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NATIONAL STANDARD

ANSI/CAN/UL/ULC 2258:2018

STANDARD FOR SAFETY

Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids

Approved American National Standard
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ANSI/UL 2258-2019

Standards Council of Canada
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SCC FOREWORD

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UL Standard for Safety for Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids, ANSI/CAN/UL/ULC 2258:2018

First Edition, Dated May 17, 2018

Summary of Topics

This revision of UL/ULC 2258 has been issued as part of the project to support the National Research Council of Canada program to address Climate Change Adaptation in Canadian Codes and Standards.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated August 24, 2018.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

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ANSI/CAN/UL/ULC 2258:2018

Standard for Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids

First Edition

May 17, 2018

This ANSI/CAN/UL/ULC Safety Standard consists of the First Edition including revisions through March 12, 2019.

The most recent designation of ANSI/UL 2258 as an American National Standard (ANSI) occurred on March 12, 2019. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface or SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on March 12, 2019.

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Preface

This is the First Edition of the ANSI/CAN/UL/ULC 2258, Standard for Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids, including revisions through March 12, 2019.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. ULC Standards is accredited by the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Appendix A, identified as Normative, forms a mandatory part of this Standard.

Appendices B and C, identified as Informative, are for information purposes only.

This ANSI/CAN/UL/ULC 2258 Standard for Safety is under continuous maintenance, whereby each revision approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This First Edition Joint American National Standard and National Standard of Canada is based on, and now supersedes, the Outline of Investigation, Issue 4 of Subject 2258 and the First Edition of CAN/ULC-S670-14.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at http://csds.ul.com.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a "yes" or "no" answer based on the literal text of the requirement concerned.

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This Edition of the Standard has been formally approved by the Joint UL/ULC Technical Committee (TC) on Combustible Liquid Tanks and Accessories, TC 2258.

This list represents the TC 2258 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

TC 2258 Membership

Name	Representing	Interest Category	Region
Beaulieu, Michel	Roth Industries Inc.	Producer	USA
Bershad, Susan	National Fire Protection Association (NFPA)	General Interest	USA
Bourassa, Eric	Granby Industries L.P.	Non-voting	Canada
Deschamps, Claude	Régie du Bâtiment du Québec (RBQ)	AHJ	Quebec
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This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE.

1 SCOPE

1.1 This Standard covers the minimum requirements for nonmetallic or composite primary tanks, secondary tanks, and open or closed secondary containments from 227 to 2500 L (60 to 660 US gal) primary tank capacity intended primarily for the storage and supply of heating fuel for oil burning equipment, or alternately for the storage of diesel fuels for compression ignition engines and motor oils (new and used) for automotive service stations, in aboveground applications.

In addition to this Standard's traditional safety requirements that primarily evaluate structural integrity, material compatibility, and mitigate fire and environmental hazards from loss of liquid containment under expected normal conditions; optional construction and/or performance requirements, and associated ratings intended to address more severe conditions associated with the effects of Climate Change are included in Appendix C.

1.2 Each tank type is permitted to be fabricated in a combination of various shapes (cylindrical, rectangular or obround), orientations (horizontal, vertical) and may have integral options (tank supports or accessories) as covered in this Standard.

1.3 These shop built tanks are completely fabricated, inspected, and tested for leakage before shipment from the factory as completely assembled vessels except for options intended for field assembly in accordance with the manufacturer's instructions.

1.4 These tanks are intended for stationary installation and use in accordance with, but not limited to, any of the following documents as appropriate for each country below. These tanks are not intended for the transportation of fuel, nor are they intended to be transported while containing liquids.

A For the United States; ANSI/NFPA 31, Standard for the Installation of Oil-Burning Equipment; ANSI/NFPA 30, Flammable and Combustible Liquids Code; NFPA 30A, Code for Fuel Dispensing Facilities and Repair Garages; and the International Fire Code published by the International Code Council.

B For Canada; the National Fire Code of Canada; CSA B139, Installation Code for Oil Burning Equipment; Regulations of the appropriate authority having jurisdiction; and CCME Environmental Code of Practice for Aboveground and Underground Storage Tank System Containing Petroleum and Allied Petroleum Products.

1.5 These requirements do not apply to steel tanks covered by the following standards:

A UL 80, Standard for Steel Tanks for Oil-Burner Fuels;

B CAN/ULC-S602, Standard for Aboveground Steel Tanks for Fuel Oil and Lubricating Oil;

C UL 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids;

D CAN/ULC-S601, Standard for Shop Fabricated Steel Aboveground Tanks for Flammable and Combustible Liquids;

E UL 58, Standard for Steel Underground Tanks for Flammable and Combustible Liquids; or

F CAN/ULC-S603, Standard for Steel Underground Tanks for Flammable and Combustible Liquids.

1.6 These requirements do not apply to nonmetallic tanks covered by the following standards:

A UL 1316, Standard for Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures, and CAN/ULC S615, Standard for Fibre Reinforced Plastic Underground Tanks for Flammable and Combustible Liquid; or

B UL 1746, Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks, and CAN/ULC-S603.1, Standard for External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.

1.7 These requirements do not cover storage of waste oils or other combustible liquids with different fire, physical or material compatibility properties with respect to the intended liquids in Clause 1.1 but do cover 100 % biodiesel and biodiesel blends up to 100 %. These requirements do not cover storage of flammable liquids.

1.8 Except for optional Climate Change Adaptation requirements in Appendix C, these requirements do not cover special evaluations for resistance to, or use after, earthquakes, floods, high wind events, or other natural disasters. These requirements do not cover resistance to vehicle impact.

NOTE: See the Note at the beginning of Appendix C for further information on the terms “Adaptation” and “Mitigation”, as they pertain to Climate Change.

2 UNITS OF MEASURMENT

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

3 REFERENCE PUBLICATIONS

3.1 Refer to Appendix for a list of publications referenced in this Standard. 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. When the latest edition of a Standard is not applicable, the appropriate edition is indicated accordingly in Appendix .

4 COMPONENTS

4.1 Except as indicated in Clause 4.2, a component of a product covered by this Standard shall comply with the requirements for that component.

4.2 A component is not required to comply with a specific requirement that:

A Involves a feature or characteristic not required in the application of the component in a product covered by this Standard; or

B Is superseded by a requirement in this Standard.

4.3 A component shall be used in accordance with its rating established for the intended conditions of use.

4.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5 GLOSSARY

5.1 Terms used in this Standard are defined in Clauses 5.2 through 5.31.

5.2 ABOVEGROUND TANK (also known as ABOVEGROUND STORAGE TANK or AST) – A storage tank that is intended for installation above grade, at grade or below grade without backfill.

5.3 ATMOSPHERIC TANK (also known as NONPRESSURE TANK) – A storage tank that has been designed to operate at pressures from atmospheric through a gauge pressure of 6.9 kPa (1.0 psig) measured at the top of the tank; not intended to accommodate an internal vacuum greater than 300 Pa (0.0435 psi) (gauge) or -2.25 mmHg (-0.0886 inHg).

5.4 AUTHORITY HAVING JURISDICTION (AHJ) – The governmental body responsible for the enforcement of any part of this Standard or the official or agency designated by that body to exercise such a function.

5.5 BIODIESEL – General description of various Class II to IIIB range of long chain fatty acid methyl ester fuels complying with ASTM D6751, Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels, processed from vegetable oils or animal fats in pure form (B100). Biodiesel may also be blended with heating fuels or diesel fuels (B1 – B99) denoting the percent volume of biodiesel in the mix.

5.6 CLOSED SECONDARY CONTAINMENT (also known as CLOSED TOP DIKE TANK) – Construction that is external to the primary tank that is designed to prevent the entrance of precipitation and debris into the containment and where the interstitial space is capable of being monitored.

5.7 COMBUSTIBLE LIQUID – Any liquid having a flash point at or above 37.8 °C (100 °F) and below 93.3 °C (200 °F), and as defined in the National Fire Code of Canada and the International Fire Code (NFPA 30)

5.8 DIESEL FUELS – General description of various Class II petroleum distillate grades complying with ASTM D975, Standard Specification for Diesel Fuel Oils, or CGSB 3.520, Diesel Fuel Containing Low Levels of Biodiesel (B1-B5) or CGSB 3.6, Off-Road Diesel Fuel, including No. 1 and No. 2 Diesel Fuel (also known as on-road diesel, including low sulfur diesel, ultra-low sulfur diesel and biodiesel blends) typically intended for powering compression ignition engines.

Note: these fuels may contain up to 5% biodiesel without identification of the content.

