

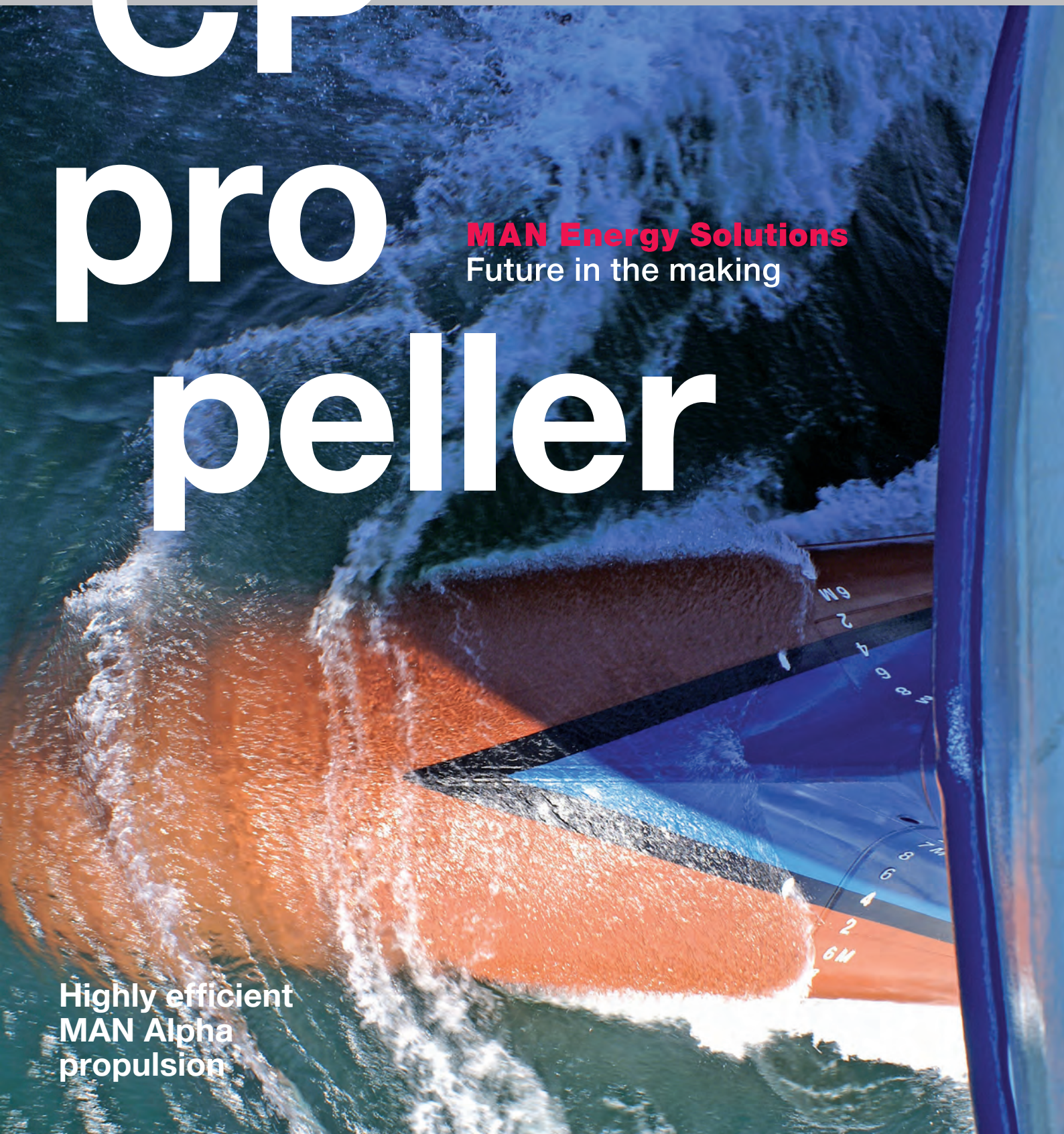


Propeller  
aft ship  
solutions

# CP pro peller

**MAN Energy Solutions**  
Future in the making

Highly efficient  
MAN Alpha  
propulsion







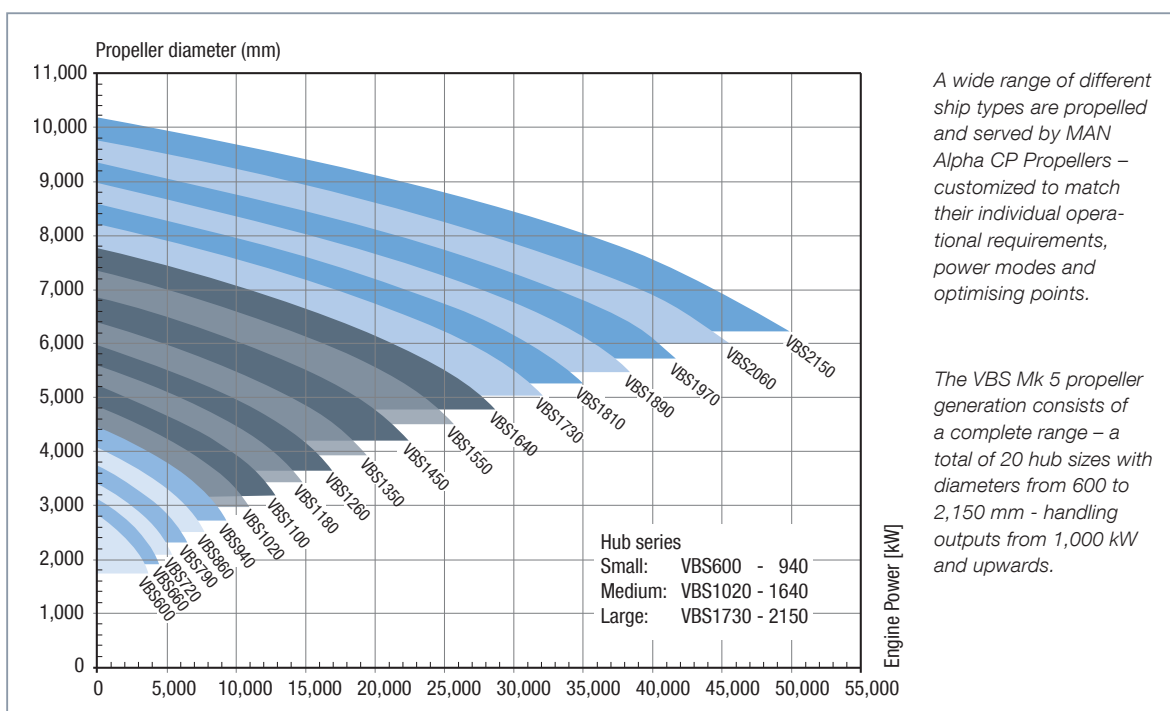


# MAN Alpha CP Propellers

## A high-efficient VBS Mk 5 generation

MAN Energy Solutions is proud to present a high-efficient VBS propeller generation, which has been developed on the basis of the industry's state-of-the-art design tools combined with the vast experience accumulated from more than 7,000 propellers. A long tradition and a proud propeller heritage date back to the first Alpha CPP design, which was produced in 1902 and patented in 1903.

Flexibility for covering efficiently any propulsion power requirement and CP Propeller application is the overall product target for MAN Energy Solutions. Optimized propeller and propulsion efficiencies contribute to lowest EEDI/EEOI with decisive 'green aspects', as every gram of fuel saved by means of higher propulsive efficiency results in more energy-efficient transport and a reduced impact on the environment.



