Set a course for optimum reliability and performance
The state-of-the-art hydrodynamic test centre in Sweden allows Rolls-Royce to set standards for steering and stabilisation products. The centre’s premium hydrodynamic environment boosts expertise, especially with its two cavitation tunnels. These allow us to study the complex interaction between rudders, propellers and hulls in depth, leading to solutions that meet customer demand for reliability, cost-efficiency and optimal performance – tailored to meet the needs of individual vessels. However, credit for these products must be given to our customers. They have shared their hard-earned experience and helped refine products to excellence by working closely with our marine engineers. Close collaboration with customers on a project is therefore a key element within the Rolls-Royce range of products.

Being a single-source supplier simplifies product and system integration on board. Well-integrated system solutions minimise running costs and technical risk, as well as maximising a vessel’s performance. Furthermore, customers have a single point of contact and receive full service from Rolls-Royce all the way from the initial conceptual design of a vessel and selection of equipment to in-service support and flexible financing.
Tenfjord™ rotary vane steering gear

Rolls-Royce supplies a complete range of steering gear, suitable for all sizes of ships. The products are designed with the totality of actuator, power pack, steering control and alarm system in mind. Due to a wide range of demands, great care has been taken from material selection through construction in order to meet the strictest quality demands. Rolls-Royce Tenfjord and Frydenbø series of rotary vane steering gears have been manufactured for more than 50 years, with more than 25,000 machines delivered. The principle of a rotary vane gives more flexibility when choosing the design and types of rudder, thanks to the rudder angles of up to 2 x 70º. Rotary vane steering gear does make navigation through narrow straits safer, because of the vessels’ increased manoeuvrability and improved control when docking.

The rotary vane principle also ensures a constant torque throughout the steering sequence, providing the gear with maximum power output. The unique technical solutions ensure very low noise and vibration levels.

The compact and simple design reduces weight and secures fast and easy installation of the steering gear. The actuators are mounted directly on the rudder stock, without necessary use of keys or keyways, facilitating easier assembly and dismantling of the rudder stock. The rudder torque is transmitted by hydraulic coupling or by expansion rings (for the smallest machines). The Brown Brothers rotary vane steering gear range is designed for naval applications and meets the highest standards for noise, shock and vibration.

The Tenfjord SR series is designed with integrated frequency controlled pumps.

Key Product Benefits
- Compact
- Low weight
- Easy installation
- Easy maintenance
- High positioning accuracy
- No external moving parts
- Up to 70º rudder angle
- Available with steering control and rudder angle indicators as one complete system
- Built-in rudder carrier
- Polymer sealings internally for optimal tightness
- Simple and robust components

The Tenfjord SR series is suitable for small to medium-sized vessels. The steering gear is designed with integrated frequency controlled pumps.

The pump utilises a reversible hydraulic pump motor together with a frequency converter for changing the speed and the direction of the pump. The design gives smooth starting and stopping of the steering gear, and enables a precise analogue control system. The pump engines are mounted directly on the rudder actuator, which lessens the need for piping work on board a vessel.

Benefits of the SR series
- Low noise level
- Low power consumption
- Low heat generation
- Excellent positioning precision

Tenfjord SR series steering gears

Typical applications:
- Work boats
- Fishing vessels
- Offshore supply vessels
- Smaller cargo vessels
- Smaller passenger vessels
- Yachts

Unique technical solutions minimize noise and vibration levels.

General description rotary vane steering gear

The Tenfjord SR series is designed with integrated frequency controlled pumps.

Typical applications:
- Suitable for vessels such as:
  - Work boats
  - Fishing vessels
  - Offshore supply vessels
  - Smaller cargo vessels
  - Smaller passenger vessels
  - Yachts

Red indicates pressurised oil.
Green indicates excess oil.

The compact and simple design lessens the weight and is quick and easy to install.

SR range

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Max. stock dia. (mm)</th>
<th>Max. working torque (kNm)</th>
<th>Max. rudder angle</th>
<th>Weight approx. (kg)</th>
<th>Max. radial load (kN)</th>
<th>Frictional head (m)</th>
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<td>480</td>
</tr>
</tbody>
</table>

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The Frydenbø steering gear has a proven service record on all types of vessels. Today’s range is suitable for medium-sized to large ships, including large container vessels and VLCCs. The weight is typically 90-60% of a RAM-type steering gear, with much smaller space requirement. Furthermore, the Frydenbø design’s dual, submerged pump power packs makes installation even easier, as no expansion tank is needed. Installation is also simpler because of the integrated storage tank and rudder carrier.

