# LUBRICANT TRANSPORT IN PISTON CYLINDER ASSEMBLIES

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## KEYWORDS
***Experiments in tribology; Modeling in tribology; Wear, Cavitation and Lubricant Transport***

## ABSTRACT
The objective of this research was to assist with the investigation of phenomena that occur in the cylinder liner and piston-ring interaction under different operating conditions. Lubricant flow and cavitation visualisation in a simulating lubrication single-ring test rig and oil transport and cavitation visualisation in a newly designed optical engine are the tools used to quantify the transport process under the piston-ring and cylinder liner. Simplification of the interface is an essential technique that enhances the researcher's confidence towards results interpretation. Engine complexity and severe oil starvation are impeding the analysis of the experimental results.

Visualisation experiments are an efficient and effective way to test various lubricant samples and compare their performance in terms of physical, chemical properties and cavitation initiation and development. The repeatability of the visualisation method establishes the parametric study effects and offers valuable results enabling the performance of each lubricant to be assessed. As a further step towards the lubricant composition effect, a link between the lubricant formulation and the operating conditions could be established as the oil performance is assessed with a view to its transport behaviour [1].

Video images captured with two high speed cameras coupled with three high intensity light sources were analysed. Post-processing of the images was achieved with the aid of a custom build MATLAB algorithm [2]. Matrices were extracted with geometrical elements of the cavities, their length, width, areas of cavitation and number of cavities, present under the piston-ring and the cylinder liner as produced by the custom algorithm. In this instance, after the initial evaluation of cavitation visualised through quartz sections in a Lister-Petter engine and the attempt to compare the imaging findings to the ones already identified in a simulating single-ring test rig, a more detailed and controlled experiment was carried out, comprising new visualisation tools apart from the initial engine design. Oil transport and cavitation were visualised and assessed for different sets of oils as parametric study. Speed and load motored tests showed their effect on oil transport at specific parts of the stroke (Fig. 1).

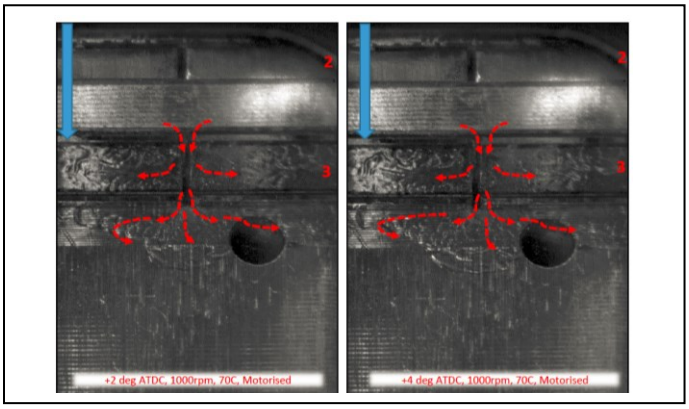


Fig.1 Pressure gases push the lubricant through the piston-rings gap [2]

In previous research, different lubricant properties had their effect on minimum oil film thickness measurements measured either with the Laser Induced Fluorescence technique of with a capacitance sensor. A specially designed liner was used for mounting an ultra-miniature pressure transducer, so that the identified cavitation results could be further quantified and verified. Different sets of lubricants were measured in the simulating single – ring test rig and the results showed that for same testing conditions, with lubricants that do not degrade through a piston engine combustion process, the film thickness varied according to the lubricant properties [3]. A link between oil formulation and operating conditions can be established. Blow-by phenomena have been captured by the imaging process.

## REFERENCES
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