Wärtsilä
Linesafe bearing

BUSINESS WHITE PAPER

CONTENTS

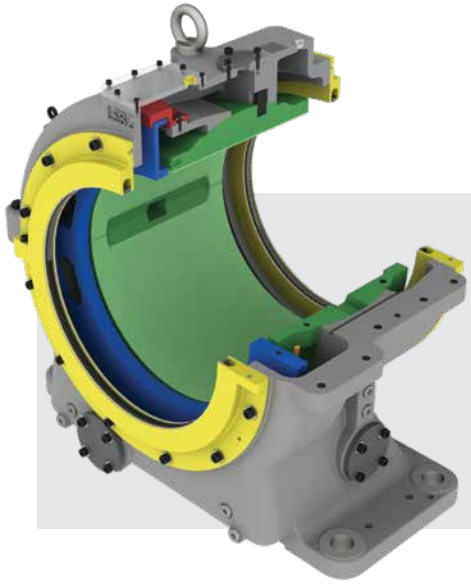
Introduction

— Modern design based on today's market drivers.

Technologies relating to ship design and operation have evolved over the years, creating greater efficiencies and extended lifespans for onboard machinery. These developments are typically born by customer needs. One such market demand is to have a heavier radial load capacity for the bearings supporting the shaftline. This demand can be due to the requirement of fewer bearings in order to meet space saving requirements, or as a means for reducing operational risks.

Additionally, the International Convention for the Safety of Life at Sea (SOLAS) treaty requires passenger ships to have a 'Safe Return to Port' system installed. This is to ensure that in the event of flooding around the bearing, the vessel can still operate and sail to the nearest port. This means that even if the shaftline tunnel is flooded, the shaftline to the propeller must still be operable, ensuring the safety of the passengers. Shipyards, meanwhile, have been calling for shaftline bearings to be easier and faster to install, to save both installation time and costs.

Wärtsilä, a company with more than 50 years of experience in designing and manufacturing shaftline bearings, has addressed these challenges by developing a unified design that encapsulates features from a range of different bearing types into a single and far superior bearing. The result of this development work is the Wärtsilä Linesafe bearing, which by allowing pressures up to 1.5 MPa, meets the demand for a higher load capacity. It is also capable, with an optional 'SRtP' kit, of operating in flood conditions, and is easier to install than conventional alternatives. This paper will describe its various aspects and illustrate the benefits it delivers to ship owners, operators and shipyards.



Flexibility within the standard configuration

The Wärtsilä Linesafe bearing has a modular design, which allows the bearing to be tailored to each customer, dependent on their specific needs. For example, the SRtP system can be fitted to passenger type vessels or forced oil lubrication can be connected to the bearing if this is necessary. At the same time the bearing's standardised casing and construction enables improved lead times and spare parts delivery.

Product description

— Developed using latest software and high-quality materials.

The Wärtsilä Linesafe bearing consists of a close fitting cylindrical sleeve which contains the rotary shaft within. The shaft and bearing surfaces are separated by a film of lubricant, thus avoiding direct contact between the surfaces. The hydrodynamic lubrication that takes place when the shaft is rotating reduces friction and wear, whilst providing smooth running over the lifespan of the unit.

The Wärtsilä Linesafe bearing has a self-aligned design and is fully split. It will operate correctly and efficiently on shaftlines with a slope of up to 4 degrees without the need of special seals.

The modular housing and plain bearing shell is manufactured from high-quality cast iron. The plain bearing is lined with an environmentally friendly white metal which provides the optimal running surface and minimises wear on the rotary shaft.

Self-lubrication is standard due to the high-quality cast aluminium oil ring and scraper. However, the sophisticated design of the Wärtsilä Linesafe bearing enables connection at any time to an external lubrication source if the operational conditions require this.

Oil leaks are effectively prevented by two shaft pass covers manufactured from high-quality cast aluminium. The oil scraper joints and deflection rings allow the shaft to rotate freely, whilst preventing dirt from entering the housing.

Design features

— Self-aligning and fully split modular design.

The Wärtsilä Linesafe bearing is designed as a flexible modular system that allows the customer to decide what it is they require from a broad range of standard components. The flexibility of the system enables individual application requirements to be efficiently met. The unit is equipped with different control devices as standard, such as oil dipstick, remote temperature sensor and local thermometer. It is also possible to accommodate a number of optional features that might be required, for example, remote oil level sensor, dial thermometers, wear down devices, etc. All these devices are available on request.

The self-aligning design of the Wärtsilä Linesafe bearing is a central feature of its overall efficiency. It allows the loads to be distributed uniformly across the running surfaces in the most effective way, thus avoiding critical overloads at the bearing edges which could otherwise cause premature wear and a shorter lifespan.

The upper and lower bearing shells are interchangeable with each other. Therefore, it is possible to exchange the two halves in emergency situations to provide a quick and reliable temporary solution.

Regardless of the type of lubrication used, in the case of emergency operation, all bearings are designed to be ready to install a temporary self-lubrication kit should the pump fail, or to enable an external lubrication unit to be connected should the customer require.

The Wärtsilä Linesafe bearing is designed using the latest 3D computer aided design (CAD) software tools that provide a realistic view of the final product throughout the entire design process. The manufacturing process utilises high-quality materials for each component. The Wärtsilä Linesafe bearing is available in different sizes and is suited for pedestal and saddle type foundations.

