



Four-  
stroke  
marine  
systems

# Naval defense

**MAN Energy Solutions**  
Future in the making

**Reliable high-power  
marine solutions**



# Future in the making

**MAN Energy Solutions is the world's leading provider of large-bore diesel engines, turbomachinery, and integrated power systems. We make four-stroke and two-stroke engines for marine and stationary applications, turbochargers and propellers, gas and steam turbines, compressors, and chemical reactors.**

**Our marine systems expertise is focused on emission reduction, complete propulsion packages, electrical propulsion, dual fuel, LNG, and digitized services.**

**We are the only manufacturer that caters to the whole spectrum of maritime defense applications: From fast patrol boats to large auxiliary ships, from offshore patrol vessels to submarines. No less than 59 navies rely on our engines to keep their naval vessels moving.**



# Specialized expertise for special situations

## Security in changing times

The naval defense segment is growing in the face of national security concerns. At the same time, the increase in asymmetric threats and terrorism demands increasing maritime security.

Modern vessels fulfill an extremely broad and complex range of tasks. As long-term partners of the defense market, we are aware of the requirements and constraints of each application and can design a precisely tailored solution.

## MAN systems perform in demanding conditions

Navies place special demands on our propulsion systems. Shockproof design, noise cancellation, and invisible magnetic signatures are just some of our reliable and perfectly integrated solutions.



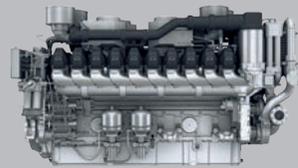


# Four-stroke engines for naval defense



**MAN 175D**  
GenSet

1,440 – 3,400 kW



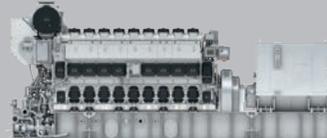
**MAN 175D**  
Propulsion

1,499 – 4,400 kW



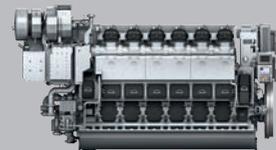
**MAN 28/33D STC**  
Propulsion

5,460 – 10,000 kW



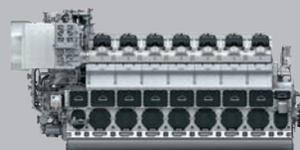
**MAN 32/44CR**  
GenSet

3,600 – 6,000 kW  
7,200 – 12,000 kW



**MAN 32/44CR**  
Propulsion

3,600 – 6,000 kW  
7,200 – 12,000 kW



**MAN 48/60CR**  
Propulsion

7,200 – 10,800 kW  
14,400 – 21,600 kW

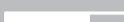
**Offshore patrol vessels****08 – 11**

MAN V175D GenSet		1,440 – 3,400 kW
MAN V175D		1,499 – 4,400 kW
MAN V28/33D STC		5,460 – 10,000 kW

**Naval combatants****12 – 15**

MAN V175D GenSet		1,440 – 3,400 kW
MAN V28/33D STC		5,460 – 10,000 kW

**Amphibious and support ships** **16 – 19**

MAN V175D GenSet		1,440 – 3,400 kW
MAN V175D		1,499 – 4,400 kW
MAN L32/44CR GenSet		3,600 – 6,000 kW
MAN L32/44CR		3,600 – 6,000 kW
MAN L48/60CR		7,200 – 10,800 kW
MAN V32/44CR GenSet		7,200 – 12,000 kW
MAN V32/44CR		7,200 – 12,000 kW
MAN V48/60CR		14,400 – 21,600 kW

**Inshore and fast patrol craft** **20 – 23**

MAN V175D		1,499 – 4,400 kW
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# For a powerful response

**Offshore patrol vessels**



© Courtesy of BAE Systems Naval Ships

**Small and compact, but operating on the open sea, offshore patrol vessels take on a very broad range of missions that include search and rescue, maritime surveillance, environmental monitoring, and fishery protection.**

