WinGD low-speed engines
Licensees Conference 2015

First experiences with the W6X72DF engine

In 2014 at our factory in Aioi, Diesel United (DU) produced the first W6X72DF for the purpose of full-scale validation testing of this large bore Dual-Fuel (DF) engine. After successful commissioning, the engine was started-up in January 2015 in its diesel fuelled mode. Together with the Automation Team from Winterthur Gas & Diesel (WinGD), commissioning of the engine in its gas-fuelled mode took place in February 2015. It successfully achieved operation based on combustion using the 2-stroke pre-mixed concept.

In this paper we would like to share our experiences in the manufacture and adjustment of the W6X72DF engine's dual-fuel technology as developed by WinGD.

Based on DF concept drawings from WinGD, in 2014 DU started work on detail design drawings and, in parallel, the purchase of components. The target was to finish assembly of the W6X72DF engine by the end of 2014. Bottlenecks were a delay in the availability of drawings for gas components, gas pipes etc. The delay in delivery of some components hence affected DU's assembly schedule. As a result, DU completed assembly of the W6X72DF in December 2014.

DU also established an LNG gas supply system next to the Aioi factory. The LNG tanks consist of one set of 80 m3 capacity with a maximum design gas pressure of 2.0 MPa. This LNG gas pressure level does not rely on a compressor but is pressurised by an evaporated LNG gas circulation system. The pressurised LNG gas which is supplied to the engine's Gas Valve Unit (GVU) can be adjusted from the engine control room.

The Gas Valve Unit (GVU) is fitted on the engine platform which accommodates the air cooler on the exhaust side.

The UNIC control system was new to DU and commissioning support was thus needed from WinGD and Wärtsilä Service experts. During this commissioning work we experienced some "teething-troubles", such as UNIC parameter setting for the servo-oil pressure sensor and some fuel leakage from the pilot-fuel supply unit. However, everyone involved worked in a spirit of close cooperation and these issues were successfully resolved in a very short time.

The first transfer to the gas operating mode was made at 25 % load simply by pressing the UNIC

transfer button “from diesel to gas mode”. The UNIC transfer system worked very smoothly and efficiently. After completing the transfer to 100% gaseous fuel, the combustion state was not steady and some parameter settings had to be adjusted, including gas injection timing, injection duration, gas injection pressure and scavenging air pressure. However, such parameter optimisation is a normal procedure during the development of new technology.

The first notable occurrence was that we were able to reach 100 % load in the gas mode only one week after first operation on gaseous fuel.

The second notable occurrence was that we were able to reach R1 power when burning LNG of methane number 67.5. The common understanding until this time was that LNG with such a low methane number would lead to knocking or early ignition and that it would be difficult to run the engine at 100 % load.

Although engine operation in the gas mode went very smoothly, we nonetheless experienced some smaller issues. For example:

a) Damage to MCM due to wrong setting of the UNIC software configuration.

b) The quality of the pilot fuel pump unit was not satisfactory.

c) The Rail Valve (RV) and Cylinder Control Module (CCM) were damaged during the Gas Admission Valve (GAV) actuation test in manual operation.

These issues were all reported to WinGD and countermeasures will be applied for serial engine production.

CUSTOMER DAY

DU had the pleasure of holding a W6X72DF Customer Day for Japanese owners and shipyards at the Aioi works on 10th April 2015. Customers were very interested in the W6X72DF engine, because it was the first demonstration in the world of a 2-stroke gas engine with pre-mixed combustion capable of complying with IMO Tier III NO_X emissions levels without an aftertreatment system or low NO_X combustion technology such as Exhaust Gas Recirculation (EGR).

NEXT STAGES

The next task in our development cooperation with WinGD is to collect information about:

a) Gas parts reliability

b) Methane slip quantity

c) Optimum BN number for cylinder oil in gas mode operation

d) Transient response in rough sea conditions

e) Lowest stable engine load

f) Ease-of-maintenance.

DU is currently carrying out these tests in cooperation with WinGD in order to further commercialise the X-DF engine from a customer point of view.

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