UL 87

STANDARD FOR SAFETY

Power-Operated Dispensing Devices for Petroleum Products

UL Standard for Safety for Power-Operated Dispensing Devices for Petroleum Products, UL 87

Twelfth Edition, Dated March 24, 2016

Summary of Topics

This revision of UL 87 dated September 4, 2019 includes the following changes in requirements:

Editorial revisions and clarification of requirements

Adding zones to the different divisions

Revisions to hose nozzle requirements

Harmonizing text with UL 87A and UL 87B requirements for Marking and Instructions

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated May 3, 2019 and July 12, 2019.

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UL 87

Standard for Power-Operated Dispensing Devices for Petroleum Products

The first and second editions were titled Power-Operated Discharge Devices. The third through sixth editions were titled Power-Operated Dispensing Devices for Flammable Liquids.

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March 24, 2016

This UL Standard for Safety consists of the Twelfth edition including revisions through September 4, 2019.

The Department of Defense (DoD) has adopted UL 87 on March 11, 1991. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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

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INTRODUCTION

1 Scope

1.1 These requirements apply to power-operated dispensing devices for petroleum products such as gasoline for use as motor fuel. Requirements for the installation and use of these dispensing devices are included in the Automotive and Marine Service Station Code, NFPA 30A, and the National Electrical Code, NFPA 70.

1.2 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. These requirements do not apply to control equipment that may authorize, monitor, or interrupt operation of a power-operated dispensing device. Such equipment includes panel mounted equipment located adjacent to the dispensing device, remote consoles located inside a permanent structure, and auxiliary equipment physically attached to the dispensing device or enclosed by the pedestal and housing.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of typical standards covering components used in the products covered by this standard.

2.1.2 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.

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

2.1.4 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.

2.2 Units of measurement

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

2.3 Undated references

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

3 Glossary

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

3.2 AIR GAP – A minimum of 1 inch (25.4 mm) free air space provided between the planes of Division 1, Division 2, Zone 1 or Zone 2 hazardous locations and an unclassified area of a dispensing device.

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

3.4 CLASS I HAZARDOUS LOCATIONS – Locations in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. For the purpose of these requirements, as applied to dispensing systems of other than the overhead type, the following classified areas are further defined. Such areas for overhead type systems shall be as specified in the Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA 30A. The area of the dispensing system covered by these requirements is the envelope defined by the maximum outer dimensions.

a) Class I, Group D, Division 1 or Zone 1 –

1) The area within a dispenser housing up to 4 feet (1.2 m) 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 or Zone 1 area.

2) The area surrounding the dispenser housing within 18 inches (46 cm) horizontally in all directions from the Division 1 or Zone 1 area located within the housing.

3) The area within 18 inches 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 Figures 3.1 and 3.2 for an illustration of Class I and Zone hazardous locations.