5.9 DESIGN SERIES – A tank design series is a set of tanks of the same diameter, number of walls, and head shape that vary in length.

5.10 FIRE JACKET – An external material enclosing the primary tank, or secondary tank or dike tank which is intended to provide protection from fire, physical damage, or both.

5.11 HEATING FUELS /FUEL OIL – General description of various Class II petroleum distillate grades complying with ASTM D396, Standard Specification for Fuel Oils, or CGSB 3.2, Heating Fuel Oil; or ASTM D3699, Standard Specification for Kerosene, or CGSB 3.3, Kerosene, including No. 1 and No. 2 Fuel Oils or K1 Kerosene (also known as oil burner fuel, including low sulfur distillates and biodiesel blends), typically intended for use in oil burning equipment.

Note: these fuels may contain up to 5% biodiesel without identification of the content.

5.12 INTERSTICE / INTERSTITIAL SPACE (also known as ANNULAR SPACE) – The space between the walls that is capable of being monitored for leakage through:

A the primary tank wall;

B the secondary containment wall;

C the multiple containment walls; or

D monitorable bulkheads.

5.13 LOW SULFUR DIESELS – Diesel fuels with additional processing to reduce the sulfur content ≤ 500 ppm (low sulfur diesel) or ≤ 15 ppm (ultra-low sulfur diesel).

5.14 MOTOR OILS – General description of various Class III petroleum distillate or synthetic grades including lube oils, hydraulic oils or transmission oils typically used as lubricating, cooling, or working fluids in motor vehicle applications.

5.15 NONMETALLIC TANK (also known as TANK SYSTEM) – A storage tank that is constructed of a nonmetallic primary tank and may include a fire jacket, or metallic secondary, or nonmetallic secondary containment.

5.16 OPEN SECONDARY CONTAINMENT (also known as OPEN TOP DIKE TANK) – Construction that is external to the primary tank that is open to the atmosphere and where the interstitial space is not capable of being pressurized but is capable of being monitored.

5.17 PERFORMANCE TESTS – A complete evaluation conducted on a limited quantity of representative "worst case" tanks intended to verify compliance with all applicable performance requirements in a Standard. Performance tests are typically destructive.

5.18 PRIMARY TANK – The product storage tank or compartment.

5.19 PRODUCTION TESTS – A limited evaluation conducted by the tank manufacturer on each tank after complete assembly but prior to shipping intended to verify compliance with critical production requirements in a Standard, such as leakage. Production tests are not destructive.

5.20 RELIEF DEVICE – A mechanical or electrical device which automatically reduces the risk of over pressure of any part of the tank system.

5.21 SECONDARY CONTAINMENT – The ability of a design or construction to contain a liquid to a minimum of 300° (for cylindrical and obround), 95 % height (for rectangular and verticals), or 110 % primary capacity (for secondary containments) only in abnormal use (from primary tank leakage or rupture) for short periods without leakage.

5.22 SECONDARY CONTAINMENT TANK (also known as SECONDARY TANK) – A primary tank with an integral secondary containment where the inner and outer walls are in intimate contact and the interstitial space is capable of being vacuum or pressure monitored. Double wall tanks are provided with a vacuum monitor.

5.23 STORAGE TANK (also known as TANK) – A vessel having a liquid capacity of at least 227 L (60 US gal), that is intended for fixed installation, and is not used for processing.

5.24 SUPPLY CONNECTION – A storage tank top or bottom opening or fitting that is intended to provide a means to supply fuel to oil burning equipment or oil to a dispensing device by gravity or suction. Bottom connections also provide a means to automatically drain water from the tank.

5.25 TANK ACCESSORY/ACCESSORIES– Optional devices or components of an aboveground, nonmetallic tank intended to provide a specific function, such as venting, heating, load bearing, spill or special containment. Tank accessories are either integrally connected or field assembled to the tank and may be emergency vents, hot wells, lift lugs, spill containers or other types.

5.26 TANK ORIENTATIONS – General description of the position of an aboveground tank with respect to stability. Horizontal tanks typically are longer and wider than high. Vertical tanks typically are higher than wide.

5.27 TANK SHAPES – General description of the geometry of an aboveground tank. Cylindrical tanks are tubes formed with formed shells and equivalent circular heads. Rectangular tanks are boxes formed with flat right angled sides. Obround tanks are cylindrical tanks with flat portions of the shell and head on two opposing sides.

5.28 TANK SUPPORT – Optional structural members of an aboveground tank intended to bear the mass of, raise above grade and/or stabilize the tank and its contents. Tank supports are integrally connected to the tank and may be saddle, leg, flat, skid or other types.

5.29 USED OIL – General descriptions of oils such as those drained from motor vehicles or cooking appliances after use that do not contain water, gas or other contaminants that change the oil Class or may adversely affect the storage tank.

5.30 VENT – A storage tank top opening that is intended to provide both normal venting (equalizing pressure from fill, withdraw or atmospheric changes typically up to 6.7 kPa (1.0 psig)) and emergency venting (relief of excessive pressure from external fire exposure typically not to exceed 17.2 kPa (2.5 psig)).

5.31 WASTE OIL – General description of oils that contain some undefined amounts of water, gasoline, diesel, or other contaminants that change the liquid Class of the oil or may adversely affect the storage tank. Oils of unknown origin shall be considered waste oil.

6 TANK COMPONENTS & TANK ACCESSORIES

6.1 The following tank components may be provided as either an attached part of a complete tank, or packed with a tank for assembly according to the manufacturer's instructions at the installation site. When provided, these components shall comply with all applicable requirements of the Standards identified below:

A Fuel filters or oil deaerators according to UL 331, Standard for Strainers for Flammable Fluids and Anhydrous Ammonia, or ULC/ORD-C331, Guide for the Investigation of Strainers for Flammable Fluids and Anhydrous Ammonia, rated at least 172 kPa (25 psig) for use with combustible liquids described in Section 1, Scope, intended for connection to the burner supply;

B Fusible link valves or shutoff valves according to UL 842, Standard for Valves for Flammable Fluids, or ULC/ORD C842, Guide for the Investigation of Valves for Flammable and Combustible Liquids, rated to at least 172 kPa (25 psi) for use with the combustible liquids described in Section 1, Scope, and intended for connection to the burner supply;

C Liquid level gauges, vent signal devices or leak detection devices according to UL 180, Standard for Liquid-Level Indicating Gauges for Oil Burner Fuels, or ULC/ORD C180, Liquid Level Gauges and Indicators for Fuel Oil and Lubricating Oil Tanks, or CAN/ULC-S675.1, Standard for Volumetric Leak Detection Devices for Underground and Aboveground Storage Tanks for Flammable and Combustible Liquids, or CAN/ULC-S675.2, Standard for Nonvolumetric Precision Leak Detection Devices for Underground and Aboveground Storage Tanks and Piping for Flammable and Combustible Liquids, rated at least 172 kPa (25 psig) for use with the combustible liquids described in Section 1, Scope, intended for use in top openings; and

D Rain covers according to the requirements of Subsection 9.2.7, Rain Test.

6.2 The following tank accessories may be provided as either an attached part of a complete tank, or packed with a tank for assembly according to the manufacturer's instructions at the installation site. When provided, these accessories shall comply with all applicable requirements identified below:

A Spill containers shall be plastic or steel leak tight constructions integral to the tank with attached covers, and have a minimum 3.8 L (1.0 US gal) capacity for use around top openings such as fill and vents in accordance with UL 2583, Fuel Tank Accessories, or CAN/ULC-S663, Spill Containment Devices for Aboveground Flammable and Combustible Liquid Storage Tanks; and

B Piping for support legs shall be fabricated from minimum Schedule 40 ASME B36.10M black pipe in sizes and threads to fit the integral leg brackets and shall comply with the requirements of Subsection 9.2.4, Pipe and Fitting Bending Test.

7 TANK SUPPORT

7.1 If tanks are optionally equipped with integral support brackets, cradles or frames or otherwise provided with some other equivalent means for mounting the tank, they shall be tested in accordance with Subsection 9.2.6, Tank Stability and Support Load Test.

7.2 Where the tank is intended to be in contact with grade but an additional structure is provided only to add stability to the tank, the tank, and additional structure shall be tested in accordance with Subsection 9.2.6, Tank Stability and Support Load Test.

8 CONSTRUCTION

8.1 SIZE & FORM

8.1.1 Tanks of this class shall be cylindrical, obround, rectangular or of another form which complies with all applicable performance tests but shall not exceed a primary tank capacity of 2500 L (660 US gal). The marked nominal capacity shall be within 95 % to 100 % of the actual capacity.

