JOINT CANADA – UNITED STATES NATIONAL STANDARD

ANSI/CAN/UL 87B:2024

STANDARD FOR SAFETY

Power-Operated Dispensing Devices for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil

ANSI/UL 87B-2024

SCC FOREWORD

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UL Standard for Safety for Power-Operated Dispensing Devices for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil, ANSI/CAN/UL 87B

Second Edition, Dated May 31, 2024

Summary of Topics

This new Second Edition of ANSI/CAN/UL 87B dated May 31, 2024 is being issued as a new joint US/Canada Standard reflecting the latest ANSI and SCC approval dates and incorporating the proposal dated September 29, 2023.

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 29, 2023.

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ANSI/UL 87B-2024

MAY 31, 2024

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ANSI/CAN/UL 87B:2024

Standard for Power-Operated Dispensing Devices for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil

Prior to the first edition, the requirements for the products covered by this Standard were included in the Outline of Investigation for Power-Operated Dispensing Devices for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil, UL 87B.

First Edition – February, 2015

Second Edition

May 31, 2024

This ANSI/CAN/UL Safety Standard consists of the Second Edition.

The most recent designation of ANSI/UL 87B an American National Standard (ANSI) occurred on May 31, 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 31, 2024.

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Preface

This is the Second Edition of the ANSI/CAN/UL 87B, Standard for Power-Operated Dispensing Devices for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil.

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

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL 87B 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.

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

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 Second Edition joint American National Standard and National Standard of Canada is based on, and now supersedes, the First Edition of UL 87B.

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

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This Edition of the Standard has been formally approved by the Technical Committee (TC) on Power Operated Dispensing Devices For Petroleum Products, TC 87.

This list represents the TC 87 membership when the final text in this Standard was balloted. Since that time, changes in the membership may have occurred.

TC 87 Membership

Name	Representing	Interest Category	Region
D. Boyd	BP America Inc.	Commercial / Industrial User	USA
C. Cranford	Gilbarco Inc.	Producer	USA
M. Ebert	Fill-Right Company	Producer	USA
W. Fiske	Intertek Testing Services	Testing & Standards Org.	USA

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TC 87 Membership Continued

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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 These requirements apply to power-operated dispensing devices, rated 600 V ac or less, for use with fuels. Fuels, as defined by these requirements, include one or more of the fuels described in 1.3.

1.2 Power-Operated Dispensing Devices for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil shall be constructed to comply with the following:

a) In the United States:

1) The requirements defined in the Standard for Power-Operated Dispensing Devices for Petroleum Products, UL 87, and

2) The requirements in this Standard.

b) In Canada:

1) The requirements defined in the Standard for Power-Operated Dispensing Devices for Flammable Liquids, CSA B346;

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

3) The requirements in this Standard.

1.3 Dispensing devices covered by these requirements are intended for use with one or more of the following:

a) Diesel fuel, which includes renewable diesel and diesel fuel/biodiesel blends with nominal biodiesel concentrations up to and including 5 % (B0 – B5) formulated in accordance with the Standard Specification for Diesel Fuel Oils, ASTM D975.

b) Diesel/biodiesel, renewable diesel/biodiesel blends, with nominal biodiesel concentrations from 5 % up to 20 % (B6 – B20) formulated in accordance with the Standard Specification for Diesel Fuel Oil, Biodiesel Blends (B6 – B20), ASTM D7467.

c) Biodiesel (B99.9/B100) formulated in accordance with the Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels, ASTM D6751.

d) Kerosene formulated in accordance with the Standard Specification for Kerosine, ASTM D3699.

e) Fuel Oil (heating oil) formulated in accordance with the Standard Specification for Fuel Oils, ASTM D396.

1.4 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) Flammable and Combustible Liquids Code, NFPA 30;

2) Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA 30A;

3) National Electrical Code, NFPA 70.

b) In Canada:

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

2) The National Fire Code of Canada;

3) Provincial or other Regulations.

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

1.6 These requirements do not apply to control equipment that may authorize, monitor, or interrupt operation of a power-operated dispensing device, nor other auxiliary equipment. These products would be covered under the Standard for Control Equipment for Use with Flammable Liquid Dispensing Devices, UL 1238.

1.7 These requirements do not cover dispensing devices for use with gasoline or gasoline/ethanol blends of any concentration. These dispensing devices are covered under the Standard for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85), UL 87A.

1.8 These requirements do not cover dispensing devices for use with LP-Gas, which are covered under the Standard for Power-Operated LP-Gas Dispensing Equipment, UL 495.

1.9 These requirements do not cover equipment intended for diesel/biodiesel blends with a biodiesel concentration between B20 and B99.9/B100.

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.

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

3 Units of measurement

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

4 Referenced Publications

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

4.2 The following publications are referenced in this Standard:

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

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

ASTM A653/A653M, *Specification for Sheet Steel, Zinc Coated (Galvanized) or Zinc-Iron-Alloy Coated (Galvannealed) by the Hot Dip Process*

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

ASTM D396, *Standard Specification for Fuel Oils*

ASTM D471, *Standard Test Method for Rubber Property – Effects of Liquids*

ASTM D975, *Standard Specification for Diesel Fuel Oils*

ASTM D3699, *Standard Specification for Kerosine*

ASTM D6751, *Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels*

ASTM D7467, *Standard Specification for Diesel Fuel Oil, Biodiesel Blends (B6 – B20)*

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

CSA 12.4, *Power-Operated LP-Gas Dispensing Equipment*

CSA B346, *Power-operated dispensing devices for flammable liquids*

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

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

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

CSA C22.2 No. 22, *Electrical equipment for flammable and combustible fuel dispensers*

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"*

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

NFPA 30, *Flammable and Combustible Liquids Code*

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*

NFPA 70, *National Electrical Code*

NFC, *National Fire Code of Canada*

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/ULC 25B, *Meters for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

UL 48, *Electric Signs*

UL/ULC 79B, *Power-Operated Pumps for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

UL 87A, *Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent (E0 – E85)*

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

UL 157, *Gaskets and Seals*

UL 330B, *Hose and Hose Assemblies for Dispensing Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

UL/ULC 331B, *Strainers for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

UL 428B, *Electrically Operated Valves for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations Up to 20 Percent (B20), Kerosene, and Fuel Oil*

UL 486A-486B, *Wire Connectors*

UL/ULC 567B, *Emergency Breakaway Fittings, Swivel Connectors, and Pipe Connection Fittings for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

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

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 495, *Power-Operated LP-Gas Dispensing Equipment*

UL/ULC 842B, *Valves for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

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

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

UL 969, *Marking and Labeling Systems*

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

UL 1332, *Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment*

UL/ULC 2586B, *Hose Nozzle Valves for Diesel Fuel, Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 Percent (B20), Kerosene, and Fuel Oil*

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*

5 Glossary

5.1 For the purpose of this Standard, the following definitions apply.

5.2 AIR GAP –

a) In the United States: A minimum 25.4 mm (1 in) free air space between planes of Division 1, Division 2, Zone 1, or Zone 2 hazardous locations and unclassified areas of a dispensing device. The air gap is intended to reduce the entry of flammable gases or vapors into unclassified areas.

b) In Canada: A minimum 25.4 mm (1 in) free air space between planes of Division 1 or Zone 1 and Division 2 or Zone 2 hazardous locations below 1.2 m (4 ft) of the base of the dispensing device. The air gap is intended to reduce the entry of flammable gases or vapors into unclassified or lower classification areas.

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

5.4 BASE – The part of the assembly that is intended to be secured to the foundation on which the device will be installed.

5.5 Refer to the definitions in NFPA 30A or CSA C22.1, for the applicable definition to these hazardous locations. For the purposes 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 or Zone 1 –

1) The area within a dispenser housing up to 1.2 m (4 ft) vertically above the base, except for that area defined as Division 2, Zone 2, or unclassified.

2) Any area within a nozzle boot.

b) Class I, Group D, Division 2 or Zone 2 –

1) Areas within a dispenser housing above the Division 1 area.

2) The area surrounding the dispenser housing within 457 mm (18 in) horizontally in all directions from the Division 1 or Zone 1 area located within the housing.

3) The area within 457 mm (18 in) horizontally, in all directions from the opening of a nozzle boot not isolated by a vapor tight partition, except that the area is not required to be extended around a 90 degree or greater corner.

See Figure 5.1 and Figure 5.2 for an illustration of Class I hazardous locations.