# Advanced hydrodynamics

## The basis for increased propeller efficiency

For maintaining and developing MAN Energy Solution'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 Energy Solutions cooperates with the world's leading test tanks and research institutes.

### Hydrodynamic design characteristics of Mk 5

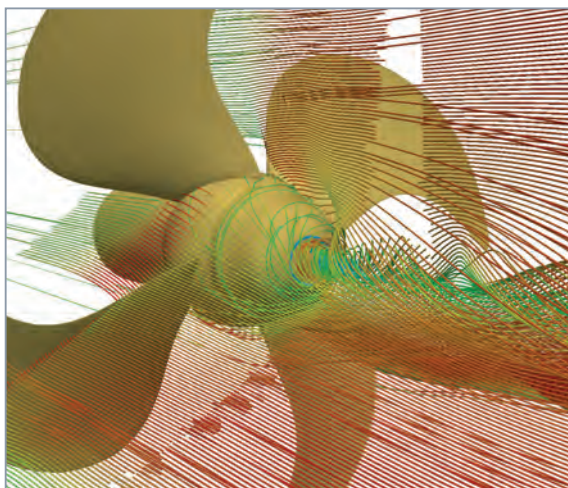
- The shape of hub is flow-optimized at its afterpart and reduced in size – resulting in a lower hub/diameter ratio and a reduced drag
- The flow optimization includes a new and more streamlined shape of the hub and blade foot integration. The blade foot is flush with the hub contour
- Maximized efficiency with due respect to controlled cavitation, pressure impulses, vibration and noise
- As always, the propeller blades are optimized to the individual ship application and wake field.

### Operational advantages

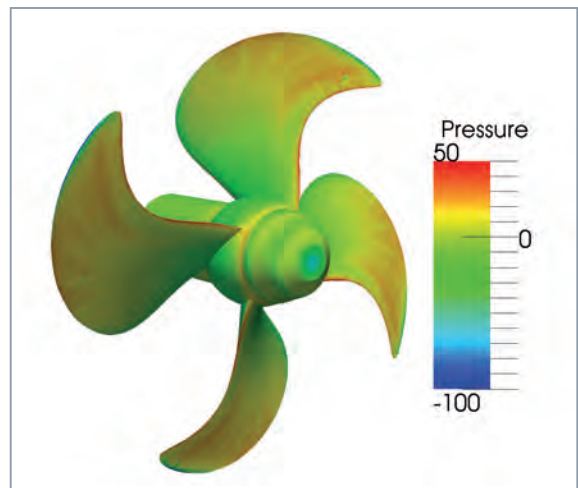
Increased propeller efficiency is translated into savings via lower fuel consumption, reduced exhaust gas emissions – or may be exploited as higher thrust, for increased ship speed or bollard pull for a given engine power.

