CSA Group
CSA 12.4:22
Second Edition

Underwriters Laboratories Inc.
UL 495
Fifth Edition

Power-Operated LP-Gas Dispensing Equipment

December 14, 2022

Approved American National Standard

ANSI/UL 495-2022

Standard for Safety for Power-Operated LP-Gas Dispensing Equipment

Second Edition, Dated December 14, 2022

Summary of Topics:

This new edition of the Standard for Power-Operated LP-Gas Dispensing Equipment, dated December 14, 2022, is a harmonized UL and Canadian Standard.

Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as “CSA Group”) and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

ISBN 978-1-4883-4320-9 © 2022 Canadian Standards Association

This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

To purchase CSA Group Standards and related publications, visit CSA Group’s Online Store at www.csagroup.org/store/ or call toll-free 1-800-463-6727 or 416-747-4044.

This ANSI/UL Standard for Safety consists of the Fifth Edition.

The most recent designation of ANSI/UL 495 as an American National Standard (ANSI) occurred on December 14, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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 https://csds.ul.com.

To purchase UL Standards, visit UL's Standards Sales Site at http://www.shopulstandards.com/HowToOrder.aspx or call toll-free 1-888-853-3503.

CONTENTS

PREFACE

This is the harmonized CSA Group and UL standard for Power-Operated LP-Gas Dispensing Equipment. It is the second edition of CSA 12.4, and the fifth edition of UL 495. This edition of CSA 12.4 supersedes the previous edition published April 1984. This edition of UL 495 supersedes the previous edition published April 2016.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Subcommittee, Power-Operated LP-Gas Dispensing Equipment are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard was reviewed by the CSA Subcommittee on Dispensing Devices for Propane Fuel for Highway Vehicles, under the jurisdiction of the CSA Technical Committee on Propane Autogas and the CSA Strategic Steering Committee on Requirements for Transportation, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with the Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard uses the IEC format but is not based on, nor is it considered equivalent to, an IEC standard.

This standard is published as anequivalent standard for CSA Group and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover power-operated equipment for dispensing liquefied petroleum gas into the fuel storage container of a vehicle where the gas is primarily used as an engine fuel.

1.2 The electrical features of power-operated dispensers are as described:

a) In the United States: UL 1238, Standard for Control Equipment for Use with Flammable Liquid and LP-Gas Dispensing Devices;

b) In Canada: CSA C22.2 No. 22, Electrical equipment for flammable and combustible fuel dispensers.

1.3 These requirements cover wiring methods used to install or interconnect control equipment when the equipment is located directly on or within the housing of the dispensing device.

1.4 These requirements do not cover control equipment that could authorize, monitor, or interrupt operation of a power-operated dispensing device or the filling of LP-Gas portable containers. Such equipment includes mounted equipment located adjacent to the dispensing device, remote consoles located inside a permanent structure, and auxiliary equipment physically attached to the dispensing device or enclosed by the housing.

1.5 Products covered by this Standard are intended to be installed and used in accordance with the applicable Codes and Regulations as determined by the Authority Having Jurisdiction (AHJ), such as, but not limited to:

a) In the United States:

1) Liquefied Petroleum Gas Code, NFPA 58; and

2) National Electrical Code, NFPA 70

b) In Canada:

1) Natural gas and propane installation code, CSA B149.1;

2) Propane storage and handling code, CSA B149.2;

3) Canadian Electrical Code, Part I Safety Standard for Electrical Installations, CSA C22.1; and

4) Other Provincial or Territorial Regulations.

Note: For the purposes of this Standard, the terms “Liquified Petroleum Gas”, “LP-Gas”, and “Propane” are interchangeable.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Standard shall comply with the requirements for that component.

2.2 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 the product covered by this Standard; or

b) Is superseded by a requirement in this Standard.

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

3 Units of measurement

3.1 The values given in SI (metric) units shall be normative. Any other values given shall be for information purposes only.

4 Reference publications

4.1 For undated references to Codes or Standards, such reference shall be considered to refer to the latest edition and all revisions to that edition up to the time when this Standard was approved.

ASME B1.20.1, *Pipe Threads, General Purpose (Inch)*

ANSI/ASME B16.26, *Cast Copper Alloy Fittings for Flared Copper Tubes*

ASME B36.10M, *Welded and Seamless Wrought-Steel Pipe*

ASTM A47/A47M, *Standard Specification for Ferritic Malleable Iron Castings*

ASTM A48/A48M, *Standard Specification for Gray Iron Castings*

ASTM A53/A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service*

ASTM A126, *Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings*

ASTM A213/A213M, *Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes*

ASTM A249/A249M, *Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes*

ASTM A269/A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*

ASTM A395/A395M, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*

ASTM A536, *Standard Specification for Ductile Iron Castings*

ASTM A539, *Standard Specification for Electric-Resistance Welded Coiled Steel Tubing for Gas and Fuel Oil Lines*

ASTM B42, *Standard Specification for Seamless Copper Pipe, Standard Sizes*

ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*

ASTM B88, *Standard Specification for Seamless Copper Water Tube*

ASTM B135/B135M, *Standard Specification for Seamless brass tube*

ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*

ASTM B858, *Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys*

ASTM D471, *Standard Test Method for Rubber Property-Effect of Liquids*

ASTM D572, *Standard Test Method for Rubber Deterioration by Heat and Oxygen*

ASTM D1790, *Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact*

ASTM E28, *Standard Test Method for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus*

ASTM E145, *Standard Specification for Gravity-Convection and Forced-Ventilation Ovens*

CSA B149.1, *Natural gas and propane installation code*

CSA B149.2, *Propane storage and handling code*

CSA C22.1, *Canadian Electrical Code, Part I Safety Standard for Electrical Installations*

CSA C22.2 No. 0, *General requirements – Canadian Electrical Code, Part II*

CSA C22.2 No. 0.15, *Adhesive Labels*

CAN/CSA-C22.2 No. 0.17, *Evaluation of Properties of Polymeric Materials*

CSA 8.1, *Elastomeric composite hose and hose couplings for conduction propane and natural gas*

CSA 8.3, *Thermoplastic Hose and Hose Couplings for Conducting Propane and Natural Gas*