The Frydenbø Modulated Flow Control modulates the oil flow to the actuator in order to give a soft start and low rudder speed for small rudder movements. The oil flow gradually increases to full flow, allowing full turning speed on the rudder. The system ensures a very precise rudder positioning at small rudder angles during course keeping, while the full flow ensures full manoeuvring capability when required.

Product benefits:
• Modulated flow control
• Integrated oil storage tank
• No expansion tank required
• High levels of positioning precision

IMO regulations require compliance with the principle of single failure criteria for large tankers over 100,000 dwt. This requirement is met by the IRV series, which incorporates automatic isolation of the actuator’s dual hydraulic system. The actuator is equipped with a double sealing system, completely separating the actuator in two individual pressure chambers. In addition, the specially-designed sensor system maintains constant control of the integrity of the seals.

Frydenbø 4-vane steering gear
This is a range of extremely compact rotary vane steering gear, which is suitable for large vessels including tankers over 100,000 dwt. The 4-vane steering gear is a further development of the well proven Frydenbø range of steering gear with two and three vanes. The key advantages of this design is its compact size because of the four vanes and its light weight as well. The 4-vane steering gear is available as the standard model as well as the IRV model, which satisfies all statutory requirements for tankers over 100,000dwt.

Frydenbø IRV series steering gear
IMO regulations require compliance with the principle of single failure criteria for large tankers over 100,000 dwt. This requirement is met by the IRV series, which incorporates automatic isolation of the actuator’s dual hydraulic system. The actuator is equipped with a double sealing system, completely separating the actuator in two individual pressure chambers. In addition, the specially-designed sensor system maintains constant control of the integrity of the seals.

Frydenbø RV series steering gear
The Frydenbø RV and IRV series are suitable for medium-sized to large vessels.

Typical applications:
• Oil tankers
• Ro-Pax vessels
• Container vessels
• Rokers
• Cruise vessels
• LNG tankers

The Frydenbø RV series is renowned for its simplicity, robustness and reliability, and satisfies all requirements for tankers over 100,000dwt.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Max. stock dia. (mm)</th>
<th>Max. working torque (kNm)</th>
<th>Max. turning angle</th>
<th>Weight actuator (kg)</th>
<th>Max. radial load (kN)</th>
<th>Max. axial load (kN)</th>
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<tr>
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<tr>
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<td>RV 2600-3</td>
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<td>2 x 36.5</td>
<td>24000</td>
<td>3000</td>
<td>4500</td>
</tr>
</tbody>
</table>

The Frydenbø 4-vane steering gear is a further development of the well proven Frydenbø range of steering gears with two and three vanes.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Max. stock dia. (mm)</th>
<th>Max. working torque (kNm)</th>
<th>Max. turning angle</th>
<th>Weight actuator (kg)</th>
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<tr>
<td>IRV 6000-4</td>
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<td>6000</td>
<td>2 x 36.5</td>
<td>24000</td>
<td>3000</td>
<td>4500</td>
</tr>
</tbody>
</table>
Brown Brothers’ steering gear systems with digital controls and autopilot have been selected by a large number of the world’s navies including the USA, Malaysia, India, Australia, Spain, Taiwan and the British Royal Navy. The range has been developed to integrate seamlessly with the vast number of applications deployed in naval fleets.

**Typical applications:**
- Corvettes
- Frigates
- Destroyers
- Aircraft carriers

**Rotary vane steering gear**
The compact size of the rotary vane steering gear facilitates ease of fitting to single or multiple-rudder installations. The standard working angle of a rotary vane unit is 37° to one side, although gears can be supplied to give maximum working angles of 70° and 90° to one side.

17 model range available for torques from 2-256Tm.

**Brown Brothers’ actuator type of steering gear**
The Brown Brothers actuator gears is a cost-effective and reliable solution. The gear is made redundant on a single rudder by means of two actuator systems. For example, one actuator can be bypassed away from the system, and still provide around 50% torque.

Furthermore, use of the actuator type means fewer interface surfaces on board because the actuator’s anchor brackets can be welded directly on to the hull cartridge. This means that actuator steering gear is less tolerance-critical for installation.