Figure 5.1

Hazardous Location Classification Within a Typical Dispenser

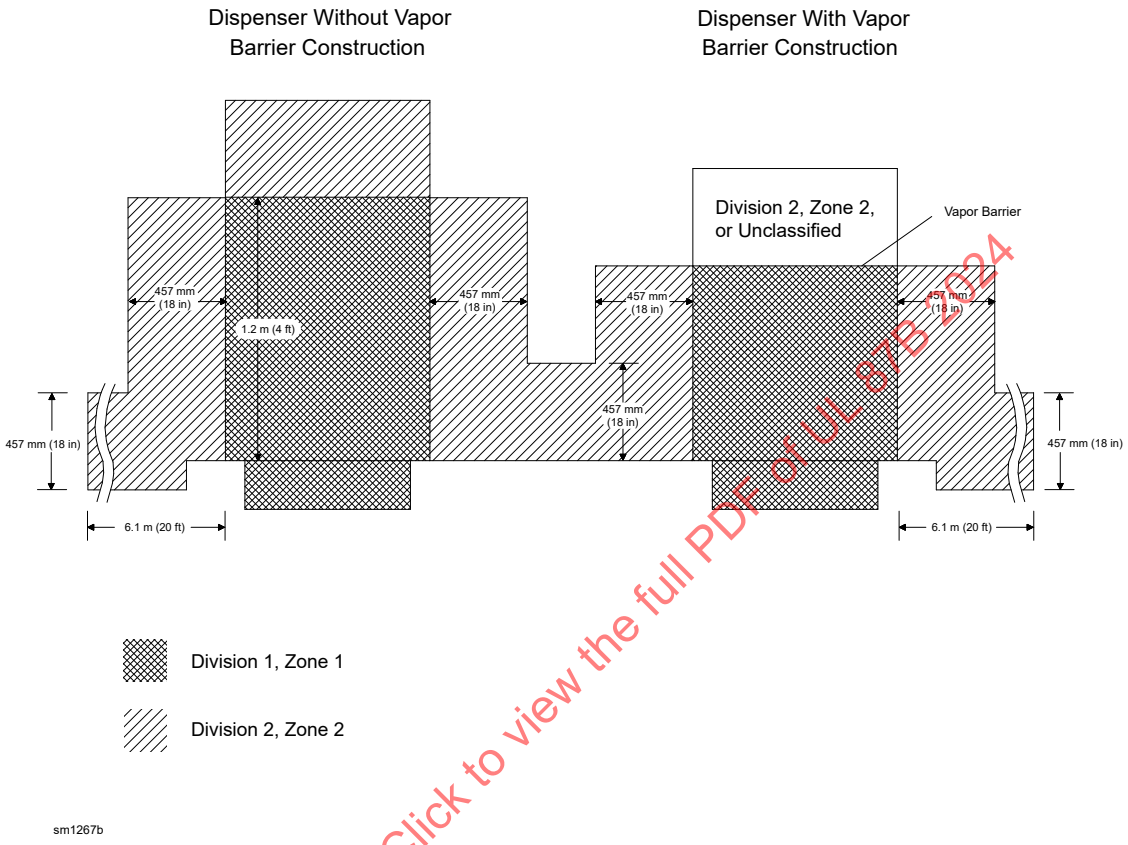
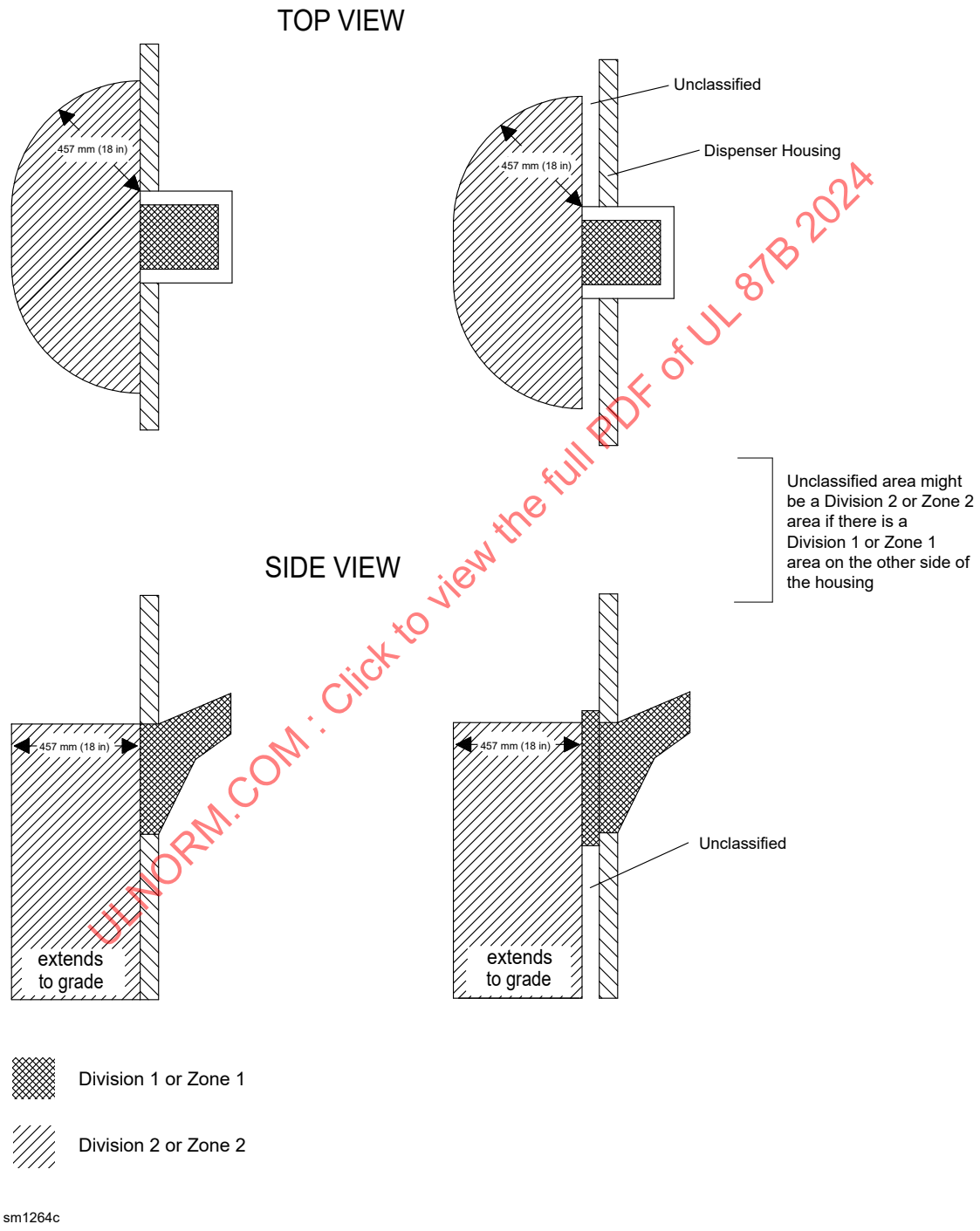


Figure 5.2

Hazardous Location Classifications Associated With a Hose Nozzle Boot



5.6 DISPENSER, REMOTE CONTROL TYPE – A dispensing device that does not contain a power-operated pump as part of the assembly, and which is intended for connection to a fluid piping system containing the power-operated pumps at a remote location. Also commonly identified as a “dispenser”.

5.7 DISPENSER, SELF-CONTAINED – A dispensing device that includes a power-operated pump as part of the assembly. Also commonly identified as a “pump” or “suction dispenser”.

5.8 DISPENSING DEVICE – A product consisting of various components as applicable, which are used to control and meter the flow of liquid from an upstream storage device.

5.9 ELECTRICAL CIRCUITS –

a) High Voltage Circuit – A circuit having a potential of not more than 600 volts and having circuit characteristics in excess of those of a low voltage or Class 2 circuit.

b) Low Voltage Circuit – A circuit involving a potential of not more than 30 volts ac (rms) (42.4 volts peak or dc) and

1) Supplied by a Class 2 transformer, or by a battery, by a battery and fixed impedance, or by a transformer and fixed impedance each of which, as a unit, is in compliance with what is required for a Class 2 transformer, or

2) Limited to a maximum of 100 volt-amperes.

A circuit derived from a source of supply classified as a high voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low voltage circuit.

c) Intrinsically Safe Circuit – A circuit incapable of releasing sufficient electrical energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture. Abnormal conditions include unintentional damage to any part of the equipment or wiring, insulation or other malfunction of electrical components, application of overvoltage, adjustment and maintenance operations, and other similar conditions.

5.10 DIESEL/BIODIESEL BLENDS – Blended fuels composed of a diesel component and a biodiesel component. The numerical value corresponding to the biodiesel component determines the blend rating (such as B20 for 20 % biodiesel, 80 % diesel).

5.11 HANGING HARDWARE – The portion of the dispensing device that is connected to the outlet of the dispenser and consists of a hose assembly and hose nozzle valve, and with emergency breakaway couplings and swivel connectors as needed.

5.12 HOUSING – That section of the device that encloses and is intended to protect operating parts, control mechanisms, or other mechanical or electrical components, the damage of which would render the device incapable of being operated as intended, lead to tampering, introduce the possibility of escape of liquid, or expose bare live electrical parts.

5.13 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.

5.14 MASTER-SATELLITE DISPENSER COMBINATION – Consists of two or more dispensing devices. The “Master” dispenser controls the dispensing operation; the “Satellite” dispenser actually dispenses as well, but is not used to control the dispensing function.

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

5.16 PANEL – A principal section of a housing or enclosure. A mounting arrangement for control and other components.

5.17 PEDESTAL – That part of the structure above the base which supports the component units, and to which they are attached.

5.18 PUMPING UNIT – A power-operated pump for diesel or diesel/biodiesel blends, which may incorporate a strainer, air separator, relief device, or other auxiliary part.

5.19 SEALS, DYNAMIC – A seal that is subject to mechanical movement or other applied forces that result in movement or flexing of the seal under normal use conditions.

5.20 SEALS, STATIC – A seal that is not subject to mechanical movement or other applied forces other than compressing forces that are applied during installation and maintained during normal use conditions.

5.21 UNCLASSIFIED AREA – In the United States: An area within a dispenser housing isolated from Division 1, Division 2, Zone 1, or Zone 2 locations by a vapor barrier or a solid nozzle boot, but not completely surrounded by a Division 1 or Division 2 area, that does not contain a level of flammable gases or vapors that are capable of producing explosive or ignitable mixtures.

5.22 VAPOR BARRIER –

a) In the United States: A solid, unpierced partition located between Division 1, Division 2, Zone 1, or Zone 2 locations and unclassified areas of a dispensing device. The vapor barrier is intended to reduce the entry of flammable gases or vapors into unclassified areas.

b) In Canada: A solid, unpierced partition located between Division 1 or Zone 1 and Division 2 or Zone 2 hazardous locations below 1.2 m (4 ft) of the base of the dispensing device. The vapor barrier is intended to reduce the entry of flammable gases or vapors into unclassified or lower classification areas.

CONSTRUCTION

6 General Construction

6.1 General

6.1.1 A power-operated dispensing device includes, as needed a base, housing or pedestal, power-operated pump, pressure relief device, strainer, meter, valves as required, hose, hose nozzle valve, motor control, locking mechanism, piping, electrical wiring, and fixtures. The pump may be integral with the dispensing device, or the dispensing device may be designed for use with a separate pump.

6.1.2 A dispensing device may be of the self-contained type with components mounted in a common pedestal and housing, or it may comprise separate assemblies intended for installation as individual units but in conjunction with each other.

6.1.3 Devices having self-contained pumping units are judged on the use of suction lifts of not less than 2 ft (61 cm).

6.1.4 The construction shall be such that parts can be replaced or reassembled to function as intended after being dismantled.

6.1.5 The device shall incorporate provisions for support independent of piping, tubing, or conduit that may be connected thereto.