Water cooling is not required for standard operation. Frictional heat generated by the hydrodynamic sliding of the shaft under normal working conditions can be dissipated by radiation and natural convection. If this is not in itself sufficient due to extraordinary circumstances, the bearing oil sump can be cooled by flowing water through a jacket integrated within the housing. Standard flanges are used for the jacket cooler connection.

The system includes the complete monitoring of temperatures and oil level gauges, and remote oil level control is available on request, making the Wärtsilä Linesafe bearing fully digital ready.

Installation

— Easier to install, simpler to service.

There has been a consistent demand for a reduction in the time needed for the installation of shaftline bearings. This demand is effectively addressed with the introduction of the Wärtsilä Linesafe bearing.

By increasing the load capacity, fewer bearings are needed with an obvious time saving value. Moreover, the self-aligning design enables installation to take place with a perfect fit to the shaft in accordance with the alignment recommendations. This makes it highly tolerant to slight installation or high angular misalignments. This makes it the ideal solution for vessels with high bending of the hull structure.

The Wärtsilä Linesafe bearing is designed as a flexible modular system that allows the customer to decide what it is they require from a broad range of standard components.

The flexibility of the system enables individual application requirements to be efficiently met. The unit comes ready to be equipped with different control devices as standard, such as oil pressure and temperature gauges, as well as accommodating a number of optional features that might be required.

Furthermore, having only one type of line shaft bearing creates time savings for onboard service needs and aids technical expert support. The Wärtsilä Linesafe bearing facilitates the manipulation of its components thanks to the use of lighter materials in the self-lubrication kit and shaft pass covers. The shaftline survey, inspection and serviceability in situ is significantly improved by an increased distance between the housing legs, which gives space for the intermediate shaft to be stored temporarily. The height of the bearing centre has also been designed to ensure that it is greater than the intermediate shaft flange ratio. With this clever design, the Wärtsilä Linesafe bearing helps save time and provides a safe environment for service personnel during installation and shaft repair.

Higher load capacity

— Supporting greater radial loads than earlier possible.

Rotating shafts of a certain length require bearings along the shaftline to support the shaft and maintain correct alignment. The Wärtsilä Linesafe bearings are designed with spherical contact areas capable of self-alignment, to accurately support the shaftline. Precise alignment not only allows for higher radial loads but also reduces shaft wear, enabling the bearings and the rotary shaft to last longer.

By combining its many years of experience in the field and features from its portfolio of bearing types, Wärtsilä has responded to the market need for a higher load capacity from the shaftline bearings. The Wärtsilä Linesafe bearing features an optimal ratio of 0.8 between the bearing shell length and the shaft diameter. This, together with the utilisation of Wärtsilä's latest technology for white metal applications, forms the basis for significantly higher radial loads than was previously possible. With its standard design, the Wärtsilä Linesafe bearing can withstand radial loads of up to 1.5 MPa.

Operating in flooded conditions

— Maintaining propulsion in emergency conditions.

The 'Safe Return to Port' requirement of the SOLAS Convention places greater demands on the entire propulsion arrangement of ships. The rotary shaftline must be able to function under even the most difficult and challenging circumstances.

A typical scenario for such a situation would be a flooded shaftline tunnel. This requires the shaftline bearings to be capable of maintaining operations for a sufficient period of time to allow the ship to safely return to harbour. The Wärtsilä Linesafe bearing retains a maximum pressure in flood conditions of 1.2 bar, and can operate for up to 3 days in such conditions.

Wärtsilä offers a SRtP kit for compliance with the 'Safe Return to Port' requirements.

Summary

"It's a major step forward in bearing design."

- **Laura Lois**
Design Engineer

Wärtsilä has heeded the needs of its marine sector customers by using its deep in-house expertise and vast experience to develop the Wärtsilä Linesafe bearing. It represents an intelligent and well designed response to the demand for a higher load capacity, which provides greater stress tolerance for reduced operational risk. The design also takes into consideration the SOLAS 'Safe Return to Port' requirements and Wärtsilä offers an 'SRtP' kit for this purpose. Installation time is shortened and eased through the unit's self-alignment capabilities, resulting in the possibility of installing fewer bearings. Furthermore, the allowable permanent tilt of the shaftline is increased to a maximum of 4 degrees.

By incorporating the various features requested by ship owners and operators into the standard design, special design considerations are largely avoided, thus shortening lead times and reducing costs.

Servicing is eased through the fully split and self-aligned design. As with the entire portfolio of Wärtsilä products, systems and integrated solutions, the Wärtsilä Linesafe bearing is supported by the company's extensive global network of service and repair outlets, providing the capability for faster technical assistance response.

The Wärtsilä Linesafe bearing provides an agile, flexible and customisable solution. It features an adaptable design that allows the customer to be in control of the final delivered product, whilst providing assurance of the quality and reliability expected. With this new bearing design, Wärtsilä has presented the market with a solution that fully meets current and anticipated future requirements.

Fig.1 Example of the Wärtsilä Linesafe bearing fitted with the SRtP kit.

An industry leader in shaft line components Wärtsilä Shaft Line Solutions delivers a portfolio of end-to-end services and integrated solutions for the marine markets that builds on our core values: lifecycle efficiency, risk reduction, environmental leadership and design excellence. As an original equipment manufacturer operating in 75 countries, we have the capabilities to support customers on a global scale, and remain committed to providing in-country and round-the-clock expertise.

wartsila.com/shaft-line-solutions

WÄRTSILÄ