Seals & Bearings Solutions for Naval Vessels
From military operations, safeguarding key trade routes and providing humanitarian assistance in harsh waters, today’s militaries demand new levels of agility and reliability from their naval vessels.

Always prepared to answer the call

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By supporting your propulsion systems with a range of integrated products, dedicated services and 24/7 support, Wärtsilä Seals and Bearings is on hand to ensure every vessel in your fleet remains equipped to respond.

Wärtsilä has been active in the seals and bearings business for over a century, and has worked with more than 76 of the world’s navies since 1966. As a result, Wärtsilä’s seals and bearings are fitted to more than 1,800 naval, governmental or coastguard vessels in service today.

**A VALUABLE TECHNICAL PARTNER**

As well as fleet owners and operators such as the world’s navies, Wärtsilä also works with an extensive global customer base that includes ship designers, ship builders, shipyards, contractors and other equipment manufacturers.

We develop solutions that support our customers’ diverse and evolving operational requirements.
A navy’s capability is heavily dependent on the vessels in its fleet. Issues along the tail shaft can cause propulsion problems, leading to unexpected delays, downtime and risk during operations.

With Wärtsilä Seals and Bearings as your technical partner, your platform availability is maximised by the reliable performance of our products, access to mission-critical parts and our truly-global, dedicated 24/7 support services.

SECURING VESSEL UPTIME

Wärtsilä Seals and Bearings products have proved themselves time and time again over decades of performance in the harshest marine environments, and in the most demanding operating conditions.

Features such as built-in redundancy and in-situ replacement options help you to keep vessels in active service for longer, by avoiding the need for dry docking.

By extending the service life of our market-leading equipment, Wärtsilä enables you to improve both the Mean Time Between Overhaul (MTBO) and Mean Time To Repair (MTTR) of your propulsion systems.
EXPERT SERVICE AT YOUR COMMAND

To reflect the critical importance of maintaining naval vessel availability, Wärtsilä has created a global field service organisation and provides access to expert technical support teams.

Whether advising on a planned maintenance programme or troubleshooting an issue, we believe that the product and service knowledge of these specialist personnel is unrivalled in the industry.

BECAUSE NO TWO NAVIES ARE THE SAME

Some navies operate a compact coastal fleet with small auxiliary vessels performing various support roles, other customers also have larger, blue-water fleets, providing support far beyond their own territorial waters.

Wärtsilä Seals and Bearings can provide solutions to suit the unique needs of your navy, working with you to find the best tail shaft solutions for your utilisation requirements.
Intelligence is your secret weapon

At sea knowledge is often your best form of defence. Wärtsilä Seals and Bearings has developed systems that monitor the ongoing condition of your hardware in-situ, enabling navies to plan maintenance based on the true status of installed equipment.

THE CLEAREST PICTURE OF WHAT’S HAPPENING

Condition monitoring systems monitor the condition of the stern tube and bracket bearings, as well as their (water or oil) lubrication status, and the condition of the stern tube seal.

A broad range of data are captured and periodically analysed to help build up the most comprehensive and accurate picture of the systems current condition. The type of data acquired include bearing temperatures, cooling water flow rates and shaft rpm, as well as gauging the wear down on the bearings.

INSIGHT-DRIVEN MAINTENANCE

For navies, the advantages of adopting an insight-driven approach to maintenance include the opportunity to extend the equipments’ operational life.

The condition monitoring system also features a valuable failure detection mode, enabling engineers to pinpoint problems and resolve them more swiftly and effectively.
GETTING MORE FROM YOUR EQUIPMENT

Continuous condition monitoring can also be augmented by Wärtsilä’s revalidation services, where specialists perform technical inspections on key components such as seals.

As the original equipment manufacturer, our assessment can be used to validate extending the operating life of components; avoiding their premature replacement, and ultimately reducing through-life refurbishment costs.
Partners for the long haul

From the initial research and development phase of each product, through to the end of its operational life, Wärtsilä supports the entire lifecycle of the seals and bearings systems that we design and manufacture.

SECURING VESSEL UPTIME

Taking end-to-end responsibility to support the life of our products gives us greater control at every stage. It means that Wärtsilä Seals and Bearings can control critical aspects, such as manufacturing lead times and the technical process of replacement at sea – factors that are vital to the ongoing success of active naval operations.