6.1.6 Fluid confining parts, except gaskets, seals, or hoses, shall be constructed of metallic materials.

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

6.1.8 Fluid-handling piping systems and equipment shall have a maximum allowable working pressure (MAWP) of not less than 345 kPa (50 psi).

6.2 Hose assemblies

6.2.1 A dispensing device may be furnished without a hose assembly. The dispenser shall be marked in accordance with 45.1.1(c) whether the hose assembly is furnished or not.

6.2.2 When the hose is located inside the housing, the assembly shall be such that electrical parts will not be sprayed with liquid in the case of hose leakage. In a weighted loop application, provision shall be made to prevent the weight from pulling on the hose coupling.

6.3 Strainers

6.3.1 A dispensing device shall be provided with at least one strainer. The strainer shall comply with Strainers, Section 14. The strainer or strainer assembly shall be constructed and located to permit the removal and replacement of the straining element without breaking liquid lines or disturbing any part of the dispensing device assembly and to permit ready access for cleaning with minimum spillage of fluid.

6.4 Electrically operated valves

6.4.1 A dispensing device for use in a remote control system, or a single inlet dual outlet self-contained dispensing device, incorporating only one pump, shall have in each discharge line a shutoff valve that closes at the time or before the hose nozzle valve is hung in place on the device.

6.4.2 A power-operated dispensing device of the self-contained single outlet type is not required to be equipped with a shutoff valve as specified in 6.4.1.

6.4.3 A plug or rotating disc type valve employing the bearing surface of the plug or disc as the liquid seal to the exterior of the valve body shall not be used in liquid lines.

6.4.4 An electrically operated shutoff valve shall close upon being de-energized, regardless of the position of any operating lever or reset handle.

6.4.5 Valves, as needed, are required in the construction of dispensing devices in order to maintain system priming thereby minimizing the risk of seal dry out.

6.5 Hose nozzle valve

6.5.1 A dispensing device may be furnished without a hose nozzle valve provided it is marked in accordance with 45.1.1(c).

6.6 Mechanically operated valves

6.6.1 A plug or rotating disc type valve, employing the bearing surface of the plug or disc as the liquid seal to the exterior of the valve body, shall not be used in liquid lines.

6.6.2 A petcock or other manually operated valve shall not be provided, which when open, permits the discharge of fluid.

7 Materials

7.1 Metallic materials

7.1.1 General

7.1.1.1 A metallic part, in contact with the fuels anticipated by these requirements, shall be resistant to the action of the fuel if degradation of the material will result in leakage of the fuel or if it will impair the function of the device. See the Long Term Exposure Test, Section 30.

7.1.1.2 The exposed surfaces of metallic parts shall be resistant to atmospheric corrosion if this corrosion will lead to leakage of the fluid or if it will impair the function of the device. The material shall comply with the requirements in Atmospheric corrosion, 7.1.2.2.

7.1.1.3 Metallic parts in contact with the fuels anticipated by these requirements shall not be constructed of lead, or materials that are substantially lead. In addition, no coatings or platings containing lead shall be used, such as terne-plated steel.

7.1.1.4 With reference to the above requirements, metallic parts include metallic materials used to form fluid confining parts as well as metallic coatings or plating that may be applied to a base material.

7.1.2 Atmospheric corrosion

7.1.2.1 Metallic materials used for fluid confining parts shall be resistant to atmospheric corrosion. In addition, metallic materials that are required to operate to address safety (e.g. thermal links on shear valves) shall be resistant to atmospheric corrosion. Ferrous materials of the thickness specified in the following items are acceptable for the preceding when uncoated:

a) A casting having a wall thickness of not less than 6.4 mm (1/4 in) if shown by production test to be free of leakage;

b) Standard pipe and fittings conforming to ASME B36.10M; and

c) Fabricated sheet steel parts having a minimum wall thickness of 2.36 mm (0.093 in).

7.1.2.2 A protective coating shall provide resistance against atmospheric corrosion to a degree not less than that provided by the protective coatings specified in 7.1.2.3.

7.1.2.3 Cadmium plating shall not be less than 0.008 mm (0.0003 in) thick, and zinc plating shall not be less than 0.013 mm (0.0005 in) 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 in) thick. Metallic parts are considered to comply with 7.1.2.1 when they are protected against atmospheric corrosion by:

a) Hot dipped, mill galvanized sheet steel complying with the coating designation G90 in Table I of ASTM A653/A653M; or

b) Coatings which have been determined to be equivalent to G90 under the requirements of UL 1332.

7.1.2.4 A metallic material other than as described in 7.1.2.1 – 7.1.2.3 shall be painted or protected in a manner that has been determined to be equivalent.

7.2 Nonmetallic materials

7.2.1 General

7.2.1.1 A nonmetallic part in contact with the fuels anticipated by these requirements, shall be resistant to the action of the fuel if degradation of the material will result in leakage of the fuel, or if it will impair the function of the device.

7.2.1.2 Gaskets or seals shall be designated as dynamic and/or static seals. See 5.19 and 5.20 respectively. If the type of seal cannot be determined, then the material shall be treated as both a static and a dynamic seal.

7.2.1.3 Gaskets and seals shall comply with the requirements as outlined in Nonmetallic materials – material level, 7.2.2 and Materials – system level, 7.3.

7.2.1.4 Materials used in the construction of hoses shall comply with Hose Assemblies, Section 18.

7.2.1.5 Nonmetallic materials in contact with the fuels anticipated by these requirements shall not be constructed of the following:

a) Polysulfide rubber;

b) Ethylene propylene diene monomer (EPDM) rubber;

c) Methyl-Methacrylate;

d) Polyvinyl Chloride (PVC);

e) Nylon 6/6; or

f) Polyurethane.

7.2.2 Nonmetallic materials – material level

7.2.2.1 Static seals

7.2.2.1.1 Static seals shall be evaluated in accordance with UL 157, modified as indicated in 7.2.2.1.2 – 7.2.2.1.4. If a specific material complies with these requirements, the material can be considered to be qualified for system testing.

7.2.2.1.2 A static seal shall be constructed of a material that is acceptable in accordance with the scope of UL 157.

7.2.2.1.3 Static seals shall be subjected to the Volume Change and Extraction Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 h;

b) The applicable test fluids shall be as described in Annex A; and

c) For all materials, the average volume change shall not exceed 40 % swell (increase in volume) or 1 % shrinkage (decrease in volume). In addition, the weight loss shall not exceed 10 %. For coated fabrics, alternate limits can be used with the average volume change not exceeding 60 % swell or 5 % shrinkage, and the weight loss shall not exceed 20 %. There shall be no visual evidence of cracking or other degradation as a result of the exposure for any material including coated fabrics.

7.2.2.1.4 Static seals shall be subjected to the Compression Set Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 h.

b) The samples shall be immersed, at room temperature, in the test fluids (see item c) while compressed for the entire test duration. No oven conditioning is required.

c) The applicable test fluids shall be as described in Annex A.

d) The recovery period shall consist of removing the sample from the compression device and immersing it in the applicable test fluid for 30 min at room temperature. The sample shall not be allowed to dry out due to exposure to air. The 30-min immersion should use the same fluid as the test fluid for each sample.

e) For all materials, the average compressions set is calculated and shall not exceed 35 %. For coated fabrics, alternate limits can be used with the average compression set not exceeding 70 %.

Exception: This requirement does not apply to composite gasket or thermoplastic materials as defined in accordance with UL 157.

7.2.2.2 Dynamic seals

7.2.2.2.1 Dynamic seals shall be evaluated in accordance with UL 157 modified as indicated in 7.2.2.2.2 – 7.2.2.2.4. If a specific material complies with these requirements, the material can be considered to be qualified for system testing.

7.2.2.2.2 A dynamic seal shall be constructed of a material that is acceptable in accordance with the scope of UL 157.

7.2.2.2.3 Dynamic seals shall be subjected to the Volume Change and Extraction Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 h;

b) The applicable test fluids shall be as described in Annex A; and

c) For all materials, the average volume change for a gasket or seal material shall not exceed 40 % swell (increase in volume) or 1 % shrinkage (decrease in volume). In addition, the weight loss shall not exceed 10 %. For coated fabrics, alternate limits can be used with the average volume change not exceeding 60 % swell or 5 % shrinkage, and the weight loss shall not exceed 20 %. There shall be no visual evidence of cracking or other degradation as a result of the exposure for any material including coated fabrics.

7.2.2.2.4 Dynamic seals shall be subjected to the Tensile Strength and Elongation Test in accordance with UL 157, except for the following modifications:

a) The test duration shall be 1000 h;

b) The applicable test fluids shall be as described in Annex A; and

c) For all materials, the average tensile strength and the average elongation of materials shall not be less than 60 % of the as-received values. For coated fabrics, alternate limits can be used with the average tensile strength and the average elongation not less than 30 % of the as-received values.

7.3 Materials – system level

7.3.1 For all materials, gaskets and seals that have been shown to comply with the applicable requirements for static seals in UL 157, along with the exceptions as noted in 7.2.2.1, the requirements of the Long Term Exposure Test, Section 30 shall be waived.

7.4 Casting impregnation materials

7.4.1 Material level

7.4.1.1 The material shall be subjected to an infrared spectrum analysis in accordance with UL 746A.

7.4.2 System level

7.4.2.1 The casting impregnation material, applied as intended to a casting, shall comply with the Long Term Exposure Test, Section 30. The casting shall not show indications of porosity leakage at any point during or after this test.

7.5 Internal parts

7.5.1 Nonmetallic parts located internally to a fluid confining part, degradation of which would not directly result in leakage, are not required to comply with Nonmetallic materials, 7.2. The part shall be tested in accordance with 7.5.2.

7.5.2 Internal nonmetallic parts shall be tested during the Long Term Exposure Test, Section 30. During this test, the part shall not degrade to the extent that visible particles can be observed in the drained fluid.

8 Frame and Enclosure

8.1 Base

8.1.1 The base shall be ordinary cast iron of 6.4 mm (1/4 in) minimum thickness, of commercial grade steel of 2.36 mm (0.093 in) minimum thickness, or of other materials or constructions that have been determined to be of equivalent strength.

