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ANSI/CAN/UL/ULC 1316:2019 (R2024)

STANDARD FOR SAFETY

Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids

Approved American National Standard
ANSI

ANSI/UL 1316-2019 (R2024)

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UL Standard for Safety for Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids, ANSI/CAN/UL/ULC 1316

Third Edition, Dated November 21, 2018

Summary of Topics

This revision of ANSI/CAN/UL/ULC 1316 dated May 9, 2024 is being issued to update the title page to reflect the latest ANSI and SCC approval dates as a Reaffirmed American National Standard (ANS) and National Standard of Canada (NSC). No changes in requirements are involved.

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

The requirements are substantially in accordance with Proposal on this subject dated March 1, 2024.

No Text on This Page

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Standard for Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids

First Edition – July, 1983
Second Edition – January, 1994

Third Edition

November 21, 2018

This ANSI/CAN/UL/ULC Safety Standard consists of the Third Edition including revisions through May 9, 2024.

The most recent designation of ANSI/UL 1316 as a Reaffirmed American National Standard (ANS) occurred on May 9, 2024. 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 May 9, 2024.

No Text on This Page

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Preface

This is the Third Edition of the ANSI/CAN/UL/ULC 1316, Standard for Fibre Reinforced Underground Tanks for Flammable and Combustible Liquids.

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

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.

Appendices A through E, are identified as Normative, forms a mandatory part of this Standard.

Appendix F, identified as Informative, is for information purposes only.

This ANSI/CAN/UL/ULC 1316 Standard is under continuous maintenance, whereby each revision is 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 Third Edition Joint American National Standard and National Standard of Canada is based on, and now supersedes, the Second Edition of UL 1316 and the Third Edition of CAN/ULC-S615-14.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the 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.

This Edition of the Standard has been formally approved by the Technical Committee (TC) on Flammable and Combustible Liquid Underground Tanks, TC 1316.

This list represents the TC 1316 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

TC 1316 Membership

Name	Representing	Interest Category	Region
Bareta, G.	Wisconsin DATCP Storage Tank Regulation	Authorities Having Jurisdication / Regulator	USA
Bourassa, E	Granby Industries LP	Producer	Québec
Boyd, D.	BP America	Commercial / Industrial User	USA
Deschamps, C.	Régie du bâtiment du Québec (RBQ)	Authorities Having Jurisdication	Québec
Frey, C.	Highland Tank & Mfg Co.	Producer	USA
Henderson, T.	California Water Resources Control Board	Authorities Having Jurisdication / Regulator	USA
Hickman, B	CO Division of Oil and Public Safety	Authorities Having Jurisdication / Regulator	USA
Legault, P.	Integrated Review Services – Consulting	General Interest	Ontario
Lexvold, J.	Xerxes Corp.	Producer	USA
Loucks, J.	Modern Welding Company, Inc.	Producer	USA
Mailvaganam, M.	Standard Individuals	General Interest	Canada
Mullen, G	WATCO Tanks, Inc.	Producer	USA
Rahaman, F.	AGI Westeel	Producer	Alberta
Pollock, S.	Steel Tank Institute	General Interest	USA
Pomes, M.	U.S. Environmental Protection Agency	Government	USA
Renkes, R.	Fiberglass Tank & Pipe Institute	General Interest	USA
Riegel, R.	UL Solutions	Testing & Standards Org.	USA
Sanderson, Darren	Hall Tank CO	Producer	USA
Schneider, W.	National Oilwell Varco	Producer	USA
Schruben, T.	Standard Individuals	General Interest	USA
Siegel, M.	AOC LLC	Supply Chain	USA
Stevens, M.	INEOS Composites	Supply Chain	USA
Thompson, J.	Association for Petroleum & Explosives Administration	Authorities Having Jurisdication	United Kingdom
Treuthardt, C. (TC Project Manager)	UL Standards & Engagement	Non-voting	USA
L. Werner (TC Chair)	UL Standards & Engagement	Non-voting	Ontario

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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.

INTRODUCTION

1 Scope

1.1 This Standard sets forth minimum design and construction requirements for fibre reinforced plastic, non-pressure tanks that are used for the underground storage of flammable and combustible liquids, such as:

a) Petroleum products, including petroleum hydrocarbon fuels with low-biofuels blends, per specifications, and similar flammable or combustible liquid petroleum derivatives, such as fuel components (cetane, hexane, heptane), and oils (lubricating, hydraulic, machine);

b) Oxygenated fuel blends, including all "petroleum product" liquids plus petroleum hydrocarbon fuels with low-biofuels blends;

c) Oxygenates, including all “petroleum product” and "oxygenated fuel blends" liquids plus pure/denatured or highest oxygenated blend stocks for use in mixing of dispensed lower fuel-blends and components, such as biodiesel and ethanol; and

d) Other flammable and combustible liquids (for which the test fuels in Appendix A are not considered to be sufficient or applicable) that can be demonstrated or determined to be compatible with the reinforced plastic underground tank materials as determined by the certifier.

In addition to this Standard’s traditional safety requirements for underground fiber reinforced plastic tanks that primarily evaluate structural integrity, material compatibility and mitigate 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 F.

NOTE: The test fuels in Appendix A are considered to be sufficient and representative for US or Canadian approved motor fuels, off-road fuels, gasoline from renewable and petroleum feedstocks, diesel, renewable diesel, synthetic diesel, biodiesel, kerosene, aviation fuels, jet fuels, fuel oil and heating oil as referenced in (a), (b), and (c).

1.2 This Standard covers tanks of either single, double or multiple wall construction.

1.3 Tanks covered by this Standard are fabricated, inspected, and tested for leakage prior to shipment from the factory as completely assembled vessels.

1.4 This Standard covers tanks where the primary tank may have a single compartment or have multiple compartments.

1.5 These tanks are intended for installation and use in accordance with applicable documents in the following list:

a) In Canada:

1) National Fire Code of Canada;

2) CAN/CSA-B139, Installation code for oil-burning equipment;

3) CCME PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products;

4) Regulations of the authority having jurisdiction; and

b) In the United States:

1) Standard for the Installation of Oil-Burning Equipment, NFPA 31;

2) Flammable and Combustible Liquids Code, NFPA 30; and

3) Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA 30A, as applicable.

