# Fuel Lubricity Additive Evaluation

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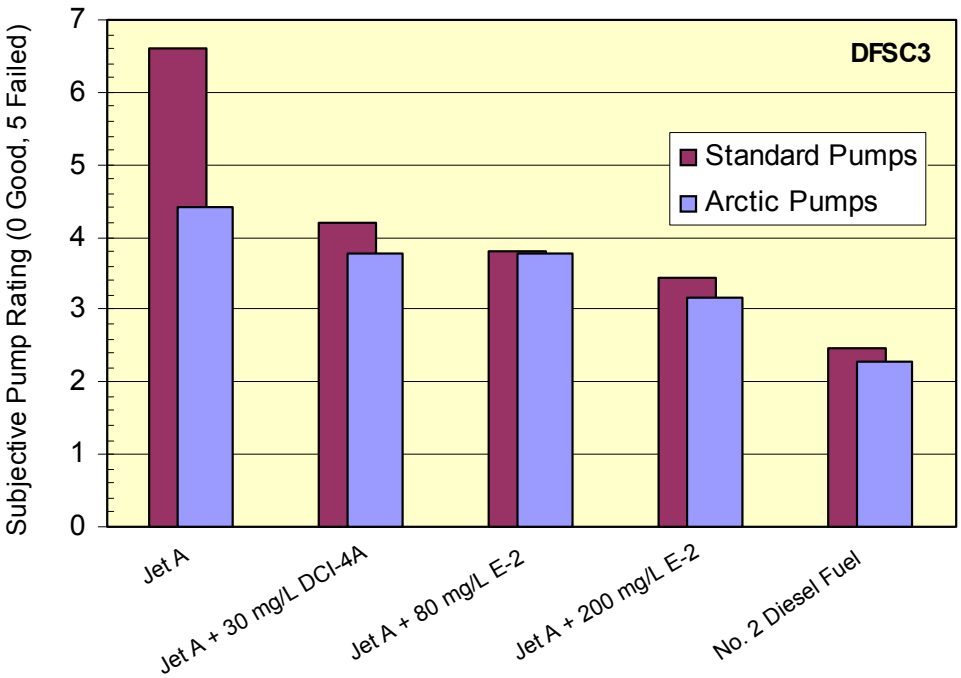
**Problems and Objectives:** To reduce its logistics burden, the U.S. Army is using aviation turbine fuel in compression-ignition powered vehicles. However, previous full scale pump stand tests, as well as isolated reports of field failures, indicate that Jet A-1 may increase wear in rotary-type fuel lubricated fuel injection pumps. Addition of a simple corrosion inhibitor additive, at higher treatment levels than qualified under MIL-I-25017E, may reduce wear rate. However, wear mechanisms other than oxidative corrosion, such as mild scuffing, are also involved. This report evaluates recently developed fuel-lubricity additives, which may be more effective than those qualified under MIL-I-25017E.

**Importance of Project:** The fuel-injection system is central to the reliable operation of compression ignition engines. Rapid failure of these components may occur with low lubricity fuel, such as kerosene. A more effective lubricity additive could significantly improve readiness of vehicles operated with Jet A-1 kerosene. However, little data exists to compare recently developed, commercially available lubricity additives.

**Technical Approach:** A range of lubricity additives was obtained from commercial sources. Laboratory scale tests were performed to define the effects of these additives on lubricity and water-separation characteristics of a severely refined Jet A-1 fuel using both the TFLRF-developed Scuffing Load Wear Test (SLWT) and the High Frequency Reciprocating Rig (HFRR). More detailed laboratory tests were performed with the better additives. However, any laboratory scale test is only an indicator of real world performance. As a result, full-scale pump stand tests were performed to define the benefits provided by the most effective additive at two concentrations. To facilitate direct comparison with the existing database, the pump stand test procedure was identical to that used in previous studies.

**Accomplishments:** The effectiveness of the lubricity additives varied considerably when evaluated in the laboratory scale tests. The most effective additive was identified as that which produced greatly reduced wear at a low concentration with minimal effect on water-separation characteristics. The pump tests confirmed that an additive concentration of 80 mg/L presented significant benefits, with a slight further improvement up to 200 mg/L. However, it should be recognized that injection-system performance might be affected by other fuel attributes, such as viscosity and water-separation characteristics, which may not be improved by lubricity additives.




**Military Impact:** This study confirms that the use of highly refined Jet A-1 in a temperate climate may produce accelerated wear of rotary fuel-injection pumps. A lubricity additive was identified that significantly improves injection-system durability with Jet A-1. The additive was slightly more effective than dilineoleic acid, the additive chemistry currently qualified under MIL-I-25017.

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