8.1.2 The base shall be provided with bolt holes to accommodate bolts not less than 12.7 mm (1/2 in) diameter for anchoring the dispenser. At least two holes shall be provided if the dispenser is not more than 1.83 m (6 ft) tall and at least four holes if the dispenser is over 1.83 m (6 ft) tall. If two holes are provided, they shall be located on opposite sides of the base and at least 330 mm (13 in) apart. If more than two holes are provided, they shall be located approximately symmetrically on a bolt circle having a diameter of not less than 330 mm (13 in). The bolt holes shall be accessible, such as by being located in the base at the sides of the dispenser provided with doors or removable panels.

8.1.3 The requirement specified in 8.1.2 does not apply to a farm or non-retail type of dispenser of a special design, which includes other provisions for anchoring the dispenser.

8.2 Pedestal

8.2.1 The pedestal shall be made of cast iron, sheet steel, or of a framework consisting of angle iron, wrought iron, or steel pipe, or made of a construction that has been determined to be equivalent.

8.2.2 Piping carrying liquid shall not serve as part of the pedestal.

8.2.3 The pedestal shall provide strength and rigidity for the assembled structure. Provisions, such as by bolting or welding, shall be made to prevent loosening of joints of the pedestal. See 8.3.8.

8.3 Housing

8.3.1 Exposure of the assembly to the weather shall not interfere with the intended performance of the operating parts that it encloses. A recess or depression in the housing that may 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.

8.3.2 A part employed in a main side section of a housing shall be:

a) Sheet steel having a minimum thickness of 0.91 mm (0.036 in);

b) Stainless steel having a minimum thickness of 0.66 mm (0.026 in);

c) Unreinforced aluminum having a minimum thickness of 1.35 mm (0.053 in); or

d) Reinforced aluminum having a minimum thickness of 1.04 mm (0.041 in).

Glass shall not be used as a part employed in a main side section. Nonmetallic material can be used if it complies with 8.3.4 and 8.3.5.

8.3.3 A part employed in a main top section of a housing shall be:

a) Sheet steel having a minimum thickness of 0.79 mm (0.031 in);

b) Stainless steel having a minimum thickness of 0.58 mm (0.023 in);

c) Unreinforced aluminum having a minimum thickness of 1.19 mm (0.047 in); or

d) Reinforced aluminum having a minimum thickness of 0.91 mm (0.036 in).

Glass shall not be used as a part employed in a main side section. Nonmetallic material can be used if it complies with 8.3.4 and 8.3.5.

8.3.4 A principal section or panel of the housing shall not be fabricated of nonmetallic material unless the material can be shown to have equivalent strength to the materials shown in 8.2.3 and 8.3.3. In addition, the material shall comply with 8.3.5. This requirement does not apply in the case of a dial glass, a small display panel, or to main panels that do not comply with these requirements, but which are backed up by metal plates that do comply with these requirements.

8.3.5 Nonmetallic materials used as a principal section or panel of the housing shall comply with all of the following:

a) The material qualifies for a minimum flammability classification of HB as described in:

1) In the United States, UL 94;

2) In Canada 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 part of the basic dispensing pedestal;

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

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

8.3.6 Other metallic materials can be used as a part in a main top or side section, as long as they can be shown to have equivalent strength to the materials shown in 8.3.2 and 8.3.3.

8.3.7 When the housing also serves as a pedestal, it 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 does not affect strength, rigidity, or support.

8.3.8 The housing shall afford space for making field connections of fluid handling piping and electrical equipment. Openings with closures such as covers, panels, or similar parts, 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 planned to be removed by authorized persons for this purpose.

8.3.9 The housing assembly shall incorporate vent openings near the bottom, totaling an area of not less than 806 mm^2 (1-1/4 in^2), to permit the liberation of fuel vapors. These openings shall be of such size and arrangement as to avoid clogging.

8.3.10 Openings in the housing for the reception of hose nozzles, when they are not in use, shall be fitted with a nozzle guard or boot, constructed and positioned to drain to the outside of the housing, fluid which may escape from the nozzle.

9 Vapor Barrier

9.1 A dispensing device that requires the housing of electronic components within an unclassified, Division 2, or Zone 2 area as defined in 5.21 shall be provided with a vapor barrier that reduces the entry of flammable gases or vapors within the enclosure.

9.2 The construction of a vapor barrier shall be equivalent to an unpierced partition. This shall be accomplished by one of the following methods, which are shown in Figure 9.1, and include:

a) An unpierced panel;

b) Two or more panels that are welded together with continuous seams; or

c) Other means determined to be equivalent to an unpierced panel. See 9.3.

9.3 Vapor barriers that are constructed in accordance with 9.2(c) shall be evaluated to determine equivalency to an unpierced partition. The following are factors that shall be evaluated when determining equivalency:

a) Rigidity of the assembly and

b) Effectiveness of the assembly sealing against vapors.

9.4 Factors to be taken into consideration when evaluating the mechanical securement of the vapor barrier panels are:

a) The spacing and number of fasteners used to secure the panels; and

b) The thickness of the panels used for the vapor barrier.

9.5 A vapor barrier shall be fastened by one of the following methods:

a) A metallic bolt and nut with machined flat surfaces and redundant machined flat washers. Machined is defined as an additional process that assures that the surface is flat.

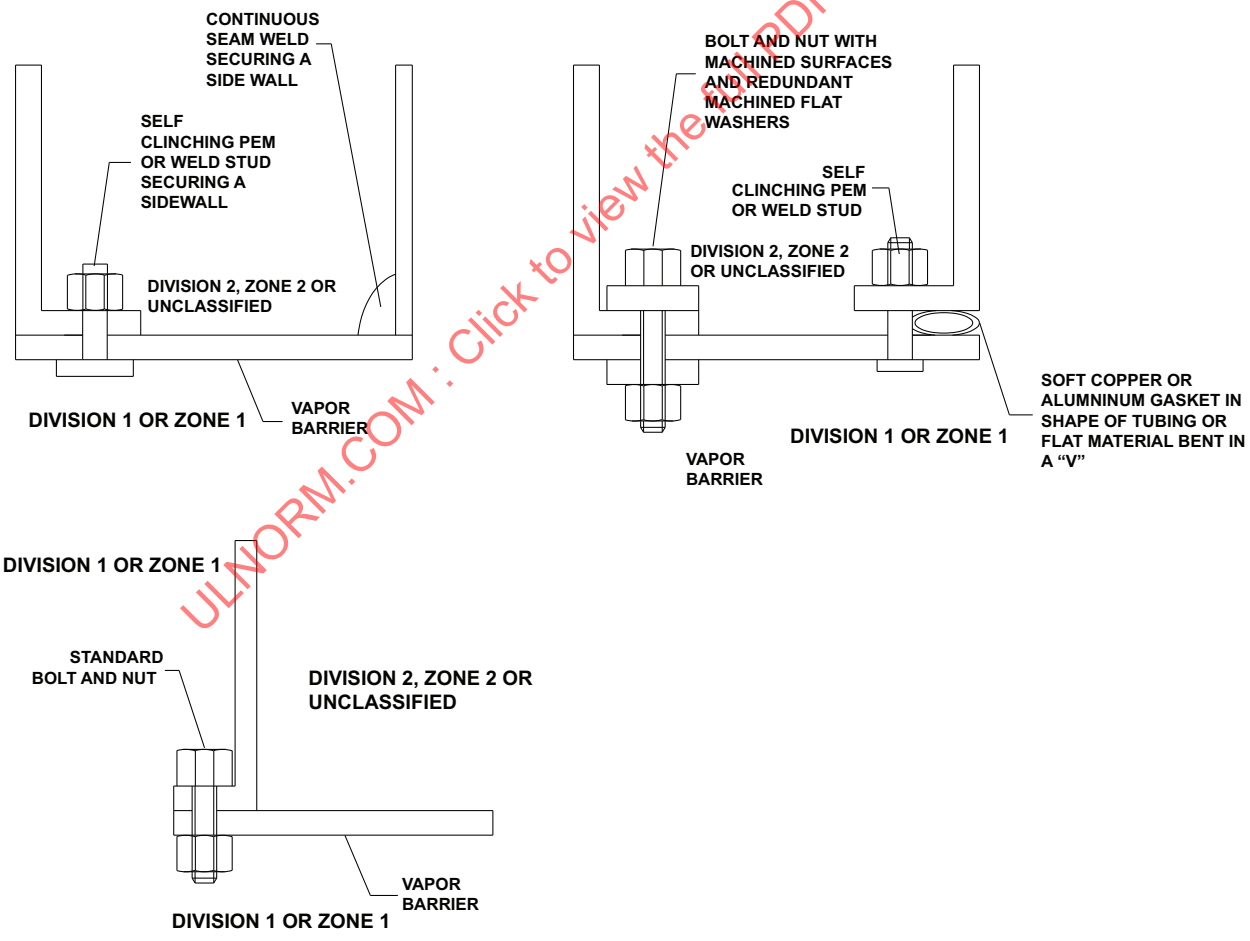
b) Metallic self-clining threaded PEM studs;

c) Metallic welded threaded studs; or

d) Other methods that meet the intent of (a) – (c).

Figure 9.1

Typical Vapor Barrier Construction



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9.6 Wiring which exits through the vapor barrier to a classified area shall be housed within rigid metal conduit when completing an explosion proof conduit system. Intrinsically safe wiring which exits through the vapor barrier to a classified area or wiring which exits through the vapor barrier to a Division 2 or Zone 2 classified area may be housed within assemblies that comply with 9.8. The exit means shall be provided with vapor/explosion seals as defined in 26.15.

9.7 The conduit seal shall be mechanically retained within the conduit when the conduit assembly completes an explosion proof conduit system.

9.8 Conduit or other assemblies, such as valves or pulsers, which exit the barrier, are required to be secured and sealed at the barrier with metallic bolts and nuts with machined flat surfaces and redundant machined flat washers.

Exception: Conduit and other assemblies that are secured and sealed at the vapor barrier by means other than that described above shall be evaluated to determine whether they comply with the intent of this requirement. The following are factors that shall be evaluated when determining compliance with the requirement:

a) Actual contact surface; and

b) Softness of the metal.

