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1

UL 2447

OUTLINE OF INVESTIGATION
FOR
CONTAINMENT SUMPS, FITTINGS AND ACCESSORIES FOR FUELS

ISSUE NO: 1

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Summary of Topics:

This First Issue of Subject 2447, Outline of Investigation for Containment Sumps, Fittings and Accessories for Fuels, covers requirements for:

Containment Sumps – Tank, Dispenser, Transition and Fill/Vent types.

Sump Fittings – Penetration, Termination, Internal and Test/Monitor types.

Sump Accessories – Covers, Lids, Frames, Brackets and Chase Pipe.

The initial draft is based on a combination of existing requirements, internal guidelines and parallel Standards. The proposed requirements are intended to reflect general updates in design and technology, regulatory compliance, industry needs, and also to address scope of use, biofuels, compatibility and functional safety issues with respect to generally expected assembly, use and environmental conditions over the product's average service life.

These requirements are not intended to specifically address each and every stakeholder's needs or concerns, and every conceivable operating condition or weather extreme. As with all standards, the requirements reflect a minimum level of safety, are not warranties or guarantees, and rely upon external stakeholders to ensure proper installation, use, and periodic inspection with maintenance or replacement as appropriate for continued safety.

This issue becomes effective June 30, 2015.

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CONTENTS

INTRODUCTION

1 Scope	5
2 General	7
2.1 Units of measurement	7
2.2 Undated references	7
3 Glossary	7

CONSTRUCTION

4 General	9
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PERFORMANCE

5 General	12
6 Material Properties Tests	15
6.1 General	15
6.2 Elastomers	16
6.3 Thermoplastics	16
6.4 Thermosets	16
6.5 Coated or plated metals	16
6.6 Composites	17
7 Abuse Tests	17
7.1 General	17
7.2 Drop test	18
7.3 Impact test	19
8 Fitting Assembly, Installation and Use Tests	19
8.1 General	19
8.2 Torque tests	20
8.3 Bending tests	21
8.4 Push pull test	22
9 Accessory Assembly, Installation and Use Tests	22
9.1 General	22
9.2 Frame and bracket strength tests	23
9.3 Cover and lid strength tests	24
9.4 Chase pipe strength tests	24
10 Leakage Tests	25
10.1 General	25
10.2 Sump leakage	25
10.3 Fitting leakage	26
10.4 Cover and lid leakage	26
10.5 Chase leakage	26
11 Interstitial Communication Test	27
12 Short Term Compatibility Tests	27
12.1 General	27
12.2 UV exposure test	28
12.3 Metallic stress crack test	28
12.4 Nonmetallic stress crack test	29
13 Long Term Compatibility Test	29

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MANUFACTURING AND PRODUCTION TESTS

14 Manufacturing and Production Tests	33
14.1 General	33
14.2 Dimensional measurements	33
14.3 Leakage test	33

MARKINGS AND INSTRUCTIONS

15 Markings	33
16 Instructions	35

Appendix A - Test Fuel Formulations

A1 Representative Aggressive Combustible Test Fuel Mixtures and UL-B100	37
A2 Representative Aggressive Flammable Test Fuels and Mixtures	38

INTRODUCTION

1 Scope

1.1 These requirements cover containment sumps, and associated sump fittings and accessories (products) intended for below or at grade use as an enclosure for housing of, and access to, underground piping, connector piping, and other fueling system components (such as pumps, valves, sensors, wiring, etc.) in addition to temporary containment of typical liquid fuels as identified in this Outline. These products are intended for use in commercial (public) or private (fleet) automotive fueling station applications. Some fittings or accessory products may be optionally evaluated for repair or replacement applications in sumps that have been in service.

1.2 Containment sumps may be either primary or secondary constructions of metallic, nonmetallic or composite materials. Typical containment sump types intended for use in the following automotive fueling station applications are:

- a) Tank Sumps – Sumps intended for installation above underground flammable liquid storage tanks;
- b) Dispenser Sumps – Sumps intended for installation below flammable liquid dispensing equipment;
- c) Transition Sumps – Sumps intended for access to liquid or vapor piping run manifolds, fittings and valves in a fueling system; and
- d) Fill/Vent Sumps – Sumps intended for housing of fill and/or vent pipe ends, drain valves, gauges or monitors connected to the tank.

