

Driving Fuel Economy through Lubricant Technology

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Performance you can rely on.



Introduction

Role of the lubricant

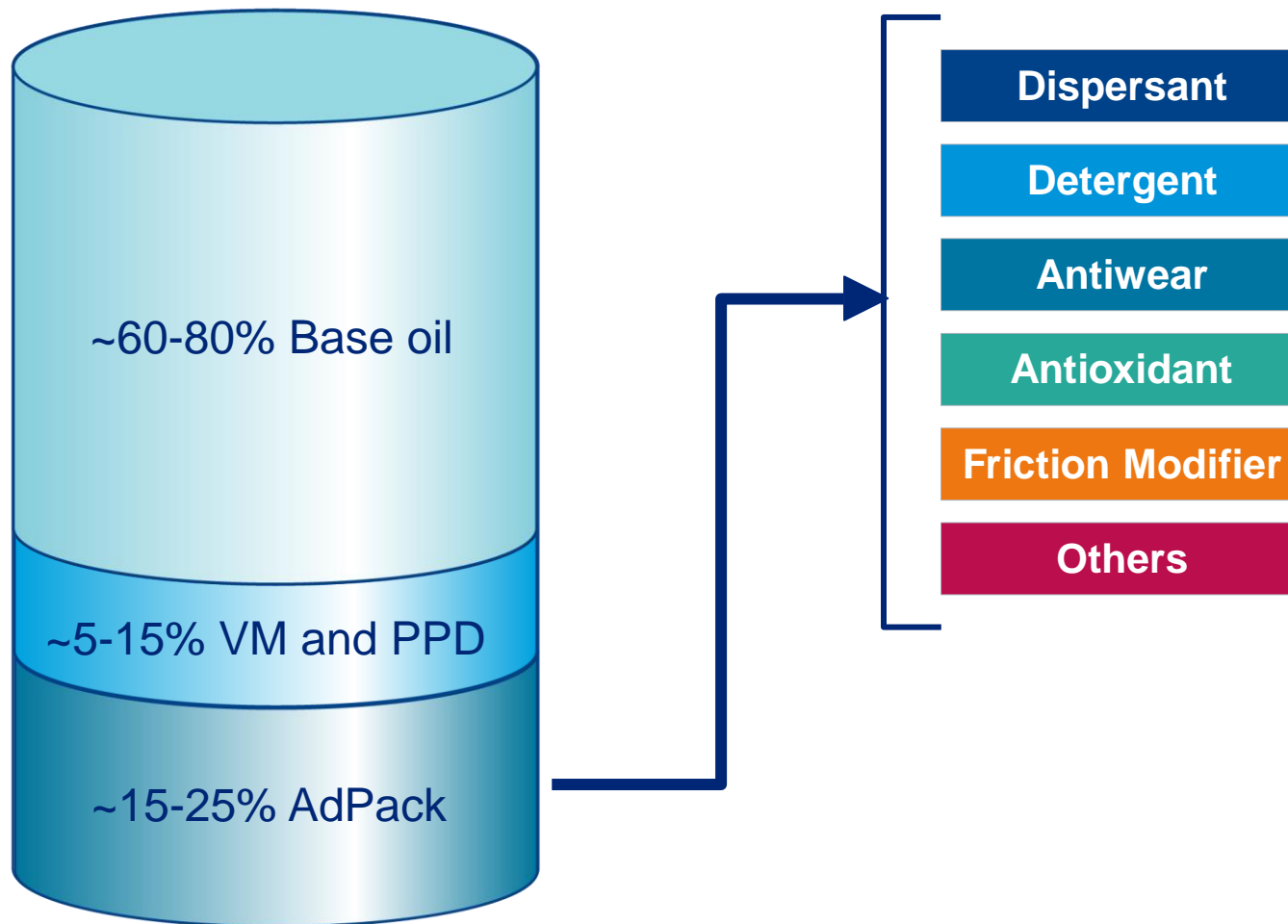


- Primary role:
 - Keep surfaces separate under all loads, temperatures and speeds, thus minimising friction and wear
- Secondary roles:
 - Act as a cooling fluid removing the heat produced by friction or from external sources
 - Carry away the debris (deterasive and dispersive functions)
 - Protect surface from water and the attack of aggressive products
 - Neutralise acids from combustion
- Properties:
 - Resistant to the engine environment
 - Inert to metals and seals
 - Keep good properties along time

