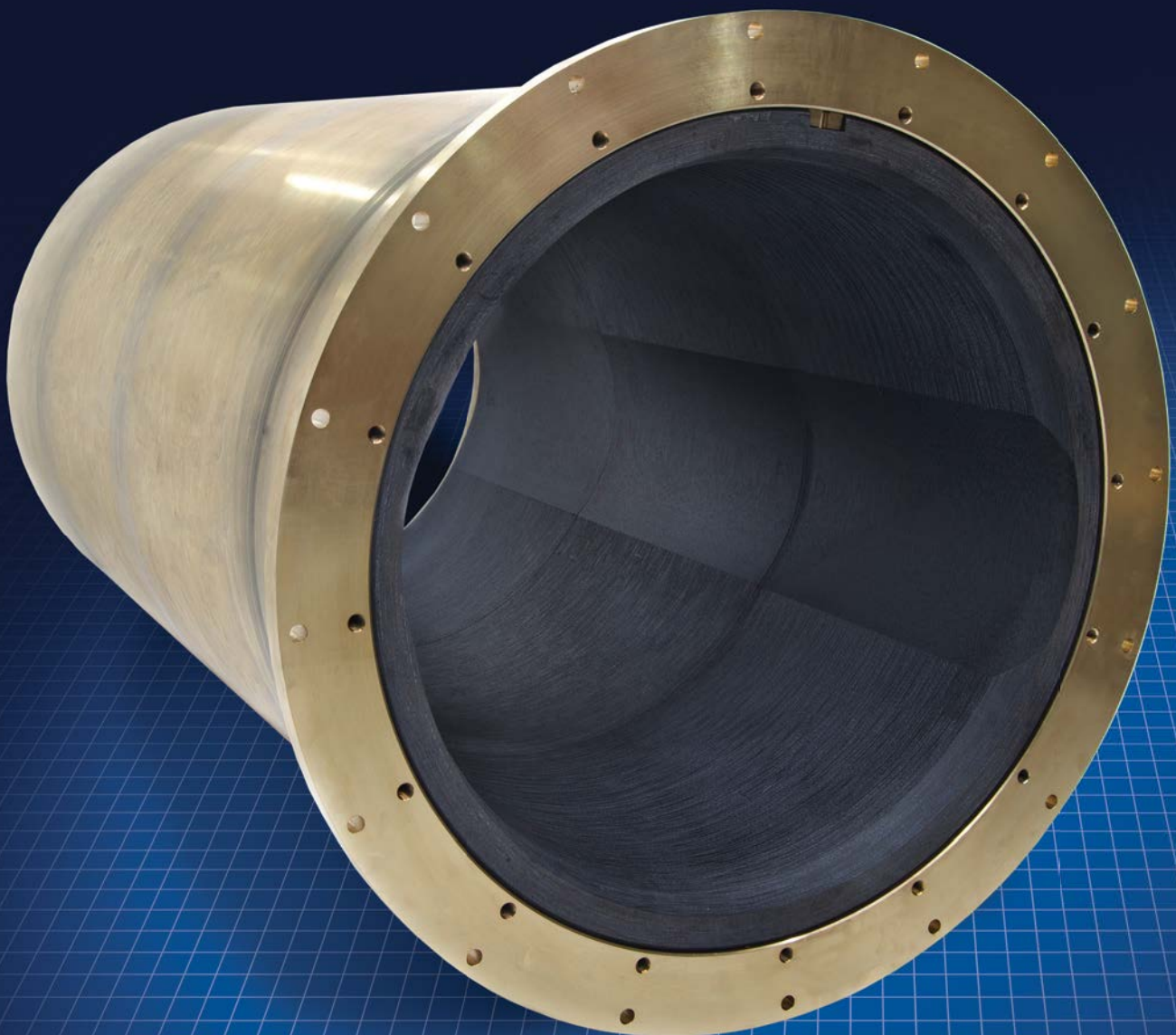


WÄRTSILÄ

Seals, Bearings & Stern Tubes

**COMPOSITE BEARING SOLUTIONS
FOR STERN TUBES AND RUDDERS**





PRODUCTS, PACKAGES AND SERVICES AVAILABLE FROM WÄRTSILÄ SEALS & BEARINGS

- Complete water lubricated packages for new build vessels
- Oil to water stern tube conversions
- Measurement and alignment services
- Underwater engineering seal repair and maintenance
- Stern tubes
- Stern tube seals
- Water quality system (WQS)
- Ropeguard and a cutter system
- Fully split construction for seal
- Hydraulic couplings
- Oil supply package