**Hydraulic power units**
- Can be configured to meet specific customer requirements
- Variable or fixed displacement pumps
- Pressure compensated or proportional systems
- Dual or single power units
- Inherent safety and reliability

The Brown Brothers actuator gears have been selected for the Royal Navy Type 45 destroyers currently under construction.

**Typical applications:**
- Corvettes
- Frigates
- Destroyers
- Helicopter carriers

If problems occur with the hydraulic driving mechanism, replacing an actuator is easier than a rotary vane or a ram type of steering gear.

**Brown Brothers™ naval rotary vane steering gear**

**Brown Brothers™ actuator type of steering gear**
Ulstein Hinze™ conventional rudders, type classic

General description rudders
Rolls-Royce is a supplier of rudders as well as propellers. We can therefore draw on our long experience and know-how in the field of ship design and hydrodynamics. The Ulstein Hinze conventional rudders, type classic are the result of years of experience in ship design and hydrodynamics. You can rest assured of our guaranteed optimal reliability, excellent manoeuvrability and low lifecycle costs.

The different rudders are built as full spade rudders with 3 different standard profiles to ensure optimal manoeuvrability for the various types of vessel.

The Ulstein Hinze conventional rudders, type classic are the result of years of experience in ship design and hydrodynamics. You can rest assured of our guaranteed optimal reliability, excellent manoeuvrability and low lifecycle costs.

The directional stability of ships in transit must be considered when designing the rudder. We develop and use advanced computer programs to simulate different manoeuvres such as the IMO criteria (e.g. zig-zag test). The software uses the actual hull shape to calculate the hydrodynamic hull forces. With this software we can evaluate different rudder sizes and types to optimise the rudder design for each vessel.

Requirements for good manoeuvrability at low speed often governs a rudder’s design. Extensive testing of model vessels has been carried out in collaboration with leading European test centres, in order to optimise and document the manoeuvring properties of our rudders at low speed.

Rolls-Royce offers a range of rudders to meet customer requirements – both with and without flap.

The rudder design is also important for overall propulsive efficiency. It is a compromise: if a rudder is optimized for propulsive efficiency, you will loose manoeuvrability (especially at low speed) and vice versa. This is why a good understanding of shipowners’ requirements is vital when designing rudders.

The Ulstein Hinze conventional rudders, type classic are the result of years of experience in ship design and hydrodynamics. You can rest assured of our guaranteed optimal reliability, excellent manoeuvrability and low lifecycle costs.

The different rudders are built as full spade rudders with 3 different standard profiles to ensure optimal manoeuvrability for the various types of vessel.

Available options:
• Trunk module with steering gear foundation
• Automatic lubrication system
• Special bearings/liners
• Heel connection module

Product benefits:
• Easy installation
• Easy maintenance
• Custom-built to fit hull
• Optimal performance
• Suits all steering gear

Typical applications:
• Passenger vessels
• Cargo vessels
• High-speed crafts

The illustration visualises the hydrodynamics for classic rudders.

Typical applications:
• Passenger vessels
• Cargo vessels
• High-speed crafts

The CS rudder for higher speed. Slim profile increases overall propulsive efficiency and reduces cavitation risk. Tapered blade, rounded corners and smooth surface. Ulstein Hinze CS has the same profile as FS, but without a flap.

The CB rudder for lower speed. A bulbous profile and large vane end-plates improves manoeuvrability at low speed. Heel module optional. Ulstein Hinze CB has the same profile as FB, but without the flap.

The CM rudder for medium speed. Medium profile optimises the proportion between manoeuvrability and propulsive efficiency. Tapered or rectangular blade. Ulstein Hinze CM has the same profile as FM, but without a flap.

The CB rudder for lower speed. A bulbous profile and large vane end-plates improves manoeuvrability at low speed. Heel module optional. Ulstein Hinze CB has the same profile as FB, but without the flap.

The CM rudder for medium speed. Medium profile optimises the proportion between manoeuvrability and propulsive efficiency. Tapered or rectangular blade. Ulstein Hinze CM has the same profile as FM, but without a flap.

The CS rudder for higher speed. Slim profile increases overall propulsive efficiency and reduces cavitation risk. Tapered blade, rounded corners and smooth surface. Ulstein Hinze CS has the same profile as FS, but without a flap.