1.6 Accessories, such as, ladders, tank sumps, risers, and guide lugs, that do not affect tank performance and are attached to the tank internally or externally during manufacture are permitted but not covered by this standard.

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

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

2 Units of Measurement and References

2.1 When a value for measurement is followed by a value in other units in parentheses, the second unit is only approximate. The first stated value is the requirement.

2.2 Any undated references 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, refer to Appendix B.

3 Glossary

3.1 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.

3.2 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 NFPA 30, Flammable and Combustible Liquids Code.

3.3 CRUSHED STONE – Washed, crushed aggregate or crushed gravel with an angular particle size of not more than 13 mm (0.5 in) diameter that is clean and free flowing and with no more than 5 % passing a No. 8 sieve (2.38 mm screen size opening). The material has a minimum dry gravel density of 1520 kg/m^3 (95 lb/ft^3) and meets the Fine Aggregate requirements for deleterious substances and soundness of ASTM C33/C33M, Standard Specification for Concrete Aggregates.

3.4 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.

3.5 DOUBLE WALL TANK – A primary tank with an integral secondary containment where the space between the walls is capable of being monitored.

3.6 FIBRE REINFORCED PLASTIC (FRP) – A composite material consisting of a combination of rigid thermoset resin and glass fibre reinforcements. The glass fibre reinforcements may take the form of short randomly oriented fibre and/or woven or nonwoven fabrics and/or glass fibre rovings.

3.7 FLAMMABLE LIQUID – Any liquid having a flash point below 37.8 °C (100 °F) and a vapour pressure not exceeding 275 kPa (absolute) (40 psig) at 37.8 °C (100 °F) and as defined in the National Fire Code of Canada, and NFPA 30.

3.8 INTERSTICE / INTERSTITIAL SPACE or 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.

3.9 MANWAY – An opening on a tank designed to provide personnel access to the interior of the tank.

3.10 MONITORABLE BULKHEAD / BULKHEAD – A partitioning structure within a primary tank separating the primary tank into independent liquid containment compartments and consisting of two layers of material with a space between them that is capable of being monitored for leaks.

3.11 MULTIPLE WALL TANK – A double wall tank, which incorporates additional tank walls of containment where each interstice is capable of being monitored independently.

3.12 NONPRESSURE TANK – A tank that is vented to atmosphere in a manner that will maintain internal pressures at the top of the tank of 0 ±7 kPa (0 ±1 psig).

3.13 PEA GRAVEL – A naturally rounded aggregate, actual size no greater than 19 mm (0.75 in), freeflowing and with no more than 5 % passing a No. 8 sieve (2.38 mm screen size opening). The material has a minimum dry gravel density of 1520 kg/m^3 (95 lb/ft^3) and meet the Fine Aggregate requirements for deleterious substances and soundness of ASTM C33, Standard Specification for Concrete Aggregates. Local names vary and include "pea gravel", "pea stone", "roofing gravel", etc.

3.14 PRIMARY TANK – The product storage tank or compartment.

3.15 SECONDARY CONTAINMENT / CONTAINMENT – A structure that is external to the primary tank designed to create an interstice and capture and contain leakage in case of failure of the primary tank.

3.16 STRIKER PLATES – also known as impact pads, deflector or deflection plates, or gauge plates. A device designed to prevent possible damage to the inside tank wall surface from repeated impact of dipsticks or other devices used to gauge tank contents.

CONSTRUCTION

4 General

4.1 All tank types constructed in accordance with this Standard shall use fibre reinforced plastic materials to form all liquid containment surfaces except openings, manways, and lift lugs and shall be spherical or shall have a cylindrical shell with any shape heads, but are permitted to be primary, secondary or tertiary containment types of any capacity.

4.2 Tanks shall be capable of being lifted for transport and installation, and shall be capable of being anchored against upheaval by ground water. The lifting means shall be evaluated per Section 15, Tank Lifting Test, and the anchoring means shall be evaluated per Section 18, Buried Tank Load Test.

4.3 Tanks shall be designed for burial with 2.13 m (7.0 ft) of backfill above the tank top shell, unless specifically tested for greater burial depth.

5 Interstitial Spaces and Leak Monitoring

5.1 All extra exterior containments (secondary or tertiary walls) shall provide a continuous interstitial space connecting to the monitor opening and shall cover the greater of at least:

a) The bottom 300° of the primary tank circumferential shell area and 100 % of both heads; or

b) The bottom 95 % of the primary tank surface area.

However, in either case the area immediately adjacent to tank fittings and manways may be excluded.

NOTE: The authority having jurisdiction may require that the tank have 360° containment except for the areas penetrated by fittings and manways.

5.2 Multiple compartment tanks shall be provided with monitorable bulkheads, and each interstice and bulkhead design shall be evaluated per 17.2 for strength and 17.3 for communication.

5.3 The design shall permit access to each interstice for monitoring at ground level through a suitable connection or access chamber. Bulkhead interstices may be continuous with the secondary containment interstice or independently monitorable.

6 Vent Openings

6.1 Each tank or each compartment of a multiple compartment tank shall have a top opening for normal venting through a fitting or pipe of a NPS size not less than 102 mm (4.0 in).

7 Tank Lifting

7.1 All tanks shall be capable of being lifted for transport and installation, and provided with specific lifting information for each type and method in the manufacturer's instructions.

7.2 Permanent types, such as integral lugs, shall be steel and attached to the tank shell or head, and have a minimum 50 mm (2.0 in) hole or opening.

7.3 Temporary types, such as eye/hook fittings, shall be steel and capable of being threaded into a fitting or bolted to a flange, and have a minimum 50 mm (2.0 in) hole or opening.

7.4 Straps, slings or webs that provide support under or around the tank for lifting are also permitted.

7.5 For all of the above lifting methods, the instructions or marking on the tank shall indicate the minimum number of lugs or fittings to be used for lifting.

7.6 Any of the above lifting means used shall be evaluated per Section 15, Tank Lifting Test.

7.7 The location of all non-integral lift points shall be either marked on the tank, such as near threaded openings for temporary types, or clearly identified in the instructions, such as a drawing for straps.

