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Abstract
This paper reports on the establishment of a testing facility to investigate spray and impingement characteristics of a recently developed, fully adaptive lubrication system for large two stroke marine diesel engines. The reported part of this research relates to development steps towards the new lubrication system as well as the implementation of a dedicated testing facility and the establishment of validation approaches in order to corroborate technology developments in this context.

The major objective of this development yields an optimization of lubricant utilization and at the same time a significant reduction of lubricant fraction in the exhaust gas. A requisite to obtain the desired level of flexibility calls for a revised approach in injecting the lubricant. Common lubrication system concepts make use of a constant volume pump which is connected to a non-return valve type lubricant injector. The amount of injected lubricant is adjusted on basis of engine load and fuel property dependent feed rate settings, which leads to the injection of lubricant as a function of the amount of engine cycles between single lube oil injections. The desired flexibility of the new lubrication approach foresees a cycle based adjustment of the injected amount of lubricant as well as the injection pressure in order to provide the possibility to shape the injection spray pattern. Concept studies nominate the application of a common rail system with integrated needle lift type injectors and adjustable injection pressure as compliant with the requisite to inject the lubricant with a high level of flexibility.

This paper hence encompasses design and development aspects of the new lubrication system but most of all highlights steps in developing a validation concept in order to compare common lubrication systems with the new type of lubrication system.

Investigating on mentioned injection characteristics calls for the establishment of a sound testing environment. Therefore a system was designed to provide testing conditions which are similar to the boundary conditions that are found in a real engine. The test cell design features a cylinder liner segment between two lubrication quill positions in order to simulate the lubricant spray and impingement on a simulated segment of a cylinder liner under engine like conditions over the full engine load range.

Initial results of the test cell provide an insight regarding relevant information on the injection spray characteristics over the full engine load range as well as the possibility to compare common lubrication system performance with the new common rail lubrication system.

Keywords
Injection system development and validation, computational injection spray simulation, experimental spray investigation

Introduction

Detailed investigations related to lubricant flow optimizations and transportation mechanisms clearly demonstrate the importance of an appropriate lubricant injection. [1,2,3,4] A characterization of relevant contributors to the total lubricant balance of a large two stroke marine diesel engine was performed to address the optimization potential of single components of the tribosystem. Optimizations of piston ring pack geometries showed superior functionality in terms of considerably reducing the amount of lubricant in the exhaust gas. Another, yet equal important aspect which must be taken into consideration when looking at further reducing lubricant consumption of such an engine type, relates to a detailed investigation regarding the application of the lubricant by means of a properly designed lubrication system. Design aspects of such a recent development focus on controlling lubricant spray characteristics over the complete engine load range and related variations of boundary conditions. Thus, investigations in the context of this paper, focus on developing an evaluation approach to support lubricant spray simulation tool

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