CSA-C22.2 No. 22, *Electrical Equipment for Flammable and Combustible Fuel Dispensers*

CSA C22.2 No. 25, *Enclosures for use in Class II, Division 1, Groups E, F, and G hazardous locations*

CSA C22.2 No. 30, *Explosion-proof equipment*

CSA C22.2 No. 45.1, *Electrical Rigid Metal Conduit – Steel*

CSA C22.2 No. 45.2, *Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel*

CSA C22.2 No. 56, *Flexible metal conduit and liquid-tight flexible metal conduit*

CSA C22.2 No. 65, *Wire connectors*

CSA C22.2 No. 145, *Electric motors and generators for use in hazardous (classified) locations*

CSA C22.2 No. 207, *Portable and stationary electric signs and displays*

CSA C22.2 No. 213, *Nonincendive electrical equipment for use in Class I and II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations*

CSA C22.2 No. 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "I"*

CAN/CSA-C22.2 No. 60079-15, *Explosive atmospheres - Part 15: Equipment protection by type of protection "n"*

SAE J512, *Automotive Tube Fittings*

SAE J513, *Refrigeration Tube Fittings – General Specifications*

UL 1, *Flexible Metal Conduit*

UL 6, *Electrical Rigid Metal Conduit – Steel*

UL 6A, *Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel*

UL 21, *LP-Gas Hose*

UL/ULC 25, *Meters for Flammable and Combustible Liquids and LP-Gas*

UL 48, *Electric Signs*

UL 51, *Power-Operated Pumps and Bypass Valves for Anhydrous Ammonia, LP-Gas, and Propylene*

UL 94, *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 109, *Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use*

UL/ULC 125, *Flow Control Valves for Anhydrous Ammonia and LP – Gas*

UL 132, *Relief Valves for Anhydrous Ammonia and LP-Gas*

UL 331, *Strainers for Flammable Fluids and Anhydrous Ammonia*

UL 429, *Electrically Operated Valves*

UL 486A-486B, *Wire Connectors*

UL 536, *Flexible Metallic Hose*

UL/ULC 567, *Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas*

UL 569, *Pigtails and Flexible Hose Connectors for LP-Gas*

UL 674, *Electric Motors and Generators for Use in Hazardous (Classified) Locations*

UL 746C, *Polymeric Materials Used in Electrical Equipment Evaluations*

UL 860, *Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service*

UL 913, *Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations*

UL 969, *Marking and Labeling Systems*

UL 1203, *Explosion Proof and Dust-Ignition Proof Electrical Equipment for Use in Hazardous (Classified) Locations*

UL 1238, *Control Equipment for Use with Flammable Liquid Dispensing Devices*

UL 60079-15, *Explosive Atmospheres – Part 15: Equipment Protection by Type of Protection "n"*

UL 121201, *Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*

ULC/ORD-C331, *Guide for the Investigation of Strainers for Flammable Fluids and Anhydrous Ammonia*

5 Definitions

5.1 For the purpose of this standard the following definitions apply.

5.2 BASE – That part of the assembly that is intended to be secured to the foundation on which the dispensing device will be installed.

5.3 CLASS I HAZARDOUS LOCATIONS – refer to the definitions in the National Electrical Code (NFPA 70), Canadian Electrical Code, Part I Safety Standard for Electrical Installations (CSA C22.1), or Propane storage and handling code CSA (B149.2) for the applicable definition to these hazardous locations. For the purpose of defining the hazardous locations requirements for devices covered within this Standard, hazardous locations are further defined as follows:

a) Class I, Group D, Division 1 and Zone 1, Group IIA – the entire space within a dispenser enclosure and 450 mm (18 inches) horizontally from the enclosure exterior up to an elevation 1.2 m (4 feet) above the dispenser base; or

b) Class I, Group D, Division 2 and Zone 2, Group IIA – the area up to 450 mm (18 inches) above grade and from 450 mm (18 inches) to 6 m (20 feet) horizontally from any edge of the dispenser enclosure.

5.4 HOUSING – that section of a dispensing device that encloses and is intended to protect and support operating parts, control mechanisms, or other mechanical or electrical components, that should not be accessible during normal operation.

5.5 INTENDED CARE AND USAGE – intended care means tasks such as lubrication and cleaning. Intended usage covers the manipulations involved in starting the dispenser, dispensing the liquid, and restoring the dispenser to its standby condition.

5.6 NOZZLE BOOT – the component on the dispenser into which the nozzle spout is inserted when the nozzle is returned to the dispenser.

CONSTRUCTION

MECHANICAL EQUIPMENT

6 General

6.1 A power-operated dispensing device typically includes a base, housing, pressure-relief device, vapor eliminator, strainer, meter, valves as required, hose, hose-nozzle valve, motor control, locking mechanism, and piping.

6.2 A dispensing device may be of the self-contained type with components mounted in a common housing, or it may be comprised of separately housed assemblies intended for installation as individual units but in conjunction with each other.

6.3 A dispensing device may be furnished without the hose. When a dispensing device is provided with a hose retrieving mechanism, the manufacturer shall specify the proper installation requirements.

6.4 The construction of a dispensing device shall be such that parts can be replaced or reassembled to function as intended after being dismantled.

6.5 A dispensing device shall incorporate provisions for support independent of piping, tubing, or conduit that may be connected thereto.

6.6 Liquid and vapor openings for field connection shall be plugged or capped by the manufacturer prior to shipment to prevent entrance of foreign material.

6.7 Fluid-handling piping systems and equipment shall have a maximum allowable working pressure (MAWP) of not less than 2.4 MPa (350 psig).

7 Materials

7.1 Fluid-containing parts other than a seal ring or gasket shall have a melting point (solidus temperature) of not less than 510 °C (950 °F).

7.2 Fluid-containing parts, except as listed in 7.3, shall be of:

a) Steel, stainless steel;

b) Ductile (nodular) iron (Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures, ASTM A395/A395M, or Standard Specification for Ductile Iron Castings, ASTM A536, Grade 60-40-18 or 65-45-12);

c) Malleable iron (Standard Specification for Malleable Iron Castings, ASTM A47/A47M);

d) Gray iron (Standard Specification for Gray Iron Castings, ASTM A48/A48M, Class 40B, or Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings, ASTM A126, Class B or C);

e) Brass;

f) Aluminum; or

g) A material determined to be equivalent.

