



# *Switching To Ethanol?*

*Guidelines for Conversion of Retail Service Station Tanks from Gasoline to Ethanol - Blended Gasoline*

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*This document contains general guidelines based on information from a variety of sources. It is not intended to replace thorough review, careful planning, consideration of site-specific issues, or sound judgment of retail station owners or operators. Mention of trade names does not imply endorsement. Additional information on materials compatibility and station preparation is available from a variety of sources.*

***“E10 is approved for use in any make or model of vehicle sold in the U.S. Many automakers recommend its use because of its high performance and clean-burning characteristics.”***

### **Ethanol Online**

**National Ethanol  
Vehicle Coalition**  
[www.E85fuel.com](http://www.E85fuel.com)

**U.S. Dept. of  
Energy**  
[www.eere.energy.gov](http://www.eere.energy.gov)

***“Ethanol is a clean-burning, high-octane fuel that is produced from renewable sources.”***

*This information provides recommended guidelines for conversion of retail service station tanks from gasoline to ethanol-blended gasoline. Proper planning and good housekeeping are essential for an efficient, trouble-free conversion and continued customer satisfaction.*

## **What is Ethanol?**

Ethanol is a clean-burning, high-octane fuel that is produced from renewable sources. Ethanol is grain alcohol, produced from crops such as corn. Because it is domestically produced, ethanol helps reduce America's dependence upon foreign energy sources.

Pure, 100% ethanol is not generally used as motor fuel; instead, a percentage of ethanol is combined with unleaded gasoline. Ethanol blends are beneficial because:

- Fuel cost decreases
- Fuel octane rating increases
- Harmful gasoline emissions decrease

Any amount of ethanol can be combined with gasoline, but the most common blends are these:

### **E10 - 10% ethanol and 90% unleaded gasoline**

Blends up to 10% (E10) are approved for use in any make or model of vehicle sold in the U.S.. Many automakers recommend its use because of its high performance and clean-burning characteristics.

### **E85 - 85% ethanol and 15% unleaded gasoline**

E85 is an alternative fuel for use in Flexible Fuel Vehicles (FFVs). There are currently more than 4 million FFVs on America's roads and automakers are rolling out more each year. In conjunction with more flexible fuel vehicles, more E85 pumps are being installed across the country. When E85 is not available, these FFVs can operate on straight gasoline or any ethanol blend up to 85%. The National Ethanol Vehicle Coalition and the U.S. Department of Energy recommend 1 micron filtration for E85 applications. For filtration of E85, use Bio-Tek® 1 micron High Bio-Content Filters. General Motors Corporation®, the Ford Motor Company® and Cim-Tek® Filtration are all members of the **National Ethanol Vehicle Coalition**.

### **For more information:**

[www.E85Fuel.com/pdf/e85\\_technical\\_booklet.pdf](http://www.E85Fuel.com/pdf/e85_technical_booklet.pdf)  
[www.eere.energy.gov/afdc/e85toolkit/converting\\_petroleum.html](http://www.eere.energy.gov/afdc/e85toolkit/converting_petroleum.html)



*“Depending upon individual conditions, about 40% to 80% of the ethanol will be drawn away from the gasoline by the water and will separate into two distinct layers.”*

*“The top layer will be a gasoline that is lower octane and perhaps out of specification, while the bottom layer is a mix of water and ethanol that will not burn.”*

### **Did You Know?**

***In a 10% Ethanol Blend, it takes as little as 18 gallons of water in a 6,000 gallon tank to cause Phase Separation. In a 2% blend it takes only 3.6 gallons to cause Phase Separation!***

