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UL 1856

OUTLINE OF INVESTIGATION
FOR
UNDERGROUND FUEL TANK INTERNAL RETROFIT SYSTEMS

Issue Number 1

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Summary of Topics

This is the First Issue of Subject 1856, Outline of Investigation for Underground Fuel Tank Internal Retrofit Systems covers lining, upgrade and structural types of nonmetallic retrofit systems (products) intended for field installation inside of steel or fiberglass underground fuel tanks in commercial (public) or private (fleet) automotive fueling station applications. These products are also intended for primary containment of typical liquid fuels as identified in this Outline, and may provide other features, such as secondary containment and structural improvements, as described for each specific type of retrofit system.

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INTRODUCTION

1 Scope

1.1 These requirements cover nonmetallic retrofit systems (products) intended for field installation inside of steel or fiberglass underground fuel tanks in commercial (public) or private (fleet) automotive fueling station applications. These products are intended for containment of typical liquid fuels as identified in this Outline, and may provide other features as described for each specific type of retrofit system.

1.2 These products are nonmetallic thermoset (such as FRP, epoxy, PUR or polyesters) or thermoplastic (such as PE) materials that may or may not be bonded to the interior tank wall, depending upon the system type. These products typically use pre-fabricated sections with coatings applied on site, or homogeneous or layered spray-on/roll-on materials applied on site, and may optionally be covered for minor repair of the host tank.

1.2.1 Lining systems provide only primary containment of stored fuels, and do not add significant structural strength to the host tank.

1.2.2 Upgrade systems provide both primary containment and secondary containment of stored fuels with interstitial monitoring, and are co-structural with the host tank.

1.2.3 Structural systems provide both primary containment and secondary containment of stored fuels with interstitial monitoring, and are self-structural without the host tank.

1.3 These products are intended for containment of automotive fuels and exposure to soil fluids that have similar chemical, physical and material compatibility properties as represented by the test liquids in these requirements based on fuels formulated in accordance with 40 CFR Part 80, Regulation of Fuels and Fuel Additives, and meeting the following ASTM Fuel Specifications and blend limitations:

- a) ASTM D-975, Standard Specification for Diesel Fuel Oils, with biodiesel blends up to a maximum of 5 percent (B5);
- b) ASTM D-7467, Standard Specification for Low Blend Biodiesel, with biodiesel blends from 6 to 20 percent (B6 to B20).
- c) ASTM D-4814, Standard Specification for Automotive Spark-Ignition Engine Fuel, gasoline or oxygenated gasoline, with limited ethanol blends up to a maximum of 10 percent (E10);
- d) ASTM D-5798, Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines, high blend ethanol, with gasoline/ethanol mixtures blends from 51 to 83 percent (E51 – E83); and
- e) Mid Range Ethanol Blends (E11 to E50) using variable mixtures of ASTM D4814 Low Blend Ethanol and ASTM D5798 High Blend Ethanol

1.4 Products covered by this outline are intended to be installed and used in accordance with one or more of the following:

- a) Flammable and Combustible Liquids Code, NFPA 30;
- b) Code for Motor Fuel Dispensing Facilities and Garages, NFPA 30A;
- c) Uniform Fire Code, NFPA 1;

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- d) International Fire Code published by the International Fire Council; or
- e) Other applicable federal and state regulations for the specific product or application it is being utilized in.

1.5 These products are intended for field installation, by only qualified persons, inside the host tank without a need for excessive excavation, in accordance with the manufacturer's instructions and the local requirements. Prior to installation, cleaning, inspecting, repairing and preparing the host tank interior surface is also conducted by qualified persons in accordance with the manufacturer's instructions.

1.6 These products are intended to be periodically inspected and maintained for continued service, or taken out of service if deemed necessary by qualified persons in accordance with industry recommended practices, the manufacturer's instructions or applicable regulations.

1.7 These products and the manufacturer's installation instructions have not been investigated for their physiological effect, if any, for safety of any persons during the installation process, and the potential risk associated with the opening, entering, purging, cleaning, inspecting, surface preparation, system installation, and testing of a tank that has been used to store flammable or combustible liquids.

1.8 These products and requirements are not intended to cover or evaluate the installation equipment, safety of the installer, compliance with worker safety regulations (such as confined spaces, hazardous locations, or OSHA), or any environmental emissions or disposal regulations, (such as EPA).

1.9 These products have not been evaluated for use after natural disasters, or exposures to chemicals not representative of the test liquids or excessive physical damage beyond the expected installation and uses as identified in these requirements.

1.10 These requirements do not cover additional claims, if any, related to improved fuel quality, nor the effect, if any, of the products material(s) on fuel quality or properties.

1.11 These requirements do not cover thin coatings or paints that may be directly applied to internal tank surfaces, and do not cover flexible or rigid tank bladders that are not directly bonded to internal tank surfaces.

1.12 These requirements do not cover external corrosion protection systems for steel underground tanks, which are found in UL1746 – External Corrosion Protection Systems for Steel Underground Storage Tanks.