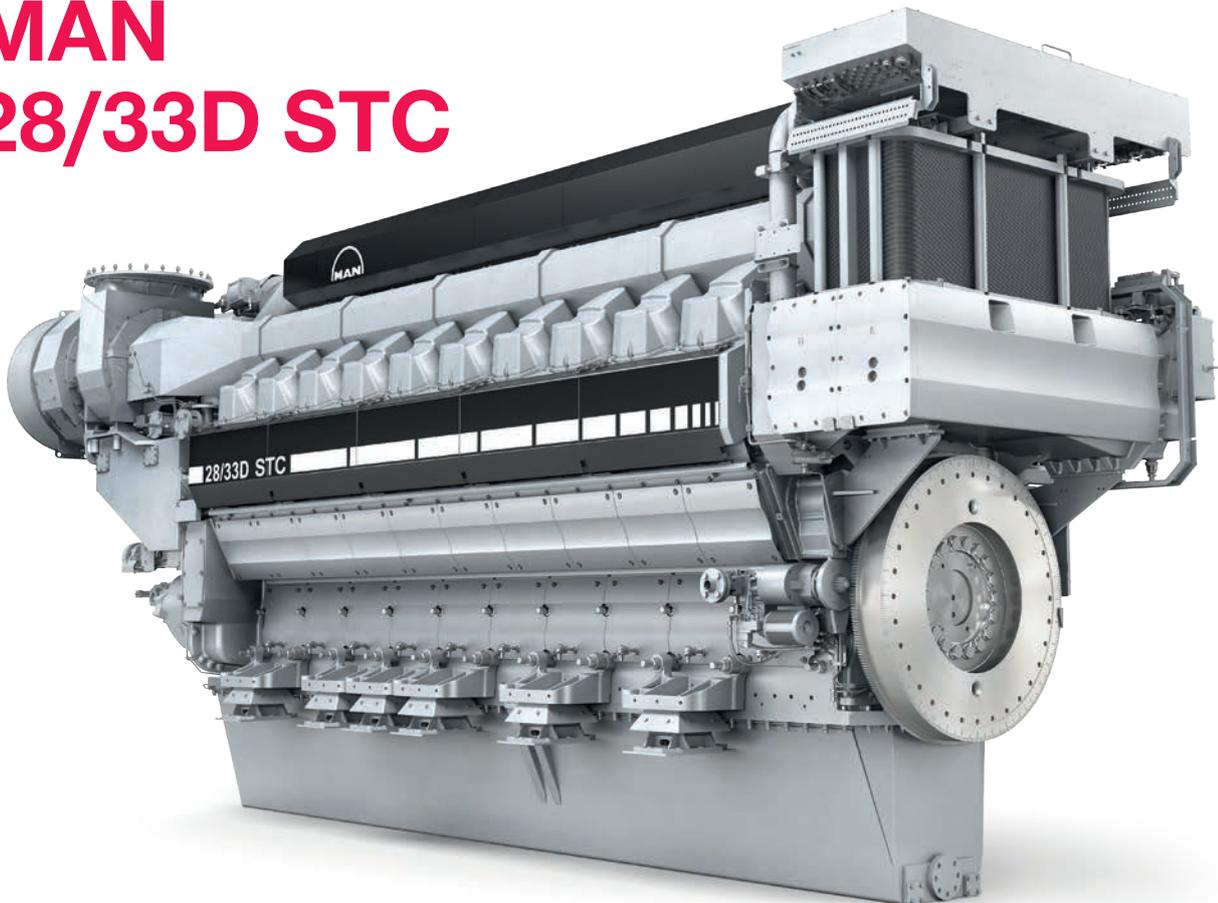
#### **Versatile performance**

While the engine load profile for a patrol boat has to be very flexible, it almost always has to deliver a quick, high-power response, endurance, and faultless operation during any mission. Easy operation and maintainability is a must.

Our engine options also offer you freedom and flexibility of design, with solutions for both mechanical and hybrid electric propulsion.