Navies can rely on Wärtsilä to provide complete lifecycle management, delivered through a range of hardware, commercial and technical support services. From responding to technical support queries to the turnkey delivery and management of major projects, call on Wärtsilä when it matters most.
WÄRTSILÄ SERVICES INCLUDE:

- Dedicated customer support
- Comprehensive research and development programmes
- Technical concept and design
- High precision manufacturing
- Full dynamic and static Factory Acceptance Test (FAT) facilities
- Turnkey project delivery and management
- Contract and inventory management
- Delivery and expert installation assistance
- Spare parts delivery and management
- Global field service
- Alignment and measurement services
- Underwater dive services
- Shock testing

ISO International Standards:
ISO 9001
ISO 14001
ISO 18001
Reassurance that runs deep

Naval submarines are like no other vessels in the fleet – subject to the demands of extensive periods of routine operations at extreme depths. Since factors such as quiet running, reliable long-term performance and long maintenance intervals are paramount to the versatility of these vessels, Wärtsilä’s seals and bearings are the ideal choice for submarine systems.

INTRODUCING WÄRTSILÄ SUBMARINE SOLUTIONS

Designing equipment for submarine propeller shafts, one of the most demanding applications for marine seals and bearings, requires extensive experience and skill to overcome the extremes of shock, temperature and pressure which a submarine is subjected to.

For the last 50 years Wärtsilä Seals and Bearings has been supporting submarine fleets with a range of solutions, all tailored to suit the specific requirements of each platform. Example equipment supplied to SSK, SSN and SSBNs includes: Fixed couplings, propeller shafts, propeller shaft and stern tube bearings, shaft seals and thrust bearings.

Wärtsilä Seals and Bearings’ engineering knowledge is a key contributor to the successful performance of the solutions, allowing submarines to achieve longer Mean Time Between Overhauls (MTBO) with minimal crew involvement.

Revalidation and requalification of components can be completed either in-situ, or at one of Wärtsilä’s facilities, to extend the operational life of key non-wearing components.
As the business has grown, so too has the range of marine products and systems that we offer. Wärtsilä today manufactures complete shaftline systems from the engine to the propeller, and everything in between.

**STEALTHY, ROBUST AND HIGHLY EFFICIENT JUST LIKE YOUR NAVY**

Our products have been specifically engineered with the demands of modern naval operations in mind. Each component is designed and tested to be shock resistant, long lasting, quiet and efficient in its operation – all qualities required of the vessel itself. Our integrated solutions approach avoids the compatibility issues that can arise from using multiple manufacturers, with everything engineered to work together.

Beyond these technical demands, Wärtsilä’s products and services also help customers to meet the wider priorities of operating a naval fleet: to extend maintenance intervals, to manage whole-life costs and to demonstrate the highest standards of environmental sustainability.
During naval operations a key advantage of waterjet driven craft is their superior manoeuvrability – not to mention their fuel efficiency at high speeds and the ability to operate in shallow draft, often in close proximity to land.

Wärtsilä provides seals and bearings that safeguard the performance of this technically-complex propulsion system.

**INTRODUCING WÄRTSILÄ WATERJET SOLUTIONS**

Wärtsilä Jetguard seals have been designed to take into account requirements from navies such as high performance and shock resilience.

While chosen for their lightweight properties, the use of aluminium hulls can create material compatibility issues, leading to the accelerated corrosion of localised equipment. The use of composite materials within Wärtsilä Jetguard seal components eliminates the risk of corrosion, while providing a light-weight alternative design.

This design is based on extensive experience and knowledge gained from waterjet applications and submarine seals.

**Precision**

**where it counts**

During naval operations a key advantage of waterjet driven craft is their superior manoeuvrability – not to mention their fuel efficiency at high speeds and the ability to operate in shallow draft, often in close proximity to land.

Wärtsilä provides seals and bearings that safeguard the performance of this technically-complex propulsion system.
SUPPORTING YOUR STRATEGIC AND TACTICAL OPERATIONS

For all navy customers, our global footprint means that wherever you’re based – and critically wherever your vessels are eventually deployed – you can rest assured that Wärtsilä will be ready to assist you.

Our dedicated service teams are on hand to provide technical support, together with in-situ replacements, overhauls, retrofits and conversions.