Formulating low viscosity lubricants is a balance

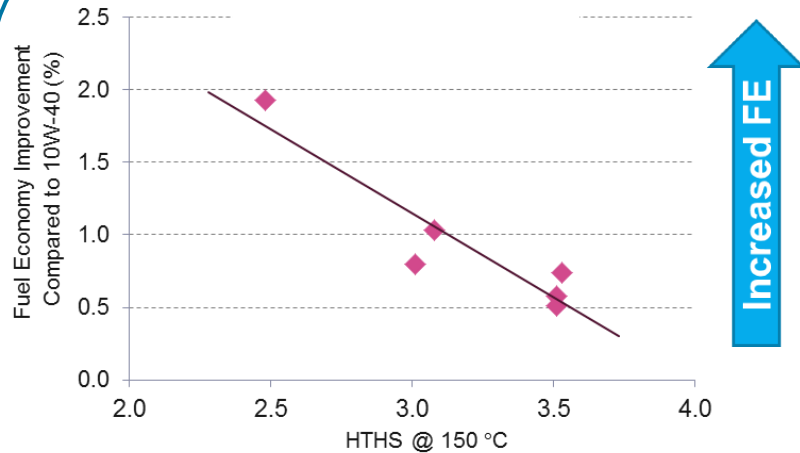
How low can you go?

- Careful balance to achieve optimal performance at low viscosity

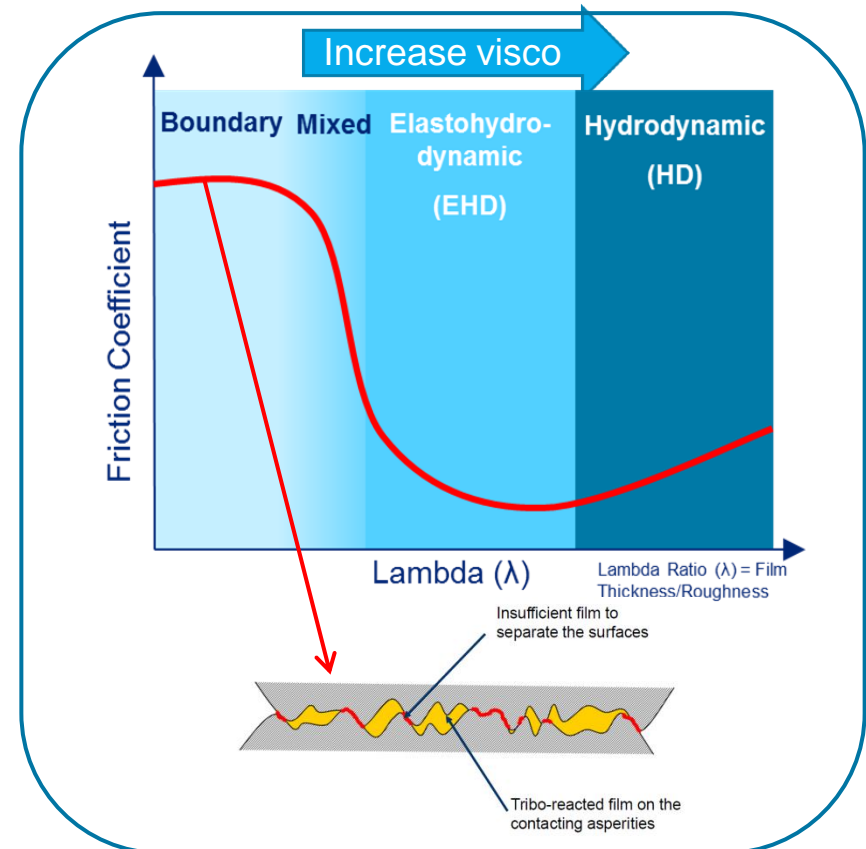


*All quantities are an approximation of typical levels in current HDD formulations. Exact quantities are depend upon componentry and quality level