# Strength meets stealth

**MAN**  
**28/33D STC**



**Continuous low-load operation capability and high torque for fast acceleration are just two of the features that make the MAN 28/33D STC perfectly suited to offshore action. This powerful engine builds on the heritage of the successful MAN PA6B.**

**Robust and reliable, not only does the MAN 28/33D STC offer strength and stealth for any mission, it also keeps downtime low for high availability. In mechanical propulsion systems, it gives you torque that is easy to control and an optimal acceleration response.**

#### **Benefits**

##### **Economic operation**

One of the lowest total cost of ownership (TCO) on the market

##### **Low maintenance costs**

Due to long time between overhaul (TBO) intervals and onboard maintenance

##### **Best power-to-weight ratio in its class**

5.2 kg/kW, unequaled by any other medium-speed engine

#### **MAN 175D GenSet: The perfect combination**

With its continuous, reliable performance and state-of-the-art technology, the MAN 175D GenSet allows you to focus entirely on your mission. Your crew don't have to learn to use different systems: The interface, maintenance procedures, and documentation are aligned and consistent.

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##### **Sequential turbocharging (STC)**

Two identical yet independent turbochargers provide high torque at low rpm. Fuel injection quantity, rate, and timing are electronically controlled for perfect acceleration control.

##### **Low acoustic and thermal signature**

Ideal for naval applications. It is capable of extended operation at low loads with high efficiency and minimal heat dissipation.

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**Further power solutions  
MAN 175D GenSet**

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**Always  
ready for  
action** **Naval combatants**



© Courtesy of DAMEN

**Corvettes, frigates, and destroyers depend on high-power, efficient engines that won't let their crews down or risk the success of their missions – whether on far-from-home deployments or fast escort operations.**

