

Table 3. Key UL Testing Standards for Refueling Equipment

UL Testing Standard	Equipment Covered	Listing for Ethanol Blends
UL 58	Underground steel tanks	Does not list for specific fuels
UL 1316	Underground fiberglass tanks	E85 (non-aggressive test fluids)
UL 971	Pipes	E100 (non-aggressive test fluids)
UL 2447	<i>Sumps:</i> tank, dispenser, transition, fill/vent <i>Sump fittings:</i> penetration, termination, internal, test and monitoring <i>Sump accessories:</i> cover, frame, brackets, chase pipe	E85 (non-aggressive test fluids for current listings). The new Standard 2447 requires testing with aggressive E25, E85, B25, and Reference Fuel F and requires manufacturers to resubmit and recertify by July 2015
UL 87	Dispenser, hose, nozzle, breakaway, swivel, valves, pumps, meters, and flow limiter, mechanical line leak detector, and strainers	E10 (standard is expected to sunset in the future and be replaced with UL 87A)
UL 87A	Same as UL 87	E25 and/or E85 (tests with aggressive test fluids)

Source: UL

UL Standard 87 has long been available for listing ethanol blends up to E10, and most equipment listed under this standard was not exposed to test fluids. In late October 2007, UL introduced testing Subject 87A—a new listing standard that covered blends between E10 and E85. UL Subject 87A requires the use of Reference Fuel C as a surrogate for gasoline (50:50 mix of isooctane and toluene) and an aggressive test fluid based on the formula SAE J-1681 (from the automotive industry) with 15 weeks of conditioning at 60°C. The elevated temperature is intended to simulate aging and is adopted from vehicle fuel system testing protocols. The conditioning phase is followed by performance testing specific to each type of equipment. In 2009, UL amended 87A to allow a separate test fluid of E25 to address an anticipated increased ethanol use in the mid-level range.

To determine the impacts of E15, NREL contracted with UL to test the best-selling new and used equipment under UL 87A with an E17 aggressive test fluid (Boyce et al. 2010). The results were mixed, with 30 of 54 pieces of equipment (56%) passing the test. Of particular concern was the failure of all six dispensers because they typically last 15 years or more. There were some positive results, with hoses, shear valves, and a submersible turbine pump (STP) performing well in UL testing. The conclusion was that existing equipment could not obtain a retroactive listing for E15.

A parallel activity was performed by ORNL to examine the compatibility of individual infrastructure materials with a range of test fuels representing ethanol-blended gasoline under controlled environmental conditions. The materials included 12 metal specimens, 19 elastomers, 23 plastics, and 2 pipe thread sealants. The majority of these materials were known infrastructure materials. The test fuels were formulated according to the protocols outlined in SAE J1681