Commercial Marine

WE MOVE YOU. WITH RELIABLE POWER.

mtu

A Rolls-Royce solution

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FROM
2023
OUR MAIN ENGINE SERIES WILL BE READY FOR SUSTAINABLE FUELS.

3

Welcome to the cutting edge

SUSTAINABLE POWER THAT MATTERS

01

We at Rolls-Royce provide world-class power solutions and complete life-cycle support under our product and solution brand ***mtu***. Fully utilizing the potential of digitalization and electrification, we strive to develop climate-neutral drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by climate change and the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems.

A solution provider

mtu systems power the strongest tugboats, the most modern yachts and the biggest land vehicles and provide energy for the world's most important mission-critical applications. With advanced solutions such as microgrids we integrate renewable energies and manage the power needs of our customers.

For over 110 years we have provided innovative solutions for our customers – meeting even the most demanding drive and power requirements. Our products and services span a wide range of applications and power needs, with both standard and customized options.

An expert in technology

mtu products are known for cutting-edge innovation and technological leadership. That same spirit of innovation inspires our sustainability efforts. Our focus is on developing and implementing system solutions that both maximize efficiency and reduce emissions – which in turn helps to reduce our impact on the environment.

A passionate and reliable partner

We at Rolls-Royce spend every day working together with our customers, to deliver engines, systems and complete life-cycle solutions that best fit their needs. We understand that each application is different and has its own specific demands. Our engineers embrace the challenge of finding the perfect solution for your unique power requirements. Every step of the way – from project planning, through design, delivery and commissioning; to the lifetime care of your equipment – we are dedicated to helping you get the most from your ***mtu*** investment.

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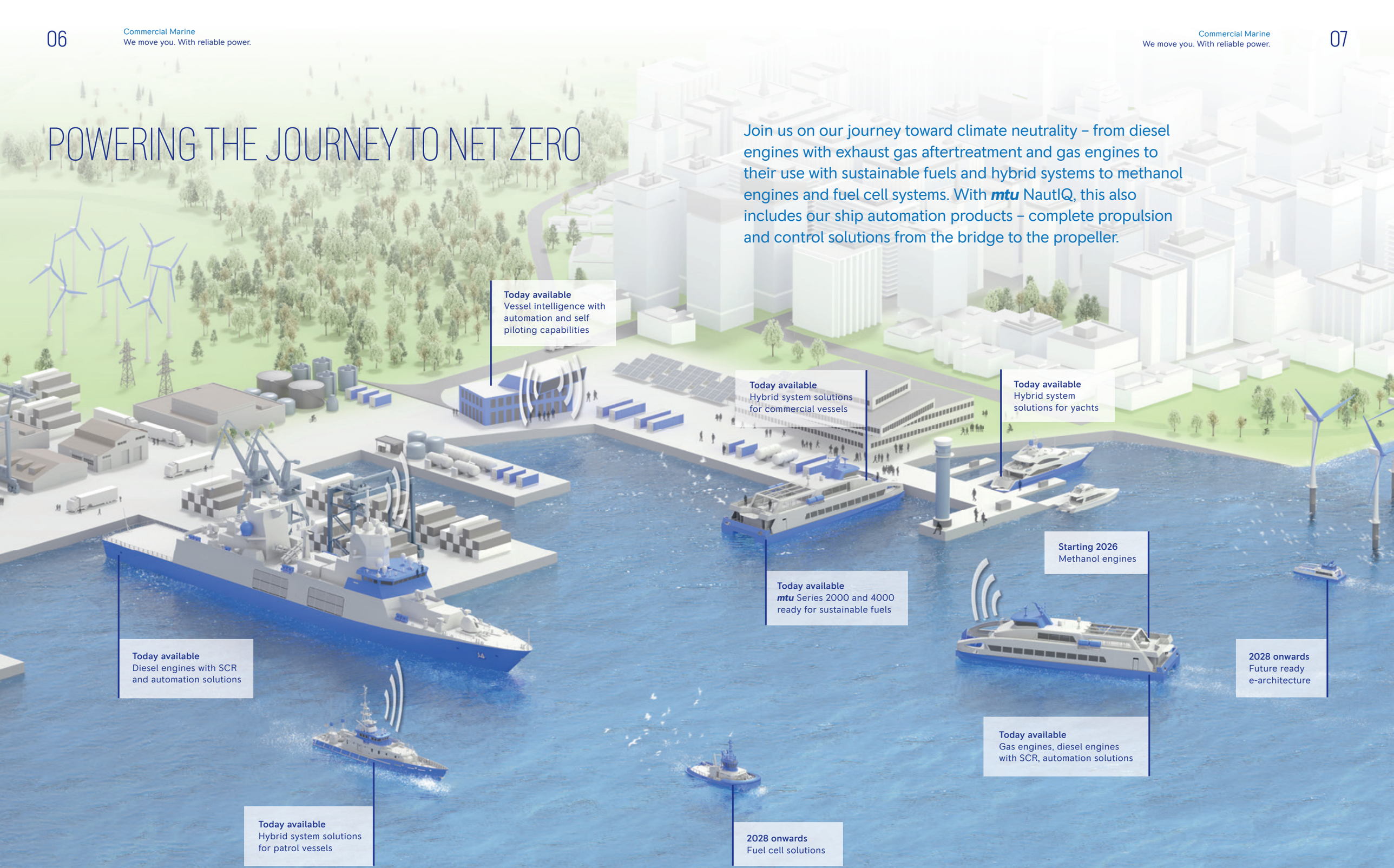
1 **Edda Mistral**
4x 16V4000M63L

2 **FRS Halunder Jet Helgoland Katamaran**
4x 16V 4000 M63L

3 **PSA Tallan**
2x 16V 4000 M63L

POWERING THE JOURNEY TO NET ZERO

Join us on our journey toward climate neutrality – from diesel engines with exhaust gas aftertreatment and gas engines to their use with sustainable fuels and hybrid systems to methanol engines and fuel cell systems. With ***mtu*** NautIQ, this also includes our ship automation products – complete propulsion and control solutions from the bridge to the propeller.



System solutions

PULLING MORE THAN 100,000 TONS OF STEEL TAKES MORE THAN A POWERFUL ENGINE

02

System solutions

A LIFETIME OF INTELLIGENT POWER SOLUTIONS

Refits
Refurbishment of propulsion and automation systems is a cost-effective way to preserve and improve valuable vessels. Our service include the supply of equipment, planning and implementation of the entire refit.

ValueCare services
mtu ValueCare ensures maximum performance and lasting value, with a complete portfolio of service and support solutions starting from genuine spare parts, training, ***mtu*** qualified technicians up to various overhaul solutions and our ValueCare Agreements (VCA).

Planning
We supply a complete propulsion concept. Our engineers provide extensive analysis, docmentation and risk mitigation services, as well as integrated mechanical, electrical and electronic interfaces.

Propulsion System Integration
We provide comprehensive engineering and technical support for the design and implementation of a vessel's propulsion system. Our application engineering team helps reduce design, installation and commissioning costs.

Propulsion Systems
mtu engines and propulsion systems are characterized by high power density, low weight, compact design, and mechanical and thermal robustness, as well as simple operation, straightforward maintenance and low life-cycle costs.

Integrated Automation System
Our Integrated Automation System ***mtu*** NautIQ allow operators to monitor and control the whole propulsion plant, the on-board power supply and the entire vessel. Our Automation Systems are versatile, user-friendly and modular.

Application overview

PROPULSION SYSTEMS TAILORED TO YOUR NEEDS

03

Offshore service and supply vessels
No matter how rough conditions are at sea: You have to get out there, and your vessels' availability must be guaranteed. So what you need are propulsion systems that are 100 % reliable, punctual and safe. We make sure they are: with engines braving even the harshest conditions, with preventive maintenance concepts designed for continuous heavy duty service and, with comprehensive support 24/7.

Coastal cargo, inland cargo and pusher towboats
Your competitive position and financial success depend on reliable, timely operation. We provide the foundation for this with high quality products, preventive maintenance programs, 24/7 service and as a result, maximum uptime.

Passenger vessels and ferries
Reliable operation of your fleet is a crucial factor in the success of your business. We lay the foundation by supplying high-quality products and delivering preventive maintenance programs designed to ensure continuous heavy-duty service. You can rely on our 24/7 service – and on securing maximum uptime for your vessel.

Offshore wind park crew boats
With its long-standing, strong commitment to the marine sector, we have always felt a particular responsibility for the environment – and have lived up to that responsibility in all aspects. That's what makes us the ideal partner for companies active in similar, forward-looking sectors – such as power generation from renewables.