8 Manways

8.1 Any manway center shall be located no more than 305 mm (12.0 in) from the top centerline of the tank. A manway shall have a minimum inside diameter of 559 mm (22.0 in) and shall have the flange located at a minimum of 100 mm (4.0 in), above the interior top (measured at the vertical axis of the tank) and be installed with bolt holes straddling the tank longitudinal axis.

8.2 The materials used for the manway construction (flange and cover) shall meet the structural and burial performance requirements of this Standard.

8.3 Each manway shall be provided with a gasket not less than 3.2 mm (0.125 in) thick.

NOTE: The selection of the gasket material needs to consider the product to be stored, as determined by the buyer, with reference to the gasket manufacturer's documentation.

9 Striker Plates

9.1 Striker plates shall be installed under all openings except for marked vents and interstitial monitors or openings obstructed by bulkheads.

9.2 The tank shall have a striker plate of steel at least 1.35 mm (0.053 in) thick. The striker plate shall be overlaid with at least 2.0 mm (0.078 in) of the laminate used in the construction of the primary tank. When installed under a tank fitting, the striker plate shall be at least 305 mm (12.0 in) wide, and at least 0.09 m^2 (0.97 ft^2) in area under each opening. When installed under a manway or fitting, the striker plate shall be at least as wide as the width of the manway or fitting opening in both directions.

10 Tank Connections

10.1 General

10.1.1 Fittings for pipe connections shall be:

a) Steel Pipes – Steel pipe with threads or flanges in NPS sizes 1/2 (15 mm) to 24 (600 mm) conforming to ASME B36.10M, Welded and Seamless Wrought Steel Pipe, or ASME B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard. For pipe sizes over 219 mm (NPS 8), connections shall be flanged and the wall thickness of the pipe shall be not less than 6.30 mm (0.25 in);

b) Steel Couplings – Steel full or half couplings in NPS sizes 1/2 (15 mm) to 8 (219 mm) conforming to ASME B36.10M, Welded and Seamless Wrought Steel Pipe, or ASME B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard. For coupling sizes over 219 mm (NPS 8), connections shall be flanged and the wall thickness of the pipe shall not be less than 6.30 mm (0.25 in);

c) FRP Couplings – FRP full or half couplings in NPS sizes 1/2 (15 mm) to NPS 8 (219 mm) with a minimum 50 psig pressure rating made with resins determined by the tank manufacturer to be compatible with fluids to be stored, and bonded to the tank with the tank manufacturer’s resin; or

d) FRP Flanges – FRP flanges conforming to ASME RTP-1, Reinforced Thermoset Plastic Corrosion-Resistant Equipment, made with resins determined by the tank manufacturer to be compatible with fluids to be stored, and bonded to the tank with the tank manufacturer’s resin.

10.1.2 The centres of all openings in a cylindrical tank shall be located not more than 305 mm (12.0 in) from the top longitudinal centre line of the tank. If the tank is spherical, the centres of all the openings shall be located not more than a 305 mm (12.0 in) radius from the top centre of the tank.

10.1.3 The upper end of each tank connection shall terminate above the top of the shell.

10.1.4 The face of each flanged connection mounted on the wall of a tank shall terminate at least 100 mm (4.0 in) above the interior top at the vertical axis of the tank top and shall be installed with bolt holes straddling the tank longitudinal centre line.

10.2 Hardware installed for shipping only

10.2.1 All threaded tank connections shall be supplied with nonmetallic thread protectors or metallic plugs. Where plugs are used, threads shall have temporary nonhardening sealing compound applied.

10.2.2 At least one temporary venting device of a distinguishing color shall be supplied for each primary tank and any vented interstitial space. The device shall have the equivalent minimum vent area of a 4.5 mm (0.18 in) diameter opening.

10.2.3 All flanged openings shall be fitted with suitable flange protectors.

11 Corrosion Protection

11.1 All externally exposed metal surfaces that are not sealed by connected piping, excluding lifting or guide lugs, shall be:

a) Coated with the same resin used to manufacture the tank of at least 0.25 mm thickness; or

b) Shall have corrosion protection in accordance with CAN/ULC-S603.1, Standard for External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids, or UL 1746, Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks.

PERFORMANCE

12 General Performance

12.1 One worst case tank sample of a design series shall be subjected to each applicable test described in Sections 12 to 19, where multiple tests are permitted to be conducted on the same sample. Unless otherwise specified in each test, the worst case sample shall be determined based on the following, and shall be representative of production materials and processes:

a) For material variations, the resin and fiber combinations with the minimum as-received flexural strength per 19.2;

b) The minimum wall and head thickness;

c) The minimum number of compartments;

d) The minimum head depth, plus if needed to facilitate testing, one maximum diameter manway closest to the head; and

e) All connection designs represented (see Section 16 for size details).

For manways, connections, lugs or other components, the testing of different designs, constructions or locations on smaller tanks or applicable parts of a tank is permitted, provided that the tank design series worst case construction is represented either within a tank design series or between multiple tank design series.

NOTE: Other head shapes are allowed in (d) if it can be shown that the shape tested is the worst case.

12.2 For cylindrical tanks with a consistent rib design, the maximum diameter and worst case shell length with the minimum head depth shall be tested.

12.3 For a tank design series of spherical tanks that differ only in diameter, only the largest diameter tank is required to be tested.

12.4 For a double wall tank, tests are first to be conducted on the primary containment tank as well as the following tests on a complete secondary tank assembly:

a) Section 14, Water Load and Hydrostatic Pressure Test, with an empty interstitial space;

b) Section 15, Tank Lifting Tests; and

c) Section 17, Interstitial Integrity and Communication Test, first with the primary at test pressure and interstitial vented to atmosphere, and then with both the primary and interstitial at test pressure.

12.5 For a multiple wall tank, the tests required in 12.4 must also be conducted in the same manner on each additional wall of containment. If the construction of a multiple wall is identical to the construction of the secondary containment wall, no testing of the multiple wall is required.

13 Leakage Test

13.1 Single wall tanks shall be tested and proved tight against leakage by applying a soap/water or equivalent leak detection solution to the tank surface including all joints and connections after reaching a test pressure per Table 13.1 with air. Formation of sustained bubbles is evidence of leakage.