The illustration visualises the hydrodynamics for classic rudders.
Ulstein Hinze™ flap rudders

Rolls-Royce has developed and built flap rudders since 1985. The performance of a flap rudder is determined both by the flap, the link mechanism and the profile, as well as the hull and propeller. Rolls-Royce has therefore designed a range of flap rudders to cover different types of vessels and functions, in order to make sure that customers receive a rudder best suited to their vessels and operations.

**Ulstein Hinze FB** has a bulbous profile for maximum manoeuvring performance, suitable at low to medium speed. This rudder also has large upper and lower vane plates. It is ideal for use on workboats, fishing vessels and offshore vessels, as well as on small tankers, cargo vessels, ferries and other coastal vessels.

**Ulstein Hinze FM** has a moderate profile for enhanced manoeuvrability, suitable at medium speed. The rudder is suited to vessels up to 20,000 dwt with high demand for manoeuvrability.

**Ulstein Hinze FS** has a slim profile, suitable at medium to high speed. The rudder is built around a cast cone module, and has a strong link mechanism and hinge system to withstand high forces. Used for Ro-Ro, Ro-Pax, passenger and cruise vessels and tankers, but it is also an all-round flap rudder suitable for all types of vessels up to approx. 50,000 dwt.

**Available options:**
- Trunk module with steering gear foundation
- Automatic lubrication system
- Special bearings/liners
- Heel connection module

**Product benefits:**
- Superior steering abilities
- Minimum installation time
- High reliability
- Custom-built to fit hull
- Suits all types of steering gear

**Typical applications:**
- Ulstein Hinze FB rudders:
  - Offshore supply vessels
  - Fishing vessels
  - Seismic vessels
  - Cargo vessels

- Ulstein Hinze FM/FS rudders:
  - Passenger vessels
  - Cargo vessels
  - High-speed craft

Conical hydraulic connection and double sealing system.

Lift curve for flap rudders.

This document, and more, is available for download at Martin's Marine Engineering Page - [www.dieselduck.net](http://www.dieselduck.net)
Stabilisers

Neptune II gives small hull aperture.

Typical applications:
• Cruise ships
• Ferries
• Container vessels

Medium to large naval vessels:
• Landing ships
• Helicopter carriers
• Auxiliary platforms

General description fin stabilisers
Rolls-Royce fin stabiliser systems use one or more pairs of hydrofoil shaped fins projecting from a vessel’s bilge area. Vessel speeds, and the angle of the fins in the water, determine the extent of generated lift, either up or down. The stabiliser control system senses the degree of ship movement, and signals the stabiliser hydraulics to alter the angle of the fins to return the vessel to an even keel. The result is usually an 80 - 90% reduction in roll when compared with an un-stabilised vessel.

The Brown Brothers Neptune and Aquarius folding-fin stabilisers, both incorporate a one-piece fin construction, with a “fishtail” high-lift profile. When not in use, the fins are folded into recesses in the hull, flush with the vessel’s side.

For applications where retraction of the fin is not required, the Modular range is available for naval applications and the Gemini range for smaller commercial vessels where high performance and low costs are important factors.

Product benefits:
• Enhanced stabiliser performance thanks to the one-piece high-lift fin
• Low installation costs for hydraulic, mechanical and control equipment
• Ease of integration with ship’s alarm and monitoring systems
• Small hull aperture
• Linear actuators for fin tilt and extension
• Integral lubrication system
• Pin-box can be shipped supplied
• Load sensing hydraulics
• Latest generation controls

Neptune II offers optimal vessel performance with low ownership costs.

Product benefits:
• Enhanced stabiliser performance due to one-piece, high-lift fin
• Ease of integration with ship’s alarm and monitoring system
• Small hull aperture
• Modular construction
• Simplified main seal replacement
• Load sensing hydraulics
• Latest generation controls

Aquarius can boast terrific stabiliser performance, thanks to its one-piece, high-lift fin.

Typical applications:
• Large motor yachts
• Small cruise ships
• Passenger ferries
• Small naval and coast-guard vessels

Aquarius folding-fin stabilisers
The Brown Brothers Aquarius folding-fin stabiliser range gives high-performance roll damping, with a compact, lightweight design and state-of-the-art controls. The fin operating mechanism is especially configured to meet the requirements of smaller vessels, with minimum size, weight and number of parts. The stabiliser comes supplied complete with a fin-box and any necessary local stiffening, ready for the shipyard to weld into place.