REACHING FURTHER, OFFERING MORE

Our global footprint today is the result of a series of strategic acquisitions by Wärtsilä over the last two decades. These include Japan Marine Technologies (2003), the UK’s Deep Sea Seals (2003), and the acquisition of Cedervall in Spain, China and Sweden in 2011.

Today these companies and their legacy products are fully integrated into the Wärtsilä portfolio.

As a result, we can now offer a complete package of products and services to complement the vast range of propulsion systems employed by navies throughout the world.
Wärtsilä shaftline seals and bearings for an end-to-end solution
<table>
<thead>
<tr>
<th>Component</th>
<th>Patrol</th>
<th>Combatant</th>
<th>Fleet Support</th>
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**Specification**

**CONVENTIONAL SHAFT LINE APPLICATIONS**

### Wärtsilä Enviroguard PSE Seals

**Open water lubricated stern tube forward face type seals**
The Wärtsilä Enviroguard range is a water lubricated, environmentally friendly inboard sealing solution which is suitable for both blue-water and abrasive water conditions. The product is available in both metallic and composite material options. The Wärtsilä Enviroguard seals are suitable for smaller vessel types, including patrol and coastal vessels. The small range Wärtsilä Enviroguard has a long track record of outstanding performance in all water conditions. This seal type comprises hard wearing interfaces for abrasion resistance and can be adapted for shock capability. Partially and fully split options are available for ease of maintenance and seal replacement. Composite materials also offer easy maintenance and benefit from reduced weight for ease of handling and durability.

<table>
<thead>
<tr>
<th>Split Wearing</th>
<th>Yes</th>
<th>Other Options</th>
<th>Double Maintenance Seal</th>
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<td>Operating Temperature</td>
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</table>

### Wärtsilä Enviroguard M-Series Seals

**Water lubricated stern tube forward face type seals**
Inboard seals for open water lubricated stern tubes are part of the Wärtsilä Enviroguard range of wrapped omega bellows seals. They are suitable for fixed pitch or controllable pitch propeller applications. Available in partially split and fully split variants depending on installation and servicing requirements. Shock-proven, the seals offer long, low-cost component life allowing high shaft movement with minimal leakage and are also fully serviceable afloat. They are designed to interface with your ship design and have an optional packing gland for emergency sealing where required.

**MD**

<table>
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<td>Other Options</td>
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**MA / M9**

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### Wärtsilä Sternguard E-Series Seals

**Oil lubricated stern tube forward and aft face type seals**
Outboard and inboard stern tube face type seals designed for robust and reliable service in small to medium sized vessels.

<table>
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<th>Wearing Parts</th>
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### Wärtsilä Envirosafe Composite Bearings

**Water lubricated composite stern tube bearings**
The Wärtsilä Envirosafe range consists of composite water lubricated stern tube bearings, offering an environmentally friendly solution. They are available in non-split, fully split, or divided and controllable pitch applications. The bearings are designed to interface with your ship design and offer an optional packing gland for emergency sealing where required.

<table>
<thead>
<tr>
<th>Split Wearing</th>
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<tr>
<td>Shock Resistant</td>
<td>Optional</td>
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</table>
Wärtsilä Sternsafe Composite Bearings

Oil lubricated composite stern tube bearings
Wärtsilä Sternsafe composite bearings are developed specifically for stern tube applications. Our range of oil lubricated bearings offers excellent performance covering both standard and high load requirements. A variety of different supply options are available to suit specific applications.

| Split Wearing | Optional | Split Housing | Optional | Shaft Diameter | ø70 to ø1100mm |
| Split Housing | Optional | Wear Parts | Composite | Service Pressure | 6.0 bar max bearing pressure |
| Housing | Aluminium Bronze | Light Weight | No | Lubrication | Oil |
| Condition Monitoring | Optional |

Wärtsilä Sternsafe White Metal Bearings

Oil lubricated white metal stern tube bearings
Wärtsilä Sternsafe white metal bearings are made from cast iron or ductile cast iron housings which are babbitted with tin or lead based white metal. All bearings are based on a standardised design with the option of a variety of temperature sensors.

| Split Wearing | No | Split Housing | No | Wear Parts | Tin/Lead | Housing | Cast Iron/Ductile Cast Iron | Light Weight | No |
| Condition Monitoring | Optional |

Wärtsilä Floodguard Seals

Bulkhead face type seals
The Wärtsilä Floodguard is a water lubricated face type seal suitable for both standard and high speed applications. For gas tight requirements, we can also offer bespoke lip type designs to suit custom specifications.