1.2.1 Containment sump fittings may be included as either an integral part of the containment sump, or as a field installed kit, and may include but are not limited to the following sump applications:

- a) Penetration Fittings – Fittings intended for sealing pipe penetrations through the sump wall;
- b) Termination Fittings – Fittings intended for connecting pipe terminations at the sump wall;
- c) Internal Fittings – Fittings intended for connection of working components inside the sump; and
- d) Test and Monitor Fittings – Fittings intended for periodic testing or continuous monitoring of the sump and/or pipe.

1.2.2 Containment sump accessories may be included as either an integral part of the containment sump, or as a field installed kit, and may include but are not limited to the following sump applications:

- a) Sump Covers and Sump Lids – Covers or Lids intended to limit access to the sump with structural and leak resistance features;
- b) Sump Frames – Frames intended to provide structural support of the sump walls and/or components above or in the sump;
- c) Sump Brackets – Brackets intended to provide structural attachment points for components inside the sump; and

- d) Chase Pipe – Soil pipe intended to provide a structural conduit for routing underground carrier pipe to and from the sump.

1.3 Containment sumps, fittings and accessories 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 D975, Standard Specification for Diesel Fuel Oils, with biodiesel blends up to a maximum of 5 percent (B5);
- b) ASTM D7467, Standard Specification for Diesel Fuel Oil and Biodiesel Blends (B6 to B20), with low biodiesel blends from 6 to 20 percent (B6 to B20);
- c) ASTM D4814 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 D5798, Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines, with high gasoline/ethanol 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) NFPA 30, Flammable and Combustible Liquids Code;
- b) NFPA 30A, Code for Motor Fuel Dispensing Facilities and Garages;
- c) NFPA 1, Uniform Fire Code;
- 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 factory manufactured and intended for on-site field assembly, inspection and leak testing for the specified applications and use conditions by qualified persons in accordance with the manufacturer's instructions and local requirements.

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

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

1.8 These products have not been evaluated for special use applications where exposed to heavy or continuous physical abuses, excessive mechanical stresses; or environments that operate outside of the expected atmospheric conditions and ambient use temperature range.

1.9 These requirements do not cover underground piping products, which are found in either the Standard for Nonmetallic Underground Piping for Flammable Liquids, UL 971 or the Outline for Metallic Underground Piping for Flammable Liquids, SU 971A.

1.10 These requirements do not cover connector piping products, which are found in the Outline for Flexible Connector Piping for Fuels, SU 2039, or tank accessories, which are found in the Outline for Fuel Tank Accessories, SU 2583.

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 purpose of this outline, the following definitions apply.

3.2 Containment Sumps – Primary and/or secondary atmospheric enclosure of various types (see 3.2.1 to 3.2.4) for burial below or at grade. Sumps are intended to provide a connection interface for underground piping, wiring, and accessible housing for fueling system components, and the temporary containment of these liquids in the event of spills or leaks.

3.2.1 Tank Sump – A containment sump design with or without a bottom, and with a lid. Intended for attachment to a manway ring, collar, or connecting pipe above an underground tank.

3.2.2 Dispenser Sumps – A containment sump design with a bottom and partially open top or lid. Intended for attachment to a frame under a liquid dispensing device at a fueling island.

3.2.3 Transition Sumps – A containment sump design with bottom, lid, and some above grade parts. Intended to house liquid or vapor piping manifolds, fittings, valves and other fueling components.

3.2.4 Fill Sumps or Vent Sumps (aka Spill Buckets or Vapor Recovery) – A containment sump design with bottom opening and lid. Intended to interface with tank fuel fill or vapor recovery connecting pipe and house adapters/caps, drain valves, gauges or monitors.

3.3 Sump Fittings – Primary and/or secondary connections of various types (see 3.3.1 to 3.3.4) and designs (threaded, clamped, fused), intended for liquid tight joining or sealing of internal or external piping or other fueling system components to or through sump wall(s). Fittings are typically for new constructions, but may be additionally designed for repair/replacement of in service sumps.

3.3.1 Penetration Fittings – Fittings intended to provide a liquid tight seal and securement of primary or secondary piping passing into or through one or more containment sump wall(s).