8.1.2 Primary tanks shall be formed or molded from only nonmetallic materials which comply with the applicable requirements in this Standard. Tanks of any form shall not have any shell penetrations below the liquid level line except for supply connections.

NOTE: Primary tanks may include metallic components, e.g., fittings or supports.

8.1.3 Secondary tanks shall have containment of at least 300° or 95 % height of the primary tank and an interstitial space capable of being vented and monitored. The secondary tank walls are permitted to be in direct contact with the exterior surface of the primary tank, or separated from it by supporting members.

8.1.4 The secondary containment shall not have any drains or shell penetrations except for welded through connections for burner supply piping or top fittings from the primary tank, or the secondary containment interstitial vent.

8.1.5 The secondary containment top opening shall be permitted to combine interstitial space venting and monitoring.

8.1.6 Contained tank assemblies with open secondary containment shall have containment of at least 110 % of the primary tank, spill coverage of at least 25.4 mm (1 inch) beyond the primary tank projected area, and a wall height of at least half that of the primary tank height (with supports). The open or closed secondary containment shall have tank hold downs.

8.1.7 The secondary containment shall not have any drains or wall penetrations except for welded and supported through connections for burner supply piping from the primary tank.

8.1.8 The secondary containment dike shall not prevent venting or liquid flow and may be of either an open or closed top design with/without baffles or supports.

8.2 MATERIALS

8.2.1 All materials shall be evaluated for compatibility with the intended fluids, installation and use as identified in this Subsection. Combinations of materials shall be compatible with each other with respect to dielectric corrosion or other chemical reactions between materials.

8.2.2 Other than as indicated in Clause 8.2.3, a product shall be factory built as a complete assembled unit and shall include all the essential components necessary for its intended function.

8.2.3 If the product is not assembled by the manufacturer as a complete unit, it shall be arranged in subassemblies where it shall be capable of being incorporated into a final assembly without alteration, such as cutting, drilling, threading, welding, or similar operations by the installer or user. Two or more subassemblies that have a definite relationship to each other for the intended installation or operation of the product, shall:

A Be arranged and constructed to be incorporated into the complete assembly without need for fitting or alignment; or

B Be assembled, production tested, and shipped from the factory as one element except for fittings, components and accessories described in Section 6, Tank Components and Tank Accessories.

8.2.4 All completely assembled tanks shall comply with the requirements in Section 9, Tank Performance Tests, as appropriate.

8.2.5 All polymeric materials and composites where polymers are the major component shall additionally comply with the requirements in Section 10, Materials Compatibility Tests, as appropriate.

8.2.6 All metallic materials and composites where metals are the major component shall additionally comply with Section 10, Materials Compatibility Tests, as appropriate.

8.2.7 All threaded fittings and pipe provided with the tank which are intended to be connected to external pipe (fill, vent) or devices (gauge) shall be compatible with NPT threaded pipe, and shall be threaded and in accordance with ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).

8.2.8 Electrical components, whether provided by or recommended for use by the manufacturer, shall not be located inside the primary tank or secondary containment unless evaluated for the application or in accordance with UL 180, Liquid-Level Gauges for Oil Burner Fuels and Other Combustible Liquids.

8.3 PRIMARY TANKS

8.3.1 Primary tanks shall be constructed from nonmetallic or combinations of metallic and nonmetallic materials which comply with the applicable requirements in this Standard.

8.3.2 Primary tanks shall have a minimum of three top openings (fittings or pipe), for fill, vent and a liquid level gauge, two of which shall be of equal size not less than 50.8 mm (2 in) in diameter.

8.3.3 Primary tanks shall have provisions for a minimum 12.7 mm (0.5 in) burner supply connection, for fuel withdrawal located either in the top, bottom or head of the primary tank.

8.4 SECONDARY TANKS

8.4.1 Secondary tanks are permitted to be constructed from metallic, nonmetallic or combinations of metallic and nonmetallic materials or from materials which comply with the applicable requirements in this Standard.

8.4.2 Secondary tanks shall have a minimum of one top opening (fitting or pipe) not less than 50.8 mm (2 in) in diameter for connection of the interstitial vent pipe.

8.4.3 Secondary tanks shall have containment features as described in Clauses 8.1.3 through 8.1.5 with provisions for a minimum 12.7 mm (0.5 in) opening, for monitoring the interstitial space located only in the top of the secondary containment tank.

8.5 OPEN OR CLOSED SECONDARY CONTAINMENTS

8.5.1 Open or closed secondary containments are permitted to be constructed from metallic, nonmetallic or combinations of metallic and nonmetallic materials or from materials which comply with the applicable requirements in this Standard.

8.5.2 Secondary containments shall be either closed top types with penetrations only for primary tank fittings and pipe, or open top types with additional openings permitted.

8.5.3 Open or closed secondary containments shall have containment features as described in Clauses 8.1.6 through 8.1.8, with provisions for a minimum 12.7 mm (0.5 in) opening, for monitoring the interstitial space located only in the top of a closed secondary containment.

8.6 FUNCTIONAL TANK COMPONENTS

8.6.1 Tank designs are not prohibited from using any combination of functional components provided they are integral with the tank and evaluated in accordance with the applicable requirements of this Standard. Some typical functional components are identified in Clauses 8.6.2 and 8.6.3.

8.6.2 Thermal insulations shall not interfere with emergency venting or fluid communication of the interstitial space, and shall be subject to applicable Section 10, Material Compatibility Tests, following all applicable performance tests.

8.6.3 Rain covers shall resist rain and debris from entering the interstitial space of an open secondary containment dike and shall be evaluated according to the Rain Test, Subsection 9.2.7, following all applicable performance tests.

9 TANK PERFORMANCE TESTS

9.1 GENERAL

9.1.1 All tests shall be performed on complete tank systems representative of production unless it has been determined by the certifier that separate components of the tank when individually tested are equivalent representatives of the complete tank system. Unless otherwise indicated, all tests shall be conducted at 10 to 32 °C (50 to 90 °F).

9.1.2 One tank of each design type shall be used for all of the Normal Use Tests in Subsection 9.2. These tests shall be conducted in the order indicated, followed by the Leakage Test, Subsection 11.1.

9.1.3 One tank of each design is permitted to be used for each of the Abnormal Use Tests in Subsection 9.3. These tests may be conducted in any order, followed by the Leakage Test, Subsection 11.1.

9.1.4 One tank of each design type in the largest exposed surface area (or wet surface area – WSA) to capacity ratio (typically the smallest size) shall be used for the Pool Fire Test, Subsection 9.3.7.

9.1.5 Representative plaques or components of the tank shall be used for the Material Compatibility Tests, Section 10, provided they are of identical material composition, forming process, and are of the average minimum thickness specified.

9.1.6 It is permitted to cease tests on the same tank as described in Clauses 9.1.1 through 9.1.5 and complete testing on a second sample tank, provided that the manufacturer includes markings and instructions:

A The conditions under which the tank not be placed or remain in service (Clause 12.2.1.2B (i)); and

B Outlining the damage that is not allowed or how that damage is to be repaired (Clause 12.4.4 E).

NOTE 1: The manufacturer may choose to proceed with additional testing on the same tank if they decide the damage is acceptable (i.e. will not compromise the functionality or structural integrity of the tank).

NOTE 2: Assessment of damage may be conducted after each test, or after completion of all tests in each section. Damage assessments may include leak testing (per Subsection 11.1, Leakage Test, to determine if the damage will lead to a hazard) or an autopsy (such as determining damage to the primary tank by an integral secondary tank or, open or closed secondary containment).

9.1.7 Tank systems which are to be marked "Outdoor Use" shall be evaluated to the applicable requirements of Subsection 9.2.7, Rain Test, Subsection 9.3.5, Freeze/Thaw Cycle Test, Subsection 10.6, UV Compatibility Test, and Subsection 10.7, Extreme Temperature Tests.

9.2 NORMAL USE TESTS

9.2.1 Tank Drop Test

9.2.1.1 There shall be no failure or damage to any part of the tank system, or any leak detected according to the requirements of Leakage Test, Subsection 11.1, resulting from the drop conditions as indicated in Clause 9.2.1.2. The tank system shall be visually examined for damage after the applied drop and any tank damage (including interior components) shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.2.1.2 The empty tank system shall be dropped from a minimum height of 914 mm (3 ft) onto a concrete surface in the most unfavorable bottom position (typically a corner or edge). If a tank is supplied with protective packaging which is not to be removed until assembly, the test shall be conducted with the packaging in place.