### Benefits of the Mk 5 propellers

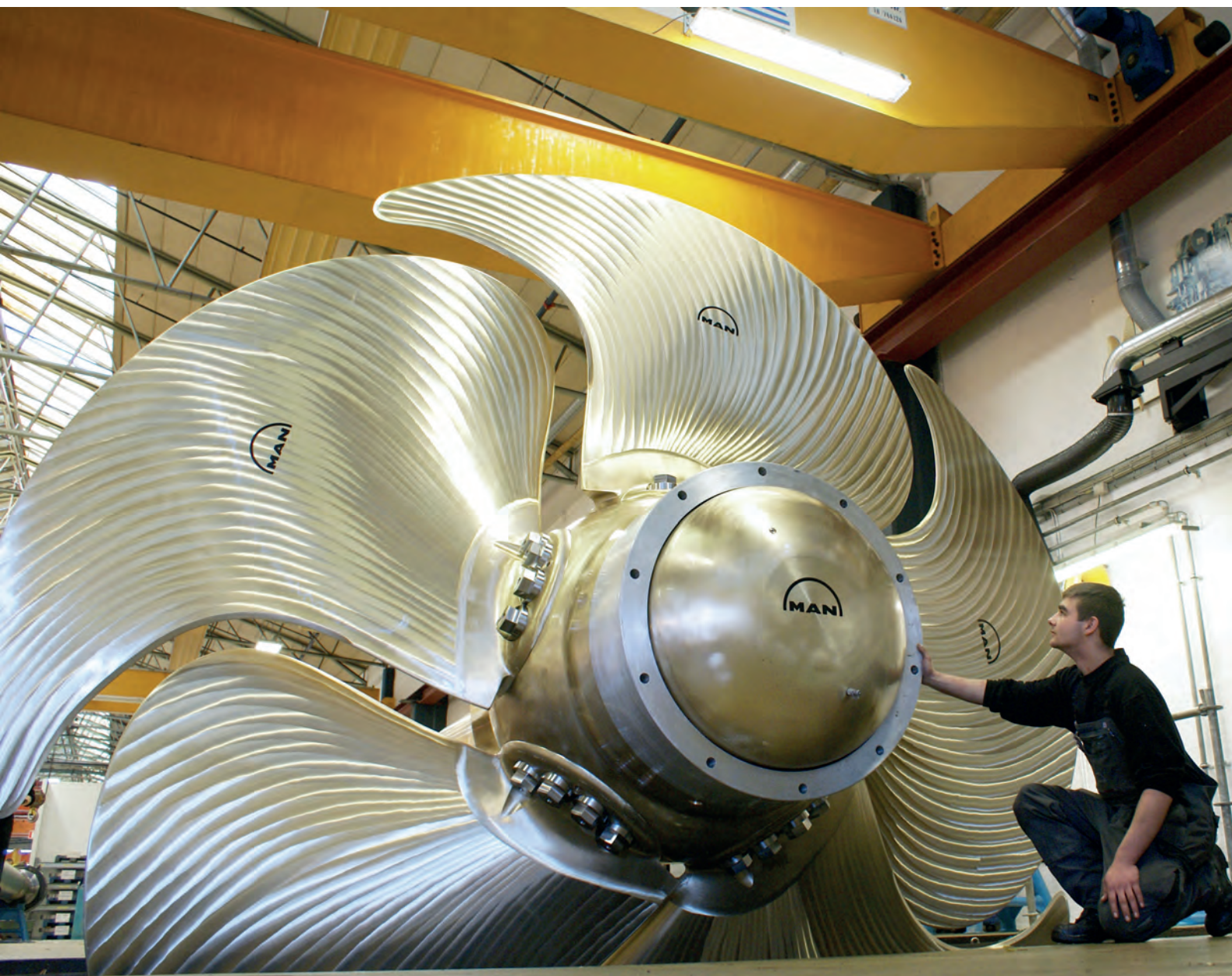
- Efficiency increased by up to 2%
- Higher cavitation inception speed – for high-speed vessels
- Reduced risk of root cavitation for high-speed vessels – higher blade loading for demanding applications.



