

Lubricity of Reformulated & Oxygenated Gasolines

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In the past few years there have been a number of compositional changes to gasoline to comply with the 1990 Clean Air Act Amendments (CAAA). Such changes have included wintertime oxygenated fuel programs in carbon monoxide non-attainment areas and year round reformulated gasolines in certain ozone non-attainment areas. Reformulated gasolines also contain oxygenates (MTBE or ethanol). These compositional changes to gasoline have prompted some inquiries about any possible reduction in the lubricity of gasoline.

The lubricity requirements of gasoline are generally much lower than for diesel fuels. Diesel fuel pumps operate at much higher pressures than their gasoline counterparts and rely on the fuel for part of their lubrication. Gasoline engines inject fuel upstream of the inlet valves and therefore operate at lower pressures. Nonetheless, there have been anecdotal reports of fuel pump failures, in recent years, which some have attributed to low lubricity gasoline.

Because fuel lubricity has not technically been an issue for gasoline applications, little research work has been done in this area. In fact, there is no standard industry test for determining gasoline lubricity. Most researchers use a modified version of test procedures used to assess diesel fuel lubricity. Consequently, there is little published technical work on gasoline lubricity. Among work that has been published, there are conflicting results. For instance one technical paper found that both aromatics and the oxygenate MTBE enhanced lubricity. In yet another study, gasoline containing the same additive gave slightly less lubricity. This would seem to imply that other variables are at play and may indeed be more important. Work by Ford Motor Company found that reformulated gasoline with oxygenates and high aromatic content gave slightly lower lubricity but concluded, "These data

suggest that the lubricity characteristics of CaRFG and variations of it are not unusual or markedly different from other commercially available gasoline." Still other work exploring the lubricity benefits of detergents stated, "The incorporation of oxygenates does not appear to significantly improve lubricity and may well detract from it", while yet another study found that oxygenated fuels may provide better lubricity. Obviously these constantly conflicting results make thorough assessment difficult. To further complicate such assessment, fuel lubricity is affected by a number of other factors including detergents and other additives as well as sulfur content of the fuel.

Based on the limited information that is currently available, only the following conclusions can be drawn.

- Gasoline lubricity is not currently one of the characteristics controlled by industry specification. This is in large part because, at the current time, fuel lubricity is not thought to have a major impact on fuel system parts in gasoline engines. Lubricity requirements may become of more importance with the introduction of "direct injection" gasoline engines which will require high pressure injection pumps. However as of this date, the American Automobile Manufacturers Association (AAMA) has not deemed gasoline lubricity to be of enough significance to include any type of lubricity specification in their AAMA Gasoline Specification. Nor is there any such requirement in ASTM D 4814 Standard Specification for Automotive Spark Ignition Engine Fuel.

- There are numerous components in gasoline that affect its lubricity. Tests conducted to date have not successfully isolated all these factors and consequently various test results sometimes con-

tradict each other. This is also in part because wear characteristics are being measured within such a small range of variation.

- While tests to date may not be able to totally define long term wear characteristics resulting from various fuels, they do indicate that there is no concern about catastrophic failure related to gasoline lubricity.
- As noted by Ford's work, the lubricity of reformulated gasolines and oxygenated fuels is "Not unusual or markedly different from other commercially available gasoline."

References

Comparison of the Lubricity of Gasoline and Diesel Fuels, Wei Dan Ping, et.al., SAE Paper # 962010

CaRFG Performance and Compatibility Test Program, California Air Resources Board, March 1996

Development of a Benchtop Fuel Lubricity Assessment Method, J.G. Eleftherakis, et.al., SAE Paper # 941915

Two-Stroke-Cycle Gasoline Engine Fuel Evaluation, Specialized ASTM TC Sequence II, Valvoline Oil Company, December 1988

AAMA Gasoline Specification-American Automobile Manufacturers Association, February 5, 1996

ASTM D 4814 Standard Specification for Automotive Spark Ignition Engine Fuel

The information contained in this document is based on a limited number of technical papers, test reports, and information sources. While presented in a condensed form, Downstream Alternatives Inc. has made every attempt to represent the information as accurately as possible, and it is believed to be accurate as of the date of printing.

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