Special vessels
From fire and rescue boats to research and survey vessels: No matter what specialized task your vessel performs, we can provide exactly the right propulsion solution – involving both high quality products and preventive maintenance programs for the highest level of reliability

Pilot boats
No matter how rough the sea state, ships have to be guided to harbor, so your vessel's availability must be beyond doubt. You need propulsion systems that are safe, powerful and fully reliable. We make sure your engines can brave even the harshest conditions.

Tugboats
Harbor and escort tugs must maneuver with high power, precision and speed in all situations. Our engines help you meet these requirements with broad performance maps, proven common-rail technology and sequential turbocharging. The result: impressive bollard pull figures.

Offshore converter platforms
Maritime conditions demand everything from the technology of offshore converter platforms. Around the clock, all systems must be redundant, low-maintenance and remotely operable. Our marine generator sets are reliable and proven for emergencies and are available with various safety designs and certifications.

FPSO, semi-submersible rigs, fixed and jack-up platforms
Our compact, powerful and reliable offshore power generator sets are designed to meet the demanding requirements of the offshore platform power supply where safety is paramount and where engines with high starting and operating reliability minimize the risk of personal injury and material damage.

Core technologies

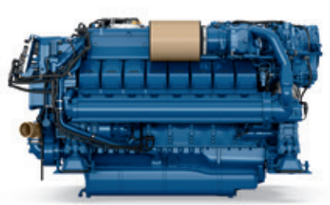
DECISIVE ACTION REQUIRES A STRONG HEART

04

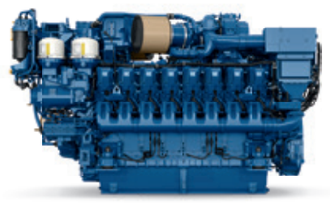
Core technologies

ALL ENGINES AT A GLANCE

For decades, thousands of our engines have been at sea, in rivers and lakes around the world. They perform reliably and efficiently as main or auxillary drive systems and provide energy as on-board power supply systems. Their performance, power and reliability has been proven time and time again. ***mtu*** engines for commercial marine are available in the power range of 720 - 9100 kW (966 - 12203 bhp).



mtu Series 2000
The powerful heart for maximum agility



mtu Series 4000
One of the most successful heavy-duty engines ever

mtu Series 1163
The proven, evolved engine for the marine industry

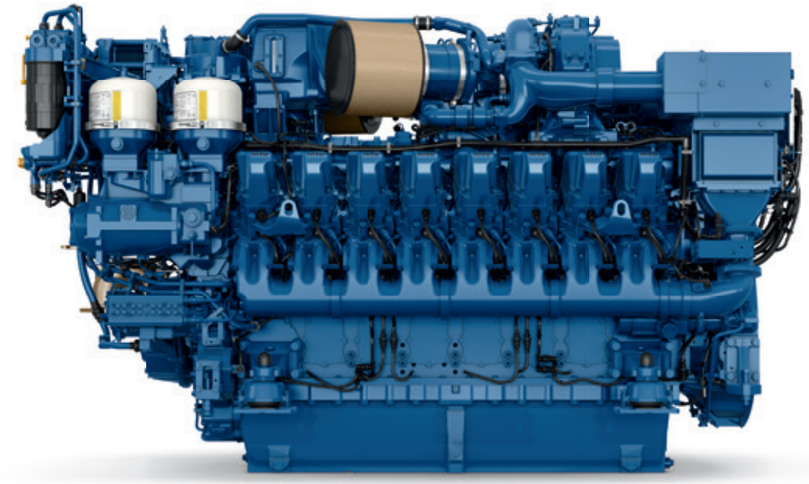
mtu Series 8000
The most powerful highspeed engine for the very highest demands

For detailed technical data scan the QR code

Analytics
We use the most diverse analysis and simulation tools to develop state-of-the-art propulsion solutions. These include vibration analyses, component strength verification and dynamic response simulations of entire propulsion systems.

Electronics
The latest generation of our electronic management system, ADEC (Advanced Diesel Engine Control) controls key systems such as fuel injection and turbocharging that affect engine consumption and emission levels as well as performance.

Fuel injection
We optimize fuel combustion in the cylinder by means of its electronically controlled common rail fuel injection system in combination with other technologies such as turbocharging.



Turbocharging
We develop and produce its own turbochargers for high-performance applications. Turbocharging helps achieve low fuel consumption and high performance across a broad range of running speeds.

Sustainable fuels
Fuels are key to a carbon-neutral future for energy and propulsion. We rely on HVO, methanol, and on other sustainable fuels produced using green, renewable electricity.

Low Lifecycle Costs
Our engines are fine-tuned to provide maximum uptime. Our long overhaul intervals of up to 96,000 hours ensure economical operation and reliable performance.

Mountings
Our engines are installed on special rubber mountings to reduce the transmission of structure-borne noise to the vessel's hull. Double resilient mountings are available as an option, and assist the single resilient mountings in achieving even more effective noise reduction.

Aftertreatment
As installation space is always restricted inside the engine room, our inhouse developed airless SCR (Selective Catalytic Reduction) solution is compact and maintenance friendly.

