



Hybrid-Capable Marine Transmissions from ZF **Protect the Environment and Lower Costs**

- **Driveline technology specialist ZF offers hybrid technology for a wide variety of ship models and applications**
- **Electric mode reduces emissions as well as operating and maintenance costs**
- **ZF offers complete systems consisting of the transmission and electric motor along with control components**
- **ZF Group Synergy effect: CeTrax electric central drive modified for maritime use**

Hamburg/Friedrichshafen. In light of the ever stricter regulations at sea and in ports, the future of shipping belongs to clean and sustainable propulsion technology. ZF can support shipbuilders and fleet operators who want to lower their emissions, fuel consumption and operating costs with a hybrid-capable transmission portfolio in many application segments. In so doing, the ZF Group offers fully integrated transmissions, electric motors, inverters and control components, which further increases reliability, profitability and quality.

Many arguments support maritime hybrid drives: reduced noise and emissions, increased fuel savings, and more effective power development when moving slowly. In addition, stricter environmental regulations and laws will apply starting in 2020. As a specific example, in 2026 Norway will only allow zero-emission ships in its fjords. Hybrid ships may continue to enter such harbors and waters that are closed to conventional engines. For this reason, both manufacturers and operators benefit from a wide-ranging portfolio of hybrid-capable transmissions that ZF produces for nearly all application segments. To do so, the company expands its transmissions with an additional power take-in (PTI) that exerts force on the propeller shaft via an electric motor alone or in combination with the conventional engine. This additional drive can handle a large variety of gear ratios. An optional spur gear



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drive compensates for the speed differences between the main engine and the electric motor.

Fully integrated quality thanks to synergy effect

Marine hybrid transmissions from ZF feature a robust design, the highest degree of reliability and flexibility for customer-oriented installations. ZF is able to offer the modules in combination with a flexible coupling, an electric pump, inverters and an electric control unit. With CeTrax, ZF has a suitable electric motor that was developed within the company for the power range up to a maximum of 300 kWe. CeTrax has already proven itself in other applications on land and is now celebrating its maritime premiere in combination with ZF's hybrid transmissions. The combination of these two innovative technologies in one driveline ensures a perfect interaction and ideal power development.

Advantages for nearly all ship models

The range of hybrid-capable transmissions covers the scope from about 600 kW conventional power (ZF 33X0 series) to a maximum of 11,500 kW (ZF 83700). In the lower power range, the hybrid-capable transmissions can be combined with electric engines and inverters between 150 kWe and 600 kWe. ZF thus offers suitable drive solutions for a large variety of different ship models. Harbor tugboats, for example, can be operated in fuel-optimized stand-by-mode, ferries and motor yachts can operate all-electric, and research vessels can maneuver almost silently and with very little vibration. This saves operating hours since the main engine is offline in PTI operation. This increases the lifetime of the engine and reduces operating costs since maintenance intervals can be extended. The electric motor also allows for two additional operating modes. In addition to the all-electric and conventional modes, the electric motor can be added in to boost acceleration, or, can be used in generator mode to provide hotel electric power aboard the ship, which allows for additional fuel savings. Both residents of ports and aquatic creatures benefit from the reduced noise and emissions levels, while increased comfort for passengers and crew is experienced aboard the ship.



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Caption:

- 1.) Electric propulsion: The Norwegian ferry "Vision of the Fjords" makes its way through the coastal waters of the Nærøfjord without any emissions thanks to a ZF hybrid transmission.
- 2.) Thanks to an additional PTI, the brand-new ZF 8300 marine transmission can be extended with hybrid functions, for example by combining it with the CeTrax electric drive, a ZF in-house development.

Image: ZF (1,2), Brødrene Aa (1)

Press contacts:

Gernot Hein, Head of Communication & Public Affairs / Press Spokesperson, Industrial Technology Division,
Phone: +49 851 494-2480, e-mail: gernot.hein@zf.com

Svenja Stütz, Head of Marketing and Communications, Marine & Special Driveline Technology Business Unit,
Phone: +1 734 582-1297, e-mail: svenja.stuetz@zf.com

ZF Friedrichshafen AG

ZF is a global leader in driveline and chassis technology as well as active and passive safety technology. The company has a global workforce of 146,000 with approximately 230 locations in some 40 countries. In 2017, ZF achieved sales of €36.4 billion. ZF is one of the largest automotive suppliers worldwide.

ZF allows vehicles to see, think and act. The company invests more than six percent of its sales in research and development annually – in particular for the development of efficient and electric drivelines and also in striving for a world without accidents. With its broad portfolio, ZF is advancing mobility and services in the automobile, truck and industrial technology sectors.

In the Industrial Technology Division, ZF pools its activities for off-road applications. These include the development and production of transmissions and axles for agricultural and construction machinery along with driveline technology for forklift trucks, rail and special vehicles. The division is also responsible for the worldwide



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business of marine propulsion systems, aviation technology as well as the development and production of gearboxes for wind turbines and industrial applications. Test systems for all kinds of applications in driveline and chassis technology are also included in the division's portfolio.

For further press information and photos, please visit: www.zf.com