



## ETHANOL CONVERSION REQUIREMENTS



As higher percentages of ethanol (greater than 10% ethanol by volume) are blended with gasoline, owners and operators must ensure their fuel systems are compatible. What may have been compatible with E10 (10% ethanol, 90% unleaded gasoline) is probably not compatible with a higher percentage ethanol blend. Before you store or dispense E-blend, such as E85 (85% ethanol, 15% unleaded gasoline), you must verify your ethanol fuel path is equipped with compatible components.

Ethanol guidance was developed cooperatively through the Fire Prevention Division and the ethanol industry. The concerns regarding E-blend are based on reviews of available literature and research. Your fuel system could degrade and a product release could occur without converting to compatible equipment. Ultimately, the equipment and components must be compatible with the product stored and dispensed.

**Concerns with E-blend fuel Compatibility:** The Tucson Fire Code requires E-blend fuel systems with greater than 10% ethanol be UL listed or manufacturer approved. Components and equipment used for storing/dispensing conventional fuels are time tested for compatibility and readily available through your petroleum supplier. Ethanol, however, does not have the same compatibility characteristics of conventional fuels. Soft metals such as zinc, brass and aluminum, commonly found in conventional fuel storage and dispensing systems are not compatible with fuel systems containing greater than 10% ethanol. Steel tanks and piping must be UL listed or manufacturer approved.

Some nonmetallic materials may also degrade when in contact with ethanol such as natural rubber, polyurethane, adhesives (used in old 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 fuels, fiberglass and steel fuel systems/components must be UL Listed or manufacturer approved for use with E-blend fuels. A list of E85 compatible equipment can be found at: <http://www.e85fuel.com/information/manufacturers.php>.

**Phase Separation:** Ethanol is completely 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 fuel will absorb the water. If enough water is present, it will overwhelm the ethanol's capacity to remain blended with the gasoline. Because ethanol easily mixes with water, the ethanol will be drawn from the gasoline into the water at the bottom of the tank and thus separate 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 a layer of ethanol and water 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 fuel systems by loosening deposits on the internal surfaces of tanks and piping. If a corrosion cell exists, the ethanol can accelerate the corrosion cell and cause a leak. 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 can contaminate a vehicle's fuel system.

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

## **Starting the Process of Converting to E-blend**

The conversion to E-blend fuel requires time and effort to evaluate existing equipment, verify compatibility and obtain and install ethanol compatible equipment.

Here are some of the procedures you will have to follow when converting your system to E-blend fuels. The specific details are included in a separate checklist, which the owner and ADEQ licensed contractor will have to complete and submit to the Tucson Fire Department.

1. Before your fuel system will be permitted to store or dispense an E-blend fuel the checklist shall be completed and submitted to the Tucson Fire Department.
2. 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 ADEQ licensed contractor to discuss conversion to a higher percentage ethanol blend and purchasing of compatible components. For additional information and financial assistance you may contact the National Ethanol Vehicle Coalition (NEVC) at 887.485.8595. The NEVC provides grants for the labor and materials associated with the conversion to ethanol from conventional fuels.
3. The following equipment/components/materials shall be compatible with the ethanol blend you intend to store and dispense (see the checklist for more detail):

- Auto shutoff or overfill valve
- Tank (Is it approved by the manufacturer or UL listed for E- blend fuels?)
- Submersible pump, o-rings and gaskets
- Line leak detectors
- Leak detection equipment (ATG probes, floats, sump sensors)
- Piping material (UL listed or manufacturer approved)
- Thread sealant

- Flex connectors, grommets
- Filters
- Dispensers and hanging hardware
- Spill containment and sumps

3. Water contamination is unacceptable 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 vapor-tight and that all sump and spill containment covers prevent water from entering the system. Any water intrusion problems shall be corrected.

4. If you decide to convert, make all necessary arrangements for the conversion with your ADEQ licensed contractor. Prior to work being performed on the fuel system and related components a permit must be obtained from the Tucson Fire Department and the City of Tucson Development Services Department. A walk-through permit process is available weekday mornings at Development Services, 201 N. Stone Avenue, (520) 791-5550.

5. Each tank dedicated to E-blend must be clean. After any water problems have been corrected, you must clean each tank dedicated to E-blend to remove all sludge from the bottom of the tank. A cleaning permit is required and available by contacting the Fire Prevention Division at (520) 791-4502 (no fee associated with this permit). Any sludge or particulates remaining in the bottom of the tank will be suspended in the ethanol and may cause problems with the filters and fuel lines. Obtain a Clean Tank Certificate or similar documentation from the tank cleaner after the tank is cleaned and provide this with your permit.

6. Fill pipe and access covers shall be properly identified (API RP 1637 color code).

7. The owner and an ADEQ licensed contractor shall sign the ethanol compatibility checklist and submit it to the Tucson Fire Department.

### **First Delivery and Ongoing Maintenance**

1. Follow normal delivery procedures for the first delivery of E-blend fuel. The Renewable Fuels Association (RFA) recommends filling the tank to 80 percent capacity and keeping the tank as full as possible for 7 to 10 days.

2. As soon as the product stabilizes, a precision test (0.1 gph leak rate) shall be conducted with your ATG system to make sure your system is tight and the leak detection equipment is operating properly. Report any failures to the Tucson Fire Department (520) 791-4502.

3. You must test for water using alcohol compatible paste when you stick your tanks at the beginning of each shift for the first 48 hours after delivery. Checking for water regularly is a part of the ongoing maintenance required for ethanol storage.

**Safe Handling**

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

**Spills and Releases**

Ethanol blend fuel spills and releases shall be handled as you would gasoline fuel spills and releases. Follow your spill control policy.