Generator Sets

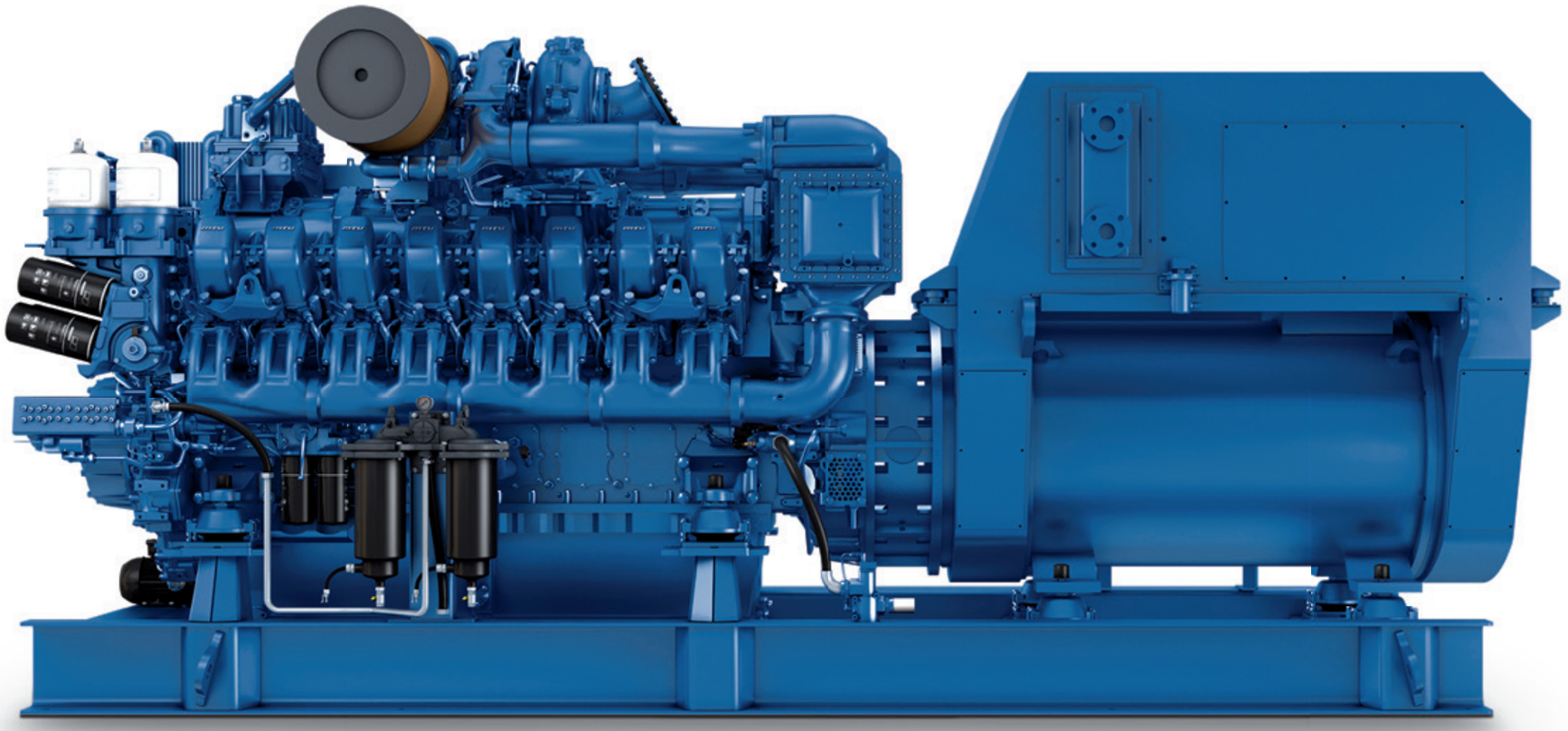
GENERATING POWER

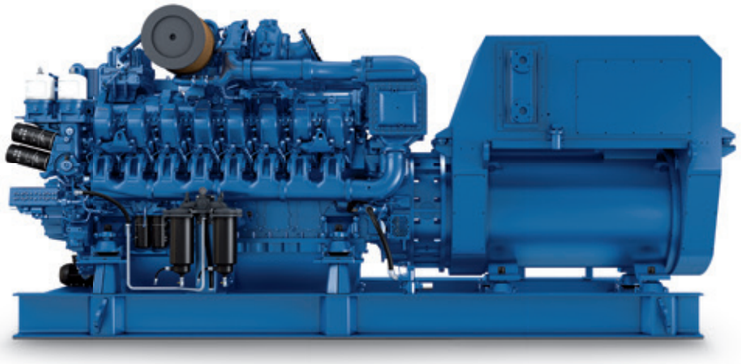
05

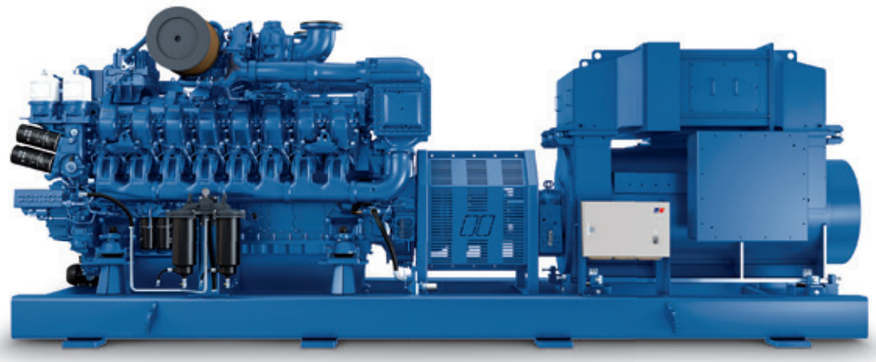
We offer a complete genset portfolio for commercial applications – from 5 to 3,200 kWe – for auxiliary and emergency power generation and diesel-electric propulsion. Obtainable as 50/60 Hz versions, our gensets feature numerous options and accessories such as soundshields, control panels, PTOs for fire fighting pump drives, etc. High uptime and long time between overhauls of up to 60,000 hrs ensure economical operation and reliable performance.

As a system supplier specializing in generator sets and automation systems, we configure complete propulsion solutions, implementing the best possible technologies for your needs. From cost-efficient pre-engineered standardized gensets designed and qualified by our central engineering headquarters in Germany to customized, advanced solutions as well as variable speed gensets - our quality and reliability have been proven in the field, all over the world, for decades.

Available for prompt delivery, our constant-speed gensets are easy to configure thanks to their modular design. This helps shorten project time frames while enabling our global network of partners and distributors to provide complete genset solutions backed by our factory engineers. Local content requirements can be met by means of global component sourcing and worldwide manufacturing options.







Variable speed generator sets

FLEXIBLE POWER FOR LOWER LIFE-CYCLE COSTS

Do you want a flexible system with advanced technology for super-efficient operation? Our variable speed gensets makes this possible, maximizing operational flexibility and minimizing operating costs. The patented Superior System Controller (SSC) determines the best operating point in the engine performance map in relation to the electrical power demand. And for customers who prefer to use a generator of their choice, we offer a precise simulation and calculation to ensure safe, economical operation.

Benefits:
- Less fuel consumption at part load, up to 15%*
- Longer maintenace intervals and up to 20%* lower maintenance costs
- Lower noise signature

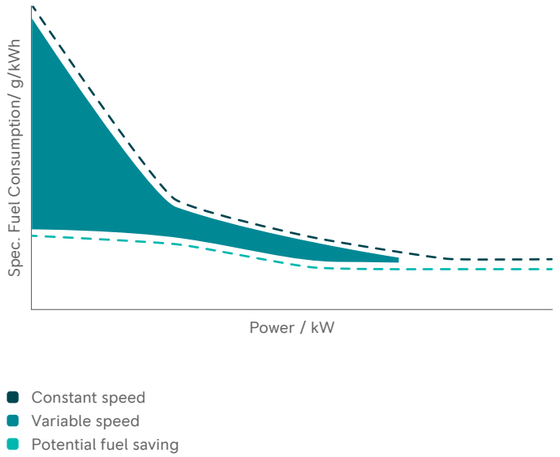
Flange-mounted or free-standing
We supply gensets with flange-mounted or free-standing generators on a common baseframe as per customer requirements.

Flange-mounted benefits:
- Cost effective solution
- Compact design saves installation space and offers more room for cargo or crew
- Easy service access inside the engine room

Free-standing benefits:
- Longest maintenance intervals based on sleeve bearings and maintenance-free, non-aging and heat resistant coupling
- Easy in-vessel serviceability

* can vary significantly depending on project / operation profile
(efficiency gain depends on system losses and generator operating curve)

Comparison of fuel consumptions

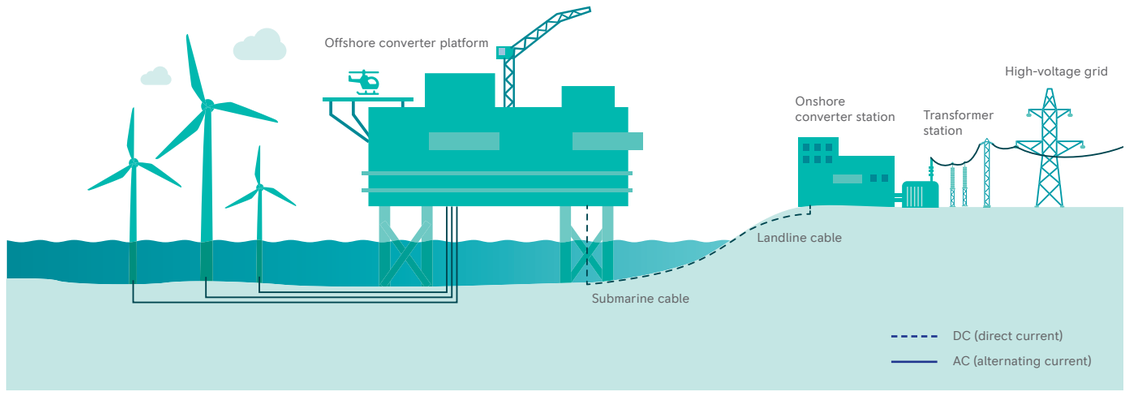


Rev counter showing variable range of RPM

Offshore wind converter stations

SAFEGUARDING SEA WIND ENERGY STABILITY

Innovative grid connection designs enable modern wind energy operations at sea to transmit power to the mainland much more efficiently. Offshore converter stations now play a key role as does the safe, sustainable and reliable supply of power.
That's where our power generation solutions enter the picture.



Our offshore wind energy portfolio comprises engines, generator sets, SCR packages and more.

Leveraging the skills and expertise gained from decades of offshore project experience, ***mtu*** diesel engines and generator sets are specifically designed to ensure the uninterruptible power supply of offshore converter stations.

Light, compact, rugged and highly efficient, they pack a lot of performance in very little space, making them an excellent choice for auxiliary/emergency backup power on the high seas.

Low emissions
Incorporating advanced selective catalytic reduction (SCR) exhaust aftertreatment technology, ***mtu*** Series 4000 engines are IMO Tier III certified to meet all relevant local emissions and environmental standards.

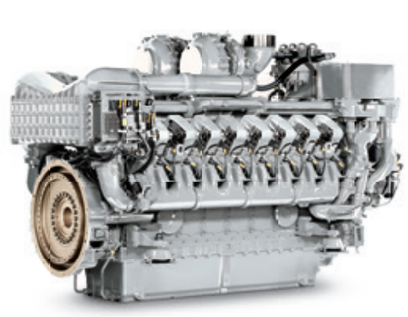
All-around support
With service sites located around the world, our team of experts is able to provide 24/7 support wherever and whenever needed, including with our specially trained offshore wind operations staff. In addition to maintenance and repair support, we also offer a range of data analysis as well as remote services.

Flexibly customizable
Featuring a modular design, mtu generator sets can be customized to seamlessly integrate with virtually every type of offshore converter platform setup. Our comprehensive offshore power generation portfolio also includes compact and highly flexible SCR packages that can be tailored for individual needs.