Figure 3.1
Hazardous location classifications within a typical dispenser

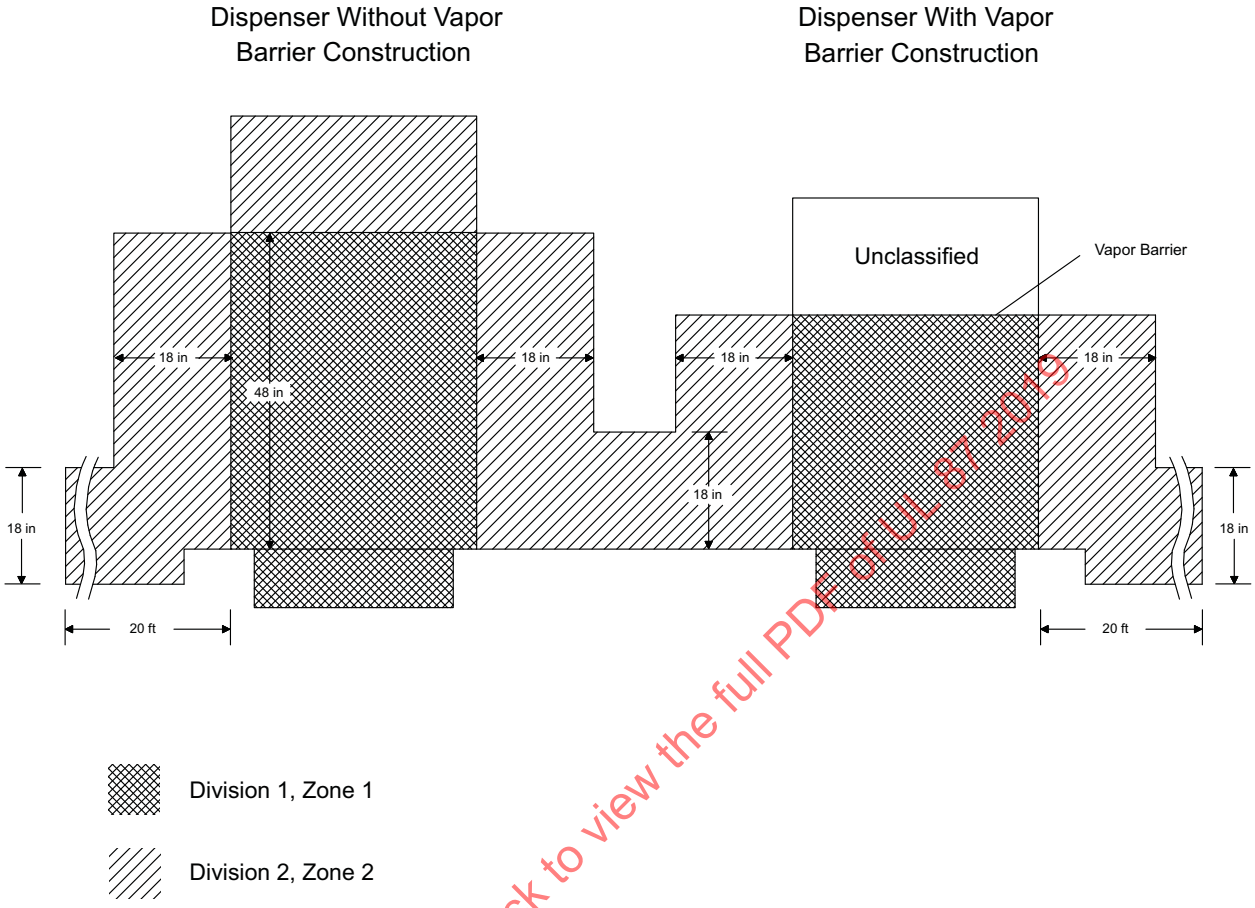

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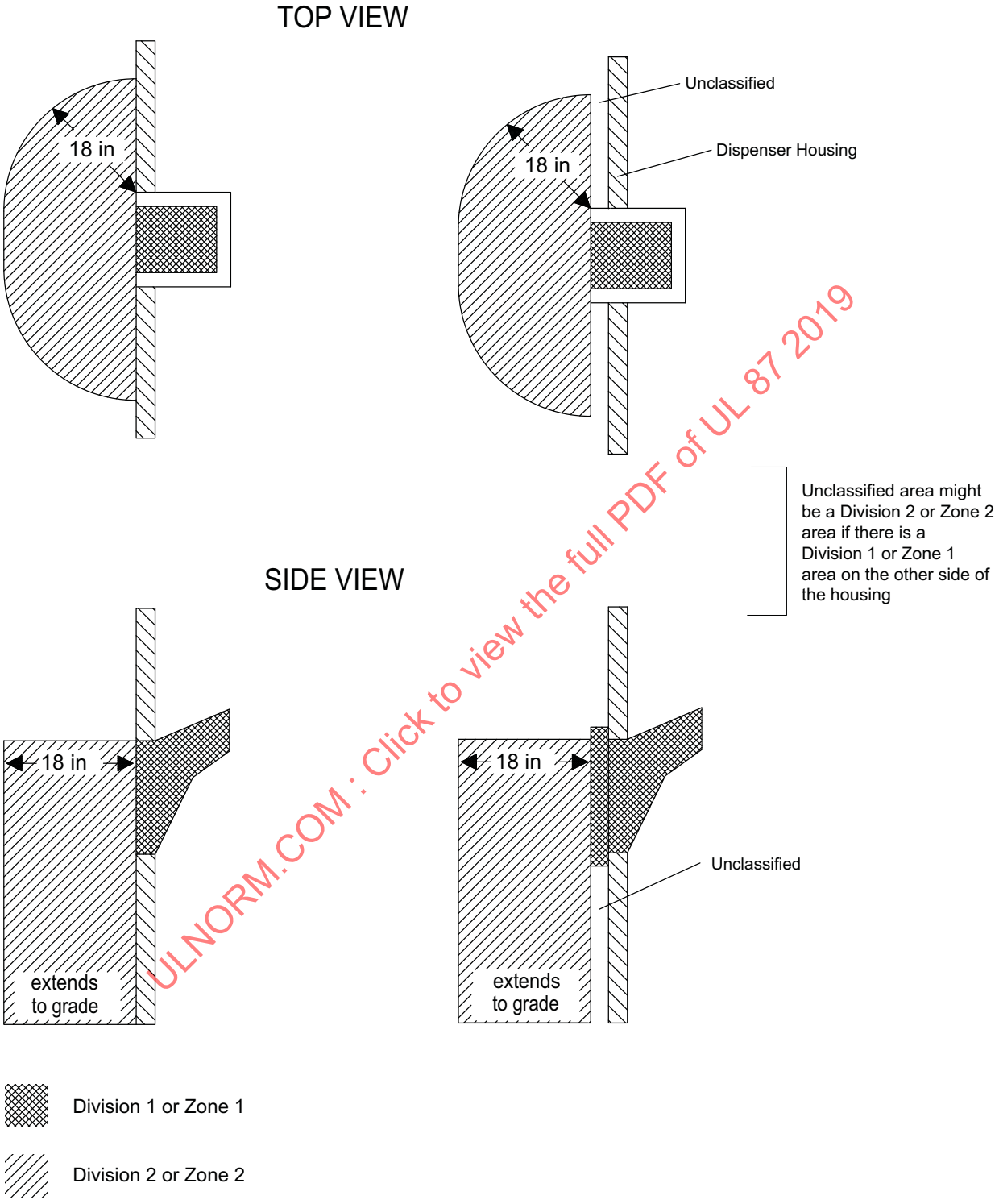
Figure 3.2
Hazardous location classifications associated with a hose nozzle valve boot



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3.5 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.″

3.6 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.″

3.7 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.

3.8 ELECTRICAL CIRCUITS –

a) High-Voltage Circuit – A circuit involving 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 alternating-current (rms) (42.4 volts peak or direct current) 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.

3.8A 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.

3.8B HOSE NOZZLE VALVE, AUTOMATIC – A hose nozzle valve which is held open during the entire filling operation. It may be held open by manual force or by an integral hold-open or latching device. It incorporates a mechanism that shuts off the flow of liquid during refueling operations to prevent overflow from the fill opening when liquid reaches a predetermined point on the spout.

3.9 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.

3.10 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.

3.11 MASTER-SATELLITE DISPENSER COMBINATION – Consists of two or more dispensing devices, one defined as the ″Master″ dispenser and the other(s) as the ″Satellite″ dispenser.

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

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

3.14 PUMPING UNIT – A power- or hand-operated pump for petroleum products which may incorporate a strainer, air separator, relief device, or other auxiliary parts.

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

3.16 VAPOR BARRIER – A solid, unpierced partition located between Division 1, Division 2, Zone 1, or Zone 2 hazardous 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.

3.17 VAPOR RECOVERY SYSTEM – A system constructed to capture vapors displaced during filling operations. The vapors are not processed during the course of this activity. Examples of vapor recovery systems include balance-pressure vapor displacement systems and vacuum-assist systems.

CONSTRUCTION

4 General

4.1 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 retractor, hose-nozzle valve, motor control, locking mechanism, piping, and 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.

4.2 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.

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

4.4 A dispensing device, other than one including a hose reel or weighted loop in its assembly, may be furnished without the hose.

4.5 When a dispensing device is provided with a hose retrieving mechanism intended for use with coaxial type hose, the dispensing device shall be marked as specified in 42.1.1(c).

4.6 A dispensing device may be furnished without a hose-nozzle valve if the dispensing device is marked as specified in 42.1.1(d).

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

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

5 Materials

5.1 Fluid-containing parts other than a seal ring or gasket shall have a melting point (solidus temperature) of not less than 950°F (510°C) and a tensile strength of not less than 10,000 psi (68.9 MPa) at 400°F (204°C).

5.2 A nonmetallic part in contact with the fluid to be handled shall be subjected to the following tests:

a) Polymeric parts that are affected by aging shall not crack or show visible evidence of deterioration following exposure for 168 hours in an air oven at a temperature of 100 ±1°C (212 ±2°F).

b) An elastomeric part:

1) Is to be immersed in ASTM Reference Fuel C, ASTM Reference Fuel A, and IRM Oil No. 903. Following the immersion, the elastomeric part shall not show a volume change of more than 25 percent swelling (40 percent in Reference Fuel C) or 1 percent shrinkage and the weight loss (extraction) shall not be more than 10 percent. The immersion-extraction test is not to be conducted with reference Fuel A and IRM Oil No. 903.