Wärtsilä Seals and Bearings products and services support you by maximising efficiency and minimising operational risks at the lowest lifecycle cost. Wärtsilä has a long history and wide expertise base for developing, manufacturing and supplying bearings for the marine market. Our bearing portfolio is designed to ensure smooth and continuous operation of all types of vessels, even in the most challenging environments. All Wärtsilä composites are manufactured in our dedicated facility in the UK. In addition, we provide retrofits and upgrades of any seal or bearing, regardless of vessel type and location. Whatever the requirement, Wärtsilä can provide a solution.

APPLICATION FIELD

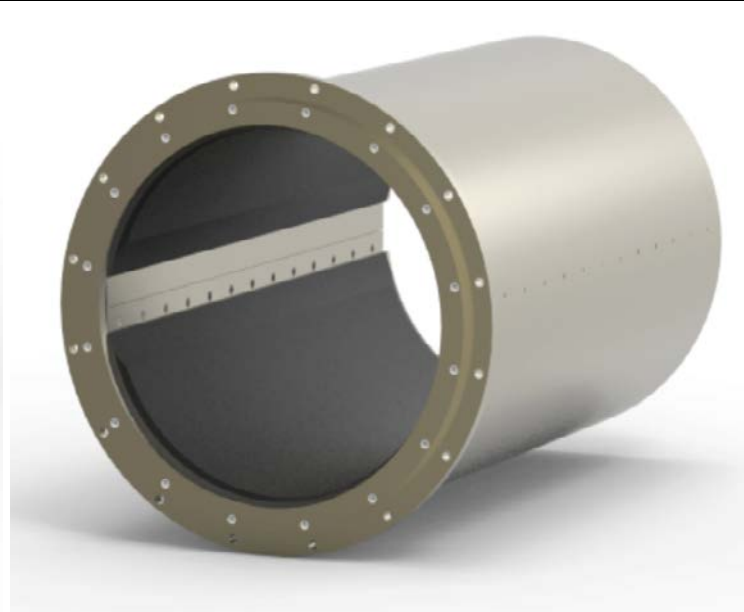
Wärtsilä Seals and Bearings is a supplier to all major markets including:

- Offshore
- Cruise and ferry
- Merchant
- Inland waterway and coastal vessels
- Workboat and superyacht
- Naval

WATER LUBRICATED COMPOSITE PROPELLER SHAFT BEARINGS



Wärtsilä Envirosafe non-split bearing assembly



Wärtsilä Envirosafe split bearing package

WÄRTSILÄ ENVIROSAFE

The propeller shaft bearings are some of the most critical components on a vessel that can affect performance. Wärtsilä Envirosafe is the culmination of years of research and development, collaborating with yards and owners around the world to develop a superior composite bearing material for the marine industry.

Wärtsilä Envirosafe range can be supplied for all water lubricated propeller shaft bearing applications from open brackets to stern tubes. Split bearings can be also supplied in a housing, or fitted directly into the stern tube or brackets. This allows easy bearing replacement

or system inspection with the shaft remaining in-situ, meaning cost efficient servicing.