9.2.2 Tank Handle and Lift Lug Strength Test

9.2.2.1 There shall be no failure, or damage of any tank handles, lift lugs, or their attachment areas as recommended by the manufacturer for handling of the tank system, or any leak detected according to the requirements of Leakage Test, Subsection 11.1, resulting from the static load conditions as indicated in Clause 9.2.2.2. The tank system shall be visually examined for damage (including interior components) after the applied load and shall be assessed with respect to preconditioning a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.2.2.2 The empty tank system before assembly shall be subjected to a load of 2 times the empty tank mass applied for 1 min to integral tank handles (to a maximum 76.2 mm (3 in) width), lift lugs (to a maximum 25.4 mm (1 in) width) or any lifting means supplied with the tank or recommended by the manufacturer's installation instructions for handling.

9.2.3 Pipe and Fitting Torque Test

9.2.3.1 There shall be no failure or damage of any tank pipe, fittings or attachment areas, or any leak detected according to the requirements of Leakage Test, Subsection 11.1, resulting from the static torque conditions as indicated in Clauses 9.2.3.2 or 9.2.3.3 as appropriate. Each pipe/fitting size and material type shall be subjected to the test. The tank system shall be visually examined for damage (including interior components) after the applied torque and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.2.3.2 For unique pipe and fittings which are supplied with the tank system, 1.5 times the manufacturer's rated torque with the supplied or specified lubrication, tool or method as recommended in the instructions shall be applied to the pipe or fitting. There shall be no tank system damage that results in leakage.

9.2.3.3 For standard pipe or fittings which are compatible with trade size piping described in Clause 8.2.7, torque values in accordance with Table 9.2.3.1 with Schedule 40 steel pipe or fittings lubricated with pipe thread sealant shall be applied to the pipe or fitting. There shall be no tank system damage that results in leakage.

Table 9.2.3.1
Torque Test Values

Nominal pipe size		Torque		Normal pipe size		Torque	
mm	(inch)	N·m	(lbf·in)	mm	(inch)	N·m	(lbf·in)
12.7	(0.50)	181	(1600)	50.8	(2.00)	373	(3300)
19.1	(0.75)	226	(2000)	63.5	(2.50)	396	(3500)
25.4	(1.00)	271	(2400)	76.2	(3.00)	407	(3600)
31.8	(1.25)	316	(2800)	88.9	(3.50)	418	(3700)
38.1	(1.50)	350	(3100)	101.6	(4.00)	429	(3800)

9.2.4 Pipe and Fitting Bending Test

9.2.4.1 There shall be no failure or damage of any tank pipe, fittings or attachment areas, or any leak detected according to the requirements of Leakage Test, Subsection 11.1, resulting from the static bending conditions as indicated in Clauses 9.2.4.2 or 9.2.4.3 as appropriate. Each pipe/fitting size and material type shall be subjected to the test. The tank system shall be visually examined for damage (including interior components) after the applied torque and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.2.4.2 For unique pipe and fittings which are supplied with the tank system, a load of 1112 N (250 lbf) shall be applied to the supplied pipe at 914 mm (36 in) from the tank connection in the most unfavorable direction. If the tank system exhibits obvious deformation or bending (≥ 30°) as a result of the applied load, the test is to be discontinued. There shall be no tank system damage that results in leakage.

9.2.4.3 For standard pipe or fittings which are compatible with trade size piping described in Clause 8.2.7, a load of 1112 N (250 lbf) shall be applied to a Schedule 40 steel pipe at 914 mm (36 in) from the tank connection in the most unfavorable direction. If the tank system exhibits obvious deformation or

bending (≥ 30°) as a result of the applied load, the test is to be discontinued. There shall be no tank system damage that results in leakage.

9.2.5 Tank Impact Test

9.2.5.1 There shall be no failure or damage to pipe, fittings or any other normally exposed part of the tank system, or any leak detected according to the requirements of Leakage Test, Subsection 11.1, resulting from the impact conditions as indicated in Clauses 9.2.5.2 or 9.2.5.3 as appropriate. The tank system shall be visually examined for damage (including interior components) after the applied impact and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.2.5.2 For exposed parts of the tank, several representative tank sections such as flat, curved or corner areas shall be selected and each subjected to a 6.78 J (5.0 ft·lb) impact force applied with a 50.8 mm (2 in) steel ball, weighing 0.54 kg (1.18 lbs). The sphere is to fall freely from rest through a vertical distance of 1.30 m (4.25 ft). The impact areas selected shall be considered worst case with respect to material, shape, or thickness.

9.2.5.3 For exposed parts of pipe, fittings or other accessories supplied or recommended by the manufacturer, several representative areas shall be selected and each subjected to a 6.78 J (5 ft·lb) impact force applied with a 50.8 mm (2.0 in) steel ball, weighing 0.54 kg (1.18 lbs). The sphere is to fall freely from rest through a vertical distance of 1.30 m (4.25 ft). The impact areas selected shall be considered worst case with respect to material, shape, size and thickness.

9.2.6 Tank Stability and Support Load Test

9.2.6.1 There shall be no failure or damage of any part of a tank system with or without integral supports which could cause a hazard under a static load described in Clause 9.2.6.2 or Leakage Test, Subsection 11.1. The tank system shall be visually examined for damage after the applied load and any tank damage (including interior components) shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.2.6.2 Each tank system shall be subjected to an evenly distributed load of 2 times the maximum primary tank capacity (based on the mass of No. 2 fuel oil) for 1 min. Water shall be used in the primary tank and other fluids or masses for the remainder shall be loaded on the tank top. The supports and tank system shall be visually examined during the applied load. There shall be no collapse, tip over, or leakage.

9.2.7 Rain Test

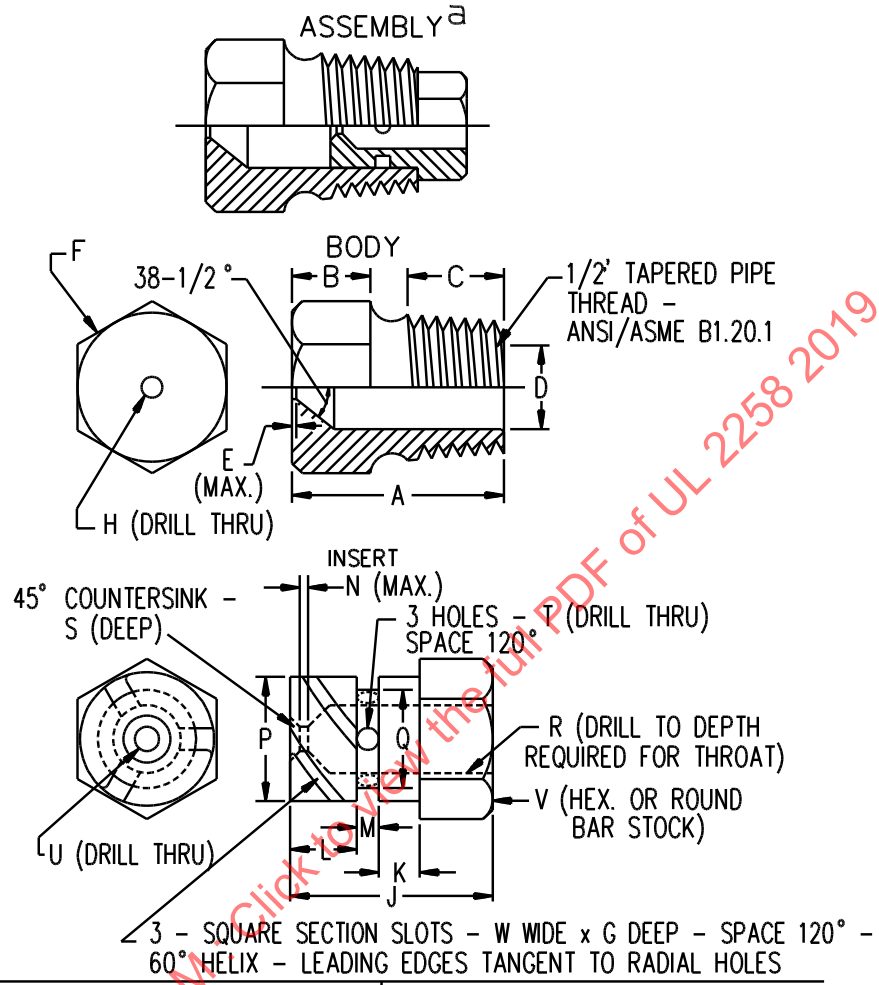
9.2.7.1 All tank systems rated for "Outdoor Use" shall be evaluated for resistance to rain as described in Clause 9.2.7.2. Tanks provided with supplied covers shall be evaluated after their assembly in accordance with the manufacturer's instructions, and in the normally closed position. Following the simulated rain exposure, there shall be no water entering the inside of the primary tank, secondary or interstitial containment.