Streamlines during operation, showing reduced hub vortex



Pressure distribution on the VBS Mk 5 propeller



*VBS Mk 5 propeller with 1,450 mm hub diameter – five-bladed version*



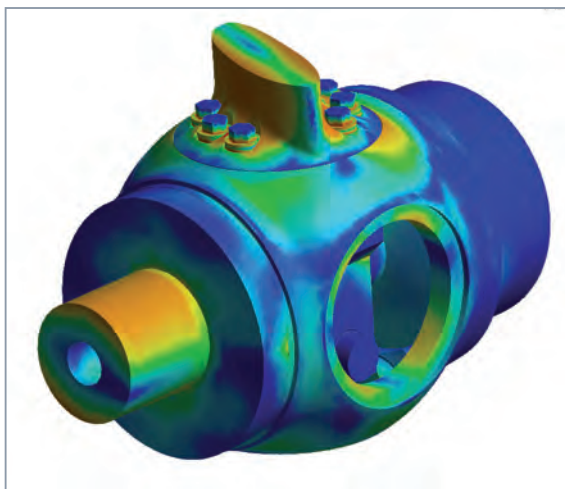
# Mechanical optimization

## Even higher operational reliability

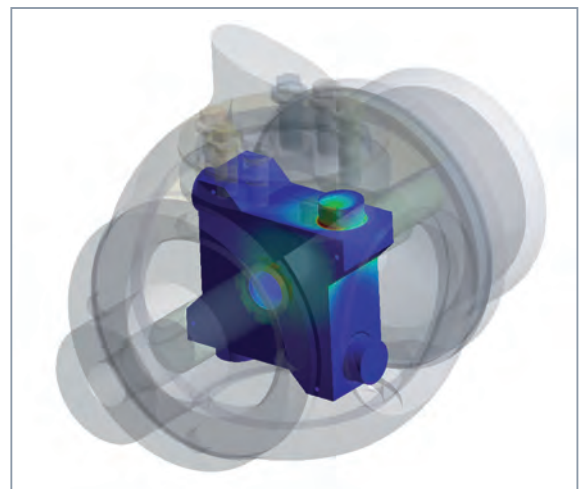
Less is more: The new hub design is simplified with approx. 40% fewer parts. The MAN Alpha Propeller reliability and durability have always been very high, and the Mk 5 design extends that design philosophy. Additionally, the overall weight has been reduced for less impact on strut and stern tube bearing loads.

### Mechanical design characteristics

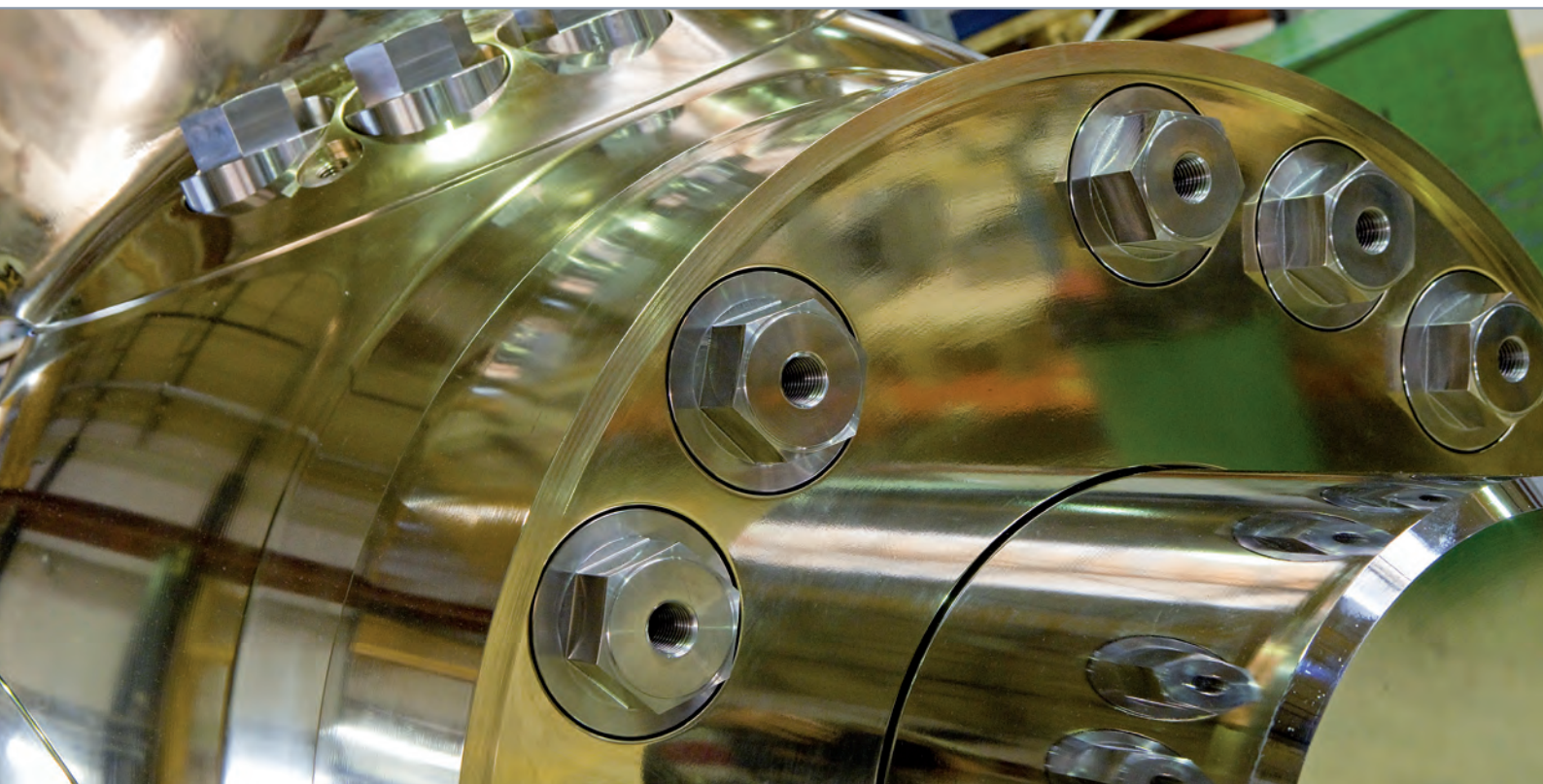
- Robust approach – with ample design margins
- Material fatigue levels calculated for a 30 year life-time, considering all possible external loadings in service
- Pyramidal strength concept – limited damage at extreme and excessive impacts (debris or ground contact)
- Hub and internal parts have been designed for ice operation according to the newest IACS ice class rules. MAN Energy Solutions is first with the implementation of the 2010 rules into the actual design
- Compact design – 8-10% smaller hub and a weight reduction of 15% – ensuring a well-balanced load distribution
- Higher blade pitching torque for fast, high-loaded manoeuvring with large safety margins for crash stop and extreme manoeuvres
- Standard pitching angles from +35 to -25 degrees
- Optimized internal pitching principle for reduced loads during normal operation and extreme loads
- The unsurpassed blade sealing from Mk 3 is kept
- One hydraulic tightened nut/staybolt-assembly for the entire internal hub mechanism.