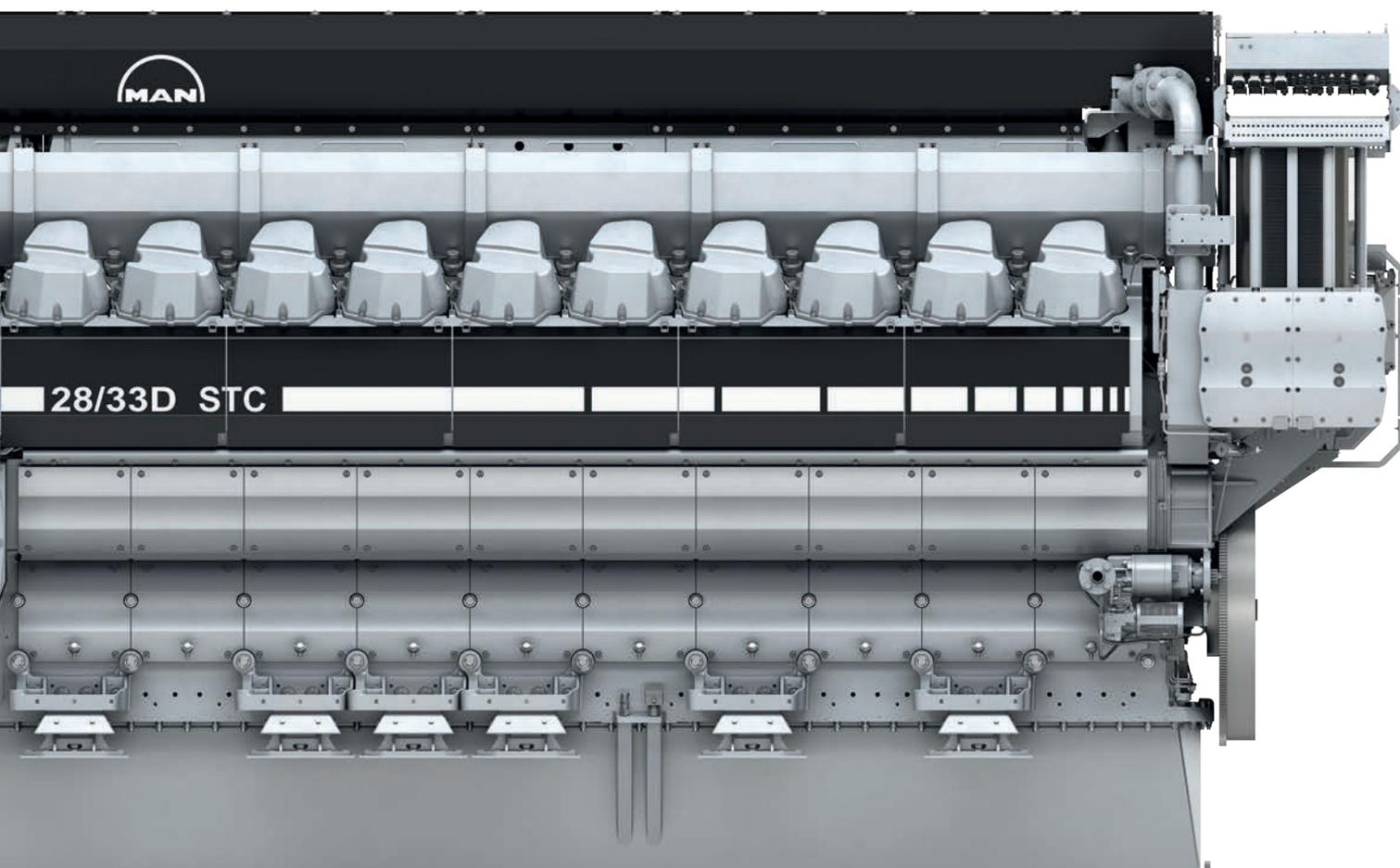
#### **Silent and swift**

Naval combatant applications usually require high speed for fast escort operations, without having to compromise on acoustic, thermal, and visual signatures. They also have to withstand shocks or even be chemical, biological, radiological, and nuclear capable (CBRN).

Our powerful and compact engines deliver this level of performance while ensuring maximum availability and outstanding specific fuel oil consumption (SFOC). Best-in-class life-cycle costs are supported by our worldwide logistics service.

# Maximum readiness

**MAN**  
**28/33D STC**



**With its compact design and powerful performance, the MAN 28/33D STC is perfect for military vessels. The powerful engine has a high power-to-weight ratio and is fully compliant with current environmental standards, producing NO<sub>x</sub> emissions that fulfill IMO Tier II and EPA Tier II requirements with internal measures only and IMO Tier III requirements with a combined selective catalytic reduction system (MAN SCR).**

**Maintenance costs are kept low thanks to high engine availability. And with main overhauls only necessary every 32,000 hours, servicing downtime is kept to a minimum. As a result, you can count on low overall operating costs and best-in-class SFOC.**

## Benefits

### **Best power-to-weight ratio in its class**

5.2kg/kW, unequaled by any other medium-speed engine

### **High reliability and low maintenance requirements**

All maintenance in situ, no removal from vessel necessary, no change of crankshaft

### **Simple efficiency**

Sequential turbocharging (STC) provides optimum matching over all loads with only two turbochargers

## **Noise and shock optimization**

The acoustic propulsion module dramatically reduces airborne and structure-borne noise, and enhances safety – yet is easy to install, operate, and maintain.

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### **Military design**

Developed in close cooperation with naval forces, the engine has a high power-to-weight ratio, all pumps are attached, and all maintenance can be carried out onboard by the crew.

### **Combat-capable**

The MAN 28/33D STC is built to withstand shocks and achieve enhanced noise emission levels when fitted with special elastic mountings. It is designed for CBRN operations.

### **Cooling system**

The concept includes aligned cylinder units to minimize the installed weight. The intercooler assembly is centrally mounted, also contributing to the engine's light weight.

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**Further power solutions**  
**MAN 175D GenSet**

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# Mastering complex challenges

**Amphibious and  
support ships**



© Courtesy of Irving Shipbuilding

**Naval amphibious and support ships transport troops and supplies over long distances. Non-military deployment can be just as challenging. In disaster relief operations, the ships can act as hospitals, crisis management units, communications centers, or helicopter platforms.**

