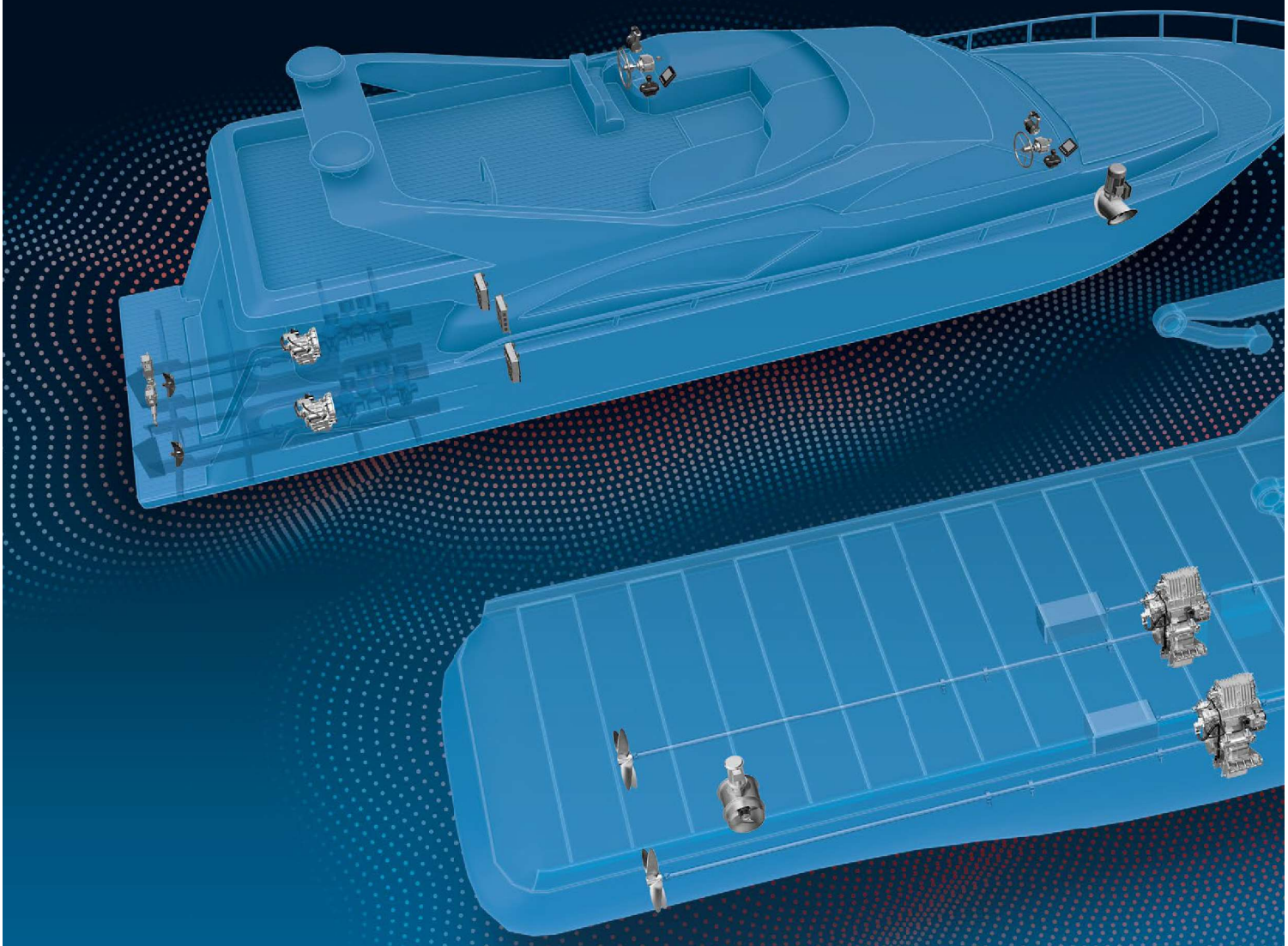
Product Overview

Marine Propulsion Systems



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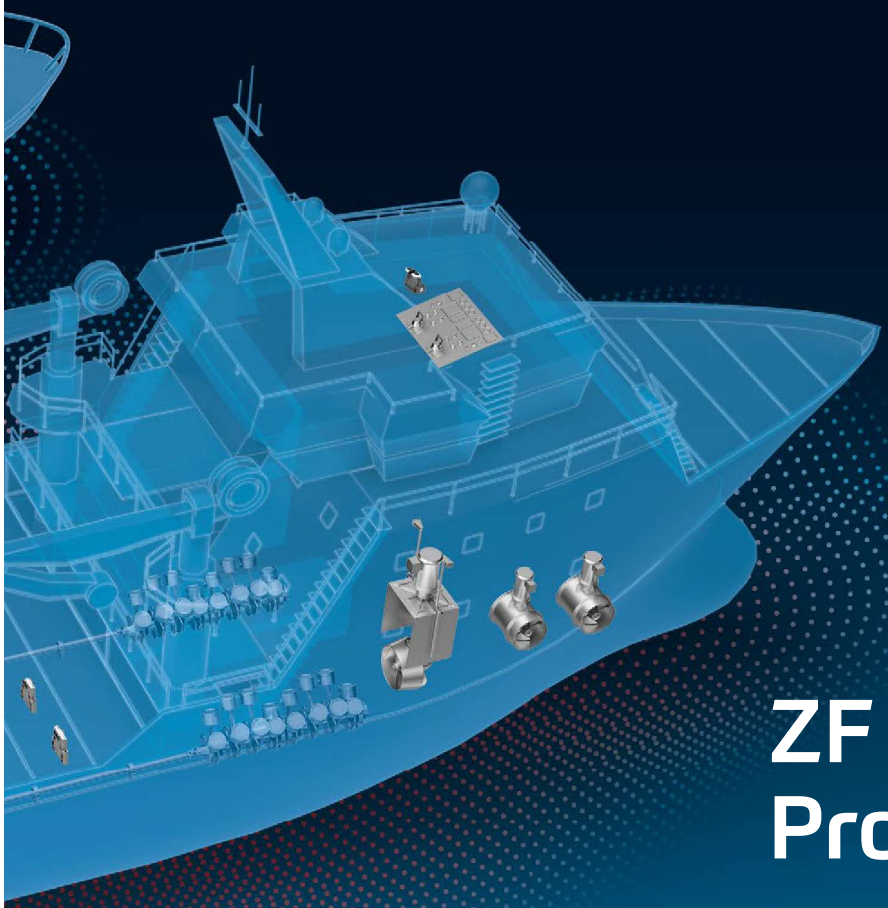


ZF is Propulsion.