2) Shall not crack or show visible evidence of deterioration following exposure to an aging test as specified in the Standard for Gaskets and Seals, UL 157. The maximum service temperature used to determine the conditioning time and temperature for the oven aging is determined to be 60°C (140°F) unless the product is designated for use at a higher temperature.

5.3 The volume change and extraction tests are to be conducted in accordance with the Standard for Gaskets and Seals, UL 157.

5.4 A metallic part shall be resistant to atmospheric corrosion if the corrosion of such part may permit external leakage or impair the intended operation of the product. Ferrous materials of the thickness specified in the following items have been investigated and determined to be acceptable for the preceding when uncoated:

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

b) Standard pipe and fittings conforming to the Standard for Welded and Seamless Wrought Steel Pipe, ANSI/ASME B36.10M; and

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

5.5 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coatings specified in 5.6.

5.6 Cadmium plating shall not be less than 0.0003 inch (0.008 mm) thick, and zinc plating shall not be less than 0.0005 inch (0.013 mm) 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 0.00015 inch (0.0038 mm) thick. Metallic parts are protected against corrosion by:

a) Hot-dipped, mill-galvanized sheet steel complying with the coating designation G90 in Table I of the Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653/A653M, or

b) Coatings which have been determined to be equivalent to G90 under the requirements of the Standard for Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment, UL 1332,

comply with the intent of 5.5. When coating is used on a fluid casting and is capable of contacting the fluid, the coating shall be investigated in order to determine its compatibility with the fluid intended to be dispensed.

5.7 A metallic part other than those described in 5.4 and 5.6 and subject only to atmospheric corrosion shall be painted or protected in a manner that has been determined to be equivalent to retard corrosion.

5.8 Sand castings used in the construction of fluid-confining parts, whose malfunction permits external leakage, shall be free from porosity leakage and shall have a thickness of not less than that specified in Table 5.1. See the High-Pressure Leakage Test, Section 28, and the Manufacturing and Production Tests, Sections 38 – 41.

Table 5.1
Minimum thickness of liquid-confining sand-castings

Material	inch	(mm)
Cast iron	3/16	4.8
Malleable iron, ductile iron, or cast steel	1/8	3.2
Brass or bronze	3/32	2.4
Aluminum	5/32	4.0

5.9 For flanges, a plant-fiber gasket shall be not more than 1/32 inch (0.8 mm) thick. A cork composition gasket shall be shellacked in place on one side and coated with graphite on the other.

6 Base

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

6.2 The base shall be provided with bolt holes to accommodate bolts not less than 1/2 inch (12.7 mm) diameter for anchoring the dispenser. At least two holes shall be provided if the dispenser is not more than 6 feet (1.83 m) tall and at least four holes if the dispenser is over 6 feet tall. If two holes are provided, they shall be located on opposite sides of the base and at least 13 inches (330 mm) 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 13 inches. 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.

6.3 The requirement specified in 6.2 does not apply to a farm or non-retail type of dispenser of a special design which includes other provision for anchoring the dispenser.

7 Pedestal

7.1 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.

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

7.3 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 8.8.

8 Housing

8.1 Exposure of the assembly to the weather shall not interfere with the intended performance of the operating parts which 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.

8.2 A part employed in a main side section of a housing shall be no less than the strength that has been investigated and determined to be equivalent to that of sheet steel having a minimum thickness of 0.036 inch (0.91 mm).

8.3 Stainless steel having a minimum thickness of 0.026 inch (0.66 mm), unreinforced aluminum having a minimum thickness of 0.053 inch (1.35 mm), or reinforced aluminum having a minimum thickness of 0.041 inch (1.04 mm) has been investigated and determined to be the equivalent of carbon steel having the thickness specified in 8.2.

8.4 The top housing or canopy shall provide no less protection for internal parts than that of sheet steel having a minimum thickness of 0.031 inch (0.79 mm) or nonmetallic material complying with 8.7. The top housing shall be secured in place by mechanical means.

8.5 Stainless steel having a minimum thickness of 0.023 inch (0.58 mm), unreinforced aluminum having a minimum thickness of 0.047 inch (1.19 mm), or adequately reinforced aluminum having a minimum thickness of 0.036 inch (0.91 mm) has been investigated and determined to be the equivalent of carbon steel having the thickness specified in 8.4.

8.6 A principle section or panel of the housing, enclosing components in the Class I, Group D, Division 1 or Zone 1 area shall not be made of glass or nonmetallic material other than one complying with 8.2 and 8.4, if breakage will expose internal parts to possible damage. This does not apply in the case of a dial glass, a small display panel, or to main panels of such materials which do not comply with these requirements but which are backed up by metal panels affording the required protection of internal parts.

8.7 Nonmetallic materials may be used for parts in locations other than as described in 8.6 when:

a) The material qualifies for a flammability classification of HB as described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

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.

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

8.8 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 and support.

8.9 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.

8.10 The housing assembly shall incorporate vent openings near the bottom, totaling an area of not less than 1-1/4 square inches (8.06 cm^2), to permit the liberation of gasoline vapors. These openings shall be of such size and arrangement as to avoid clogging.

8.11 Openings in the housing for the reception of hose nozzles, when they are not in use, shall be fitted with a nozzle guard or holster 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 area as defined in 3.17 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 and shown in Figure 9.1:

a) An unpierced panel.

b) Two or more panels mechanically secured together with or without a seal. The seal shall be constructed like a gasket and made from a soft metal, such as copper or aluminum.

c) Two or more panels that are welded together with continuous seams.

Exception: Vapor barriers that are constructed by means other than those specified in (a) – (c) shall be evaluated to determine their equivalency to an unpierced partition. The following are factors that are to be evaluated when determining equivalency:

