MAN Energy Solutions
Future in the making

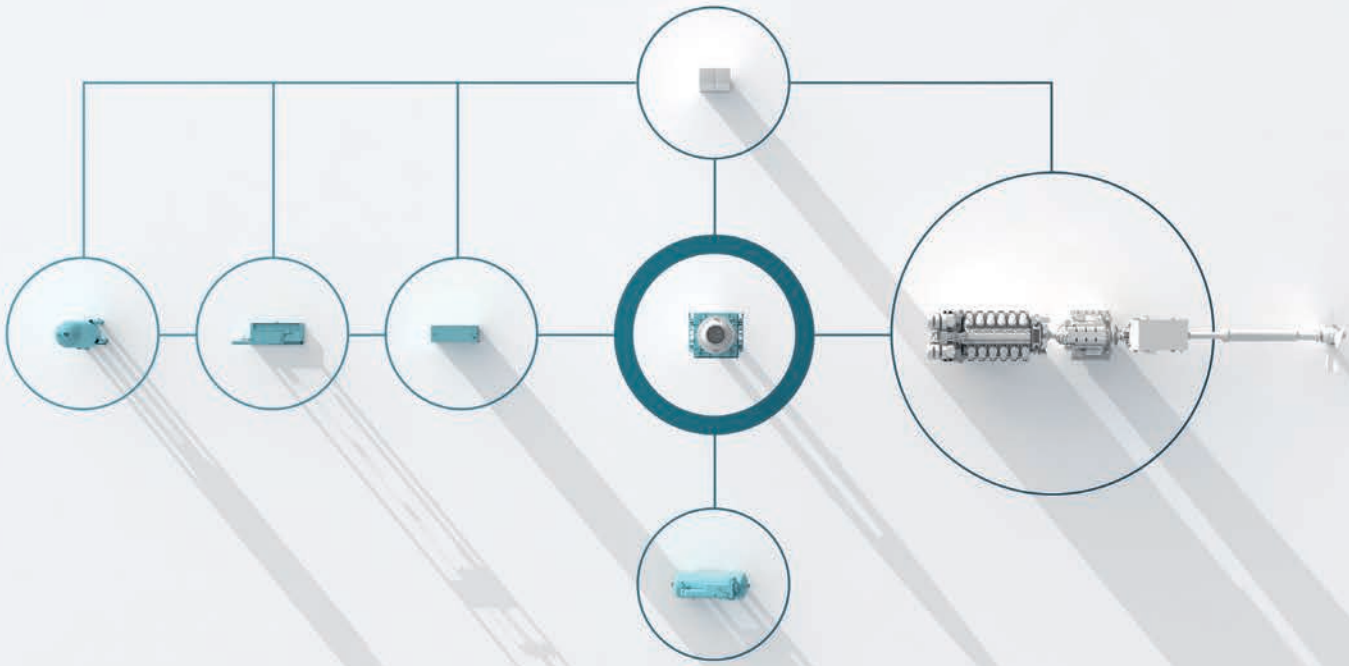
Exhaust after-treatment systems

MAN exhaust gas after-treatment systems ensure vessels with conventional propulsion can meet the International Maritime Organization's (IMO) strict regulations, even in emission control areas (ECA). Our system solutions are highly effective technologies to minimize harmful NO_x and SO_x emissions.

Our systems optimize ship performance not only in terms of emissions, but also economy and operation. Ship operators benefit from smart processes, efficient operation and predictive maintenance services. Using MAN SCR in combination with MAN ECOMAP can reduce the operating costs of the entire system.

Benefits at a glance

- Reduce NO_x emissions up to 90 %
- IMO Tier III compliance
- Increased fuel efficiency
- One source, one point of contact



Four-stroke marine systems

Reducing emissions at sea

A world of tough regulations

As ships carry passengers and cargo throughout the world, they produce exhaust emissions that have a damaging impact on fragile ecosystems. Finding ways to reduce emissions and make ships greener is an important factor for the future of the marine sector.