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.

ZF Marine is recognized as an outstanding and reliable partner for propulsion systems, supplying complete driveline systems as well as components for all types of vessels such as motor yachts, watersports boats, sailboats, government craft, high-speed ferries, workboats and commercial vessels, covering a power range from 10 to 12,000 kilowatts.

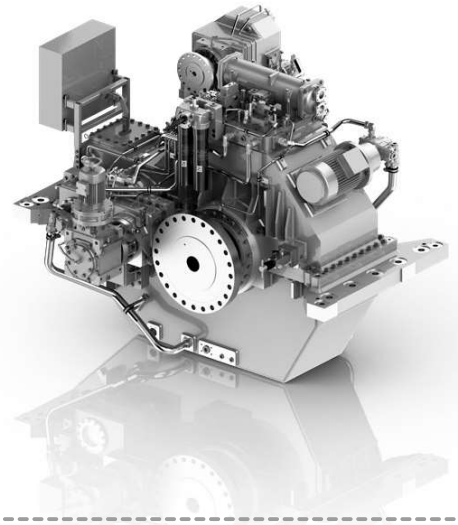
The product portfolio includes a comprehensive range of transmissions (reversing, non-reversing and hybrid), propellers, steering systems, electronic control systems, azimuth thrusters, tunnel thrusters and sail drives.

ZF annually invests about 6% of its sales in research and development. Marine products benefit from ZF Group R&D investments e.g. through design of light gearboxes with high torque transfer rate, worldwide unique acoustics test benches and continuous development of single parts.

Excellent products are backed-up by dedicated 24/7 service through the extensive worldwide network of ZF Marine.

Transmissions for commercial & fast craft applications

ZF provides a complete line of compact, high performance transmissions, specially configured to meet designer's requirements. Numerous ratios are available that perfectly match today's medium- and high-speed diesel engines. Highest quality standards, intelligent design concepts and ease of maintenance ensure compliance with specified operating profiles at minimum down-time and life cycle cost.



ZF 83000

Fast craft applications

Large motor yachts, superyachts, offshore supply vessels, government vessels and fast ferries are typical applications for this series of marine transmissions. It is characterized by an optimum power-to-weight ratio, capable of withstanding high loads under extreme operating conditions.

TOUGH GEAR®

Commercial applications

With its outstanding ToughGear series ZF Marine provides a complete line of heavy-duty transmissions featuring robust cast iron housings built to ZF's industry recognized "Class 1A" specification. Numerous ratios are available that perfectly match today's medium-speed diesel engines.