a) Rigidity of the assembly and

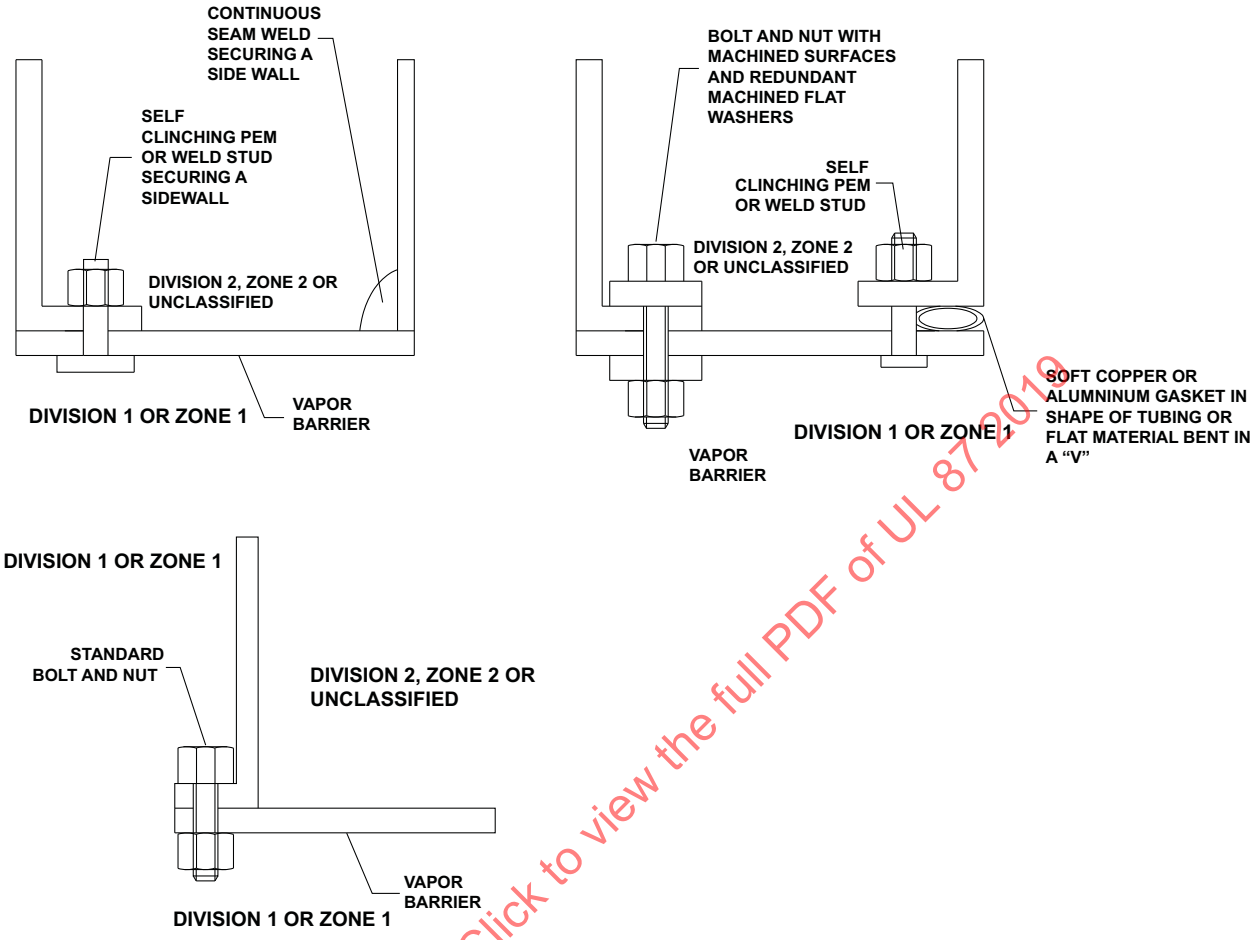
b) Effectiveness of the assembly sealing against vapors.

9.3 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.

Figure 9.1
Typical vapor barrier constructions



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NOTE – Bolt spacings are subject to engineering judgement, with consideration given to metal thickness, size of fasteners, and potential to ripple or warping as a result of tightening of the fasteners.

9.4 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-clinching threaded PEM studs; or

c) Metallic welded threaded studs.

See Figure 9.1.

Exception: Vapor barriers that are secured by methods other than those described in (a) – (c) shall be evaluated to determine whether they comply with the intent of these requirements.

9.5 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 is not prohibited from being housed within assemblies that comply with 9.7. The exit means shall be provided with vapor/explosion seals as defined in 24.15.

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

9.7 Conduit or other assemblies, such as valves or pulsers, that 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 are to be evaluated when determining compliance with the requirement:

a) Actual contact surface and

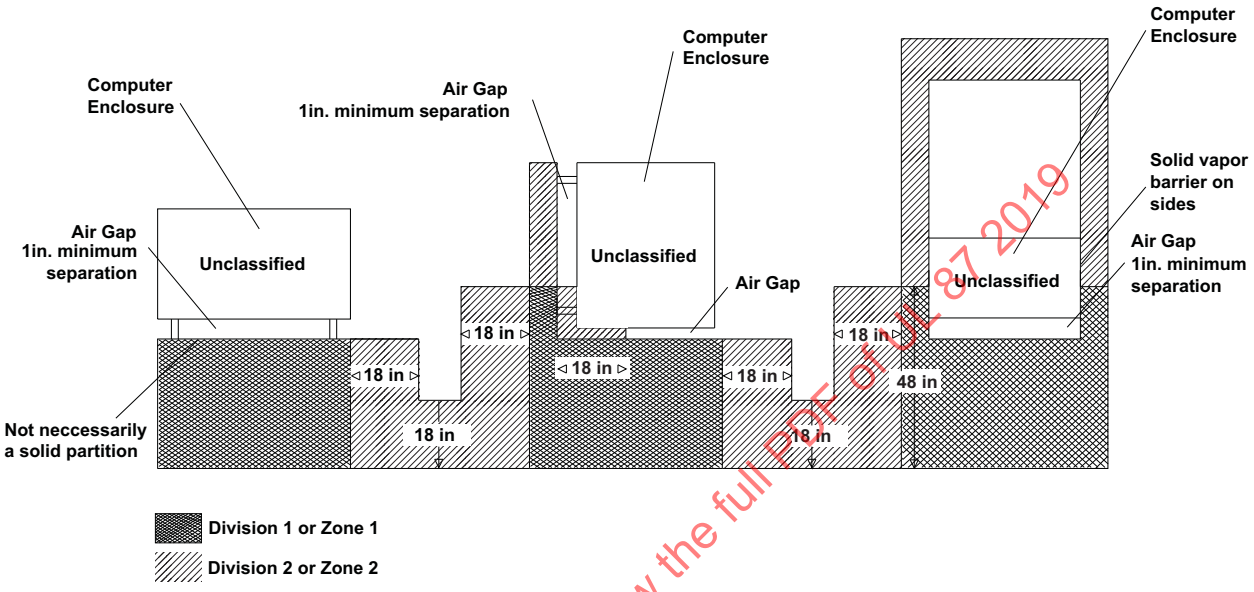
b) Softness of metal.

9.8 Unused openings in a vapor barrier shall be sealed in the same manner as described in 9.7.

10 Air Gap

10.1 Dispensing devices which incorporate an air gap construction shall provide a minimum 1 inch (25.4 mm) free air space between planes of classified areas and unclassified areas. 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 1 inch (25.4 mm) per ″running″ inch 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 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 area is provided. The size and position of assemblies shall not create areas 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.

