



# Fixed Pitch Propellers

Marine Propulsion Systems

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ZF is a leader in the marine market supplying propulsion systems and components for all types of vessels – motor yachts, defense craft, high-speed ferries, workboats and commercial vessels, in a power range from 10 to 14,000 kW – to customers including major shipyards and engine manufacturers worldwide.

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

For over 25 years ZF has produced propellers for the Commercial & Fast Craft and Pleasure Craft markets. Our close association with some of the leading schools of hydrodynamic design has helped shape our propeller families to be some of the industry's best in efficiency and design.

ZF Marine has in-house naval architects ready to assist customers with the most challenging of applications and hull designs. Our manufacturing facility can produce propellers in a multitude of configurations, in a range of diameters from 50 centimeters (20") to 2 meters (79") or greater.

# The right propeller for your application



**ZF Propellers**

ZF Marine offers both standard and custom designed propellers utilizing CAD-CAM design technology. From yachts to ferries, cruisers to fishing vessels, whether it's a pleasure or commercial application, ZF Marine can provide "off the shelf" products, or can custom design propellers to meet specific performance criteria.

## Custom designed for individual applications

Our flexibility in being able to partner with naval architects, engineers, and end customers to design and manufacture propellers that are

unique to a single application is what sets ZF apart. Our in-house naval architects can work side by side with your project team to analyze your hull design and help maximize the performance and efficiency of the vessel's propulsion system. ZF offers complete flexibility in the diameter, number of blades, blade area ratio, section shape, skew, rake, and cupping. Our propellers can be designed to meet your exact specifications.



# Design and manufacturing

ZF propellers are manufactured to ISO 484/2 tolerance standards and can be ordered to meet any classification society requirements.

## Design

ZF Marine's team of design engineers offer close customer support throughout the lifecycle of a project. Once input from the customer about application and performance specification has been established, our design team runs simulations through our in-house software to complete an optimal propeller design. The design is presented to the customer and must be approved for manufacturing to commence.

## Casting

High quality alloys are chosen with the exact composition to meet both ZF's quality standards and any classification society requirements. The chemical composition and physical properties of the materials are precisely controlled and tested for each cast.

## Machining

Numerical Control machining centers are linked to the designer's 3D CAD geometry files to machine the propeller to a high tolerance. ZF Marine propellers can be machined to meet the highest geometrical tolerances required by the ISO 484/2 Class S standard.

## Dynamic Balance

Every propeller is dynamically balanced to ensure smooth operation. Dynamic balancing considerably reduces noise and vibration.

## Inspection

The propellers are scanned by industry leading measurement devices to verify every aspect of the geometry and ensure design compliance.



All of our series and custom designed propellers are serialized for easy tracking. In the event that a propeller is damaged beyond repair, a replacement can be manufactured to the original specification.

# Pleasure Craft Propellers

Pleasure Craft propellers from ZF are designed for maximum comfort and efficiency for various pleasure craft applications. Whether a sailboat, sportfish, or mega yacht, ZF has a product for the application. In addition to "standard" sized propellers ZF can create custom solutions for unique applications.



SailMaster



CruiseMaster



FishMaster

<b>Application</b>	Sailing Vessels	Cruisers/ Trawlers	Sportfish Boats (> 30 knots)
<b>Number of blades</b>	3	4, 5	4, 5
<b>DAR range*</b>	0.5-0.55	0.55-0.80	0.8-1.20



YachtMaster



SpeedMaster



TorqueMaster



SurfMaster

<b>Application</b>	Displacement Yachts	Planing Hulls (> 25 knots)	Planing Hulls (< 25 knots)	Surface Drives
<b>Number of blades</b>	4, 5	4, 5	4	5, 6
<b>DAR range*</b>	0.55-1.20	0.8-1.20	0.6-0.9	0.8-1.20
		Progressive Pitch	Constant Pitch	

# Commercial & Fast Craft Propellers

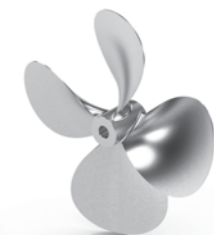
Commercial & Fast Craft propellers from ZF are designed to meet the rigours of medium and continuous duty work applications. ZF offers a wide range of options, whether in commercial or government applications, or in nickel aluminium bronze, manganese bronze or stainless steel material -- it's all about getting the work done. In addition to standard and commercial thickness options, ZF offers DuraEdge, which increases prop thickness at the tip of the blade. DuraEdge also offers increased durability and longevity for continuous duty applications.



CrewMaster



TowMaster



WorkMaster

<b>Application</b>	Crew Boats	Tugs/Push Boats	General Workboat
<b>Number of blades</b>	4	3, 4, 5	4
<b>DAR range*</b>	0.8-0.85	0.55-0.75	0.7

Kaplan



SurfMaster



SpeedMaster



TorqueMaster

<b>Application</b>	Surface Drives	Planing Hulls (> 25 knots)	Planing Hulls (< 25 knots)
<b>Number of blades</b>	5, 6	4, 5	4
<b>DAR range*</b>	0.8-1.20	0.8-1.20	0.6-0.9
		Progressive Pitch	Constant Pitch

\*Other DARs are available upon customer request.

