ME-GI Factory Acceptance Tests (FAT)

We are pleased to report that the FATs of the first two ME-GI engines at our licensee Doosan Engine in Korea have been completed successfully with performance and efficiency results even better than anticipated. Both engines passed the FATs with no extraordinary events experienced, apart from one issue outlined below, and that within the required timeline.

As is well known, the ME-GI engine does not suffer from the multiple deratings and large methane slip of other systems, which was proven during these tests. In addition, the ME-GI is the only dual fuel two-stroke engine to date that has been publicly tested in gas running condition and the only two-stroke engine that has passed actual factory acceptance testing.

While we are extremely pleased about the demonstrated efficiency and performance of the ME-GI engine, an issue regarding the chrome plating on the cylinder cover at the sealing surface of the gas injection valves was noted. The purpose of chrome plating in this location, is to ensure a more durable sealing surface for the insertion and removal of the gas injection valve during overhaul. Attached fig. 1 shows the location.

Specifically, the method of application of the chrome plating generated secondary cracks in the chrome layer. Such a situation is unacceptable, as even very small cracks can allow gas to escape and give a measurable indication of a gas leak. The gas leak is in no way detectable in the engine room as it is led to the ventilated double wall gas piping, which is continuously monitored.

Fig. 1: Chrome plating on the cylinder cover
We have continued the investigation into the chrome plating process with different vendors and will at the next engine shop test, which is scheduled shortly, prove that we have resolved this matter.

It is notable that we have also run the ME-GI engine with cylinder covers without chrome plating with zero gas leakage and we could basically settle with that. However, we feel that the chrome plating enhances the service life that our customers expect from MAN B&W.

Further, we used cylinder covers with chrome plating for the actual public demonstrations tests in Copenhagen, at Hyundai Heavy Industries Co., Ltd. and at Mitsui Engineering & Shipbuilding Co. Ltd., which all performed without any issues. We therefore conclude that the issue with the secondary cracks is clearly related to manufacturing techniques and application of the chrome layer, and has no design implications. We reiterate that the performance results of the ME-GI engine have been excellent with efficiency better than predicted, and that the ME-GI engine will continue to be the class leading product that is the tradition of MAN B&W brand. Attached fig. 2 shows the results in terms of equivalent SFOC and NOx emissions for gas and diesel.

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**Fig. 2: GI latest performance results, gas vs. diesel: SFOC & NOx emissions**