Table 13.1
Minimum tank leakage test pressure or vacuum

Tank outside diameter	Single wall tank minimum test pressure	Double wall, multiple wall and compartment tank minimum test pressure or vacuum
≤ 3.05 m (10.0 ft)	+34.5 kPa (+5.0 psi)	+34.5 kPa (+5.0 psi) or -34.5 kPa (-5.0 psi)
> 3.05 m (10.0 ft)	+20.5 kPa (+3.0 psi)	+20.5 kPa (+3.0 psi) or -20.5 kPa (-3.0 psi)

13.2 Multiple wall tanks and multi-compartment tanks shall be proved tight against leakage by applying pressure or vacuum to each interstitial space and/or monitorable bulkhead while all compartments of the primary tank are vented to atmosphere. After reaching the required value, the source shall be removed and the test pressure or vacuum shall be held for 30 min without loss or gain of 1.0 kPa (0.15 psi).

13.3 As an alternative to 13.2, use of the 13.1 leak detection method with pressure is permitted for both the interior surface of each primary tank and compartment bulkhead, or the exterior surface of the tank, fittings and manways. Any wall not capable of leak testing per 13.1 shall be pressure or vacuum tested per 13.2.

NOTE: Vacuum or pressure levels are permitted to be adjusted to compensate for changes in temperature and/or atmospheric pressure that occur during the test period in accordance with the Ideal Gas Law (PV = nRT).

14 Water Load and Hydrostatic Pressure Test

14.1 The worst case primary tank of each design series shall withstand water load and hydrostatic pressure testing with no evidence of leakage when conducted in accordance with the Section 13, Leakage Test. The worst case sample is a cylinder L:D ratio of at least 2:1, and for bulkheads, any length tank with each compartment cylinder length at least as long as the tank diameter.

14.2 Each sample tank shall be placed on at least a 152 mm (6.0 in) thick bed of compacted sand, crushed stone or pea gravel with optional backfill depth to a maximum of 25 % of the tank OD to prevent bending from water load. As an alternative, the tank may be buried for this test in accordance with the Section 18, Buried Tank Load Test. Any secondary containment, interstitial and bulkhead spaces shall be dry and vented during the test.

14.3 The primary tank and all compartments manifolded for a multi-compartment tank shall then be filled with water to maximum capacity and subjected to an internal hydrostatic pressure per Table 14.1 gradually applied in 34.5 kPa (5.0 psi) increments and held for 1 min at the final pressure level.

Table 14.1
Minimum hydrostatic test pressure

Tank Outside Diameter	Primary Tank Minimum Test Pressure
≤ 3.05 m (10.0 ft)	+172.5 kPa (+25.0 psi)
> 3.05 m (10.0 ft)	+103.5 kPa (+15.0 psi)

14.4 For multi-compartment tanks, each bulkhead design shall be independently evaluated with the test pressure applied to one compartment full of water, while the adjacent compartment is full of water and vented. Then, after release of pressure on the tested compartment, the same test procedure shall be applied to the other compartment.

15 Tank Lifting Test

15.1 A sample of the worst case tank loading condition in a design series shall be evaluated for damage per 15.3 and leakage per 15.4 after lifting it for at least 1 min at a minimum load of 2 times the empty tank weight in accordance with each different lifting method recommended by the tank manufacturer's instructions.

15.2 The different methods are the use of permanent lugs integral to the tank, temporary fittings used in openings, and lifting straps. The worst case test considerations for each lug type and lifting method, the lug location(s) on the tank, the angle of lift and the use of a spreader bar, as identified in the instructions shall be considered.

NOTE: The minimum number of lugs on a tank will be based on the tank weight and the maximum load rating per lug.

15.3 There shall be no failure of the permanent lifting lugs, damage to the tank wall around permanent lugs, temporary fittings, or strap contact areas, or threaded openings used for lifting. Unacceptable damage is defined by cracking, splitting, delamination or thread stripping.

15.4 There shall be no leakage from the tank or any threaded openings used for lifting. The test shall be conducted in accordance with the Section 13, Leakage Test, using the soap and bubble method.

16 Tank Connection Torque and Bending Test

16.1 Representative threaded connection tank openings (fittings) shall be subjected to the torque test per 16.4 and the bending tests per 16.5, where there shall be no resulting damage or leakage per 16.6 afterwards. Both fitting tests are recommended to be conducted on a single sample by installing the required pipe or plug described in Clause 16.3 to the torque values in Table 16.1 . As an alternative, separate samples and tests are permitted, but will require separate evaluations per 16.6.

Table 16.1
Minimum torques

NPS Pipe size	Torque for FRP monitor fittings N·m (in·lb)	Torque for all other tank connections N·m (in·lb)
2	187 (1650)	373 (3300)
2-1/4	192 (1700)	384 (3400)
2-1/2	198 (1750)	395 (3500)
3	204 (1800)	407 (3600)
3-1/2	209 (1850)	418 (3700)
4	215 (1900)	429 (3800)
6	238 (2100)	475 (4200)
8	260 (2300)	520 (4600)

16.2 The tests shall be conducted on all sizes of threaded fittings in the manufacturers design range covered by Table 16.1 , or on a worst case size with the highest shear stress on the attachment layup. The tests shall be on a complete tank, or on smaller samples that represent the fittings attachment to the tank wall. If variations in construction exist, the worst case design (based on materials, processes and minimum thickness of the fitting, layup and tank shell) shall be tested.

16.3 The pipes used for testing shall be ASTM Schedule 40 steel types with thread types that match the fittings evaluated. If separate torque and bending tests are conducted, steel plugs are permitted instead of pipes for the torque test. If different fitting thread types exist, the worst case (maximum number of threads/distance) shall be evaluated. Accessories or other pipe attachments and pipe lubricants are permitted to facilitate the tests.

16.4 A torque value as specified in Table 16.1 shall be applied to each fitting through a pipe at least 1.22 m (4.0 ft) long, followed by bend testing per 16.3. A shorter pipe or fitting plug is permitted for the torque test.

16.5 A bending moment of 1350 N·m (995 ft·lb) for fiberglass monitor fittings, or 2700 N·m (1990 ft-lb) for all other tank connections shall be applied in 2 directions to each fitting through the pipe installed to the torque values in 16.4, followed by a visual exam and leak test per 16.6. The force used shall be applied at right angles to the pipe at 1.22 m (4.0 ft) above the fitting, first parallel then perpendicular to the longitudinal tank axis, or 90° apart for spherical tanks.