3.3.2 Termination Fittings – Fittings intended to provide a liquid tight seal and securement of primary, secondary or chase piping ending at the inner or outer containment sump wall.

3.3.3 Internal Fittings – Fittings intended to provide a liquid tight seal and securement of various fueling system components inside the containment sump, such as interstitial access ports, leak detection tubes, plugs.

3.3.4 Test or Monitor Fittings – Fittings intended to provide a means to conduct periodic testing or continuous monitoring of primary and/or secondary piping from inside the sump.

3.4 Sump Accessories – Various types (see 3.4.1 to 3.4.4) and designs (bolted, clamped, fused) of mechanical hardware or parts intended to provide structural support of sump walls, fueling system components within sumps, fueling system equipment outside sumps, or loads above the sump. Accessories are typically for new constructions, but may be additionally designed for repair/replacement of in service sumps.

3.4.1 Sump Covers & Sump Lids – Typically either a rigid structural plate or semi-rigid cap over the mating sump top opening. Intended to limit access to the sump, resist surface or ground water entry, and support either working loads (for below grade lids) or vehicle load (for at grade covers).

3.4.2 Sump Frames – Typically a major rigid structural framework connected to the sump top wall perimeter. Intended to resist earth loading, and support external equipment or internal component loads, and below grade lids or at grade covers.

3.4.3 Sump Brackets – Typically a minor rigid structural support connected to the sump wall or frame. Intended to provide a load bearing attachment point for internal fueling system components inside the sump such as valves, pipes, sensors, controls, etc.

3.4.4 Chase Pipe – Typically a flexible underground nonmetallic soil pipe. Intended to resist earth loading and provide a structural conduit for routing underground piping to/from the sump, but does not provide rated fuel containment.

3.5 Size (Pipe Size or Fitting Size) – Nominal or trade dimensions (inches or mm) of pipe and fittings based on inside diameters or thread. Note - Nominal or trade sizes may not be equivalent to the actual measurements.

3.6 Primary Sump (Primary) – A single wall sump construction intended to temporarily contain any liquids leaking from pipe, valves or other liquid conveying components housed inside or above the sump. Internal primary sump walls are not intended for long term exposure of contained fuels, but may be subjected to long term fuel vapor exposures.

3.7 Secondary Sump (Secondary) – The outer wall of a double wall sump construction intended to surround the primary sump, temporarily contain any liquids leaking from the primary sump or from connecting secondary piping, and provides fluid communication and monitoring capabilities. Interstitial spaces are not intended for long term exposure of contained fuels.

3.8 Fuel – 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 D4814 Standard Specification for Automotive Spark-Ignition Engine Fuel, aka gasoline, gasohol, oxygenated gas, or low blend ethanol (max E10);
- b) ASTM D5798, Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines, with high gasoline/ethanol blends from 51 to 83 percent (E51 – E83);
- c) Mid Range Ethanol Blends (E11 to E50) using variable mixtures of ASTM D4814, Low Blend Ethanol and ASTM D5798, High Blend Ethanol.
- d) ASTM D975, Standard Specification for Diesel Fuel Oils, aka on- road diesel, or low blend biodiesel (max B5); and
- e) ASTM D7467, Standard Specification for Diesel Fuel Oil and Biodiesel Blends (B6 to B20), with low biodiesel blends from 6 to 20 percent (B6 to B20);

3.9 Qualified Person – A worker specifically trained by the manufacturer to perform proper field installations of its sumps and accessories in accordance with the specified instructions. The qualified person is not required to be an employee of the manufacturer.

3.10 Swivel Joint – A connection or joint designed to allow frequent rotational movement of the pipe during normal functional use.

3.11 Union Joint – A connection or joint designed to allow rotational movement of the pipe only during assembly, installation or maintenance.

CONSTRUCTION

4 General

4.1 Containment Sumps shall be primary or secondary design types for below grade use with the capability for at grade access, and are permitted to be constructed of any material combinations. Sumps are permitted to be constructed in any shape, and of multiple pieces for field assembly with manufacturer supplied installation kits (hardware, seals, etc.). In addition:

- a) Only fittings or accessories described in the sump manufacturer's instructions are permitted to be factory or field installed on or through the sump. The recommended sump, fitting and accessory combinations may be specific model(s) and/or generic material(s)/type(s); and
- b) Any parts of the sump wall that are also part of an underground pipe, and functions as a liquid or vapor containing part of the piping system shall additionally comply with UL 971 or SU 971A as applicable.