Fuel Economy and viscosity are linked



- FE improvements observed with reduced HTHS



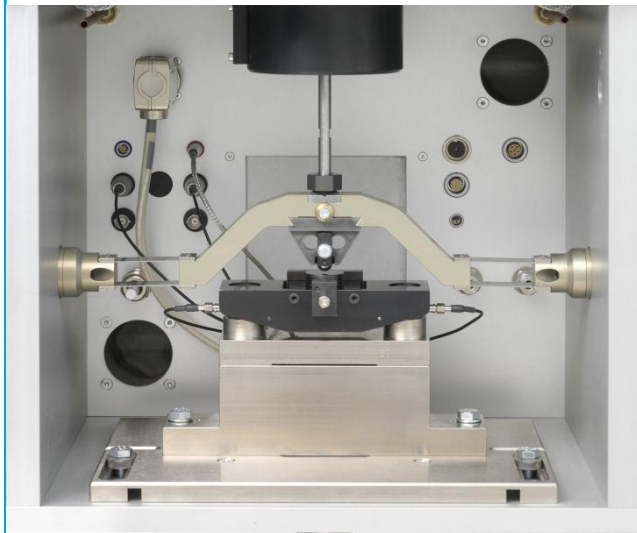
- Well established link between reduced HTHS and Fuel Economy benefits
- Careful balance between hydrodynamic and boundary lubrication needed to gain maximum fuel economy benefits

Testing approach

Bench test rigs (Level E)



Examples of level E tribo-testing



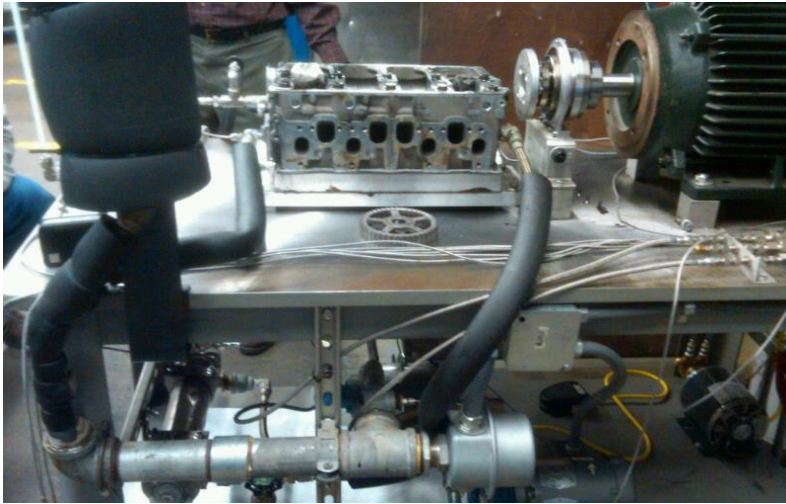
SRV-5 reciprocating test rig



Block-on-ring test rig

Testing approach

Sub-system testing (Level D)



Examples of sub-assembly test rigs

Valve-train test rigs developed by Infineum used for formulation development and fundamental understanding

Testing approach

Engine testing (Level C)



Examples of engine test installation used for evaluation and validation of lubricant performance

Testing approach

Vehicle testing (Level B)