The Wärtsilä Floodguard range has a long track record of proven performance in military applications to ensure vessel integrity is maintained, allowing continued passage to dock and high shaft speeds. Being fully split as standard, the seal enables maintenance and replacement without removing the shaft.

| Split Wearing | Yes | Split Housing | Optional | Wear Parts | Composite | Housing | Aluminium Bronze/Aluminium | Light Weight | Optional |
| Shock Resistant | Optional | Condition Monitoring | No |

Wärtsilä Thrust Bearing

Oil lubricated thrust bearings
Wärtsilä thrust bearing solutions are single collar, self-aligning thrust bearings. The bearings have two faces of tilting pads on pivots, and transmit thrust from the shaft to the bearing housing minimising the tilting effect, and reducing stress levels. The standard is for axial loads only, with an option for axial and radial loading.

The oil circulating and cooling system is available either as a self-lubricating system with integrated cooler or as an external pump and cooler unit. Fitted with complete remote monitoring of the temperatures and oil flow, the thrust bearing solution enables easy management of the product.

| Split Wearing | Yes | Split Housing | Yes | Wear Parts | Tin | Housing | Cast Iron | Light Weight | No |
| Shock Resistant | Optional | Condition Monitoring | Optional | Other Options | Axial & Radial Loads |
| Shaft Diameter | ø126 to ø1285mm | Lubrication | Oil |

Wärtsilä Generator Bearing

Oil lubricated generator bearings
Wärtsilä generator bearings are self-aligning with cast-iron housings, and centrifugally cast tin-based white metal bearing surfaces. They can all be fitted with systems to remotely monitor temperature and oil flow. Depending on the intended installation, the bearings can be altered to support both axial and radial loads.

All bearing designs offer a variety of lubrication and cooling options to ensure they are appropriately prepared for the intended application. The range includes generator bearings which are designed according to a. DIN 31690 (which is adapted for fixing to a platform), b. DIN 31693 (which has a laterally positioned flange) and c. DIN 31694 (which has a flange in the middle of the bearing).

| Split Wearing | Yes | Split Housing | Yes | Wear Parts | Tin | Housing | Cast Iron | Light Weight | No |
| Shock Resistant | Optional | Condition Monitoring | Optional | Other Options | Axial & Radial Loads |
| Shaft Diameter | ø110 to ø800mm | Lubrication | Oil |

Wärtsilä Stern Tubes

Water and oil lubricated stern tubes
Wärtsilä stern tube solutions are ready-to-install stern tubes but can also be custom designed to fit specific vessel requirements. The solutions are designed to meet individual customer requirements and specifications.

The Wärtsilä standard stern tube assemblies are fitted with centrifugally cast white metal bearings or composite bearings, depending on the application or lubricating medium. The solution encourages a fit-and-forget concept as bearings and all additional items are already fitted and installed on delivery. The installation and alignment is a simple and swift procedure when compared to traditional methods, allowing for significant reduction in installation time and resources.
### Wärtsilä Shaft Coating

A properly applied glass-reinforced epoxy laminate will provide the most effective long wearing, corrosion protection for water-borne propeller shafting and other metal surfaces exposed to severe marine environments. Wärtsilä ensures satisfactory shaft protection by carefully applying a qualified materials system to a pre-prepared shaft surface, either on site or at our facilities. Application to all shaft diameters and lengths can be considered on request.

### Wärtsilä Journals

Wärtsilä tail shaft journals are engineered and manufactured to ensure the best performance of the Wärtsilä Envirosafe composite water lubricated bearings.

### Wärtsilä Hydraulic Couplings

**Oil lubricated hydraulic couplings**
Wärtsilä hydraulic shaft couplings provide a simple and quick way to connect shafts, eliminating the need for keyways, tapers or thrust rings. The hydraulic shaft coupling range consists of four designs, which include flange couplings that connect a shaft to a gearbox, engine or other shaft type and couplings that connect two standard shafts.