4.1.1 Tank sumps shall not exceed a total height/depth of 12.0 ft. (3.66 m) or diameter/length of 10.0 ft. (3.05 m), and shall have closed bottoms or open bottoms that connect to a tank manway collar, riser or pipe. Tank sumps requiring entry shall have a top access opening of at least 30.0 in (76.2 cm) diameter. Tank sumps shall be provided with a water resistant lid, and may be provided with a structural cover.

4.1.2 Dispenser sumps shall not exceed a total height/depth of 10.0 ft. (3.05 m) or diameter/length of 8.0 ft. (2.45 m), and shall have a closed bottom. Dispenser sumps shall be provided with lids that have opening(s) intended for use below dispensers which permit pipe/wire passage and resist water entry, and may be provided with a structural cover.

4.1.3 Transition sumps shall not exceed a total height/depth of 8.0 ft. (2.45 m) or maximum dimension of 6.0 ft. (1.80 m) and shall have a closed bottom. Transition sumps shall be provided with a water resistant lid, and may be provided with a structural cover.

4.1.4 Fill/vent sumps shall not exceed a total height/depth of 4.0 ft. (1.22 m) or diameter/length of 4.0 ft. (1.22 m) but shall contain at least 4 gal spill, and shall have provisions for a bottom connection to fill/vent piping. Fill sumps shall be provided with a water resistant lid, and may be provided with a structural cover.

4.2 Sump fittings shall be primary or secondary types designed to form leak tight connections through or to the sump wall and piping, and are permitted to be constructed of any material combinations. Fittings are permitted to be constructed of multiple pieces for assembly with manufacturer supplied installation kits (hardware, seals, etc.). In addition:

a) The fitting manufacturer's instructions shall identify the recommended fitting-sump combinations which have been evaluated to this Outline by specific model(s) and/or generic material(s)/type(s), and if intended for new and/or repair/replacement installations; and

b) Any parts of the fitting that are also part of an underground pipe, and functions as a liquid or vapor containing part of the piping system shall additionally comply with UL 971 or SU 971A as applicable.

4.2.1 Penetration fittings shall be designed to provide a fixed, leak tight connection between the sump wall and through piping without disabling any containment functions of either the mating sump or pipe. Penetration fittings shall not exceed a nominal 8.0 in (20.32 cm) pipe size, but are permitted to be rigid to flexible, and may be secured and sealed by any means.

4.2.2 Termination fittings shall be designed to provide a fixed, leak tight connection for piping ending at the sump wall without disabling any containment functions of either the mating sump or pipe. Termination fittings shall not exceed a nominal 8.0 in (20.32 cm) pipe size, but are permitted to be rigid to flexible, and may be secured and sealed by any means.

4.2.3 Internal fittings shall be designed to provide a fixed, leak tight connection for various fueling system components to the inside of the sump wall without compromising containment. Internal fittings shall not exceed a nominal 4.0 in (10.15 cm) pipe size, shall be rigid connections, but may be secured and sealed by any means.

4.2.4 Test and monitor fittings are permitted to be integral options on penetration, termination or internal fittings specifically designed to interface with periodic testing or continuous monitoring devices. The test and monitor connection of these fittings shall not exceed a nominal 0.5 in (1.27 cm) pipe size, shall be rigid connections, but may be secured and sealed by any means.

4.2.5 All fitting end threads shall be ANSI/ASME B1.20.1, Pipe Threads, General Purpose (NPT), or meet similar nationally recognized thread design specifications, such as NPTF, BSPT, BSPP or NPSM. Union joints are permitted. Swivel joints are not permitted.

4.3 Sump Accessories shall be designed to provide various structural support and/or water resistance for sumps and sump components, and are permitted to be constructed of any material combinations. Accessories are permitted to be constructed of multiple pieces for assembly with manufacturer supplied installation kits (hardware, seals, etc.). In addition:

- a) The accessory manufacturer's instructions shall identify the recommended accessory-sump combinations which have been evaluated to this Outline by specific model(s) and/or generic material(s)/type(s), and if intended for new and/or repair/replacement installations; and
- b) Sump accessories shall not modify, damage or disable the working function(s) of any of the sump components to which they attach or interface with.

