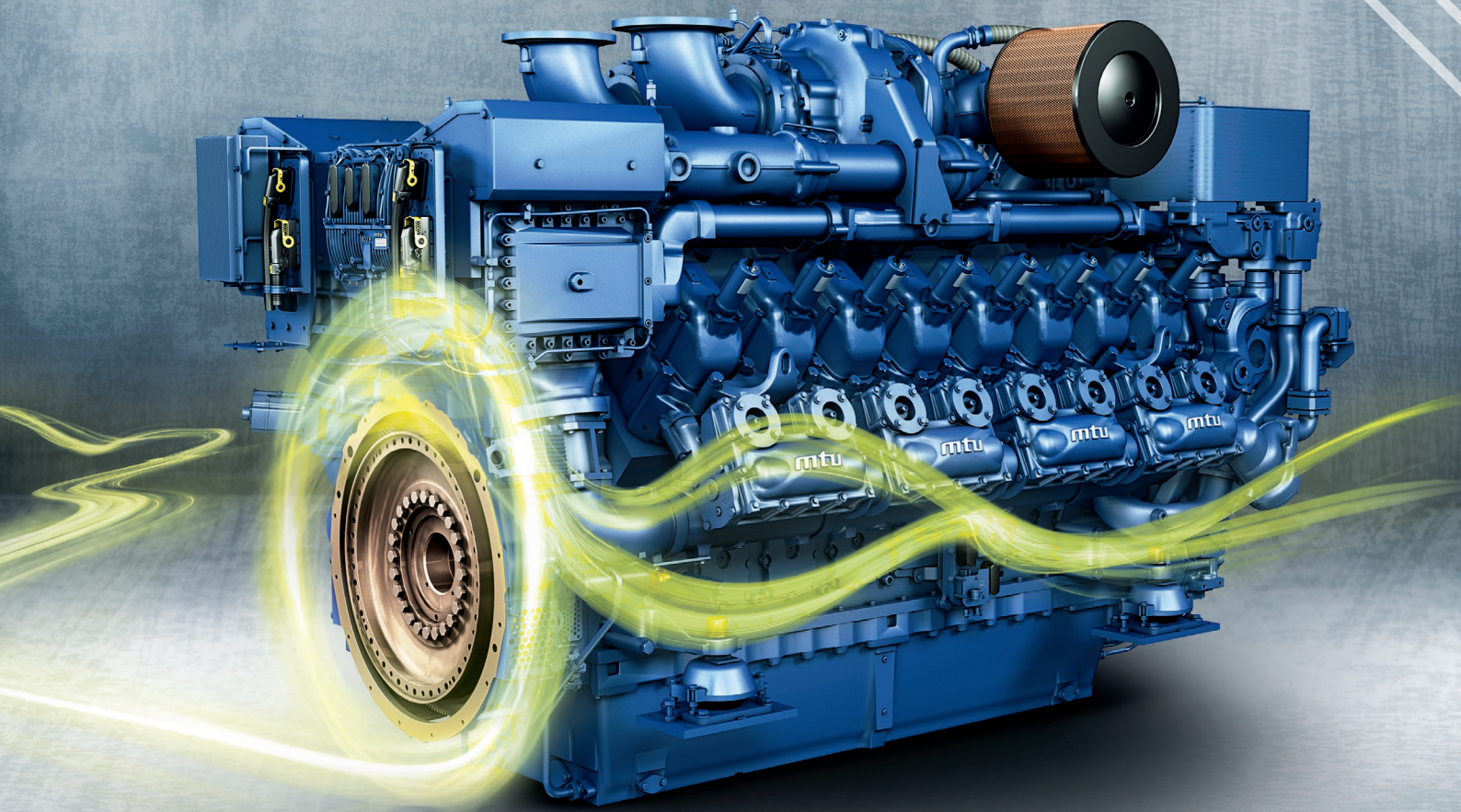




Marine Commercial

# SERIES 4000 M55RN PURE GAS ENGINE



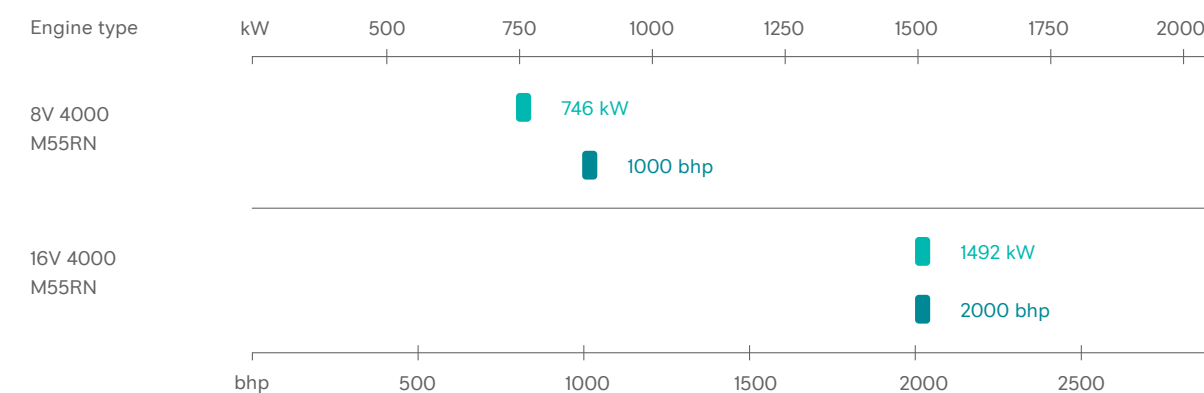
A Rolls-Royce  
solution

# A TOUGH ENGINE FOR A GREEN TOMORROW - THE NEW SERIES 4000 M55RN.

More than 20 years ago, in 1996, the first Series 4000 marine engine was presented at SMM exhibition in Hamburg. Since then, the Series 4000 is trusted in numerous applications.

With more than 40,000 Series 4000 engines sold worldwide we gained experience from more than 180,000,000 operating hours which were directly fed into the development of our brand new pure gas engine. As an expert for tough applications like mining, oil&gas, rail and marine, we were always ready to go the next step - ahead of

everyone else. This is just as true today, as it was in 1996 when we introduced the first high-speed diesel engine with common rail fuel injection. In 2016 we presented the only high-speed pure gas engine from 746 - 1492 kW (1000 - 2000 bhp).



- 1 12V4000 GS L64 gas generator set for distributed energy systems - year 2014
- 2 4000 M03 IRONMAN marine engine - year 2007
- 3 16V 4000 M55RN - the combination of a well proven marine engine and decades of gas system expertise - year 2016

# DIESEL PERFORMANCE. GAS BENEFITS.

**The new Series 4000 M55RN**

Our Series 4000 M55RN for commercial marine applications is the latest marine engine of the powerful Series 4000 family. When designing the Series 4000 M55RN we kept three topics always in our mind: Life-cycle-costs, performance and environmental friendliness.

We used our legendary IRONMEN engines as a basis for the development of our pure gas engine. The engine is equipped with a multipoint gas injection system, a dynamic motor management system and an advanced turbocharger design. The multipoint gas injection system is designed to enhance the engine's dynamic acceleration behaviour to match the performance of modern diesel engines.

**First single-fuel gas engine for FPP**

The wide rpm range and engine map ensures that fixed pitch propellers can be used in the propulsion design. The result is a cost efficient and less complex propulsion system compared to controllable pitch propellers or electrical propulsion systems. A special safety concept has been developed to allow the engine to be integrated into a "gas safe" machinery space. The simulation of real-life manouvres at the test bench confirmed a dynamic acceleration comparable to a high speed diesel engine.

**Gas engine is part of Rolls-Royce's Green and High-Tech Programme**

The emissions of the new *mtu* gas engine are significantly below the current emission limits specified in IMO III even without exhaust gas aftertreatment system. Particulate mass, for example, is below the detection level. The gas engine emits no sulphur oxides and only small quantities of nitrogen oxide.

