REWARD

REal World Advanced Technologies foR Diesel Engines

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Project partners:

1 - AVL - AVL List GmbH - AT
2 - REN - Renault SAS - FR
3 - VCC - Volvo Car Corporation - SE
4 - CRF - CRF SCpA - IT
5 - CNRIM - Instituto Motori – Consiglio Nazionale delle Ricerche (CNR) - IT
6 - JM - Johnson Matthey Plc - UK
7 - RIC - Ricardo Plc - UK
8 - SCF - Schaeffler AG - DE
9 - LMM - Le Moteur Moderne - FR
10 - DELPHI - Delphi Automotive Systems Luxembourg S.A. - LU
11 - UNR - Uniresearch BV - NL
12 - IFPEN - IFP Energies Nouvelles - FR
13 - VIF - Virtual Vehicle Research Center - AT
14 - CTH - Chalmers Tekniska Högskola - SE
15 - CTU - Czech Technical University - CZ
16 - UPVLC - Universitat Politecnica de Valencia – Motores Termicos - ES

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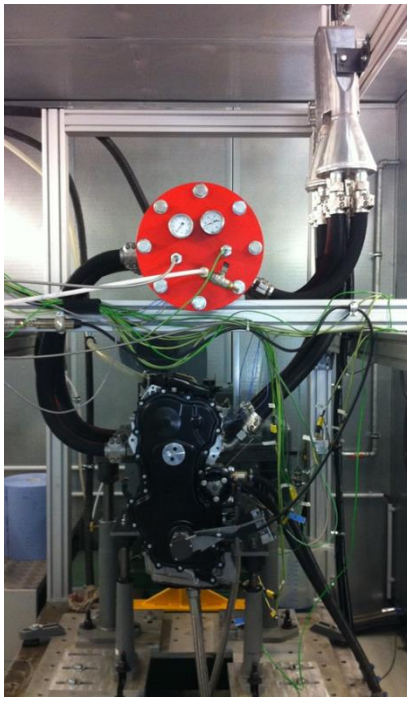
Publishable Executive summary



With the increasing pressure to reduce emissions, friction reduction is always an up to date topic in the automotive industry. Among the various possibilities to reduce mechanical friction, the usage of a low-viscosity lubricant in the engine is one of the most effective and most economic options. Therefore, continuously lower viscosity lubricants are being developed and offered on the market that promise to reduce engine friction while avoiding deleterious mixed lubrication and wear.

Sub-Task 3.1.3 in the REWARD project investigates the improvement of mechanical efficiency of Diesel engines. As the use of a lower viscosity lubricant in the engine is one of the most economic ways to reduce engine friction, the friction reduction potential of low-viscosity lubricants is experimentally analyzed.

A downsized Diesel engine is used on a highly accurate engine friction test-rig to determine the potential for friction reduction using low viscosity lubricants under realistic operating conditions including high engine loads. In particular, two hydrocarbon based lubricants, 0W30 and 0W20, are investigated and a novel experimental lubricant which is based on a polyalkylene glycol base stock:

- 0W30 engine oil which represents the state-of-the-art
- 0W20 engine oil which represents a low-viscosity lubricant for new engine developments
- PG engine oil (polyalkylene glycol) as a future perspective.

Despite the apparent large difference of 25 % and more in the lubricant viscosities, the corresponding effect on engine friction is much smaller and highly accurate test-rigs are required to measure the benefit of the individual lubricants experimentally; such a highly accurate test-rig is available at VIF.

Total engine friction is measured for all three lubricants which show a general 5 % advantage for the 0W20 in comparison to the 0W30 lubricant. The polyalkylene glycol based lubricant, however, shows strongly reduced friction losses which are about 25 % smaller than for the 0W20 lubricant.

As the 0W20 and the polyalkylene glycol based lubricant have the same HTHS-viscosity, the findings contradict the common understanding that the HTHS-viscosity is the dominant lubricant property related to the engine friction losses.

Along with the friction benefit, the investigated PG has a higher heat capacity compared to the two hydrocarbon based engine oils. Therefore, better cooling performance is identified for PG in this study.

However, the eventual implementation of polyalkylene glycol based lubricants in future engines depends on further properties. For instance, the chemical compatibility of PG with other materials, the wear characteristics, the performance with DLC coatings, and the ageing behavior in fired engine operation.