16.6 Following the tests, each fitting and the surrounding tank area shall be visually examined for unacceptable damage, such as fitting cracking, splitting or thread stripping and delamination or bond failure in or between the fitting layup and tank wall at the perimeter of the layup. The samples shall then be subjected to the Section 13, Leakage Test, using the pneumatic method.

17 Interstitial Integrity and Communication Test

17.1 Each interstitial space of a double wall tank or a multiple wall tank or a bulkhead shall be subject to an integrity test per 17.2 and communication test per 17.3 simulating each condition of the different leak monitoring methods as recommended in the manufacturer's instructions. The tests shall be conducted with the tank leveled on a supporting bed with optional partial backfill per 14.2, or as an alternative, the tank may be buried per Section 18, Buried Tank Load Tests. During each test, the primary tank shall be open to atmosphere, and each interstitial space shall be separately evaluated.

17.2 For interstitial integrity, the test values below shall be applied and maintained until detection, and following the test(s), there shall be no visible leakage or loss of pressure for each interstitial space, per the Section 13, Leakage Test:

a) Pressure Systems at rated pressure for at least 1 h, then an additional 17.9 kPa (2.6 psi) pressure for at least 1 s.

b) Vacuum Systems at rated vacuum for at least 1 h, then an additional 17.9 kPa (2.6 psi or 5.3 in Hg) vacuum for at least 1 s.

c) Liquid types at rated liquid head (measured at tank bottom) for at least 1 h, then an additional 17.9 kPa (2.6 psi) head for at least 1 s.

17.3 For interstitial communication, each monitoring method below shall have a detection rate of 91.4 cm/h (3.0 ft/h) or faster, calculated by dividing the distance (between the monitor opening and opposite tank head through the interstitial space where the simulated leak is introduced) by the detection time (between the leak introduction and detection points).

a) For pressure and vacuum systems, drill a 3.2 mm (0.125 in) hole to simulate a leak after the interstitial space achieves the rated values. Detection is determined by a visible change in the pressure or vacuum as applicable at the monitor opening.

b) For liquid or dry monitored systems, water is gravity fed into a 3.2 mm (0.125 in) hole located at the top end of the tank farthest from the monitor opening at a pressure of at least 0.914 m (3.0 ft) above the tank top to simulate the leak until detected at the monitor opening.

18 Buried Tank Load Tests

18.1 The worst case tank in each design series shall withstand the unusual loading conditions resulting from flooding at the site and shall be tested as described in 18.2 – 18.4 with no evidence of buckling, leakage, or failure. Alternately post-test evaluation per 18.4 is permitted to be conducted after each individual test. The worst case is a maximum length (L) tank or tank with a cylinder length to diameter (L:D) ratio of at least 5:1.

18.2 A sample tank, in an empty condition, shall be installed in a pit, with anchoring, backfilling, and compacting done in accordance with the manufacturer's printed instructions. For multiple wall tanks, the interstices and primary tanks shall be manifolded during the test. The burial depth measured from the top center line of the tank to grade shall be the rated maximum burial depth, but not less than 2.13 m (7.0 ft). Alternatively, the tank is permitted to be buried at a minimum of 0.91 m (3.0 ft) with additional vacuum applied to the interstitial and primary spaces at 11.2 kPa/m [0.88 (in Hg)/ft] to simulate the additional saturated soil load between the tested depth and rated burial depth (not less than 2.13 m (7.0 ft).

Note: The tank manufacturer recommended backfill is expected to be pea gravel, crushed stone or other materials that provide equivalent support.

18.3 After the tank has been buried per 18.2 for at least an hour, the pit shall be filled with water, level with the top of the backfill, and maintained in this condition for a period of 18 h, followed by an additional 17.9 kPa (5.3 in Hg) vacuum for 5 min. For tanks using the alternate burial method with water on top of the backfill, the differential vacuum applied in 18.2 shall be held for 18 h followed by an additional 17.9 kPa (5.3 in Hg) vacuum for 5 min.

18.4 Following the above burial and flooding conditions, the tank shall not leak per Section 13, Leakage Test.

19 Immersion

19.1 All fibre reinforced plastic materials of tank construction shall be capable of withstanding the effects of deterioration resulting from the action of stored materials or surrounding soil conditions as described in this Section.

19.2 Except as determined in 19.3, samples of the laminates employed in the construction of the primary tank and containment walls of a double wall or multiple wall tank shall be immersed in environments conforming to Table 19.1 , with either 50 % flexural strength and impact strength retention after 270 d, or 70 % flexural strength and impact strength retention after 180 d, compared to the “As Received” condition, when tested in accordance with ASTM D790-91, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials, as modified in Appendix C with the coupon tested with the tank interior surface in tension and ASTM D256-90, Izod Test Method A, Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics. Five specimens are to be cut from each coupon, parallel to the longest dimension of the coupon. Refer to Appendix D for Alternative Glass Qualification.

Table 19.1
Immersion test

Test liquids or environment	Temp. °C/°F	Single wall tank	Double wall or multiple wall tank	
			Primary tank	Additional containment
Part A. General test required fuels				
ASTM Reference Fuel F	40 ± 2 °C / 104 ± 4 °F	X	X	X
CE25a[1]	40 ± 2 °C / 104 ± 4 °F	X	X	X
CE85a[1]	40 ± 2 °C / 104 ± 4 °F	X	X	X
FB25a	40 ± 2 °C / 104 ± 4 °F	X	X	X
B100a	40 ± 2 °C / 104 ± 4 °F	X	X	X
Fuel Oil #6	**	X	X	X
Part B. Special use marked for optional ratings				
MeOH[3]	40 ± 2 °C / 104 ± 4 °F	X	X	X
Other flammable and combustible liquids[4]	40 ± 2 °C / 104 ± 4 °F	X	X	X
Part C. Required external soil and environmental fluids				
pH 10 Sodium Carbonate – Sodium Bicarbonate[2]	40 °C / 104 °F	X	–	X
Distilled Water	40 °C / 104 °F	X	–	X
Sulphuric Acid Dilute – pH 3	40 °C / 104 °F	X	–	X
Air oven aging	70 °C / 158 °F	X	–	X
NOTES: ** – in accordance with the manufacturer's rating + 10 °C or 66 °C (150 °F), whichever is higher X = Immersion test required				
[1] The "C" prefix indicates the use of ASTM Reference Fuel C as a standardized test fluid to represent gasoline Fuel C is comprised of 50 % isooctane and 50 % toluene as defined in ASTM D471, Standard Test Method for Rubber Property – Effect of Liquids and the "a" suffix indicates use of aggressive ethanol test fluid made through the introduction of defined amounts of water,				