11 Pumping Units

11.1 A pumping unit may be located in the pedestal or installed remotely from the pedestal. A pumping unit of the conventional motor-operated type may be constructed for conversion to hand operation for emergency use.

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 50 psi (345 kPa) and anticipate a temperature rise of 27.8°C (50°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.

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

12.3 Expansion pressures in a self-contained dispenser may be relieved by connection to:

a) An atmospheric vented air eliminator.

b) A separate return line to 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.

d) A variable-volume expansion chamber.

12.4 Expansion pressures in a remote-control type dispenser may be relieved by connection to:

a) A separate return line to tank.

b) 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.

c) A variable-volume expansion chamber.

12.5 An air eliminator or a similar vent shall be made of metallic tubing of not less than 1/4 inch (6.4 mm) 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 holster is considered to be outside of the pedestal housing.

12.6 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.

12.7 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 fitting calling attention to the need for connecting this part by piping with the underground tank.

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

12.9 A float in a float-actuated mechanism shall provide a buoyancy equal to at least 150 percent of that force required to operate the mechanism with which it is related.

12.10 A cork float shall be provided with a dip coating of heavy-body, 5 pound (2.3 kg) cut shellac, as described in the Standard Specification for Shellac Varnishes, ASTM D360, or with a coating that has been determined to be equivalent.

12.11 A float shall be attached to its corresponding lever, rod, or other part of the mechanism and shall be secured by a setscrew, lock washer, locknut, or by a part that has been determined to be equivalent, to reduce the risk of detachment under service conditions.

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 force of three times that exerted by the spring in any position of its intended function.

14 Strainer

14.1 A dispensing device shall be provided with at least one strainer or filter located at the inlet.

14.2 A strainer 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.

14.3 A drain opening shall be closed by a brass pipe plug, or a steel pipe plug coated to resist corrosion, not smaller than 1/4-inch pipe size. A petcock or valve shall not be provided for drainage purposes.

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

15 Visible Discharge Indicator

15.1 The total liquid capacity of a visible discharge indicator, if supplied with the device, shall not exceed 1 quart (0.9 liter). A transparent part shall be made of glass. (See also 28.3 and the Temperature Reduction Test, Section 35.) Edges of glass parts shall be beveled or rounded.

15.2 The design and assembly of an indicator, as well as its location in the device, shall reduce the risk of breakage of glass parts. Tension on the hose shall not stress the parts of an indicator.

15.3 An indicator shall be located in the device so that, in the event of leakage of liquid or rupture of glass parts, liquid will not drip on lamps or lampholders.

16 Valves

16.1 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. See Control Application, Section 19, for additional information.

16.2 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 16.1.

16.3 A hose nozzle valve shall comply with the applicable requirements in the Standard for Hose Nozzle Valves, UL 2586.

16.4 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.

16.5 A petcock or valve shall not be used which, when open, permits the discharge of liquid.

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

17 Piping and Fittings

17.1 Pipe threads shall be in accordance with the Standard for Pipe Threads, General Purpose (Inch), ANSI/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 inches	Shoulder distance, inches	(mm)
1/8	3/8	9.5
1/4, 3/8	9/16	14.3
1/2, 3/4	3/4	19.1
1	15/16	23.8
1-1/4	31/32	24.6
1-1/2	1	25.4
2	1-1/32	26.2
2-1/2	1-33/64	38.5
3	1-37/64	40.1

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

17.5 Pipe shall be standard full-weight (ASTM Schedule 40) wrought iron or steel, or iron-pipe size brass or copper pipe. Malleable-iron, steel, brass, or copper fittings shall be used. 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 33.1.

17.6 Tube fittings appropriate for the tubing employed shall be used. Brass or copper in combination with aluminum shall not be used unless coated with chromium or a metallic coating that has been determined to be equivalent to preclude electrolytic action. A coating shall have a thickness of not less than 0.0002 inch (0.005 mm).

17.7 Seamless drawn aluminum or copper tubing that may handle liquid and steel tubing of the seamless, brazed, or welded type shall have a wall thickness of not less than that specified in Table 17.2.

17.8 Steel tubing of the wall thickness specified in Table 17.2 shall be protected with a corrosion-resistant coating that has been determined to be equivalent to that provided by hot-dip galvanizing.

17.9 A liquid-line opening for field connection shall be furnished with a metal-to-metal seat union that complies with the requirements in the Standard for Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service, UL 860; or the fitting provided for field connections shall comply with the Torque Test, Section 33, and 43.3. The opening shall be plugged or capped prior to shipment to reduce the risk of entrance of foreign material.

Table 17.2
Wall thickness for aluminum copper and steel tubing

Outside diameter,		Minimum wall thickness			
		Aluminum and copper,		Steel,	
inches	(mm)	inch[a]	(mm)	inch[a]	(mm)
1/8	3.17	0.0265	0.67	0.028	0.71
1/4	6.35	0.0265	0.67	0.028	0.71
5/16	7.94	0.0265	0.67	0.028	0.71
3/8	9.53	0.0265	0.67	0.028	0.71
1/2	12.70	0.0315	0.80	0.028	0.71
5/8	15.88	0.0365	0.93	0.035	0.89
3/4	19.05	0.0385	0.98	0.035	0.89
7/8	22.23	0.0410	1.04	0.049	1.24
1	25.40	0.0460	1.17	0.049	1.24
1-1/8	28.58	0.0460	1.17	0.049	1.24
1-1/4	31.75	0.0505	1.28	0.049	1.24
1-3/8	34.93	0.0505	1.28	–	–
1-1/2	38.10	–	–	0.065	1.65

[a] Nominal wall thickness of tubing will have to be greater than the thickness indicated to maintain the minimum wall thickness.

18 Hose and Couplings

18.1 When a hose is supplied with the device, it shall be of a type having nonferrous couplings attached. Hose assemblies that comply with the requirements in the Standard for Hose and Hose Assemblies for Dispensing Flammable Liquids, UL 330, comply with the intent of this requirement. The couplings shall be attached by the hose manufacturer, or by the dispensing device manufacturer when facilities are provided in the factory for attaching the couplings and testing the assembled hose. See 29.2 and 39.2.

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

18.3 A dispensing device employing a hose reel or weighted loop shall be constructed to store and handle at least two different brands of hose. See 42.1.1(c).

18.4 A dispensing device employing a hose retrieving mechanism intended for use with coaxial type hose shall be constructed to handle at least two different brands of hose/hose clamp combinations. See 42.1.1(c).

19 Control Application

19.1 A motor shall not be started simultaneously 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 opened 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 circuit may be opened 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 opening of the motor circuit has been accomplished.

