UL 79

STANDARD FOR SAFETY

Power-Operated Pumps for Petroleum Dispensing Products

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UL Standard for Safety for Power-Operated Pumps for Petroleum Dispensing Products, UL 79

Tenth Edition, Dated April 29, 2016

Summary of Topics

This revision of ANSI/UL 79 dated March 19, 2021 includes the Endurance Test; 45.2

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 revised requirements are substantially in accordance with Proposal(s) on this subject dated January 15, 2021.

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APRIL 29, 2016
(Title Page Reprinted: March 19, 2021)

ANSI/UL 79-2021

UL 79

Standard for Power-Operated Pumps for Petroleum Dispensing Products

The first and second editions were titled "Power-Operated Pumps and Discharge Device Accessory Pumps." The third edition was titled "Power-Operated Pumps for Flammable Liquids." The fourth edition was titled "Power-Operated Pumps for Petroleum Products."

First Edition – July, 1929
Second Edition – June, 1938
Third Edition – April, 1967
Fourth Edition – April, 1973
Fifth Edition – July, 1975
Sixth Edition – February, 1981
Seventh Edition – December, 1992
Eighth Edition – December, 1996
Ninth Edition – June, 2005

Tenth Edition

April 29, 2016

This ANSI/UL Standard for Safety consists of the Tenth Edition including revisions through March 19, 2021.

The most recent designation of ANSI/UL 79 as an American National Standard (ANSI) occurred on March 3, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 cover products described in 1.2. Requirements for the installation and use of these products are included in the Flammable and Combustible Liquids Code, NFPA 30; the Automotive and Marine Service Station Code, NFPA 30A; and the National Electrical Code, NFPA 70.

1.2 These requirements cover electrically-, hydraulically-, or pneumatically-driven power-operated pumps for use with petroleum products in the following applications:

a) Self-contained flammable liquid dispensing devices and submerged pumps used in storage tanks that provide the petroleum product to remote control flammable liquid dispensing devices. They are intended for operation at discharge pressures of 50 pounds per square inch (psig) (345 kPa), or the marked maximum discharge pressure rating, when less, with the ambient and liquid temperature within the range of minus 20°F (minus 29°C) – 125°F (52°C).

b) Flammable liquid dispensing systems to transfer the petroleum product from a tank or container to a vehicle or another container. They are intended for operation at the marked maximum discharge pressure, or less, with the ambient and liquid temperature within the range of minus 20°F (minus 29°C) – 125°F (52°C).

c) Vapor recovery applications for flammable liquid dispensing devices. They are intended to operate under a vacuum at the inlet and a maximum discharge pressure of 50 psig (345 kPa), or marked discharge pressure, whichever is less.

1.3 These requirements do not cover:

a) Oil burner pumps, which are evaluated under the Standard for Pumps for Oil-Burning Appliances, UL 343.

b) Pumps for engine-powered automotive equipment.

c) Pumps for marine use which are evaluated under the Standard for Mechanically and Electrically Operated Fuel Pumps for Marine Use, UL 1130.

d) Pumps for use in chemical, petrochemical, or petroleum processing plants; utility power plants; petroleum production facilities; pipeline pump stations; pipeline or marine terminals; or bulk plant distribution and related facilities.

e) Pumps used in mobile applications, such as on tank trucks, portable tanks, or portable containers mounted on vehicles.

f) Pumps rated more than 600 volts.

g) Pump assemblies also provided with a flammable liquid meter or electrically-operated shutoff valve, which are evaluated in accordance with the Standard for Power-Operated Dispensing Devices for Petroleum Products, UL 87.

1.4 The pump assembly is not prohibited from being constructed such that it provides for the installation and use of a flammable liquid hose and hose nozzle valve.

1.5 "Petroleum Products," as used herein, means gasoline, gasoline/alcohol blends up to 15% Ethanol or 15% Methanol, diesel fuel, fuel oil, lubricating oil, and the vapors of these fuels. Other petroleum products are not prohibited from being used in the pump when the materials comply with the requirements

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in Materials, Section 5, when the pump is evaluated using the additional liquids, and the additional petroleum products are marked on the pump as indicated in 74.1(f).

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.