Product benefits:
• Enhanced stabiliser performance thanks to the one-piece high-lift fin
• Low installation costs for hydraulic and lubrication systems, lower weight and a new fin extension-locking mechanism for improved safety.
• Features include an innovative tilt ram attribute, which facilitates cylinder and seal maintenance without dry docking, simplified crux assembly, improved hydraulic and lubrication systems, lower weight and a new fin extension-locking mechanism for improved safety.

Neptune II offers optimal vessel performance at low ownership costs.

Product benefits:
• Enhanced stabiliser performance due to one-piece, high-lift fin
• Ease of integration with ship’s alarm and monitoring system
• Small hull aperture
• Modular construction
• Simplified main seal replacement
• Load sensing hydraulics
• Latest generation controls

Aquarius folding-fin stabilisers
The Brown Brothers Aquarius folding-fin stabiliser range gives high-performance roll damping, with a compact, lightweight design and state-of-the-art controls. The fin operating mechanism is especially configured to meet the requirements of smaller vessels, with minimum size, weight and number of parts. The stabiliser comes supplied complete with a fin-box and any necessary local stiffening, ready for the shipyard to weld into place.

Product benefits:
• Enhanced stabiliser performance thanks to the one-piece high-lift fin
• Low installation costs for hydraulic, mechanical and control equipment
• Ease of integration with ship’s alarm and monitoring systems
• Small hull aperture
• Linear actuators for fin tilt and extension
• Integral lubrication system
• Pin-box can be shipped supplied
• Load sensing hydraulics
• Latest generation controls

Neptune II offers optimal vessel performance with low ownership costs.

Product benefits:
• Enhanced stabiliser performance due to one-piece, high-lift fin
• Ease of integration with ship’s alarm and monitoring system
• Small hull aperture
• Modular construction
• Simplified main seal replacement
• Load sensing hydraulics
• Latest generation controls

Brown Brothers™
folding-fin stabilisers

Brown Brothers Aquarius folding-fin stabiliser range is specially configured for smaller vessels.

Aquarius folding-fin stabilisers

<table>
<thead>
<tr>
<th>Model</th>
<th>Fin area (m²)</th>
<th>Total weight (tonnes)</th>
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<td>1.82</td>
<td>19.3</td>
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<tr>
<td>100</td>
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<tr>
<td>200</td>
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All data subject to change without prior notice.

Brown Brothers Aquarius folding-fin stabiliser range is specially configured for smaller vessels.

Aquarius can boast terrific stabiliser performance, thanks to its one-piece, high-lift fin.

Typical applications:
• Cruise ships
• Ferries
• Container vessels

Medium to large naval vessels:
• Landing ships
• Helicopter carriers
• Auxiliary platforms

Neptune II folding-fin stabilisers

The one-piece fin is built of fabricated materials, with a modified NACA (North American Committee on Aeronautics) section to maximise lift properties and minimise drag, with a similar effect as flapped fins.

Features include an innovative tilt ram attribute, which facilitates cylinder and seal maintenance without dry docking, simplified crux assembly, improved hydraulic and lubrication systems, lower weight and a new fin extension-locking mechanism for improved safety. Neptune II offers optimal vessel performance with low ownership costs.

Product benefits:
• Enhanced stabiliser performance due to one-piece, high-lift fin
• Ease of integration with ship’s alarm and monitoring system
• Small hull aperture
• Modular construction
• Simplified main seal replacement
• Load sensing hydraulics
• Latest generation controls

Technical data, Aquarius folding-fin stabilisers

<table>
<thead>
<tr>
<th>Model</th>
<th>Fin area (m²)</th>
<th>Total weight (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>4.2 – 5.8</td>
<td>36.5 – 42</td>
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<tr>
<td>200</td>
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<td>44 – 52</td>
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This document, and more, is available for download at Martin’s Marine Engineering Page - www.dieselduck.net
Brown Brothers™ non-retractable stabilisers

For applications where retraction of the fin is not required, the Gemini range is available for smaller commercial vessels where high performance and low cost are important factors.