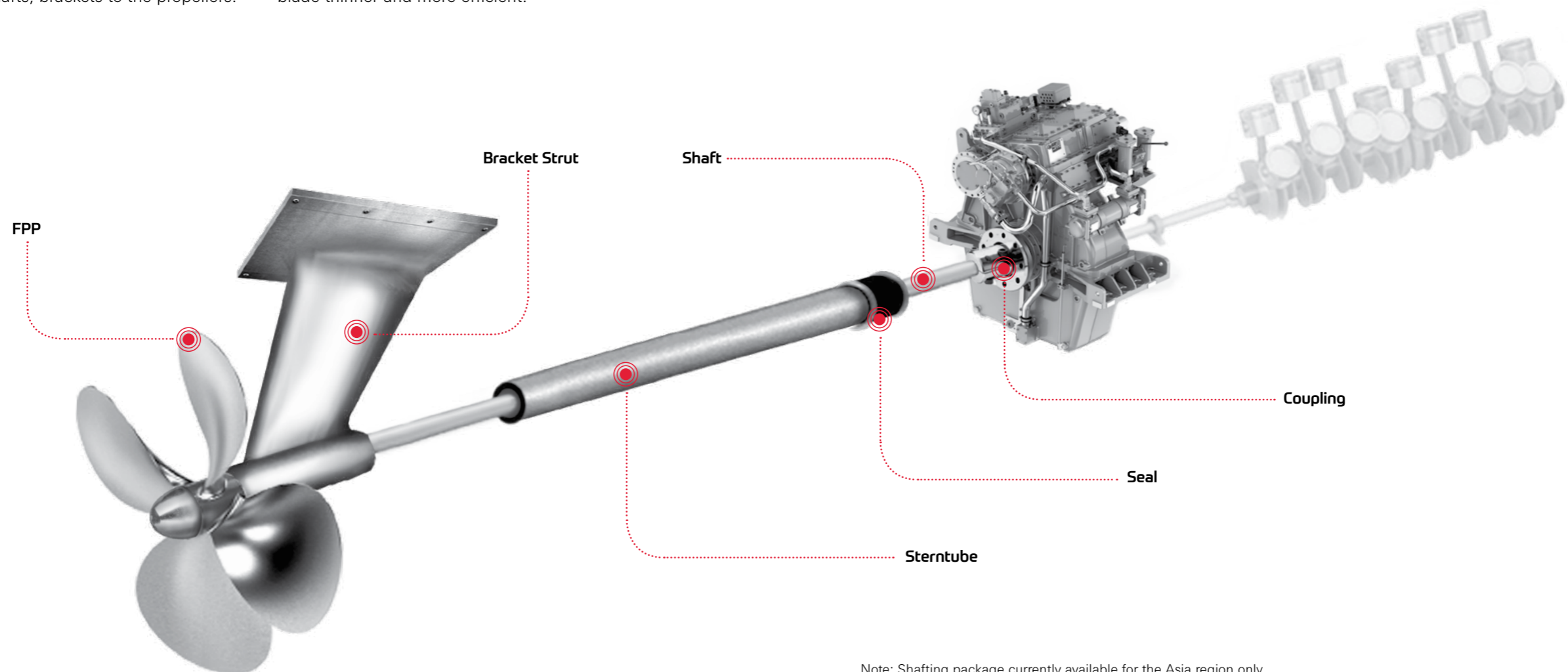
# Shafting Design & Manufacture

ZF design strategy is a holistic approach to the propulsion system. We don't only make propellers, we analyse entire propulsion system of each boat starting from hull resistance prediction and hull propulsive factors. We select most efficient gear ratio, recommend changes if needed and analyse flow in every point under the hull using the most advanced CFD tools developed specifically to our requirements. This approach gives us the widest picture of possibilities we can use to run your boat more efficiently, quietly and fast or to any other specific, most demanding requirements

## 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 gearbox 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 FPS factory in Kaohsiung 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.



# Current Range of Products

## Custom Design Propeller

- Nickel Aluminium Bronze (NiAlBr)
- Manganese Bronze (MnBr)
- Stainless Steel (SS)

## Shafting Packages - Parts

- Shaft – Forged Steel, SS316L, Duplex 2205, SS630 (SS17/4PH), Aqualoy Steel, etc. with taper machined at both ends including keys (or keyless), nuts and coupling c/w connection bolts and nuts.
- Bracket – Custom design and manufacture “V” and “I” Bracket boss with or without struts by fabrication or casting.
- Sterntube – Custom design and manufacture Sterntube system including pipes, bearing houses, stuffing box, Water and Oil Lubricated bearings, seals, etc.
- Additional products and services - Intermediate shaft with coupling and integral flange, nozzle, rudder stock, shaft earthing device, plumber block, shaft stopper, shaft brake, temperature sensor, etc.