2 General

2.1 Units of measurement

2.1.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2 Undated references

2.2.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Glossary

3.1 For the purposes of this outline the following definitions apply.

3.2 HOST TANK – An installed underground fuel storage tank that has been Listed for compliance in accordance with the applicable Standards for:

- a) Steel Underground Tanks for Flammable Liquids, UL 58;
- b) External Corrosion Protection Systems for Steel Underground Storage Tanks, UL 1746;
- c) Glass Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures, UL 1316;

3.3 RETROFIT SYSTEM – Engineered nonmetallic (thermoset or thermoplastic) material(s) that are field installed inside of a host tank, and provide different refurbished levels of containment, optional repair, and other features as follows:

- a) Lining System – A retrofit system that is directly bonded to the interior wall of the host tank, provides only primary containment of stored fuels, and does not add significant structural strength to the host tank.
- b) Upgrade System – A retrofit system that is directly bonded to the interior wall of the host tank, provides both primary containment and secondary containment of stored fuels with interstitial monitoring, and is co-structural with the host tank.
- c) Structural System – A retrofit system that may or may not be bonded to the interior wall of the host tank, provides both primary containment and secondary containment of stored fuels with interstitial monitoring, and is self-structural from the host tank.

3.4 REFURBISH – The addition of materials to an existing tank structure after surface preparations, for the intended purpose of returning the entire tank wall to at least its original design thickness and/or strength.

3.5 REPAIR – The localized addition of materials to an existing tank structure after surface preparations to plug a leak or intended to return a portion of the tank wall to its original design thickness and/or strength.

3.6 PRIMARY CONTAINMENT (PRIMARY) – The ability of an enclosed tank design or construction to directly contact and confine a liquid while in normal use (intended fuel storage) without leakage. Primary retrofit systems form a refurbished primary (100 percent of all surfaces covered) within the existing tank structure.

3.7 SECONDARY CONTAINMENT (SECONDARY) – The ability of a tank design or construction to directly contact and confine a liquid in abnormal use (from primary leakage) without leakage. Secondary retrofit systems form both a new primary and interstitial space (of minimum 330 annular degrees) within the existing tank structure, which becomes the refurbished secondary.

3.8 THIN COATING – Any material directly applied to the interior of the tank wall that has a combined total system thickness of less than 70 mils.

3.9 QUALIFIED PERSON – A worker specifically trained by the manufacturer to perform proper field installation of its retrofit system in accordance with the specified instructions. The qualified person is not required to be an employee of the manufacturer.

3.10 FUELS – Typically those liquids identified in 40 CFR Part 80 "Regulation of Fuels and Fuel Additives" and compliant with only the ASTM Fuel Specification below that are dispensed in commercial or fleet motor vehicle fueling stations for used in automotive engines (internal combustion or compression ignition):

- a) ASTM D-975, Standard Specification for Diesel Fuel Oils, with biodiesel blends up to a maximum of 5 percent (B5);
- b) ASTM D-7467, Standard Specification for Low Blend Biodiesel, with biodiesel blends from 6 to 20 percent (B6 to B20).
- c) ASTM D-4814, Standard Specification for Automotive Spark-Ignition Engine Fuel, gasoline or oxygenated gasoline, with limited ethanol blends up to a maximum of 10 percent (E10);
- d) ASTM D-5798, Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines, high blend ethanol, with gasoline/ethanol mixtures blends from 51 to 83 percent (E51 – E83); and
- e) Mid Range Ethanol Blends (E11 to E50) using variable mixtures of ASTM D4814 Low Blend Ethanol and ASTM D5798 High Blend Ethanol

3.11 CO-STRUCTURAL – A retrofit system that is designed to meet equivalent structural requirements of an underground tank standard, with shared structural strength between the host tank and retrofit system.

3.12 SELF-STRUCTURAL – A retrofit system that is designed to meet equivalent structural requirements of an underground tank standard, without any structural contribution from the host tank.

3.13 ADHESIVE FAILURE – Failure (typically loss of strength and detachment) between the host tank surface and the system bonding adhesive.

3.14 COHESIVE FAILURE – Failure of materials or layers within either the host tank or retrofit system, but not the bonding adhesive between them.

CONSTRUCTION

4 General

4.1 All retrofit systems shall be designed for field installation (without the need for excessive excavation or tank opening) inside of existing steel and/or fiberglass underground fuel storage (host) tanks that have previously been certified as meeting any one of following standards:

- a) Steel Underground Tanks for Flammable Liquids, UL 58;
- b) External Corrosion Protection Systems for Steel Underground Storage Tanks, UL 1746;
- c) Glass Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures, UL 1316;

Note – If necessary for system installation, tank top excavation and cut openings are permitted, provided these details are in the instructions.

4.2 All retrofit systems shall clearly define the above host tank(s) and basic parameters for which they are designed for, including, but not limited to the items below.

- a) System bonding to steel and/or fiberglass (if applicable),
- b) Maximum tank diameter and length/diameter ratio,
- c) Minimum tank opening size needed for installation,
- d) Maximum hole or crack dimensions which may be repaired,
- e) Minimum containment coverage in circumferential degrees, and
- f) Minimum average thickness of any field applied material(s).

4.3 All retrofit systems shall clearly define for steel and/or fiberglass tanks as applicable, the process(es) and minimum specifications for each step in the installation, including, but not limited to the items below:

- a) Tank cleanout, surface inspection, thickness measurement and any other manufacturer required procedures prior to host tank repair and system installation,
- b) Identification of any tank or material characteristics which would not be suitable for system installation,
- c) Repair of any holes, cracks, dents, pits or other host tank damage prior to system installation,
- d) Preparation of the host tank surface (such as sand blasting or chemical etching) for system installation,
- e) Installation of the retrofit system (for each layer if applicable), and any curing procedures,
- f) Measurement of any thickness, hardness or other material properties, and leakage testing procedures.