



Converting Existing Underground Storage Tank (UST) Systems to Ethanol Compatible

As higher percentages of ethanol (greater than 10% ethanol by volume) are blended with gasoline, owners and operators must ensure their UST systems are compatible. What may have been compatible with E10 is probably not compatible with a higher percent ethanol blend. Before you store or dispense a higher percent blend of ethanol (E-Blend), such as E85, you must verify that your ethanol fuel path is compatible.

We developed ethanol guidance based on a review of available information on ethanol's compatibility with UST systems, industry literature and protocols, and published reports and research documents. The conclusion is straightforward: without converting to compatible equipment, your UST system could degrade and a product release could occur. Ultimately, the equipment and components must be compatible with the percentage volume of ethanol-blend you intend to use.

Concerns with E-Blend Fuel

Compatibility. Iowa law [567-135.4(3)] and NFPA 30, 2000 Edition (2.2.2) require UST systems to be compatible with the product stored. Components and equipment used for storing/dispensing conventional fuels are time tested for compatibility and readily available through your petroleum supplier. E-Blend, however, does not have the same compatibility characteristics of conventional fuels when it comes to storage and dispensing. Soft metals such as zinc, brass or aluminum, which are commonly found in conventional fuel storage and dispensing systems, are not compatible with E85. Steel tanks and piping must be UL Marked or certified by the manufacturer for use with E-Blend Fuels.

Some nonmetallic materials may also degrade when in contact with ethanol such as natural rubber, polyurethane, adhesives (used in older fiberglass piping), certain elastomers and polymers used in flex piping, bushings, gaskets, meters, filters, and materials made of cork. In order to store and dispense E-Blend fuel, fiberglass and steel UST systems/components must be listed by UL Marked or certified by the manufacturer for use with E-Blend fuels.

If you have concerns about specific storage and dispensing equipment, see New England Interstate Water Pollution Control Commission (NEIWPC), *Health and Environmental Impacts of Adding Ethanol to Gasoline in the Northeast States*, July 2001, pp. 70-71. A list of E85 compatible equipment can be found at <http://www.e85fuel.com/information/manufacturers.htm>.

Phase Separation. Ethanol is completely miscible (mixable) in water. Ethanol also blends well with gasoline. When water infiltrates a tank, (e.g., through sump covers and loose fittings at the top of the tank), the ethanol in the ethanol-gasoline blend will absorb the water, which, if enough is present, will overwhelm the ethanol's capacity to remain blended with the gasoline. Because

it mixes easier with water, the ethanol will be drawn from the gasoline into the water at the bottom, separating from the gasoline. The product in the tank is no longer a blend of ethanol and gasoline, but two layers of product--a layer of gasoline on top and an ethanol layer on the bottom. You're not getting an ethanol blend anymore, but a greater concentration of ethanol or gasoline. Phase separation can be a problem for vehicles' fuel lines as the product is no longer an ethanol blend.

Accelerated Corrosion and Conductivity. Ethanol can accelerate corrosion in steel UST systems by scouring or loosening deposits on the internal surfaces of tanks and piping. If a corrosion cell exists, the ethanol can accelerate (scour) the corrosion cell and cause a perforation. As mentioned above, ethanol is not compatible with soft metals such as zinc, brass, copper, lead, and aluminum. These metals will degrade or corrode in contact with ethanol and possibly contaminate a vehicle's fuel system.

Tank leak detection equipment composed of certain metals (mentioned above), polymers and elastomers may not be compatible with ethanol. Because ethanol has a higher conductivity than gasoline, capacitance probes will not work in ethanol-blend fuels. Verify the floats used in magnetostrictive probes are alcohol compatible and that the ATG system is properly calibrated for ethanol.

Starting the Process of Converting to a Higher Percentage Ethanol

The conversion to E-Blend fuel requires time and effort to evaluate existing equipment, verify compatibility and order ethanol compatible equipment (it's not commonly in stock). Costs are also an important consideration. Some grant money is available through National Ethanol Vehicle Coalition or NEVC (see website below). Here are some of the procedures you will have to follow in converting your system to E-Blend. The specific details are included in a separate checklist, which the owner and Iowa licensed installer or professional engineer will have to complete and submit to the department.

1. Start the process by contacting the DNR (515.281.8879 or 515.281.8895) to discuss conversion requirements and obtain a checklist of items (available on our website) that must be verified before your system can store and dispense a E-Blend.
2. You will need to verify that components in the fuel path are compatible with the E-Blend to be stored and dispensed. Contact your petroleum equipment supplier or an Iowa licensed installer to discuss converting to a higher percent ethanol blend and purchasing the appropriate equipment. A list of licensed installers is available on our website (see p. 4).