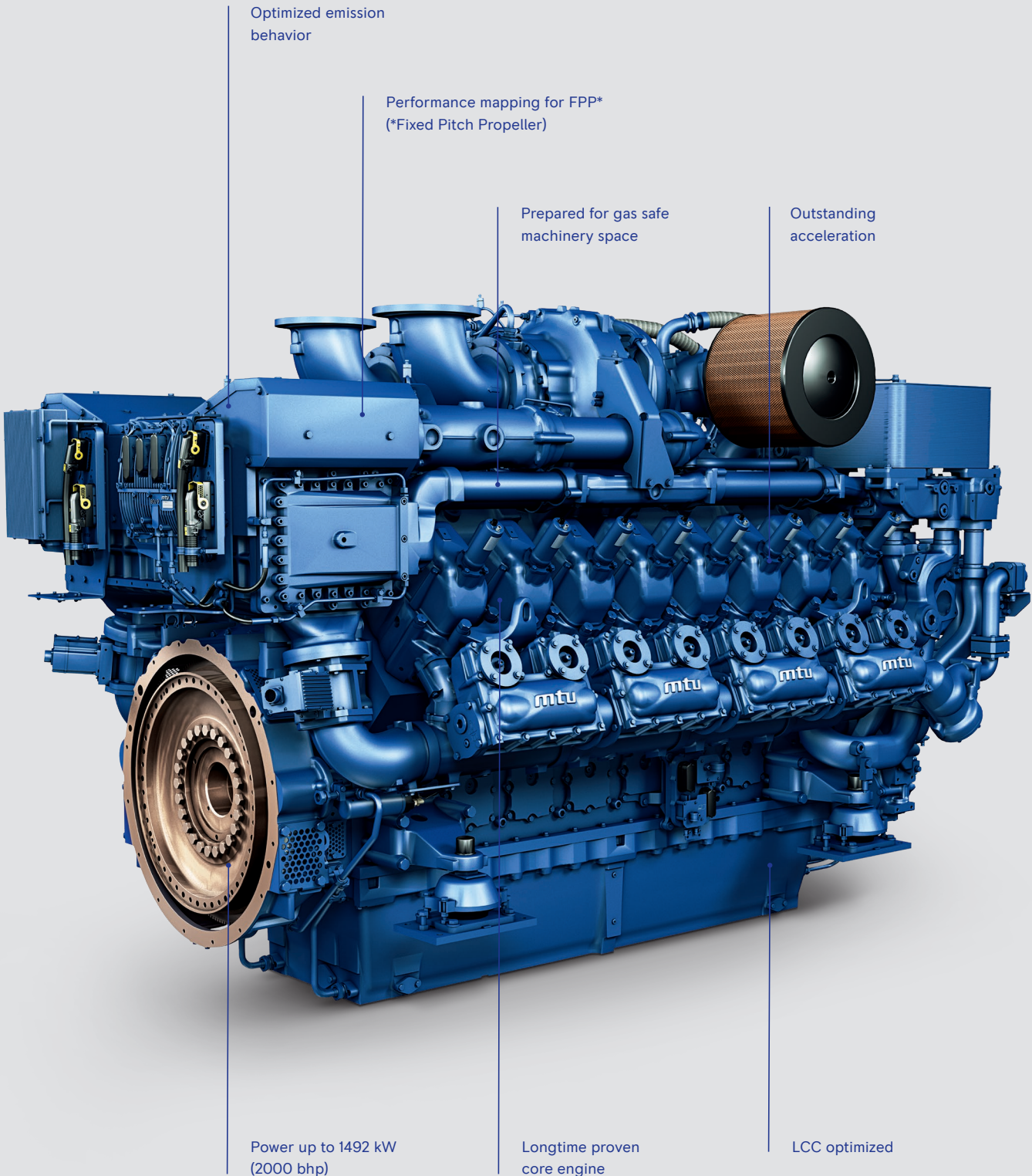
The new gas engine is part of Rolls-Royce's Green and High-Tech Programme. As such, Rolls-Royce is making a targeted investment in environmentally friendly solutions of the future aimed at reducing pollutant emissions and the consumption of energy and raw materials.

