Tech topic

Performance of turbine oils in generators

Identifying key factors that impact the reliability of engine-driven generators

Key insight

The top reasons for unplanned removal and maintenance of generators are:

- Diode failures
- Filter plugging
- Corrosion
- Seal leaks

Introduction

Not all jet turbine oils are created equal. One area of varied performance is in the reliability of the accessory components — specifically generators, including integrated drive generators (IDG), variable frequency generators (VFG) and variable frequency starter generators (VFSG).

Diode failures

The electrical conductivity of turbine oil is of critical importance in diode failures. The fluid friction between the rotating generator components and the lubricant can generate static electrical charges on different parts of the generator during operation in any of the engine-driven generators. These electrical charges need a path to dissipate, either through the air around the generator if the ambient humidity is high enough, or through the lubricant.

IDG oil pressure switches malfunction when diodes fail due to inadequate oil conductivity.

ExxonMobil

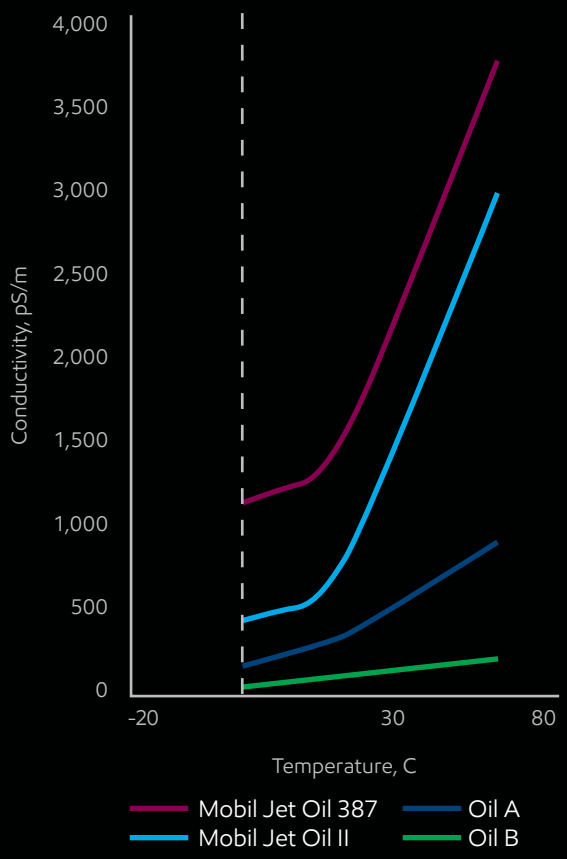
Performance of turbine oils in generators

Diode failures (continued)

To dissipate via the lubricant, the lubricant must have adequate electrical conductivity. If the ambient humidity is too low and the lubricant lacks sufficient conductivity, eventually the charge will be very strongly separated, and the result is a powerful electrical discharge. This discharge has the potential for permanent damage to diodes in the generator control circuitry.

There are significant differences in electrical conductivity between approved turbine oils. These differences can be directly associated with reliability of operation for engine-driven generators. Some high thermal stability (HTS) oils, such as Mobil Jet™ Oil 254 lubricant, have naturally higher conductivity than standard oils due to the base oil and additive combinations in HTS oils. For that reason, HTS oils are not generally associated with diode failures. The risk of insufficient conductivity is greatest when the oil is fresh and the temperature is below freezing. Among standard oils, Mobil Jet™ Oil II lubricant has the highest conductivity when fresh. Some competitive turbine oils have demonstrated unacceptably low conductivity. In contrast, Mobil Jet™ Oil 387 lubricant has higher electrical conductivity, which can minimize the risk of diode failures.

ASTM D2624 electrical conductivity



Corrosion and filter plugging

IDG housings show signs of corrosion.

Turbine oils are sometimes exposed to very high temperatures in generators, which can result in oxidation of their base oil. As a result of this oxidation, the fluid develops a high total acid number (TAN), causing corrosion and the potential failure of non-ferrous components in the generator, as well as damage from corrosion-related debris in the oil. In severe cases, this debris can even lead to filter plugging and differential pressure indication (DPI) alarms in the cockpit. Corrosion damage and blocked filters necessitate expensive unscheduled maintenance, cancelled or delayed flights and significant incremental costs to operators. Mobil Jet Oil 387 lubricant has industry-leading oxidative stability, and will protect generators from acidic corrosion more effectively than any other jet oil.