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</table>

**Wärtsilä High Friction Hydraulic Couplings**

A new generation of Wärtsilä high friction hydraulic couplings to provide solutions where it was previously impossible to maximise propulsion efficiency without shaft connection complexity. This innovative technology reduces surface contact pressure while increasing torque transmission capacity by 30% – offering substantial cost-savings in the shaft line. The couplings avoid the use of costly reinforcement sleeves, as well as the need to substitute large connection couplings. Designed for an easy, clean and fast install/uninstall with minimal personnel. Re-engineered to be 30% lighter, they are available in a wide range of sizes to ensure the perfect fit for your vessel.

<table>
<thead>
<tr>
<th>Wearing Parts</th>
<th>Alloy Steel</th>
<th>Conditional Monitoring</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Alloy Steel</td>
<td>Other Options</td>
<td>Hydraulic Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Weight</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock Resistant</td>
<td>Optional</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Wärtsilä Hydraulic Nuts

**Oil lubricated hydraulic nuts**
Wärtsilä hydraulic nuts are designed for heavy equipment installation. Manufactured from high quality materials, the nuts are designed to use as both an installation tool and as a permanent nut. The fitting process is controlled by means of a hydraulic procedure. The process is clean, quick and trouble free with the simple use of one set of hydraulic equipment.

<table>
<thead>
<tr>
<th>Wearing Parts</th>
<th>Alloy Steel/Steel</th>
<th>Shock Resistant</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Weight</td>
<td>No</td>
<td>Shock Resistant</td>
<td>Optional</td>
</tr>
</tbody>
</table>

**Wärtsilä Hydraulic Bolts**

**Oil lubricated hydraulic bolts**
Wärtsilä hydraulic bolts are designed to ensure the connection of flanges while still being able to meet the requirements of high torque transmission. The high quality bolts keep the connections rigid under extreme operating conditions. They are easy to install or remove and are also reusable.

<table>
<thead>
<tr>
<th>Wearing Parts</th>
<th>Alloy Steel</th>
<th>Shock Resistant</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Weight</td>
<td>No</td>
<td>Shock Resistant</td>
<td>Optional</td>
</tr>
</tbody>
</table>

### Wärtsilä Water Quality System

**Open/closed water filtration and quality systems**
Wärtsilä water quality systems are designed to provide filtered water for open and closed lubricated stern tube systems, significantly improving the longevity of installed equipment. Designed to increase the life of both the seal and the bearing by filtering the water supply to the required standard. A range of pumped and/or filtered systems for open and closed water applications is available:

- Open water filtration systems options
- Dual pumped and filtration
- Pumped and filtration
- Dual pumped and filtration with cyclone separators with increased filtering efficiency and semi-automated maintenance
- Closed water filtration systems
- Dual pumped and filtration and temperature monitored

### Wärtsilä Sea-Master condition monitoring system

**Condition monitoring systems**
The system monitors the condition of the stern tube and bracket bearings, their (water or oil) lubrication along with the stern tube seal condition, capturing a comprehensive range of data to build up an accurate picture of current equipment conditions.

Utilising condition monitoring can be used to validate extending the equipment’s operational life. The system also features a failure detection module to pinpoint problems and resolve them more swiftly and effectively.

**Example data collected:**

- Aft and forward stern tube bearings: temperatures and wear down
- Bracket bearings: temperatures and wear down
- Cooling water flow rate to stern tube seal and bearings
- Shaft power
- Shaft vibrations
**SUBMARINE APPLICATIONS**

### Wärtsilä Diveguard Face Seal

**Water lubricated high pressure face type seals**

The Wärtsilä Diveguard range is a water lubricated, high pressure inboard sealing solution for submarines which has a standard single barrier, or an optional double barrier for additional safety. Commonly supplied as a bespoke design solution for the most demanding subsea applications, this seal offers exceptional performance in military vessels and benefits from low noise and a long operational life. Redundancy options are available, including high pressure inflatable seals (allowing high pressure testing), optional emergency packing (standard and planetary gearing options) and flow restrictors.

### Wärtsilä Envirosafe Composite Bearings

**Water lubricated composite stern tube bearings**

The Wärtsilä Envirosafe range consists of composite water lubricated stern tube bearings, offering an environmentally friendly solution. They are available in non-split, fully split shells or full housing and bearing packages.