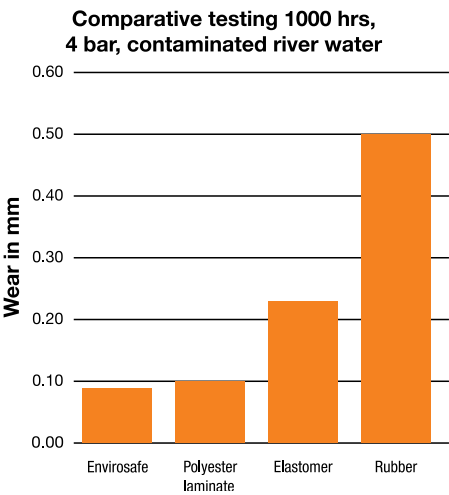
Wärtsilä Envirosafe offers class leading bearing life due to its extremely low comparative wear rates. Extensive validation testing has been undertaken by Wärtsilä's experienced composite tribologists at the comprehensive in-house composite research and testing facility in the UK.

WARRANTY

Wärtsilä offers a 16 year extended warranty on Wärtsilä Envirosafe composite stern tube bearings in Class Approved vessels.*

KEY FEATURES AND BENEFITS

- Market leading wear resistance that gives long life expectancy
- Environmentally friendly, pollution free, water lubricated bearing system
- Low speed hydrodynamic operation increases the lifecycle efficiency of propulsion
- Low friction, giving low wear and long life
- High abrasion resistance and low noise generation
- Low swell rate and thermally stable, equally suitable for icebreaker and tropical use
- Readily available (stock billets)
- Suitable for both blue and brown water applications
- Future proof - fully compliant with the 2013 US EPA Vessel General Permit rules
- Approved by all major Classification Societies