19.3 When the dispenser manufacturer specifies a hose nozzle valve and/or hose assembly intended for the dispenser the function of the control application and locking mechanism, Section 25, is to be verified on a representative sample of the dispenser with that hose nozzle valve and/or hose assembly intended for the dispenser. Alternate combinations of nozzles and hoses shall be verified by the end user and when instructions as shown in 43.4 are included. Alternately, the marking shown in 42.1.1(d) can be used to cover the combinations when each combination is verified by the testing agency.

Note – It is permissible to use a combination of the instructions and marking to cover the combinations of hose nozzle valves and/or valve and hose combinations.

19.4 The hose may not form part of the control application or locking mechanism and in such cases shall not need to be described in the instructions or marking.

ELECTRICAL EQUIPMENT

20 General

20.1 Electrical equipment intended for use in hazardous locations shall comply with the requirements for Class I, Group D or Zone 1 equipment in the National Electrical Code, NFPA 70, unless otherwise indicated by these requirements.

20.2 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.

20.3 Electrical equipment and wiring shall be arranged so that the liquid handled will not drip or drain on them during intended care and usage.

20.4 A device shall be constructed so that the enclosure or housing, frame, and similar noncurrent-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.

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

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

20.7 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 20.8.

20.8 A pressure wire connector that is intended for grounding and that is located where it may 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.

20.9 When a conduit run contains wiring to which field wiring connections are to be made, the conduit run shall terminate in an outlet box or enclosure complying with the requirements for equipment for the locations specified in the National Electrical Code, NFPA 70. The box or enclosure shall be located 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 20.1.

Table 20.1
Trade size of conduit and vertical clearance for box hubs

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

20.10 A vertical clearance less than that specified in 20.9 may be employed if the intended unions, sealing fittings and interconnections are provided by the dispenser manufacturer.

20.11 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.

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

20.13 The size of a junction box in which field installed conductors are to be connected by splicing shall be not less than that specified in Table 20.2. 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 14 AWG (2.1 mm^2). 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 18 AWG (0.8 mm^2) when the wire size is marked on the installation wiring diagram.

20.14 The size of a junction box in which field installed conductors are to be connected to factory installed terminal strips shall be determined by Table 20.2 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.

Table 20.2
Size of junction boxes

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

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

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

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

20.18 A terminal plate tapped for a wire-binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick for a 14 AWG (2.1 mm^2) or smaller wire, and not less than 0.050 inch (1.27 mm) thick for a wire larger than 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.

20.19 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 the Standard for Wire Connectors, UL 486A-486B.

20.20 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.

20.21 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 lampholders shall be connected to the white or gray conductor.

21 Motors

21.1 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.

21.2 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 of dual-voltage rating.

22 Switches

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

22.2 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.

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

23.1 Lighting, electrical, and electronic equipment utilized in Class I, Group D, Division 2 or Zone 2 hazardous locations shall also 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 34) or otherwise protected to reduce the risk of water entering a lampholder or the enclosure for electrical and electronic equipment.

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

23.3 A lampholder shall be mechanically supported and shall be wired in the assembly at the factory.

23.4 Lighting, electrical, or electronic parts other than lampholders which may produce arcs or high temperature 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 the National Electrical Code, NFPA 70.

23.5 Lighting, electrical, or electronic parts other than lampholders which do not produce arcs or high temperature 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.

23.6 The requirement specified in 23.5 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 150 square inches (645 cm^2).

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

c) A plastic panel shall comply with 8.7.

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 1 or Zone 1 hazardous location.

23.7 Lighting, electrical and 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 or holster in or above the Class I, Group D, Division 2 or Zone 2 hazardous location by means of a solid partition or enclosure.

23.8 A lighting fixture intended for mounting on a dispenser shall comply with the Standard for Electric Signs, UL 48. 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.

24 Wiring Methods

24.1 The wiring of circuits within the device shall comply with the requirements specified in 24.2 – 24.24. Splices in conductors shall be insulated and positioned to reduce the risk of high-voltage parts contacting metallic parts of the dispensing device.

24.2 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 is provided for each ungrounded supply conductor.

24.3 Except for intrinsically safe circuits 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 20.15.

24.4 Gasoline-resistant wire may be exposed to gasoline vapor (not liquid gasoline) at temperatures within the limits of the temperature rating of the wire type.

24.5 A conductor having solid neoprene insulation or other material that has been determined to have equivalent resistance to gasoline vapor 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.

24.6 Regarding the requirements specified in 24.5, appliance wiring material having 90°C (194°F) solid neoprene insulation may be used for internal wiring not exposed to liquid gasoline if the insulation is at least 3/64 inch (1.2 mm) in thickness for 12 and 14 AWG (3.3 and 2.1 mm^2) sizes and at least 2/64 inch (0.8 mm) in thickness for 16 and 18 AWG (1.3 and 0.8 mm^2) sizes. A braid covering may or may not be provided. Since the wire having 2/64 inch thickness of insulation is to be rated 300 volts, this wire shall not be used in discharge devices rated in excess of this voltage.

24.7 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 gasoline-resistant 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 and pumps.

24.8 Except as specified in 24.9, if wiring is not routed near components that may attain temperatures as great as, or in excess of, the temperature limit of the insulated conductor (such as resistors, coils, ballasts, or similar parts), wire size shall be as specified in Table 24.1. 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 motor may be used.

24.9 The acceptability of conductor routed close to components producing heat, or wire size smaller than specified by Table 24.1, is to be evaluated on the basis of a temperature test.

24.10 Except as permitted in 24.11 and 24.12, 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 equipment for use in hazardous locations specified in the National Electrical Code, NFPA 70. 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 equipment for use in hazardous locations. At least five full threads shall engage in each threaded joint.

Table 24.1
Wire sizes for circuit requirements

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

24.11 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 having a melting point of not less than 510°C (950°F). General-purpose fittings may be used.

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

24.13 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.

24.14 A seal shall be provided at the location where a conduit enters an enclosure for a switch, lamp starter, or other part that may produce arcs, and in the conduit at any location where conduit as specified in 24.10 is connected to a general-purpose enclosure, lampholder, or receptacle.

24.15 When wiring is enclosed as permitted by 24.11, seals shall be located so that any vapors entering the conduit system in the area described in 3.4(a) will not enter or be communicated to the wiring system installed as specified in 24.11. 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 24.11.

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

24.17 A factory-installed conduit seal incorporated as part of the device shall comply with the requirements in the Hydrostatic Strength Test, Section 29, and the Leakage of Wire Sealing Test, Section 36.