The Brown Brothers Gemini range of non-retractable stabilisers can be supplied with a plain or high-lift profile fins depending on the application. Gemini stabilisers provide high performance roll damping, as well as a compact, lightweight design and modern controls, as well as proving highly dependable with low maintenance costs. The power unit is compact, incorporating pump, motor, proportional control valves and cooler. All items required are packed away in the power unit for easy installation.

**Product benefits:**
- Enhanced stabiliser performance due to high-lift fin
- Compact power unit containing all the hydraulic, mechanical and control equipment
- Ease of integration with ship systems

**Technical data, Modular range**

<table>
<thead>
<tr>
<th>Model</th>
<th>Fin area (m²)</th>
<th>Design speed (knots)</th>
<th>Weight (tonnes)</th>
</tr>
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<tbody>
<tr>
<td>NR8</td>
<td>0.8</td>
<td>30</td>
<td>3</td>
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<tr>
<td>NR17</td>
<td>1.5</td>
<td>19</td>
<td>3.5</td>
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<tr>
<td>NR22</td>
<td>1.9</td>
<td>30</td>
<td>6.8</td>
</tr>
<tr>
<td>NR26</td>
<td>2.9</td>
<td>19</td>
<td>8.4</td>
</tr>
<tr>
<td>NR30</td>
<td>3.5</td>
<td>27</td>
<td>9.04</td>
</tr>
<tr>
<td>NR41</td>
<td>4.8</td>
<td>19</td>
<td>12.2</td>
</tr>
<tr>
<td>NR50</td>
<td>6.5</td>
<td>19</td>
<td>18.6</td>
</tr>
<tr>
<td>NR80</td>
<td>7.0</td>
<td>26</td>
<td>21.1</td>
</tr>
<tr>
<td>NR100</td>
<td>9.0</td>
<td>19</td>
<td>26.6</td>
</tr>
<tr>
<td>NR120</td>
<td>9.5</td>
<td>25</td>
<td>29.9</td>
</tr>
<tr>
<td>NR150</td>
<td>12.0</td>
<td>18</td>
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Gemini offers a compact low weight design.

Gemini non-retractable stabilisers

The Gemini range of non-retractable stabilisers are suited to small, commercial vessels.

Brown Brothers modular stabilisers

The Brown Brothers Modular non-retractable stabilisers incorporate superior hydrodynamic features, and fully satisfy military standards for noise, shock and vibration levels.

The latest finshaft coatings and reduced-friction, long-life bearings are used throughout the design to ensure long service. A keyless taper socket fin attachment allows the hydrodynamic profile of the fin blade to remain unbroken, reducing the potential for cavit...
Intering™ stabilisation systems

Intering controlled tank systems are designed to give 40-50% lower roll on average. Unlike passive tanks, Intering tank stabilisers react immediately and individually to any changes in roll motion, providing top performance and flexibility. They are also effective at low speed or when stationary.

Rolls-Royce Intering U-shaped tank stabiliser systems use water or heavy fluid, and can be supplied as stand-alone systems. They can also be combined with an anti-heeling system for increased safety/payload or Brown Brothers fin stabilisers for for enhanced roll reduction at any speed.

The U-shaped tank stabiliser comprises two tanks which are linked by a channel across the ship: one port and one starboard. The system is tuned so that when a ship rolls, more water will rise on the “high” side, thus creating a righting moment to reduce the roll. Valves block the water flow in cycles by controlling the air pressure above the waterline to create optimal effect. The inevitable free surface effect of stabiliser tanks can be compensated if these are included in a ship’s design from the outset.

Intering tank stabilisation systems provide roll reduction of up to 40 – 50% in normal rough seas, which is enough to prevent damage from rolling.

Brown Brothers™/Intering™ combined stabiliser systems

Rolls-Royce can supply a combination of fin stabilisation and passive tank stabilisation systems, giving advantages which cannot be achieved from a single system alone.

Tank stabilisers are an attractive complement to fin stabilisers, which need a minimum speed of six or seven knots in order to be effective. A combined system can reduce the required fin size and improve roll reduction at all speeds.

Product benefits
- Roll reduction achieved at all speeds
- Reduced drag from using smaller fins
- Fins do not need to be off-set, thereby increasing efficiency

Product benefits
- More comfort and smoother running of vessels
- Efficiency independent of ships speed
- Immediate and individual reaction to any change in roll motion
- Dual use of tanks in harbour for anti-heeling operation
- No need to alter tank water levels
- Low maintenance – no moving parts in water

The required fin size for the combined system is smaller with enhanced roll reduction at all speeds.

