AUTOMOBILE ENGINE COOLANT RELATED FIRES

By

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Automobile engine coolant related fires may result from engine coolant leakage, an increase in the concentration of the glycol in the water/glycol mixture, the nature of the vapor/particle distribution, and contact with an ignition source in the engine compartment. Ethylene glycol, a common coolant, is a flammable liquid with an ignition temperature near 800F. In recent years, propylene glycol is being used because of environmental reasons. Propylene glycol is also a flammable liquid with an ignition temperature near 700F. In an automotive application, the glycol is mixed with water at about a 50/50 ratio. Ignition of this concentration of coolant is difficult because of the water. When released at high temperatures into the atmosphere where the water evaporates, the glycol vapor/liquid droplets can reach the state of an ignitable mixture. Typical ignition sources in the engine compartment include hot surfaces (exhaust manifold, exhaust system) and electrical components (relays, distributor, spark plug wires). Automobile accidents, resulting in hot vapor expulsion from the coolant system, are also known to cause fires.

Figure 1

Figure 1 is a view of a late model sedan that was being driven home from a radiator shop where the radiator had been repaired. The repair entailed draining and replacing the coolant. After driving several miles, the owner of the vehicle noticed smoke under the hood. The vehicle was stopped and a fire ensued in the engine compartment. Burn patterns in Figure 1 confirmed the engine compartment origin of the fire.

Figure 2

Figure 2 is a closer view of the engine compartment with the hood raised. Inspection revealed an open engine coolant system cap as indicated by the arrow in Figure 2 and shown in detail in Figure 3. Apparently, the radiator coolant system cap was not found secured to the flange assembly.

Figure 3

Figure 4 shows an exemplar cap constructed of steel. The cap has a locking feature, which keeps it in place and reduces the chance of accidental removal when the coolant is hot. Because of the steel construction, such a cap would not be consumed in a fire of this magnitude and should have remained in place.

Figure 4

The absence of the cap suggests that the radiator repair shop did not properly secure it to the cooling system flange assembly. This results in heating of the coolant with no pressure in the system. Water will boil first at about 212 F, while the glycol will not boil off until about 370 F. Once the water had boiled away and the glycol coolant was expelled from the open flange, it was ignited by several possible ignition sources in the engine compartment and resulted in the coolant related fire.

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