

23 June 2015

Factory acceptance for first two-stroke low-pressure dual-fuel engine

The first Wärtsilä low-speed two-stroke dual-fuel (DF) engine destined for a commercial application has successfully completed its Factory Acceptance Test (FAT) at a Chinese licensee of Winterthur Gas & Diesel (WinGD), the Switzerland-based designer, developer and licensor of Wärtsilä brand low-speed two-stroke engines.

The engine is a five cylinder, 50 cm bore 5RT-flex50DF built by Yuchai Marine Power Co., Ltd. (YCMP) at its factory in Doumen, Zhuhai City, Guangdong Province, in the South of the People's Republic of China. It will power a new "handy-size" LNG carrier, designed by MARIC, in the fleet of Chinese ship-owner and operator Zhejiang Huaxiang Shipping CO., Ltd. The new vessel is under construction at the shipyard of Qidong Fengshun Ship Heavy Industry CO., LTD, also in the People's Republic of China. While designed to ocean-going standards, in service the LNG carrier will operate principally in Chinese coastal waters and deliver LNG to terminals in the estuaries of major Chinese rivers. WinGD's scope-of-supply for this project also includes a gas valve unit (GVU), some ancillary equipment and the commissioning of both the engine and GVU aboard the LNG carrier.

Technical Data of the LNG Carrier:

Rated power: 6000kW at 124rpm

LNG Capacity: 14,300m³

Length overall: 125.8 metres

Beam: 22.7 metres

Draught: 7.2 metres

With its Wärtsilä 5RT-flex50DF two-stroke dual-fuel engine burning the "natural boil-off gas" (NBOG) which arises through vaporisation of a small part of an LNG carrier's cargo due to the ambient air and sea temperatures and the motion of the ship, the vessel will comply with both the NO_x and SO_x requirements of the strictest IMO emissions regulations without exhaust aftertreatment.

Organised by YCMP with the support of the WinGD testing team, augmented by gas engine specialists from company headquarters in Winterthur, Switzerland, the FAT took place on 2-3 June 2015 in the presence of representatives from the classification societies, the ship owners, the shipyard, YCMP and WinGD. Inspection

of the engine and selected components according to classification society requirements took place on 4 June.

To mark the acceptance of the first WinGD DF engine for a commercial application, and the first built by YCMP, on 10 and 11 June, a commemorative event was held which included a short demonstration run of the RT-flex50DF.

Martin Wernli, CEO Winterthur Gas & Diesel Ltd. (WinGD) noted: "The system is based on the low-pressure gas admission system proven over more than two decades on Wärtsilä four-stroke DF engines. Our product objectives were to reduce both first and operating costs. The 5RT-flex50DF does not require the high-pressure electrically-driven compressor needed by two-stroke engines in which gas is injected under high pressure. Thus, not only can our fuel system be simpler and less expensive, it saves a considerable amount of onboard electrical power, which means that a vessel's auxiliary generators can be dimensioned smaller. Such savings are, of course, of special interest on smaller LNG carriers such as the 14000 m³ vessel which this engine will power."

WinGD dual-fuel technology

Pioneered by Wärtsilä on medium-speed four-stroke engines in the mid-1990s, widely proven and representing the "industry standard" for DF engines, WinGD's low-speed DF marine engines employ the lean burn Otto cycle – i.e. ignition of a lean air-gas mixture by injection of a small amount of liquid fuel – with the gaseous fuel admitted to the cylinders at low pressure via electronically-controlled valves.

The lean burn combustion of gaseous fuels is an enabler of both the low emissions and high efficiencies of WinGD low-speed DF engines. Even without aftertreatment their NO_x emissions in gas operation mode are within the limits set by IMO TIER III for vessels operating in Emissions Control Areas (ECAs), while natural gas is virtually sulphur-free, also ensuring compliance with IMO limits for SO_x emissions in ECAs. Moreover, since methane is the major constituent of natural gas and the simplest combination of hydrogen and carbon in the hydrocarbon series, in their gaseous fuel mode, the CO₂ emissions of WinGD DF engines are lower than from diesel engines of comparable performance. The lean burn combustion process is also an enabler of the excellent efficiencies attained by modern gas engines.

To provide back-up operation for emergencies and voyages where arisings of NBOG are insufficient, like all WinGD marine DF engines, the 5RT-flex50DF is equipped with

a fully dimensioned liquid fuel system capable of injecting either HFO or distillate fuels (e.g. MDO or MGO). In its 100% liquid fuel mode the 5RT-flex50DF is compliant with IMO TIER II exhaust emissions regulations.

With its low-speed two-stroke DF engines, WinGD is responding to demand for high efficiency gas engines for LNG carriers being built in response to a global trend to natural gas and for vessels such as tankers and container ships considering LNG as a fuel for economical, low emissions propulsion power to ensure IMO Tier III compliance in ECAs. Since the lifespan of ships is usually measured in decades, and gas is expected to gradually replace liquid fuels in many engine applications, WinGD is also stressing the “future proof” aspect of its low-pressure DF technology for two-stroke engines. Significantly, the system can be readily retrofitted to Wärtsilä low-speed two-stroke diesel engines already in service.



The 5RT-flex50DF is the first two-stroke low-pressure DF engine passing the FAT

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WinGD in brief:

Winterthur Gas & Diesel Ltd. (WinGD) is a leading developer of two-stroke low-speed gas and diesel engines used for propulsion power in merchant shipping. WinGD's target is to set the industry standard for reliability, efficiency and environmental friendliness. WinGD provides designs, licences and technical support to manufacturers, shipbuilders and ship operators worldwide. The engines are sold under the Wärtsilä brand name and are manufactured under licence in four shipbuilding countries. WinGD has its headquarters in Winterthur, Switzerland, where it started the development of large diesel engines under the name "Sulzer" already in 1898.