Note: Shafting package currently available for the Asia region only

# References

## 1. Crew Boat "FAST SERVER"

**Prime Mover**  
4 x Caterpillar 3512C-HD  
1,678 kW each at 1,800 rpm

**Reduction Gear Unit**  
4 x ZF 7600, 2.5:1

**Propeller**  
CrewMaster, diameter 1422mm X 4 blades

**Control**  
ZF Premium ClearCommand

**Owner**  
Edison Chouest Offshore, USA

## 2. Tug

**Propeller**  
TowMaster, diameter 2000mm x 4 blades

**Speed**  
12 knots

**Owner**  
KHH Harbor, Taiwan

## 3. TF Express 3 x 28.5m Aluminum Ferry

**Main Engines**  
3 x 1650HP

**Gear Ratio**  
ZF3000A 2.52:1

**Design speed**  
40 knots

**Propeller**  
SpeedMaster, diameter 950mm x 5 blades

## 4. Ocean Alexander Yacht OA120 Series

**Main Engines**  
2 x 2600HP

**Gear Ratio**  
ZF5000A 2.962:1

**Design speed**  
20 knots

**Propeller**  
YachtMaster, diameter 1320mm x 5 blades



1.



3.



2.



4.

## Data Sheet for propeller and shafting design

Shipyard	
Boat's name or project no.	
Contact	
Phone	
Fax	
E-mail	
	Project no.: FPS
	Date

The propeller suggestion can only be as accurate as the information that you provide.

### Boat information

<b>Type of analysis</b>	Powerboat <input type="checkbox"/> Sailboat <input type="checkbox"/> Re-power <input type="checkbox"/>	<b>Year</b>	New _____ Old _____ Years _____
<b>Boat use</b>	Work/commercial <input type="checkbox"/> Towing <input type="checkbox"/> Pleasure <input type="checkbox"/>	<b>Hull type</b>	Displacement <input type="checkbox"/> Semi-Disp. <input type="checkbox"/> Planing <input type="checkbox"/>
<b>Bottom design</b>	Open <input type="checkbox"/> Tunnel <input type="checkbox"/> Pocket <input type="checkbox"/>	<b>Appendage</b>	Skeg <input type="checkbox"/> Wedge <input type="checkbox"/> Stabilizer <input type="checkbox"/> Rope cutter <input type="checkbox"/>
<b>Hull material</b>	Fiberglass <input type="checkbox"/> Wood <input type="checkbox"/> Aluminum <input type="checkbox"/>	<b>Classification and notation</b>	_____

### 1. Hull data

Light load displacement \_\_\_\_\_ Half load displacement \_\_\_\_\_ Full load displacement \_\_\_\_\_

Length overall \_\_\_\_\_ Length waterline \_\_\_\_\_ Bpx (max. chine beam) \_\_\_\_\_

LCG from transom \_\_\_\_\_ Deadrise angle at midship \_\_\_\_\_°, at transom \_\_\_\_\_°

Draught at full load \_\_\_\_\_ Draught at midship \_\_\_\_\_ Shaft angle \_\_\_\_\_

Max. diameter \_\_\_\_\_ Clearance \_\_\_\_\_ Distance between hull and center of prop. shaft \_\_\_\_\_

Shaft diameter SAE  Metric  Size \_\_\_\_\_ Sterntube lub Water  Oil

Shaft Material \_\_\_\_\_ Bracket V  P

### 2. Existing or new engine data

Number of engines Single  Twin  Triple  Other  Manufacturer \_\_\_\_\_ Model \_\_\_\_\_

Maximum engine rating \_\_\_\_\_ HP  KW  Cv  @ \_\_\_\_\_ rpm

Make and type of gearbox \_\_\_\_\_ Reduction ratio \_\_\_\_\_ : 1

Demand speed, or not Yes  \_\_\_\_\_ knots @ \_\_\_\_\_ tons No  if no, suggested by ZF-FPS

If re-power, fill in the above with NEW engine data and try your best to fill in the item 3 for existing propeller data and item 4 for re-power data.

### 3. Existing propeller data

Manufacturer \_\_\_\_\_ Model/series \_\_\_\_\_ Material MnBr  NiAlBr  Stainless Steel

Propeller Size Diameter \_\_\_\_\_ x Pitch \_\_\_\_\_ x Blade \_\_\_\_\_ x Area Ratio \_\_\_\_\_

Existing performance Full throttle ship speed \_\_\_\_\_ mph  knots  @ \_\_\_\_\_ tons (sea trial disp.)

Full throttle engine rpm \_\_\_\_\_ rpm @ engine load \_\_\_\_\_ %

### 4. Re-power data (old engine information)

Number of engines Single  Twin  Triple  Other  Manufacturer \_\_\_\_\_ Model \_\_\_\_\_

Maximum engine rating \_\_\_\_\_ HP  KW  Cv  @ \_\_\_\_\_ rpm

Make and type of gearbox \_\_\_\_\_ Reduction ratio \_\_\_\_\_ : 1

Existing performance Full throttle ship speed \_\_\_\_\_ mph  knots  @ \_\_\_\_\_ tons (sea trial disp.)

Full throttle engine rpm \_\_\_\_\_ rpm @ engine load \_\_\_\_\_ %