



Utah Department of  
**Agriculture**  
and Food

# ETHANOL BLENDED GASOLINE FACTS FOR RETAILERS & CONSUMERS

---

E10 GASOLINE (10% ETHANOL, 90% GASOLINE)

350 N. REDWOOD ROAD  
SALT LAKE CITY, UT 84114

# ETHANOL BLENDED GASOLINE FACTS FOR RETAILERS & CONSUMERS

E10 GASOLINE (10% ETHANOL, 90% GASOLINE)

---

## • *GASOLINE ETHANOL BLENDS*

---

Ethanol has been added to gasoline since the late 1970s and since that time, the U.S. fuel grade ethanol production capacity has grown to an estimated 9 billion gallons per year. Until the late 1980s, ethanol's primary role in the fuels market was that of an octane enhancer and it was viewed as an environmentally sound alternative to the use of lead in gasoline. With its 112.5 blending octane value(R+M/2), ethanol continues to be one of the most economic octane enhancers available to the refiner or fuel blender.

In the late 1980s, some states began to use ethanol and other oxygenates in mandatory oxygenated fuel programs to reduce automobile tailpipe emissions of carbon monoxide (CO). Fuel oxygenates, such as ethanol, add chemical oxygen to the fuel, which promotes more complete combustion thereby lowering CO emissions. Hydrocarbon (HC) exhaust emissions are also reduced, but to a lesser degree.

The success of these early oxygenated fuel programs led to a similar national program in the 1990 Clean Air Act Amendments. These amendments require that, beginning in November 1992, all CO non-attainment areas implement mandatory oxygenated fuel programs during certain winter months. The oxygenated fuels program has been tremendously successful and nearly all of the original non-attainment areas have now achieved compliance.

In the 1990 Clean Air Act Amendments also required that certain ozone non-attainment areas sell Reformulated Gasoline (RFG) beginning January 1, 1995. Other ozone non-attainment areas were allowed to "opt-in" to this program. It currently estimated that reformulated gasoline comprises over 32% of all gasoline sold. The purpose of the RFG program is to reduce automobile emissions of the volatile organic compounds (VOCs), and Oxides of Nitrogen (NOx), which are ozone precursors. The program is also designed to reduce toxic emissions (benzene,

formaldehyde, acetaldehydes, and polycyclic organic matter), which pose high cancer risks.

Compliance with the RFG program is determined through the use of the "Complex Model". This model, developed by the EPA, is a set of mathematical equations that predict the change on emission levels that occur from various alterations to gasoline. RFG is required to contain a minimum of 2.0 weight percent oxygen (on average) and benzene is limited to 1.0 weight percent maximum (on average).

Ethanol is the oxygenate most widely used in reformulated gasoline. While ethanol had been blended at the 5.7% and 7.7% level, it is more frequently blended at the 10 volume percent level to take maximum advantage of available tax credits. At the 10 volume percent level, ethanol would add approximately 3.5 weight percent oxygen to the blend, the highest level allowed under EPA regulations.

The requirement to use oxygen in RFG was replaced by the Renewable Fuels Standard (RFS) in the Energy Policy Act of 2005. THE RFS requires an increasing amount of renewable transportation fuel use beginning with 4.0 billion gallons per year usage requirement in 2006 and escalating to 7.5 billion gallons of annual usage requirement in 2012.

---

**• RENEWALBLE FUEL STANDARD**

---

In 2005, Congress enacted a Renewable Fuel Standard (RFS), as part of the Energy Policy Act of 2005 (EPACT), to increase the use of biofuels in the U.S. In 2007, Congress revised and expanded the RFS as part of the Energy Independence and Security Act (EISA). Under the EPACT, the Administrator of the U.S. Environmental Protection Agency (EPA) must annually determine a RFS which is applicable to refiners, importers, and certain blenders of gasoline, and publish it in the Federal Register. On the basis of this standard, gasoline suppliers (refiners and importers) determine the volume of renewable fuel that it must ensure is used as transportation fuel. The RFS is then calculated as a percentage, by dividing the amount of renewable fuel that the EISA requires to be blended for a given year by the amount of gasoline expected to be used during that year, including certain adjustments specified by the EPACT.

---

**• ETHANOL & ENGINE PERFORMANCE**

---

Ethanol, an alcohol fuel, provides a higher octane rating which can increase engine performance and will aid in fuel system cleansing because it does not leave gummy

deposits. The use of leaded gasoline generally resulted in greater deposits throughout the fuel system. When cleaner gasoline with ethanol and detergents replaced leaded gasoline in the mid 1980s, there were some initial problems with plugged fuel filters as deposits were flushed from the fuel system. Today, all gasolines sold in the U.S. include detergents designed to keep fuel systems clean.