**Our experience and understanding of systems:**

We help our customers to integrate the engine and gas regulating unit (GRU) into their vessel design. During the design phase of any given individual propulsion system, our engineers provide you and support that is unique anywhere in the world. It's this expertise that we gladly make available to you.

| Engine model             |           | 8V 4000 M55RN | 16V 4000 M55RN |
|--------------------------|-----------|---------------|----------------|
| Power range              | kW        | 746           | 1492           |
|                          | bhp       | 1000          | 2000           |
| Rated speed              | rpm       | 1600          | 1600           |
| Dry weight (engine only) | kg (lbs)  | 6044 (13325)  | 9800 (21605)   |
| Displacement             | l (cu in) | 38.2 (2331.1) | 76.3 (4656.1)  |
| Emissions legislation*   |           | IMO III       |                |

\* These engines meets the IMO III emission standards with no additional exhaust gas aftertreatment.  
IMO - International Maritime Organisation (MARPOL)



# FIRST FERRIES WITH SINGLE-FUEL GAS ENGINES COMMISSIONED IN DUTCH WADDEN SEA

For years, the maritime industry has been working hard to clean things up and minimize vessel emissions. Sustainable solutions are particularly in demand in sensitive ecosystems such as the Wadden Sea, which was declared a World Heritage Site in 2009. Dutch shipping company Doeksen is setting a good example: the first of two single-fuel, natural-gas-powered ferries has started operations. The new 70-meter-long catamaran is fitted with 16-cylinder Series 4000 gas engines from the Rolls-Royce brand **mtu**, each with an output of 1492 kilowatts, and ferries up to 600 passengers and 64 cars across the Wadden Sea at speeds of up to 14 knots.

Doeksen operates ferry services to the two islands Terschelling and Vlieland from its base in Harlingen. “We were looking for a new ferry concept that was both sustainable and innovative,” explains Paul Melles, Managing Director of Doeksen. After a strategic study, those responsible decided to build two smaller catamarans instead of one large ferry, which not only makes the timetable more flexible, allowing more services to and from Terschelling, but ultimately also boosting efficiency, thereby also lowering operating cost. The study recommended single fuel LNG (liquefied natural gas) as the fuel of choice with the option of using BIO LNG or LBG (liquified bio gas) in the future.