9.2.7.2 The test tanks shall be positioned on a level surface and subjected to a 30 min. simulated rain exposure, emitted from a Rain Test Spray Head (Figure 9.2.7.1) focused on the tank area(s) most likely to allow entry of water. The nozzle shall operate at 34.5 kPa (5.0 psig) within 914 mm to 1524 mm (3.0 to 5.0 ft) of the test area:

A For 15 min at a 45° angle with respect to the tank top; then

B Followed by 15 min parallel to the tank top.

Figure 9.2.7.1
RAIN TEST SPRAY HEAD



Item	inch	mm	Item	inch	mm
A	1-7/32	31.0	N	1/32	0.80
B	7/16	11.0	P	.575	14.61
C	9/16	14.0		.576	14.63
D	.578	14.68	Q	.453	11.51
	.580	14.73		.454	11.53
E	1/64	0.40	R	1/4	6.35
F	c	c	S	1/32	0.80
G	.06	1.52	T	(No. 35)[b]	2.80
H	(No.9)[b]	5.0	U	(No. 40)[b]	2.50
J	23/32	18.3	V	5/8	16.0
K	5/32	3.97	W	0.06	1.52
L	1/4	6.35			
M	3/32	2.38			

[a] Nylon Rain-Test Spray Heads are available from Underwriters Laboratories

[b] ANSI B94.11M Drill Size

[c] Optional - To serve as a wrench grip.

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9.3 ABNORMAL USE TESTS

9.3.1 Tank Top Load Test

9.3.1.1 All types of tank systems with flat top surface areas shall not leak, collapse, or tip over or have other damage which could cause a hazard after being subjected to the top load test described in Clause 9.3.1.2. The tank system shall be visually examined for damage (including interior components) after the test and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.3.1.2 The empty tank of a completely assembled system (except for piping) shall be subjected to an 1112 N (250 lbf) load evenly distributed over a 305 mm x 305 mm (12 in x 12 in) square plate in the center of each test area for 1 min. The tank is permitted to be stabilized for this structural test.

9.3.2 Tank Stability Test

9.3.2.1 All tank systems with or without integral supports shall not tip over or have other damage which could cause a hazard after being subjected to both push and tilt stability tests described in Clause 9.3.2.2. The tank system shall be visually examined for damage (including interior components) after the test and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.3.2.2 Tank systems after assembly of all components except connecting pipe shall be subjected to 1 min. of pushing and tilting in the most unfavorable condition without tip over. Pushing shall be simulated by applying a horizontal force of 222.4 N (50 lbf) to the highest part of the empty tank. Tilting shall be simulated by placing the tank on an incline plane inclined at 15°, then filling to rated capacity with water.

9.3.3 Interstitial Communication Test

9.3.3.1 All tank systems with an interstitial space, or any design with insulation or other materials capable of preventing leak detection shall show evidence of communicating leakage within 24 h after being subjected to the communication test described in Clause 9.3.3.2. The tank system shall be visually examined for damage (including interior components) after the test and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.3.3.2 With the primary tank filled to 100 % rated capacity with water on a level surface, a maximum of 2 % of the rated primary tank capacity of water shall be injected into the interstitial space of the tank system at a point farthest from the leak detector or monitor opening. If the tank system provides an integral leak detection system, provided by the manufacturer, that device shall be evaluated for leak detection in accordance with the instructions.

9.3.4 Buoyancy Test

9.3.4.1 A primary tank within an integral secondary tank or, open or closed secondary containment shall not uplift, rotate, leak or have other damage which could cause a hazard after being subjected to the buoyancy test described in Clause 9.3.4.2. The tank system shall be visually examined for damage (including interior components) after the test and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.3.4.2 The interstitial space of the sample on a level surface shall be filled with water to the maximum capacity with the primary tank empty and held for at least 1 h.

9.3.5 Freeze/Thaw Cycle Test

9.3.5.1 All tank systems with an interstitial space rated for "Outdoor Use" shall not crack, leak or have other damage which could cause a hazard after being subjected to the freeze/thaw cycle described in Clause 9.3.5.2. The tank system shall be visually examined for damage (including interior components) after the test and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

9.3.5.2 The interstitial space of the sample shall be filled with water to 2 % of the rated primary tank capacity or a depth of at least 50.8 mm (2.0 in) from the bottom of the interstitial space, then subjected to a temperature cycle of 24 h at -20 ±2 °C (-4 ±4 °F) followed by 24 h at 20 ±2 °C (68 ±4 °F) followed by 24 h at -20 ±2 °C (-4 ±4 °F).

9.3.6 Proof of Design and Hydrostatic Load Tests

9.3.6.1 All types of tank systems and any pipe, fittings, gauges, fill limiting devices or other accessories supplied or recommended by the manufacturer shall not rupture, leak or have other damage which could cause a risk of injury after being subjected to the proof of design and/or hydrostatic load test described in Clauses 9.3.6.2 through 9.3.6.4, as appropriate. The tank system shall be visually examined for damage (including interior components) after the test and shall be assessed with respect to preconditioning of a fire test sample (refer to Clause 9.3.6.2) according to Clause 9.1.6.

Exception: If the tank is marked as described in Clause 12.2.1.2 B (vi) and instructions are provided as in Clause 12.4.4F for reduced field test pressures, the test pressures in Clauses 9.3.6.2 and 9.3.6.3 shall be reduced to 103.4 kPa (15 psig).

9.3.6.2 The primary tank in a completely assembled tank system shall be filled through the inlet fitting to maximum capacity with water. With all other openings capped, additional water shall then be applied in a slowly increasing pressure until at least 172.4 kPa (25 psig) is held for at least 1 min. The tank system shall be visually examined during and after the test for leakage.

9.3.6.3 The secondary tank or the interstice of a completely assembled tank system shall be filled through an interstitial fitting to maximum capacity with water while maintaining the water pressure in the primary tank, or alternately, with the primary tank and interstitial spaces manifolded together. With all other openings capped, additional water shall then be applied in a slowly increasing pressure until at least 172.4 kPa (25 psig) is held for at least 1 min. The tank system shall be visually examined during and after the test for leakage.

9.3.6.4 The open or closed secondary containment of a completely assembled tank system shall be filled to the maximum capacity with water while maintaining water in the primary tank. After 1 min under this maximum hydrostatic load there shall be no rupture, leakage or other damage to the open or closed secondary containment or primary tank, such as excessive distortion, which could make the primary tank unstable.

9.3.7 Pool Fire Test

9.3.7.1 During the Pool Fire Test described in this Section, the following general conditions shall be met for compliance: The Comparative Small Scale Fire Test, Subsection 9.3.8, shall be used to measure flame resistance and rates after exposures, and determine a "worst case" from multiple materials and alternate, or reformulated grades within the same generic polymer family (i. e. HDPE, LDPE, isophthalic FRP, terephthalic FRP, etc.):

A The tank system shall contain all of the test fuel, even if distortion or melting is present;

