



CENTRAL NEWS

Phase Separation with E10

By Blaine Ballentine

The New Fuel

Some states have mandated that gasoline within their borders contain 10% ethyl alcohol, the same variety of alcohol used in adult beverages, resulting in a fuel called E10 or gasohol. Although the change has created a lot of problems and questions, it is amusing for us in the Midwest when E10 is referred to as a “new” fuel because it has been available in Iowa for more than 30 years. In fact, if you dig through our literature from the late 70s, you will find that Cen-Pe-Co Motor Klenz (discontinued long ago) was recommended for “both leaded and unleaded gasoline and gasohol.” Since its introduction in the early ‘80s, Cen-Pe-Co Gas-O-Klenz has been recommended for “leaded or unleaded gasoline or gasohol.”

Although you are unlikely to notice the difference between gasoline and gasohol under most circumstances in a newer passenger vehicle,



there are significant differences. Pure ethanol (E100) is high in octane, but has about 35% less energy content than gasoline, so E10 contains about 3.5% less energy than gasoline. Ethanol contains oxygen and E10 enleans the fuel mixture when equal volumes of fuel are introduced to the cylinder. E10 can swell elastomers in old equipment, increase intake valve deposits, absorb moisture, degrade faster during storage, and increase corrosion.

Phase Separation

The most hazardous property of E10 is probably phase separation. E10 will hold water until it hits its saturation point, which is where it will not hold any more water. Below the saturation point, the contaminated E10 is clean and clear with no milky appearance, no cloudiness, and not even any haziness. Above its saturation point, E10 separates into two phases. There is fuel on the top and a mixture of water and alcohol on the bottom. You can imagine trying to start an engine on a water/alcohol mixture that settled to the bottom of the tank after phase separation.

You are probably thinking that this would be a major inconvenience if it happened to you, but you would just drain the water/alcohol mixture off the bottom and use the remaining fuel. That is potentially

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dangerous. Ethanol is a high octane fuel component with an octane of 105 to 115, which is often blended with a low octane gasoline to arrive at an octane in the finished fuel of 87, for example. If water contamination pulls all of the alcohol out of the fuel, the octane of the remaining gasoline can be 85, which is below most manufacturers' recommendations and may risk detonation. The entire tank may need to be drained.



go back into solution without agitation, even if returned to warmer temperatures. Needless to say, if you have phase separation from falling temperatures, you will be late for work.

Passenger cars are at relatively little risk of water contamination because their fuel tanks are not vented to the atmosphere (unless you have a classic from the '70s or earlier). So unless a car is filled with contaminated fuel, there is not much risk of phase separation.

Small engines and storage tanks, on the other hand, are at much greater risk because they are usually vented to the atmosphere where they can draw moisture from the air. Boats are at greatest risk of water contamination with their infrequent use and fuel tanks that are vented to a very humid atmosphere.

If phase separation occurs, two-cycle engines represent the worst case scenario. Here, not only does the engine ingest the free water/alcohol mixture, but the two cycle oil stays in the fuel phase. So, you have no lubrication while trying to burn a water/alcohol mixture, which can cause immediate damage.

Temperature Effects

While any contamination is undesirable, water contamination below the fuel's saturation point does not cause any immediate problems. Above the fuel's saturation point, you will have trouble. The insidious thing is that the saturation point is dependent on temperature. Warm fuel can hold a lot more water than cold fuel.

Water contaminated E10 can be clean and clear on a warm day, but that same fuel can drop water and alcohol to the bottom of your tank as the fuel cools during the night. The water/alcohol mixture will not

Central Petroleum Company conducted a simple test of phase separation. A sample of E10 was obtained from a local gas station and contaminated with 0.4% distilled water. The sample remained clean and clear with no dropout, even after several days. The sample was then placed in a refrigerator (37°F) over night, and 2% water/alcohol mixture settled to the bottom. Remember, only 0.4% water was added, but there was a 2% dropout.

The sample was returned to room temperature, but left undisturbed. The 2% dropout remained on the bottom even after several days. The sample was then shaken, and the water/alcohol mixture went back into solution. Again, there was no dropout after several days.

Finally, the contaminated E10 sample was placed in the freezer (-5°F) overnight, and 5% water and alcohol dropped out. The ethyl alcohol in the E10 was an effective anti-ice agent, because the dropout remained a liquid at -5°F.

Phase Separation Additives

Several gasoline additives are available that claim to prevent, inhibit, or reverse phase separation in E10 fuel. Although a case could be made to support these claims under certain conditions, their effect in the real world is likely to be small.

For example, you could put pure ethyl alcohol in a bottle and claim it is a "green" (made from corn) biochemical additive that inhibits phase separation. It is true that alcohol absorbs water, which is why our sample above held 0.4% water at room temperature, and your "additive" will allow the fuel to hold a little more water at a given temperature. The problem is with the treat rate.

If you recommend a quart of your special "additive"

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per 25 gallon tankful, you have added 1% alcohol to a fuel that already contains 10% alcohol, creating E11.

