RECO-COOL

TECHNICAL BULLETIN 0001/12

INCIDENCE OF AUTOMOTIVE FIRES CAUSED BY COMBUSTION OF COOLANT PRODUCTS

Most automotive coolants are manufactured with up to 50% of Mono-Ethylene Glycol. MEG is widely reported as having a Flash Point of 113 °C (recorded as a neat solution >99% purity, Pensky Marten closed cup ASTM D93), and a Fire Point of approximately 123 °C.

Because of this, MEG (and coolants, in particular) has sometimes borne the blame in automotive fires where combustion has initiated at points close to the cooling system. The cooling system itself is in very close proximity to fire initiation sites, such as the combustion chamber itself, turbocharger units, and the fuel system.

The following is a set of conclusions drawn by the INTERNATIONAL SYMPOSIUM OF FIRE INVESTIGATION SCIENCE AND TECHNOLOGY following a report commissioned by the symposium on this subject in 2008.

1. Ethylene glycol coolants will not auto-ignite on the metal surfaces in a motor vehicle and cause a vehicle fire, except under very specific and unlikely conditions.

2. Ethylene glycol coolants released into an engine compartment will likely contain a percentage of water.

3. Water in ethylene glycol coolant inhibits ignition and combustion of the coolant.

4. In order to ignite ethylene glycol and water mixtures, the majority of the water must first be evaporated from the mixture.

5. In order to ignite ethylene glycol, it must first be located where it is pocketed and heated sufficiently to establish a vapor plume with a air-fuel mixture within the upper and lower flammability limits of the vapor in essentially static air flow conditions.

6. In order to ignite ethylene glycol, an adequate piloted ignition mechanism must be located within the vapor plume above a heated pocket of liquid ethylene glycol, in essentially static air flow conditions.

7. In order for ethylene glycol engine coolant to be the first fuel in a vehicle fire, the conditions listed in items 5 and 6 above must be present, and the burning plume of ethylene glycol vapors must be located such that nearby combustibles are ignited and that they continue to burn.

8. Malfunction of the engine or extended heavy overloading of the engine prior to the release of engine coolant could lead to the coolant having a lower concentration of water when it is released. It is, however, very likely that the coolant will continue to contain sufficient water to inhibit ignition or combustion of the coolant.

9. There is a very low probability that engine coolant released in a motor vehicle will find a place to be pocketed and heated, and then for a vapor plume to develop above the pocket, and that location to also have an electric arc sufficient to ignite the vapor plume in a static air flow location.

10. Based on available information, an electrolysis ethylene glycol reaction is considered to not be a viable ignition mechanism in motor vehicle fires.

Analysis of the information and test data presented in this paper indicates that engine coolant is not a good candidate for the first fuel in a vehicle fire. The exception to this requires that the investigator can substantiate that at the start of the fire, the conditions that ethylene glycol needs to ignite and burn, with sufficient energy to spread to other nearby combustible materials, were in existence. This process (absent electrolysis) as noted earlier, depends on many factors (in light of the heat limitations of the components in the motor vehicle) that include consideration of the percentage of water content of the coolant, having a quantity of the coolant pocketed where it can be heated to boiling, having essentially static air flow, having sufficient residency time in the pocketed heated condition to establish a vapor plume, having the vapors in the plume with the proper air-fuel mixture, and having an igniter of sufficient energy resident in the vapor plume for ignition.

The experienced investigator will recognize that the potential for all of these factors to co-exist at the start of a vehicle fire is, for all practical purposes, approximately zero. This analysis is aided by the determination, based on the available test data, that auto-ignition of engine coolant on heated automotive surfaces is likewise, for all practical purposes, approximately zero.

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