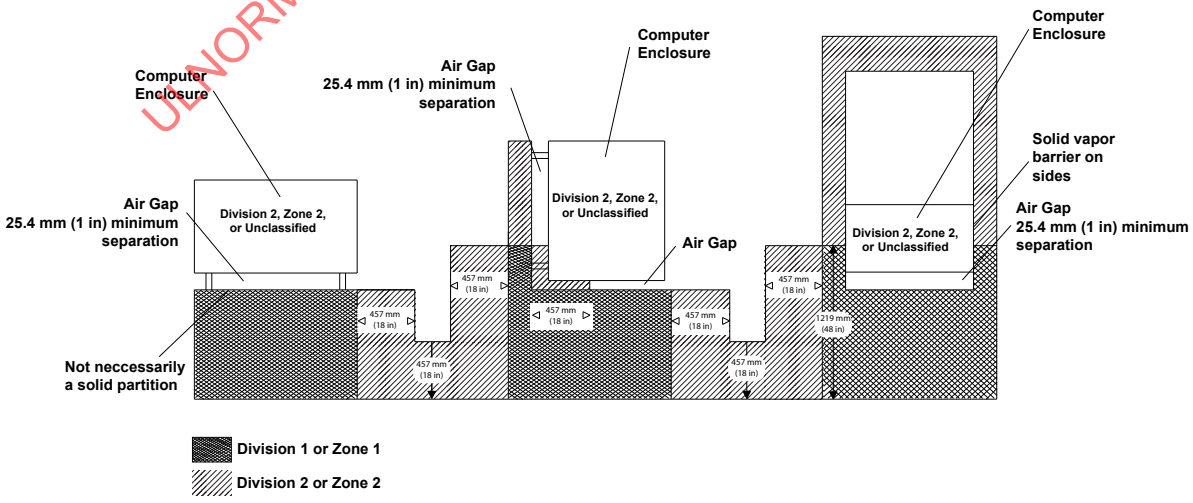
9.9 Unused openings in a vapor barrier shall be sealed in the same manner as described in 9.8.

10 Air Gap

10.1 Dispensing devices that requires the housing of electronic components within an unclassified, Division 2, or Zone 2 area as defined in 5.2 shall be provided with an air gap that reduces the entry of flammable gases or vapors within the enclosure. See Figure 10.1 for details.

Figure 10.1

Use of Air Gaps Within a Typical Dispensing Device



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10.2 When an air gap is provided with a decorative cover that incorporates louvers, screens, or similar parts, a minimum 25.4 mm (1-in) per “running” in of the gap is required.

10.3 A decorative cover used on a horizontal air gap that is vertically larger than the air gap meets the intent of the requirements in this section as long as it does not extend above the plane of the unclassified or different classification area

10.4 The front edge of a decorative cover that is located adjacent to the classified area shall be flush with the bottom of the cover, except for vertical members.

10.5 Conduit or other assemblies that are routed through the air gap shall be mechanically secured such that a minimal amount of open air is provided. The size and position of assemblies shall not create an area within the air gap where the movement of air is stopped.

10.6 Unused openings in the decks of the air gap shall be mechanically sealed.

10.7 Where nonmetallic materials are used to seal unused openings in the air gap panel, the materials shall be subjected to the testing indicated in 7.2.2.2.3 and 7.2.2.2.4, modified as follows – the materials shall be subjected to a saturated vapor exposure rather than immersing the materials in the fluids. The tests shall be performed by hanging the material samples 25.4 mm (1 in) above the liquid level, such that the material is subjected to vapors of the test fluids.

11 Pumping Units

11.1 A pumping unit shall be evaluated in accordance with UL/ULC 79B.

12 Pressure Relief

12.1 A dispensing device assembly shall incorporate means for pressure relief, or it shall depend upon being connected at installation with a power-operated pump incorporating a pressure relief if complete instructions are provided for this purpose. Such pressure relief shall be constructed to prevent or relieve operating pressure and thermal expansion pressures in the system in excess of 345 kPa (50 psi) and anticipate a temperature rise of 27.8 °C (50 °F) in an ambient of 24 °C (75 °F).

12.2 Pumping unit operating pressures in a self-contained dispenser may be relieved by:

a) A bypass valve connected between the outlet and suction ports; or

b) Automatic change in volumetric capacity of the pump upon an increase in pressure at its outlet.

12.3 Expansion pressures may be relieved by connection to:

a) An atmospheric vented air eliminator for a self-contained dispensing device;

b) A separate return line to the tank;

c) The suction side of the pump with instructions calling the user’s attention to avoid the use of suction line check valves unless provided with a relief valve; or

d) A variable volume expansion chamber.

12.4 An air eliminator or similar vent shall be made of metallic tubing of not less than 6.4 mm (1/4 in) outside diameter. Its terminal shall be located outside of the pedestal housing, and it shall be protected

from clogging and from exposure to the weather. A vent terminating in the hose nozzle space of a nozzle guard or boot is considered to be outside of the pedestal housing.

12.5 The suction return port and passageway from the float chamber of an air separator to the pump shall be sized to prevent the chamber from filling with liquid.

12.6 When a pressure relief requires communication with the storage tank, an instruction card shall be attached to the interior of a door or other part adjacent to return line fittings calling attention to the need for connecting this part by piping with the underground tank.

12.7 A return line fitting shall be not less than 3/8 in taper nominal pipe thread (NPT) size and shall include a terminal pipe union or tubing connector fitting.

12.8 A valve used as a pressure relief device shall comply with the Start-to-Discharge Test, Section 33, both before and after the Long Term Exposure Test, Section 30.

12.9 A valve used as a pressure relief device shall comply with the material requirements in Materials, Section 7.

Exception: The valve seal is not required to comply with compression set requirements. Only Volume Change and Extraction are required at the material level.

13 Springs

13.1 A spring employed in a dispensing device assembly to reduce the risk of leakage, or in a safety mechanism, such as is employed in an operating handle, shall:

a) Be protected against abrasion and corrosion; and

b) Demonstrate no loss in strength following subjection to a compression force of three times that exerted by the spring in any position of its intended function.

13.2 In reference to 13.1(a), springs that are exposed to the fuels anticipated by these requirements shall comply with the applicable material requirements from Materials, Section 7. Springs not exposed to fuels, but exposed to the environment, shall comply with the atmospheric corrosion requirements in 7.1.2.

14 Strainers and Filters

14.1 A strainer or filter shall be evaluated to the applicable requirements in UL/ULC 331B. The additional requirements of 14.2 and 14.3 apply.

14.2 When provided, a drain opening shall be closed by a pipe plug not smaller than 1/4 in pipe size. A petcock or valve shall not be provided for drainage purposes. The materials shall comply with Materials, Section 7.

14.3 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.

15 Valves

15.1 Electrically operated valves

15.1.1 Electrically operated valves for use in non-classified areas of the dispenser shall be evaluated in accordance with UL 428B. Electrically operated valves for use in a classified location within a dispenser shall be evaluated in accordance with UL 428B and CSA C22.2 No. 213/UL 121201, for valves located in the Class I, Division 2 area; or in accordance with UL 428B and UL 1203 or CSA C22.2 No. 30 for valves located in the Class I, Division 1 area.

15.2 Hose nozzle valves

15.2.1 When supplied with the device, a hose nozzle valve shall comply with the applicable requirements in UL/ULC 2586B.

15.3 Shear valves

15.3.1 When supplied with the device, shear valves shall comply with the applicable requirements in UL/ULC 842B.

15.4 Mechanically operated valves

15.4.1 When supplied with the device, a mechanically operated valves shall comply with the applicable requirements in UL/ULC 842B.

16 Mechanical Line Leak Detectors

16.1 When supplied with the device, mechanical line leak detectors shall comply with the applicable requirements in UL/ULC 842B.

17 Piping and Fittings

17.1 Pipe threads shall be in accordance with ASME B1.20.1.

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

17.3 A male thread for attachment to pipe fittings shall have no shoulder within the distance specified in Table 17.1, from the beginning of the thread, including any chamfer, nor shall any shoulder prevent an additional turn being made within this distance as determined by assembling the part into a fitting within a tolerance of plus or minus one thread.

Table 17.1
Shoulder Distance from Beginning of Thread

Pipe size, ANSI B36.10 nominal in	Shoulder distance	
	mm	(in)
1/8	9.5	(3/8)
1/4, 3/8	14.3	(9/16)
1/2, 3/4	19.1	(3/4)
1	23.8	(15/16)
1-1/4	24.6	(31/32)
1-1/2	25.4	(1)
2	26.2	(1-1/32)
2-1/2	38.5	(1-33/64)
3	40.1	(1-37/64)

17.4 A threaded pipe connection shall be made with litharge and glycerine cement, shellac, shellac and inert powder filler, a suitable pipe joint sealing compound for diesel fuel, biodiesel/diesel fuel, biodiesel blends or a suitable thread sealant tape for diesel fuel, biodiesel/diesel fuel, biodiesel blends.

17.5 ASTM Schedule 40 metallic pipe shall be used, and the metallic materials shall comply with Materials, Section 7. A union, if used, shall be the ground joint type or a part that has been determined to be equivalent.

Exception: A fitting need not comply with these requirements if it complies with the requirements specified in Torque Test, Section 38.

17.6 Tube fittings shall be metallic, and all metallic materials shall comply with Materials, Section 7.

17.7 Tubing shall have a minimum wall thickness in accordance with Table 17.2 in any configuration that is used.

Table 17.2
Wall Thickness for Tubing

Outside diameter		Minimum wall thickness	
mm	(in)	mm	(in)
3.17	(1/8)	0.71	(0.028)
6.35	(1/4)	0.71	(0.028)
7.94	(5/16)	0.71	(0.028)
9.53	(3/8)	0.71	(0.028)
12.70	(1/2)	0.80	(0.0315)
15.88	(5/8)	0.93	(0.0365)
19.05	(3/4)	0.98	(0.0385)
22.23	(7/8)	1.24	(0.049)
25.40	(1)	1.24	(0.049)
28.58	(1-1/8)	1.24	(0.049)

Table 17.2 Continued on Next Page

Table 17.2 Continued

Outside diameter		Minimum wall thickness	
mm	(in)	mm	(in)
31.75	(1-1/4)	1.28	(0.0505)
34.93	(1-3/8)	1.28	(0.0505)
38.10	(1-1/2)	1.65	(0.065)

17.8 A liquid line opening for field connection shall comply with Materials, Section 7. The connection shall be either a metal-to-metal seat union that complies with the requirements in UL 860, or a threaded connection shall comply with the Torque Test, Section 38, and Installation Instructions, Section 48. The opening shall be plugged or capped prior to shipment to reduce the risk of entrance of foreign material.