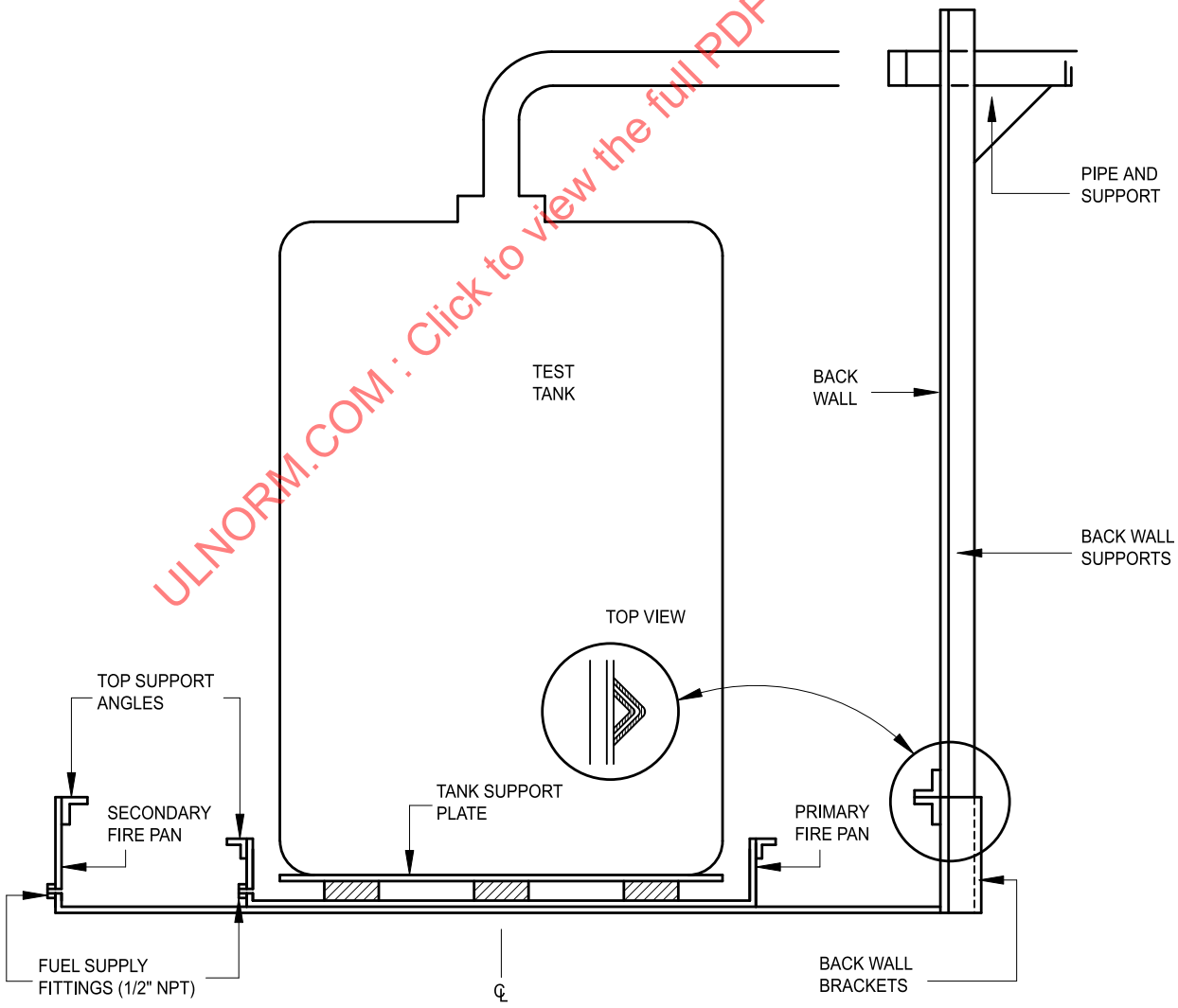
B The tank system shall not sustain damage which would result in a hazard, such as tip over or adding fuel to the pool fire; and

C The primary tank pressure shall not exceed 17.2 kPa (2.5 psig).

9.3.7.2 A representative tank with the greatest surface area per capacity (typically the smallest size) and in the thinnest wall thickness shall be placed in a test fixture described in Clause 9.3.7.3. Any damage sustained during the Normal or Abnormal tests as described in Clause 9.1.6 shall be re-created for the fire test sample. Any supplied fittings and accessories shall be installed in accordance with the manufacturer's recommended instructions, and connections shall be made with 50.8 mm (2.0 in) Schedule 40 steel pipe for the fill and vent. The fire test shall be conducted in a controlled environment.

9.3.7.3 The test fixture in Figure 9.3.7.1 shall be formed of steel in a thickness sufficient to resist structural failure or significant deformation. The main parts shall consist of a tank support plate, primary fire pan, secondary fire pan, and back wall to simulate an indoor installation with one wall. A fuel distribution and control system, smoke abatement system and fire extinguishing system are also required to conduct the test.

Figure 9.3.7.1
FIRE TEST FIXTURE



9.3.7.4 The tank support plate shall be a flat rigid plate sized exactly to the projected bottom area (footprint) of the test tank. Fire brick or other noncombustible materials shall be used to elevate the support plate approximately 102 mm (4 in) from the primary fire pan during the test. Tanks with integral supports for the system will not require a support plate.

9.3.7.5 The primary fire pan shall be 203 mm (8 in) high with a reinforced top angle and sized 152 mm (6 in) longer on the length and width than the test tank footprint. A 12.7 mm (0.5 in) metal threaded fitting for the fuel supply shall be centered on one side and located no more than 25.4 mm (1 in) from the bottom.

9.3.7.6 The secondary fire pan shall be approximately 3.0 m x 2.5 m x 0.30 m (10 ft x 8 ft x 1 ft) high with a top angle and metal threaded supply fitting. Brackets for attaching the back wall shall also be installed to rigidly hold the assembly and piping in place during the test. Pea gravel or other noncombustible materials are allowed to absorb any oil from rupture or spills.

9.3.7.7 The back wall shall be the same length as the secondary fire pan, at least 2.13 m (7.0 ft) high with back supports, and a pipe support to mate with the brackets in the fire pan. Additional supports as needed are allowed to be added to the back wall to rigidly hold the assembly in place during the test, but without increasing the reflected heat.

9.3.7.8 A fuel supply pipe shall be fabricated from steel or copper tubing routed through the primary and secondary fire pan fittings and shall terminate in a distribution network which will evenly supply oil under the tank support plate below the water line. Shutoff or other suitable control valves shall be used to control the fuel flow rate during the test.

9.3.7.9 Provisions for exhausting the smoke and heat shall be in place during the test. Provisions for extinguishing the oil fire shall be available at all times during the test. Water shall not be used. The extinguishing system shall not damage the tank or contents to a degree where the requirements in Clause 9.3.7.1 cannot be determined.

9.3.7.10 Thermocouples shall be used to monitor the temperature of the flame, tank, materials and fluid at critical areas, but shall not interfere with venting, heat transfer or spread flame to the test tank. Thermocouples shall be minimum 0.64 mm diameter (22 gauge) Type K chromel alumel wires (or equivalent with maximum 2 s time constant) rated for high temperature use.

9.3.7.11 A pressure gauge (rated for high temperature use) coupled to the fill pipe shall be used to monitor the primary tank pressure at all times during the test. The vent pipe shall not be blocked. All secondary containments types shall also be monitored for pressure in the interstitial space.

9.3.7.12 With the test tank, support plate and primary fire pan centered in the secondary fire pan and the test tank 610 mm (2.0 ft) from the back wall and all piping and accessories installed, the primary fire pan shall be filled with approximately 102 mm (4.0 in) of water during the test. The water level shall not be more than 12.8 mm (0.5 in) above the tank support plate for tanks without integral supports or more than 12.8 mm (0.5 in) above the bottom of any support for tanks with integral supports. The primary tank shall then be filled to half the rated capacity with No. 2 fuel oil and the primary fire pan primed with approximately 3.2 mm (1/8 in) of the same fuel.

9.3.7.13 After ignition of the fuel in the primary fire pan, additional fuel shall then be dispensed by a controlled dosing pump and shall sustain fire within the test fixture for 30 min. Observations of the tank's structural integrity, fluid containment and venting shall be made throughout the fire test in addition to the temperature and pressure measurements.

9.3.7.14 After the 30 min exposure time, the fire shall be extinguished immediately with an appropriate foam, chemical or inert gas which will not affect the test tank. Water shall not be used. Any excess fuel in the test fixture shall be removed and the tank cooled before a visual examination is conducted.

9.3.8 Comparative Small Scale Fire Test

9.3.8.1 The Horizontal Burning (HB) Test in accordance with UL 94, Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, shall be conducted on all polymeric tank containment wall materials for purposes of:

A Measuring changes in burn rate before and after the 90 day exposures for compliance with Clauses 9.3.8.2 to 9.3.8.5; and

B Determining "worst case" (highest as-received burn rate) material for selection of the sample for the Pool Fire Test, Subsection 9.3.7.

9.3.8.2 Samples subjected to the Thermal Compatibility Test, Subsection 10.3, shall not exceed the as-received burn rate by more than 20 %.

9.3.8.3 Samples subjected to the Fuel Compatibility Test, Subsection 10.4, shall not exceed the initial burn rate by more than 20 %.

9.3.8.4 Samples subjected to the Fluids Compatibility Test, Subsection 10.5, shall not exceed the as-received burn rate by more than 20 %.

9.3.8.5 Samples subjected to the UV Compatibility Test, Subsection 10.6, shall not exceed the as-received burn rate by more than 20 %.

