

Introduction

Ethanol's history in the automobile industry dates back to the 1880s when Henry Ford built one of his first automobiles and fueled it with ethanol. Today more than 15% of U.S. motor fuels contain ethanol which is sold primarily as E10 (10% ethanol, 90% gasoline).



Ethanol is a high octane, non-toxic, biodegradable alcohol produced from renewable resources such as grain or wood. The use of ethanol blended fuels provide environmental benefits. Because ethanol contains 35% oxygen by weight, it reduces tail pipe emissions of carbon monoxide and air toxics. Ethanol is blended with low octane fuel to produce a blend that is comparable with other fuels. Research has shown that ethanol may slightly lower fuel economy but is much less of a factor than wind direction and geography.

Since the Clean Air Act Amendments of 1990, oxygenates (compounds that contain oxygen) like ethanol have been required in gasoline. In order to satisfy the growing demand for ethanol blended fuel, precautionary measures must be taken to prevent product contamination.

Product Contamination

Ethanol is miscible (mixable) in all proportions with water. This is unlike conventional gasoline which does not have a high tolerance for water, and the water quickly separates to the bottom. In ethanol blended gasoline, water can be added to a saturation level before separation will occur and the ethanol/water mix will fall out of the gasoline. This separation is known as "phase separation".

Phase Separation

The amount of water that causes phase separation will vary with temperature. At 60° F, water can be absorbed by E10 up to 0.5 volume percent before phase separation occurs (about 3.8 teaspoons per gallon or 5 gallons per 1,000 gallons). Once the phase separation occurs, the ethanol/water phase will fall to the bottom leaving the low octane blended gasoline.

The ethanol/water phase will result in a leaner combustion mixture which will cause engine failure or damage if distributed to the consumer. If the ethanol/water phase is above the UST pump suction, this phase will also be dispensed to consumer vehicles where immediate engine failure will occur.

Because of phase separation, tanks must be properly prepared for conversion and subsequently maintained.



Ethanol Blended Gasoline

- Large amounts of water can cause the ethanol to separate from the gasoline
- When water is present, ethanol can leave the blend and enter the water
 - Water/ethanol mixture does not burn
 - The octane of the remaining gasoline is reduced

Blended Fuel

↓ Ethanol ↓

Water

Phase Separation Timeline



Original sample of ethanol blended fuel.



Added blue dyed water. The water is absorbed by the ethanol blend.



Added water past the saturation point. Phase Separation occurs



Time has passed allowing the ethanol/water to separate to the bottom.

Tank Conversion

Pre-Conversion

- ☑ Review history of tank to insure no prior instances of water contamination.
- ☑ Determine if tank has been internally lined.
 - Epoxy linings prior to 1980 are not suitable for gasoline/ethanol blends. Lining installed in 1980 or later may be satisfactory, but compatibility should be confirmed with supplier.
 - Fiberglass tanks after 1970 are compatible but should also be confirmed by the supplier.
- ☑ Inspect tank fill cap and replace gasket as necessary. Check brass adapter and replace as necessary.



- ☑ Order special water detection paste for ethanol fuels in order to detect water bottoms in ethanol blend tank. See back for details on supply information.

- ☑ Order and install the 10 micron filter specifically designed to detect and shut down delivery if phase separation occurs. See back for details on supply information.

Conversion

- ☑ Allow present tank inventory to be reduced to a maximum of 10% by volume of tank capacity.
- ☑ If water/sediment bottoms are present, pump out bottoms to assure complete removal.
- ☑ Introduce the blend into the tank as soon as possible. This initial delivery should fill the tank to 90% of capacity to safeguard against phase separation.
- ☑ Purge all lines until blend is clear.
- ☑ Recheck tank for water bottoms with water detection paste within 24 hours.

Ongoing Precautionary Measures

Several steps can be implemented to insure the quality of ethanol blended gasoline at retail outlets.

- Order and install the 10 micron filter specifically designed to detect and shut down delivery if phase separation occurs. See back for details on supply information.
- Monitor tanks for water bottoms daily using an automatic tank gauge (ATG) or manual gauging using water detection paste, see back for details. If using an ATG, a manual stick for water and product levels

should be conducted at least monthly to ensure the ATG is working correctly. If water is detected immediately, stop sales from tank and remove the

water. Fuel should be tested to verify it still meets minimum octane requirements.

- Inspect all fill and vapor recovery caps to insure secure closure and prevention of water entry.
- Timely inspection of spill reservoir and proper disposal of contents. This may require the removal of debris and water by pump, as opposed to the flushing of contents into the tank.
- Standing water above underground tank openings should be removed as soon as possible in an environmentally safe manner.
- Tanks should be manually gauged checking for water after heavy rains or snow melting.
- Limit the filling of tanks in times of heavy precipitation.

Contact Us

Marathon Petroleum Company LLC

Mail:

Marathon Petroleum Company LLC
P.O. Box 1
Findlay, Ohio 45839

E-mail:

General Information:
Webmaster@mapllc.com

Links:

<http://roadmap.fdy.mapllc.com/products-services/>

Other Contacts:

Water Detection Paste:

Kolor Kut Paste

Houston, TX
713-926-4780

Sartomer Company

<http://www.sartomer.com/>
Exton, PA
610-363-4100

Dispenser Filters:

BIB Manufacturing Company

800-325-8577

Champion Laboratories, Inc.

<http://www.champlabs.com/>
1-800-882-0890

Cim-Tek Filtration

<http://www.cim-tek.com/>
217-64-78-2511

Manufacturers should be contacted for a list of suppliers in your area.



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Ethanol Blended Gasoline



Bulk Storage & Service Station Product Quality Assessment

Overview

- The emerging role of ethanol blended fuels
- How you play a key role in the distribution system
- Precautionary measures which will maintain product quality