---

• *CONVERSION PROCEDURES - RETAIL UNITS*

---

Ethanol is infinitely soluble in water and the sensitivity of gasoline/ethanol blends to water requires certain precautionary steps to prevent phase separation. These steps include drying out wholesale storage tanks and proper preparation of retail storage tank dispensers.

**GASOLINE ETHANOL BLEND PROGRAM – Station/Store Operator  
Checklist**

**Investigatory/Preparatory**

- Verify tank material compatibility. Also submersible pumps.
- Investigate tank water problems and correct. Review history of water problems and initiate any necessary corrective action. Remove ALL water from tank and ensure tank is free of water before delivery of ethanol blended gasoline.
- Tight seals on fill caps and proper water run off from manhole covers.
- Remove water bottoms (if present). Check for tilted tanks.
- Clean tank bottom, if necessary.

**Conversion Plan (before 1<sup>st</sup> delivery)**

- Equip pump or dispenser with 10 micron filter (or “water slug” filter).  
**(Remember – Safety First – Shut Off Breaker)**
- Recheck for water bottoms and remove any present.
- Issue Alcohol compatible paste. Discard any old incompatible pastes.
- Procure proper pump labels.
- Confirm any applicable accounting procedures.

### **First Delivery**

- ☑ Check for Water. Water bottoms must be removed before first delivery of ethanol blends.
- ☑ Follow normal delivery procedures and ensure that accurate tank gauge and dispenser readings are taken.
- ☑ Verify (with transport driver) correct compartment for correct tank.
- ☑ Pumps should be shut down during initial delivery. (Check company policy)
- ☑ Purge lines from tanks to dispensers. (Check company policy)
- ☑ Install required decals and if necessary change octane decals. Also repaint manhole covers to proper color code (e.g., API color code).
- ☑ Fill tanks to at least 80% of capacity. Keep as full as possible for 7 to 19 days.
- ☑ Test for water bottoms at the beginning of each shift for the first 48 hours after initial delivery.
- ☑ Check for water bottoms daily.
- ☑ Notify designated personnel if water is detected and have it removed at once.
- ☑ Replace filters if pump/dispenser is running slow.
- ☑ Check pump calibration two weeks after initial load conversion.

### **Ongoing Maintenance**

- ☑ Check for water. No level is acceptable.

---

#### ***• AUTOMOBILE COMPATIBILITY***

---

Automobile and parts manufactures have been responsive to the changes occurring in gasoline. Material problems are less likely to occur with newer vehicles because of the upgrading of fuel system materials that has occurred since the introduction of ethanol and higher aromatic gasolines. All major automobile manufactures have indicated that their late model vehicles are equipped with fuel system components upgraded for use with these fuels. **NOTE:** Ethanol blended fuels are approved under the warranties of ALL auto manufactures marketing vehicles in the U.S.

While all auto manufactures warrant the use of 10v% ethanol blends, their upgrading of fuel systems occurred at different times. In general, 1980 and later model years should not experience problems with 10v% ethanol blends. Fuel systems in 1975 to 1980 model years were upgraded, but not to the same extent as later models. Pre-

1975 models may have fuel system components that are sensitive to high aromatic gasolines and ethanol. Specific documentation of the effect fuel components have on older fuel system parts is often lacking.

In the early 1980s, one area that presented problems in isolated cases was fuel filter plugging. Occasionally, in older model vehicles or equipment, deposits in fuel tanks and fuel lines were dissolved by ethanol blends. When this occurs, the vehicle's fuel filter may become plugged...this is easily remedied by a filter change.

---

• *GLOSSARY OF INDUSTRY TERMS*

---

**Aromatics:** High octane blending components that have a benzene ring in their molecular structure. Commonly used term for the BTX group (benzene, toluene, xylene). Aromatics are hydrocarbons.

**Complex Model:** A computer model that measures the effect of various fuel changes. The computer equations are based on test results from various test programs. Refiners are required to use this model to develop their reformulated gasoline.

**Conventional Gasoline:** Represents all gasoline sold in non-control areas or in other words, all gasoline that is not reformulated gasoline.

**Ethanol (ethyl alcohol, grain alcohol):** Typically fermented from the starch found in grain. An octane enhancer added at a rate of up to 10% in gasoline. Will increase octane 2.5 to 3.0 numbers at 10% concentration. Ethanol is an oxygenate.

**Oxygenated Gasoline:** Gasoline containing an oxygenate such as ethanol. Provides chemical enrichment of the A/F charge thereby improving combustion and reducing tailpipe emissions of CO.

**Reformulated Gasoline (RFG):** Gasolines which have had their composition and/or characteristics altered to reduce vehicular emissions of pollutants. Specifically, those gasolines which meet the RFG requirements of the 1990 Clean Air Act Amendments.

---

• *REFERENCES*

---

RFA Renewable Fuels Association, FUEL ETHANOL Industry Guidelines, Specifications, and Procedures. October 2005.

The Renewable Fuels Foundation, Changes in Gasoline IV. June 2009.