2.1.5 Electrical components, including motors and wiring, when incorporated by a manufacturer in an assembly with a pump, and including the means provided in the pump assembly for electrical connections, shall comply with the requirements for equipment for use in hazardous locations, Class I, Group D, National Electrical Code, NFPA 70, Articles 500 and 501.

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 purposes of these requirements, the following definitions apply.

3.2 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 mixture.

3.3 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.

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3.4 LINE-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 circuit.

3.5 LOW-VOLTAGE CIRCUIT – A circuit involving a peak open-circuit potential of not more than 42.2 volts supplied by:

a) A battery;

b) A Class 2 transformer; or

c) A combination of a transformer and a fixed impedance that, as a unit, complies with the performance requirements for Class 2 transformers in accordance with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.
A circuit derived from a line-voltage circuit by connecting a resistance in series with the supply circuit as a means of limiting the voltage and current is not a low-voltage circuit.

3.6 RAINPROOF ENCLOSURE – An enclosure that prevents the entrance of a beating rain to the extent that there is no wetting of electrical parts and no water enters a compartment housing field installed wiring.

CONSTRUCTION

4 Assembly

4.1 The construction of a pump shall be such that parts can be assembled in the intended manner after being dismantled to the extent needed for replacement of parts or for other maintenance or servicing.

4.2 When a pump requires the use of special pipe flanges, gaskets, bolts, or other special fittings or parts for making connections, such parts shall be furnished as part of the pump assembly.

4.3 A product shall be formed and assembled so that it has the strength and rigidity required to resist the abuses to which it is subjected without resulting in the risk of fire, electric shock, or injury to persons due to total or partial collapse with:

a) Resulting reduction of spacings;

b) Loosening or displacement of parts; or

c) Other defects.

4.4 A pump-motor assembly to be shipped from the manufacturer disassembled shall be provided with the marking described in 74.9.

5 Materials

5.1 A metal part to be used for bodies or closures shall be inherently resistant to the action of the liquid to be handled. Other parts in contact with the liquid to be handled shall be resistant to the action of such liquid when malfunction of the part results in:

a) Leakage;

b) Malfunction of equipment connected to the outlet of the pump; or

c) A risk of injury to persons.

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5.2 With reference to the requirement in 5.1, an elastomeric part used in contact with liquid or vapor shall have the following properties when tested as specified in the Standard for Gaskets and Seals, UL 157:

a) Those properties relating to minimum tensile strength and elongation after oven aging, as specified in UL 157. The service temperature used to determine the conditioning time and temperature for oven aging is to be 140°F (60°C), unless the product is designated for use at a higher temperature, or the temperature of the component measured during the temperature test is higher.

b) Low temperature rating of minus 20°F (minus 29°C).

c) Volume change and extraction as specified in the requirements for UL 157, for end-use applications of gasoline, gasoline/alcohol blends up to 15% Ethanol, gasoline/alcohol blends up to 15% Methanol, diesel fuel, fuel oil, and lubricating oil. Other end-use applications, when marked on the pump, shall use the fluids marked for exposure.

Exception No. 1: Polytetrafluoroethylene (PTFE) is considered to comply with the requirements of this paragraph.

Exception No. 2: When an elastomeric part does not comply with the requirements described in (a) – (c), the pump assembly shall be evaluated in accordance with 5.5.

Exception No. 3: Testing with methanol is only required when the product is specifically rated for methanol blend use.

5.3 An elastomeric part forming a part that is depended on for protection of electrical components from rain or submersion in water shall have the following physical properties when tested as specified in the Standard for Gaskets and Seals, UL 157:

a) Those properties relating to minimum tensile strength and elongation after oven aging, as specified in UL 157. The service temperature used to determine the conditioning time and temperature for oven aging is to be 140°F (60°C), unless the product is designated for use at a higher temperature, or the temperature of the component measured during the temperature test is higher.

b) Low temperature rating of minus 20°F (minus 29°C).

5.4 The Standard for Gaskets and Seals, UL 157, provides for the testing of either finished elastomeric parts, or sheet or slab material. Sheet or slab material is to be tested when the elastomeric parts are O-rings having a diameter of less than 1 inch (25.4 mm). The material tested is to be the same as that used in the product, regardless of whether finished elastomeric parts, or sheet or slab material is tested.