Another way lubricant filters in generators may become plugged is from copper chelation. Copper chelation is an industry-known side effect of some lubricants' additives interacting with bronze wear-metal particles, forming a "sludge" that can block filters prematurely and cause unplanned maintenance. Both Mobil Jet Oil II and Mobil Jet Oil 387 lubricants use additives that completely avoid chelation.

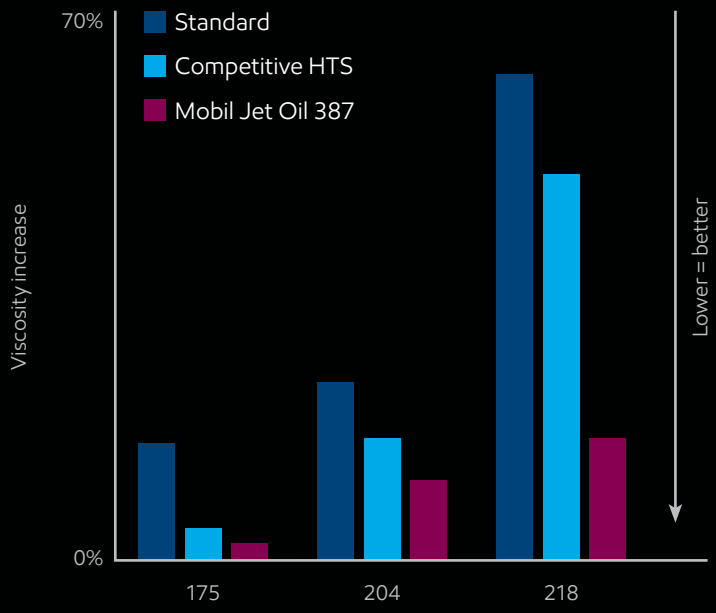
Performance of turbine oils in generators

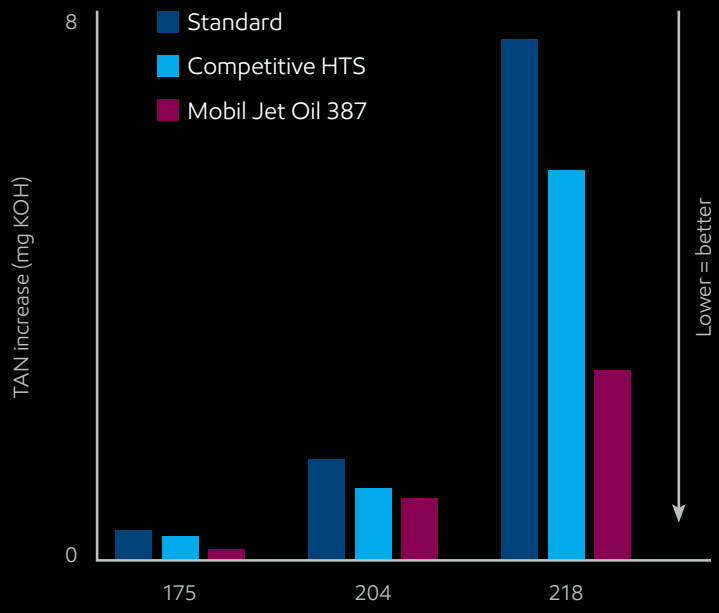
Mobil Jet™ Oil 387 stability

Oxidative stability and resistance to acid formation (TAN) offers engines protection for extended periods.

Required by MIL PRF 23699 & SAE AS5780 specifications for 72 hours at stated temperatures.