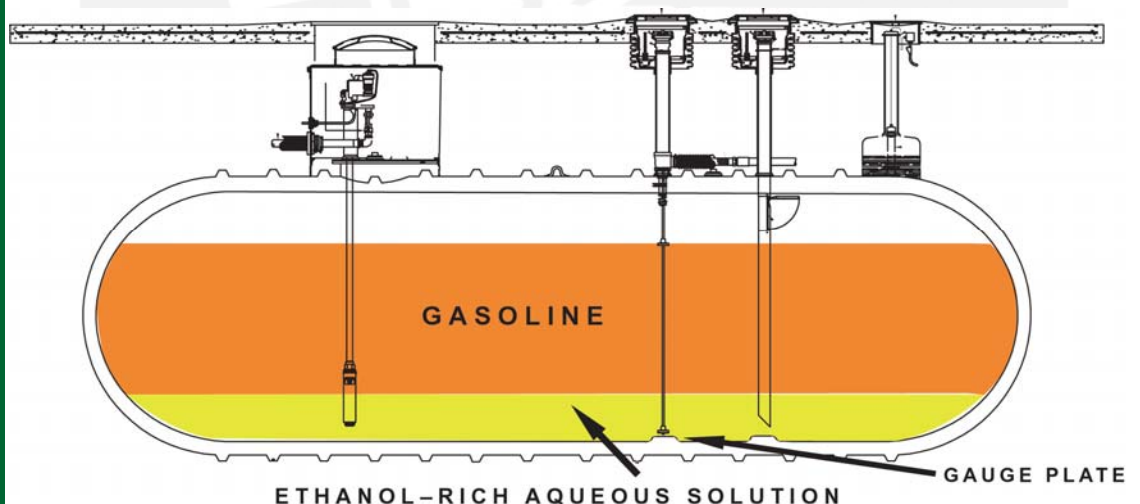
## **Phase Separation**

The worst enemy of any ethanol blend is water. The potential for Phase Separation requires that gasoline oxygenated with ethanol not be exposed to water during its distribution or use in a vehicle. Because of this requirement, gasoline oxygenated with ethanol is usually not transported in pipelines, which sometimes contain water. Rather, the ethanol is usually added to tanker trucks at the terminal immediately before delivery to the service station.

If water contaminates the fuel, the water dissolves into the ethanol and disperses through the tank. Once it exceeds the tolerance level, the alcohol water mixture will separate from the gasoline. Depending upon individual conditions, about 40% to 80% of the ethanol will be drawn away from the gasoline by the water, forming two distinct layers. The top layer will be a gasoline that is a lower octane and perhaps out of specification, while the bottom layer is a mix of water and ethanol that will not burn. **This is Phase Separation.**

***Housekeeping at the service station is very important to prevent water contamination.***

### **Phase Separation in Ethanol Blends**



**“Storage tanks that were lined with epoxy or polyester coatings before 1980 may not be suitable for ethanol-gasoline blends.”**

**Containment Solutions Inc.<sup>®</sup> recommendations for Ethanol Storage**

**Online at:  
[www.eere.energy.gov/afdc/e85toolkit/conversions.html](http://www.eere.energy.gov/afdc/e85toolkit/conversions.html)**

Owens-Corning<sup>®</sup> Fiberglass Corporation before December-1994

## **Phase Separation Guidelines**

- **Ethanol-compatible water detecting paste should be used to test your tank for Phase Separation.**
- **During the first 48 hours from conversion, the tank should be tested at regular intervals.**
- **Immediately stop the sale of the product if a phase separated layer is detected.**
- **Check product quality at the nozzle for clarity. Hazy or cloudy product indicates the presence of a phase separated layer.**
- **Determine if water has leaked into the tank or if a recent delivery was contaminated.**
- **Immediately call your fuel supplier to analyze the fuel and take appropriate steps to reblend the ethanol and gasoline to the correct octane levels.**
- **Pump off the phase separated layer and dispose of the product in accordance with local, state, or federal regulations.**
- **Deliver sufficient enriched ethanol-blended gasoline so as to fill the tank to 90% of capacity and to the right octane level. This will minimize the effect of any residual water.**
- **Install new Bio-Tek<sup>®</sup> Alcohol Monitor Filters.**
- **When delivery is complete, purge all island pumps until the product is clear. After gasoline from all dispensers is checked and found to be clear, the product may be sold.**
- **If there is a Bio-Tek<sup>®</sup> Alcohol Monitor filter installed and the fuel flow**

**Remove water *BEFORE* it becomes a problem!  
Design and follow a Daily Maintenance Program**

## **Equipment & Tank Construction**

### **For Ethanol Blends up to E10**

Equipment such as nozzles, hoses, and meter seals have long been compatible with gasoline-ethanol blends and it is unlikely that they would need modification. Very old submersible pumps could require replacement of impellers or seals. Although this is rare, if any doubt exists as to the compatibility of these units, the manufacturer should be consulted.