**Websites**

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

<http://resource.pei.org/altfuels/guide.asp>

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

<http://www.eere.energy.gov/>



### **Dispensers and Dispenser Sumps**

The Tucson Fire Code requires dispensers bear the UL mark or be listed by another independent approved testing laboratory. Currently there are no E-blend compatible dispensers with a UL mark. The Tucson Fire Marshal will accept dispensing equipment that is manufacturer approved until a UL or other listed dispensing equipment is readily available. All new installations and conversions shall be manufacturer approved. When a listed component becomes available it shall be used. All previously converted fuel systems that store and dispense E-blend fuels shall be compatible by July 1, 2008.

Owners and operators shall check **non-manufacturer approved** E-blend dispensers weekly for leaks and equipment failure. Any component of the dispenser that leaks or does not operate as designed due to exposure to E-blend fuels shall be removed and replaced with compatible components. Notify the Tucson Fire Department immediately, (520) 791-4502, of component failures. Each weekly check of dispensers shall be recorded on the Tucson Fire Department inspection record at: [Ethanol Inspection Record \(PDF\)](#) or [Ethanol Inspection Record \(MS Word\)](#)

The inspection records shall be completed by the owner/operator or someone authorized by the owner/operator and knowledgeable about the inspection requirements. The inspection records shall be kept on-site when practical and available upon request to the Tucson Fire Department for review within two days.

If an owner/operator discontinues storing and dispensing E-blend fuel and switches back to gasoline before buying E-blend compatible dispensers, weekly visual inspections of the dispenser must continue for six months after conversion. Owner/operators shall also continue keeping the weekly inspection records.

**Table 2: Dispensers and Dispenser Sump**

<b>COMPONENT</b>	<b>Model/Brand</b>	<b>Manufacturer</b>	<b>UL Listed</b>	<b>Manufacturer Approved</b>
<b>Dispenser</b>			Yes No	Yes No
Pipe sealant			Yes No	Yes No
Seals/Gaskets			Yes No	Yes No
Suction Pump			Yes No	Yes No
Hoses			Yes No	Yes No
Nozzle/Swivel			Yes No	Yes No
Break-away			Yes No	Yes No
Filter			Yes No	Yes No
Meter			Yes No	Yes No
Dispenser/Sump			Yes No	Yes No
Pipe			Yes No	Yes No
Pipe sealant			Yes No	Yes No
Flex Connector			Yes No	Yes No

Sump			Yes No	Yes No
Emergency Valve			Yes No	Yes No
Sensor			Yes No	Yes No
Check valve			Yes No	Yes No

### **Before E-Blend is Transferred to the Tank**

Once equipment compatibility has been established, the items below shall be completed before E-blend fuel can be transferred to the tank:

Items are the responsibility of the owner and ADEQ Licensed Contractor.

- 1) Check for the presence of water in the fuel storage tank. Water contamination is unacceptable for E-blend fuels due to the phase separation problems.
- 2) Check all visible fittings and connections at the top of the tank to ensure vapor tightness.
- 3) Check sump and spill containment covers to ensure water is prevented from entering. Correct water infiltration problems if necessary.
- 4) Ensure the tank has been cleaned of all water and sediment. Obtain a Clean Tank Certificate or comparable documentation (e.g., see API Publication 2015, Cleaning Petroleum Storage Tanks and NFPA 326, Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair, 199 Edition).
- 5) Ensure correct labeling by identifying the fill port and then paint access covers according to API RP 1637. Properly label the dispenser.

### **First Delivery**

- 1) Fill fuel storage tank to 80 percent capacity (recommended by the Renewable Fuels Association or FFA) and keep tank as full as possible for 7 to 10 days.
- 2) Conduct a precision test of the tank system (0.1 gph leak rate) with ATG system within seven days after tank is filled to make sure system is tight and leak detection equipment is operating properly. Report any "Fail" results to the Fire Prevention Division, **797 E. Ajo Way Tucson, Arizona 85713 Phone: (520) 791-4502, Fax: (520) 791-5346**
- 3) If you stick your tanks, test for water using alcohol compatible paste at the beginning of each shift for the first 48 hours after delivery. If there is water in the tank, remove it and correct the problem.
- 4) Check for water daily with your stick or ATG system. Check and replace filters as needed.

5) The owner/operator shall demonstrate to the inspector how to visually inspect the E-blend dispenser for leaks and problems and how to complete the weekly inspection record.

6) The Ethanol Compatibility Checklist shall be signed by the ADEQ licensed contractor and tank owner/operator and then submitted to the Fire Prevention Division. Include a copy of the Clean Tank Certificate or comparable documentation with the checklist.

**Ongoing Maintenance**

1) Check the tank daily for water. Water contamination is unacceptable.

2) Calibrate the dispenser liquid meter at the time of conversion and then again two weeks after conversion to verify meter accuracy. Particulate materials in the product may cause excessive wear of the meter, which would require more frequent calibration (API RP 1626).

3) Conduct monthly visual inspections of the dispensing equipment, dispenser sump beneath the dispenser if installed and all the other items on the inspection checklist record. The inspection checklist records shall be kept on-site when practical and available upon request for review by Tucson Fire Department personnel within two working days.

**Installer Certification**

I have inspected the fuel system components, and reviewed available installation records of the site referenced on pages 1 and 2 of this checklist. I have found the information listed on the above checklist regarding the equipment/components of this site to be true and accurate.

**ADEQ Licensed Contractor #** \_\_\_\_\_

**SIGNED:** \_\_\_\_\_

**OWNER'S SIGNATURE:** \_\_\_\_\_

**DATE:** \_\_\_\_\_