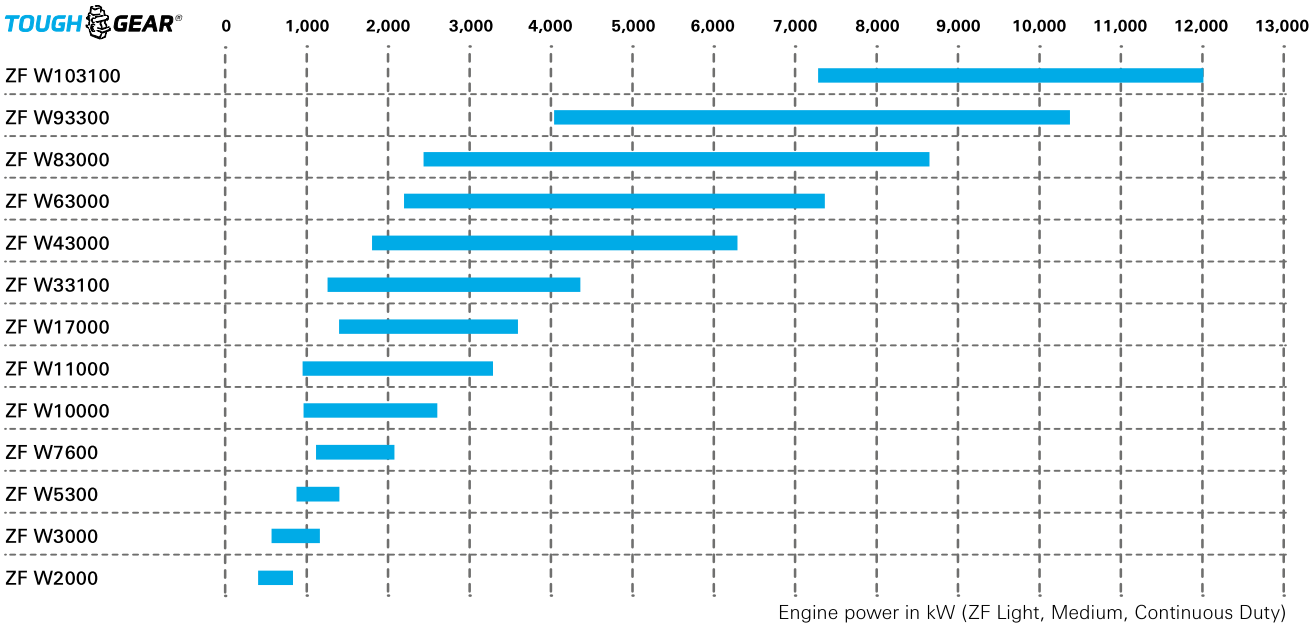
ZF 8300 PTI

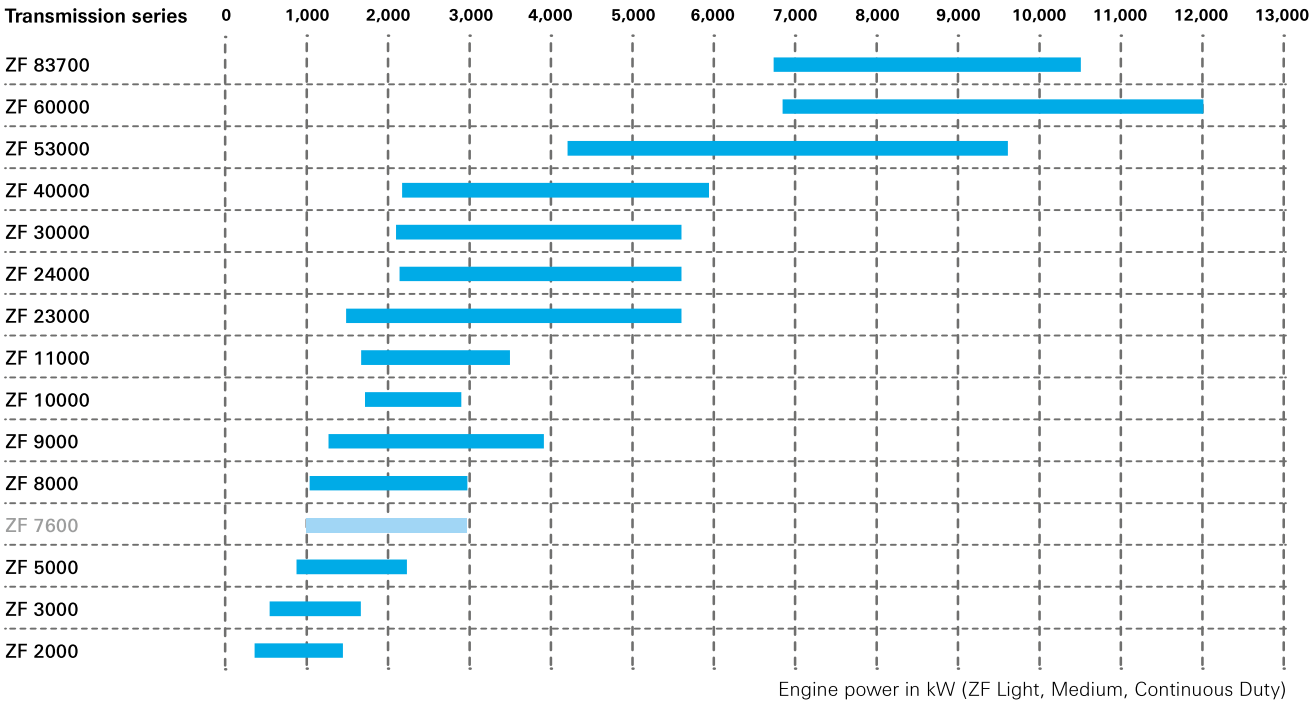
Hybrid-ready transmissions

For installation in medium and large vessels ZF Marine has developed a series of hybrid-ready marine transmissions for commercial and fast craft applications. Variants of both the ToughGear series and fast craft transmissions feature optional Power Take-In (PTI) drives with various gear ratios.

Transmissions for commercial & fast craft applications

Power range of ZF transmissions





Transmission configurations

ToughGear transmission series	PTI option	PTO option	PTH option	Shallow case	Semi deep case	Deep case	NR	NC	Shaft brake	AUTO-TROLL
ZF W103100		●	●		●			CEW		
ZF W93300		●	●		●			CEW		
ZF W83000		●	●	●	●		CEW	CEW		
ZF W63000		●		●			CEW			
ZF W43000	●	●	●	●	●		CEW	CEW		
ZF W33100		●			●		CEW	CEW		
ZF W17000		●		●	●	●	CEW/EW	CEW/EW	●	
ZF W11000	●	●		●	●	●	CEW/EW	CEW/EW	●	●
ZF W10000	●	●		●	●	●	CEW/EW	CEW/EW	●	●
ZF W7600		●			●	●	CEW/EW	CEW/EW		●
ZF W5300	●	●			●		CEW/EW	CEW/EW	●	●
ZF W3000	●	●			●	●	CEW/EW	CEW/EW	●	●
ZF W2000		●			●	●	CEW/EW	CEW/EW		●

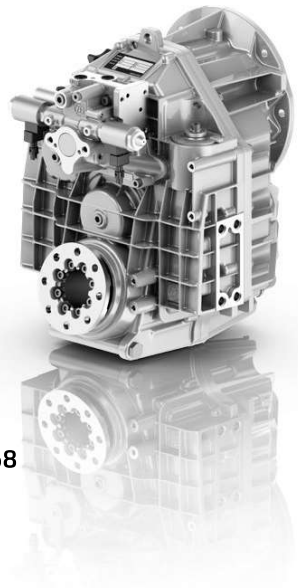
Transmission series	PTI option	PTO option	Shallow case	Semi deep case	Deep case	A and V	C	D	NR2H L/R	NR2	NR2B
ZF 83700	●	●		●					●[1]		
ZF 60000		●	●						●[1]		
ZF 53000		●	●						●[1]		●[1]
ZF 40000	●	●	●	●				●	●[1]	●[1]	●[1]
ZF 30000	●	●	●	●				●	●[1]	●[1]	●[1]
ZF 24000	●	●	●	●			●	●	●[1]	●[1]	●[1]
ZF 23000		●	●				●	●			
ZF 11000	●	●			●						
ZF 10000	●	●			●						
ZF 9000	●	●	●	●		●			●[1]	●[1]	●[1]
ZF 8000	●	●	●	●		●		●	●[1]	●[1]	●[1]
ZF 7600		●	●	●	●	●			●[1]	●[1]	●[1]
ZF 5000	●	●	●	●		●		●	●[1]		
ZF 3000	●	●	●	●	●	●		●			
ZF 2000			●	●	●	●					

[1] Waterjet only / Abbreviations: PTI: power take-in, PTO: power take-out, PTH: power take home, A: down-angle, V: remote V-drive, C: coaxial, D: diagonal, NC: no clutch, NR: non-reversing, NR2: non-reversing/ two shafts (input above output), NR2B: non-reversing/two shafts (input below output), NR2H: non-reversing/two shafts (input horizontal output), EW: engine-wise, CEW: counter engine-wise

Transmissions for pleasure craft applications

ZF offers a wide range of lightweight and robust transmissions suitable for all types of engines and propulsion systems, covering every application, such as motor yachts, cruisers, sport fishing vessels, watersports boats and sail boats, but also patrol boats, fishing and small commercial vessels.

ZF 30 M



ZF 68

While the mechanically operated “M”-series transmissions are typically installed in lower horsepower applications such as sailboats and river craft, they are also utilized in life saving applications such as lifeboats.

ZF transmissions for pleasure craft applications are designed for both forward and reverse reduction operation. The mid-range transmissions are primarily employed in various types of pleasure craft including watersports boats, sport fishing vessels, cruisers and luxury motor yachts. Transmissions with higher power ratings are equipped with ZF Marine’s innovative SuperShift2 clutch control.

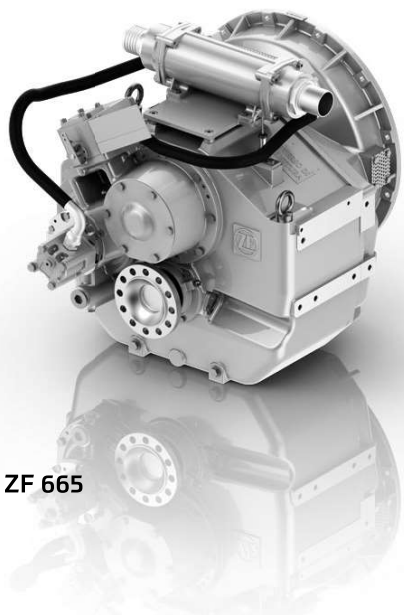
The transmissions are made of a robust yet lightweight sea-water resistant aluminum alloy housing. The output shaft thrust bearings of these transmissions are designed to take maximum propeller thrust astern and ahead. All the gears are calculated and optimized for minimum noise and maximum strength, case hardened with precisely ground gear teeth for long life and smooth running.