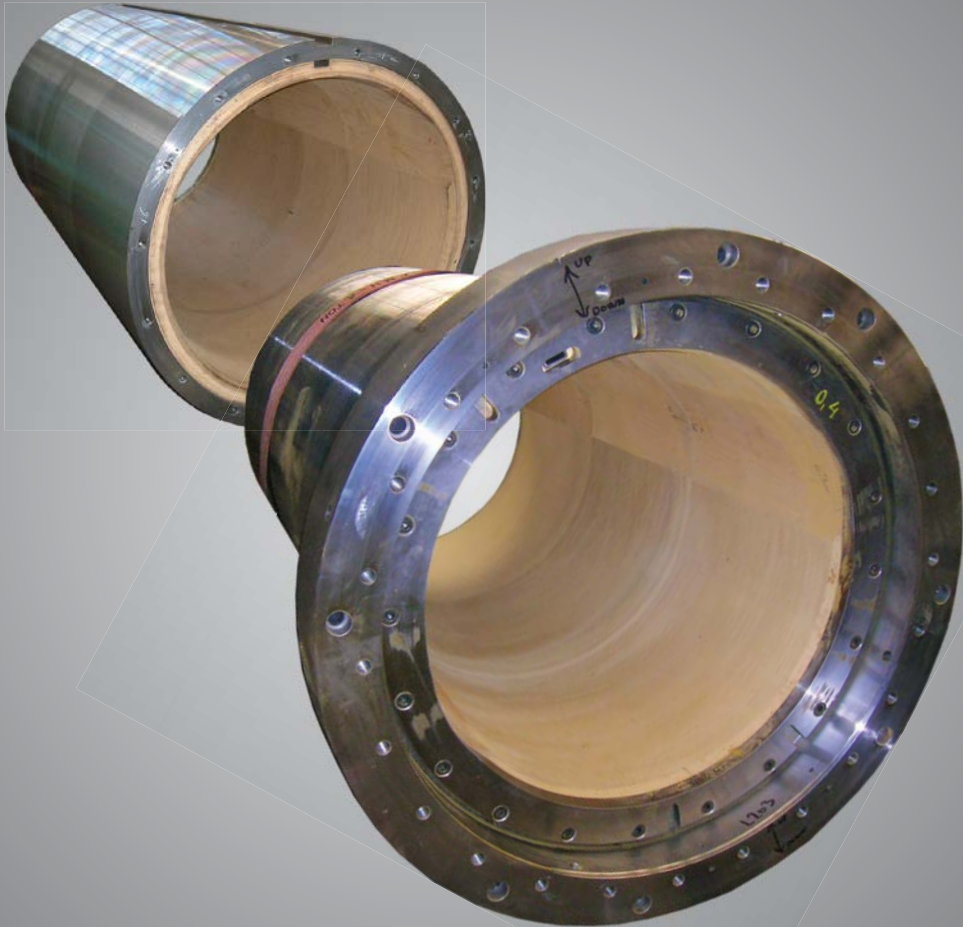
TECHNICAL SPECIFICATION

Wärtsilä Envirosafe is a highly technical, filament wound composite bearing material. It comprises advanced resin with synthetic fibre composition, and utilises advanced friction modifiers to provide outstanding bearing properties and performance.

Material properties	Wärtsilä Envirosafe value
Compressive strength	80 MPa
Swell in water	0.2%
Thermal expansion	6 x 10 ⁻⁵ / °C
Density	1.34 kg/m ³
Co-efficient of friction - wet	0.2
Co-efficient of friction - dry	0.1

*Applicable when sold as part of a package. Terms and conditions apply.

OIL LUBRICATED COMPOSITE PROPELLER SHAFT BEARINGS



WÄRTSILÄ STERNSAFE

Wärtsilä Sternsafe is an advanced composite bearing (white metal bearings also available) developed specifically for oil lubricated stern tube applications and brackets in the conjunction with one of the world's biggest

ship owners. The Wärtsilä Sternsafe range offers excellent performance covering both standard and high load requirements. A variety of different supply options are available to suit specific applications.

TECHNICAL SPECIFICATION

Wärtsilä Sternsafe is a lightweight composite bearing, offering reduced friction and a very low wear rate combined with good elasticity and strength. In emergency conditions Wärtsilä Sternsafe bearings can operate continuously at full power with no risk of seizure even in an oil and water emulsion, or sea water in the event of complete aft seal failure.

Two grades of Sternsafe are available, Standard grade OCS-N and the higher load capable grade OCS-NX.

Material properties	Wärtsilä Sternsafe TM OCS-N	Wärtsilä Sternsafe TM OCS-NX
Compressive strength	117 MPa	120MPa
Swell in water	1%	0.2%
Maximum operating capability	100 °C	160 °C
Density	1.6 kg/m ³	1.6 kg/m ³
Maximum bearing load*	6 Bar	8 Bar

KEY FEATURES AND BENEFITS

- Can run on oil and water emulsion in emergency conditions
- The material does not seize
- Stable, low swelling backing material
- Low weight
- Bio-oil compatible
- More elastic than traditional oil lubricated bearing materials
- Long bearing life and through life cost saving

*Subject to Classification Society conditions

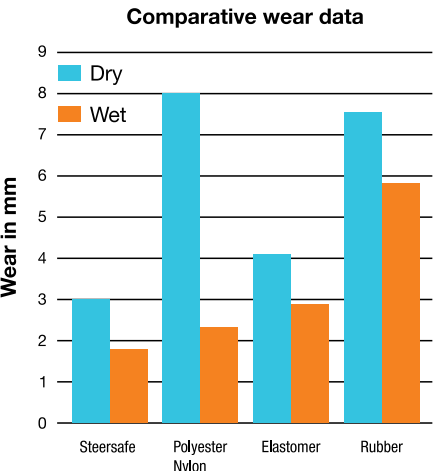
COMPOSITE RUDDER BEARINGS



WÄRTSILÄ STEERSAFE

Years of research and testing has resulted in the extensive use of Wärtsilä bearings in rudder and steering gear on vessels of all classes.

The Wärtsilä Steersafe material is approved to operate at pressures up to 10 MPa (100 Bar), by all major Classification Societies. Wärtsilä Seals and Bearings has undertaken



extensive testing on many rudder bearing materials including the Wärtsilä Steersafe. This bearing wear is considerably less than other rudder bearing materials, when running wet or dry. Also the risk of bearing failure during service is reduced, since extreme hot or cold environments will not affect operation. In addition, design and machining is simplified, as calculations to compensate for varying workshop temperatures are not necessary.