18 Hose Assemblies

18.1 When supplied with the device, hose assemblies shall comply with the applicable requirements in UL 330B. The couplings shall be attached to the hose by suitable means.

19 Control System

19.1 A motor shall not be started energized with the lifting of the hose or its nozzle from its position on the device. A separate intentional, manual operation shall be required for closing the starting switch. The motor circuit shall be de- energized at the time or before the hose, or the last hose in the case of a multiple station remote control discharge system incorporating a single motor, is returned to its position on the device following operation.

19.2 As a means of complying with 19.1, the motor may be de- energized by the weight of the hose and nozzle upon replacement in their intended position, or interference devices may be provided to prevent replacement of the nozzle until the motor circuit has been de-energized.

19.3 The discharge of liquid shall occur only when the hose nozzle valve is held in the open position manually, or when the hose nozzle valve is of the automatic closing type with latch open device, when the valve mechanism is latched to maintain the valve in the open position. In both cases, the valve shall be removed from its position on the device. The discharge of liquid shall be stopped immediately upon the release of the hand control by the operator or the functioning of an automatic closing mechanism.

20 Meter

20.1 A meter shall be evaluated to the applicable requirements in UL/ULC 25B.

21 Breakaway Couplings and Swivel Connectors

21.1 When supplied with the device, a breakaway device or a swivel connector shall be evaluated to the applicable requirements in UL/ULC 567B.

ELECTRICAL EQUIPMENT

22 General

22.1 Electrical equipment intended for use in hazardous locations shall comply with the requirements for Class I, Group D, equipment, unless otherwise indicated by these requirements.

22.2 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.

22.3 Electrical equipment and wiring shall be arranged so that the liquid handled will not drip or drain on them during intended care and usage. Intrinsically safe equipment shall comply with the applicable construction and performance requirements in:

a) In the United States, UL 913.

b) In Canada, CSA C22.2 No. 60079-11.

22.4 A device shall be constructed so that the enclosure or housing, frame, and similar non-current carrying 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.

22.5 The surface of an uninsulated 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.

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

22.7 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. See also 22.8.

22.8 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 a marking “EQUIPMENT GROUND”, by a green color identification, or both.

22.9 An outlet or junction box shall comply with the applicable construction and performance requirements in:

a) In the United States, UL 1203;

b) In Canada, CSA C22.2 No. 30.

22.10 When a conduit run contains wiring to which field wiring connections shall be made, the conduit run shall terminate in an outlet box or enclosure complying with the requirements for equipment for the locations specified in NFPA 70 or CSA C22.1. The box or enclosure shall be subjected so that the connections are capable of being made and so that clearance between it and adjacent parts is provided for gripping the installation conduit or fitting with a wrench intended for this purpose. The clearance shall enable wrench movement through an arc of not less than 45 degrees. 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 be no less than specified in Table 22.1.

Table 22.1
Trade Size of Conduit and Vertical Clearance for Box Hubs

Conduit sizes		Vertical clearance	
O.D. in mm	Trade size, (in)	mm	(in)
21	(1/2)	178	(7)
26	(3/4)	178	(7)
33	(1)	229	(9)
42	(1-1/4)	273	(10-3/4)
48	(1-1/2)	292	(11-1/2)

22.11 A vertical clearance less than that specified in 22.10 may be employed if the intended unions, sealing fittings, and interconnections are provided by the dispenser manufacturer.

22.12 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.

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

22.14 The size of a junction box in which field installed conductors shall be connected by splicing shall not be less than that specified in Table 22.2. 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 furnished conductor for pump motor and lighting circuits is considered to be not smaller than 2.1 mm^2 (14 AWG). A field furnished conductor for a reset motor, signaling, or other circuit rated less than 5 amperes may be considered to be not smaller than 0.8 mm^2 (18 AWG) when the wire size is marked on the installation wiring diagram.

Table 22.2
Size of Junction Boxes

Size of conductor		Free space within box for each conductor			
		Box with hubs		Box without hubs	
mm^2	(AWG)	cm^3	(in^3)	cm^3	(in^3)
1.3 or less	(16 or smaller)	21.3	(1.3)	24.6	(1.5)
2.1	(14)	29.5	(1.8)	32.8	(2.0)
3.3	(12)	32.8	(2.0)	36.9	(2.25)
5.3	(10)	36.1	(2.2)	41.0	(2.5)
8.3	(8)	44.2	(2.7)	49.2	(3.0)

22.15 The size of a junction box in which field installed conductors shall be connected to factory installed terminal strips shall be determined by Table 22.2 as the summation of the volumes required for each field furnished conductor plus the approximate volume utilized by the factory installed wiring and terminal block.

22.16 A conductor intended to be spliced to a field-installed conductor shall be not smaller than 0.8 mm^2 (18 AWG) and shall be rated for the maximum operating voltage of the dispenser. Factory wiring terminating at a terminal strip shall also be 0.8 mm^2 (18 AWG) minimum unless arranged or guarded to be protected from damage during field wiring.

22.17 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, 100 % of the ampere ratings of all other loads, or both.

22.18 A terminal wire binding screw to which field installed conductors shall be connected shall not be smaller than 4.2 mm diameter (No. 8), except that a 3.5 mm diameter (No. 6) screw may be used for the connection of one 0.8, 1.3, or 2.1 mm^2 (18, 16, or 14 AWG) conductor.

22.19 A terminal plate tapped for a wire binding screw shall be of metal not less than 0.76 mm (0.030 in) thick for 2.1 mm^2 (14 AWG) or smaller wire, and not less than 1.27 mm (0.050 in) thick for a wire larger than 2.1 mm^2 (14 AWG). Terminal plates shall provide at least two full threads and shall incorporate upturned lugs or parts that have been determined to be equivalent to hold the wires in position.

22.20 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 sufficiently secure connection in which the threads will not strip with tightening torque, in accordance with:

a) In the United States, UL 486A-486B.

b) In Canada, CSA C22.2 No. 65.

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

22.22 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 or lamp holders shall be connected to the white or gray conductor.

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

a) In the United States:

1) UL 1,

2) UL 6, or

3) UL 6A.

b) In Canada:

1) CSA C22.2 No. 56,

2) CSA C22.2 No. 45.1, or

3) CSA C22.2 No. 45.2.

23 Motors

23.1 When 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.

23.2 A tag shall be attached to the motor circuit wires indicating the voltage from which the motor is intended to operate, in the case of motors of single voltage rating; or the voltage for which the motor has been connected, in the case of motors for dual voltage rating.

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

a) In the United States, UL 674;

b) In Canada, CSA C22.2 No. 145.

24 Switches

24.1 A switch shall be rated for the maximum load that it controls.

24.2 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 United States or the identified conductor in Canada.

25 Class I, Group D, Division 2 or Zone 2 Location, Lighting, Electrical, and Electronic Equipment

25.1 Lighting, electrical, and electronic equipment utilized in Class I, Group D, Division 2 or Zone 2 hazardous locations shall comply with outdoor use requirements for such components and, unless of the weatherproof type, shall be in a raintight enclosure, see the Rain Test, Section 39; or shall be otherwise protected to reduce the risk of water entering a lamp holder or the enclosure for electrical and electronic equipment.

25.2 A lamp holder shall be an unswitched type. A lamp holder for an incandescent lamp shall be not larger than a medium base type. A lamp holder for an electric discharge (fluorescent) lamp shall not be of the combination type including a starter holder.

25.3 A lamp holder shall be mechanically supported and shall be wired in the assembly at the factory.

25.4 Lighting, electrical, and electronic parts other than lamp holders which may produce arcs or high temperatures shall be in an enclosure complying with the requirements for Class I, Group D or Zone 1 equipment for use in hazardous locations specified in NFPA 70 or CSA C22.1.

25.5 Lighting, electrical, and electronic parts other than lamp holders which do not produce arcs or high temperatures when operated as intended and which are located in the Class I, Group D, Division 2 or Zone 2 hazardous location may be in a general purpose enclosure. Such enclosure shall be of metal and shall be of the total enclosed type or constructed to reduce the risk of escape of sparks or hot metal particles.

25.6 The requirement specified in 25.5 is not intended to preclude the use of small areas of glass or plastic in a Class I, Group D, Division 2 or Zone 2 hazardous location, where such material is required for the transmission of price and volume data, instructional information, or both. The use of nonmetallic materials shall comply with the following:

a) The total area of nonmetallic material that is not backed up by metal panels shall not exceed 645 mm^2 (150 in^2);

b) A glass panel shall be at least 2.4 mm (3/32 in) thick;

c) A plastic panel shall comply with Materials, Section 7;

d) The construction shall be such that breakage of the nonmetallic panel will not permit sparks or hot metal particles to enter a Class I, Group D, Division 2 or Zone 2 hazardous location.

25.7 Lighting, electrical, electronic equipment, and wiring in a Class I, Group D, Division 2 or Zone 2 hazardous location must be completely sealed off from a gasketed joint, hose, stuffing box, or hose nozzle boot in or above the Class I, Group D, Division 2 or Zone 2 hazardous location by means of a solid partition or enclosure. Such equipment shall be in accordance with:

a) In the United States:

1) UL 121201, or

2) UL 60079-15;

b) In Canada:

1) CSA C22.2 No. 213, or

2) CSA C22.2 No. 60079-15.

25.8 Additionally, signs shall comply with the applicable construction and performance requirements in:

a) In the United States, UL 48;

b) In Canada, CSA C22.2 No. 207.

25.9 The dispenser and lighting fixture shall include means for secure mounting of the fixture and to reduce the risk of water entering the conduit system of the dispenser.

26 Wiring Methods

26.1 The wiring of circuits within the device shall comply with the requirements specified in 26.2 – 26.24. Splices in conductors shall be insulated and positioned to reduce the risk of high voltage parts contacting metallic parts of the dispensing device.

26.2 Conductors intended for field connection to a 120-volt branch circuit protective device shall be provided and arranged such that an individual grounded neutral conductor in the United States or the individual identified conductor in Canada is provided for each ungrounded supply conductor.