The transmissions are compatible with all types of engines and propulsion systems, including waterjets and surface-piercing propellers. They are built to stand up to not only pleasure craft but commercial vessel duty cycles. All of ZF Marine’s transmission design, manufacture and quality control standards meet ISO 9001.

The 2-speed (TS) series transmissions have been developed for applications, where optimum acceleration, safety and maneuverability are determining factors. These 2-speed, power-shift, reverse reduction marine transmissions are equipped with a planetary step-up gear on the power input side and electric shift from first to second speed.

ZF 335

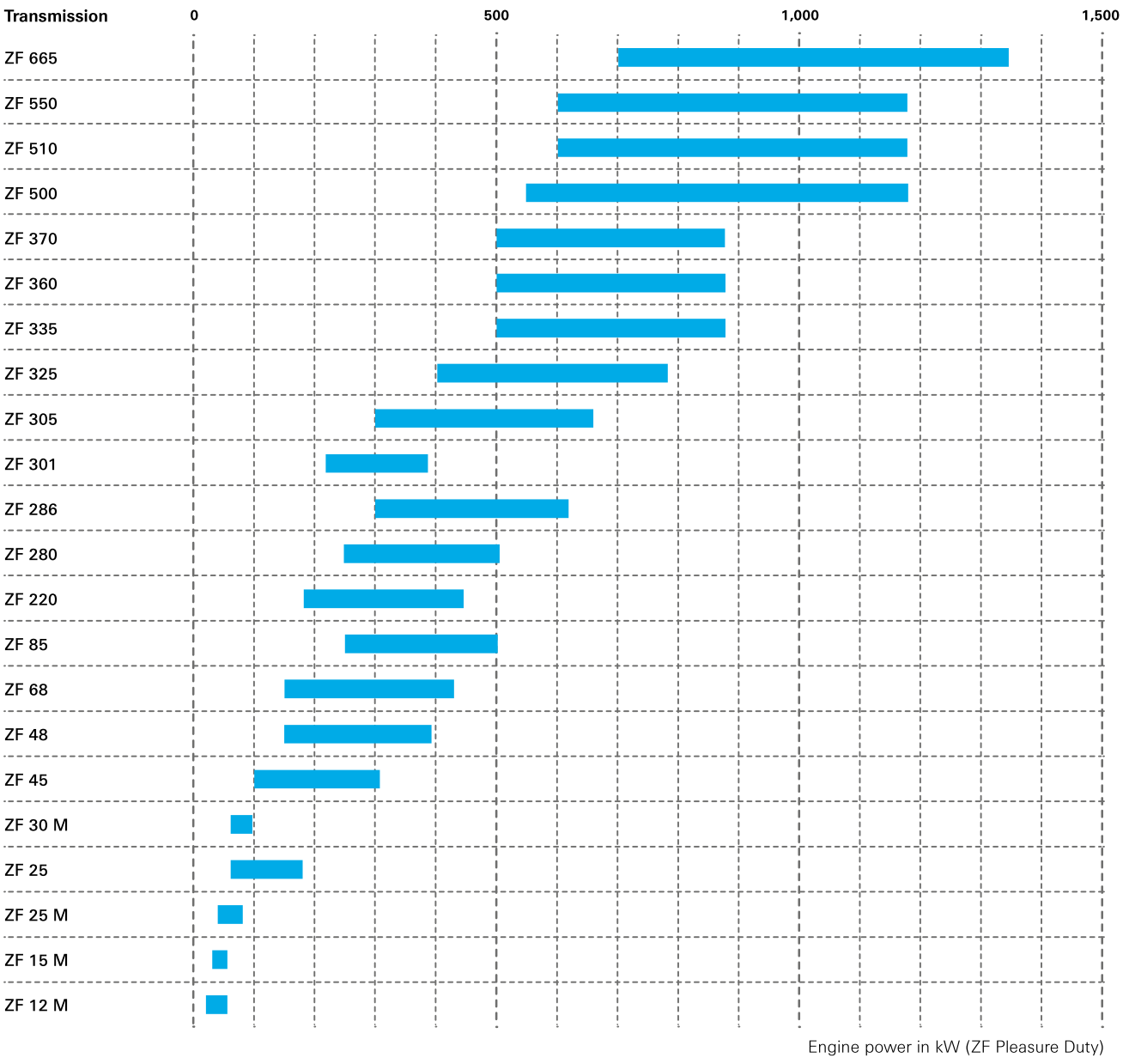
ZF 500



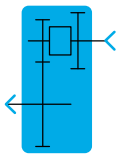
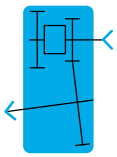
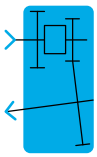
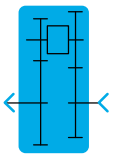
ZF 665

Transmissions for pleasure craft applications

Power range of ZF transmissions



Transmission configurations

Transmission	Parallel offset	Down angle	V-drive	Coaxial
ZF 665	●	●	●	
ZF 550	●	●	●	
ZF 510		●	●	
ZF 500	●	●	●	
ZF 370			●	
ZF 360	●	●	●	
ZF 335		●	●	
ZF 325	●	●	●	
ZF 305	●	●		
ZF 301		●		●
ZF 286	●	●	●	
ZF 280	●	●	●	
ZF 220	●	●		
ZF 85		●	●	
ZF 68	●	●	●	
ZF 48			●	
ZF 45	●	●		●
ZF 30 M	●			
ZF 25	●	●		
ZF 25 M	●	●		
ZF 15 M	●	●	●	
ZF 12 M	●			

Transmission functionalities

In addition to their large variety and versatility ZF Marine transmissions deliver another strong asset in terms of their outstanding functionalities.

Dynamic positioning capabilities

Transmissions from ZF Marine are designed to work in the most demanding applications. Our systems are designed for the tough duty cycles that workboats face.
The SuperShift2 and AutoTroll features, combined with ZF controls enable the propulsion system to respond quickly and with the right amount of thrust to hold the vessel's position even in challenging weather conditions.
For as long as the vessel needs to be on station, repeated gear engagements, reversals, and exact propeller speed are all available with no risk of damage to the propulsion system.