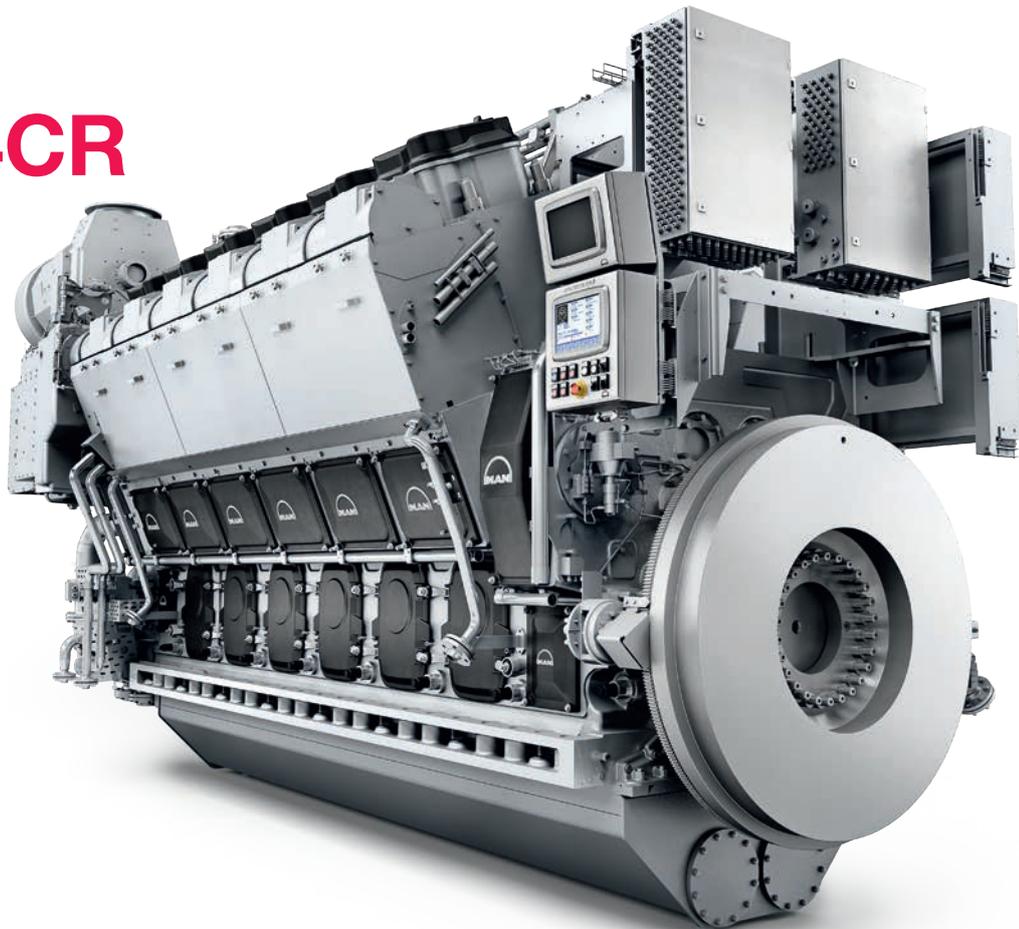
#### **High expectations**

Great demands are made of amphibious and support ships, including a long operational life. Worldwide logistic support missions can be long in range and duration. The engines must offer maximum shock resistance, silent operation, and low visual or infrared signatures. The large and complex propulsion systems have to deliver a high number of running hours and are expected to last for a very long time.

Offering reliable, high power operation with low fuel consumption, our engines pass the test in terms of reliability and economy. What's more, our systems include powerful gensets for integrated electric and hybrid systems.

# Robust and flexible

**MAN**  
**32/44CR**



**The development of the MAN 32/44CR has benefited from many years of experience of industrial-sized diesel engine architecture. It has proven itself in merchant navy applications and can provide a solid reference list. Its high reliability ensures a long TBO.**

## Benefits

### Highly efficient common rail technology

Best-in-class SFOC

### Low operating costs

Higher efficiency and improved maintainability

### Low exhaust emissions

Complies with IMO Tier II and IMO Tier III (with optional MAN SCR)

## Propulsion and auxiliary power in one

The MAN 32/44CR is designed as a multi-purpose drive. It can be used for mechanical or diesel-electric propulsion or for diesel-electric power generation. Using it as a marine main engine and auxiliary engine brings huge advantages in terms of operation and support.

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### Common rail injection

Allows flexible setting of injection timing, duration, and pressure. This flexibility allows the fuel consumption and emissions to be optimized based on its operating profile.

### High-efficiency turbocharger

The use of MAN Energy Solutions turbochargers equipped with the latest high-efficiency compressor wheels can alleviate the NO<sub>x</sub>-SFOC trade-off. The higher pressure ratio increases the efficiency of the engine and therefore compensates for the increase in SFOC normally associated with lower NO<sub>x</sub> emissions.