7.3 Fittings, couplings, and pipe fittings shall not be made from:

a) Malleable iron;

b) Gray iron (ductile iron); or

c) Aluminum.

7.4 A brazing material used to join liquid-confining parts shall have a melting point (solidus temperature) of not less than 510 °C (950 °F).

7.5 A nonmetallic part in contact with the fluid to be handled shall be resistant to the action of such fluid and shall comply with the applicable requirements in Sections 31 – 33.

7.6 If atmospheric corrosion of a part may interfere with the intended function of a dispenser, the part shall be of corrosion-resistant material or be provided with a corrosion-resistant protective coating.

7.7 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coatings specified in 7.8.

7.8 Cadmium plating shall not be less than 0.008 mm (0.0003 inch) thick, and zinc plating shall not be less than 0.013 mm (0.0005 inch) thick, except on parts where threads constitute the major portion of the area, in which case the cadmium or zinc plating shall not be less than 0.0038 mm (0.00015 inch) thick.

7.9 If warping of a casting can affect the tightness of a liquid-confining joint, or the necessary fit of parts, the casting shall be stress relieved to reduce the possibility of warping.

7.10 A pressure confining part made of drawn brass or machined from brass rod shall withstand, without cracking, the Moist Ammonia-Air Stress Cracking Test, Section 28.

8 Base

8.1 The base shall be made of material suitable for its intended purpose.

8.2 A provision shall be made for securely mounting the equipment in position.

9 Housing

9.1 A recess or depression in the housing that could collect water shall be arranged to direct such collection to the outside or to points within the structure where it can fall to the ground without damage to the internal components.

9.2 The strength of a part used in a main side section of a housing shall be at least equivalent to that afforded by sheet steel that is not less than 0.91 mm (0.036 inch) thick.

9.3 Stainless steel not less than 0.635 mm (0.025 inch) thick, unreinforced aluminum not less than 1.3 mm (0.053 inch) thick, and reinforced aluminum not less than 1.04 mm (0.041 inch) thick are judged to be the equivalent of carbon steel having the thickness specified in 9.2.

Note: The dimensions shown in 9.3 are noted as readily available industry standard dimensions.

9.4 The top housing shall provide protection for internal parts at least equivalent to that afforded by sheet steel not less than 0.759 mm (0.0299 inches) thick or a nonmetallic material as described in 9.7.

9.5 Stainless steel not less than 0.635 mm (0.025 inch) thick, unreinforced aluminum not less than 1.29 mm (0.051 inches) thick, and reinforced aluminum not less than 0.66 mm (0.036 inches) thick are judged to be the equivalent of carbon steel having the thickness specified in 9.4.

Note: The dimensions shown in 9.5 are noted as readily available industry standard dimensions.

9.6 A principal structural section or access panel of the housing, enclosing components in a Class I, Division 1 area and classified as a Zone 1 area shall not be made of glass or nonmetallic material, other than one complying with the requirements in 9.2 and 9.4, if breakage will expose internal parts to possible damage. This does not apply to a dial glass, a small display panel, or to a bezel of a material that does not comply with these requirements but that is backed up by a metal panel affording the required protection of internal parts.

9.7 Nonmetallic materials used for sheeting materials and access cover panels shall be tested to and meet the requirements of the Impact test in Section 35.

9.8 A nonmetallic material may be used for parts in locations other than as described in 9.6 and 9.7 if:

a) The material is classed HB or less flammable, in accordance with:

1) In the United States: UL 746C, Standard for Polymeric Materials Used in Electrical Equipment Evaluations.

2) In Canada: Evaluation of Properties of Polymeric Materials, CAN/CSA C22.2 No. 0.17.

b) The material is resistant to deterioration and deformation;

c) The material is not used for support of internal functional components;

d) The material is not in contact with heat producing parts; and

e) The temperature of the material does not exceed 65 °C (149 °F) in service.

9.9 A housing shall provide rigidity and strength for the assembly as well as support for the components. It shall be arranged in such a manner that removal of access panels will not affect strength, rigidity, and support. Structural components shall not contain liquid propane.

9.10 The housing shall provide space for making field connections of fluid-handling piping and electrical equipment. Openings with acceptable closures, such as covers, access panels, or the like, shall be provided for making field connections and for inspection and adjustment of the operating mechanism after the device is installed, unless sections of the housing are intended to be removed by authorized personnel for this purpose.

9.11 The housing assembly shall incorporate vent openings near the bottom having a total area of not less than 12.90 cm^2 (2 in^2) to permit vapors to escape. These openings shall be of such size and arrangement to prevent clogging.

9.12 An opening in a housing for storing a hose nozzle valve or fuel-transfer valve when it is not in use, shall be fitted with a nozzle boot constructed and positioned to drain or vent housing fluid or vapor that could escape from the valve to the outside of the housing.

9.13 The housing shall have access panel(s) for servicing.

9.14 Removable panels shall be secured in place by mechanical means.

10 Hydrostatic Relief Valve

10.1 A hydrostatic relief valve shall be installed in a liquid propane system wherever liquid propane can be contained or trapped due to valve closure. Such a hydrostatic relief valve shall have a start-to-discharge pressure setting of neither less than 2.76 MPa (400 psig) nor more than 3.450 MPa (500 psig) and shall comply with the applicable construction and performance requirements in the Standard for Relief Valves for Anhydrous Ammonia and LP-Gas, UL 132.

11 Strainers and Filters

11.1 A dispensing device may be installed with at least one strainer or filter located upstream from the meter.

11.2 A strainer or filter shall be constructed and located so as to permit the removal and replacement of the straining element without disconnecting liquid lines or disturbing any part of the dispensing device assembly, and to permit ready access for cleaning.

11.3 The force necessary to open a strainer or filter shall not permanently distort the assembly, the dispensing device, or piping to which it is attached.

11.4 Strainers and filters shall comply with the applicable construction and performance requirements:

a) In the United States: UL 331, Standard for Strainers for Flammable Fluids and Anhydrous Ammonia;

b) In Canada: ULC/ORD-C331, Guide for the Investigation of Strainers for Flammable Fluids and Anhydrous Ammonia.