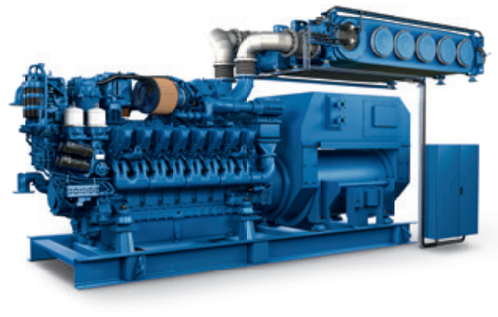
We specialize in complete, integrated and thoroughly tested power generation solutions from a single source. Everything we develop is designed to ensure optimal long-term performance, thereby prolonging preventive maintenance and overhaul intervals.

Our offshore wind farm portfolio
- Diesel engines
- Generator sets
- SCR packages
- Documentation of hardware & software configurations
- Offshore wind park crew boats*

* For more on our mobile offshore wind park solutions, see pgs. 12 and 13



mtu Series 4000 marine engine



Marine generator set ***mtu*** Series 4000 with SCR solution

Ship automation systems

POWER UNDER CONTROL

06

mtu NAUTIQ PORTFOLIO
THE FUTURE OF MARINE CONTROL

INTEGRATED SHIP AUTOMATION AND PERFORMANCE & EQUIPMENT HEALTH MANAGEMENT SOLUTIONS

mtu NautIQ Master
mtu NautIQ Core
mtu NautIQ Foresight

PROPULSION AND GENSET MONITORING & CONTROL SOLUTIONS

mtu NautIQ BlueVision NG
mtu NautIQ Genoline NG

DIGITAL SOLUTION

mtu Go

REMOTE CONTROL SOLUTIONS

mtu NautIQ CoDirect
mtu NautIQ CoOperate
mtu NautIQ CoPilot - Coming Soon!

mtu NautIQ

INTEGRATED SHIP AUTOMATION

mtu NautIQ Master is an Integrated Platform Management System and offers the optimal solutions to meet a wide range of requirements for all types and sizes of vessels. Typically used on complex commercial projects.

Scan the QR-code for more details about ***mtu*** NautIQ Master

Integrated Platform Management System (IPMS)
With marine design becoming more sophisticated, and more capability being integrated with fewer people on board, only proven designs and software functionality can truly meet the demands within modern project time scales and risk profiles. As world experts in the field of integration, we introduce ***mtu*** NautIQ Master, the latest evolution of our powerful IPMS solution, allowing more COTS product integration. It is a true System of Systems capable platform.

This powerful mix of ***mtu*** NautIQ Master distributed processing and highly redundant architecture, coupled to industry standard equipment and protocols allows for a truly supportable platform, with minimal obsolescence risk. This reduces platform cost, integration time and commissioning/installation issues, whilst retaining the survivability and power of the original ***mtu*** NautIQ Master, with its scalability and flexibility in terms of system architecture.

mtu NautIQ Core Alarm, Monitoring and Control System (AMCS) option is an entry-level system that offers a reliable and highly cost-effective solution and is designed using pre-engineered building blocks incorporating built-in expansion for future proofing. A selection of display systems are available to meet operational requirements and console design.

Scan the QR-code for more details about ***mtu*** NautIQ Core

mtu NautIQ Core has been specifically created to deliver Commercial Off-The-Shelf (COTS) solutions for all shipping sectors including: tugs and salvage vessels, ferries, offshore support vessels, inland waterway or pilot boats. The standard ***mtu*** NautIQ Core packages are future-proofed allowing for later integration of additional hardware, software and auxillary equipment through the vessels lifetime.

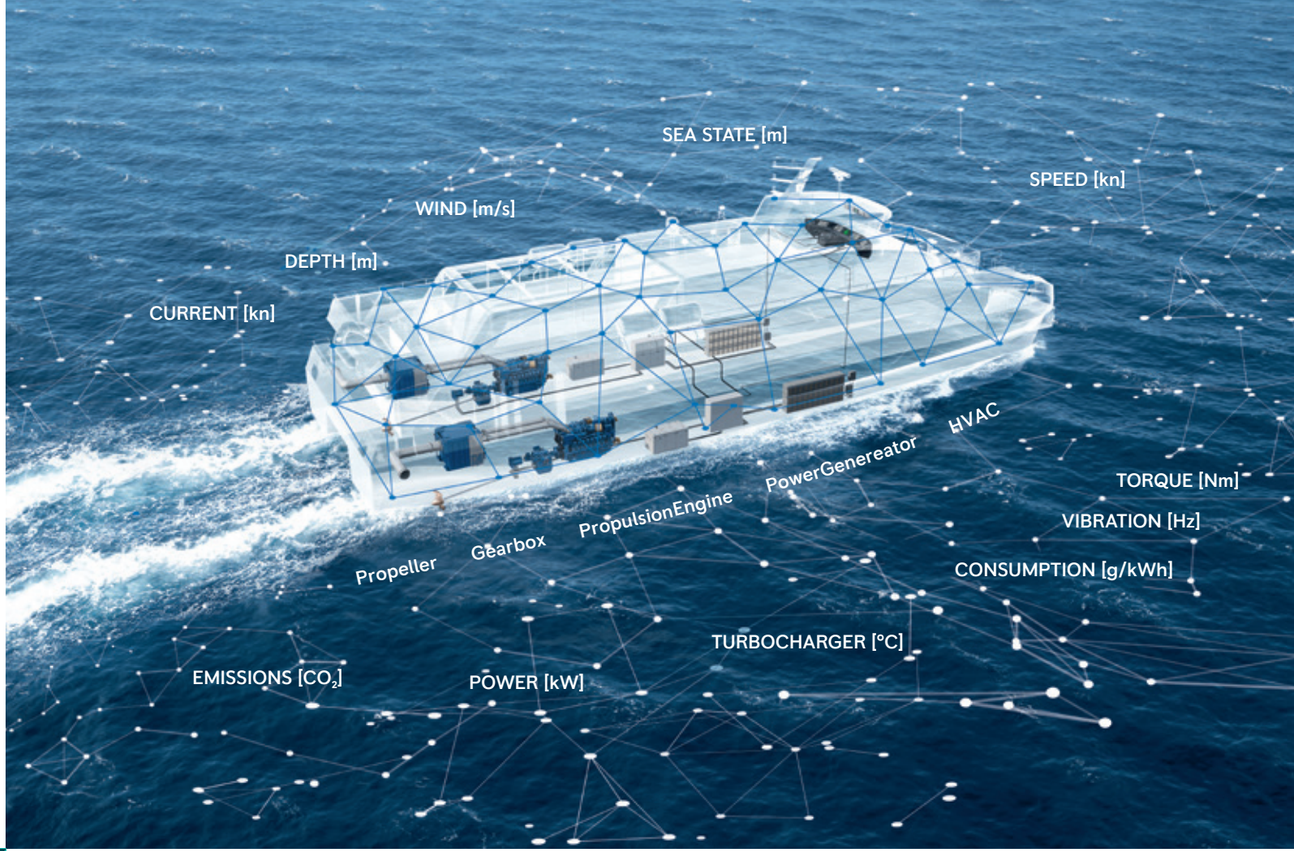
mtu NautIQ Foresight

FROM BRIDGE TO PROPELLER

mtu NautIQ Foresight is an Equipment Health Management System. It allows you to monitor and have full control over the technical condition of your vessel from bridge to propeller.

The system maximizes the availability of your vessel, and you can even use it to monitor a whole fleet. By providing system status at a click, ***mtu*** NautIQ Foresight makes availability management easier than ever before. It provides support for the maintenance and upkeep 24 hours a day, 7 days a week – and thus helps minimize vessel downtime.

With ***mtu*** NautIQ Foresight you can collect and analyze data from ***mtu*** systems and third-party key components on the vessel, considering additional factors, such as navigational data.



Improved vessel availability

It's all about uptime. Real-time data analytics combined with artificial intelligence and machine learning techniques reduce unplanned downtime and maximize asset availability.
The real-time sensor data on vibration, pressure, and temperature is compared with long-term figures for the respective operating conditions and ideal characteristic curves. The results enable optimum operation.

Peaked performance

Monitoring fuel oil consumption and measuring torque is the first step to understanding the state of the vessel. This information, combined with the health monitoring data, allows you to analyze and improve the vessel's performance. Weather and navigational data let you draw conclusions about factors such as hull condition. Additionally, the optimal speed can be determined. This performance monitoring system enables fuel cost optimization and contributes to reduced emissions.

Optimized life cycle costs

Maximized availability and peaked performance optimize life cycle costs. Due to the improved plannability, downtimes are reduced to a minimum and unplanned maintenance is turned into planned maintenance.

