the *Peter R Cresswell*. **NW**



Peter R Cresswell sails on the Great Lakes, Canada

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