12 Meters

12.1 A meter shall be provided downstream from the strainer or filter.

12.2 Meters shall comply with the applicable construction and performance requirements in the Standard for Meters for Flammable and Combustible Liquids and LP-Gas, UL/ULC 25.

13 Vapor Separators

13.1 A vapor eliminator shall comply with the requirements in 13.2 and 13.3 and in the High-Pressure Leakage Test, Section 26, and the Hydrostatic Strength Test, Section 27.

13.2 A vapor eliminator shall be arranged for connection of piping to return vapors to the LP-Gas supply tank. The vapor shall be returned from the eliminator to the supply tank through an orifice not larger than 1.397 mm (No. 54 drill size), an orifice larger than 1.397 mm (No. 54 drill size) that is protected by an excess flow check valve, or a float-controlled orifice.

13.3 The float and related parts shall comply with the requirements in 7.10 and in the Float Crushing Test, Section 29.

14 Valves

14.1 A shutoff valve or equivalent device shall be provided in the liquid-inlet and vapor-outlet piping of each device. The valves shall be installed to permit the complete dispensing device to be temporarily moved so that components can be repaired or replaced if necessary.

14.2 A shutoff valve or valves shall be provided to safely evacuate all the LP-Gas contained in the dispenser piping for the purposes of maintenance or repair. The valve shall have means for connection to piping, which may be manifolded.

14.3 A shutoff valve shall be installed in the piping ahead of the hose connection of each dispensing device supplied by a remote pump to relieve the hose of pump pressure when another dispenser served by the same pump is in operation. The valve shall be interconnected with the control mechanism so that the valve will be closed when the motor-control switch is moved to the off position. Conversely, the valve shall be opened when the motor-control switch is moved to the on position.

14.4 A hose-nozzle valve or fuel-transfer valve shall be provided for each discharge hose. The valve shall be compatible with the dispensing-device locking mechanism. Hose-nozzle valves and fuel-transfer valves shall comply with the applicable construction and performance requirements in the Standard for Flow Control Valves for Anhydrous Ammonia and LP-Gas, UL/ULC 125.

14.5 An excess-flow check-valve, automatic shutoff valve, or differential back pressure valve shall be installed in the fuel supply piping at the inlet to the dispensing hose. The hose, piping, and fittings on both sides of the excess-flow check valve shall have a flow rating greater than the valve itself. Any valve or fuel supply piping shall include a shear section reduced in thickness by 20 % at the outlet end and shall be mounted so that any break in the valve or piping under abnormal conditions will occur at the shear section so that the valve mechanism will not be damaged. A separate fitting, such as an emergency breakaway fitting, installed at the inlet of the dispensing hose, shall be used in conjunction with the excess-flow check valve, automatic shutoff valve, or differential back pressure valve. An emergency breakaway fitting shall comply with the applicable construction and performance requirements in the Standard for Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas, UL/ULC 567.

14.6 A plug- or rotating-disc-type valve, in which the bearing surface of the plug or disc provides the seal to the exterior of the valve body, shall not be used in liquid lines.

14.7 An electrically operated shutoff valve shall close upon being de-energized, regardless of the position of any operating lever or reset handle. An electrically operated valve shall comply with the applicable construction and performance requirements in:

a) In the United States: Standard for Electrically Operated Valves, UL 429, and Standard for Explosion Proof and Dust-Ignition Proof Electrical Equipment for Use in Hazardous (Classified) Locations, UL 1203;

b) In Canada: CSA-C22.2 No. 139, Electrically Operated Valves and CSA C22.2 No. 30, Explosion-proof equipment.

15 Piping and Fittings

15.1 Joints in wrought iron, steel, brass, or copper pipe may be threaded, welded, or brazed. Pipe threads shall be in accordance with the Standard for Pipe Threads General Purpose (Inch), ANSI/ASME B1.20.1.

15.2 An opening threaded for attachment to pipe shall be constructed so that a pipe threaded two threads beyond the standard number (for the size in question) may be run into the opening without distorting any part of the fitting.

15.3 A threaded pipe connection shall be made with litharge and glycerine cement, shellac and inert powder filler, or a pipe-joint sealing compound resistant to LP-Gas.

15.4 Pipe shall be steel (black or galvanized), brass, or copper, and shall comply with the following, as applicable:

a) For steel pipe:

1) Dimensional requirement of Standard for Welded and Seamless Wrought-Steel Pipe, ANSI/ASME B36.10M; and

2) Material specifications of:

i) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, ASTM A53/A53M; or

ii) Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service, ASTM A106/A106M; or

b) For brass pipe: Standard Specification for Seamless Red Brass Pipe, Standard Sizes, ASTM B43; or

c) For copper pipe: Standard Specification for Seamless Copper Pipe, Standard Sizes, ASTM B42.

15.5 Tubing shall be steel, brass, or copper and shall have a wall thickness of not less than that specified in Table 15.1. Tubing shall also comply with the following as applicable:

a) 300 series stainless steel tubing meeting one of the following:

1) ASTM A213/A213M, Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes;

2) ASTM A249/A249M, Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes; or

3) ASTM A269/A269M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service;

b) For steel tubing: ASTM A179/A179M, Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat- Exchanger and Condenser Tubes; or

c) For brass tubing: ASTM B135/B135M, Standard Specification for Seamless Brass Tube; or

d) For copper tubing:

1) Type K or L, Standard Specification for Seamless Copper Water Tube, ASTM B88;

2) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, ASTM B280; or

3) Standard Specification for Seamless Copper Tube, ASTM B75/B75M.