26.3 Except for intrinsically safe circuit rated not more than 30 volts ac (42.4 volts peak), the internal wiring of the device shall consist of wires of a type or types that have been successfully evaluated for use with respect to the temperature, ampacity, voltage and conditions of service to which the wiring may be subjected. See 22.16.

26.4 Wiring resistant to fuels may be exposed to vapors of the fuels (not liquid fuel) at temperatures within the limits of the temperature rating of the wire type.

26.5 A conductor having solid neoprene insulation or other material that has been determined to have equivalent resistance to the vapors of fuels may be used for internal wiring and as leads for components, such as motors, ballasts, solenoid valves, or similar parts when it has a temperature rating consistent with its use.

26.6 Regarding the requirements specified in 26.5, appliance wiring material having 90 °C (194 °F) solid neoprene insulation may be used for internal wiring not exposed to fuel if the insulation is at least 1.2 mm (3/64 in) in thickness for 3.3 and 2.1 mm^2 (12 and 14 AWG) sizes and at least 0.8 mm (1/32 in) in

thickness for 1.3 and 0.8 mm^2(16 and 18 AWG) sizes. A braid covering may be provided, but is not required. Since the wire having 0.8 mm (1/32 in) thickness of insulation shall be rated 300 volts, this wire shall not be used in discharge devices rated in excess of this voltage.

26.7 Factory installed internal wiring routed:

a) Through Class I, Group D, Divisions 1 and 2 or Zone 1 and Zone 2 hazardous locations;

b) From Division 1 to Division 2 or Zone 1 and Zone 2 hazardous locations; and

c) From Division 1 or Division 2 or Zone 1 and Zone 2 hazardous locations to unclassified areas within the dispensing device;

is not required to be resistant to fuel when it has been determined that the wiring is routed within the product so it does not come into contact with flammable liquids or their condensed vapors during normal use and routine servicing, such as changing filters cleaning strainers, or replacing meters or pumps.

26.8 Except as specified in 26.9, if wiring is not routed near components that could attain temperatures as great as, or in excess of, the temperature limit of the insulated conductor (such as resistors, coils, ballasts, or similar parts), minimum wire size shall be as specified in Table 26.1. Minimum wiring sized on the basis of the table is applicable to both component leads and other wiring except motor leads. Leads furnished with a Class I, Group D or Zone 1 motor may be used.

26.9 The acceptability of conductors routed close to components producing heat, or wire size smaller than specified by Table 26.1, shall be evaluated on the basis of a temperature test.

Table 26.1
Wire Sizes for Circuit Requirements

Wire size		Circuits not employing motors amperes	Circuit for motors amperes
mm^2	(AWG)		
0.8	(18)	6	4.8
1.3	(16)	8	6.5
2.1	(14)	15	12.0
3.3	(12)	20	16.0

26.10 Except as permitted in 26.11 and 26.12, wiring shall be in threaded rigid metal conduit, threaded steel intermediate metal conduit, or Type MI cable with termination fittings that comply with the requirements for Class I, Group D or Zone 1, equipment for use in hazardous locations specified in NFPA 70 or CSA C22.1. All boxes, fittings, and joints shall be threaded for connection to conduit or cable terminations in compliance with the requirements in Class I, Group D or Zone 1 equipment for use in hazardous locations. At least five full threads shall engage in each threaded joint.

26.11 Wiring in a Class I, Group D, Division 2 or Zone 2 hazardous location shall be enclosed in conduit, electrical metallic tubing, or other raceway or general-purpose enclosure made of metal, excluding zinc. General-purpose fittings may be used.

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

26.13 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.

26.14 A seal shall be provided at the location where a conduit or cable enters an enclosure for a switch, lamp starter, or other part that could produce arcs and sparks, and in the conduit at any location where conduit, as specified in 26.10, is connected to a general-purpose enclosure, lamp holder, or receptacle.

26.15 When wiring is enclosed as permitted by 26.11, seals shall be located so that any vapors entering the conduit system in the classified area will not enter or be communicated to the wiring system installed as specified in 26.11. There shall be no union, coupling, box, or fitting, in the conduit between the seal and the point at which the conduit connects to the wiring system installed as specified in 26.11.

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

26.17 A factory installed conduit seal incorporated as part of the device shall comply with the requirements in the Hydrostatic Strength Test, Section 32, and the Leakage of Wire Seal Test, Section 41.

26.18 When a conduit seal is incorporated as part of the device, the wires or conductors shall be securely held and tightly sealed where they pass into the enclosure. When a sealing compound or cement is used, it shall:

a) Provide a tight fit;

b) Neither soften nor crack under service conditions;

c) Be resistant to the solvent action of the hazardous location chemicals to which it is capable of being exposed – see Tests on Sealing Compounds, Section 42;

d) Be resistant to moisture and aging; and

e) Have a depth equal to the inside diameter of the conduit, or 15.9 mm (5/8 in), whichever is greater.

26.19 Sealing compounds used as a conduit seal shall not flow or creep at the operating temperature of the device. Sealing compounds that soften with the application of heat shall have a softening point of not less than:

a) 93.3 °C (200 °F) when used adjacent to motors having Class A (Class 105) insulation; and

b) 113.3 °C (236 °F) when used adjacent to motors having Class B (Class 130) insulation.

The softening point shall be determined in accordance with ASTM E28.

26.20 When a nipple is used to retain the sealing standard compound for the lead wires of the device, the depth of the seal shall not be less than the internal diameter of the nipple, or 15.9 mm (5/8 in), whichever is greater. Based on the compound, the size of the lead wires, and the construction of the sealing well, a greater depth of sealing compound may be required to form a tight seal. Means shall be provided in the nipple to anchor the sealing compound when the nipple completes an explosion proof conduit system or enclosure.

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

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

26.23 Splices in wiring shall be located only in junction boxes or compartments that have been determined to be equivalent. Splices shall be made mechanically and electrically secure and be soldered unless a wire connector is used. Joints shall be covered with insulation that has been investigated and determined to be equivalent to that on the conductors.

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

27 Locking Mechanism

27.1 A dispensing device shall be provided with effective means for locking both the motor switch and each hose nozzle valve. The locking mechanism shall be of such design that a simple locking operation for each dispensing control will prevent starting the motor and the discharging of even small quantities of fluid through the dispensing outlet. When the locking means is based upon the use of an ordinary padlock, the padlock [considered to have a 6.4 mm (1/4 in) minimum diameter shackle] need not be supplied by the manufacturer as part of the equipment.

PERFORMANCE

28 General

28.1 Representative samples of a dispensing device or its component parts shall comply with the tests described in Sections 30 – 46 as applicable.

28.2 All tests shall be performed using the test fluids specified for that test. No substitution of test fluids is allowed. When the test indicates that FB25a or B100a shall be used, the test fluid shall be prepared as described in Annex A.

28.3 For hydrostatic strength tests, the tests shall be conducted using water as the test fluid.

28.4 Tests performed on a dispensing device shall be performed in accordance with Test Sequences, Section 29, using one sample for each applicable test fluid. In addition, with reference to 12.8, a valve used as a pressure relief device shall be subjected to the Long Term Exposure Test, Section 30, using one sample for each applicable test fluid.

28.5 To reduce the effects of seal dry out due to removal of the test fluid after specific tests, the tests performed after long term exposure shall be started within 4 h of removal of the test fluid. If necessary to coordinate testing, the sample may be left filled with the most recent test fluid at room temperature until the next test is initiated. If the previous test used an aerostatic or hydrostatic source, the sample shall be filled with kerosene.

28.6 With respect to Long Term Exposure Testing of full hydraulic trees of dispensers, see 28.4, portions of the hydraulic tree that were previously tested at the component level and using suitable metallic material closures need not be subjected to repeated Long Term Exposure testing. This waiver includes new parts that are made of the same material as previously tested components. Hydraulic trees that consist of components or materials that were all previously tested with suitable closures would be considered in compliance without a repeated Long Term Exposure Test. In these cases, the test sequence in Section 29 can be waived, and the High Pressure Leakage Test, Section 31, and the Hydrostatic Strength Test, Section 32, are performed on a sample of the hydraulic tree in the as-received condition.

29 Test Sequences

29.1 General

29.1.1 The following test sequences outline the order in which tests shall be performed on a dispenser's hydraulic tree. All tests in the sequence shall be performed in the order indicated and shall be performed on one sample for each applicable test fluid exposure during the Long Term Exposure Test.

29.2 General dispenser test sequence

29.2.1 A dispenser shall be subjected to the following tests in the order shown.

a) Long Term Exposure, Section 30;

b) High Pressure Leakage Test, Section 31;

c) Hydrostatic Strength Test, Section 32.

29.2.2 Tests indicated in 29.2.1 shall be performed on one sample in the sequence shown for each test fluid. The remainder of the tests in this Standard may be performed on additional samples, as needed, and in any sequence.

30 Long Term Exposure Test

30.1 General

30.1.1 The test outlined in 30.2 – 30.4 shall be performed on one or two samples of the device. If the product is rated for use with diesel fuel (B0 – B5) or a diesel/biodiesel blend above 5% but not greater than 20% biodiesel (B6 – B20), kerosene or fuel oil, then the test shall be performed using the FB25a test fluid. If the product is rated for use with biodiesel (B99.9/B100), then the test shall be performed using the B100a test fluid. See Annex A.

30.2 Samples

30.2.1 A sample of a complete device shall be tested. If an assembly shall be tested, the components may be tested individually. All inlet and outlet openings of the samples shall be sealed in accordance with 30.2.3.

30.2.2 If platings or coatings are used internal to the device, additional samples may be used. See 30.4.2.

30.2.3 Closures shall be provided to seal off inlet and outlet openings on the samples in accordance with 30.2.1. These closures shall be fabricated of suitable materials. The main inlet and outlet closures shall be provided with a 1/4 in NPT opening for connection to the test apparatus. All closures shall be installed by the manufacturer and provided with a torque rating. There will be no other adjustment to connections for the duration of the test.

30.2.4 Any o-rings, gaskets, or other sealing materials, shall be provided and installed by the manufacturer. The dynamic sealing devices shall be the same as those that will be used in the final product installation. Static seals shall be representative of the seals being used in the final product installation. If the sealing device or material is not considered part of the component under test, but will be provided in an end product at the time of installation, a representative seal shall be provided for the test. The testing of the static seals, as part of the assembly under test, is only required in the Long Term Exposure Test to test the surrounding components.

