MAN Alpha
High-performance Naval Propellers

Engineering the Future – since 1758.
MAN Diesel & Turbo
Highest Propeller Performance
Reduced Hydroacoustics
Increased Flexibility
Larger Fuel Savings
Lowest Total Cost of Ownership
MAN Diesel & Turbo is proud to present a naval propeller programme, which has been developed on the basis of the industry’s state-of-the-art design and optimisation tools combined with the vast experience accumulated from more than 7,000 propellers. A long tradition and a grand heritage with propellers for both commercial marine and military applications date back to the first Alpha design, which was produced in 1902 and patented in 1903.

Flexibility for covering efficiently any propulsion power requirement in the 4-40 MW shaft power range is our overall target. The optimised propeller performance from both controllable pitch propeller (CPP), fixed pitch propeller (FPP) and adjustable bolted propeller (ABP) designs with tailored blade configurations contributes to forceful and energy-efficient missions with a reduced impact on the environment.
Increased Propulsive Efficiency
Hydrodynamic competences in force

For maintaining and developing MAN Diesel & Turbo’s position in the propulsion forefront, many resources are invested and the latest advanced design tools including e.g. CFD (Computational Fluid Dynamics), FEM (Finite Element Methods) and Topology Optimisation are deployed. To verify the calculations, MAN Diesel & Turbo cooperates with the world’s leading test tanks and research institutes.

Hydrodynamic design characteristics

- Maximised efficiency with due respect to controlled cavitation, pressure impulses, vibration and noise
- Skew, rake, area-ratio and blade number parameters are all balanced and efficiency-optimised
- The shape of the hub is flow-optimised and reduced in size – resulting in a low drag
- The flow optimisation includes a streamlined shape of the hub and blade integration
- As always, the propeller designs are optimised to the individual ship application and mission profile.

Operational advantages

Increased propeller efficiency is translated into savings via lower fuel consumption, reduced exhaust gas emissions – or may be exploited as higher thrust for increased ship speed for a given engine power.

Benefits of the MAN Alpha propellers

- Efficiency increased by up to 6% (Kappel design)
- Lower propeller-induced pressure impulses
- Reduced risk of cavitation – high blade loading possible for demanding applications.

CFD streamlines during operation, showing reduced tip vortex

High blade loading simulation – reduced root cavitation below
Hydrodynamic integration and optimisation

The perfectioned layout and hydrodynamic propeller integration are always optimised with the ship’s hull and any ‘flow-guiding’ devices placed before the propeller, e.g. pre-swirl fins and vortex-generators. After the propeller, the optimisation will consider high-efficiency rudders, integrated rudder bulbs, post-swirl fins or similar.

According to a recent design study, the combination of a 5-bladed propeller with Kappel blades and fairing cone operating with a rudder with integrated rudder bulb will offer a power saving of up to 9%.
High Propulsion Performance and Low Noise
Innovative Kappel propeller blade designs

Multiple MAN Alpha propeller design solutions are available – all the way from propellers based on the very advanced and unique Kappel tip fin design to conventional blade designs for both CPP and FPP in 4 and 5-bladed executions.

Nature of optimisation parameters
- Lower speed and larger propeller diameter
- Larger diameter and blade number optimisation
- Lower pressure impulses and smaller clearance to the ship’s hull – offer the deployment of a larger propeller.

Kappel design – tip fin benefits
Tip vortices are formed due to the difference in pressure between the pressure and suction sides of the propeller as the water will move from the region of high pressure to the region of low pressure. The pressure on both sides near the tip will therefore equalise and the efficiency of the tip region will decrease.

High efficiency
The Kappel propeller minimises the flow over the tip, and the outer region of the Kappel propeller therefore retains high efficiency increasing the total efficiency of the Kappel propeller compared to conventional propellers.

Low hydroacoustics
In addition to the higher efficiency, especially for high-loaded propeller blades, the Kappel designs ensure a reduced noise signature in general. For similar reasons, silent Kappel propellers are also designed for submarine applications with lowest acoustic signatures and surface ships employing stealth technology.

Tip vortices – conventional versus Kappel. Tip vortices are tubes of circulating water that are formed at the tip as the propeller generates thrust

Kappel propeller surface pressure distribution and streamlines
Scale model 1:28. A 6.4 metre MAN Alpha fixed pitch propeller with Kappel blades - optimised for a feeder vessel.

Kappel submarine propellers for silent missions: 8-bladed model propeller test and 7-bladed propeller finished machined.
The hubs are designed and optimised with due consideration to the propeller/shaft torque, material properties and weight. The MAN Alpha propeller reliability and durability have always been very high, and the latest generation of CPP and FPP designs follows that philosophy.

**Mechanical design characteristics**

- Robust approach – with ample design margins
- As standard, the propeller material is specified as G-CuAl10Ni. Other material available upon request
- Material fatigue levels are calculated for a 30-year lifetime, considering all possible external loadings in service
- Designed for ice operation according to the newest IACS and FSICR ice class notations
- Ice loadings include the influence of ice milling on the complete system’s torsional response
- Compact hub/blade root design and low weight ensuring well-balanced load distribution
- Optimised for reduced material stresses during normal operation and extreme loads
- Shock resistant component designs analysed and documented to current military standards.
More speed and power featured
Novel blade and blade foot design advantages:
- The ‘multi-radius-fillet’ design reduces the blade weight by approx. 4% and contributes to a higher cavitation inception speed.
- The optimised hub/blade interface allows for higher propulsion power densities.