24.18 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 37;

d) Be resistant to moisture and aging; and

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

24.19 Sealing compound 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) 200°F (93.3°C) when used adjacent to motors having Class A (Class 105) insulation and

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

The softening point is to be determined in accordance with the Standard Test Method for Softening Point by Ring-and-Ball Apparatus, ASTM E28-92.

24.20 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 5/8 inch (15.9 mm), 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.

24.21 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.

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

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24.23 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.

24.24 Circuits for lighting and for motors shall be readily identifiable in the junction box provided for field connections.

25 Locking Mechanism

25.1 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 gasoline through the dispensing outlet. When the locking means is based upon the use of an ordinary padlock, the padlock [considered to have a 1/4 inch (6.4 mm) minimum diameter shackle] need not be supplied.

PERFORMANCE

26 General

26.1 Representative samples of a dispensing device and its component parts shall comply with the tests described in Sections 26 – 35.

26.2 Endurance and leakage tests conducted on devices and parts are to employ kerosene or an equivalent nonflammable solvent as the liquid medium.

26.3 Hydrostatic strength tests are to be conducted using water or other liquid to develop the required pressure.

27 Endurance Test

27.1 Mechanical shaft seal

27.1.1 A mechanical-shaft seal shall not seize, leak, or otherwise malfunction during operation when tested as specified in 27.1.2.

27.1.2 A pump, meter, or other assembly employing a mechanical-shaft seal is to be subjected to the following endurance test. The assembly is to be operated continuously for a total of 300 hours; 50 hours at the maximum operating pressure to which it will be subjected in use and 250 hours at a pressure of 10 psig (68.9 kPa). Operating parts are to be kept ″wet″ during the test by maintaining a flow of liquid.

27.2 Hose

27.2.1 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 27.2.3.

27.2.2 A hose arranged as described in 27.2.1 and assembled in the device in the intended manner and subjected continuously to the maximum operating or bypass pressure, whichever is greater, is to be withdrawn and returned as specified in 27.2.3.

27.2.3 This endurance test is to 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 is to be withdrawn in a direction parallel to the side of the housing through which the hose passes. The rate of cycling is to be similar to that of intended operation, and the hose is to 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.

27.3 Retrieving mechanism

27.3.1 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 27.3.2. Any clamp or fitting for attachment to the hose shall not cause damage to the hose during this test.

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

27.4 Boot control assembly endurance test

27.4.1 A boot control assembly shall not seize, show excessive wear, have breakage or otherwise malfunction during operation when tested as specified in 27.4.2. If the spring does not provide boot control it may be replaced as needed if it breaks.

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

28 High-Pressure Leakage Test

28.1 A mechanical-shaft seal and any other liquid-handling part, including any joint made in the assembly of the complete dispensing device, shall not leak when subjected to a hydrostatic pressure of 75 psig (518 kPa) for 1 minute.

28.2 This test is to be conducted following and using the same samples as used for the Endurance Test, Section 27.

28.3 An indicator shall withstand an internal hydrostatic pressure of 250 psig (1.72 MPa) for 1 minute without showing evidence of damage or leakage.

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29 Hydrostatic Strength Test

29.1 A liquid-handling part of the dispensing device, except an air separator housing and a mechanical-shaft seal, shall withstand, without rupture, an internal hydrostatic pressure of 250 psig (1.72 MPa) for 1 minute. An air-separator housing that is vented to the atmosphere, when so tested, shall withstand 100 psig (0.69 MPa).

29.2 A hose coupling attached to a hose by a dispensing device manufacturer shall withstand a hydrostatic-test pressure of 350 psig (2.42 MPa) without rupture or leakage. See 18.1.

29.3 In the hydrostatic test specified in 29.2, the pressure is to be increased at the rate of 300 psig (2.07 MPa) per minute to 200 psig (1.38 MPa), and is to be held at that level for 5 minutes. The pressure is then to be increased to 350 psig (2.42 MPa) at a rate not greater than 1000 psig (6.90 MPa) per minute and held for at least 1 minute.

29.4 A conduit seal in a factory-sealed device shall withstand for 1 minute, without rupture or permanent distortion, a hydrostatic test pressure of 600 psig (4.148 MPa). 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 2-inch (60.3 mm outside diameter) or larger trade size conduit with wires sealed in place, a device with a seal and without wires is not prohibited from being used. The hydrostatic pressure is to 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.

30 Moist Ammonia-Air Stress Cracking Test

30.1 After being subjected to the conditions described in 30.2 – 30.3, a pressure-confining brass part containing more than 15 percent zinc shall:

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

b) Perform as intended when tested as described in 30.4.

30.2 One test sample of each size is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Samples with threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened as intended in normal use. Polytetrafluoethylene (PTFE) tape or pipe compound are not to be used on any threads. Samples with male threads are evaluated as received.

30.3 The samples are then to be tested in accordance with Apparatus, Section 6, Reagents and Materials, Section 7, Test Media, Section 8, Test Sample Preparation (9.3 - 9.4), Test Procedure (10.1 - 10.4) of the Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys, ASTM B858-06, except the pH level of the test solution shall be High 10.5 ±0.1 and the exposure temperature shall be 25 ±1°C.

30.4 After the exposure period, the samples are to be examined for cracks or other signs of stress corrosion using a microscope having a magnification of 25X. Pressure-confining parts exhibiting degradation as indicated in 30.1 as a result of the test exposure described in 30.2 and 30.3 shall withstand, without rupture, a hydrostatic test pressure of five times the rated pressure of the valve, for 1 minute.

31 Float Crushing Test

31.1 A hollow float shall exhibit no signs of leakage after immersion in water as described in 31.2 and shall withstand an external pressure of 35 psig (241 kPa) without distortion.

31.2 Two samples of a hollow float are to be subjected to this test. Each float is to be first checked for freedom from leakage by being suddenly immersed in water heated at just below the boiling point and observed for 3 minutes for the appearance of bubbles. When no leakage is noted, each float is then to be placed in a container of appropriate size and strength which may be built up of pipe and pipe fittings. The container is to be connected to a source of hydrostatic pressure, and a calibrated pressure gauge is to be installed in the pressure supply piping. Care is to be taken to completely fill the container with liquid to expel all air. The pressure is then to be increased slowly to 35 psig (241 kPa) and held for 1 minute. The floats are then to be removed from the container and examined.

32 Marking Adhesion Test

32.1 Representative samples of a pressure-sensitive label, or a label secured by cement or adhesive are to be subjected to exposure conditions for indoor use (standard atmosphere, water immersion, and oven aging) or, if applicable, to exposure conditions for outdoor use (the above plus low temperature and ultraviolet light and water exposure), to determine compliance with the applicable requirements for permanence and legibility in the Standard for Marking and Labeling Systems, UL 969.