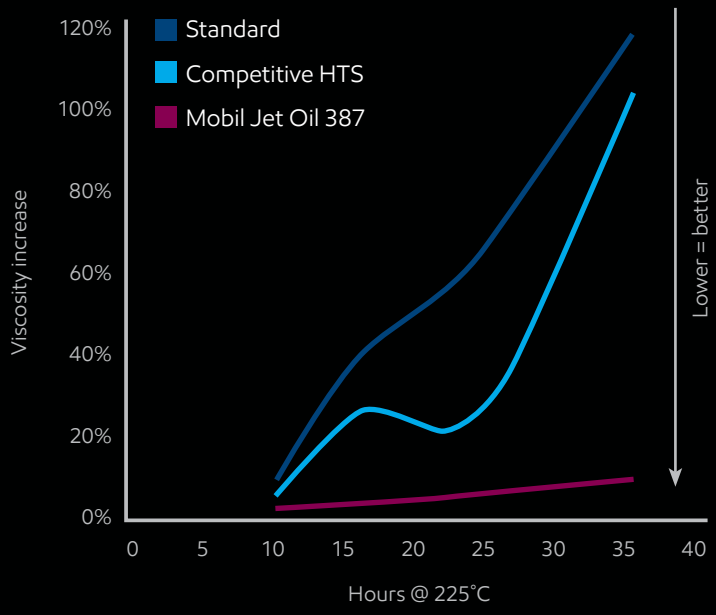
Mobil Jet Oil 387 lubricant maintains viscosity over a wide range of temperatures. It was specifically designed to have excellent oxidative and corrosion stability.

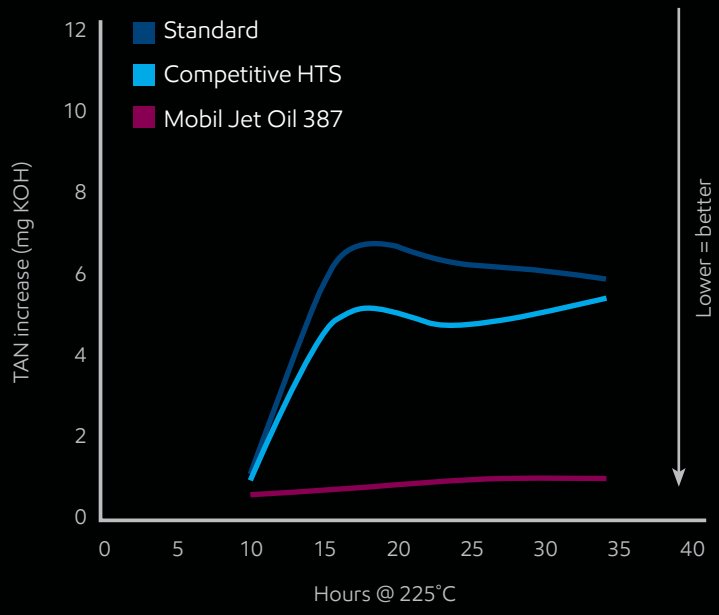




Def Stan 05-50 method 9 oxidation test required by SAE AS5780

Mobil Jet Oil 387 lubricant maintains consistent viscosity and low TAN as compared to other oils, and also performs longer under extreme heat conditions, improving effective life of the oil.





Performance of turbine oils in generators

Seal leaks

HTS oils can be aggressive on seals. When the wrong Viton elastomer seal is used in an accessory, an HTS oil can cause the elastomer seal to swell, become brittle and crack. In such a state, it can no longer maintain a tight seal between the components, allowing oil leakage that may lead to IDG shutdown.

Mobil Jet™ Oil 387 lubricant provides superb seal compatibility and prolonged seal life. Compared to the competitive HPC oils tested, Mobil Jet Oil 387 lubricant offers improved protection against oil leaks.

The fluorocarbon elastomer specimen exposed to Mobil Jet Oil 387 lubricant is pliable and shows no cracks.

The fluorocarbon elastomer specimen exposed to competitive HPC oil is brittle with visible cracks.

Conclusion

Of all the turbine oils that were tested, Mobil Jet Oil 387 lubricant was the only one that overcomes all of these oil-related generator reliability issues. This may reduce the mean time between unplanned removals (MTBUR) for the generator and reduce costs for operators. When it comes to turbine oil performance, this is yet another demonstration of how Mobil Jet Oil 387 lubricant strikes the perfect balance.

For more information

Please contact your ExxonMobil aviation sales representative.