*Stress distribution under maximum ice load according to IACS, using advanced contact and material models*



*Stress analysis of internal parts under ice load*

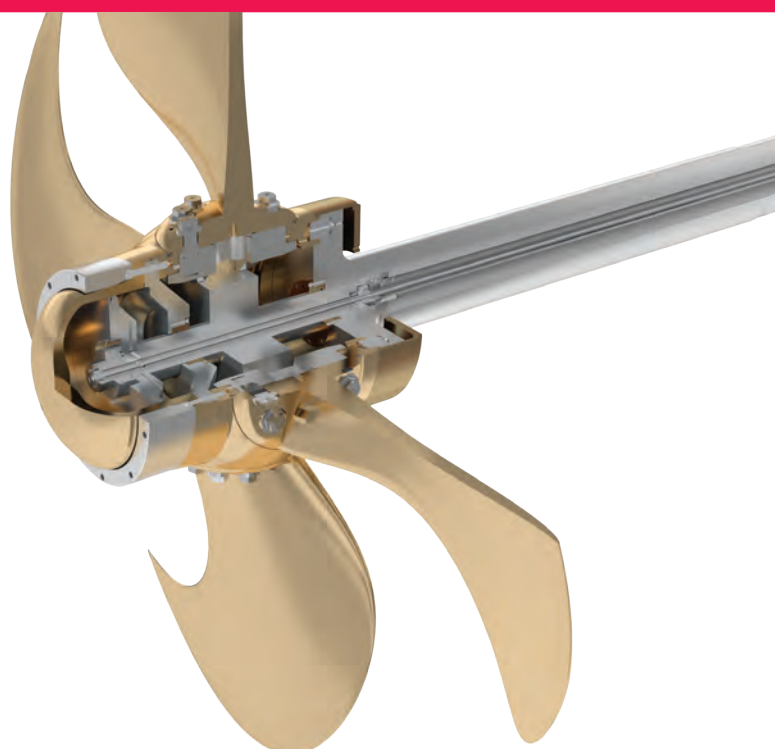


#### **Novel blade and blade foot design features**

- The 'multi-radius-fillet' design reduces the blade weight by approx. 4% and contributes to a higher cavitation inception speed
- The optimized hub/blade interface allows for higher propulsion power densities.

#### **Operational advantages**

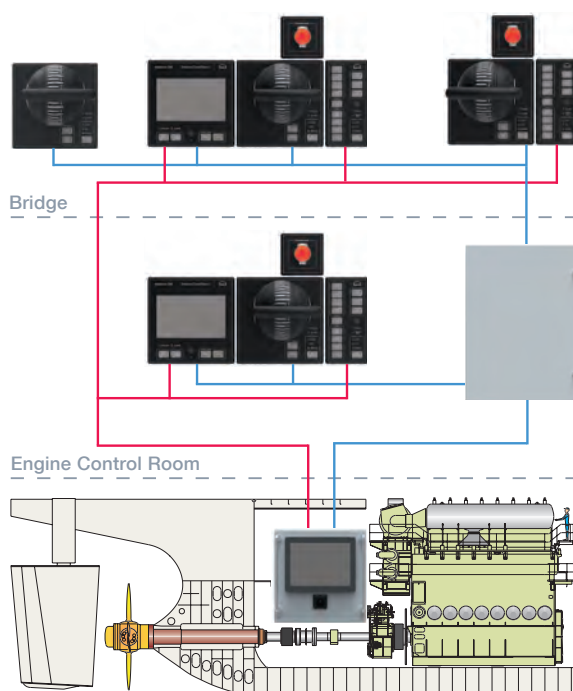
- Low wear rates and a very long lifetime
- Higher reliability with fewer components
- Reduced bearing loads due to lower weight
- Smaller hub dimensions resulting in higher efficiency
- Large pitching range and great manoeuvrability
- Increased service and inspection friendliness.