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## Further power solutions

**MAN 175D**  
**MAN 175D GenSet**  
**MAN 32/44CR GenSet**  
**MAN 48/60CR**

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# Quick response

**Inshore and fast patrol craft**



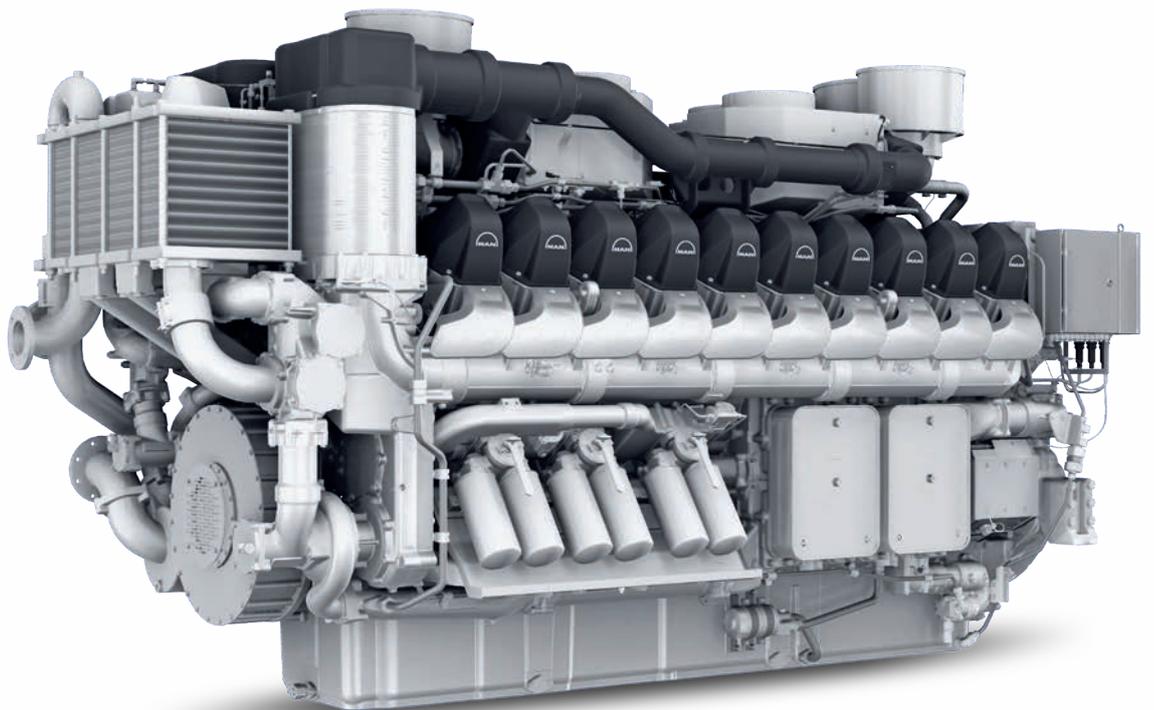
**Inshore and fast patrol craft cover a multitude of coastguard duties, including search and rescue, fire-fighting, environmental surveillance, border control, customs, and police duties. In a military context, they can be deployed as littoral combat crafts, protecting infrastructure or in special operations.**

#### **Ease of use**

Because they are deployed in coastal waters, engines for inshore patrol craft usually have very high emission compliance standards (IMO Tier III). In terms of performance, an extremely fast response is a must in the majority of cases.

The typically small crews on these boats have their own specialized duties, such as rescue, inspection, and combat. That means that simple engine operation and maintenance is essential.