Table 15.1
Wall Thickness for Copper, Brass, and Steel Tubing

Outside diameter,		Minimum wall thickness			
		Brass or copper,		Steel,	
inches	(mm)	inch	(mm)	inch	(mm)
1/8	(3.17)	0.0265	(0.673)	0.028	(0.711)
1/4	(6.35)	0.0265	(0.673)	0.028	(0.711)
5/16	(7.94)	0.0265	(0.673)	0.028	(0.711)
3/8	(9.53)	0.0265	(0.673)	0.028	(0.711)
1/2	(12.70)	0.0315	(0.80)	0.028	(0.711)
5/8	(15.88)	0.0365	(0.927)	0.035	(0.889)
3/4	(19.05)	0.0385	(0.97)	0.035	(0.889)
7/8	(22.23)	0.0410	(1.041)	0.049	(1.24)
1	(25.40)	0.0460	(1.168)	0.049	(1.24)
1-1/8	(28.58)	0.0460	(1.168)	0.049	(1.24)
1-1/4	(31.75)	0.0505	(1.283)	0.049	(1.24)
1-3/8	(34.93)	0.0505	(1.283)	–	–
1-1/2	(38.10)	–	–	0.065	(1.65)

15.6 Steel tubing of the wall thickness specified in Table 15.1 shall be protected with a corrosion-resistant coating determined to be equivalent to that provided by hot-dip galvanizing.

15.7 Fittings intended for the tubing employed shall be used. Tube fittings shall be designed and constructed to be equivalent in mechanical strength, provisions for assembly and disassembly, and resistance to corrosion to tube fittings conforming to one or more of the following standards:

a) Automotive Tube Fittings, SAE J512;

b) Cast Copper Alloy Fittings for Flared Copper Tubes, ANSI/ASME B16.26;

c) Refrigeration Tube Fittings – General Specifications, SAE J513; or

d) Standard for Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use, UL 109.

15.8 A liquid line opening for field connection shall be furnished with a metal-to-metal seat union that complies with the requirements in the Standard for Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service, UL 860, or the fitting provided for field connections shall comply with the Torque Test, Section 34.

16 Hose and Couplings

16.1 A hose supplied with the dispensing device shall be provided with nonferrous couplings attached to the hose.

16.2 A hose assembly shall comply with the applicable construction and performance requirements:

a) In the United States: Standard for LP-Gas Hose, UL 21;

b) In Canada: Elastomeric Composite Hose and Hose Couplings for Conducting Propane and Natural Gas, CSA 8.1.

16.3 A high-pressure flexible connector assembly shall comply with the applicable construction and performance requirements:

a) In the United States: Standard for Pigtails and Flexible Hose Connectors for LP-Gas, UL 569;

b) In Canada: Thermoplastic Hose and Hose Couplings for Conducting Propane and Natural Gas, CSA 8.3.

17 Control Application

17.1 A motor shall not be energized simultaneously when the hose-nozzle valve or fuel-transfer valve is lifted from its position on the device. A separate intentional manual operation shall be required for closing the starting switch.

17.2 As a means of complying with 17.1, a motor may be energized simultaneously when the hose-nozzle valve or fuel-transfer valve is lifted from its position on the device, provided that a separate intentional manual operation is required for opening a normally closed shutoff valve that is installed in the piping ahead of the hose connection.

17.3 The motor shall be de-energized at or before the time that the hose, or the last hose of a multiple-station remote-control discharge system incorporating a single motor, is returned to its storage position on the dispenser following operation.

17.4 As a means of complying with 17.3, the motor may be de-energized by the weight of the hose and the nozzle valve or fuel-transfer valve when they are replaced in their intended position. As an alternative:

a) An interference device that prevents replacement of the nozzle until the motor has been de-energized; or

b) A dead-man switch complying with the requirements in 17.3 may be used.

17.5 When the dispenser manufacturer specifies a hose nozzle valve and/or hose assembly intended for the dispenser, the function of the control application and locking mechanism shall be verified on a representative sample of the dispenser with that hose nozzle valve and/or hose assembly intended for the dispenser.

ELECTRICAL EQUIPMENT

18 General

18.1 In Canada, general requirements applicable to this Standard are given in CSA C22.2 No. 0.

18.2 Unless otherwise noted, electrical equipment intended for use in hazardous locations shall comply with the requirements for Class I, Group D, Division 1 or Zone 1, Group IIA equipment.

18.3 Intrinsically safe equipment may be housed in a general-purpose enclosure. A general-purpose enclosure may also be used for field connections to an intrinsically safe circuit.

18.4 Electrical equipment and wiring shall be arranged so that the liquid being handled will not drip or drain on them during intended maintenance and use.

18.5 A device shall be constructed so that the enclosure or housing, frame, and similar dead metal parts of all high-voltage electrical equipment are bonded to the means provided for connecting the conduit of the

supply circuit. Means shall also be provided so that connection to a field-installed equipment grounding conductor can be made in the same junction box used for field-installed conductors.

18.6 The surface of an insulated lead intended solely for the connection of an equipment grounding conductor shall be finished in a continuous green color or a continuous green color with one or more yellow stripes, and no other lead shall be so identified.

18.7 A soldering lug, a push-in, screwless connector, or quick-connect or similar friction-fit connector shall not be used for the grounding terminal intended for the connection of field supply connections.

18.8 A wire-binding screw intended for the connection of an equipment grounding conductor shall have a green-colored head that is hexagonal, slotted, or both. A pressure wire connector intended for connection of such a conductor shall be plainly identified such as by being marked "G," "GR," "Ground," or "Grounding," or by a marking on a wiring diagram provided on the product. Also see 18.9.

18.9 A pressure wire connector that is intended for grounding and that is located where it could be mistaken for a neutral conductor of a grounded supply shall be identified by being marked "EQUIPMENT GROUND," by a green color identification, or both.

18.10 Each conduit run to which field connections are to be made shall terminate in an outlet box or enclosure complying with the requirements for equipment for use in hazardous locations, Class I, Group D, Division 1 or Zone 1, Group IIA, as applicable. The box or enclosure shall be located so that the connections can be made and so that ample clearance between it and adjacent parts is provided to permit gripping the installation conduit or fitting with an appropriate wrench. The clearance shall permit wrench movement through an arc of not less than 45°. To provide space for the field installation of conduit unions and sealing fittings, the clearance measured vertically between the lower end of the outlet box hubs and the plane of the lower edge of the dispenser base shall not be less than specified in Table 18.1 except as noted in 18.11.

Table 18.1
Trade Size of Conduit and Vertical Clearance for Box Hubs

Conduit size		Vertical clearance,	
Trade size, inch	O.D., (mm)	inch	(mm)
1/2	(21.3)	7	(178)
3/4	(26.7)	7	(178)
1	(33.4)	9	(229)
1-1/4	(42.3)	10-3/4	(273)
1-1/2	(48.3)	11-1/2	(293)

18.11 A vertical clearance less than that specified in Table 18.1 may be used if the intended unions, sealing fittings, and interconnections are provided by the dispenser manufacturer.