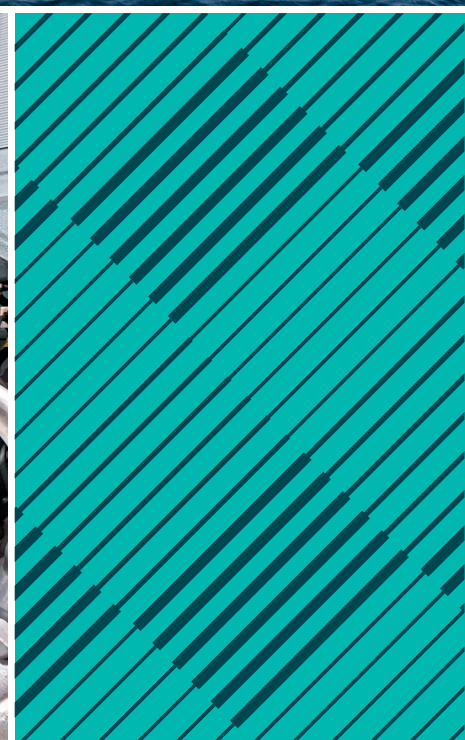
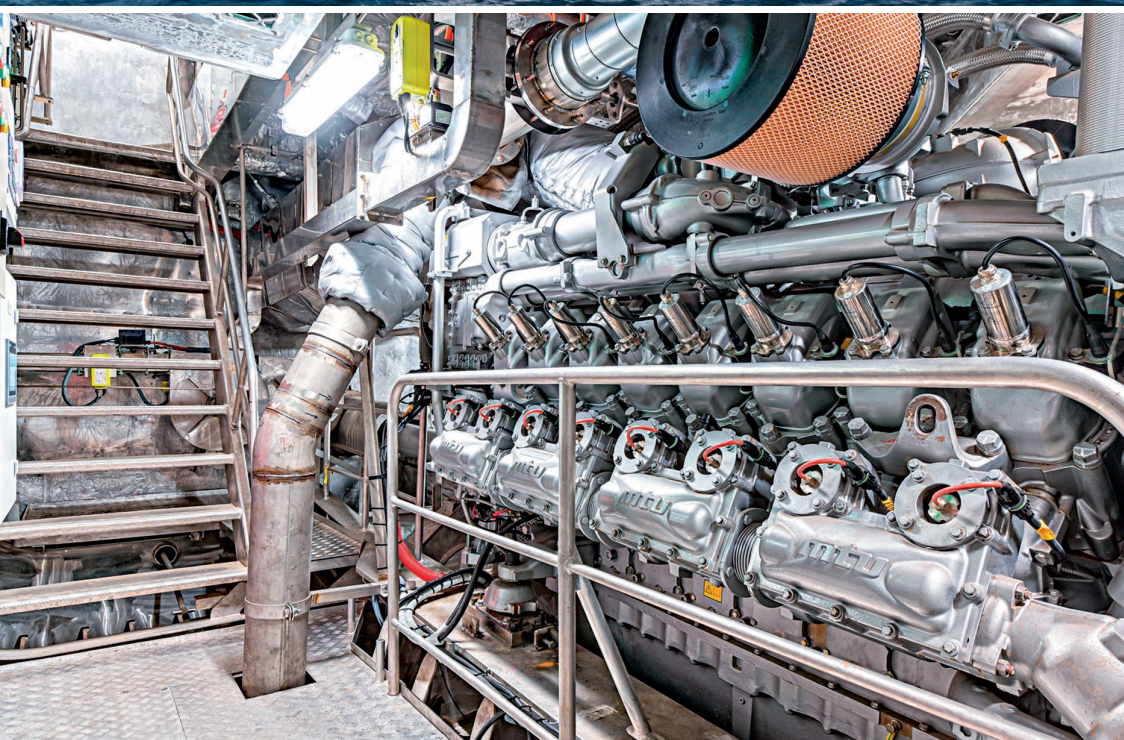
It is of great concern to Paul Melles to minimize the shipyard’s environmental footprint. “Climate change cannot be denied, and we simply have to do something”, he stresses. “We have a wonderful landscape and seascape right here on our doorsteps – the Wadden Sea is a world natural heritage site.” The shipping company plies these routes frequently, so it has to take care of the environment. “Full Electric propulsion was not an option for us yet, given the battery systems currently available on the market,” explains Melles. “Terschelling is 21 nautical miles from Harlingen, meaning we would have to recharge the batteries after every trip. We just don’t have that amount of time, and it’s why LNG is the optimum solution for us right now.”

Melles sees LNG very much as a transitional fuel. “This is a good, practical transition fuel, but a fossil fuel nonetheless, and thus finite,” he says definitively. At some point there will be working solutions for electric propulsion, perhaps also for hydrogen drive systems. But until then, he’s got another idea: bio-LNG – gas produced and liquefied in biogas plants. “This would enable another major reduction in CO<sub>2</sub> emissions,” he says. “There is the potential to obtain this in the area. And that’s what we’re looking into now: that’s our next goal.”

Compared with the gas oil normally used on the ships, liquefied natural gas has the advantage of giving off significantly less in the way of hazardous emissions.

The mobile **mtu** gas engine is already well below the current emission guideline limits (IMO III) without exhaust gas aftertreatment – for example, particulate mass is below the verification limit. It does not emit any sulphur oxides and only small amounts of nitrous oxides. “We know Rolls-Royce as a top-notch manufacturer of high-performance diesel engines by the brand **mtu** that are extremely reliable. And even though this is a completely new product that has yet to establish itself, we are entirely convinced of the merits of the new **mtu** gas engine”, Melles says.

The ferry has a residual heat recovery system which makes use of the thermal energy from both the engine’s cooling system and exhaust gas. The two Orcan units supply the entire electrical energy needs of the bow thruster system, as well as supporting part of the normal onboard electrical requirement. This avoids 318 metric tons of CO<sub>2</sub> per unit per year and saves 260,000 liters of fuel.





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