Reduced emissions

mtu NautIQ Foresight bundles all operational data in one system. The combination of engine, power generation, navigational and weather data enable in-depth analytics of the vessel's movement and its performance. In the next step, the operation of the vessel can be adjusted to run in a more efficient and environment-friendly manner.

Scan the QR-code for more details about ***mtu*** NautIQ Foresight

mtu NautIQ BlueVision NG

PROPULSION AND GENSET MONITORING & CONTROL SOLUTION

Our standard automation systems ***mtu*** NautIQ BlueVision NG are delivered ready for installation, perfectly matched to your propulsion system, giving you a complete package where everything is fine-tuned to your requirements: powerful engine performance, maximum efficiency, uncompromising reliability and green credentials.

The modular system design allows for a flexible configuration: intelligent data technology ensures reliable data exchange and reduces the need for excessive cabling. Optimized interfaces between the propulsion and automation systems result in complete integrated solutions that guarantee security, efficiency and reliability – and all from one source.

mtu NautIQ BlueVision NG
The extended monitoring and control system is available for ***mtu*** Series 2000 and Series 4000 engines. It comes with 1 to 4 shafts / engines and fixed pitch propeller (FPP) propulsion plants.

Our highly developed hardware is individually configured according to the respective application and customer requirements. That means components are designed with Commercial Off-The-Shelf products (COTS) to create modular, scalable solutions that work for you.

1 Control Lever (CL)
2 Color Display MTD2

Features:	***mtu*** NautIQ BlueVision NG_Basic	***mtu*** NautIQ BlueVision NG_Advanced	***mtu*** NautIQ BlueVision NG_Avantgarde
Monitoring	■	■	■
Alarms	■	■	■
Control (remote, automated and manual)	■	■	■
Propulsion Control ***mtu*** Series 2000/4000 & FPP	■	■	■
Classifiable		■	■
Operator station			■

mtu NautIQ CoDirect

WHEELHOUSE CONTROL FROM THE BEST VANTAGE POINT

mtu NautIQ CoDirect is a wireless, remote-helm system that controls a vessel's engines, steering and transmission as well as payload functions like pumps, winches or cranes. It allows marine crews to operate a vessel from a distance of up to 1,000 meters – from the safest vantage point

More visibility for tugboats and pushboats
In many cases, tugboats have limited visibility from the wheelhouse during complex maneuvers, such as dockings. ***mtu*** NautIQ CoDirect allows crews to perform the primary control from practical vantage points, such as the dock or the deck of the main vessel. For pushboats, ***mtu*** NautIQ CoDirect allows the master to control thrusters from the front of the barge train.

Enabling safer emergency response
Dangerous response missions such as marine fires, spills and search-and-rescue operations can benefit from using a remotely controlled vessel to avoid putting crews at risk. Survey and offshore operations in hazardous environments also require reduced operational risk.

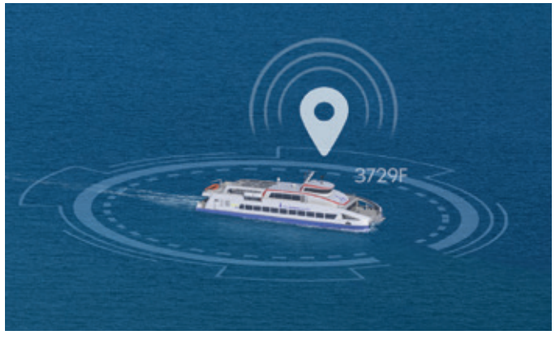
More efficiency for tenders
Tenders ferrying people and cargo from ship to ship or a harbor to a superyacht can be operated remotely, with minimal crew.

mtu NautIQ CoOperate is an optionally self-piloting ship navigation and command system. It enables off-boat remote command, including payloads on board, and offers situational awareness using cameras, sensors and other equipment, from a second location on another vessel or on shore.

Autonomous self-piloting capabilities
mtu NautIQ CoOperate consists of an onboard enclosure with flexible sensor integration and a ruggedized laptop. The system can also be used with the optional ***mtu*** NautIQ CoDirect beltpack for remote control when operated within 1,000 m of the vessel.

Where a secure link infrastructure is available, ***mtu*** NautIQ CoOperate allows vessels to be commanded from anywhere using IP radio, 4G networks, or satellite communications. The vessel can also move autonomously from waypoint to waypoint, execute a survey or search-and-rescue pattern, or match the course and speed of the mothership. The system can also be set for timed tasks, such as loitering at a waypoint or timed tasks.

Autonomous command applications
Autonomous command and control integrates with existing vessel systems and sensors to manage pre-planned and dynamically charted missions.



MORE POWER
LESS EMISSION

07

Hybrid system solutions

HYBRID DRIVE – THE BENEFITS OUT OF TWO WORLDS

The ***mtu*** Hybrid PropulsionPack offers different propulsion modes for each operation condition which will cause a perfect power availability in every scenario possible.

1 Silent cruising

Imagine a vessel which moves like by magic, with no noise, no vibration & no air pollution resolving into superior comfort. The silent mode offers your customers an enjoyable journey trough costal or nature reserve areas wothout the side effects of a conventional propulsion system.

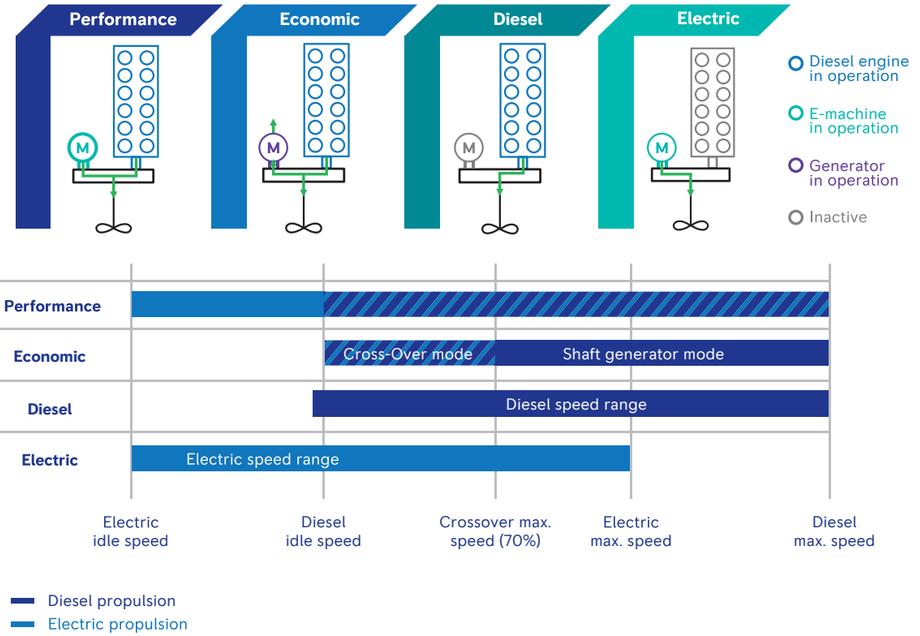
2 Performance

Combining the best out of two different worlds, the high torque of an electric machine and the superior power density of an combustion engine, is resolving into an compact high performance system.
Even the toughest jobs are not an obstacle for you and your crew.

3 Eco-friendly cursing

Live the green image and be a decarbonization pioneer within the commercial shipping community.

Participate of the newest Rolls-Royce developments to lower your carbon and your air pollution footprint.



Different hybrid modes fulfill all customer use cases
The propulsion modes for a vessel can be selected using a control lever. This lever allows the operator to choose between different hybrid modes. Depending on the selected mode, the engine provides the necessary power. On the other hand, the power supply modes can be selected on a display. This enables the operator to choose how the vehicle or vessel will receive power, whether it is from the diesel engine, electric machine, or both.