18.12 An outlet box or enclosure shall have no unplugged openings other than those to which conduit will always be connected when the dispenser is installed.

18.13 An outlet box or enclosure included as part of the assembly, and in which a branch circuit is to be connected to the dispensing device, shall not require that it be moved for intended maintenance of the device.

18.14 The size of a junction box in which field-installed conductors are to be connected by splicing shall not be less than that specified in Table 18.2. A conductor passing through the box is counted as one

conductor, and each conductor terminating in the box is also counted as one conductor. A field-installed conductor for pump motor and lighting circuits is considered to not be smaller than 14 AWG. A field-installed conductor for a reset motor, signaling, or other circuit rated less than 5 A may be considered to be not smaller than 18 AWG when the wire size is marked on the installation wiring diagram.

Table 18.2
Size of Junction Boxes

Size of conductor, AWG	Free space within box for each conductor			
	Box with hubs,		Box without hubs,	
	cubic inches	(cm^3)	cubic inches	(cm^3)
16 or smaller	1.3	(21)	1.5	(25)
14	1.8	(29)	2.0	(33)
12	2.0	(33)	2.25	(36.9)
10	2.2	(36)	2.5	(41.0)
8	2.7	(44)	3.0	(49.2)

18.15 The size of a junction box in which field-installed conductors are to be connected to factory-installed terminal strips shall be determined in accordance with Table 18.2 using the sum of the volumes required for each field-installed conductor plus the volume utilized by the factory-installed wiring and terminal block.

18.16 A conductor intended to be spliced to a field-installed conductor shall not be smaller than 18 AWG and shall be rated for the maximum operating voltage of the dispenser. Factory wiring terminating at a terminal strip shall also be 18 AWG minimum unless arranged or guarded so that it will be protected from damage during field wiring.

18.17 Terminals provided for the connection of field-installed conductors shall have an ampacity not less than 125 % of the full-load motor-current rating of horsepower-rated motors and 100 % of the ampere ratings of all other loads.

18.18 A wire-binding screw to which field-installed conductors are to be connected shall not be smaller than No. 8, except that a No. 6 screw may be used for the connection of one 18, 16, or 14 AWG conductor.

18.19 A terminal plate tapped for a wire-binding screw shall be of metal not less than 0.759 mm (0.0299 inch) thick for a 14 AWG or smaller wire, and not less than 1.214 mm (0.0478 inch) thick for a wire larger than 14 AWG. Terminal plates shall provide at least two full threads and shall be provided with upturned lugs or a means determined to be equivalent to hold the wires in position.

18.20 A terminal plate formed from stock having the minimum required thickness may have the metal extruded at the tapped hole for the binding screw to provide two full threads, except that two full threads are not required if a lesser number of threads results in a secure connection in which the threads will not strip with the tightening torque specified in:

a) In the United States: Standard for Wire Connectors, UL 486A-486B;

b) In Canada: Wire connectors, CSA C22.2 No. 65.

18.21 A conductor intended for connection to a grounded neutral supply conductor shall be identified by a white or gray finish, or the intended wiring connections shall be clearly indicated in some other manner, such as on an attached wiring diagram. All other conductors shall be finished in colors other than white, gray, or green with or without one or more yellow stripes.

18.22 A terminal for connection of a grounded neutral conductor shall be identified by a metallic plated coating substantially white in color and shall be distinguishable from other terminals, or it shall be clearly identified in some other manner, such as on an attached wiring diagram. The screw shell or white terminal of lampholders shall be connected to the white or gray conductor.

18.23 Conduit shall comply with the applicable construction and performance requirements of:

a) In the United States: UL 1, Standard for Flexible Metal Conduit, UL 6, Standard for Electrical Rigid Metal Conduit – Steel, or UL 6A, Standard for Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel;

b) In Canada: CSA C22.2 No. 56, Flexible Metal Conduit, or CSA C22.2 No. 45.1, Rigid Metal, or CSA C22.2 No. 45.2, Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel.

19 Motors

19.1 If motor protection that is evident to the installer or user is furnished as part of a dispensing device, it shall provide protection under both stalled rotor and overload conditions.

19.2 A motor shall comply with the applicable construction and performance requirements:

a) In the United States: Standard for Electric Motors and Generators for Use in Hazardous (Classified) Locations, UL 674;

b) In Canada: Electric Motors and Generators for Use in Hazardous (Classified) Locations, CSA C22.2 No. 145.

20 Switches

20.1 A switch shall be rated for the maximum load that it will control.

20.2 A motor switch shall have a sufficient number of poles to control the motor or motors. A single-pole switch installed in either a lighting or motor circuit shall not be connected to the grounded neutral conductor in the US or the identified conductor in Canada.

21 Wiring Methods

21.1 The wiring of circuits within the device shall comply with the requirements specified in 21.2 – 21.13. Splices in conductors shall be insulated and positioned to reduce the likelihood of current-carrying parts contacting metallic parts of the dispensing device.

21.2 Conductors intended for field connection to a 120 V branch-circuit protective device shall be provided and arranged so that an individual grounded neutral conductor in the US or the individual identified conductor in Canada is provided for each ungrounded supply conductor.

21.3 The internal wiring of the device shall consist of wires of a type or types determined to be acceptable when considered with respect to the temperature, ampacity, voltage, and conditions of service to which the wiring may be subjected. See 18.16.

Note: An intrinsically safe circuit need not comply with this requirement.

21.4 If wiring is not routed near a component that could attain temperatures as great as, or in excess of, the temperature limit of the insulated conductor (such as a resistor, coil, ballast, or the like), minimum wire

size shall be as specified in Table 21.1. Minimum wiring sized on the basis of the table is applicable to both component leads and other wiring except motor leads.

Motor leads of the size furnished with a Class I, Group D, Division 1 or Zone 1, Group IIA motor may be used. See also 21.5.

Motor feeders shall be rated at 125 % of the full load rating of the motor.

