

Chilean marine service company SAAM has recently taken delivery of its first two tugs powered by GE Marine 8L250 GE engines (credit: SAAM)



# GE FOCUSES ON EMISSIONS COMPLIANCE WITHOUT EXHAUST AFTERTREATMENT

**U**S engineering giant GE is represented in many business sectors, but is strongly committed to delivering technical innovations to meet the demands of increasingly strict marine environmental regulations. The company's Power Conversion and Marine divisions offer a range of products for ship power applications, including diesel engines and gas turbines for propulsion and complex systems such as Combined Gas turbine Electric and Steam (COGES) for large commercial vessels such as LNG carriers, cruise ships and container ships.

The COGES system represents a high-efficiency approach to the production of all power required to meet vessel operating needs, including electrical power requirements and propulsion. The system can operate on a range of fuels and GE's marine gas turbines can meet IMO Tier III or US EPA Tier 4 requirements without the need for the installation of additional emissions reduction equipment.

With Tier 4 of the US Environmental Protection Agency (EPA) Clean Air Act having come into force for diesel engines built after 1 January 2016, however, GE's eight-year investment programme

is now delivering major benefits for the company's diesel engine technology. GE's latest engine can now meet both EPA Tier 4 and IMO Tier III emissions standards without the need for exhaust after-treatment by Selective Catalytic Reduction (SCR). NOx emissions from these engines have been reduced by 70 per cent compared to EPA Tier 2 and IMO II emissions limits whilst high engine efficiencies have been retained.

GE has been a leader in the manufacture of medium-speed diesel engines for more than four decades, with more than 15,000 units in marine operation throughout the world. This latest development, announced in New Orleans in December 2015, means that 250MDC engines are now available in 12- and 16-cylinder V configurations alongside an 8 cylinder in-line model, with a 6 cylinder in-line already planned for future development. "GE was the first in the industry to introduce a Tier 4-compliant marine engine," said Yuvbir Singh, vice president of global locomotive, marine, stationary and drill operations at GE Transportation. "We believe this expansion of our revolutionary Tier 4 engine will help

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our marine customers improve performance while continuing to comply with stricter emission regulations.”

The engines avoid the need for exhaust after-treatment through the use of exhaust gas recirculation technology, which reduces the formation of NO<sub>x</sub> at source, during the combustion process. For operators, this provides a number of advantages, including the removal of requirements to maintain a urea-based SCR system and the need to both provide and store the liquids required for its operation on board. The significant space requirement for SCR equipment is also eliminated, reducing the need to design for large machinery spaces in the ship.

Current ratings of 250MDC engines start at 2,250kW, for the 8L250 unit, with 3,500kW and 3,650kW (brake) being available from 12 and 16 cylinder products respectively. All engines are able to operate on fuels with sulphur levels compliant with the limits of ISO 8217:2010 MDO-DMB. The engines also have improved response times to step load increases and can be matched for optimum performance with either fixed or controllable pitch propellers.

Built on the foundations of GE's previous 250 engine series, the company announced its first order for five EPA Tier 4 emissions-compliant 12V250 engines in late 2014. These are providing generating set power for Oceaneering's new vessel, *MSV Ocean Evolution*. “The GE Transportation team is very proud of this major milestone marking the first delivery of our Tier 4 emissions compliant diesel engines,” said Sofiane Laoussadi, general manager of Transportation's Marine group. “Our investment in this technology helps our customers meet their emissions requirements in the most efficient manner possible today.”

Other customers have followed, including Reinauer Transportation, which has purchased two 12V250MDC Tier 4 units for its new articulated tug & barge. “We chose the new GE Marine engines because we like their robust design and component configuration,” said Christian Reinauer. “The engine closely matches the footprint of our current vessel design. This limits the amount of re-engineering while meeting Tier 4 emissions requirements without the complications of urea after-treatment.” Harvey Gulf International Marine has also ordered 12V250MDC engines for its new Robert Allen designed Multi-Purpose Field Support Vessel, being built by Eastern Shipbuilding Group in Panama City.

As a leading manufacturer of medium-speed engines, GE also produces the well-proven V228 series, in 8, 12 and 16 cylinder configurations. These offer continuous rating power outputs from 1045kW up to 3060kW. With high reliability and low operating costs, V228 engines have helped GE Marine engines to record over 150 million hours of operation. With rugged designs, most components can operate for up to 40,000 hours in marine applications before overhaul is required.

The engine is based on a modular concept to improve maintainability. To further assist maintenance, the crankcase incorporates large doors to enable easy access to crankcase components

including bearings. To simplify removal and replacement, components such as the camshaft and exhaust manifold are built in sections. The engine mainframe is based on a monobloc cast-iron construction and all pipework is externally mounted, both for ease of access and to prevent the risk of internal contamination, should any leakage occur.

Benefiting from GE's extensive experience in gas turbine technology, the engines are equipped with high-pressure turbochargers, which enables efficient engine operation across the load range. Dual modular pulse exhaust piping, fabricated in stainless steel for long life, also maximises the use of pulse energy to maintain thermal efficiency. Combined with the turbocharging, electronic fuel injection (EFI) systems provide accurate fuel control with low emissions characteristics. These EFI systems have been well proven in the field, with more than 150 million hours of engine operation in the past 10 years alone.

Pistons feature forged steel crowns and forced lubrication and cooling to ensure long life with a three piston ring configuration helping to achieve even pressure distribution. Master and articulated rods share a common journal connection to the crankshaft, allowing generous bearing width without increasing the length of the crankshaft and engine itself. The crankshaft uses tri-metal bearings, with main bearings sized to reduce pressure for good lubrication and low wear characteristics.

GE V228 Series engines were primarily designed for application to working vessels including tugs, supply vessels, ferries, dredgers and fishing vessels. With a reputation for reliability and long life, they are also among the best in their class for fuel efficiency and through-life cost.

To support its diesel engine production, GE has invested heavily in new facilities and skilled production staff at its Grove City plant in Pennsylvania. Since 2000, the company has invested close to US\$100 million at Grove City, to cater for engine demand for rail, marine and other market sectors. Included in this was the establishment of a new 240,000ft<sup>2</sup> engine remanufacturing facility, located east of its original diesel engine plant. The Grove City plants will continue to both build and overhaul engines, between them producing more than 2,000 engines per year. [MP](#)



GE's new 250MDC engines are available in 8-, 12- and 16-cylinder configurations with a 6-cylinder unit also planned for introduction (credit: GE)