30.3 Method

30.3.1 The sample shall be exposed to the applicable test fluid in accordance with 30.1.1. The test fluids shall be prepared using the instructions in Annex A.

30.3.2 A quick connect device is connected to the 1/4 in NPT connection at the inlet, and it is used to fill the samples with the applicable test fluids. A source of pressure may be used to assist in filling or draining the samples, however, the pressure shall not exceed the rated pressure of the device under test. Once the samples are filled to exclude all air, they are closed off and sealed. The samples are then placed in the test chamber.

30.3.3 The chamber temperature is increased to 60 ±2 °C (140 ±3.6 °F). When the chamber reaches this temperature, the exposure period begins. The samples are exposed to the applicable test fluid at 60 ±2 °C (140 ±3.6 °F) for approximately 168 h. At the end of this duration, the exposure period is halted and the chamber is allowed to cool. The samples are subjected to a 347 kPa (50 psi) pressure for one min. The fluid is then drained from the samples and discarded. The samples are then immediately refilled with new test fluid and the chamber temperature is allowed to increase to 60 ±2 °C (140 ±3.6 °F) again. The total duration of the test shall equal 1008 h of exposure at 60 ±2 °C (140 ±3.6 °F).

30.3.4 At the end of the total exposure duration, the test fluid is left in the samples and the samples are removed from the chamber. The samples are then subjected to the next tests in the test sequence as outlined in Section 29 and in accordance with 28.5. Prior to the initiation of the next test in the test sequence, the test fluid shall be drained and discarded.

30.3.5 If the device contains any parts or surfaces that are plated or coated, if the device uses casting impregnation materials to eliminate porosity leakage, or if the device contains internal nonmetallic parts, the plating, coating, impregnation, or internal parts are tested both during and after this exposure. See 30.4.2 and 30.4.4.

30.4 Results

30.4.1 There shall be no leakage during this test. If leakage is observed at any point during the test, the test shall be stopped.

30.4.2 For platings or coatings, there shall be no softening of the plating or coating material. Compliance is checked by observance of the drained test fluid. There shall be no evidence of visible flaking or material. In addition, there shall be no substantial discoloration of the test fluid when observing the drained fluid. Discoloration is an indication of chemical attack on the plating or coating internal to the device. In order to determine that the base metal is not exposed, visual inspections shall be made. If the visual examination requires examination of internal surfaces, the samples shall be cut open to determine compliance. If this is necessary, additional samples can be used to determine compliance with this requirement, such that the remaining test sequence will not be disturbed by cutting open the samples.

30.4.3 For casting impregnation materials, the sample shall not show evidence of porosity leakage during or after the fluid exposure duration.

30.4.4 For internal nonmetallic parts, there shall be no visible evidence of this material in the drained test fluid.

31 High Pressure Leakage Test

31.1 All products subjected to this test shall be subjected to a test pressure as indicated in 31.2. Test pressures shall be developed from a hydrostatic source and maintained for 1 min.

31.2 All products shall be subjected to a test pressure equal to 1-1/2 times the rated pressure of the product, but not less than 518 kPa (75 psi).

31.3 There shall be no leakage outside of fluid confining areas, and there shall be no evidence of casting porosity leakage during this test.

31.4 For all tests, the inlet of the device shall be connected to the source of pressure, and the outlet shall be blocked.

31.5 A positive shutoff valve and a calibrated pressure indicating device shall be installed in the pressure supply piping. The pressure indicating device shall be installed in the piping between the shutoff valve and the device under test.

31.6 In accordance with 31.5, the pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range such that the test pressure is between 30 and 70 % of the maximum scale reading of the gauge;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other devices that are equivalent to the devices in (a) and (b).

32 Hydrostatic Strength Test

32.1 A liquid handling part of the dispensing device shall withstand, without rupture, an internal hydrostatic pressure of 1724 kPa (250 psig) for 1 min. An air separator housing that is vented to the atmosphere, when so tested, shall withstand 689 kPa (100 psig).

32.2 If the Hydrostatic Strength Test is being used as an alternate test method for the Tests on Sealing Compounds, Section 42, then the sample shall be subjected to the following test. The conduit seal in a factory sealed device shall withstand for 1 min, without rupture or permanent distortion, a hydrostatic test pressure of 4137 kPa (600 psig). When unintended leakage results in the inability of the test apparatus to maintain the required test pressure during the test of a seal for a 60.3 mm (2 in) outside diameter or larger trade size conduit with wires sealed in place, a device with a seal and without wires may be used. The hydrostatic pressure shall be gradually increased until the required internal pressure is reached. Gaskets or other means shall be used when required to prevent leakage of water during application of pressure.

33 Start-To-Discharge Test

33.1 The start-to-discharge pressure of an as-received sample of a relief valve shall not be less than 100 %, nor more than 110 %, of the set pressure marked on the valve.

33.2 A relief valve shall be connected to an air or other aerostatic supply source capable of being maintained at a pressure of at least 344 kPa (50 psi) above the marked set pressure of the valve being tested. A positive shutoff valve and a pressure-indicating device shall be installed in the pressure supply piping. The pressure-indicating device shall be installed in the piping between the valve being tested and the shutoff valve. Start-to-discharge pressures shall be observed through a water seal not more than 101.6 mm (4 in) deep.

33.3 In accordance with 33.2, the pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range such that the test pressure is between 30 and 70 % of the maximum scale reading of the gauge;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other devices that are equivalent to the devices in (a) or (b).

33.4 The shutoff valve shall be opened to permit the pressure to the valve being tested to increase to within about 172 kPa (25 psi) of the set pressure marked on the valve. The pressure to the valve is then to be increased slowly, at a rate no greater than 13.8 kPa/s (2 psi/s), until the first bubbles through the water seal are observed. The pressure at this instant, as indicated by the pressure indicating device, shall be recorded as the start-to-discharge pressure of the valve under test.

34 Dimensional Stability of Floats

34.1 A set of three samples of the float shall be used for this test for each fluid exposure in accordance with Annex A. Prior to the immersion conditioning described in 34.2, the dimensions of each float shall be determined with appropriate measuring instruments. Immediately following the immersion conditioning, and after drying for 70 ±1.2 h at 23 ±2 °C (73 ±4 °F), the dimensions of each sample shall be measured. The percentage change in dimensions shall be calculated as specified in the following equation for each of the three samples in each set and then averaged.

$$\frac{[(Mb - Ma) \times 100]}{Mb}$$

in which:

Mb is the dimension of the sample before the immersion conditioning and

Ma is the dimension of the sample after the immersion conditioning.

34.2 For products rated for diesel fuel (B0 – B5) or a diesel/biodiesel blend above 5 % but not greater than 20 % biodiesel (B6 – B20), the test shall be performed on one sample using the FB25a test fluid. For products rated for biodiesel (B99.9/B100), the test shall be performed on one sample using the B100a test fluid. For products intended for both ratings, both test fluids shall be used in separate samples. See Annex A. Each set of samples shall be immersed (completely submerged) in vessels containing the applicable test fluid for 168 h at 23 ±2 °C (73 ±4 °F).

34.3 At the conclusion of the test described in 34.2, the percentage change in dimensions shall not change by more than 2 percent.

35 Weight Change of Floats

35.1 A set of three samples of the float shall be used for this test for each fluid exposure in accordance with Annex A. Prior to the immersion conditioning described in 35.2, the weight of each sample shall be determined with an analytical balance. Immediately following the immersion conditioning, and after drying for 70 ±1.2 h at 23 ±2 °C (73 ±3.6 °F), the weight of each sample shall be measured. The percentage change in weight shall be calculated as specified in the following equation for each of the three samples in each set and then averaged.

$$\frac{[(Mb - Ma) \times 100]}{Mb}$$

in which:

Mb is the weight of the sample before the immersion conditioning and

Ma is the weight of the sample after the immersion conditioning.

35.2 For products rated for diesel fuel (B0 – B5) or a diesel/biodiesel blend above 5 % but not greater than 20 % biodiesel (B6 – B20), the test shall be performed on one sample using the FB25a test fluid. For products rated for biodiesel (B99.9/B100), the test shall be performed on one sample using the B100a test fluid. For products intended for both ratings, both test fluids shall be used in separate samples. See Annex A. Each set of samples shall be immersed (completely submerged) in vessels containing the applicable test fluids for 168 h at 23 ±2 °C (73 ±3.6 °F).

35.3 At the conclusion of the test described in 35.2, the percentage change in weight shall not increase by more than 25 % or decrease by more than 10 %.

36 Endurance Test – Hose Retrieving Mechanism

36.1 A hose, when intended for storage on a reel or in a weighted loop inside the housing, shall not leak nor show evidence of breakdown of the hose or any of its parts when tested as specified in 36.3.

36.2 A hose arranged as described in 36.1 and assembled in the device in the intended manner and subjected continuously to the maximum operating or bypass pressure, whichever is greater, shall be withdrawn and returned as specified in 36.3. The pressure in the hose shall be maintained while the hose is filled with kerosene.

36.3 This test shall consist of 100,000 cycles of operation for the reel application and 35,000 cycles for the weighted loop application. In each case, the hose shall be withdrawn in a direction parallel to the side of the housing through which the hose passes. The rate of cycling shall be similar to that of intended operation, and the hose shall be under tension during the entire operating cycle. Leakage in the hose assembly, damage to the hose or couplings, or malfunction of the reel assembly or other operating parts shall not result from this test.

37 Endurance Test – Hose Fastening Means

37.1 A retrieving mechanism provided for an extra long hose to be supplied entirely outside the housing shall not show evidence of damage when tested as specified in 37.2. Any clamp or fitting for attachment to the hose shall not cause damage to the hose during this test.

37.2 A retrieving mechanism equipped as above shall be operated through 35,000 withdrawal and return cycles. The hose need not contain liquid during this test.

38 Torque Test

38.1 A fitting other than one complying with 17.5, having an opening threaded for pipe connection, shall withstand without breakage or leakage the turning effort specified in Table 38.1, exerted as if to screw the fitting onto a pipe or into a pipe fitting.