Wärtsilä Envirosafe bearings are developed specifically for stern tube applications and offer excellent performance. A variety of different supply options are available to suit the specific application. Our range offers exceptional performance when compared to competing products. Features, such as bearings with the full split housing option, allow in-situ replacement and repair.

### Wärtsilä Thrust Bearing

**Oil lubricated thrust bearings**

Wärtsilä thrust bearing solutions are single collar, self-aligning thrust bearings. The bearings have two faces of tilting pads on pivots, and transmit thrust from the shaft to the bearing housing minimising the tilting effect, and reducing stress levels. The standard is for axial loads only, with an option for axial and radial loading.

The oil circulating and cooling system is available either as a self-lubricating system with integrated cooler or as an external pump and cooler unit. Fitted with complete remote monitoring of the temperatures and oil flow, the thrust bearing solution enables easy management of the product.

### Wärtsilä Generator Bearing

**Oil lubricated generator bearings**

Wärtsilä generator bearings are self-aligning with cast-iron housings, and centrifugally cast tin-based white metal bearing surfaces. They can all be fitted with systems to remotely monitor temperature and oil flow. Depending on the intended installation, the bearings can be altered to support both axial and radial loads.

All bearing designs offer a variety of lubrication and cooling options to ensure they are appropriately prepared for the intended application. The range includes generator bearings which are designed according to a. DIN 31690 (which is adapted for fixing to a platform), b. DIN 31693 (which has a laterally positioned flange) and c. DIN 31694 (which has a flange in the middle of the bearing).

### Wärtsilä Stern Tubes

**Water and oil lubricated stern tubes**

Wärtsilä stern tube solutions are ready-to-install stern tubes but can also be custom designed to fit specific vessel requirements. The solutions are designed to meet individual customer requirements and specifications.

The Wärtsilä standard stern tube assemblies are fitted with centrifugally cast white metal bearings or composite bearings, depending on the application or lubricating medium. The solution encourages a fit-and-forget concept as bearings and all additional items are already fitted and installed on delivery. The installation and alignment is a simple and swift procedure when compared to traditional methods, allowing for significant reduction in installation time and resources.

### Wärtsilä Shaft Coating

A properly applied glass-reinforced epoxy laminate will provide the most effective long wearing, corrosion protection for water-borne propeller shafting and other metal surfaces exposed to severe marine environments.

Wärtsilä ensures satisfactory shaft protection by carefully applying a qualified materials system to a pre-prepared shaft surface, either on site or at our facilities.

Application to all shaft diameters and lengths can be considered on request.

### Wärtsilä Journals

Wärtsilä tail shaft journals are engineered and manufactured to ensure the best performance of the Wärtsilä Envirosafe composite water lubricated bearings.
Wärtsilä Water Quality System

Open/closed water filtration and quality systems
Wärtsilä water quality systems are designed to provide filtered water for open and closed lubricated stern tube systems, significantly improving the longevity of installed equipment. The high quality bolts keep the connections rigid under extreme operating conditions. They are easy to install or remove and are also reusable.

Wärtsilä Hydraulic Bolts

Oil lubricated hydraulic bolts
Wärtsilä hydraulic bolts are designed to ensure the connection of flanges while still being able to meet the requirements of high torque transmission. Designed to increase the life of both the seal and the bearing by filtering the water supply to the required standard.

Wärtsilä Hydraulic Couplings

Oil lubricated hydraulic couplings
Wärtsilä hydraulic shaft couplings provide a simple and quick way to connect shafts, eliminating the need for keyways, tapers or thrust rings. The hydraulic shaft coupling range consists of four designs, which include flange couplings that connect a shaft to a gearbox, engine or other shaft type and couplings that connect two standard shafts.

Wärtsilä High Friction Hydraulic Couplings

Oil lubricated, high friction hydraulic couplings
A new generation of Wärtsilä hydraulic couplings to provide solutions where it was previously impossible to maximise propulsion efficiency without shaft connection complexity. This innovative technology reduces surface contact pressure while increasing torque transmission capacity by 30% – offering substantial cost-savings in the shaft line. The couplings avoid the use of costly reinforcement sleeves, as well as the need to substitute large connection couplings. Designed for an easy, clean and fast install/uninstall with minimal personnel. Re-engineered to be 30% lighter, they are available in a wide range of sizes to ensure the perfect fit for your vessel.