KEY FEATURES AND BENEFITS

- Offers versatility and can run on water, grease, oil and dry
- Market leading wear resistance gives long life expectancy
- Low swell rate in water and thermally stable
- Billets for retrofits held in stock – short delivery time
- Future proof – fully compliant with the 2013 US EPA Vessel General Permit rules
- Approved by all major Classification Societies

TECHNICAL SPECIFICATION

Material property	Wärtsilä Steersafe DCR01 value
Compressive strength	80 MPa
Swell in water	0.2%
Thermal expansion	6 x 10 ⁻⁵ / °C
Density	1.34 kg/m ³

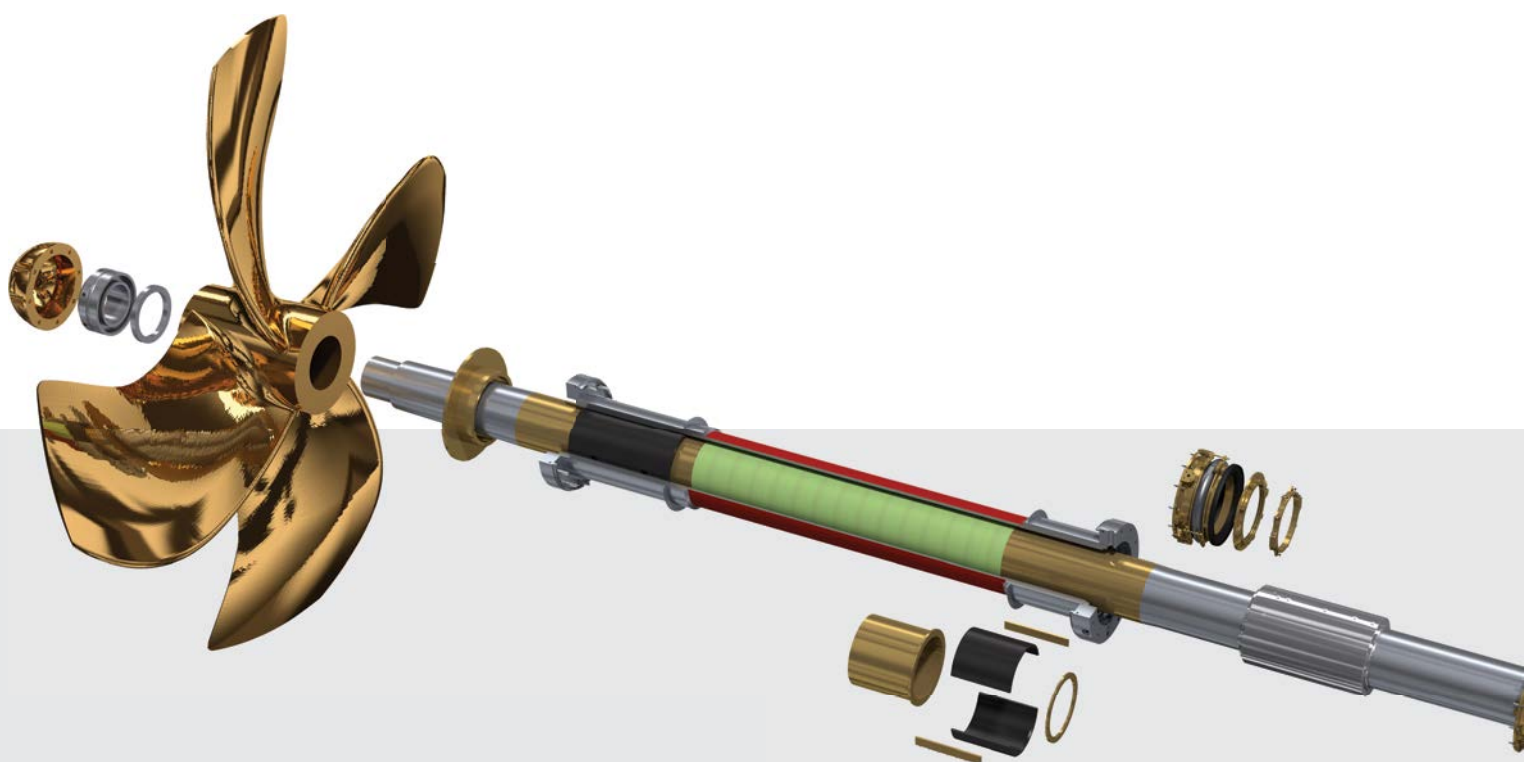
INSTALLATION AND MACHINING

All of Wärtsilä composite materials are easy to machine on standard vertical borer, lathe and milling machines.

Wärtsilä composite bearings can be supplied in several forms including rough turned tubes, which is available from stock around the world, semi-finished or finish machined. Should the rough turned tubes or semi-finished option be chosen, bearing machining can be undertaken locally to the vessel.

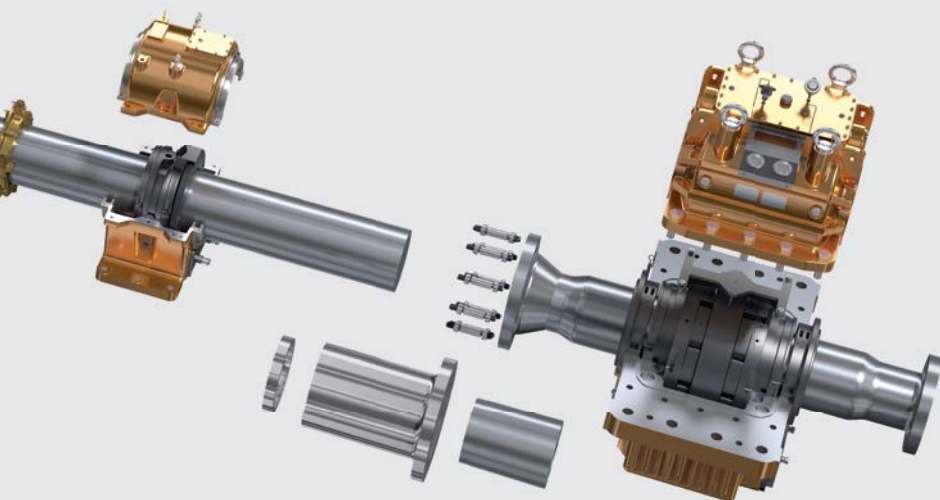
BEARING PACKAGES FOR COMPLETE STERN TUBES

Wärtsilä composite bearings can also be supplied in bearing housing or complete stern tubes for resin bonding or pressing directly into stern tubes and brackets. The Wärtsilä Envirosafe bearings can be split allowing replacement without removing the tail shaft, reducing docking time and costs. Packages are supplied ready to fit. Ordering a bearing package for a new build vessel saves time and money during installation.





Wärtsilä's unequalled network of sales and engineering offices around the world offers technical support 24 hours a day 7 days a week. Wärtsilä has a team of service engineers available to assist on-site with all composite bearing installation and repair work that you may need.



Wärtsilä Seals & Bearings provides integrated systems, packages and products that offer our customers lifecycle efficiency, reduce risks, and are environmentally sustainable. Our global service network responds at very short notice and provides expertise where and when needed.

Find out more about Seals & Bearings at [wartsila.com/sealsandbearings](https://www.wartsila.com/sealsandbearings)

Other products available from Wärtsilä Seals & Bearings



Wärtsilä Sternsafe white metal bearing



Wärtsilä Ecosafe bearings



Wärtsilä Intermediate shaft line bearing



Wärtsilä Thrust bearings



Wärtsilä Generator bearings

Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximizes the environmental and economic performance of the vessels and power plants of its customers.

In 2014, Wärtsilä's net sales totalled EUR 4,779 million with approximately 17,700 employees. The company has operations in more than 200 locations in nearly 70 countries around the world. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland.

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