Fully integrated modular system
The ***mtu*** Hybrid PropulsionPack offers a fully integrated modular system out of one hand which addresses the top five requirements of shipyards:

- Quick commissioning
- Short lead time
- Full documentation
- Low cost of modifications
- Fast response

Hybrid system solutions

HIGHER PERFORMANCE FEWER EMISSIONS

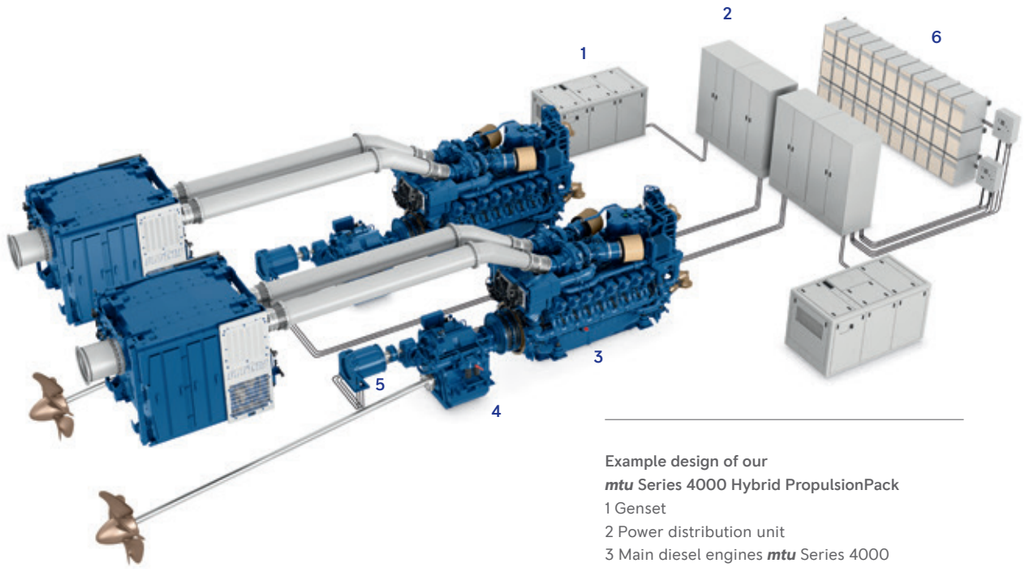
mtu Hybrid PropulsionPacks based on the proven ***mtu*** Series 2000 and 4000 are ideal for more flexibility and maximum ease of use. Our hybrid solution not only reduces noise levels, emissions and vibrations on board, but also improves efficiency, dynamics and comfort.

Maximized comfort
Reduction of vibrations, noise and air pollution through pure electric or diesel electric propulsion modes

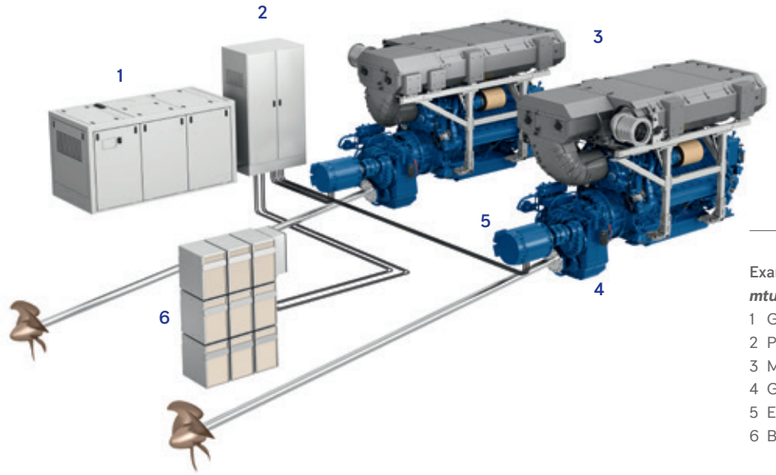
Eco-friendly cruising
Local zero emission battery powered cruising standby and anchoring

Efficiency
Fuel savings and CO_2 reduction possible via intelligent propulsion and energy management modes. (Up to 15% depending on configuration and operation profile)

Performance
Optional optimized acceleration behaviour and maximum power. Easy realization of downsized propulsion designs.

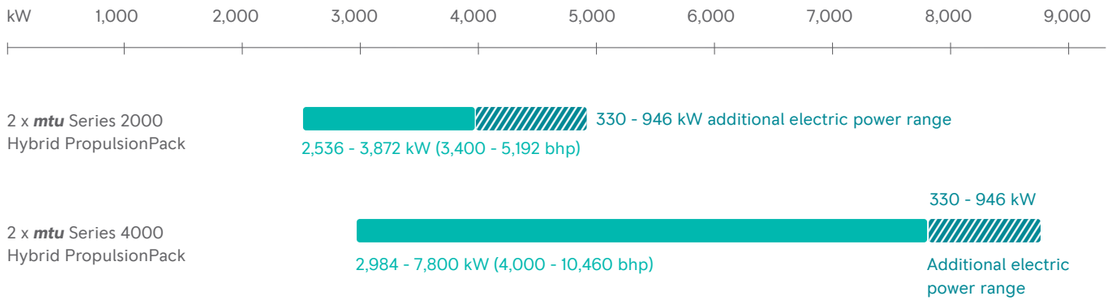


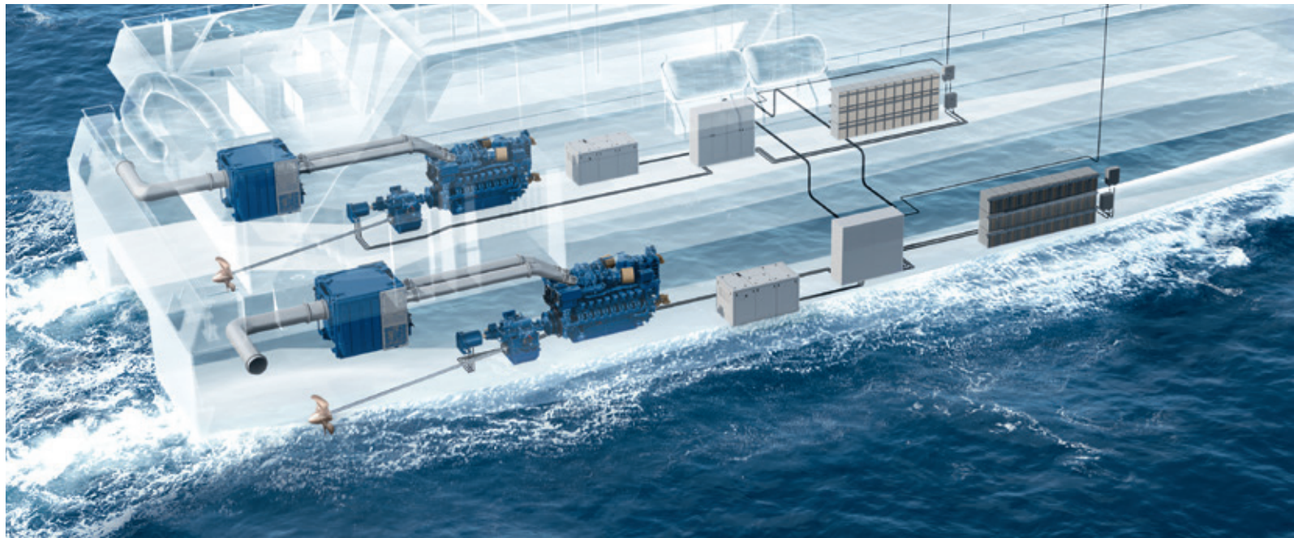
Example design of our *mtu* Series 4000 Hybrid PropulsionPack
1 Genset
2 Power distribution unit
3 Main diesel engines ***mtu*** Series 4000
4 Gearbox
5 Electric motor module
6 Battery module



Example design of our *mtu* Series 2000 Hybrid PropulsionPack
1 Genset
2 Power distribution unit
3 Main diesel engines ***mtu*** Series 2000
4 Gearbox
5 Electric motor module
6 Battery module

Full range of power





Emission reduction technologies

WORKING WITH A CLEAR CONSCIENCE

Operating on the water means working in a sensitive environment. Assuming responsibility for protecting the water and air and keeping them clean is second nature to us. We have always played a leading role in developing environmentally friendly engines and, in particular, solutions for reducing emissions. Since we have all the relevant key technologies bundled within our company in addition to our core business of building engines, we have been and will always be leaders in this field. Our engines are an embodiment of the most state-of-the-art technology available.

SCR solution

As installation space is always restricted inside the engine room, the inhouse developed airless SCR (Selective Catalytic Reduction) solution from ***mtu*** is compact and maintenance friendly. Besides easily accessible doors for replacement of the SCR catalysts, the system also features an integrated mixing pipe and dosing units. The integrated mixing pipe and DEF (Diesel Exhaust Fluid) dosing allows the shipyard highly flexible pipework between the engine and the SCR box. Additional space to fit the exhaust gas aftertreatment is reduced to a bare minimum. Amonia slip is prevented under all operating conditions by a closed loop regulated control system.

