

Assessing Retail Station Ethanol Compatibility

July 2024

Rowena Torres-Ordonez
Ethanol Technical Consultant and Advisor



U.S. GRAINS
COUNCIL

Ethanol and Retail Stations Compatibility

In the U.S., retail station equipment are compatible with E10 and, depending on the equipment, may even be with higher levels of ethanol up to E100

- Equipment has been compatible with ethanol since the 1980's
- Depending on the standard, UL* allows listing for
 - E10 (all equipment)
 - E25 (dispensers, hanging hardware)
 - E85 (most equipment)
 - E100 (tanks and pipes)

*Underwriters Laboratories, the primary third-party safety certification laboratory servicing the refueling equipment industry globally

U.S. E10 Infrastructure Experience

- Some infrastructure designed for use with E0 were already adequate for E10
- In study of historical UST failures, there were no negative impacts / widespread issues reported during multi-year nationwide deployment of E10
 - No link to one common source of leaks
 - Majority of documented issues point to factors independent of ethanol, eg.
 - Equipment installation and/or retrofit
 - Fuel transportation
 - Water intrusion
 - Human error

**[Source: UST Compatibility with Ethanol and Associated Leak Research \(RFA, 2017-18\)](#)*

U.S. E15 Infrastructure Shared Learning

Recent infrastructure compatibility evaluations for E15 can provide guidance on how to evaluate other countries' infrastructure compatibility for up to E15

- E15-compatible metals, elastomers and sealants have been identified
- Compatibility checklists for terminal and retail station equipment have been developed for comparison against material of construction, manufacturer statements, standards and codes (eg, UL)

Implications of U.S. E10 and E15 Experience for Mozambique

- Infrastructure ethanol compatibility assessments for Mozambique can be guided by E15 shared learnings
 - Materials compatibility have been determined for most materials
 - Equipment compatibility checklists have already been developed
- Infrastructure assessment can be commissioned to an engineering company (preferably local)
 - USGC can provide technical support in developing the study scope, monitoring progress and evaluating the results

Guidelines for Effective Transition

- **GENERAL:** Ensure compatibility and entire distribution system is dry or free from water
 - Transition from “no ethanol” to “with ethanol” (no matter what the level)
 - Avoid phase separation
- **DETAILED:** Checklists for terminals and retail stations (from U.S. experience)
 - Equipment checklists (what to check for compatibility)
 - Conversion checklists (procedures when transitioning)
 - From E0 to E10
 - From E10 to E15
 - Installing E85 capability

Compatibility Check vs. Material

E15 Compatibility with Various Materials		
	Metals	
<u>Compatible</u>	<u>Discoloration/Mild Corrosion</u>	<u>Non-Compatible</u>
1020 Solid Steel	Brass	
1100 Aluminum	Phosphor Bronze	
201 Nickel	Zinc-plated (galvanized steel)	
304 Stainless Steel	Lead-plated (terne) steel	
	Elastomers	
<u>Compatible</u>	<u>Uncertain¹</u>	<u>Non-Compatible</u>
Fluorosilicone Rubber	Styrene Butadiene Rubber (SBR)	Silicone Rubber
Fluoroelastomers (fluorocarbons)	Nitrite Rubber (BUNS, BUNAN)	Polyurethane
		Neoprene
	Sealants	
<u>Compatible</u>		<u>Non-compatible²</u>
Gasoil E-Seal		E-Seal Standard PTF E-Sealant
		Rector Seal
<p><small>1. SBR and NBR properties are highly dependent on material additives, processing and co-polymer concentrations. As such, some formations of SBR and NBR may not be compatible with E15 while others are.</small></p> <p><small>2. Standard PTFE (Rector Seal) when combined with Teflon tape appears to be acceptable.</small></p>		

Source: E15 Retailer Handbook, RFA (2013), p. 17

Compatibility Check vs. Manufacturer

Available for:

- Tanks
- Pipes and associated UST
- Dispenser, hanging hardware, shear valve, and submersible turbine pump

Source: Handbook for Handling, Storing, and Dispensing E85 and Other Ethanol-Gasoline Blends, DOE (2016), Appendices A-C