# High **MAN 175D** speed, compact size



**Powerful and compact, the MAN 175D makes sure you are ideally prepared for all types of naval operations. Whether you are patrolling in low-load mode or cruising at full power, the easy handling and high availability of the MAN 175D allows you to focus entirely on your mission.**

**Packing the latest technology into a minimum volume, this high-speed engine is characterized by its clear-cut design: Easy to commission, easy to operate, and easy to service. Its modular design allows it to meet all the challenges of many different applications.**

#### **Benefits**

##### **Advanced, powerful, and robust**

Peak performance and proven reliability based on cutting-edge technology and successful four-stroke engine tradition

##### **Market-leading TBO**

Time between major overhaul of up to 30,000 operating hours, whereby the engine is designed such that major overhauls can be carried out in situ

##### **Endurance**

Market-leading low SFOC allows a longer mission range and the highest combat flexibility

##### **Clear-cut design**

A functional design with the minimum weight and dimensions. Easy to commission, easy to operate, and easy to service

##### **Modular concept**

For easy adaptation to different applications, it can be configured with auxiliary equipment and modular components, such as a seawater cooler. It has four auxiliary power take-offs.



##### **Engine control system**

Based on a modular concept for low and easy maintenance, this is an internal development using proven MAN standards of robustness, reliability, and safety.

##### **Turbocharger technologies**

This is a key area of expertise of MAN Energy Solutions. The single-stage turbocharger is simple and easy to maintain, compared to more complex sequential turbochargers. It was specially developed for the MAN 175D and consequently provides highly efficient performance with a very wide operating range.

# Optimized propulsion solutions

## More than an engine

MAN Energy Solutions has a strong track record in the engineering and servicing of complete propulsion packages (including main engines, electric motors and variable frequency drives, gearboxes, propellers, and propulsion control systems) for navies and coastguards across the globe. We know what you expect: High propulsion performance and operational flexibility with low hydroacoustics.

## Highly efficient propellers

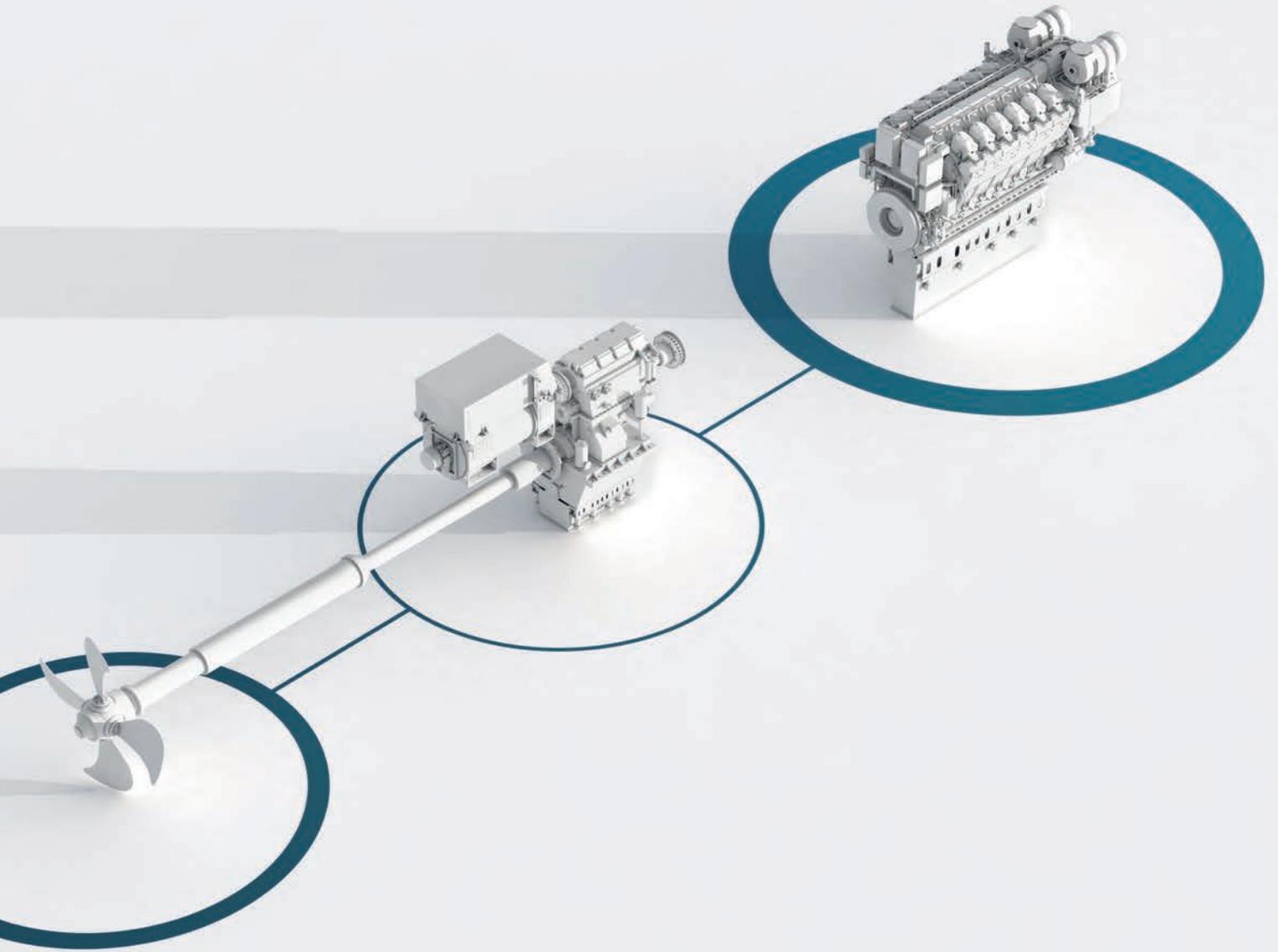
Our propellers can be found on many types of ships – from small coastal cutters or supply and inspection vessels to larger, more powerful OPVs, command support vessels, and frigates.

