

USE OF ETHANOL-BLENDED FUELS

Vehicles have evolved from the limited design models 100 years ago to the many unique colors, shapes, sizes, and brands available today. Along with allowing the consumer the option of selecting the vehicle maker, model, trim level, two-wheel, four-wheel, or all-wheel drive, they also can select from either gas, diesel, compressed natural gas, gasoline-electric, or flex-fuel to determine which propulsion system they may want.

With these many options available to the consumer, there are also opportunities for a repair facility to become exposed to different types of vehicle fuel systems. The two most recent fuel system introductions are the gasoline-electric hybrid and vehicles capable of burning ethanol-blended fuels, E85 being the most common (see Figure 1).

There are different types of ethanol-blended fuels, and it is important for collision repair technicians to know the differences and what can go wrong when servicing vehicles with ethanol-blended fuel.

Ethanol is an alcohol derived from corn and is used for two basic reasons: economics and to reduce pollutants introduced into the environment. Ethanol is mixed with fuel in three common formula ratios, though depending on your location in the world, the common ratios can be different.

FUEL RATIOS

Fuel ratios are expressed in the mixture of ethanol to gasoline, with the letter "E"

and a number. The number indicates the percent of ethanol in the fuel mixture (see Figure 2).

E10, which is a mixture of 10% ethanol and 90% gasoline, can be used in internal combustion engines of most modern vehicles. E10 is available in North America and the only type of gasoline sold in Minnesota, along with E85. As of the spring of 2006, due to the phasing out of methyl tertiary butyl ether (MTBE), which was used as a gasoline additive in the place of lead, E10 has become very common throughout North America.

Similar blends to E10 include E5 and E7, which are generally safe for engines that run on pure gasoline. Some regions mandate that locally sold fuels contain at least some ethanol. It is in this situation where these smaller ratio fuels may be sold.

E15 (15% ethanol/85% gasoline) is generally the highest ratio of ethanol to gas that is recommended by vehicle makers selling vehicles in North America in vehicles that do not carry the designation of E85 or flex-fuel.

E20 (20% ethanol/80% gasoline) is not yet widely used in North America, but will be mandated by Minnesota for all gasoline sold by 2013. Since February 2006, E20 is the required mixture for all gasoline sold in Brazil.

E85 (85% ethanol/15% gasoline) is generally the highest ethanol fuel mixture found in the U.S. It is common in Sweden, and is gaining in popularity across North America.



Figure 1 – Depending on the location and the station, E85 fuel may be sold at the same station as E10.



Figure 2 – Gas pump labels typically identify how much ethanol is in a fuel mixture.

E95 contains just 5% gasoline and is used in some diesel engines where high compression is used to ignite the fuel, as opposed to the operation of gasoline engines where spark plugs are used. This is because as octane ratings increase, compression ratios must also increase to cause the fuel to ignite.

E100 is straight ethanol used in Brazil and Argentina. Ignition in temperatures below 15°C (59°F) causes problems when using pure or neat ethanol. A common cold-weather solution is adding a small gasoline reservoir to increase the gasoline content momentarily so ignition can occur and the engine can start. Once started, the engine can be operated on pure ethanol. In Brazil, ethanol fuel is hydrated ethyl alcohol, which is a mixture of 96% ethanol and 4% water. This distillation creates the purest form of ethanol.

To clearly know which vehicles are designed to operate on which types of fuel, refer to the vehicle owner's manual, fuel fill cap, signage on the vehicle, or vehicle maker's service information.

FLEX-FUEL VEHICLES

As of 2006, most every vehicle maker has a flex-fuel, or E85-capable, vehicle for sale in North America. As an example, for 2006, General Motors vehicles equipped with a 5300 V8 engine are designed as flex-fuel vehicles.

DRIVEABILITY

Regardless of the vehicle maker, the use of ethanol-blended fuels can cause driveability issues from using ethanol-based fuels with ethanol concentrations above 10% in non flex-fuel vehicles, or from a condition called "phase separation." Phase separation occurs when water saturation occurs to ethanol-blended fuel.

Using fuel in vehicles that are not capable of handling ethanol ratios above 10% can damage parts from the fuel pump to the engine. Depending on the age of the vehicle and the vehicle maker, flex-fuel-specific parts can include the fuel tank,

fuel pump, fuel sending unit, non-metallic fuel lines and hoses, fuel filter, fuel injectors, and parts of the exhaust system.

PHASE SEPARATION

When water is absorbed by the ethanol, the alcohol in the fuel begins to be removed, therefore reducing the octane rating of the fuel. When enough moisture is absorbed into ethanol-based fuels (one gallon of ethanol fuel can absorb 3.8 teaspoons of water), beyond 3.8 teaspoons of water, the fuel can no longer absorb water and the extra water separates and settles to the bottom of the fuel tank.

What occurs as a result is poor driving conditions, such as knocking, pinging, sluggish performance, or a hard or no-start condition. From the effect of the alcohol being removed, the air-to-fuel ratio becomes lean and combustion chamber temperatures increase. Increased combustion chamber temperatures will lead to premature wear.

With ethanol fuels being used more in North America, the opportunity for water entering an open fuel system may become a concern for repair facilities. Water contamination of a fuel system may become a problem for vehicles that are stored for extended periods of time in environmental conditions that are humid or wet.

Visit <http://www.e85fuel.com> to view a listing of E85 capable vehicles.

CONCLUSION

With the ever-changing design of motor fuels, and the evolution of vehicles that are capable of burning different types of fuel, there could be a diagnostic challenge for collision facilities today and in the future. Filling a vehicle with the wrong fuel can lead to driveability problems not commonly seen by most technicians.

For comments or suggestions on the Advantage Online, please contact I-CAR Senior Instructional Designer Bob Jansen at bob.jansen@i-car.com.