Table A1: Tank Manufacturer Compatibility with Ethanol Blends				
	E10	E100		
	E10	E100		
Manufacturer	✓	✓	<i>Continued from below</i>	
FIBERGLASS^a			Highland Tank	✓ ✓
Containment Solutions	✓	✓	J.L. Houston Co.	✓ ✓
Owens Corning (single wall 1965-1994)	✓	✗	Kennedy Tank and Manufacturing Co., Inc.	✓ ✓
Owens Corning (double wall 1965-July 1, 1990)	✓	✗	Lancaster Tanks and Steel Products	✓ ✓
Owens Corning (double wall July 2, 1990-December 31, 1994)	✓	✓	Lannon Tank Corporation	✓ ✓
Xerxes (single wall prior to February 1981)	✗	✗	Mass Tank Sales Corp.	✓ ✓
Xerxes (single wall February 1981-June 2005)	✓	✗	Metal Products Company	✓ ✓
Xerxes (single wall since July 2005)	✓	✓	Mid-South Steel Products, Inc.	✓ ✓
Xerxes (double wall prior to April 1990)	✓	✗	Modern Welding Company	✓ ✓
Xerxes (double wall April 1990 and after)	✓	✓	Newberry Tanks & Equipment, LLC	✓ ✓
STEEL^b			Plasteela	✓ ✓
Acterra Group Inc.	✓	✓	Service Welding & Machine Company	✓ ✓
Caribbean Tank Technologies Inc.	✓	✓	Southern Tank & Manufacturing Co., Inc.	✓ ✓
Eaton Sales & Service LLC	✓	✓	Stanwade Metal Products	✓ ✓
General Industries	✓	✓	Talleres Industriales Potosinos, S.A. de C.V.	✓ ✓
Greer Steel, Inc.	✓	✓	Tanques Antillanos C. x A.	✓ ✓
Hall Tank Co.	✓	✓	Watco Tanks, Inc.	✓ ✓
Hamilton Tanks	✓	✓	We-Mac Manufacturing Company	✓ ✓

Letters stating compatibility:

a. Petroleum Equipment Institute
www.pei.org/ust-component-compatibility-library

b. Steel Tank Institute

www.steeltank.com/FabricatedSteelProducts/ShopFabricatedTanks/SteelandAlternativeFuels/tabid/465/Default.aspx

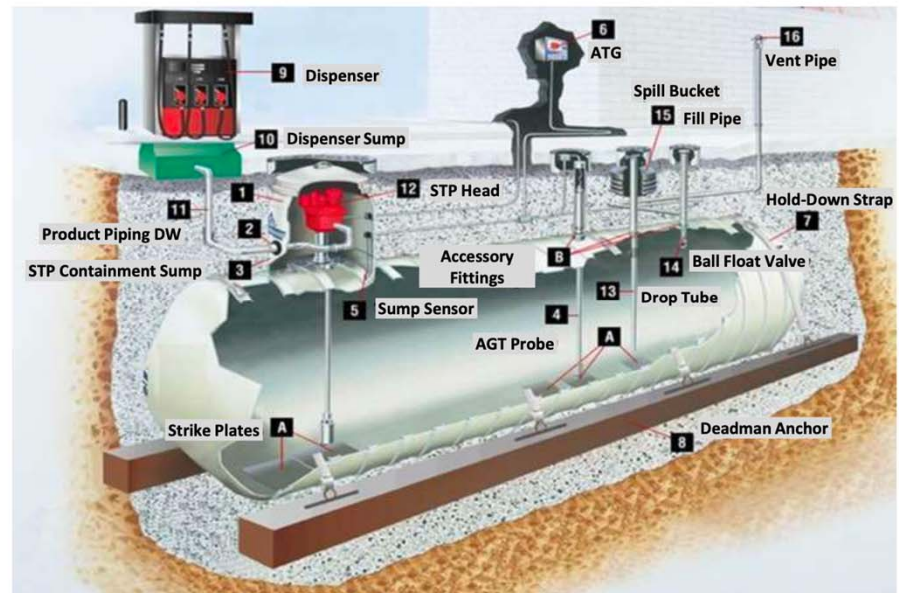
Compatibility Check vs. Standards / Codes

- The incorporation in safety standards (ie, Underwriters Laboratory) of blends greater than E10 have led to many refueling equipment products being compatible with E15

Source: *Handbook for Handling, Storing, and Dispensing E85 and Other Ethanol-Gasoline Blends, DOE (2016), Appendix F*