Determine the type of tank that will be used for storage of the ethanol-gasoline blend. Mild steel tanks are completely satisfactory. Fiberglass tanks manufactured by Containment Solutions, Inc.<sup>®</sup> and by Xerxes<sup>®</sup> Corporation carry the same standard warranty for 10% ethanol blends as for gasoline. To be sure, contact your tank manufacturer.

Storage tanks that were lined with epoxy or polyester coatings before 1980 may not be suitable for ethanol-gasoline blends. Since 1980 several satisfactory linings have been developed. If there is any uncertainty about the age and type of lining, contact the lining manufacturer before conversion to the ethanol blend.

[www.containmentsolutions.com](http://www.containmentsolutions.com)

*“A tank with a history of water and contaminants is certain to present problems when an ethanol blend is introduced.”*

*“Install Bio-Tek® Alcohol Monitor filters upon introduction of an ethanol blend into your tank. Use phase detecting paste such as: Sar-Gel® Indicator Past or Gasiola® All-Purpose Water Finding Paste to check for Phase Separation.”*

*“It is very important that you clean your tank.”*

## **Check your tank and equipment! Make sure it is suitable for Ethanol Blends!**

### **Tank Evaluation**

#### **For Ethanol Blends up to E10**

Since ethanol blends will scour contaminants from the sidewalls and the bottom of the storage tank, it is strongly recommended that a high-performance dispenser filter be used. The storage tank can accumulate a large amount of particulates that are typically mixed with water. Normal dispenser filters will prevent contaminants from reaching the customer's fuel tank, but they will not detect Phase Separation. It is essential that all water is out of the tank and recontamination does not occur before or after adding an ethanol blend to the tank.

There are many ways for water to contaminate the tank:

- **water accumulation around the fill gauge manhole**
- **secondary containment submersible pump pits**
- **faulty gaskets**
- **loose fill caps**
- **leaky fittings**
- **a leak in the tank.**

Most tank gauging systems are not effective at measuring water below  $\frac{3}{4}$  of an inch. Removal of tank bottom water and contaminants is recommended before introducing an ethanol blend. Most tanks are equipped with  $\frac{1}{2}$  inch thick gauge plates under the tank openings. This construction can mask as much as ten gallons of water in tank bottoms. Tank tilt can also mask significant quantities of water. **You must sample your tank.**

The worst enemy of ethanol blends is water. Depending on the temperature of the fuel, as little as 0.3% water can cause Phase Separation. A tank with a history of bottom water contamination is certain to present problems unless the cause of water buildup is addressed. Tanks must be prepared by taking steps to keep ground water from accumulating around the fill, gauge and submersible pump pits. **All tanks must be water-tight prior to conversion.**

### **Preparing for First Delivery**

#### **Recommended Housekeeping Procedures For Ethanol Blends up to E10**

- **Keep fill caps secure at all times.**
- **Respond to any customer complaints immediately by checking for Phase Separation.**
- **Monitor the dispenser for good flow.**
- **Change Bio-Tek® Alcohol Monitor filters when flow is restricted and check for phase separation. Contaminants and Phase Separation can both contribute to filter clogging.**
- **Always keep extra Bio-Tek® Alcohol Monitor filters on hand.**
- **Monitor fill opening and driveway covers for standing water. Correct this problem immediately.**