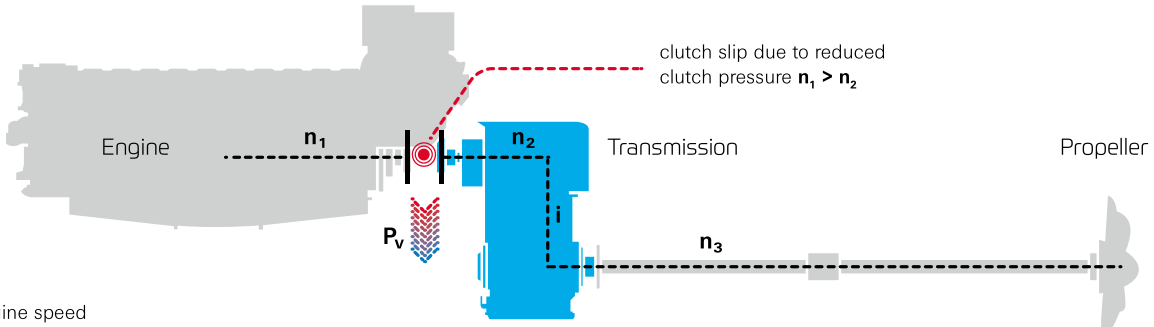
SUPERSHIFT2

ZF Marine SuperShift2 is a mechanical / hydraulic clutch control system operated by solenoid valves. The system incorporates standard components only and does not require electronic controls. This insures the maximum possible durability and dependability. SuperShift2 is fitted to transmissions of ZF Marine propulsion systems as standard equipment at no extra cost.

SuperShift2 delivers

- Quick, smooth and practically undetectable shift engagement
- Precise and predictable control of transmission output, thus providing excellent low-speed vessel maneuverability
- Seamless interaction with ZF's Joystick Maneuvering System (JMS)
- Utilizes ZF Marine's proven reliable transmission technology
- Clutch pressure, modulated in two steps, allowing fast shifts without engine stall
- Shift quality is not effected in any emergency situations
- "Get home" capability incorporated in all models
- Satisfies all requirements of any classification standard
- Compatible with other control features such as Electric Trolling, AutoTroll and Dynamic Positioning

AUTOTROLL®



n_1 = engine speed
n_2 = speed on secondary side of transmission clutch
n_3 = propeller speed
P_V = heat loss
i = transmission ratio

The ZF AutoTroll system provides infinitely variable propeller speed control when there is a need to run slower than the engine idle speed. AutoTroll allows operators to increase or reduce transmission slip to match the exact amount of thrust required during low speed operation for extended periods without risking damage to the transmission.

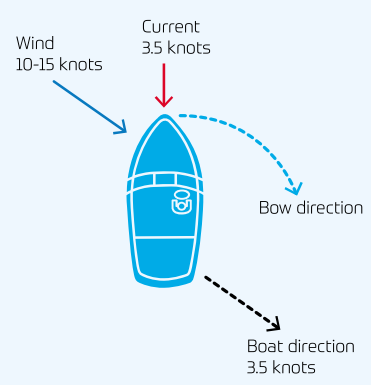
Typical applications are:
- Slow speed cruising
- Maneuvering in harbors and moorings
- Towing small boats
- Sport fishing at optimum trolling speed

iDrift®

Using ZF iAnchor as the base platform, ZF iDrift technology offers the ability to control drift speed and direction when the vessel is in windy conditions and/or active current – all while maintaining the bow's heading. Depending on the direction and strength of the wind and/or current, the bow can be oriented to the desired heading, then ZF iDrift can be activated.
ZF iDrift is the perfect solution to control the vessel's drift speed and heading when kite fishing, bottom fishing, or wreck fishing.

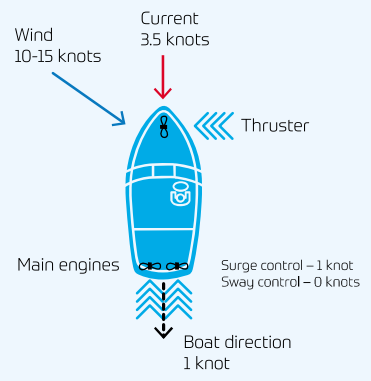
❶ Without iDrift®
Boat is bow first into the current, which is running at 3.5 knots, and wind is on the port bow at 10-15 knots. The wind will push the bow to the starboard (right) and the boat will drift with the current at 3.5 knots, but it will be pushed to the starboard because of the effect of the wind.

❶



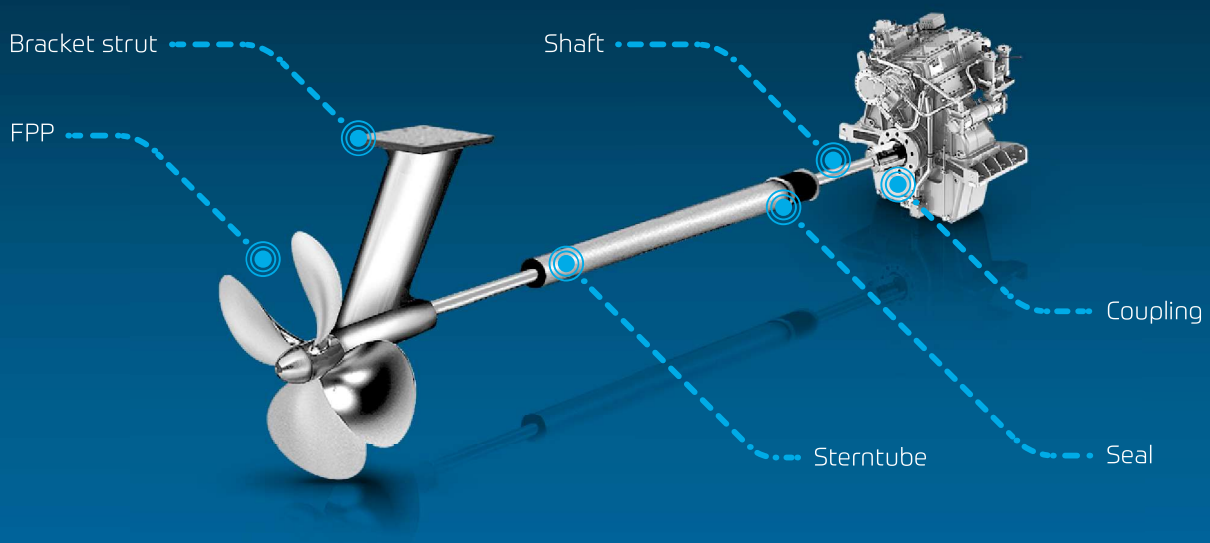
❷ iDrift® – Controlled Drift Mode (Surge & Sway)
The Surge Control allows the boat to drift at 1 knot, and now the Sway Control holds the boat – to not let it move to starboard due to the wind. The bow still holds its direction on the compass heading, the main engines are engaged, and the starboard (right) engine works to keep the boat from drifting to starboard – the boat actually drifts straight backwards at 1 knot.
All the functionality of ZF iDrift is fully engaged.