Table 19.1 Continued on Next Page

Table 19.1 Continued

Test liquids or environment	Temp. °C/°F	Single wall tank	Double wall or multiple wall tank	
			Primary tank	Additional containment
sodium chloride, sulphuric acid and glacial acetic acid in accordance with SAE J1681, Gasoline, Alcohol and Diesel Surrogates for Materials Testing. [2] A pH of 10 is obtained by mixing 10.6 g/L of sodium carbonate and 8.4 g/L of sodium bicarbonate. A pH meter is to be used and the ratio of sodium carbonate to sodium bicarbonate is to be adjusted to obtain a pH of 10. The pH value is to be checked several times during the test. [3] Commercial Grade Methanol (per SAE J1681-2000-01 Appendix E) [4] Other flammable and combustible liquids (for which the test fuels in Appendix E are not considered to be sufficient or applicable) that can be demonstrated or deemed to be compatible with the reinforced plastic underground tank materials as determined by the certifier may be added to a manufacturer's listing. Refer to Appendix E (normative), Test Fuel Formulations, for more information.				

19.3 Laminates as described in 19.2 shall be cut into 130 mm (5 in) by [16 times the thickness +25.4 mm (1 in)] test coupons. The edges shall be treated with resin to compensate for unrepresentative exposure when immersed in test environments. The test coupons shall be representative of tank laminate.

19.4 Following the prescribed exposure period, the procedure for handling the test coupons after they are removed from the environments shall be in accordance with the procedure specified in ASTM C581, Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber Reinforced Structures Intended for Liquid Service.

19.5 Where the tank has been determined to be compatible with other flammable and combustible liquids listed in Appendix A and Table 19.1 , it shall be marked in accordance with 24.5(f).

20 Impact and Cold Exposure

20.1 Coupons shall be tested as described in 20.2 and shall not crack or show rupture of the laminate. Surface crazing is acceptable.

20.2 Four coupons are to be conditioned for 8 h in a cold box maintained at −29 °C (−20 °F). These coupons and four additional unconditioned samples are then to be clamped, one at a time, between two steel rings having an inside diameter of 108 mm (4.25 in). A 0.536 kg (1.18 lb) steel ball is to be dropped once from a height of 1.8 m (6 ft) to strike the outside surface of each sample.

21 Light and Water Exposure

21.1 Specimens from coupons conditioned as described in 21.2 shall be subjected to the tests described in 20.2. The flexural strength and impact strength of the specimens shall be at least 70 % of the flexural strength and impact strength of specimens from the unconditioned coupons, as described in 19.2.

21.2 Coupons are to be subjected to either of the following test methods and light/water cycle rates:

a) 360 h using the Apparatus and Procedures per ASTM G153, Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Non-metallic Materials – using Table X1.1 Cycle 1 (102 min light and 18 min light/water); or

b) 500 h using the Apparatus and Procedures per ASTM G155, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials – using Table X3.1 Cycle 1 (102 min light and 18 min light/water).

PRODUCTION TESTS

22 Leakage Test

22.1 Each primary tank, tank compartment and interstice shall be tested and proved tight against leakage in accordance with Section 13, Leakage Test.

23 Documentation

23.1 Procedures covering materials and components, tools and fixtures, methods and workmanship, and inspection and controls shall be developed and used by the manufacturer in the production of finished tanks. Copies of the procedures and supporting records shall be kept on file and available for review and audit.

MARKING

24 General

24.1 The markings and labels defined in this section are the minimum requirements and the manufacturer may add additional information at their discretion.

NOTE: Refer to Table 24.1 for French text of safety related markings.

Table 24.1
Marking text

Clause	Description	English text	French text
24.3(a)	Maximum Test Pressure	"Maximum test pressure X kPa (X psig)"	« Pression d'essai Maximum__X__ kPa (_X__psig) »
24.3(e)	Maximum Tank Weight	"MAX TANK WEIGHT * kg" or "MAX TANK WEIGHT * lbs"	« MASSE MAX DU RÉSERVOIR * kg" ou "MASSE MAX DU RÉSERVOIR * lbs »
24.5(a)	Manufacturer's Instructions	"FOLLOW MANUFACTURER'S INSTALLATION INSTRUCTIONS"	« RESPECTER LES INSTRUCTIONS D'INSTALLATION DU FABRICANT »
24.5(b)	Venting	"Keep tank vented"	« Maintenir le réservoir à la pression de l'air libre »
24.5(c)	Maximum Ullage Conditions	"MAXIMUM ULLAGE OPERATING VACUUM AND PRESSURE (kPa) (or psig)"	« SOUS-VIDE ET PRESSION MAXIMUM DE FONCTIONNEMENT DE L'ESPACE VIDE (kPa) (ou psig) »

24.2 Markings will be either stencils with letters minimum 25 mm (1 in) high, in a contrasting colour, or labels. The text on any labels required by this standard shall be a legible size, in a contrasting colour.

24.3 These markings shall include at least the following:

a) "Maximum test pressure X kPa (X psig)" or the equivalent, in which X is 35 kPa (5 psig) for tanks 3050 mm (10 feet) in diameter or less and 21 kPa (3 psig) for tanks larger than 3050 mm (10 feet) in diameter;

b) If striker plates are not installed under any primary tank opening, it shall be marked "No Striker Plate";

c) "SW", “SINGLE WALL TANK”, "DW", “DOUBLE WALL TANK”, "TW", or "TRIPLE WALL TANK" as applicable;

d) “TOTAL TANK CAPACITY
XX
LITRES” or “TOTAL TANK CAPACITY
YY
US GALLONS”, where XX and YY are the capacity, as applicable;

e) “MAX TANK WEIGHT X kg” or MAX TANK WEIGHT X lbs” as applicable;

f) Year and month of manufacture;

g) Compartmentalized tanks shall be marked to differentiate between compartments. Manufacturers can use own labeling convention, such as "COMPARTMENT TANK – CAP: Comp 1 *" or " COMPARTMENT TANK – CAP: Base Tank*" or “CMPTS */*/*”.
(*) = Specify capacity in liters or US gallons, as applicable; and

h) Tanks optionally tested for higher temperatures for heated fuels shall identify the maximum rated temperature, refer to Table 19.1 Note **.

