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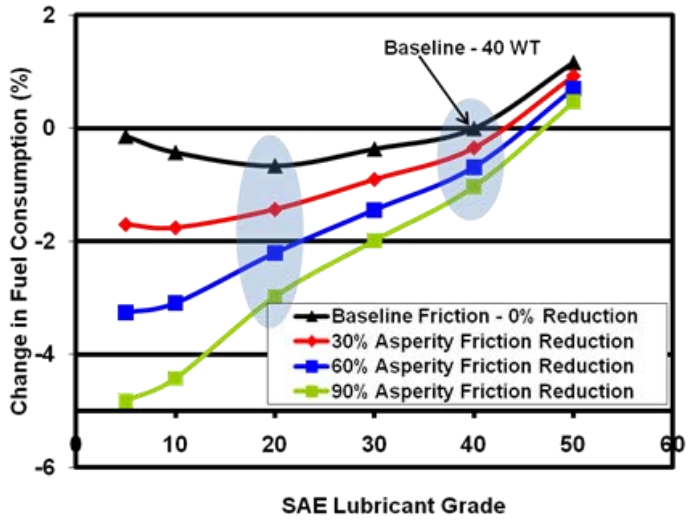
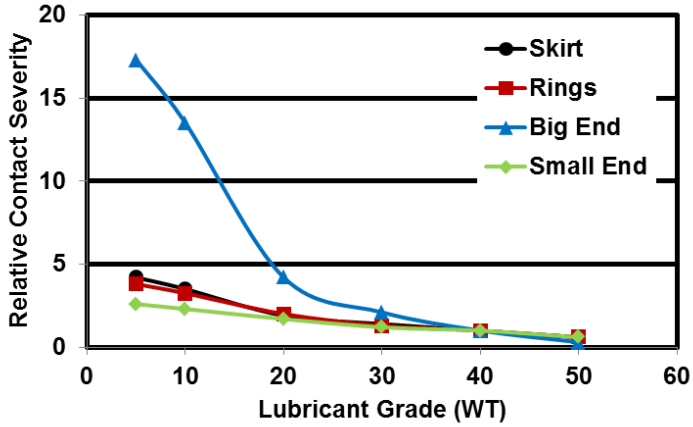
Fuels and High Performance Lubricants (Lubricant's Role in Improving Engine Efficiency)

Lubricants - Pathway to Improving Fuel Efficiency of Legacy Fleet Vehicles

With over 250 million vehicles on the road in the U.S., consuming 12-14 million barrels of petroleum per day, there is increasing interest in the development of advanced lubricant technologies to reduce parasitic friction losses in both new and legacy vehicles. While new vehicles can take advantage of multiple pathways (advanced materials, coatings, and advanced component designs) to reduce parasitic friction, legacy vehicles are limited to advanced engine lubricants (base fluids and additives).



The top figure at the right summarizes the results from recent studies on the impact of reducing lubricant viscosity and boundary friction on the fuel economy of a heavy-duty diesel-powered vehicle. These curves are based on detailed calculations of the friction mean effective pressure for the piston rings and skirt, valve-train components, and engine bearings under a range of driving conditions. Low-friction boundary films by themselves reduce fuel consumption by approximately 1% (see baseline case for 40 WT oil) depending on the driving cycle. Greater savings – up to 4-5% – are achieved by using a low-viscosity lubricant in conjunction with a low-friction boundary.



The drawback to using low-viscosity lubricants is illustrated in the 2nd figure. While a low-viscosity lubricant reduces viscous frictional losses, the resulting thinner oil film leads to greater occurrence of contact between surface asperities on mating surfaces and, hence, higher contact loads and associated wear of components. New engine designs can utilize advanced, wear-resistant materials, coatings, and engineered surfaces to alleviate the increased wear; however, legacy vehicles will need to limit the degree to which the viscosity is reduced and/or increase their reliance on anti-wear, extreme-pressure additives to compensate for the higher wear loads.

This presentation will review recent studies on the potential for low-viscosity lubricants and low-friction surfaces and additives to reduce fuel consumption, as well as the impact of such approaches on other critical lubricant metrics.