❷



Propulsors

Watersports boats, sport fishing vessels, cruisers, motor yachts, sailing yachts or commercial and fast craft vessels – different boat types require different types of propulsors. The ZF product range includes surface drives, sail boat propulsion and fixed pitch propellers, and thus, offers the right propulsion for every application.



Propulsion shafting design

In order to extract the full power of the engines, ZF is able to offer a large variety of essential parts starting from the transmission all the way to the custom designed propellers. Being able to provide shafting designs by using the required shafting calculations means that ZF is able to suit each customer's different needs of performance, price and purpose. All our proposals offer the full ZF package from gearbox, couplings, seals, bearings, sterntubes, shafts, brackets to the propellers.

All these parts are machined and matched perfectly in our ZF Propellers factory in Kaohsiung (Taiwan) to offer the highest quality standards adhering to any IACS societies rules. Additionally propellers blade thickness and stress level can be checked using our purpose built software taking into consideration non-uniform loading over the blade. This method is approved by most IACS societies and can be used as an alternative to the rules to make propeller blade thinner and more efficient.

Note: Shafting package currently available for the Asia region only

SEAREX®

Surface drives

ZF SeaRex represents the most advanced and efficient technology in surface drives and is the perfect propulsion solution for high speed boats. It also offers special patented options, such as automatically controlled trim and steering.

ZF SD SPP

Sail boat propulsion

Exceptional hydrodynamic efficiency and highest design flexibility – with unmatched maneuverability provided by the integrated joystick in the SPP version – is what characterizes the ZF Sail Drive system. Ease of installation as well as its compatibility with a large variety of fixed and foldable propellers are additional benefits.

ZF Propellers

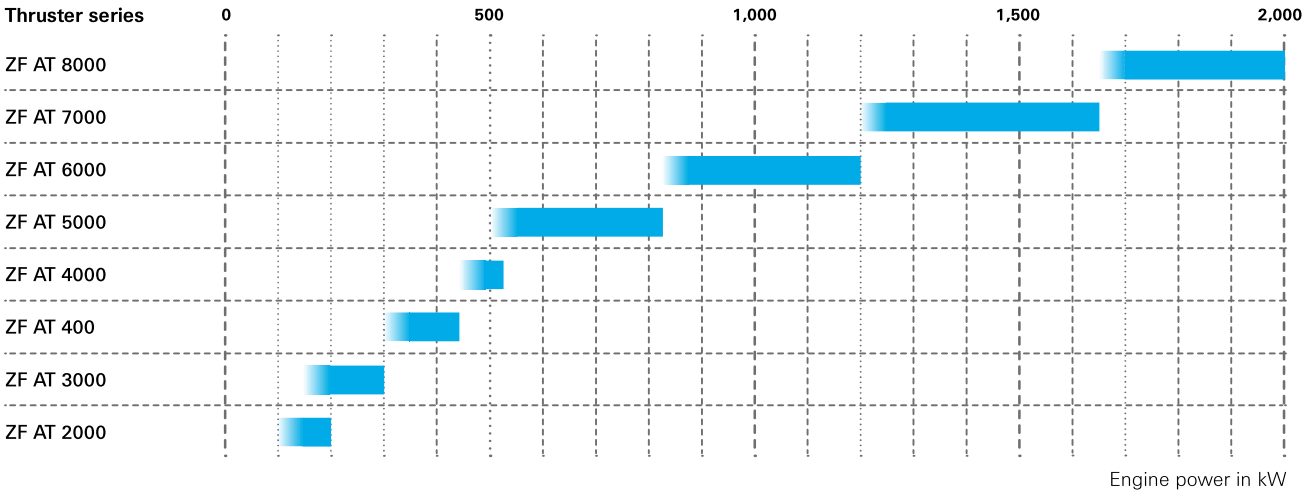
Fixed pitch propellers

Custom-designed and standard fixed pitch propellers are specialties of ZF Marine. Propellers of various designs for all kinds of craft are available, employing sophisticated CAD-CAM design and manufacturing tools and meeting the highest standards in quality and efficiency.

Thruster systems

ZF Marine develops, designs and produces tailor-made thruster systems for all types of vessels. The product line comprises azimuth thrusters which are 360° steerable as well as transverse thrusters. The scope of supply is complete with the ZF ThrusterCommand control system.

Power range of ZF thrusters*



Fixed Pitch Tunnel Thruster

Series
ZF TT 1000 – 8000 FP

100 kW – 2,000 kW input power.

Versions
L-Drive
Z-Drive

Controllable Pitch Tunnel Thruster

Series
ZF TT 4000 – 5000 CP

500 kW – 850 kW input power.

Versions
L-Drive
Z-Drive

*Rating, subject to classification and application. Mentioned data for indication purposes only. Consult ZF Marine technical staff to determine applicable power for each specific use.

Well Mounted Azimuth Thruster

Series
ZF AT 2000 – 8000 WM-FP

Well mounted (placed below deck) azimuth thrusters, fixed pitch propeller, diesel, electric or hydraulic drive, 200 kW – 2,000 kW input power.

Versions
L-Drive (vertical input shaft)
Z-Drive (horizontal input shaft)

Contra Rotation Azimuth Thruster

Series
ZF AT 2000 – 5000 WM-CR

360° steerable azimuth thruster with contra rotating propellers for higher efficiency and comfort on board, 150 kW – 770 kW.

Versions
L-Drive
Z-Drive

Retractable Azimuth Thruster

Series
ZF AT 2000 – 8000 RT-FP

Retractable azimuth thruster, mostly used as auxiliary or back up propulsion, designed for offshore applications like OSVs and PSVs, 200 kW – 2,000 kW.

Versions
L-Drive
Z-Drive

Deck Mounted Azimuth Thruster

Series
ZF AT 2000 – 6000 DM-FP

Deck mounted azimuth thruster placed on deck, containerized prime mover, 180 kW – 1,200 kW.

Version
Z-Drive

Stern Mounted Azimuth Thruster

Series
ZF AT 2000 – 6000 SM-FP

180 kW – 1,200 kW.