Operational advantages
- Low wear rates and very long lifetime
- Higher reliability with few components
- Reduced bearing loads due to low weight
- Smaller hub dimensions resulting in high efficiency
- Large pitching range and great manoeuvrability
- Increased service and inspection friendliness.
COPS – a unique layout tool
COPS is an abbreviation for Computerised Optimisation of Propulsion Systems. MAN Diesel & Turbo’s COPS expert system ensures better and more accurate pre-optimisation of hydrodynamic/mechanical aspects, integrating e.g. statistical data, torsional vibration data of the complete propulsion system including main engine parameters.

The propeller range offers excellent coverage
The propellers handle outputs from 4,000 to 40,000 kW per shaft. Multiple propeller solutions are available for direct coupled, geared diesel-mechanical, diesel-electric, hybrid and combined propulsion plants.
Optionals and special installation requirements
MAN Diesel & Turbo masters a vast number of disciplines in relation to optimisation of aftship parameters and special installation requirements, such as:

- Rudder design interaction
- Integration to rudder bulbs
- Guide vanes for wake field improvements
- Special shaft brake and locking devices
- De-magnetisation of propeller shafts.

Customised stern tube solutions
Water lubricated stern tube systems are often selected and tailored for naval propeller installations – including our new compact and easy to install water supply units.

The optional oil lubricated stern tube systems are adapted to both biodegradable oils and ordinary mineral oils. Switching from one type to the other is possible without any requirements for component changes.
Robust Hydraulic and Servo Systems
CPP manoeuvrability – swift and safe

Hydraulic power unit
The hydraulic power unit offers high-volume hydraulic modes ensuring optimal ‘crash stop’ opportunities.

ODF oil distribution unit
A new, very compact ODF oil distribution unit has been developed for gearbox mounting. A short and very robust unit with 20% fewer parts compared with today’s ordinary ODF designs. The installation length has been reduced by 22% – for the benefit of very short and compact engine-gear-propeller installations – still with the necessary access and service friendliness.

Fast propeller blade pitch changes and safe manoeuvres are possible due to a 28% higher pitching torque for a given propeller hub size – compared to previous designs.
Shock Excitations, Design Precautions and Testing
Calculations and analysis of propeller and shaft system

Shock excitations in the shaft lines
A complete MAN Alpha propeller system can be designed and documented to any shock requirements. A full shock response analysis is carried out for the complete scope of supply in accordance with current military standards.

This serves to ensure that all mission critical components are designed with ample safety margins against underwater shock inputs.

Controlled torsional vibrations
An MAN Alpha shafting and propeller system will be optimised, adjusted and documented to ensure safe operation. The optimisation will be done by proper modifications to the main engine tuning, flexible couplings or shaft line dimensions – taking the total cost structure of the complete plant into consideration.

Controlled shaft line whirling vibrations
The whirling vibrations are generally non-critical for single screw installations, but may cause problems for long and slender shaft lines’ characteristics for twin screw vessels. Fully excited, whirling vibrations may lead to critical structural vibrations and shaft bearing and stern tube seal problems. Whirling vibrations may be counteracted by proper layout of the shaft line and its bearings based on analysis and our huge experience with complex propulsion systems.
No compromises
From the pool of MAN Diesel & Turbo’s selected suppliers and manufacturing partners, we are cooperating with proven and well-established organisations worldwide. To ensure the highest level of safety, availability and continuity, all suppliers are quality-screened, audited and approved via MAN Diesel & Turbo’s extensive supplier verification system.

Highest MAN standards
Like for the extensive and advanced production of MAN Diesel & Turbo’s diesel, gas and dual-fuel engines, turbomachinery, gas turbines, steam turbines, compressors and turbochargers – including the genuine after-sales spare parts – the MAN Alpha propellers are also produced only by high-end foundries and propeller manufacturers.

PrimeServ: the MAN Diesel & Turbo service brand
PrimeServ offers after-sales service for the entire range of MAN products from spare parts supply, technical service, re-conditioning and retrofit, to engine and propeller maintenance concepts.

Logistic packages
The PrimeServ organisation’s products and services are to a high extent presented as user-friendly kits offering the highest degree of product safety, top quality spare parts and the availability of correct amounts - together with associated ‘work card’ instructions.

PrimeServ Academy training for operational staff
PrimeServ Academies are competency centres for product training with the focus on design, operation and maintenance of propulsion engines, GenSets, gearboxes, propellers and remote control systems.
PrimeServ’s worldwide service support
With more than 150 PrimeServ service stations and service partners worldwide, plus a growing network of PrimeServ Academies, the MAN Diesel & Turbo organisation is highly committed to expanding and developing the most efficient and accessible after-sales organisation in the business.

For propellers, as well as for engines, gearboxes and control systems – PrimeServ provides:
- Delivery of high-demand spares within 24 hours
- Fast, reliable and competent customer support
- Ongoing training and qualification of personnel
- Global service, open 24/7, 365 days a year.

Propeller retrofit packages
Take advantage of new designs and technology or general product improvements, matching e.g. new requirements or changed operating profiles for your ships. Attractive investments are available with short payback time.