Wärtsilä Hydraulic Nuts

Oil lubricated hydraulic nuts
Wärtsilä hydraulic nuts are designed for heavy equipment installation. Manufactured from high quality materials, the nuts are designed to use as both an installation tool and as a permanent nut. The fitting process is controlled by means of a hydraulic procedure. The process is clean, quick and trouble free with the simple use of one set of hydraulic equipment.

Condition monitoring systems
The system monitors the condition of the stern tube and bracket bearings, their (water or oil) lubrication along with the stern tube seal condition, capturing a comprehensive range of data to build up an accurate picture of current equipment conditions. Utilising condition monitoring can be used to validate extending the equipment’s operational life. The system also features a failure detection mode to pinpoint problems and resolve them more swiftly and effectively.

Example data collected:
- Aft and forward stern tube bearings: temperatures and weardown
- Bracket bearings: temperatures and weardown
- Cooling water flow rate to stern tube seal and bearings
- Shaft power
- Shaft vibrations

Wärtsilä Sea-Master condition monitoring system

Specification
WATERJET APPLICATIONS

**Wärtsilä Jetguard AN-W Seal**

Water lubricated stern tube face type seals
The AN-W seal has been designed to have high performance and shock resilience for Waterjet applications. This design is based on extensive experience and knowledge gained from submarine seals and shock environments. The seal design is fully split which enables it to be installed and serviced without the need to decouple and pull the impeller shaft.

Main components are of military specification made from aluminium bronze and duplex stainless steel.

**Wärtsilä Jetguard PSE Seals**

Water lubricated stern tube face type seals
The Wärtsilä Jetguard range is an environmentally friendly inboard sealing solution. These products are suitable for both blue-water and abrasive water conditions. Available in both metallic and composite materials.

Wärtsilä Jetguard PSE seals are suitable for smaller vessels such as patrol and coastal vessels. The small range Jetguard has a long track record of outstanding performance in all water conditions. This seal type comprises hard wearing interfaces for abrasion resistance and can be adapted for shock capability.

Partially and fully split options are available to enable maintenance and seal replacement while composite materials allow for easy maintenance and reduced weight.

**Wärtsilä Thrust Bearing**

Oil lubricated thrust bearings
Wärtsilä thrust bearing solutions are single collar, self-aligning thrust bearings. The bearings have two faces of tilting pads on pivots, and transmit thrust from the shaft to the bearing housing minimising the tilting effect, and reducing stress levels. The standard is for axial loads only, with an option for axial and radial loading.

The oil circulating and cooling system is available either as a self-lubricating system with integrated cooler or as an external pump and cooler unit. Fitted with complete remote monitoring of the temperatures and oil flow, the thrust bearing solution enables easy management of the product.

**Wärtsilä Envirosafe Composite Bearings**

Water lubricated composite stern tube bearings
The Wärtsilä Envirosafe range consists of composite water lubricated stern tube bearings, offering an environmentally friendly solution and exceptional performance. They are available in a variety of supply options to suit the specific application and include non-split, fully split shells or full housing and bearing packages.

Our range of water lubricated bearings offers excellent performance when compared to competing products and can include enhanced features, such as the fully split housing option, that allows in-situ replacement and repair which reduces operational downtime.
WE HAVE UNRIVALLED KNOWLEDGE AND SCOPE FOR SUPPORTING GLOBAL NAVIES WITH THEIR SHAFTLINE SYSTEMS, PROVIDING:

- Technical expertise and advice during concept and design phases
- Complete detailed component, equipment and system design
- High precision manufacturing
- Full FAT facilities (dynamic and static)
- Expert installation assistance/delivery
- Complete lifecycle management including hardware supply, revalidation and requalification, as well as technical and commercial support
- Comprehensive research and development programme
- Turnkey project management and delivery
- Specialist materials sourced from internal and external global suppliers
- Temperature-controlled cleanroom and inspection facilities
- ITAR-compliant with approved secure manufacturing facilities and security clearance for key employees
- Experienced partner serving 76+ navies since 1966

### OTHER

#### Wärtsilä Steerguard ER Seals

**Water and grease lubricated rudder stock face type seals**

Wärtsilä Steerguard ER face type seals offer a proven and reliable sealing solution designed to meet shock capacity requirements.