Versions
L-Drive
Z-Drive

Shallow Draught Thruster

Series
ZF SDT 2000 – 6000 FP

Shallow draught thrusters for use in shallow waters. 100 kW – 825 kW input power.

Versions
L-Drive
Z-Drive

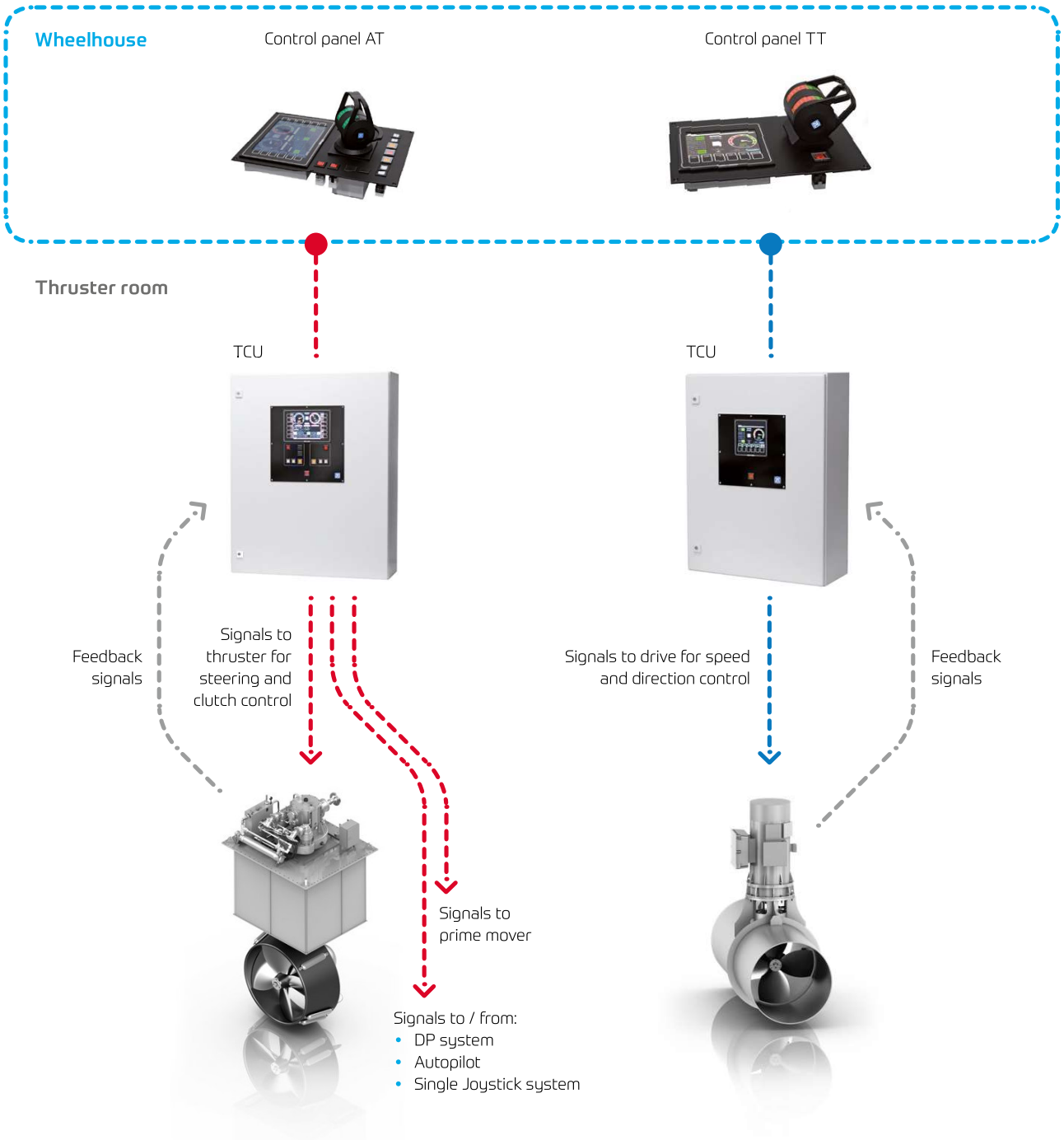
Control systems

Reliable, responsive control systems for both mechanical and electronic applications are an essential element of ZF Marine propulsion systems.

ZF control systems are designed to smoothly interface with most engine options and our complete transmissions range, either for leisure, professional or very heavy commercial applications. They comply with highest classification standards, make installation easy for boat builders and operation comfortable for boat owners.
Whatever the application – from the most basic marine applications to large offshore supply vessels with highly sophisticated dynamic positioning equipment or luxury yachts – we provide the suitable propulsion control systems for mechanical or electronic engine and transmission operation.

THRUSTER COMMAND

The ZF ThrusterCommand is designed to control a single azimuth thruster, providing follow-up steering- and propulsion control, as well as independent backup- and emergency stop functionality. Moreover, it is capable of interfacing with diesel engines and electric or hydraulic motors as power source for propulsion. For steering the system interfaces with a hydraulic or electric steering system.



Control systems

All of ZF Marine's control systems carry our product "DNA", features that you will find across all of our control systems families.

Standard features of ZF Marine control systems include

- "Plug and Play" installation for a simplified install
- Push button set up for easy parameter configuration
- Neutral start interlock to prevent unintended in gear engine start
- Emergency reversal protection allows safe shifting from full ahead to full reverse in one motion

These features are evidence of ZF Marine's understanding of what safe and unobstructed boat handling is all about.

MicroCommander® / ClearCommand®

MicroCommander and ClearCommand are robust controls that have been long established as industry standards in electronic controls technology. Both systems are suited to applications utilizing mechanically actuated engines and transmissions or any combination of electronic throttle or shift.
Premium ClearCommand was developed specifically for unique applications in multi-engine commercial, and very large pleasure craft vessel applications. It is designed to interface with many commercially available DP systems and meets the stringent standards of most classification societies.

CruiseCommand®

CruiseCommand is the next step based on the proven MicroCommander and ClearCommand product families. It is designed specifically for larger vessels with multiple control stations and electronic engines and electrically shifted transmissions. CruiseCommand incorporates all the standard features of ZF Marine control systems including warm up mode, station transfer, single lever operation, and engine synchronization.
Electric trolling valve control is a standard feature with CruiseCommand and can be activated as part of the initial system set up. This allows for a range of low speed control at engine idle.

MiniCommand

MiniCommand is the evolution of standard electronic controls. MiniCommand provides affordable single or twin lever control of electronically actuated diesel engines and marine transmissions. Designed specifically for pleasure craft and light duty commercial applications up to 60 feet in length, with a maximum of two control stations, the MiniCommand control processor incorporates the logic circuits for two engines and transmissions in one compact package.