Table F. UL Testing Standards for Refueling Equipment		
UL Testing Standard	Equipment Covered	Test Fluid (or listing)
UL 58	Underground steel tanks (no test fluids)	No test fluid
UL 1746	External Corrosion Protection Systems for USTs (option to test with up to E100)	Option up to E100
UL 1316	Underground fiberglass tanks (option to test with up to E100)	Option up to E100
UL 971	Pipes and pipe fittings non-metallic (option to test with up to E100)	Option up to E100
UL 971A	Pipes and pipe fittings metallic (option to test with up to E100)	Option up to E100
UL 2447	Sumps: tank, dispenser, transition, fill/vent, spill buckets Sump fittings: penetration, termination, internal, test and monitoring Sump accessories: frames/brackets, covers/lids, & chase pipe	Requires E25 and E85
UL 2039	Flexible Connectors	Requires E25 and E85
UL 87	Dispensers	E10 listing only
UL 87A	Dispensers	Requires E25 and E85
UL 25	Meters	E10 listing only
UL 25A	Meters	Requires E25 and E85
UL 330	Hose and hose assemblies	E10 listing only
UL 330A	Hose and hose assemblies	Requires E25 and E85
UL 331	Filters	E10 listing only
UL 331A	Filters	Requires E25 and E85
UL 428	Submersible turbine pump	E10 listing only
UL 428A	Submersible turbine pump	Requires E25 and E85
UL 567	Breakaway, swivels, pipe connection fittings	E10 listing only
UL 567A	Breakaway, swivels, pipe connection fittings	Requires E25 and E85
UL 842	Shear valve	E10 listing only
UL 842A	Shear valve	Requires E25 and E85
UL 2586	Nozzles	E10 listing only
UL 2586A	Nozzles	Requires E25 and E85

Retail Station Equipment



Sample Equipment Checklists

UST System E15 Investigation

Component	Model/Brand	Mfg.	UL Listed	Mfg. Approved
Tank or internal lining				
Piping				
Line leak detector				
Flexible connectors				
Drop tubes				
Spill and overfill prevention equipment				
Submersible turbine pump & components				
Sealants (including pipe dope and thread sealant), fittings, gaskets, o-rings, bushings, couplings and boots				
Containment sumps (including submersible turbine sumps and under-dispenser containment)				
Release detection floats, sensors and probes				
Fill and riser caps				
Product shear valves				
Other				

Dispenser, Dispenser Sump and Hanging Hardware Investigation

Component	Model/Brand	Mfg.	UL Listed	Mfg. Approved
Dispenser				
Pipe sealant				
Seals / Gaskets				
Suction Pump				
Hoses				
Nozzle / Swivel				
Break-away				
Filter				
Meter				
Dispenser / Sump				
Pipe				
Pipe sealant				
Flex Connector				
Sump				
Emergency Valve				
Sensor				
Check Valve				
Other				

Due to the differences among systems and installation techniques, there may be system components which are not on the list.

Source: E15 Retailer Handbook, RFA (2018), pp 19-21

Sample Conversion Checklist – E0 to E15 Retail

Pre- Delivery

- ✓ Place on pump or dispenser with 10-micron ethanol compatible filter. Water slug filters are optional. Always 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 product and compartment for correct tank.
- ✓ Pumps should be shut down during initial delivery.
- ✓ Purge lines from tanks to dispensers.
- ✓ Install required decals and if necessary change octane decals. Also repaint manhole covers to proper color code (for example, API color code).
- ✓ Fill tanks to at least 80% of capacity. Keep as full as possible for 7 to 10 days.
- ✓ Test for water bottoms at the beginning of each shift for the first 48 hours after initial delivery.

Post Delivery and Ongoing Maintenance

- ✓ Check for water introduction daily. No level is acceptable.
- ✓ Replace filters if pump / dispenser is running slow.
- ✓ Check pump calibration two weeks after initial load conversion

Source:

[Fuel Ethanol Industry Guidelines, Specifications and Procedures \(RFA, Jul 2018\), see pp 47-48](#)

Other Product Quality Good Practices

MOST IMPORTANT TO KEEP A “DRY” SYSTEM ACROSS THE SUPPLY CHAIN

- Use segregated systems
 - If not possible, implement procedures to minimize cross-contamination
 - for transportation, implement inspections / cleaning prior to loading
- Service should not routinely change
 - Do not deviate from SOP (standard operating procedure)
- Adequately train operations
 - Blending procedures at the loading rack
 - Loading/unloading procedures during transportation

In the US, shared learning and good practices are promoted by government agencies and ethanol industry groups through publications (guidelines, handbooks) and workshops/conferences.

References for Operational Guidelines for Ethanol Blends

- [Fuel Ethanol Industry Guidelines, Specifications and Procedures \(RFA, Jul 2018\)](#)
- [Handbook for Handling, Storing and Dispensing E85 and Other Gasoline-Ethanol Blends \(DOE, Feb 2016\)](#)
- [E15 Retailer Handbook \(RFA, 2015\)](#) – E15 Gasoline Blends Industry Guidelines, Specifications and Procedures, Retail Operations

These resources can provide templates for operations manuals for those contemplating ethanol blending