Table 21.1
Wire Sizes for Circuit Requirements

Wire size, AWG	Circuits not employing motors, A	Circuits for motors, A
18	6	4.8
16	8	6.5
14	15	12.0
12	20	16.0
10	30	24.0

21.5 The acceptability of a conductor routed close to a component producing heat or of wire size smaller than specified by Table 21.1 shall be judged on the basis of a temperature test.

21.6 Wiring shall be in threaded rigid metal conduit, threaded steel intermediate metal conduit, or Type MI cable with termination fittings that are acceptable for use in Class I, Group D, Division 1 or Zone 1, Group IIA hazardous locations. All boxes, fittings, and joints shall be threaded for connection to conduit or cable termination fittings. At least five full threads shall engage in each threaded joint.

Note: The dispenser housing may be considered as the electrical enclosure for intrinsically safe circuit wiring.

21.7 One end of a wireway between two parts factory attached to an assembly may be secured to one of the parts by means of straight threads and, if necessary for security, with a locknut, if the other end of the wireway is secured to the other part by tapered threads.

21.8 A seal shall be provided where conduit or cable enters an enclosure for a switch, lamp starter, or other part that could produce arcs or sparks.

21.9 A compartment enclosing a switch shall be sealed from any adjacent compartment in which field connections are made.

21.10 A sealing compound shall not be soluble in n-hexane. It shall not soften nor crack under service conditions. The softening point of a compound shall not be less than 93.3 °C (200 °F) as determined by the Standard Test Method for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus, ASTM E28. A seal shall have a depth equal to the inside diameter of the conduit, but not less than 15.9 mm (5/8 inch), shall form a vapor-tight fit, without voids and be tested in accordance with the UL 1203 Leakage Test on Factory-Installed Conduit Seals test method.

Note: For a vapor-tight fit, it may be necessary to split open the sheath of shielded and multiconductor cables so the compound can be poured around individual conductors.

21.11 The ends of all conduit lengths, including nipples, shall be chamfered after threading to remove burrs or sharp edges.

21.12 A splice in wiring shall be located only in a junction box or the equivalent. A splice shall be made mechanically and electrically secure and be soldered unless a wire connector is used. A joint shall be covered with insulation that has been determined to be equivalent to that on the conductors.

21.13 Circuits for lighting and for motors shall be identified in the junction box provided for field connections.

22 Locking Mechanism

22.1 A dispensing device shall be provided with means for locking each hose-nozzle or fuel-transfer valve. If the locking means depends upon the use of an ordinary padlock, the padlock (considered to have a 6.4 mm (1/4 inch) minimum diameter shackle) need not be supplied by the manufacturer as part of the equipment.

23 Lighting, Electrical, and Electronic Equipment Mounted on a Dispenser

23.1 The requirements in 23.2, 23.3, and 23.4 apply to lighting, electrical, and electronic equipment that is mounted on a dispenser.

23.2 A sign shall comply with the applicable construction and performance:

a) In the United States: Standard for Electric Signs, UL 48;

b) In Canada: Portable and stationary electric signs and displays, CSA C22.2 No. 207.

23.3 The equipment shall comply with outdoor use requirements for such components. The equipment shall be in a raintight enclosure or otherwise protected to reduce the risk of water entering a lampholder or the enclosure for electrical and electronic equipment.

23.4 Lighting, electrical, and electronic equipment shall be completely isolated from the Class I, Group D, Division 1 or Zone 1, Group IIA hazardous location in the dispenser by means such as air gaps, solid vapor-tight partitions, or vapor-explosion seals. Such equipment shall be suitable for installation in a Class I, Group D, Division 2 or Zone 2, Group IIA hazardous location in accordance with:

a) In the United States: Standard for Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations, UL 121201, or Standard for Nonincendive electrical equipment for use in Class I and II, Division 2 or, for equipment for use in Zone 2 hazardous (classified) locations, Standard for Explosive atmospheres – Part 15: Equipment protection by type of protection "n", UL 60079-15;

b) In Canada: Nonincendive electrical equipment for use in Class I and II, Division 2 and Class III, Divisions 1 and 2 hazardous (classified) locations, CSA C22.2 No. 213, and Explosive atmospheres – Part 15: Equipment protection by type of protection "n", CAN/CSA C22.2 No. 60079-15.

PERFORMANCE

24 General

24.1 Representative samples of a dispensing device and its component parts shall comply with the tests described in Sections 25 – 35.

24.2 Endurance tests shall be conducted with propane, butane, or n-hexane as the test medium. The source of aerostatic pressure, shall be air, nitrogen, or carbon dioxide gas.

24.3 Hydrostatic strength tests shall be conducted using water or other liquid to develop the required pressure. See the Hydrostatic Strength Test, Section 27.

25 Endurance Test

25.1 Mechanical shaft seal

25.1.1 A mechanical shaft seal shall not seize, leak, or otherwise malfunction during operation when tested as specified in 25.1.2.

25.1.2 The assembly shall be operated continuously for 300 h; 50 h at a pressure just under the maximum operating pressure to which it will be subjected in use, and 250 h at a pressure of 20 % of the maximum operating pressure. Operating parts shall be kept wet during the test by maintaining a flow of liquid.

25.2 Retrieving mechanism

25.2.1 A retrieving mechanism provided for an extra-long hose that is supplied entirely outside the housing shall not show evidence of damage when tested as specified in 25.2.2. Any clamp or fitting for attachment to the hose shall not damage the hose during this test.

25.2.2 A retrieving mechanism equipped with the hose shall be operated through 35,000 withdrawal-and-return cycles. The hose need not contain liquid during this test.

25.3 Nozzle boot assembly endurance test

25.3.1 The nozzle boot assembly shall not seize, show excessive wear, have breakage, or otherwise malfunction during operation when tested as specified in 25.3.2. If the spring does not provide boot control, it may be replaced as needed if it breaks.

25.3.2 A sample of the nozzle boot assembly shall be operated continuously for a total of 100,000 cycles through its full travel on the lift-to-start (or flapper) mechanism and shall also be continuously monitored on the magnetic dry contact nozzle switch to determine that it is operational throughout the test.

26 High-Pressure Leakage Test

26.1 A mechanical-shaft seal and any other liquid-handling part, including any joint made in the assembly of the complete dispensing device, shall not leak when subjected to an aerostatic pressure of 3.62 MPa (525 psig) for at least 1 min.

