Press Release
MAN Diesel

Four-Stroke Fuel Sharing Feature Launched

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MAN Diesel introduces new feature to dual fuel engines

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Already offering one of the most fuel flexible medium speed power plant arrangements in the liquefied natural gas (LNG) transport sector, MAN Diesel has now added Fuel Sharing capability to its type 51/60DF marine engine for LNG carriers.

The new feature offers operators of LNG carriers the possibility to run the engine, not only in gas or diesel mode, but also on mixtures of gas and liquid fuel – hence the designation "Fuel Sharing mode". In other words, shortfalls or fluctuations in the availability of natural boil-off gas (NBOG) from the LNG cargo of a carrier powered by the 1000 kW per cylinder MAN Diesel 51/60DF dual-fuel engine can be compensated by increasing liquid fuel injection beyond the quantity used by the dedicated pilot fuel injection system. Either heavy fuel oil (HFO) or distillate fuel can be used for this purpose, injected via the main fuel pumps.

MAN Diesel head of sales for LNG and cruise ship applications, Sokrates Tolgos, explains the concept. "The new Fuel Sharing capability of our 51/60DF engine adds an exciting new dimension to the fuel flexibility of our dual fuel diesel electric (DFDE) propulsion concept for LNG carriers," he states. "Indeed, it gives the same level of fuel flexibility as in concepts based on steam turbine generators, but of course with the advantages of the much higher efficiency of dual-fuel diesel engines at both design point and part-load, much greater redundancy, much greater power flexibility, and lower installation space requirements, which translate into the potential for increased cargo capacity for given vessel dimensions.

By adding our Fuel Sharing capability to the 51/60DF, the operator can now, within wide limits, determine the proportions of gaseous and/or liquid fuel used in each single engine. In this way, the crew of an LNG carrier can run all engines in operation at a given time at similar load points, regardless of required vessel power and the available amount of gaseous fuel. This innovative 51/60DF engine feature fits in perfectly with the requirements of LNG carrier charterers who allow only the use of NBOG throughout the vessel's round trip. It opens a new era for future LNG carrier designs based on energy efficient dual-fuel diesel engines with unmatched fuel flexibility and low emissions."

With Fuel Sharing, there are two options for operating an LNG carrier's multi-engine DFDE plant. In a first option, all engines can run in the fuel sharing mode – i.e. each engine is fuelled with identical proportions of gas and liquid fuel. In the second option, as many engines as possible can be run in full gaseous fuel mode with the balance of power provided by one or more engines in fuel sharing mode. For the engines not running in full gaseous fuel mode, all can be run in fuel sharing mode or just one, with the remaining engine or engines on 100% liquid fuel. The second option is the optimum in terms of both vessel's exhaust emissions and energy consumption.

Engine Lubrication

In terms of engine lubrication, tests and analyses carried out by MAN Diesel have resulted in rules that specify two separate lube oil tanks with lube oils of different base number (BN). Mixable grades of BN20 and BN40 lube oil must be employed and certain upper and lower limits for the resulting base number in the engine's lube oil system must be respected. "These limits form a corridor for the lube oil system's BN values which is readily achievable by very simple operating rules and can be easily verified based on only monthly measurements using a standard portable device. These will be backed by quarterly verification in the laboratory, which is part of the purchase contract between ship operator and lube oil vendor in most cases anyway," Tolgos stresses.

51/60DF and the MAN Diesel LNG Carrier DFDE Concept

The vast majority of today's LNG projects require ships with cargo capacities in the range of 145,000 m^3 – 215,000 m^3 with a combined 35 – 45 MW of installed propulsion and onboard electrical power. MAN recommends four or five inline type 51/60DF dual-fuel engines of identical or similar cylinder count instead of an inhomogeneous mix of inline and vee engines to provide the required cylinder count and total power output. As a consequence, the MAN Diesel alternative minimises the drop in the vessel's available power when an engine is out of service thus enabling the crew to carry out maintenance work on any engine at any time during the voyage.

Fuel sharing adds a further important dimension to this basic flexibility. Furthermore, with the 51/60DF being capable of operating below 15% MCR not only in diesel mode but with its upgraded design version in gas mode as well, the MAN Diesel alternative gives LNG operators the required fuel and power flexibility throughout the vessel's complete operating profile – also during port and LNG terminal operations.

51/60DF

Announced in 2006, MAN Diesel's 51/60DF dual-fuel engine is based on the well-proven 48/60B heavy fuel engine and offers a market-leading 1,000 kW/cylinder output at 514 rpm for 60 Hz generator sets and 975 kW at 500 rpm for 50 Hz versions in both its gaseous and liquid fuel operating modes and now, in addition, in its third mode – the fuel sharing mode. For marine applications it is offered in inline versions with 6, 7, 8 and 9 cylinders and vee configuration versions with 12, 14, 16, and 18 cylinders in a power range from 5,850 to18,000 kW.

Significantly, the 51/60DF dual-fuel engine can switch between fuels at any engine load above 15% MCR. In its gaseous fuel mode, the engine burns natural or forced boil-off gas ignited by a distillate micro-pilot fuel amounting to less than 1% of the energy required to achieve its rated output. The micro-pilot fuel is injected via a common rail system which allows flexible setting of injection timing, duration and pressure for each cylinder. In the liquid fuel mode, the 51/60DF engine operates as a normal diesel engine, injecting either marine diesel oil (MDO) or gas oil (MGO) or heavy fuel oil (HFO) through a separate, normally dimensioned injector in a camshaft actuated pump-line-nozzle system. In the new fuel sharing mode, the 51/60DF can now operate on mixtures of gas and liquid fuel.

At 1.5 g/kWh (IMO cycle E2) in gaseous fuel operating mode, the 51/60DF already complies with IMO Tier III limits for NO_x by a considerable margin without the need for exhaust gas treatment or any other countermeasures.

The first production 51/60DF dual-fuel engines recently completed their Factory Acceptance Testing at the MAN Diesel works in Augsburg, Germany

About MAN Diesel

MAN Diesel is the world's leading provider of large bore diesel engines for marine and power plant applications. The company designs two-stroke and four-stroke engines, generating sets, turbochargers, CP propellers and complete propulsion packages that are manufactured both by MAN Diesel and its licensees. The engines have power outputs ranging from 450 to 97,300 kW. MAN Diesel employs approx. 8,000 staff, primarily in Germany, Denmark, France, the Czech Republic, India and China. The global after-sales organisation, MAN Diesel PrimeServ, comprises a network of the company's own service centres, supported by authorised partners. MAN Diesel is a company of MAN SE, which is listed on the DAX share index of the 30 leading companies in Germany.

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