# Electro-hydraulic pitch setting

## Precise manoeuvring and propeller control



### Alphatronic 3000 in control

Safe and accurate propulsion management all the way – from the navigator's finger tips to the propeller tips. Any pitch manoeuvring order given from one of the control consoles is translated into electrical signals, governing the hydraulic servo oil via the oil distribution unit to the CPP servo cylinder for pitch setting.

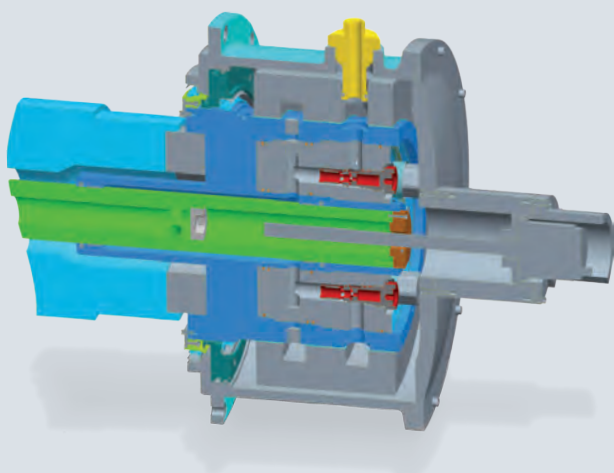
### Three levels of propulsion control

- Normal control with automatic load control
- Backup control from bridge and ECR
- Independent telegraph system for communication of thrust orders from bridge to machinery space.

### Speed pilot - optional feature

Optimizes the voyage planning and operational ship speeds e.g. for pulling, steaming and convoy sailing – with fuel saving potentials of up to 4%.





*The new ODF for the Mk 5 propeller design includes a unique 100% linear feedback system – a contact-less ultrasonic design with no use of linkage bars. No wear and no hysteresis in feedback. Servo oil working pressure up to 90 bar*

#### **ODF oil distribution unit**

A very compact ODF oil distribution unit – for gearbox mounting – has been developed for the VBS Mk 5 propellers. 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 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.

#### **Safety feature**

The ODF includes highly reliable safety valves with internal dampening, which locks the propeller pitch in any position in case of external system failure.

#### **Shaft-mounted ODS unit for low speed plants**

An oil distribution unit – specifically tailored to shaft installation in direct coupled low speed engine plants is also part of the VBS Mk 5 programme.