SmartCommand®

SmartCommand, a powerful control system for electronically controlled engines and ZF transmissions, integrates the latest in CANbus technology with a user-friendly multifunction control head for up to six vessel control stations.
SmartCommand provides complete control with dedicated control modes for all standard ZF Marine control system functions with the addition of Easidock, and AutoTroll.

JMS® featuring iDrift® and iAnchor®

ZF Marine's Joystick Maneuvering System (JMS) operates off of the SmartCommand control system, offering simple and intuitive vessel control at your fingertips.
JMS manages the vessel's main engines, ZF transmissions and bow thruster all through the joystick, giving the operator precise speed, smooth maneuvering and easy docking. JMS offers vessel operators the ability to move the vessel sideways or rotate 360 degrees on the vessel's axis. The control functions iAnchor (automatic positioning) and iDrift (drift speed and direction control) are unique JMS features.

SteerCommand

Based on the SmartCommand platform, SteerCommand brings to marine the most advanced steer-by-wire technology for unparalleled performance and greatest ease of installation.
Traditional bulky hydraulic steering systems with their plumbing and many liters of fluid are now replaced with simple electronic harnesses. The vessel control experience is also significantly improved. Steering feel at the helm is more precise, and ZF Marine's patented force feedback system offers rudder feel at the helm. Individual rudder controls offer increased maneuverability by allowing each rudder to move independently.

ZF Marine global aftersales & service network

- Product Competence Center
- Regional or Sub-Regional Competence Center
- Local Competence Center

Customer satisfaction with the products and services provided by ZF is the topmost objective in all our company's activities. All services integrated into the product cycle, ranging from development and consultancy to aftermarket service are focused on this. Thus, proximity to international customers is of great significance to ZF.

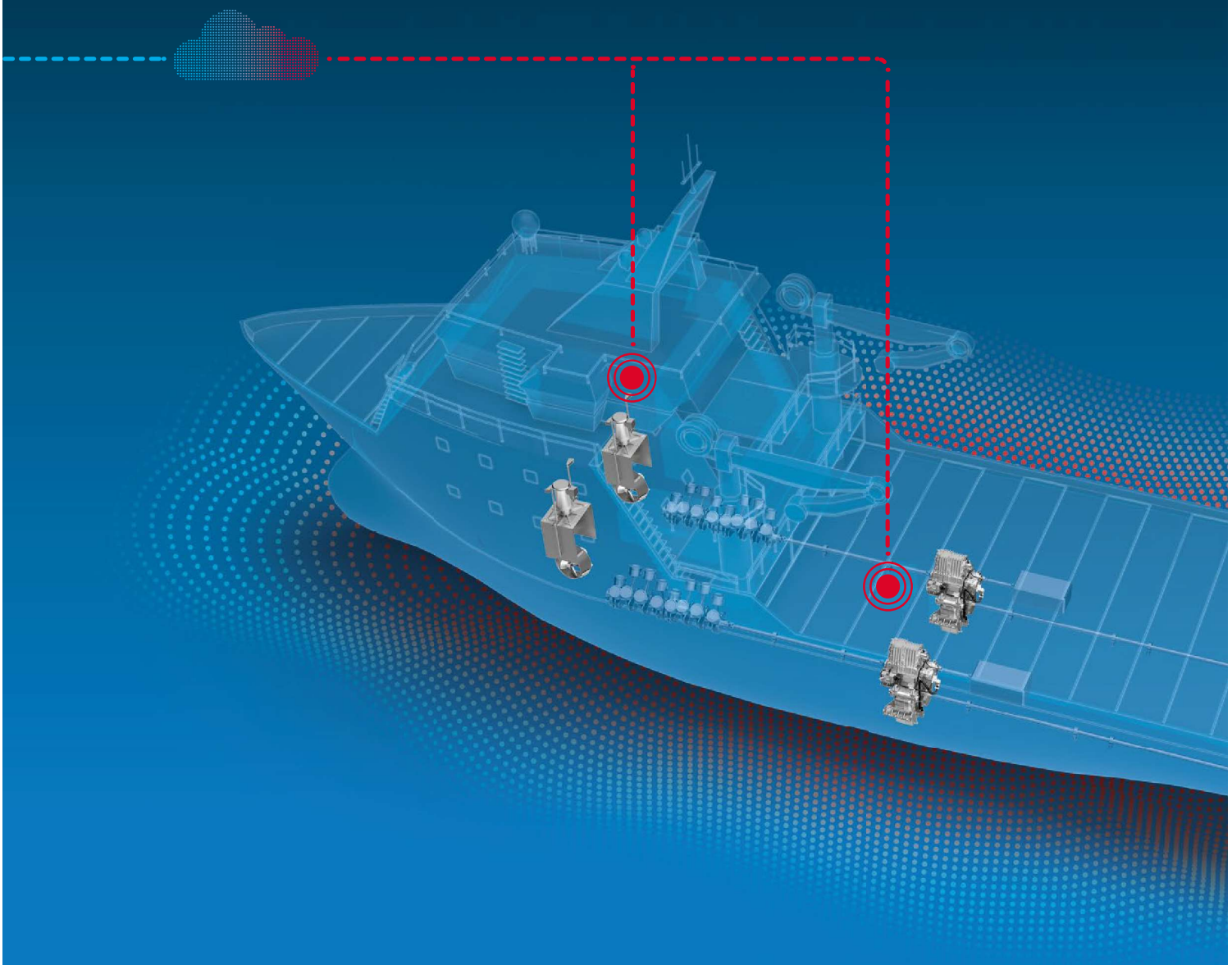
Smart propulsion

As a continuous innovator, ZF is preparing for the next generation of marine propulsion systems as well as intelligent connection solutions that will further improve productivity and efficiency for different segments and markets. Extending high-performance mechanical systems with digital services opens up new potential to optimize the productivity of marine operations.

Vision of intelligent propulsion management
ZF develops a concept of the connected propulsion system as a contributor to the overall vision of "Intelligent Mechanical Systems".

New technologies

As a technology company, ZF dedicates considerable effort to innovative approaches in all its product fields. ZF anticipates that one of the current big mega-trends, the trend toward “digitalization”, will not turn out to be just a show-item, but that the high rate of innovation will soon lead to stronger demand. As such, ZF accepts this challenge and combines mechanics, electronics and digital technologies for industrial applications. High performance mechanical systems are turned into smart systems by using ZF’s digital know-how and electronics competence. Through their connectivity features these “Intelligent Mechanical Systems” will enable performance optimization of the overall system.



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