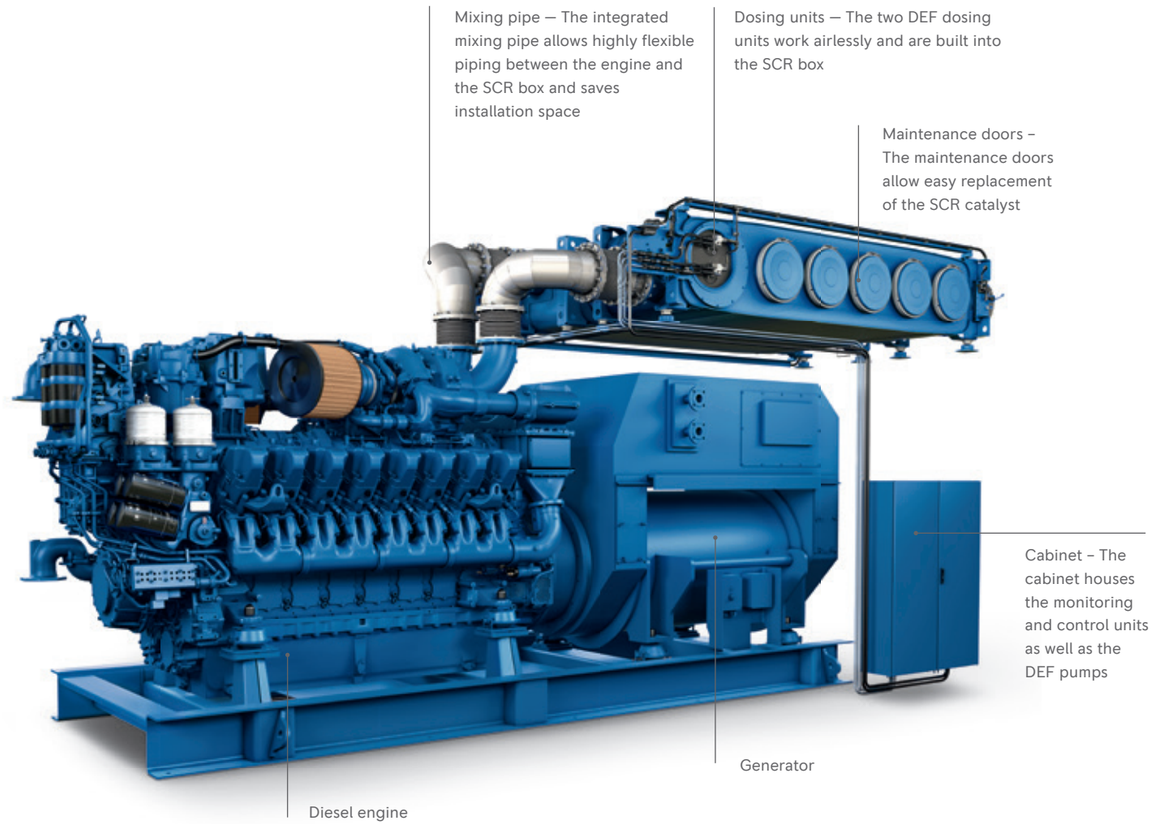
Besides the exhaust emissions related features, our SCR system also reduces noise.

SCR – the ideal solution for the marine world

When using EGR (Exhaust Gas Recirculation) technology, the quality of the fuel is essential. Fuel with more than 15 ppm sulfur will lead to the formation of sulfur acid in the EGR cooling process. Sulfur acid will cause substantial engine failures over time. As many vessels operate worldwide, especially in the offshore service and supply business, ***mtu*** evaluates SCR as the preferred solution to maintain reliability of our engines and the safety of your vessel and crew. SCR technology allows operation with lower fuel quality.

Developing all major key technologies inhouse like, SCR, EGR, turbocharging and common rail fuel injection, means we are able to shape the ideal solution to meet IMO III and EPA Tier 4 emissions regulations.

At ***mtu*** we treat EGR as the ideal solution for applications like mining or oil&gas onshore, but within the marine world we are convinced that SCR technology grants much higher availability and component lifetime.



Diesel-mechanical propulsion solution or generator set with SCR box

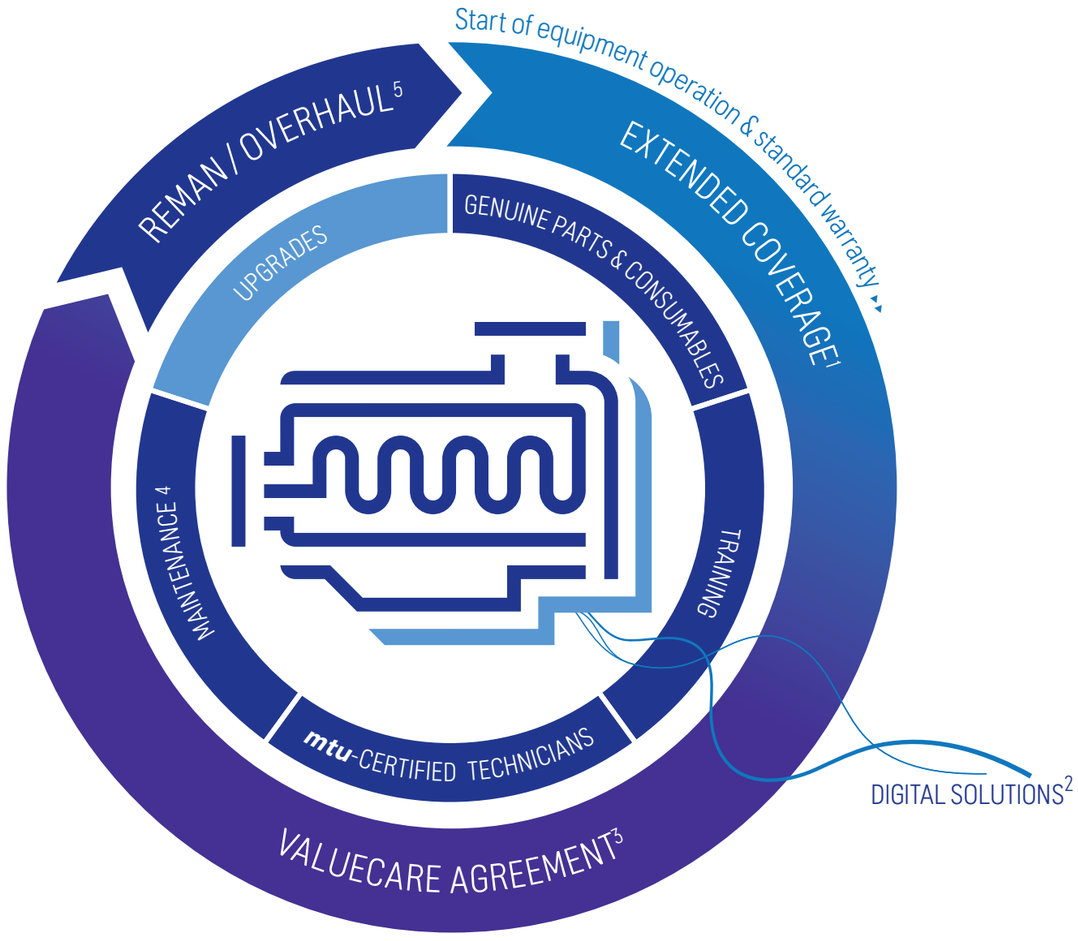
mtu lifecycle solutions

MORE UPTIME
LESS STRESS

08

mtu lifecycle solutions

SERVICE SOLUTIONS DESIGNED AROUND YOUR PRIORITIES



1 Avoid the unexpected with added protection beyond the standard warranty.
2 Make better decisions faster with digitally-enhanced tools.
3 Maximize availability and optimize lifecycle costs with a ValueCare Agreement.
4 Improve system performance and extend equipment life with on-demand support.
5 Keep a good thing going with reman/overhaul solutions.

mtu ValueCare agreements

FOCUS ON YOUR OPERATIONS LEAVE THE REST TO US

You've got a tough job. With us as your partner, you'll get the power, performance and peace of mind to get it done right. The digitally connected power systems of our ValueCare agreements make it easy to keep your business running smoothly and reduce total cost of ownership by maximizing uptime, optimizing lifecycle costs and helping you avoid equipment-related business disruptions through preventive maintenance.

Service solutions designed around your priorities
mtu ValueCare agreements make it easy to optimize lifecycle costs, maximize uptime and devote more time and resources to your core business, with tailored solutions to move your business forward.