*Factory test of oil distribution unit and hydraulic power unit*

# Propulsion package layout

The perfect match begins with the propeller

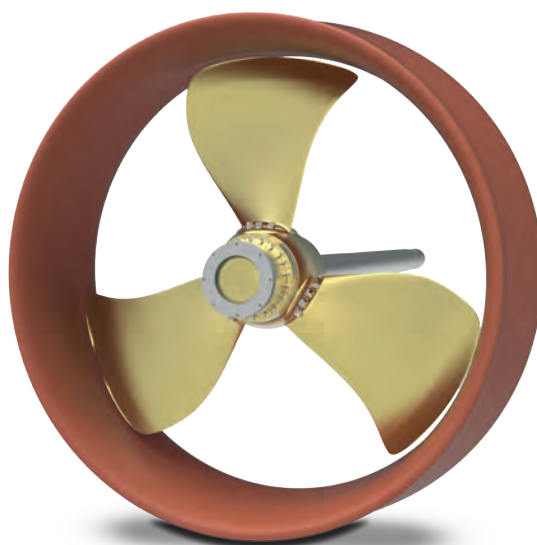


## **COPS – a unique layout tool**

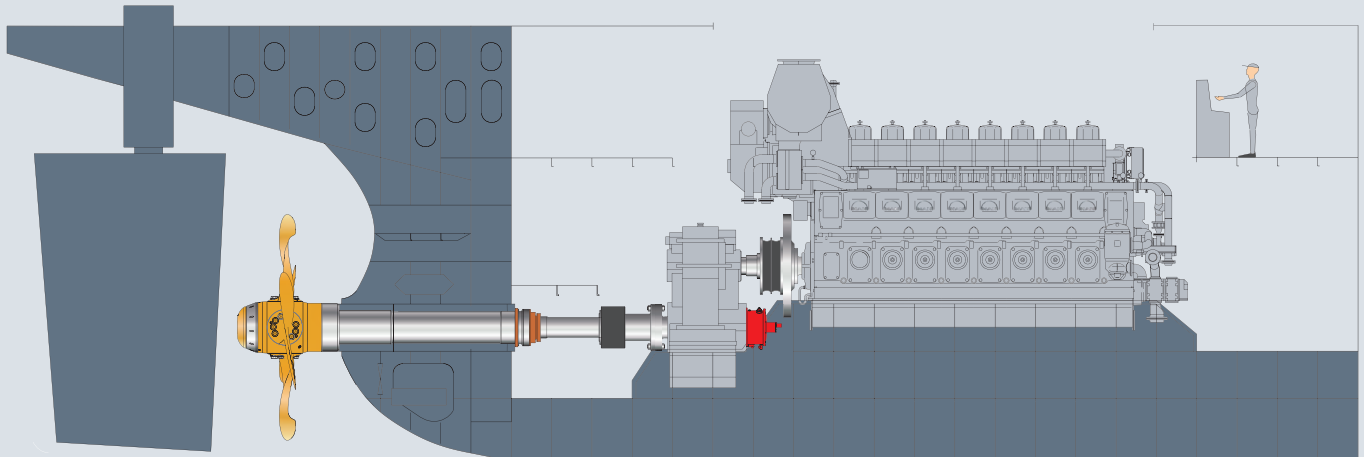
COPS is an abbreviation for Computerized Optimization of Propulsion Systems. MAN Energy Solution's COPS expert system ensures better and more accurate pre-optimisation of hydrodynamic/mechanical aspects – with additional consideration to e.g. statistical data, PTI/PTH, torsional vibration calculations and more.

## **The VBS Mk 5 range offers excellent coverage of any propeller demand**

20 standard four-bladed hub sizes range from 600 to 2,150 mm, corresponding to a power range from 1,000 kW and up to and above 40,000 kW. Hub series for two-, three- and five-bladed propeller configurations are also available.







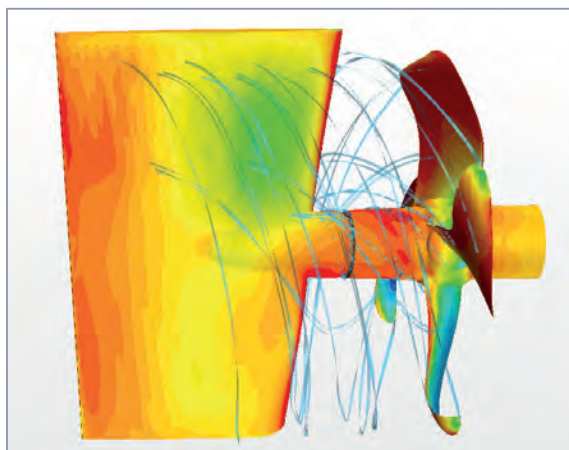
*The propellers are prepared for biodegradable servo and lube oils. The servo oil and lube oil systems are adapted to both biodegradable oils and ordinary mineral oils. Switching from one type to the other is possible without any requirements for component changes. Stern tube/shaft/bearing systems are as standard customized for oil lubrication. Water lubricated systems are available upon request.*

Tailored propeller systems and plant solutions: Efficient and compact propulsion packages with an even shorter required installation length, e.g. due to the new ODF oil distribution unit, are shown in the above installation with a Renk gearbox and an MAN 8L32/44CR propulsion engine.

#### **Special options for special requirements**

MAN Energy Solutions masters a vast number of disciplines in relation to optimization of aft ship parameters and special requirements, such as:

- Customized bollard pull and speed nozzles
- Flow straightening and wake equalizing ducts
- Guide vanes for wake field improvements
- Special rudder designs and their interaction
- Integration of fairing cones and rudder bulbs
- Full-feathering propeller blades
- Hub/blades in stainless steel
- Special blade designs – Kappel.



# Unique service features

## Propel the new VBS Mk 5 way ahead

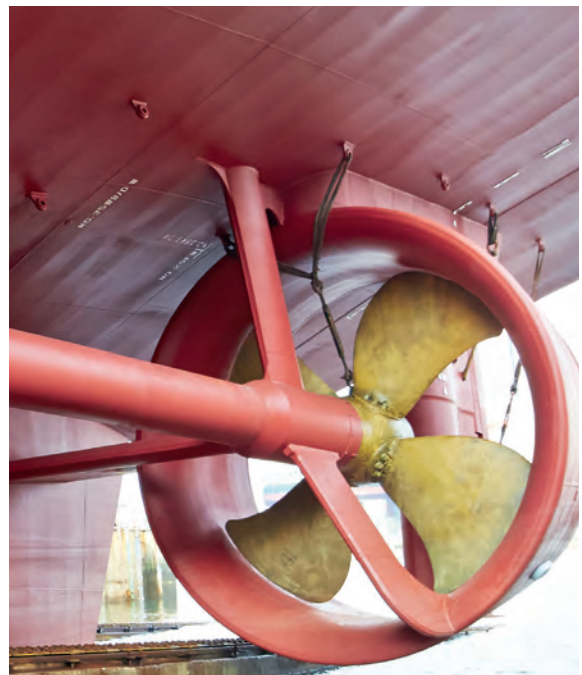
### Benefits for shipowners and operators

The new propellers have been developed with a number of inherent service, inspection and exchange features – including the unique possibility of inspecting/repairing all of the hub interior parts with the propellers placed in-situ. ISI (In Situ Inspection) of propellers is an obvious time and money saving feature.