<table>
<thead>
<tr>
<th>Split Wearing</th>
<th>Optional</th>
<th>Shaft diameter</th>
<th>ø530 to ø1300mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Housing</td>
<td>Optional</td>
<td>Axial movement</td>
<td>Up to 4mm</td>
</tr>
<tr>
<td>Wearing Parts</td>
<td>Composite &amp; Cast Iron</td>
<td>Radial movement</td>
<td>±3mm</td>
</tr>
<tr>
<td>Light Weight</td>
<td>No</td>
<td>Lubrication</td>
<td>Grease/Oil/Seawater</td>
</tr>
<tr>
<td>Shock Resistant</td>
<td>Optional</td>
<td>Condition Monitoring</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operating Temperature</td>
<td>-5° - 40° C</td>
</tr>
</tbody>
</table>

#### Wärtsilä Steersafe Composite Bearings

**Oil lubricated rudder bearings**

Wärtsilä Steersafe composite bearings are developed specifically for rudder applications. They offer excellent performance in applications where oil, grease, water or dry running may be required. A variety of different supply options is available to suit the specific application.

<table>
<thead>
<tr>
<th>Split Wearing</th>
<th>No</th>
<th>Shaft diameter</th>
<th>ø70 to ø1300mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Housing</td>
<td>No</td>
<td>Service Pressure</td>
<td>100 bar max bearing pressure</td>
</tr>
<tr>
<td>Wearing Parts</td>
<td>Composite</td>
<td>Lubrication</td>
<td>Dry/Grease/Oil/Seawater</td>
</tr>
<tr>
<td>Light Weight</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Wärtsilä Sternguard E-Series Seals

**Oil lubricated stabiliser seals**

Outboard and inboard stern tube face type seals are designed for robust and reliable service in small to medium-sized vessels. The outboard seal offers high abrasion resistance.

<table>
<thead>
<tr>
<th>Split Wearing</th>
<th>No</th>
<th>Shaft diameter</th>
<th>ø50 to ø330mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Housing</td>
<td>No</td>
<td>Light Weight</td>
<td>No</td>
</tr>
<tr>
<td>Wearing Parts</td>
<td>Composite &amp; Ni-Resist</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Specification**

-Wärtsilä Steerguard ER Seals
-Wärtsilä Steersafe Composite Bearings
-Wärtsilä Sternguard E-Series Seals
REFERENCES

**CHILEAN NAVY**
Cabildo [de la] [Port], Trazur Class, Research Vessel
Enviroguard seals, Sternguard seals

**FRENCH NAVY**
BPC Tonnerre, Mistral Class, Amphibious Assault
Ocean guard seals, Sternguard seals

**INDIAN NAVY**
INS Kamorta, Kamorta Class Corvette
Enviroguard seals, Floodguard seals, Envirosafe bearings

**IRISH NAVY**
LÉ Samuel Beckett, Samuel Beckett Class OPV, Offshore Patrol
Enviroguard seals, Envirosafe bearings

**ROYAL NAVY**
HMS Queen Elizabeth, Queen Elizabeth Class, Aircraft Carrier
Enviroguard seals

**ROYAL NAVY**
HMS Daring, Daring Class, T45 Destroyers
Enviroguard seals

**ROYAL NAVY**
HMS Clyde, River Class OPVs, Offshore Patrol
Enviroguard seals

**ROYAL NEW ZEALAND NAVY**
HMNZS Canterbury, Class MRV, Multi Role
Enviroguard seals

**SOUTH AFRICAN NAVY**
SAS Amatola, Meko-A200 Corvettes, Valour Class
Enviroguard seals, Sternguard seals

**SPANISH NAVY**
Alvaro de Bazan, Fregates F-100, Alvaro de Bazan Class
Enviroguard seals, Floodguard seals, Envirosafe bearings, Sternguard seals

**US ARMY & US NAVY – SPEARHEAD**
USNS Spearhead, JHSV Class, Fast Transport
Jetguard seals

**US NAVY**
USNS Independence, LCS Class, Littoral Combat Ship
Jetguard seals

**US NAVY**
USNS Lewis and Clark, T-AKE1, Support
Enviroguard seals, Sternguard seals, Water Quality System
Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises environmental and economic performance of the vessels and power plants of its customers. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland.

www.wartsila.com/navy