*(Continued on page 7)*

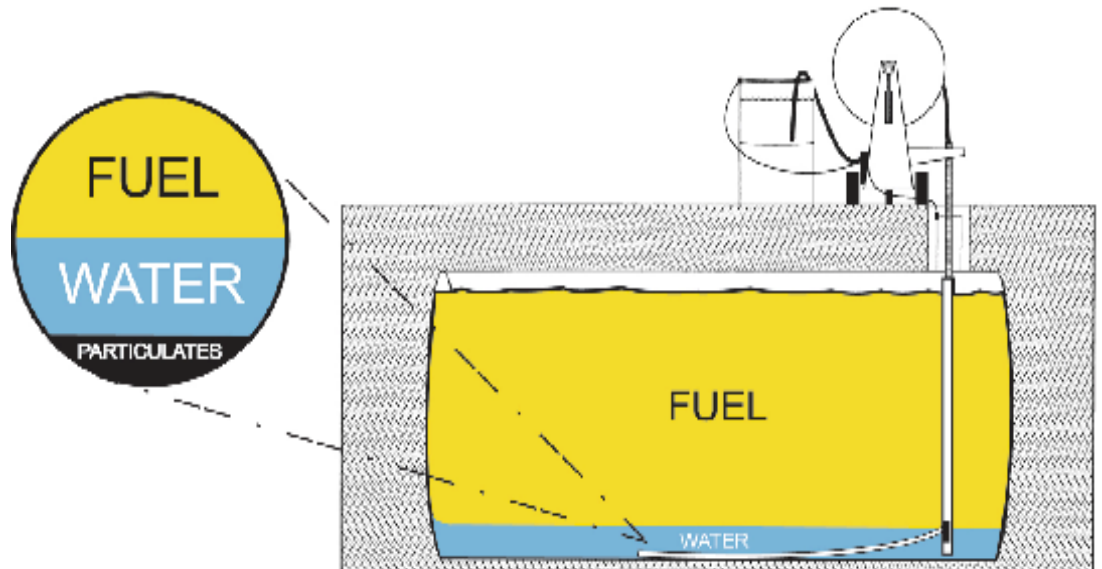
**“The Cim-Tek® Cim-Cart IV contaminant removal system is a valuable tool to remove tank bottom contaminants. It snakes along the bottom of the tank removing bottom water contamination while the station is in operation.”**

**“Conventional water finder paste and water detection filters will not detect the phase separated bottom layer quickly enough to prevent problems. Special phase detection paste and monitor filters are recommended.”**

- **Clear snow buildup to prevent melting snow from leaking into the fill opening.**
- **Monitor for Phase Separation with ethanol compatible detection paste. If a layer is detected, follow the recommended “Phase Separation Guidelines”.**
- **Take regular tank samples. Remember tank tilt and tank gauge plates can mask water.**
- **Remember that most tank gauging systems may not be effective at measuring water below 3/4 of an inch.**

### **For Ethanol Blends up to E10**

It is very important that you clean your tank and take samples. Older tanks or tanks that are not equipped with pressure vents may require special cleaning. The Cim-Tek® Cim-Cart IV contaminant removal system removes water and contaminants from the bottom of the tank. It snakes along the bottom of the tank removing water and particulates while the station is in operation. There are some cases where another method of cleaning may be required. Please contact Central Illinois Manufacturing Company for more information.



**For more information about the Cim-Cart IV please call Cim-Tek® customer service at 888.898.7187 or visit [www.cim-tek.com](http://www.cim-tek.com) to view a demonstration video.**

**Bio-Tek® Alcohol Monitor filters, with high-performance filtration technology, filter particulates while monitoring for Phase Separation.**

**“Regular water detecting filters or “water slugs” will not detect Phase Separation.”**

**“The potential for phase separation requires that gasoline oxygenated with ethanol not be exposed to water during distribution or use in a vehicle.”**

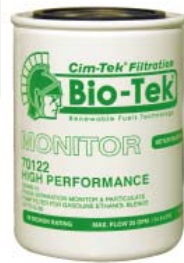
## **First Delivery** **For Ethanol Blends up to E10**

When the initial load arrives, follow normal delivery procedures. Take stick and pump readings for an accurate inventory record. After the initial delivery, it is recommended that operators dispense a few gallons of product through each dispenser to ensure the product is clear.

The best defense for preventing Phase Separation is implementing a daily maintenance routine. Installing Bio-Tek® Alcohol Monitor filters upon the introduction of an ethanol blend into your tank is strongly recommended. The Alcohol Monitor will filter out the contaminants while monitoring for Phase Separation. Once the Bio-Tek® Alcohol Monitor detects Phase Separation, it will restrict the flow signaling the station operator. Use ethanol compatible phase detecting paste such as Sar-Gel® Indicator Paste or Gasoila® All-Purpose Water Finding Paste to check for Phase Separation. Make sure to discard any paste that will not allow you to detect Phase Separation.