10 MATERIALS COMPATIBILITY TESTS

10.1 GENERAL

10.1.1 All metallic and nonmetallic material compatibility tests shall be performed on tank system components, and these test items shall be either complete components (such as formed fittings), sections cut from tank components (such as flat plaques) or specially prepared test samples (such as formed bars) if they are representative of production line materials and processes.

10.1.2 All metallics shall be evaluated for corrosion resistance after exposures as specified in Fuel Compatibility Test, Subsection 10.4, and Fluids Compatibility Test, Subsection 10.5, and stress cracking according to the Metallic Stress Cracking Test, Subsection 10.9, as applicable. There shall be no corrosion of the base metal and no delamination, blistering, cracking or similar damage of protective platings or coatings.

10.1.3 All nonmetallics shall be evaluated for property retention after exposures as specified in Subsections 10.2 to all composites will require separate and/or combined evaluation (s) of metallic corrosion resistance, nonmetallic property retention, extreme temperature resistance and/or stress cracking specified in Clauses 10.1.2 and/or 10.1.3 as applicable for the composite material combinations, extreme temperature resistance according to the Extreme Temperature Tests, Subsection 10.7 and stress cracking according to the Nonmetallic Stress Cracking Test, Subsection 10.8, as applicable. Each type of nonmetallic material shall meet the applicable minimum property retention values.

10.1.4 All composites will require separate and/or combined evaluation (s) of metallic corrosion resistance, nonmetallic property retention, extreme temperature resistance and/or stress cracking specified in Clauses 10.1.2 and/or 10.1.3 as applicable for the composite material combinations.

10.1.5 When alternate grades of the same generic material are used to form any component, consideration may be given to evaluate a single representative material provided the processes and

thickness are the same, with the "worst case" selected with respect to the material property to be evaluated.

10.1.6 Test fuel mixtures representative of the range of combustible liquids identified in the Scope shall be as indicated below, with formulation and property details as described in Appendix :

A UL B100 (refer to ASTM D6751); and

B F75/B25a.

10.2 MATERIAL PROPERTY TESTS

10.2.1 Three seamed and unseamed test samples (as applicable) shall be subjected to the appropriate material property tests described in Clauses 10.2.4 and 10.2.5 for each generic material type. One additional sample shall be subject to 90 day exposures prior to testing in accordance with the Comparative Small Scale Fire Test, Subsection 9.3.8.

10.2.2 All test samples shall be within ±10 % of the average tank wall thickness as measured in the center of each test plaque or bar. If the average as-received seamed and unseamed sample material property results vary by more than 10 %, both sample types shall be evaluated in additional material property tests in Subsections 10.3 through 10.6, otherwise, unseamed samples shall be used and compared to unseamed samples for percent retention purposes.

10.2.3 All samples shall be conditioned for 8 to 48 h at 20 ± 2 °C (68 ± 4 °F) and 50 ± 5 % RH prior to testing to any of the described methods. The average value of each test set shall be used to determine compliance, but standard deviation, precision and bias, and other statistical calculations are not required.

10.2.4 For thermoset materials, Flexural Strength shall be in accordance with Sections for Apparatus, Specimens, Procedure A or B and Calculations in ANSI/ASTM D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials. Flexural strength shall be conducted by applying the force to the sample side that represents the inside of the tank wall. Izod Impact Resistance shall be in accordance with Sections for Apparatus, Specimens, Notching and Procedure A or C in ANSI/ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

10.2.5 For thermoplastic materials , Tensile Strength and Ultimate Elongation shall be measured in accordance with Sections for Apparatus, Specimens, Procedure, Speed and Calculations in ANSI/ASTM D638, Standard Test Method for Tensile Properties of Plastics, except that only break values shall be recorded. Tensile Impact Energy shall be in accordance with Sections for Apparatus, Specimens, Procedure and Calculations in ASTM D1822, Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials.

10.2.6 Composite type materials (nonmetallic integral with metallic) shall be subjected to a 6.78 J (5.0 ft·lb) impact with a 50.8 mm (2.0 in) steel ball dropped onto the center outside surface of the material clamped in a 152.4 mm (6.0 in) diameter steel ring. There shall be no cracking, disbonding or delamination or other damage that would reduce the composite's critical mechanical strength or material compatibility properties.

10.3 THERMAL COMPATIBILITY TEST

10.3.1 The average of three test samples shall retain at least 70 % of the average as-received material property as described in Clauses 10.2.4, 10.2.5 or 10.2.6 after 30, 60 and 90 days in an air circulating oven at 88 ± 2 °C (190 ± 3.6°F). One additional 90 day sample shall be subjected to the Comparative Small Scale Fire Test, Subsection 9.3.8.

10.4 FUEL COMPATIBILITY TESTS

10.4.1 The average of three test samples shall retain at least 70 % of the average as-received material property as described in Clauses 10.2.4, 10.2.5 or 10.2.6 after 30, 60 and 90 days immersed in the test fuels specified in Clause 10.1.6 at 60 ± 2 °C (140 ± 3.6° F). One additional 90 day sample shall be subjected to the Comparative Small Scale Fire Test, Subsection 9.3.8.

10.5 FLUIDS COMPATIBILITY TESTS

10.5.1 The average of three test samples shall retain at least 70 % of the average as-received material property as described in Clauses 10.2.4, 10.2.5 or 10.2.6 after 30, 60 and 90 days immersed in the following fluids at 60 ± 2 °C (140 ± 3.6°F):

A Saturated Sodium Chloride Solution;

B pH 3 Sulfuric Acid;

C pH 10 Sodium Carbonate/Bicarbonate Solution; and

D Distilled Water.

One additional 90 day sample shall be subjected to the Comparative Small Scale Fire Test, Subsection 9.3.8.

10.6 UV COMPATIBILITY TEST

10.6.1 The average of three test samples of exposed materials shall retain at least 70 % of the average as-received material property as described in Clauses 10.2.4, 10.2.5 or 10.2.6 after the simulated UV light types and exposure times below. The cycle rate shall be light for 17 min and light and water for 3 min:

A 360 h (Indoor rating) or 720 h (Outdoor rating) in accordance with ASTM G153, Apparatus and Procedure of Operating Enclosured Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; or

B 500 h (Indoor rating) or 1000 h (Outdoor rating) in accordance with ASTM G155, Apparatus and Procedure of Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials.

One additional 90 day sample shall be subjected to the Comparative Small Scale Fire Test, Subsection 9.3.8.

10.7 EXTREME TEMPERATURE TESTS

10.7.1 For nonmetallic and composite tank materials that are susceptible to external impact during use, three segments cut from different tank areas shall be subjected to a repeat Subsection 9.2.5, Tank Impact Test, immediately after at least 12 h at 38 ± 2 °C (100 ± 3.6 °F) and -20 ± 2 °C (-4 ± 3.6 °F) (Indoor Use rated) or 50 ± 2 °C (122 ± 3.6 °F) and -30 ± 2 °C (-22 ± 3.6 °F) (Outdoor Use rated).

10.7.2 For nonmetallic and composite pipe and fittings that are susceptible to external impact during use, three segments of each pipe and fitting in each size assembled according to the manufacturer's instructions and with any supporting areas shall be cut from the tank and shall be subject to the same impact after extreme temperatures specified in Clause 10.7.1.

10.8 NONMETALLIC STRESS CRACKING TEST

10.8.1 Thermoplastic test containers representative of the tank and fitting material, shape, thickness and molding process shall not crack or leak after being subjected to the stress cracking test method as described in Clause 10.8.2 based on Procedure B of ANSI/ASTM D2561, Standard Test Method for Environmental Stress-Crack Resistance of Blow-Molded Polyethylene Containers.

10.8.2 One 19 to 95 L (5 to 25 US gal) container with one 38.1 or 50.8 mm NPT (1.5 or 2.0 NPS) opening and fitting shall be filled with a 10 % polyoxyethylated nonylphenol (for example Type CO-630 IGEPAL™) water solution and placed in an air oven at 60 ± 2 °C (140 ± 3.6 °F) for 180 h. The fitting with capped steel pipe nipple shall be assembled to the container per the manufacturer's instructions. Following the exposure, samples are to be visually examined without magnification tools.

NOTE : IGEPAL is a Trade Mark of Rhodia Operations.

10.9 METALLIC STRESS CRACKING TEST

10.9.1 Metal tank fittings or other components with more than 15 % zinc content (excluding platings) shall not crack or leak after being subjected to a moist ammonia-air mixture of minimum 0.60 L (20 US Fluid oz.) of 0.94 specific gravity aqueous ammonia for 10 days at 35 ± 2 °C (95 ± 3.6 °F).