26.2 This test shall be conducted following and using the same samples as used for the Endurance Test, Section 25.

27 Hydrostatic Strength Test

27.1 A liquid-handling part of the dispensing device shall withstand for at least 1 min, without rupture, an internal hydrostatic pressure of 12.07 MPa (1750 psig).

Note: A mechanical shaft seal need not be subjected to this test.

28 Moist Ammonia-Air Stress Cracking Test

28.1 After being subjected to the conditions described in 28.2 – 28.4, a pressure confining brass part containing more than 15 % zinc shall:

a) Show no evidence of cracking, delamination, or degradation; or

b) Perform as intended when tested as described in 28.4.

28.2 One test sample of each size shall be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Samples with female threads, intended to be used for installing the product in the field, shall have the threads engaged and tightened as specified in Table 34.1. Samples with female threads other than tapered pipe threads shall be torqued as specified by the manufacturer. Polytetrafluoethylene (PTFE) tape or pipe compound shall not be used on any threads. Samples with male threads are evaluated as received.

28.3 The samples shall then be tested in accordance with Apparatus, Reagents and Materials, Test Media, Test Sample Preparation, Test Procedure of the Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys, ASTM B858, except the pH level of the test solution shall be high, 10.5 ±0.1, and the exposure temperature shall be 25 ±1 °C (77 ±2 °F).

28.4 After the exposure period, the samples shall be examined for cracks or other signs of stress corrosion using a microscope having a magnification of 25X. Pressure-confining parts exhibiting degradation as indicated in 28.1 as a result of the test exposure described in 28.2 and 28.3 shall withstand, without rupture, a hydrostatic test pressure of five times the rated pressure of the valve, for at least 1 minute.

29 Float Crushing Test

29.1 A hollow float shall not leak when immersed in water as described in 29.2 and shall withstand for at least 1 min an external pressure of 5.17 MPa (750 psig) without distortion.

29.2 Two samples of a hollow float shall be tested using the following method.

a) Each float shall be checked for leakage by being suddenly immersed into water heated to just below the boiling point and observed for at least 3 min for the appearance of bubbles. If no leakage is noted, proceed to the next step.

b) Each float shall then be placed in a container of appropriate size and strength. The container shall be connected to a source of hydrostatic pressure, and a calibrated pressure gauge shall be installed in the pressure-supply piping. Care shall be taken to completely fill the container with liquid to expel all air.

c) The pressure shall then be increased slowly to 5.17 MPa (750 psig) and held for at least 1 min.

d) The floats shall then be removed from the container and examined for distortion.

30 Marking Adhesion Test

30.1 Following the tests described in 30.2 and 30.3, the labels shall comply with the requirements for permanence and legibility in the Standard for Marking and Labeling Systems, UL 969, or Adhesive Labels, CSA C22.2 No. 0.15.

30.2 Representative samples of a pressure-sensitive label, or a label secured by cement or adhesive, shall be subjected to exposure conditions for indoor use (standard atmosphere, water immersion, and oven aging) or, if applicable, to exposure conditions for outdoor use (the above plus low temperature and ultraviolet light and water exposure), to determine compliance with the applicable requirements for permanence and legibility in the Standard for Marking and Labeling Systems, UL 969, or Adhesive Labels, CSA C22.2 No. 0.15.

30.3 If the labels are exposed to unusual conditions in service (such as motor fuels, oils, detergents, and the like), representative samples shall be subjected to an additional immersion test. This test shall be conducted in the same manner as the immersion test described in the Standard for Marking and Labeling Systems, UL 969, or CSA C22.2 No. 0.15, except that the samples shall be immersed in a solution representative of service use instead of in demineralized water. For exposure to detergents, the solution shall consist of a mixture of 25 g of a commercial detergent per liter of water.

31 Volume-Change Test

31.1 An elastomeric part in contact with the fluid handled shall not have a volume change of more than 25 % swelling or more than 1 % shrinkage when subjected to a volume-change test. The test is to be conducted using the method described in the Standard Test Method for Rubber Property – Effect of Liquids, ASTM D471, except that it shall be modified as described in 31.2.

31.2 The tests shall be conducted at a temperature of 23 ±2 °C (73 ±4 °F) using n-hexane as the test liquid. Three specimens shall be used in each test. Each specimen shall be placed on a small-diameter wire hook. Its volume shall then be determined by weighing first in air (M_1) and then in water (M_2). The specimens then shall be wiped dry and placed in the test liquid. After 70 h, the specimens shall be removed from the liquid one at a time, immediately wiped dry, and weighed in air while on the same hook (M_3). The weight shall be obtained within 30 s after removal of the specimens from the test liquid. The final weight in water (M_4) shall be determined immediately thereafter. Before determination of the weights in water (M_2 and M_4), each specimen shall be dipped in ethyl alcohol, then dipped in water to eliminate surface air bubbles. The change in volume shall be calculated as follows, with the results reported as the average of the three specimens tested:

$$Volume\ Change\ (\%) = \frac{(M_3 - M_4) - (M_1 - M_2) \times 100}{(M_1 - M_2)}$$

32 Weight-Loss Test

32.1 An elastomeric part in contact with the fluid handled shall not have a weight loss (extraction) of more than 10 % when subjected to a weight-loss test. The test shall be conducted using the method described in the Standard Test Method for Rubber Property – Effect of Liquids, ASTM D471, except that it shall be modified as described in 32.2.

32.2 The test shall be conducted at the same time and using the same specimens and test liquid as for the Volume-Change Test, Section 31. For this test, each specimen shall be weighed on a balance pan, in air, to the nearest milligram (M_1) prior to immersion in the test liquid. After a 70 h immersion, and after the weight determinations needed for the volume-change calculation, the specimens shall be allowed to reach constant weight by conditioning in air at a temperature of 23 ±2 °C (73 ±4 °F) for at least 70 h. The specimens shall then be weighed in air (M_2). The loss in weight shall be calculated as follows and the results reported as the average of the three specimens tested:

$$Weight\ Loss\ (\%) = \frac{(M_1 - M_2) \times 100}{M_1}$$