- **Upon the introduction of an ethanol blend, immediately check for Phase Separation.**
- **For the first 48 hours of ethanol in the tank, check for Phase Separation every few hours.**
- **Install Bio-Tek® Alcohol Monitor filters.**

*(Continued on page 9)*



### **Bio-Tek®** **400 Series** **Alcohol Monitors**

70114 400MB-05  
70120 400MB-10  
70106 400MB-30



### **Bio-Tek®** **300 Series** **Alcohol Monitors**

70116 300MB-05  
70122 300MB-10  
70018 300MB-30



## Why recommend High-Performance Filtration?

As previously mentioned, ethanol will scour and release a higher than usual amount of contaminants into the fuel. Bio-Tek® filters and Alcohol Monitors utilize a microglass element instead of a cellulose media. When compared to cellulose, High-Performance Microglass media has a higher dirt-holding capacity resulting in a longer filter life. The fully pleated High-Performance Microglass media provides flow rates up to 25 GPM and a maximum working pressure of 50 PSI. Cim-Tek Filtration offers a variety of microglass media in 1 to 30 micron efficiency ratings for High-Performance Filtration. Bio-Tek Alcohol Monitor filters are recognized by Underwriters Laboratories for use in service station pumps and dispensers.

### Cellulose Media



Large Fibers

- **Low Void Area**
- **Not suitable for fine filtration**

vs.

### Microglass Media



Glass Fibers, Small & Rigid

- **High Void Area**
- **Suitable for fine filtration**

## Summary

*The demand of ethanol-blended gasoline is growing rapidly across the United States. Alternative fuel sources are here to stay so it is very important to know how to prepare and maintain the site for introduction of ethanol-blended gasoline. Make sure that the storage tank and its components are compatible with ethanol. Ethanol has a scouring effect and will break loose any particulates in the lines and on the tank. To prepare the tank clean it thoroughly and make sure it is free of water. Use the proper tools such as an ethanol-compatible water-finding paste and Bio-Tek® Alcohol Monitors to filter contaminants and monitor the tank for Phase Separation. Check the fuel several times for the first 48 hours to be sure there is no Phase Separation. Modify your current daily maintenance program to include daily samples, checking the filters, and sticking the tank to monitor for Phase Separation. If Phase Separation is suspected, immediately test the fuel and take the proper steps listed in the "Phase Separation Guidelines." Proper planning and good housekeeping are essential for an efficient, trouble-free conversion and continued customer satisfaction.*

# Service Station Conversion Checklist

## Preparation for Conversion

- Is the tank constructed of ethanol compatible materials?
- Are the other fuel delivery system components compatible with ethanol?
  - Nozzles
  - Hoses
  - Meters
  - Seals

## Tank Evaluation

- Does the site have a history of water contamination?  
Check possible entry points.
  - Fill Gauge
  - Submersible pump pits
  - Gaskets
  - Fill caps
  - Fittings
  - Standing water
- Have samples been taken from the tank?

## Prior to First Delivery

- Has the tank been properly cleaned?
- Has all water been removed from the tank?
- Do you have ethanol-compatible water-finding paste?
- Do you have a sufficient amount of ethanol compatible filters?
  - 70018 300MB-05
  - 70120 300MB-10
  - 70116 300MB-30
  - 70114 400MB-05
  - 70120 400MB-10
  - 70106 400MB-30
- Do you have the proper decals ready to put into place?

## First Delivery

- Has the tank fuel level been lowered to near minimum levels?
- After delivery, check the tank for Phase Separation with ethanol compatible water-sensitive paste several times for the first 48 hours, daily thereafter.
- Install Bio-Tek<sup>®</sup> Alcohol Monitor filters upon the first delivery of the ethanol-blended gasoline.
- Have you flushed the sample delivery lines until product is clear?
- Have you put on the proper decals?

# Preventive Maintenance Checklist

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- Check the tank(s) for Phase Separation with ethanol compatible water-sensitive paste.**
- Monitor the dispenser for good flow.**
- Check fill opening and driveway covers for standing water. Remove water if necessary.**
- Are the fill caps secure?**
- If the dispenser flow is slow, stick the tank checking for Phase Separation. If no Phase Separation is present, change your dispenser filters.**
- Clear snow build up around the fill openings.**
- Take daily tank samples.**
- Examine all the gaskets monthly.**
- Check for loose or leaky fittings.**
- Do you have a supply of Bio-Tek<sup>®</sup> Alcohol Monitor filters?**
- Have there been any customer complaints?**
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

\_\_\_\_\_  
Date / Time

\_\_\_\_\_  
Completed By



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