10.9.2 The samples are to be grease free and positioned above the fluid in a glass container. Threaded parts shall be assembled with mating steel pipe or fittings according to the manufacturer's instructions. Following the exposure, samples are to be visually examined without magnification tools.

11 MANUFACTURING AND PRODUCTION TESTS

11.1 LEAKAGE TEST

11.1.1 All tanks shall be proved leak tight by any one, or a combination of the methods described in Clauses 11.1.2 through 11.1.4. Other methods are allowed to be used provided that the methods are shown to be equivalent and included as part of the manufacturer's installation instructions. Testing rigs that are designed to prevent tank damage during the test, such as wire cages or support boxes, may be used, provided that they do not interfere with determining leakage.

11.1.2 For primary tanks or secondary tanks capable of being pressure tested and visually examined before or after the complete system assembly, there shall not be any leakage after subjecting the tank to 20.7 to 34.5 kPa (3.0 to 5.0 psig) air or water for at least 1 min.

11.1.3 For primary tanks or secondary tanks capable of being vacuum tested and visually examined after the complete system assembly, there shall not be any pressure change after subjecting the tank to a vacuum of 127 mmHg (5.0 inHg) or 20.7 to 34.5 kPa (3.0 to 5.0 psig) air or water for at least 15 min.

11.1.4 For open or closed secondary containments, there shall not be any leakage as demonstrated by filling the open or closed secondary containments with water sufficiently high to evaluate all bottom and side seams, or using one of the vacuum or pressure change methods in Clause 11.1.3.

11.1.5 Leakage shall be determined visually and detection means such as soap suds or die penetrants are permitted. Gauges used for pressure or vacuum shall have a minimum 10 kPa (1.45 psig) or 10 mmHg (0.45 inHg) graduations and at least a 1.0 % accuracy.

12 MARKINGS AND INSTRUCTIONS

12.1 GENERAL MARKING INFORMATION

12.1.1 Each tank shall be provided with a nameplate fixed to the tank in a permanent and legible manner where most likely visible after installation (such as top or head) or as otherwise indicated, but not on removable components (covers), around fill openings, or in spill containers.

12.1.2 Each tank shall be provided with all appropriate Identification Markings, Subsection 12.2, using any one of the permanent and legible types described in Marking Methods, Subsection 12.3.

12.2 IDENTIFICATION MARKINGS

12.2.1 All Tanks

NOTE: Refer to Table 12.4.1 for French text of safety related markings.

12.2.1.1 Each tank nameplate shall be marked with the following manufacturer identification and general information as applicable:

NOTE: Words within "quotes" are the required verbatim markings.

A The manufacturer's name, trade name, trademark or other descriptive marking which identifies the company responsible for the product and factory ID code if manufactured at more than one factory;

B The manufacturing date in standard format indicating as a minimum, the year/month;

C The manufacturer’s web address and phone number to obtain installation, inspection and maintenance instructions for compliance with Clause 12.1.1;

D The tank series, model, catalog number or equivalent identification, and nominal capacity in US gallons and litres;

E The tank basic design type as appropriate;

(i) "Primary Tank" and "Secondary Tank"; or

(ii) "Diked Tank", "Double Wall Secondary Containment"; or

(iii) "Open (or Closed) Secondary Containment".

F The tank location use rating as appropriate;

(i) "Indoor Use Only"; or

(ii) "Indoor or Outdoor Use".

G The tank fuel rating: "General Use Combustible Liquids".

12.2.1.2 Each tank shall be marked with the following critical assembly, installation, inspection and cautionary information on or near the nameplate:

A "IMPORTANT – Assemble and Install per Installation Code and Manufacturer Instructions";

B A “CAUTION” header preceding the following critical points:

(i) "WARNING – Remove tank from service or do not place tank in service if ___*___ – contact tank manufacturer";

Where * is the specific requirements for unacceptable damage which shall be identified per Clause 9.1.6;

(ii) "This Tank is Intended for Stationary Use Only";

(iii) "Do Not Reduce Vent Capacity Below 32 mm Diameter (1-1/4 in NPS)";

(iv) "Inspect Tank Periodically According to Manufacturer's Instructions";

(v) "Do Not Transfer Oil from Old Tank into This Tank"; and

(vi) "WARNING – Do Not Leak Test at More Than 21 kPa (3.0 psig)" in accordance with the 103.4 kPa (15 psig) exception of Clause 9.3.6.1.

C "CONSULT LOCAL AUTHORITY BEFORE INSTALLING TANK".

12.2.2 Primary Containment Tanks

12.2.2.1 In addition to Subsection 12.1, General Marking Information, primary containment tanks shall be marked with additional information as appropriate on the nameplate or other location as follows:

A In order to reduce the risk of damage to the tank while conducting leak testing of the tank or piping, primary tanks shall be marked:

(i) "Do Not Exceed 34.5 kPa (5 psig) Test Pressure" unless a specific construction has additional damage potential at lower pressures per Clause 12.2.2.1, item B; and

(ii) "Follow Manufacturer's Instructions for Field Leak Testing".

B Constructions where permanent deformation (such as a rectangular) or personal injury (such as tip-over of a flat bottom tank) may occur while leak testing: "Do Not Exceed * kPa (psig) Test Pressure" [where * is the manufacturer maximum field test pressure, but not less than 10 kPa (1.5 psig)].

12.2.3 Secondary Containment Tanks

12.2.3.1 In addition to Subsection 12.1, General Marking Information, secondary containment tanks shall also be marked with additional information as appropriate on the nameplate or other location as follows:

A Identification of an interstitial space opening that requires venting located near the opening: "Interstitial Vent – Do Not Plug"

B Identification of an interstitial space opening that is intended for monitoring located near the opening:

"Interstitial Monitor" or "Monitor Opening"

12.2.4 Open or Closed Secondary Containments

12.2.4.1 In addition to Subsection 12.1, General Marking Information, open or closed secondary containments shall also be marked with additional information as appropriate on the nameplate or other location as follows:

A The secondary containment capacity located on the nameplate next to basic tank type:

"____L (___US gal) Secondary Containment Capacity" or percent of primary "____ % Secondary Containment Capacity"

B For closed top dikes secondary containments with venting covers, the statement located on the vent cover:

"Venting Cover – Do Not Obstruct"

12.2.5 Tank Accessories

12.2.5.1 In addition to Subsection 12.1, General Marking Information, tanks provided with optional accessories conforming to the requirements of Section 6, Tank Components and Tank Accessories, shall also be marked with additional information as appropriate on the nameplate or other location as follows:

A Identification of spill container in compliance with Clause 7.1, located on the nameplate next to the basic tank type:

"With Spill Container"

B Identification of tank support compliance with Clause 7.2, located on the nameplate next to the basic tank type:

"With Support"

12.3 MARKING METHODS

12.3.1 The required markings shall be molded into the tank wall (raised or indented), on a metal tag according to the requirements of Clause 12.3.2 or adhesive labels according to the requirements of Clause 12.3.3 affixed to the tank. The markings shall use letters at least 3 mm (3/32 in) high of a color contrasting to the background, if not molded. The general information shall be on a limited area of the tank shell.

12.3.2 Metal tags shall be of a corrosion resistant metal at least 0.60 mm (0.024 in) thick provided with embossed, etched, stamped, engraved, punched characters, or equivalent marking method that penetrates the tag surface. The tag shall be securely attached to the tank or plate, or fixed to a bracket or holder securely attached to the tank. Ink stamping or paint stenciling shall be evaluated to Clause 12.3.3.

12.3.3 Adhesive label systems or decal transfers shall comply with CSA C22.2 No. 0.15, Adhesive Labels or UL 969, Standard for Marking and Labeling Systems; rated for outdoor use (exposure to water, UV light and minimum temperature range of -29 to 60 °C (-20 to 140 °F)) and occasional exposure to oils; and suitable for the intended surface (base metal or paint type).

12.4 INSTRUCTIONS

12.4.1 Each tank shall be supplied with instructions in accordance with Clauses 12.4.2 through 12.4.5, intended to provide proper procedures for assembly, installation and use of the tank. These instructions shall be preceded by the statement "IMPORTANT INFORMATION – FOLLOW ALL INSTRUCTIONS" in bold text minimum 12 mm (0.5 in) high with at least the following information in text minimum 3 mm (1/8 in) high using any or all of the following methods:

A Shipped with the tank in a protective packaging cover;

B Shipped with the tank in a protected opening;

C Shipped on the tank as an adhesive label; or