We offer propeller blades with conventional high-skew profiles for our four- and five-blade series (CPP/FPP), as well as propellers for a shaft power of up to 40 MW. Highly efficient Kappel designs with specially modified fin tips ensure low noise signatures. And this impressive portfolio of products also includes a variety of water-lubricated stern tube systems.

## Benefits of a complete propulsion system

Together with AKA (hybrid propulsion systems), we can create complete solutions for the complex propulsion needs of large ships.

- **MAN engines**  
Reliable and high-power
- **MAN ALPHA propellers**  
Noise-optimized
- **AKA hybrid systems**  
Tailored to operational requirements



# MAN PrimeServ

# Service with passion



MAN PrimeServ is the dedicated MAN Energy Solutions service brand. Via a network of over 100 service centers worldwide, MAN PrimeServ provides 24/7 service across the globe. Our range of services includes technical support, consulting, and OEM spares, as well as maintenance, repair, and comprehensive individualized service plans.



# 365

days a year

# 24

hours a day



F&B

SULZER  
TURBO

B&V Industrietechnik



**MAN Energy Solutions**

Alpha  
PROPULSION SYSTEMS

SEMT  
PIELSTICK

Ruston

Paxman

Mirrlees  
Blackstone

GENERATING SETS

B&W  
VALVE

#### MAN PrimeServ provides:

- Prompt delivery of high-demand OEM spare parts within 24 hours
- Fast, reliable, and competent customer support
- Individually tailored O&M contracts
- Ongoing training and qualification of operators and maintenance staff
- Global service, 24 hours a day, 365 days a year
- Diagnosis and troubleshooting with our high-performance online service

#### MAN Energy Solutions and legacy brands

MAN PrimeServ is our brand name for high-quality aftersales support for the entire MAN Energy Solutions product portfolio. Through refinements to our products and repair techniques, we ensure and reinforce our technological leadership and technical expertise as an original equipment manufacturer (OEM) for the brands united under MAN Energy Solutions.

# Worldwide service

**We offer retrofitting and upgrade services to bring engines and turbochargers already in service up to the very latest standards of performance and efficiency.**

Using the latest digital technology, we enable you to maximize the performance and availability of your MAN equipment by accessing real-time data analysis, remote support, and rapid solutions. We also offer an extensive range of training courses at MAN PrimeServ Academies around the world.

Armed forces must always be ready for action and so is our service team, offering continuous support, dedicated training, and fast delivery of spare parts wherever your military operations take you.

**For more information, please visit**  
[www.man-es.com/services](http://www.man-es.com/services)



# 100

service centers  
worldwide



# Get your engines started ...



#### An interactive experience

Download our MAN Brochure Store app from the App Store or Google Play Store. Use its exciting interactive features to explore our complete range of products and services. Suitable for iPhone, iPad, and Android.



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