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HERCULES Project Raised the Bar for Performance of Piston Rings, Liners

By [George Backwell](#) at April 30, 2011 22:06

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Large bore diesel engine piston ring and cylinder liner design was ratcheted up more than a few notches on the efficiency scale by research that flowed from the (now concluded) European Union sponsored HERCULES project. The piston ring itself might seem a fairly inconsequential part of the whole engine, yet commercially important length of Time Between Overhauls (TBO) is largely determined by piston running behaviour and its effects on the wear of piston rings and cylinder liners. Recognising this fact, one sector of the interrelated study was devoted to an investigation into how engine friction might be reduced, but first it may be helpful to reprise HERCULES.

The HERCULES Project

The project title word HERCULES is itself an acronym (at a far stretch) signifying 'High Efficiency R&D on Combustion with Ultra-low Emissions for Ships', which pithily defines the scope of the three-and-a-half year project led by MAN Diesel SE and Wärtsilä Corporation with a team of more than forty European engine component suppliers, equipment manufacturers, universities, research institutions and shipping companies. The cost of the project was met by a combined grant of EUR 33 million that came largely from the European Union with a smaller contribution from the Swiss Federal Government.

HERCULES aimed to look to the development of marine diesel engines that would lower gaseous and particulate emissions, and at the same time increase engine efficiency and reliability by reducing fuel consumption, CO2 emissions and engine life-cycle costs. The fruits of the project were expected to become incorporated into new engines over a ten-year time-span as indeed seems to be the case.

Towards State of the Art Piston Rings and Cylinder Liners

Friction between piston ring and cylinder liner is a major source of power consumption in the primary driveline of the low-speed two-stroke crosshead marine diesel engines that power the majority of large ocean-going merchant ships; friction correlates too with TBO due to ring and cylinder liner wear.

Accordingly, HERCULES researchers set up a 'Tribometer', which is a friction test-rig, to determine accurately the friction losses and wear resistance on piston rings as well as cylinder liner materials (the efficient performance of the piston ring depends not only upon its lubrication but also on a good running surface of carefully machined, deep-honed, liners). In due course, researchers were able to identify materials (including rings made up of chrome steel and ceramics) with profiles that would ameliorate wear and enhance durability of both rings and liners.

Sole player from the industry in this particular aspect of the HERCULES team project was the Germany-based division of U.S. international corporation Federal-Mogul, founded in Detroit in 1899, and now headquartered in Southfield, Michigan. The parent company's arm in Burscheid in North Rhine-Westphalia specialises in the manufacture, and continuing R&D of piston rings and cylinder liners marketed under its brand-name 'Goetz'. Commitment to R&D carries long-term growth benefits: on 28, April 2011, Federal-Mogul Corporation reported Q1 results showing strong sales and earnings growth from its multi-faceted business operations.



Checking Tolerance: Photo courtesy of MAN Diesel & Turbo

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