5.5 When the limits for tensile strength and elongation, volume change or extraction, aging, or low temperature are exceeded, the gasket material may be retested in the complete pump assembly after conditioning as outlined below.

5.6 When the limits for tensile strength, elongation, volume change or extraction are exceeded, the complete assembly constructed with the gasket installed as intended shall be filled with the appropriate test fluid for 70 hours at room temperature, and then shall comply with the requirements for the Leakage Test, Section 43 and the Hydrostatic Strength Test, Section 49.

5.7 Where the oven aging results are not in accordance with 5.2(c), the complete assembly with the gasket installed as intended, shall be placed in an air oven for the same duration and at the same temperature used when testing the gasket material, and then shall comply with the Leakage Test, Section 18, and the Hydrostatic Strength Test, Section 49, while at the test temperature.

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5.8 Where the low temperature results are not in accordance with 5.2(d), the complete assembly with the gasket installed as intended, shall be placed in a cold chamber for 24 hours at the same temperature used when testing the gasket material, and then shall comply with the Leakage Test, Section 18, and the Hydrostatic Strength Test, Section 21, while at the test temperature.

5.9 A plastic part of a pump that comes in contact with fluid or vapor and whose malfunction of the parts results in the hazards specified in 5.1 shall comply with the requirements of the Dimensional Stability Test, Section 51.

5.10 Except as indicated in 5.11, liquid-confining parts, which under conditions of deterioration would result in external leakage of the fluid being confined, other than a valve disc or soft seat, a seal ring, a diaphragm, or a 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 (69 MPa) at 400°F (204°C).

5.11 A brazing material used for joining liquid-confining parts of a pump shall have a melting point (solidus temperature) exceeding 1000°F (538°C).

5.12 Sand castings used in the construction of liquid-confining parts, failure of which will allow external leakage, shall be free from porosity leakage and shall have a design thickness of not less than that specified in Table 5.1.

Table 5.1
Minimum thickness of liquid-confining sand-castings

Material	Minimum wall thickness, 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

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

5.14 When atmospheric corrosion of a part will interfere with the intended function of a pump or permit external leakage, the part shall be of corrosion-resistant material or be provided with a corrosion-resistant protective coating.

5.15 A coating as specified in 5.14 need not be provided on ferrous materials used for fluid-confining parts having the following thicknesses:

a) Castings having a wall thickness of not less than 1/4 inch (6.4 mm);

b) Standard pipe and fittings conforming to ANSI/ASME B36.10M, Schedule 40; and

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

5.16 A protective coating as specified in 5.14 shall provide resistance against corrosion to a degree not less than that provided by the protective coatings indicated in 5.17.

5.17 Cadmium plating shall have a thickness of not less than 0.0003 inch (0.008 mm) and zinc plating shall have a thickness of not less than 0.0005 inch (0.013 mm). However, on parts where threads

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constitute the major portion of the area, the thickness of the cadmium or the zinc plating shall be not less than 0.00015 inch (0.0038 mm) as determined by the Metallic Coating Thickness Test, Section 56.

5.18 A protective coating indicated in 5.16 or other coatings in contact with liquid shall be resistant to the action of the liquid, as indicated in the Coating Liquid Resistance Test, Section 57.

5.19 A pressure confining part made of drawn brass or machined from brass rod, and consisting of 15% or more zinc content, shall withstand, without cracking, the Moist Ammonia-Air Stress Cracking Test, Section 54.

5.20 The reliability of a nonmetallic, pneumatic pressure confining part shall be determined for each application. Among the factors to be taken into consideration with the reliability of a nonmetallic material are:

a) Mechanical strength;

b) Resistance to impact;

c) Resistance to distortion and creeping at temperature and pressures to which the material is subjected under conditions of intended use; and

d) Dimensional stability.

Compliance with this requirement is determined by the tests of Sections 51, 68, 69, and 70.

5.21 An adhesive that is relied upon to reduce the risk of fire, electric shock, or injury to persons, or that is relied upon to maintain electrical spacings, shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

5.22 The requirement in 5.21 also applies to an adhesive used to secure a conductive part, including a nameplate, which when loosened or dislodged is capable of:

a) Energizing an accessible dead metal part,;

b) Making a live part accessible;

c) Reducing spacings below the minimum values specified in Table 31.2; or

d) Short-circuiting live parts.