24.4 Each tank shall include a label titled “Important Notes Label”. The label shall be permanent, such as paint or paper label imbedded in clear resin on the outside surface of the tank. Letters in the title are a minimum of 12.5 mm (0.5 in) high.

24.5 The Important Notes Label shall include at least the following:

a) “FOLLOW MANUFACTURER’S INSTALLATION INSTRUCTIONS”;

b) "Keep tank vented", or the equivalent;

c) “MAXIMUM ULLAGE OPERATING VACUUM AND PRESSURE (kPa) (or psig)”;

d) For double wall tanks, “CONTAINMENT WRAP IS X °”, where X identifies the angular value;

e) “ENSURE THAT THE STORED PRODUCT IS COMPATIBLE WITH THE CONSTRUCTION MATERIAL, INCLUDING GASKETS”; and

f) Compatibility:

1) “Suitable for petroleum products, oxygenates, and oxygenated fuels with ethanol up to 100 % or biodiesel up to 100 % at ambient temperatures, and #6 fuel oils up to (manufacturers rated temperature, as per Table 19.1)”, or

2) If optional fuels have been tested and listed, those fluids are placed on an additional label on the tank.

NOTE: Manufacturers should be aware that the authority having jurisdiction may also require that the mark of the certifying agency be included on each tank in an equivalent location as described above.

24.6 Connections not meeting the required torque and bending test values shall be labelled “Nonmetallic Piping Only”.

INSTALLATION INSTRUCTIONS AND SUPPLEMENTARY MANUALS

25 General

25.1 Two copies of the manufacturer's installation instructions shall be provided with each tank. One set of installation instructions shall be permanently attached to the exterior of the tank.

25.2 The installation instructions shall include:

a) The method of intended lifting, including the intended distribution of the load between the fittings, when more than one fitting is provided, any required lifting angles, the use of spreader bars, or the use of lifting straps around the tank in place of lifting lugs;

b) Direction that the backfill to be used shall be either pea gravel or other material, as specified by the manufacturer;

a) If applicable, the need to add suitable corrosion protection, as per 11.1;

d) The maximum burial depth as evaluated under 18.2;

e) The maximum test pressure or vacuum as evaluated under 13.1;

f) The maximum interstitial space leak detection pressure and/or vacuum evaluated under Section 17; and

g) Tanks optionally tested for higher temperatures for heated fuels shall include in the instructions the maximum allowed operating temperature.

25.3 The installation instructions shall include a requirement that any repairs required due to any defect or damage shall be made by the original tank manufacturer or their designated representative.

APPENDIX A – (NORMATIVE) – LIST OF STANDARDS ON FUELS AND OTHER FLAMMABLE AND COMBUSTIBLE LIQUIDS

(Reference: 1.1, 19.5)

A.1 The tanks covered by this Standard are intended for the storage of flammable and combustible liquids that have been formulated in accordance with, but not limited to, all US or Canadian approved motor fuels, off road fuels, renewable gasoline, diesel, renewable diesel, synthetic diesel, biodiesel, kerosene, aviation fuels, jet fuels, aviation biofuels, fuel oil, and heating oils and are to be tested to the appropriate test fuels:

Petroleum products, oxygenated fuel blends and oxygenates[1]	Test fuels	ASTM and CGSB Standards
PETROLEUM PRODUCTS		
Includes petroleum hydrocarbon fuels with low bio-fuels blends per Specs and similar flammable or combustible liquid petroleum derivatives, such as fuel components (cetane, hexane, heptane, etc.), and oils (lubricating, hydraulic, machine, etc.).	ASTM Reference Fuel C (Gasoline) (Class I flammable liquids)	• CAN/CGSB 3.5, Automotive Gasoline • ASTM D910, Standard Specification for Leaded Aviation Gasolines • ASTM D7719, Standard Specification for High Aromatic Content Unleaded Hydrocarbon Aviation Gasoline
	ASTM Reference Fuel F (Diesel/Fuel Oil) (Class II & III combustible liquids)	• CAN/CGSB 3.18, Diesel Fuel for Locomotive-Type Medium-Speed Diesel Engines • CAN/CGSB 3.2, Heating Fuel Oil • CAN/CGSB 3.3-, Kerosene • CAN/CGSB 3.6, Off-Road Diesel Fuel • CGSB 3.11, Naval Distillate Fuel • CAN/CGSB 3.22, Wide-Cut Type Aviation Turbine Fuel (Grade JET B) • CAN/CGSB 3.23, Aviation Turbine Fuel (Grades JET A and Jet A-1) • CAN/CGSB 3.24, Aviation Turbine Fuel (Military Grades F-34, F-37 and F-44) • CAN/CGSB 3.27, Naphtha Fuel • C/CGSB 3.517, Diesel Fuel • ANSI/ASTM D396, Standard Specification for Fuel Oils • ANSI/ASTM D975, Standard Specification for Diesel Fuel Oils • ASTM D1655, Standard Specification for Aviation Turbine Fuels • ANSI/ASTM D3699, Standard Specification for Kerosene • ASTM D4304, Standard Specification for Mineral and Synthetic Lubricating Oil Used in Steam or Gas Turbines • ASTM D4814, Standard Specification for Automotive Spark-Ignition Engine Fuel • ASTM D6158, Standard Specification for Mineral Hydraulic Oils • ASTM D6615 Rev A, Standard Specification for Jet B Wide-Cut Aviation Turbine Fuel
	#6 Fuel Oil (Special Option) (Tested to the temperature rating provided by the manufacturer +10 °C)	• CAN/CSA-A123.3, Asphalt Saturated Organic Roofing Felt
Oxygenated fuel blends		