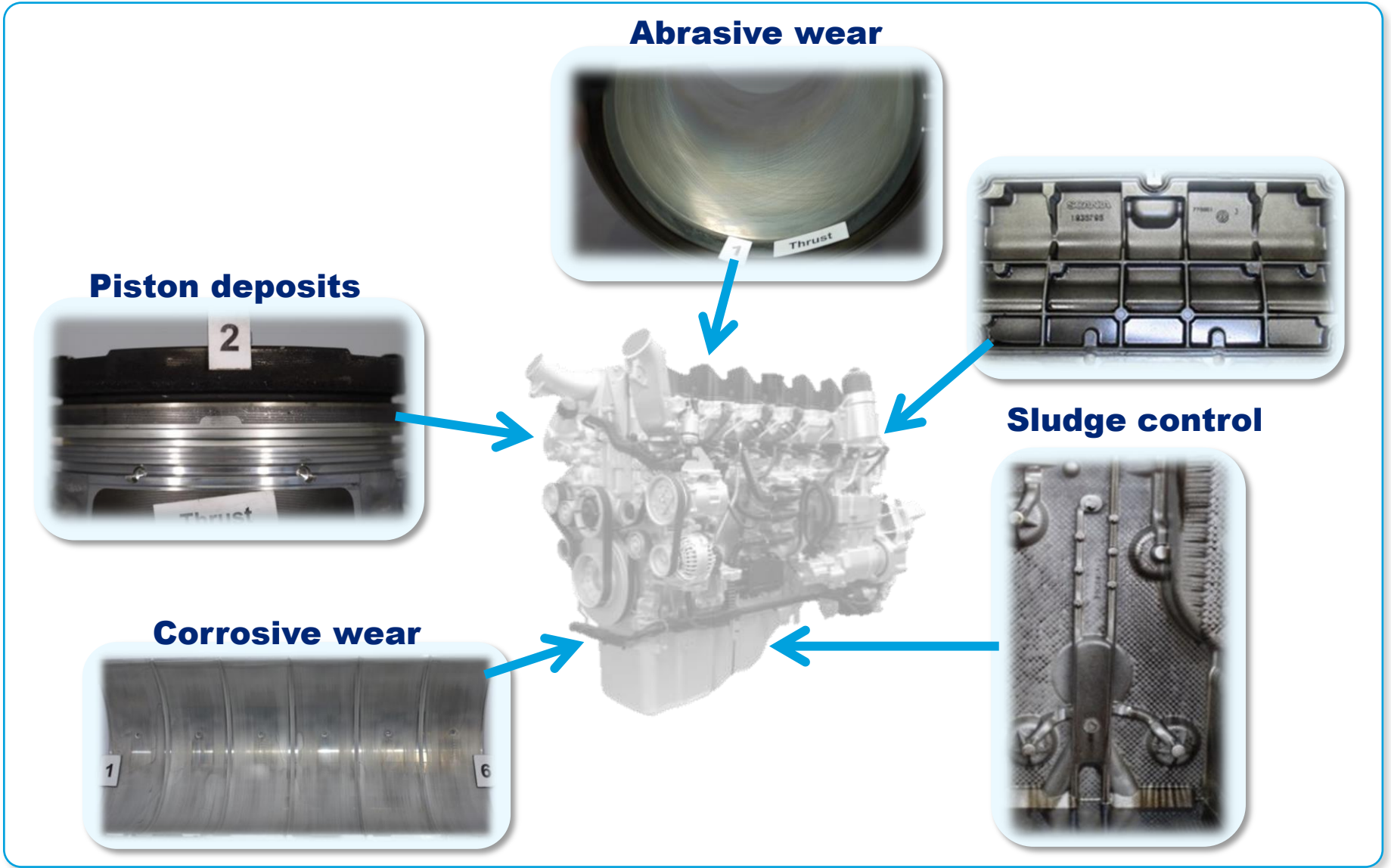
Examples of vehicle testing on a dynamometer to evaluate lubricant performance in real driving condition in a very control and repeatable environment

Testing approach

Vehicle testing on road (Level A)



Examples of field testing to validate lubricant performance in a very variable environment, representative of the end-user utilisation



Conclusion

Formulating for Fuel Economy on current engines



- Fuel Economy is readily accessible by using special lubricant formulation
 - Infineum has many years of experience working in this area
- There is a strong correlation between fuel consumption and lubricant viscosity. Nevertheless, a lot of other oil formulation parameters matter!
 - Balance between viscometric contribution and general other performance especially wear protection
 - Extensive experience on testing lubricant performance in collaboration with OEMs
- Extra care must be taken to match Fuel Economy lubricant and modern engine requirement:
 - Hardware
 - Coatings
 - Operating conditions
 - After-treatment strategy

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