

An Investigation of Hot Surface Ignition Temperatures of Polyalphaolefin-Based Dielectric Coolants

by

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Dielectric Coolants, based on synthetic hydrocarbons rich in Polyalphaolefin (PAO) compounds, are becoming increasingly utilized as a heat transfer medium on advanced military airframes. This could potentially bring them in contact with hot surfaces as a result of their integration or from leaking in proximity to high temperature equipment. Previous studies, including the Air Force Wright Aeronautical Laboratories study AFWAL-TR-88-2101, examined the hazards of hot surface ignition for common fluids integrated on aircraft. It was demonstrated that a maximum surface temperature of 400° F produced no ignition when fluids studied contacted a hot surface. The work also provided the basis for so-called safe temperatures for exposure that offered a very low probability of ignition when exposed. These findings were later summarized in the Society of Automotive Engineers paper number 901950 on the subject. These previous works do not provide any insight into the hazards of the hot surface ignition of PAO based dielectric coolants.

A study was conducted on a variety of PAO-based dielectric coolants conforming to the material standard MIL-PRF-87252. The purpose was to compare the hot surface ignition temperatures of the fluids when exposed to a common, consistent ignition source. This was base lined against common fluids like MIL-PRF-83282 and JP-8 to provide the essential context of previous studies. This study establishes the comparative hazard of PAO dielectric coolant as compared to other common hydrocarbon fluids when integrated on aircraft in the presence of hot surfaces. Surface temperatures causing ignition were compared for different brands of PAO and Mil Hydraulic Oil and examined in terms of probability of ignition.

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