Intering™ tank stabilisation systems

Typical applications:
- Ro-Ro vessels
- Container vessels
- Yachts
- Offshore supply vessels
- Diving support vessels
- Paper carriers
- Fin breakers
- Cable layers

Intering controlled tank systems are maintenance-free, and provide smooth and precise operation.

Typical applications:
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- Container vessels
- Yachts
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- Cable layers

Intering™ tank stabilisers are effective even at low speed.

Rolls-Royce is a turnkey supplier of marine stabilisation systems, including the Intering tank stabilisation systems and Intering Anti-heeling systems. This range of products can be supplied as stand-alone systems or as part of a collective system. More than 650 vessels to date have been fitted with Intering motion control equipment.

General description stabilisation systems

Intering™ stabilisation systems

Product benefits
- Up to 40 – 50% roll reduction at sea
- Damage to cargo and ship avoided

Product benefits
- More comfort and smoother running of vessels
- Efficiency independent of ships speed
- Immediate and individual reaction to any change in roll motion
- Dual use of tanks in harbour for anti-heeling operation
- No need to alter tank water levels
- Low maintenance – no moving parts in water

Intering tank stabilisers are optimised to be effective in different loading conditions. More than one set of tanks can be fitted when necessary. Where tank space is limited, Intering systems can use a corrosion-inhibiting heavy fluid, reducing the space required by more than 30%.

The illustration visualises a combined tank stabiliser and anti-heeling system.

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Parametric roll prevention systems are designed to prevent the build up of parametric roll in head or following seas. Sea-keeping model tests demonstrate that the Intering Parametric Roll Prevention system can reduce the risk of parametric disturbance by shifting the critical wave threshold to such high values that the chances of ever encountering such a roll during a vessel’s service life are extremely low.

A typical example of a complete ship system will include several pairs of U-shaped tanks and pneumatically controlled air valves, plus a control unit with pitch and roll sensors. The controller detects the onset of parametric rolling and uses the damping effect of the tanks fluid’s oscillations, which is controlled by air valves in accordance with the ship’s motion.

The system is effective in preventing parametric roll and also in minimising regularly disturbed roll motion by up to 20%.

**Product benefits:**
- Prevents the build-up of parametric roll in a head or tail wind for improved safety
- Reduces regular ship roll by about 20%
- Automatic response – system is always in standby mode

**Typical applications:**
- Ro-Ro vessels
- Container ships
- Ferries
- Paper carriers
- Ice breakers
- Offshore supply vessels
- Heavy lift ships

The Anti-heeling were developed to keep ships upright during loading and unloading. The Intering anti-heeling system uses a constant pneumatic air purge and regulating valve system to force air into the top of one tank while venting the one on the other side. This rapidly transfers water from one side of the vessel to the other, creating a righting moment, which compensates for heeling forces. This system is available as a stand-alone system and/or in combination with the functionality of continuous cyclical heeling in level ice (Ice-Heeling System).

Intering systems up to 5,000 tonnes metres per minute are in operation and can be supplied as either stand-alone air blower activated, combined with tank stabilisers, pump activated, with dedicated heeling pump or integrated into the ballast system. Trim control systems can be combined with the anti-heeling systems. Unlike anti-heeling systems, these make use of ballast tanks fore and aft in the vessel to compensate for any trim moments automatically or on the command of a controller: be operated by dedicated trim pumps or designed as an integral element within the ballast system.

**Product benefits:**
- Rapid loading and unloading
- Damage avoided to ramps, rolling cargo, cell guides and containers
- Unlimited change of water flow direction (air blower system)
- No current peaks for motor starts during operation (air blower system)
- Loading and discharging quicker
- Harbour time reduced thus saving on port costs
- Systems with heel compensation have a rate of up to 5,000 tm/min when in operation

**Typical applications:**
- Mainly large container ships
- Heavy lift ships
- Offshore supply vessels
- Ice breakers
- Paper carriers
- Ro-Ro vessels
- Container ships
- Ferries

The fast reacting valve group is an integral part of the air blower anti-heeling system.

**The anti-heeling system keeps ships upright during loading and unloading.**

**The anti-heeling were developed to keep ships upright during loading and unloading.**

**These images show the benefit of the parametric roll prevention system.**

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