4.3.1 Sump lids shall be rigid or semi-rigid designs sized to fit the mating sump top opening, resist water entry and support worker loads. Tank, dispenser and transition lids shall be completely closed. Dispenser lids shall have openings to allow passage of dispenser piping, wiring and leaking fluids from the dispenser into the sump.

4.3.2 Sump covers shall be rigid designs intended for at grade use and are subject to vehicle traffic and snowplow impacts. Sump covers shall be designed for H2O loads and installation flush with the surrounding surface, or if of a raised design, and shall have a perimeter mounting ring angled at no more than 45 degrees.

4.3.3 Sump frames shall be rigid designs sized to fit the mating sump top wall (internal or external), resist earth/water loads, and support equipment and lid or cover loads. Connection of frames shall not destroy the leak tight containment features of any sump below 80 percent of the wall height.

4.3.4 Sump brackets shall be rigid designs sized to connect to the sump wall or frame (internal only), and provide a load bearing attachment point for components inside the sump. Connection of brackets shall not destroy the leak tight containment features of any sump below 80 percent of the wall height.

4.3.5 Chase pipe shall be flexible or semi-rigid pipe designs sized to connect with external penetration or termination fittings, resist burial loads, and provide a conduit for routing underground piping to and from the sump, but shall not permit transfer of soil fluids into the sump. The pipe and fitting combination shall resist entry of soil fluids into the sump. Chase pipe is not rated to contain flammable liquids.

4.4 All materials used in the construction of sumps, fittings and accessories shall be suitable for their intended use locations with respect to normal (expected use within marked ratings) and abnormal (reasonable foreseeable misuse) conditions per the required performance tests described in this Outline.

4.4.1 Nonmetallics used in the construction of products shall be evaluated for long-term exposure compatibility to air, soil, water, ultraviolet light, and internal and external fluids within the expected ambient use temperature range evaluated by the requirements in this Outline.

4.4.2 Metallics used in the construction of products shall be inherently corrosion resistant (such as stainless, aluminum, brass), plated or coated per 4.5, or evaluated for equivalent corrosion resistance per 4.6. All metals shall comply with all applicable requirements in this Outline.

4.5 Corrosion resistant coatings or platings shall be minimum designation G90 (minimum 40 percent zinc galvanizing on all sides) per ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

4.6 Equivalent alternate corrosion protection methods shall be determined by an evaluation of coating or plating performance in accordance with the Standard for Electrical Metallic Tubing, UL 797, using a visual corrosion comparison between benchmark G90 and the alternate protection after exposures to Table 13.1 Test Liquids.

4.7 All components required for a complete field assembly of the product and other fueling system products intended for the application shall either be provided with the sump, fitting or accessory, or if a common item, specified in the instructions.

4.8 All adhesives, gaskets, sealing compounds, fusion welds and other joining methods shall be evaluated with the complete assembly after installation per the manufacturer's instructions.

PERFORMANCE

5 General

5.1 Representative production samples of each general type of sump product (containment sump, sump fitting and sump accessory) shall be subjected to the appropriate Performance Tests as specified in Table 5.1, with sample variations of product type, design, materials, size and ratings specified in each method.

5.1.1 Critical dimensions (such as length, width, height, diameter, thickness, etc.) of 3 randomly selected test samples of each sump product type evaluated, shall be measured before any tests are conducted. All test sample dimensions shall be within the manufacturer's quality control specifications.

5.1.2 Representative sample sizes for the Performance Tests specified in Table 5.1 are defined as either:

- a) "ALL" for all types, shapes, and sizes within a manufacturer's product range;
- b) "WC" for worst types, shapes and sizes per 5.1.3 to 5.1.7, Table 5.1 notes and other guidance in each specific test; or
- c) As otherwise indicated in the specific test.

When determining a WC sample(s), the test objectives, parameters, pass/fail criteria and other sequential tests using the same sample shall be considered in addition to construction variations in a design series.