32.2 When the labels are exposed to unusual conditions in service (such as motor fuels, oils, detergents, and similar parts), representative samples are to be subjected to an additional immersion test. This test is be conducted in the same manner as the immersion test described in the Standard for Marking and Labeling Systems, UL 969, except that the samples are to be immersed in a solution representative of service use, instead of in demineralized water. For exposure to detergents, the solution is to consist of a mixture of 25 grams of a commercial detergent per liter of water. Following the test, the labels shall comply with the requirements for permanence and legibility in UL 969.

33 Torque Test

33.1 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 33.1, exerted as if to screw the fitting onto a pipe or into a pipe fitting.

33.2 The sample fitting used in this test is to be rigidly anchored or otherwise supported. A section of Schedule 80 pipe is to be connected to a female pipe threaded section of the sample, or an appropriate pipe fitting is to be connected to a male pipe threaded section, the male threads having first been lubricated with No. 10 SAE machine oil. After the torque force has been applied, the fitting shall not leak when tested as specified in 28.1.

Table 33.1
Torque requirements for pipe connections

Pipe size, ANSI B2.1 nominal inches	Torque, lb-in	Torque, (N·m)
1/8	150	16.9
1/4	250	28.2
3/8	450	50.8
1/2	800	90.4
3/4	1000	113
1	1200	136
1-1/4	1450	164
1-1/2	1550	175
2	1650	186
2-1/2	1750	198
3	1800	203

34 Rain Test

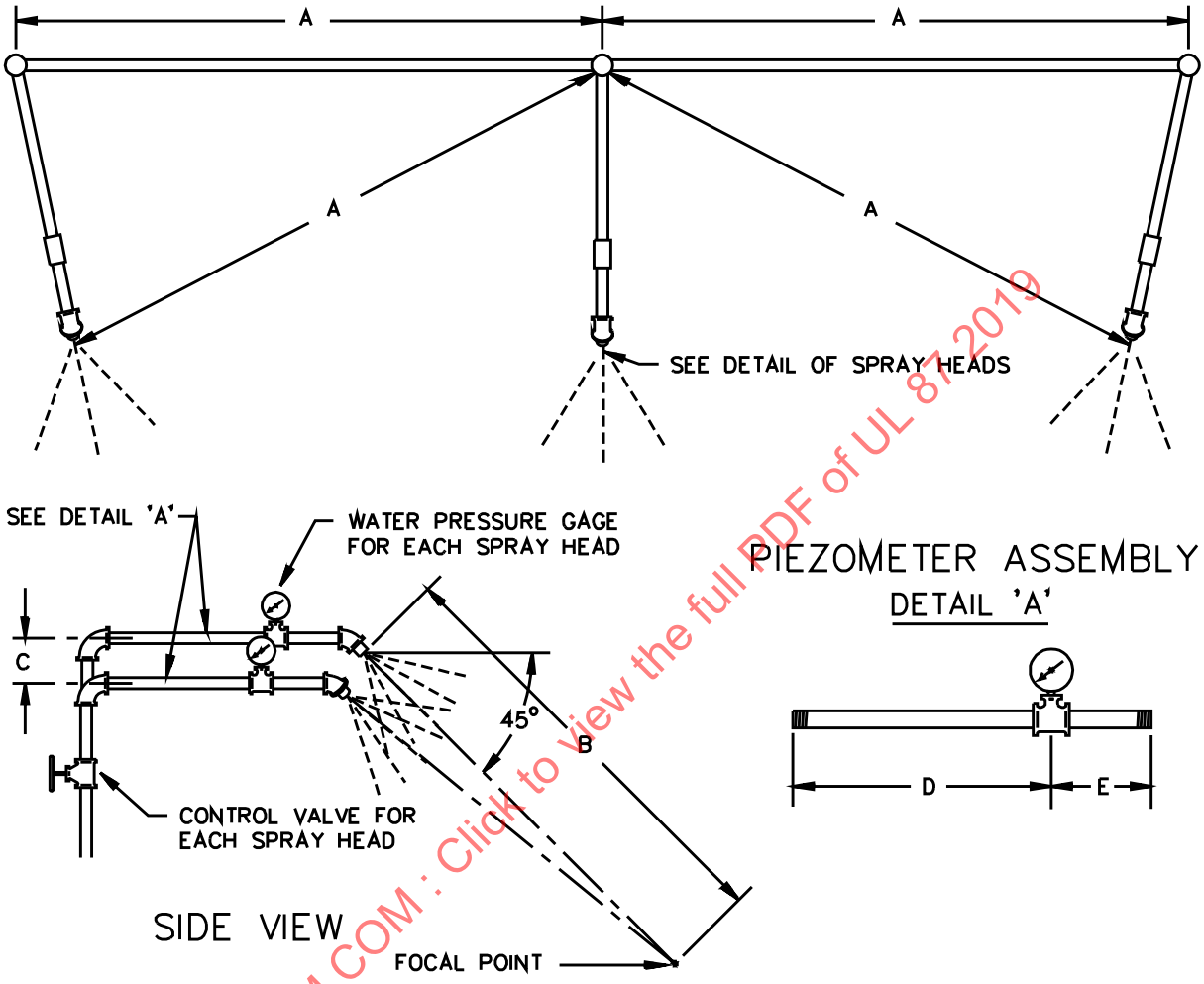
34.1 To determine whether an enclosure complies with 8.1, the enclosure shall be tested as described in 34.2. At the conclusion of the test there shall be no accumulation of water within the enclosure, and no water shall appear within the enclosure at a level higher than any area intended for live parts.

Exception: For enclosures containing live parts, the water is not prohibited from entering the enclosure above these live parts when the construction is such that the water is not visible on live parts, insulating material, or mechanism parts. However, no water shall enter any space that is above live parts and in which wiring is present under any proper installation conditions.

34.2 The water-spray-test apparatus is to consist of three spray heads mounted in a water supply pipe rack as shown in Figure 34.1. Spray heads are to be constructed in accordance with the details shown in Figure 34.2. The enclosure is to be set up as intended by the manufacturer. The enclosure is to be positioned in the focal area of the spray heads so that the greatest quantity of water enters the enclosure. The water pressure is to be maintained at 5 pounds per square inch (34.5 kPa) at each spray head. The enclosure is to be exposed to the water spray for 1 hour.

34.3 The water spray is to produce a uniform spray over the entire surface or surfaces under test. Unless the construction of the product is such that a test on one side is representative of a test on another side, the test in 34.2 is to be repeated on other sides of the enclosure as required.

Figure 34.1
Rain test spray-head piping



Item	inch	mm
A	28	710
B	55	1400
C	2–1/4	55
D	9	230
E	3	75

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