The following equipment/components/materials must be compatible with the ethanol blend you intend to store and dispense (see the checklist for more details):

- Auto shutoff or overfill valve
- Tank (Is the warranty in effect? Is it certified or UL listed for the product stored?)
- Submersible Pump, O-rings and gaskets
- Line leak detectors
- Leak Detection Equipment (ATG probes, floats, sump sensors)
- Piping material (UL listed or certified by manufacturer)
- Pipe sealant/adhesives
- Flex connectors, grommets

- Filters
 - Dispensers and hanging hardware (allow two-year phase in for compatibility)
 - Spill containment and sumps
3. Your UST insurance carrier must be informed of your plans to convert to a higher percentage ethanol. They may have other requirements other than what the department requires. The checklist requires an amended certificate of insurance.
 4. No level of water is acceptable for ethanol blend fuel due to the phase separation problems. You will need to make certain all fittings and connections at the top of the tank are tight (no vapors escape and no water enters) and that all sump and spill containment covers prevent water from entering. Any water intrusion problems must be fixed
 5. Contact the National Ethanol Vehicle Coalition (NEVC) at 877.485.8595. The NEVC provide grants for the labors and materials for converting to ethanol from conventional fuels.
 6. Determine costs and make your decision regarding the conversion. If you decide to convert, make all necessary arrangements for the conversion with your petroleum supplier or licensed installer.
 7. The tank dedicated to E-Blend must be clean. After any water problems have been fixed, you must clean the tank dedicated to E-Blend to remove all sludge from the bottom of the tank. Any sludge or particulates in the bottom of the tank will be suspended in the ethanol and cause problems with filters and fuel lines. Obtain a *Clean Tank Certificate* or similar documentation from the tank cleaner after the tank is cleaned.
 8. Fill pipe and access covers must be properly identified (API RP 1637 color code). We don't want the transport driver to mistakenly deliver E85 to an E10 tank.)
 9. The owner and an Iowa licensed installer or professional engineer must sign the ethanol compatibility checklist and submit it to the DNR. A copy of the revised certificate of insurance and the *Clean Tank Certificate* must accompany the checklist.

First Delivery and Ongoing Maintenance

1. Follow normal delivery procedures for the first delivery of E-Blend. The Renewable Fuels Association (RFA) recommends filling the tank to 80 percent capacity and to keep the tank as full as possible for 7 to 10 days¹
2. As soon as product stabilizes, a precision test (0.1 gph leak rate) is conducted with your ATG system to make sure your system is tight and the leak detection equipment is operating properly. Report any *Fail* results.
3. You must test for water (use alcohol compatible paste if you stick your tanks) at the beginning of each shift for the first 48 hours after delivery.² Checking for water regularly is a part of the ongoing maintenance with ethanol storage.

¹ Renewable Fuels Association (RFA), Fuel Ethanol, Industry Guidelines, Specifications and Procedures, December 2003, p. 15

² Ibid.

Safe Handling

The safety equipment and precautions used for handling gasoline apply to ethanol and ethanol blend (API 1626).

Spills and Releases

Ethanol blend spills and releases should be handled as they would be with gasoline. Notify the proper authorities including DNR Emergency Response at 515.281.8694 or 515.281.8941.

Sources:

1. New England Interstate Water Pollution Control Commission (NEIWPC), Health, Environmental and Economic Impacts of Adding Ethanol to Gasoline in the Northeast States, Volumes 1 and 3, July 2001.
2. Renewable Fuels Association, Fuel Ethanol: Industry Guidelines, Specifications and Procedures, RFA Publication #960501, Revised December 2003.
3. US Department of Energy, National Renewable Energy Laboratory: Handbook for Handling, Storing, and Dispensing E85, April 2002
4. US Army Information Paper, Subject: Fuel Ethanol (E85).
5. State of Delaware, Department of Natural Resources and Environmental Control, Tank Management Branch, Memorandum, Subject: Storing, Dispensing and Using Ethanol Fuel (E85), September 8, 2004.
6. Memorandum: Water Phase Separation in Oxygenated Gasoline (corrected version) by David Korotney, EPA, Chemical Engineer, Fuels Studies and Standards Branch
7. American Petroleum Institute, Storing and Handling Ethanol and Gasoline-Ethanol Blends at Distribution Terminals and Service Stations, API Recommended Practice 1626, First Edition, April 1985, Reaffirmed June 2000.
8. National Fire Protection Association (NFPA) 30, Flammable and Combustible Liquids Code, 2000 Edition; NFPA 30A Code for Motor Fuel Dispensing Facilities and Repair Garages, 2000 Edition

Websites

To download DNR's checklist for converting your UST system to E-Blend or to view a list of licensed installers see

<http://www.iowadnr.com/land/ust/index.html>

For the Renewable Fuels Association (RFA) see

<http://www.ethanolrfa.org/>

For the National Ethanol Vehicle Coalition (NEVC) see

<http://www.kww.com/Global/link.asp?L=119121>

For a listing of equipment approved to handle, store and dispense E85 see

www.E85fuel.com or <http://www.e85fuel.com/information/manufacturers.htm>

For the Department of Energy, Energy Efficiency and Renewable Energy see

http://www.eere.energy.gov/afdc/infrastructure/fuel_inf.html