Petroleum products, oxygenated fuel blends and oxygenates[1]	Test fuels	ASTM and CGSB Standards
Includes all "Petroleum Products" liquids; plus petroleum hydrocarbon fuels with low-biofuels blends. For low-level 3 – 10 % ethanol blends:	CE25a (Class I flammable liquids) (EtOH Blends)	• CAN/CGSB 3.511, Oxygenated Automotive Gasoline Containing Ethanol (E1 – E10) • ASTM D4806, Standard Specification for Denatured Fuel Ethanol for Blending with Gasoline for Use as Automotive Spark-Ignition Engine Fuel
	CE85a (Class I flammable liquids) (EtOH Blends)	• CAN/CGSB 3.512, Automotive Ethanol Fuel (E50 – E85) • ANSI/ASTM D5798, Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark Ignition Engines (Includes Iso-butanol)
	FB25a (BioDiesel Blends) (Class II & III combustible liquids)	• CAN/CGSB 3.520, Diesel Fuels Containing Low Levels of Biodiesel (B1 – B5) • CAN/CGSB 3.522, Diesel Fuel Containing Biodiesel (B6 – B20) • CAN/CGSB 3.524, Biodiesel (B100) for Blending in Middle Distillate Fuels
Oxygenates		
Includes all “Petroleum Product” and "Oxygenated Fuel Blends" liquids; plus pure/denatured or highest oxygenated blend stocks for use in mixing of dispensed lower fuel-blends and components, such as biodiesel and ethanol.	Special Option (EtOH Blend Stock) (Class I flammable liquids)	• CAN/CGSB 3.512, Automotive Ethanol Fuel (E50 – E85) • CAN/CGSB 3.516, Denatured Fuel Ethanol for Use in Automotive-Spark Ignition Fuels
	M100 or MeOH Special Option (MeOH Blend Stock) (Class I flammable liquids)	• CGSB 3-GP-531M, Methanol, Technical
	B100a Special Option (Diesel/Fuel Oil) (Class II & III combustible liquids)	• CAN/CGSB 3.524, Biodiesel (B100) for Blending in Middle Distillate Fuels
[1] Combines sub-groups of commercially available fuels for general-purpose commercial engines (SI or CI) and heating/burning appliances and other equipment.		

APPENDIX B – (NORMATIVE) – REFERENCE STANDARDS

(Reference: Clause 2.2)

B.1 The documents shown below are referenced in the text of this Standard. Unless otherwise stated elsewhere in this Standard such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this Standard.

American Society of Mechanical Engineers (ASME)

- ASME B16.5-17, Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
- ASME B36.10M-15 (E2016), Welded and Seamless Wrought Steel Pipe
- ASME RTP-1-17, Reinforced Thermoset Plastic Corrosion-Resistant Equipment

American Society for Testing and Materials (ASTM)

- ASTM C33/C33M-16 (E2016), Standard Specification for Concrete Aggregates
- ASTM C581-15, Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service
- ASTM D396 Rev A-17, Standard Specification for Fuel Oils
- ASTM D471-16 (Rev A), Standard Test Method for Rubber Property – Effect of Liquids
- ASTM D664-17, Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration
- ASTM D790-91, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Material
- ASTM D910-17 (Rev A), Standard Specification for Leaded Aviation Gasolines
- ASTM D975-17, Standard Specification for Diesel Fuel Oils
- ASTM D1655-17 (Rev A), Standard Specification for Aviation Turbine Fuels
- ASTM D3699-18, Standard Specification for Kerosene
- ASTM D4304-17, Standard Specification for Mineral and Synthetic Lubricating Oil Used in Steam or Gas Turbines
- ASTM D4806-17, Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel
- ASTM D4814-17, Standard Specification for Automotive Spark-Ignition Engine Fuel
- ASTM D5798-17, Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines
- ASTM D6158-16, Standard Specification for Mineral Hydraulic Oil
- ASTM D6615-15 (Rev A), Standard Specification for Jet B Wide-Cut Aviation Turbine Fuel
- ASTM D6751-15 (Rev A) (E2016), Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels

• ASTM D7719-17, Standard Specification for High Aromatic Content Unleaded Hydrocarbon Aviation Gasoline

• ASTM G153-13, Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

• ASTM G155-13, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Canadian Council of the Ministers of the Environment National Task Force on Storage Tanks

• CCME PN 1326-2003 (UPD 2015), Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products

Canadian General Standards Board (CGSB)

• CAN/CGSB 3.2-2017, Heating Fuel Oil

• CAN/CGSB 3.3-2014, Kerosene

• CAN/CGSB 3.5-2016 (AMD 1 2017), Automotive Gasoline

• CAN/CGSB 3.6-2010, Off-Road Diesel Fuel

• CGSB 3.11-2017, Naval Distillate Fuel

• CAN/CGSB 3.18-2010 (R2016), Diesel Fuel for Locomotive-Type Medium-Speed Diesel Engines

• CAN/CGSB 3.22-2012 (R2017), Wide-Cut Type Aviation Turbine Fuel (Grade JET B)

• CAN/CGSB 3.23-2016, Aviation Turbine Fuel (Grades JET A and Jet A-1)

• CAN/CGSB 3.24-2016, Aviation Turbine Fuel (Military Grades F-34. F-37 and F-44)

• CAN/CGSB 3.27-2012, Naphtha Fuel

• CAN/CGSB 3.511-2016 (AMD 1 2017), Oxygenated Automotive Gasoline Containing Ethanol (E1– E10)

• CAN/CGSB 3.512-2013 CORR 1, Automotive Ethanol Fuel (E50 – E85)

• CAN/CGSB 3.516-2017, Denatured Fuel Ethanol for Use in Automotive Spark-Ignition fuels

• CAN/CGSB 3.517-2017, Diesel Fuel

• CAN/CGSB 3.520-2017, Diesel Fuels Containing Low Levels of Biodiesel (B1 – B5)

• CAN/CGSB 3.522-2017, Diesel Fuel Containing Biodiesel (B6 – B20)

• CAN/CGSB 3.524-2017, Biodiesel (B100) for Blending in Middle Distillate Fuels

• CGSB 3-GP-531M-1982, Methanol, Technical

CSA Group

• CAN/CSA-A123.3, Asphalt Saturated Organic Roofing Felt

• CAN/CSA-B139 Series 2015, Installation code for oil-burning equipment

National Fire Protection Association (NFPA)