Bronze

Ensure parts availability and price stability

- Digital connectivity (***mtu*** Go Connect) and access to ***mtu*** Go platform
- Automated delivery of parts (preventive) at a predefined rate based on operating hours
- Preventive maintenance labor options to fit your business needs
- Dedicated support for technical issues

Silver

Eliminate unexpected maintenance costs

- Proactive maintenance planning, troubleshooting and remote engine health monitoring
- Fixed pricing per operating hour for maintenance and repairs
- Key corrective maintenance components always in-stock at our main warehouses
- 24/7 standby service with remote technical support

Silver also includes all benefits of Bronze level

Gold

Maximize operational uptime

- Operational uptime commitment to meet or exceed your availability targets
- Regular supervision by local service partner (e.g. monitoring of parts stock, improvements)
- 24/7 emergency assistance with on-site support
- Monthly reports, including availability and average repair times
- Asset health monitoring
- Annual performance meetings and trend analysis with us to address technical updates, engine fleet data, operational optimization and more

Gold also includes all benefits of Silver & Bronze levels

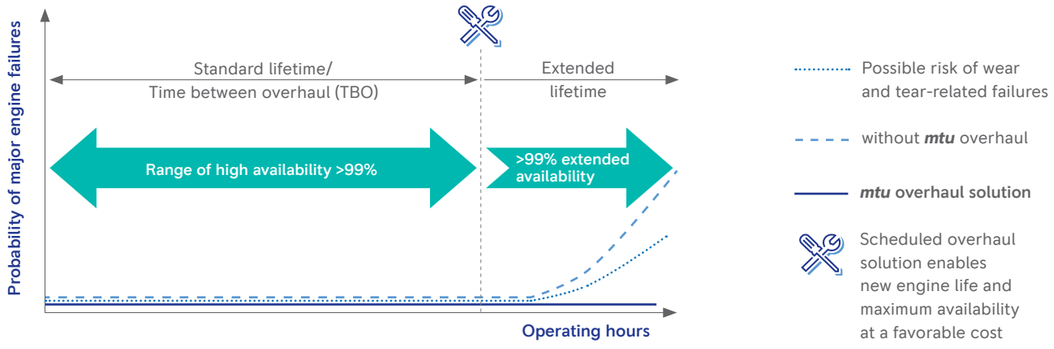
mtu lifecycle solutions

WHATEVER YOUR CIRCUMSTANCE – WE'VE GOT YOU COVERED

mtu engines are built to last thanks to high engineering standards and an unwavering commitment to service and support. ***mtu*** also provides solutions that enable your engine to run even longer after its productive service life.

Provided by the same experts that originally built your engine, ***mtu*** reman and overhaul solutions make it run like new again. How? By delivering the same high standards of performance, service life and quality as with new mtu products. What's more, we offer fixed pricing and turnaround times up front along with a full factory warranty.

In addition to our factory remanufacturing offer, you can also choose from three different overhaul solutions, including in-situ options directly inside the ship. While the decision for a reman or overhaul solution is determined by a variety of factors, including the engine series and type, you can always count on one thing: high-quality results.



mtu reman solutions – optimizing uptime and efficiency

Exchange and save
To reduce downtime, many ***mtu*** engines can simply be exchanged for a factory remanufactured unit – without waiting. When you return your original core, we give you credit based on its technical condition. We even handle the total costs to replace it, thereby protecting you from any unforeseen costs. We also offer swing engines to keep your operation running if servicing requires engine removal. ***mtu*** reman is available for the ***mtu*** Series 2000 and 4000.

Environmental benefits
Restoring end-of-life products rather than discarding them minimizes the need for raw materials and energy to produce new parts. It also significantly reduces waste and CO_2 emissions. This efficient use of resources and energy not only benefits the environment. With many engines, the process can be repeated multiple times to greatly extend the life span of these non-renewable products.

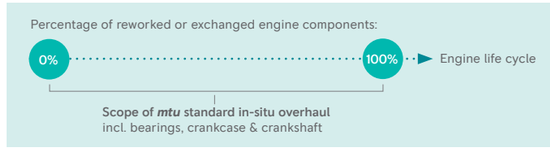
Your engine has a unique history that takes into acccount everything from its specific operating conditions to how it integrates with your existing equipment. In order to safeguard its continued reliability and performance, a customized overhaul at an ***mtu*** factory is of vital importance.

mtu factory overhaul solutions are also conducted by the experts that originally built the engine. The same rigorous standards as with our factory remanufacturing process are applied. In essence, we breathe new life into your engine, restoring it to a like-new condition. Whether for ***mtu*** Series 183, 396, 493, 538, 595, 652, 956 and 1163 or for ***mtu*** Series 2000 and 4000, you can expect an overhauled product that delivers the same high level of performance, service life and quality as a new one. From the gearbox to the automation, electronics and loose parts (e.g. oil cooler), the entire unit is fully restored.

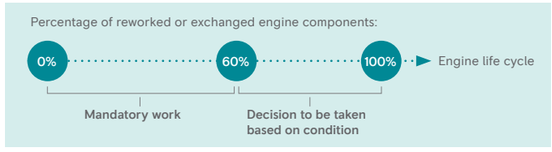
mtu in-situ overhaul solutions directly inside the ship – saving time and costs while benefitting the environment.

In addition to factory-based overhauls, we also offer in-situ overhaul solutions directly inside the ship. Our in-situ overhaul solutions are ideal when circumstances do not allow engine removal from the vessel. With our in-situ options, you can choose between a comprehensive standard overhaul or a more basic, condition-based service.

mtu standard in-situ overhaul
This comprehensive offer covers the replacement, overhaul and/or reconditioning of all engine components. The work performed fully complies with overhaul manual and maintenance specifications. The engine's service life is extended by a full cycle before the next scheduled overhaul.



mtu condition-based in-situ overhaul
With this more basic in-situ offer, replacement and overhaul of a defined scope of parts and components is mandatory. A list of other parts and components are also examined to determine whether to overhaul, exchange or continue using them. This option can potentially reduce the work scope, downtime and costs.



mtu lifecycle solutions

EXTENDED COVERAGE PROTECT YOUR INVESTMENT

Agreement start and duration

* See your EC Terms & Conditions for details

Costs covered[2]
In case of corrective claim: material, labor, travel costs (optional)

Covered equipment
mtu engine, gearbox, automation system (only if ***mtu*** scope of supply)

[1] Maximum validity period limited by extended warranty end date / max. operating hours, whatever occurs first
[2] Exclusions: e.g. Removal & reinstallation of engine, gearbox etc. and all preventive maintenance

Place of Performance
At authorized ***mtu*** service partners, up to worldwide coverage possible

Deductible
EUR 500 per repair visit and propulsion line

Flexible options and local support to suit your needs (e.g. operating hours)

100 % genuine parts and components

Protection against unexpected repair costs

Whether it's connecting you with a local service partner or assigning an urgent problem to a dedicated team of our experts, we're ready to assist you – wherever you are, whatever you need.

Europe, Middle East, Africa +49 7541 90-77777
Asia/Pacific +65 6860 9669
North and Latin America +1 248 560 8888

info@mtu-solutions.com

mtu lifecycle solutions

GENUINE SPARE PARTS

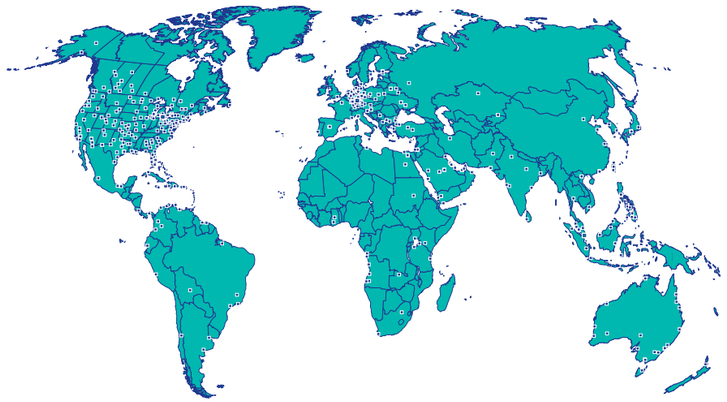
Only we can guarantee genuine spare parts that are designed, tested and approved specifically for ***mtu*** engines and systems to reach maximum uptime.

Genuine parts maximize performance, prolong engine life and meet today's strict requirements (e.g. emission regulations), all thanks to years of intensive research and development, quality audits, and progressive modifications — making them the best possible match for your engine and guaranteeing state-of-the-art technological fit. We offer a supply chain management, optimizing your purchasing and ordering processes.

Take advantage of broad benefits of *mtu* genuine spare parts:
- Engineered to secure high engine reliability and availabilty
- Value sustainability of your equipment / the only parts that live up to our standards
- Factory / OEM warranty coverage incl. professional service support
- Long-term supply solutions through the entire equipment lifetime
- State-of-the-art Parts Logistics Centers

Non-genuine parts are simply not worth the risk of endangering your mission.

Whenever and wherever you need expert support, our specialists are available. Our global service network of more than 1,200 locations – backed by our cutting-edge parts logistics centers – provides you this assurance. To find your local distributor, visit www.mtu-solutions.com.



More than 1,200 service locations worldwide.

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