### Valuable service features

The following VBS Mk 5 specialities are offered:

- The propeller blades can be exchanged inside a propeller nozzle – without pulling the shaft
- The hub is completely serviceable with the propeller installed in the ship. No need for shaft/coupling flange dismantling, shaft pulling and removal of the rudder
- Possibility for check/inspection and replacement of internal parts without removing the propeller blades
- Hub bearing surfaces are exchangeable
- The hub and shaft flange connection is designed for easy inspection during docking and survey
- Maintenance concepts for hub wearing parts are available
- Underwater exchange of propeller blades is possible.

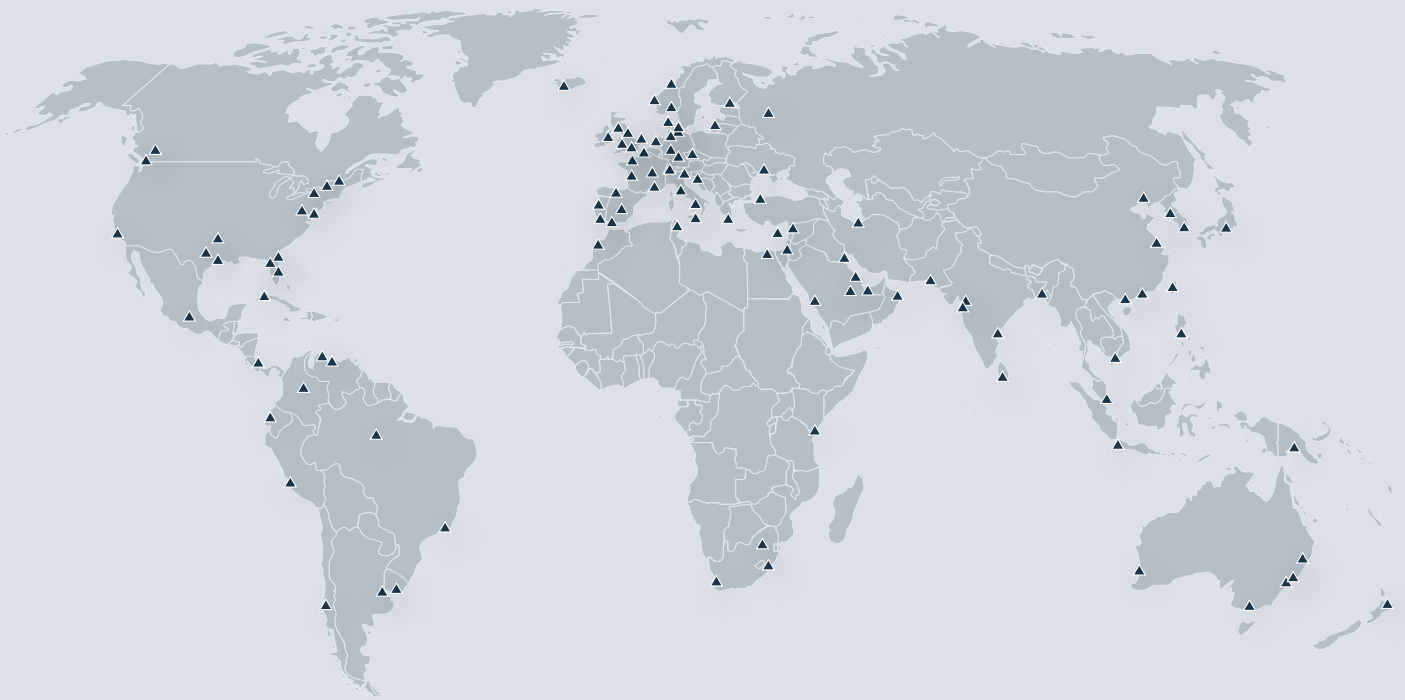






# World class propeller service

## Wherever you are operating



### **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 Energy Solutions organization 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 – MAN PrimeServ provides:**

- Prompt delivery of high-demand spare parts within 24 hours
- Fast, reliable and competent customer support
- Ongoing training and qualification of service personnel
- Global service, open 24/7, 365 days a year.

### **PMC - propeller maintenance concepts**

To ensure the long-term peak performance and reliability of your MAN Alpha propeller and Alphasonic propulsion control system, MAN Energy Solutions can offer extended packages with after-sales services for new and existing systems.

A service package will typically include our standard propeller maintenance performed in connection with the 5 and 10 year inspections – in accordance with the docking periods recommended by the classification societies.





### **Propeller repair and reconditioning**

MAN PrimeServ carries out repair and reconditioning services for all MAN Energy Solutions products at an attractive price negotiated case by case.

### **Propeller retrofit packages**

A wide range of propeller retrofit and upgrade solutions are offered for your existing fleet. Take advantage of new technology or general product improvements, matching e.g. new requirements or changed operating profiles. Attractive investments are available with short payback time.



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