Look at it this way. The ethanol in E10 is like you have added 10 quarts of moisture absorbing additive to a 25 gallon tankful of gasoline. If there is enough water contamination to cause phase separation, how much difference would adding one more quart make? You can answer that question in terms of “how much more water,” or “how many degrees cooler.”

There is a demonstration of an additive that reverses phase separation on the internet. E10 is contaminated with 0.5% water, which produces 1.7% dropout. Then 5.1% additive with agitation is used to reverse the phase separation, which is over 10 times more additive than water. The additive’s label recommends 1 quart to 80 gallons of fuel, yet 16 times that rate was added to reverse phase separation in the demonstration. How much protection from phase separation do you think it would provide at the regular treat rate?



Gasoline additives may claim to inhibit phase separation, but we advise skepticism because the effect at normal treat rates is likely to be small.

Prevention

Here is another one of those situations where an ounce of prevention is worth a pound of cure. The best way to stop phase separation is to prevent moisture intrusion.

Take the normal precautions against condensation by keeping your tanks full, sheltering tanks and equipment from temperature swings, and topping off or draining the tanks of seasonal equipment prior to storage. Make sure small storage containers are sealed. Storage tanks should have vents that do not inhale easily, and should have filters with water separators. Boats, and if possible other small engines, should a 10-micron filter with a water separator.

Finally, use a good gasoline additive such as Cen-Pe-Co Gas-O-Klenz. We could claim GasO-Klenz inhibits phase separation based on dispersancy, but in practice, the difference it would make in phase separation is negligible. However, Gas-O-Klenz, will help alleviate other problems from using E10.

GasO-Klenz

If you have kept your fuel tanks clean with Gas-O-Klenz, the additional solvency of E10 will not clean deposits out of your tank and move them to the filter and the rest of the fuel system. Gas-O-Klenz is a fuel stabilizer that prolongs the storage life of E10, which is less stable than gasoline. It cleans intake valve deposits in E10 fuel, which is more prone to forming deposits than gasoline. Gas-O-Klenz contains powerful rust inhibitors to combat the greater corrosion tendency of E10. Finally, no additive can increase the slightly lower energy content of E10 fuels, but GasO-Klenz can help burn the fuel more completely, putting more power to the ground and paying you back in fuel economy.

E10 is a different fuel with its own set of characteristics. However, most of the challenges it presents can be prevented with good tank hygiene and a good fuel additive.

References

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From the Farm Shows



Above: The Silver Bullet and Hauler on display at the Cen-Pe-Co booth in the Ohio Farm Science Review in London, OH.



Right: Working the show are (from left to right) Dave Fitzpatrick, OH Duane Tooman, OH and Molt Boerger, OH.



Left: Working the Cen-Pe-Co booth at Empire Farm Days, in Seneca Falls, NY are (from left to right) Ed Jacobs, NY Andy Batty, NY and Erich Haesche, NY.



HD transmission recommendations

In their March 2010 Lubrication Manual Eaton, who manufactures over 90% of the heavy duty truck transmissions in North America,¹ no longer recommends the use of API MT-1 gear lubes in their transmissions that are under warranty². In their automated transmissions and in their transmission above 1850 ft lb of torque they require a synthetic SAE 50 meeting Eaton PS-164 Rev 7 specifications. In their mechanical transmissions below 1850 ft lbs they recommend either the synthetic SAE 50 or a heavy duty engine oil SAE 50 meeting Mil-L-210418 specifications, or CAT TO-4 SAE 50.

Although SAE 90 gear lubricants meeting API MT-1 have been recommended as recently as 2007,³ Central Petroleum Company has received confirmation from Eaton that such fluids are no longer recommended. The additive in some MT-1 gear lubricants can attack copper, causing oil cooler failures. Further, Eaton states that continuing to use API MT-1 gear oils in the transmission “will void any warranty.”⁴ Therefore, even though we have never had a complaint or any report of a failure, and we are not using an aggressive active sulfur additive, we no longer recommend Cen-Pe-Co Hy-Torque Gear Lube in

heavy duty transmissions.

Central Petroleum Company recommends Cen-Pe-Co Synthetic MTF 50 for Eaton transmissions. Those with mechanical (not automated) transmissions below 1850 ft lbs of torque also have the option of using Cen-Pe-Co S-3 Engine Oil SAE 50 or Cen-Pe-Co TO-4 Oil SAE 50.

It has been our experience that these mineral (petroleum) oil formulations make the transmission quieter than synthetics, and some drivers have reported a better shift-feel. On the other hand, Eaton permits much longer drain intervals with synthetic products, such as Cen-Pe-Co Synthetic MTF 50.

References

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Automated	Cen-Pe-Co Synthetic MTF 50
Mechanical >1850 ft lbs	Cen-Pe-Co Synthetic MTF 50
Mechanical < 1850 ft lbs	Cen-Pe-Co Synthetic MTF 50 Cen-Pe-Co S-3 SAE 50 Cen-Pe-Co TO-4 SAE 50