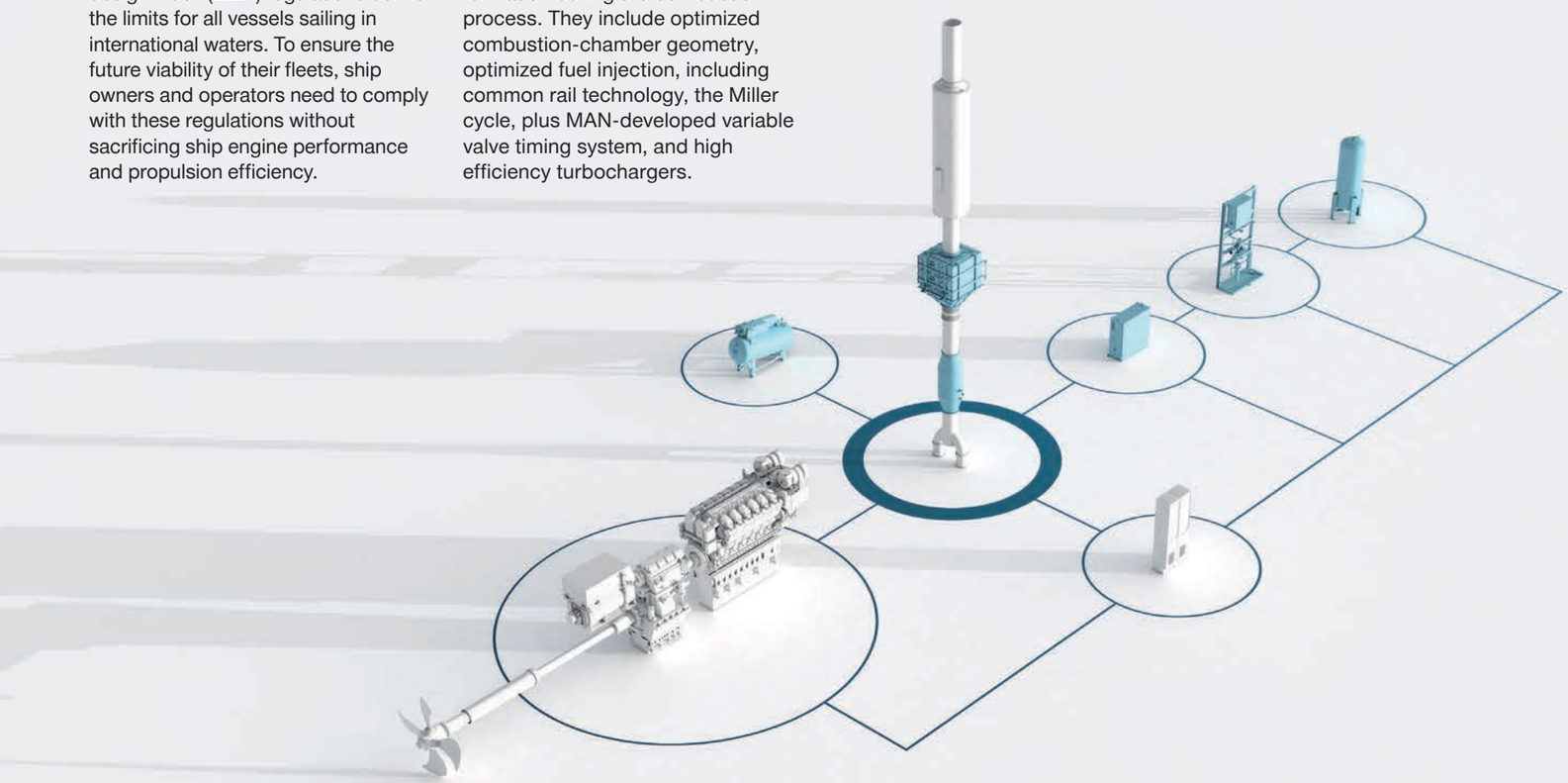
IMO Tier III, ECA and energy efficiency design index (EEDI) regulations define the limits for all vessels sailing in international waters. To ensure the future viability of their fleets, ship owners and operators need to comply with these regulations without sacrificing ship engine performance and propulsion efficiency.

Effective solutions for lower emissions

We offer proven exhaust after-treatment and holistic propulsion systems that meet the International Maritime Organization's strict regulations for NO_x emissions and fuel sulfur content, even in ECAs.

Primary measures for emission reduction are fully integrated into the engine design and reduce NO_x formation during the combustion process. They include optimized combustion-chamber geometry, optimized fuel injection, including common rail technology, the Miller cycle, plus MAN-developed variable valve timing system, and high efficiency turbochargers.

Effective secondary measures include catalytic reduction, wet scrubbing and exhaust gas recirculation. MAN produces and supplies all of these in customizable packages for newbuilds and retrofits. We take care of certification and can already attest to 12,000 running hours without loss of emission compliance.



General competence

MAN Energy Solutions unites comprehensive technologies and competencies under one roof: injection systems, turbochargers, control and after-treatment systems. This enables us to design and implement highly efficient emission-reduction packages.

For example, the MAN SCR (selective catalytic reduction) control system is integrated in the overall engine control system and adapted to the fuel injection system and turbocharger, enhancing the efficiency and reliability of the whole system. Up to 2.5 g/kWh of fuel oil consumption can be saved thanks to MAN SCR integration and optimized control strategies compared to the use of an SCR system provided by a third-party supplier.

System solutions

MAN SCR

Selective catalytic reduction is the most tested and approved system for achieving NO_x reduction rates of up to 90 %. By inducing chemical reactions in the engine's exhaust gases, harmful substances are transformed into ecologically benign constituents. The MAN Energy Solutions SCR system standard is available in fourteen different sizes. In this way, it fully covers the entire portfolio of MAN four-stroke medium speed engines. Furthermore, customized SCR systems can be offered on demand.

MAN wet scrubbers

As the shipping industry today relies to a large extent on high-sulfur fuels, we have developed various desulfurization technologies to meet current and future emission standards by cutting up sulfur oxides in the exhaust gas by up to 95 %. The main technology currently used in marine applications is the wet scrubber, based on the use of seawater or freshwater with an alkaline reagent like caustic soda. Efficient wet scrubbing enables a ship to run on HFO while continuing to comply with the IMO sulfur limits.

Key components

- **Main engines**
  Fuel-efficient, powerful and reliable four-stroke high and medium speed propulsion engines.
- **Auxiliary GenSets**
  Reliably deliver power at a low cost per kWh while respecting the environment.
- **Propellers, gearboxes, and propulsion control systems**
  Efficient propulsion solutions delivered under the MAN Alpha brand.
- **SCR reactor**
  In the SCR reactor, the NO_x is reduced catalytically to nitrogen and water by adding ammonia as a reducing agent.
- **Compressed air reservoir module**
  Supplies compressed air to the injection process and to the soot blower system.
- **Urea dosing unit**
  Defines and adjusts the amount of urea injected into the system.
- **Pump module**
  Pumps urea to the vaporizer/mixer by a urea pump in the supply unit.
- **Mixing unit**
  It is essential that both the injection and the mixing of the reducing agent are performed effectively.
- **Urea tank**
  The urea tank contains the reducing agent and has to be adapted to the vessel's requirements.
- **Control unit**
  Controls the injection of urea and compressed air into the vaporizer.

MAN Energy Solutions
86224 Augsburg, Germany
P + 49 821 322-0
F + 49 821 322-3382
info@man-es.com
www.man-es.com

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