6 Bodies, Covers, and Heads

6.1 A pump body assembly shall withstand the deformation, leakage, and hydrostatic strength test requirements specified in 42.1, 43.1, and 49.1. These requirements do not apply to body sections of submersible type pumps intended to be immersed in the liquid.

6.2 Plugs and other parts, other than cap screws and bolts threaded into noncorrosion-resistant ferrous parts of the pump, shall be of corrosion-resistant metal or provided with a protective coating when they are required to be removed for adjustment, repair, or other care of the pump.

6.3 A plug, cap, or other part threaded into or on the pump body shall engage with at least four full threads.

6.4 A bolt or a screw hole shall not extend through the outer walls of a pump body into a liquid-handling section.

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7 Drive-Shaft Seals

7.1 A stuffing box or a seal shall comply with the requirements specified in the Endurance Test, Section 45.

7.2 An adjustable stuffing box, when guarded or not accessible, or when clearly visible to the operator, shall be provided with a spring-loaded follower gland or the equivalent.

7.3 An automatic spring take-up for a gland shall employ a spring made of corrosion resistant material or coated to retard corrosion.

7.4 The physical characteristics of a take-up spring shall be such that it advances the gland through not less than one-half its possible travel from its initial setting with the spring compressed.

7.5 The stuffing-box recess shall be such that packing material does not come into contact with screw threads.

8 Diaphragms

8.1 A metal part coming in contact with a diaphragm shall have no sharp edges, burrs, projections, and surfaces that are capable of chafing or abrading the diaphragm.

8.2 A pump, in which a flexible diaphragm, bellows, or similar construction constitutes the only fluid seal, shall be constructed such that the atmospheric side of the diaphragm or bellows is enclosed in a casing construction to reduce external leakage in the event of a diaphragm or bellows rupture, or shall have provisions for connection of a vent pipe or tubing intended to be routed to the outdoors or other location determined to be equivalent. See 74.8.

9 Springs

9.1 A spring shall be guided and arranged to reduce binding, buckling, or other interference with its free movement. When required, ends of a spring shall be closed and squared.

10 Floats

10.1 A float constructed to actuate a mechanism shall have a buoyancy not less than 50 percent greater than that required to operate the mechanism. See the Float Buoyancy Test, Section 50.

10.2 A hollow float shall withstand an external crushing pressure of not less than 35 psig (240 kPa). See the Float Test, Section 49.

10.3 A cork float shall be provided with a coating that is resistant to the action of the liquid with which it is in contact.

10.4 A float shall be secured to its corresponding lever, rod, or other part of the mechanism by a method that prevents the float from becoming detached under its intended conditions of operation.

10.5 A float constructed of nonmetallic materials shall comply with the requirements of the

a) Float Buoyancy Test, Section 50;

b) Dimensional Stability Test, Section 51; and

c) Weight Change Test, Section 52.

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11 Air Separators

11.1 Air separators that are provided as an integral part of a pump assembly shall be provided with floats that comply with the requirements of Floats, Section 10.

11.2 The valve mechanism operated by the float shall be subjected to the endurance test described in 46.1. When the valve mechanism closes a vent to atmosphere, it shall also be subjected to the leakage test described in 43.6.

12 Strainers

12.1 A strainer integral with or provided as part of a pump assembly shall comply with the requirements in 12.2 – 12.5 and with the applicable requirements in the Standard for Strainers for Flammable Fluids and Anhydrous Ammonia, UL 331.

12.2 A strainer shall enable the removal of foreign matter (sediment or dirt) without depositing the foreign matter in the outlet side of the strainer when the screen or filter element is removed for cleaning.

12.3 A strainer shall be installed and located so that removal and replacement of the strainer element is accomplished without breaking liquid lines or disturbing any part of the pump assembly. The location shall provide for the collection and removal of any spillage.

12.4 A drain opening shall be closed by a pipe plug made of corrosion resistant material or a steel pipe plug coated to resist corrosion, not smaller than 1/4 inch pipe size (ANSI B36.10M). A pet cock or valve shall not be provided for drainage purposes.

12.5 The force necessary to open a strainer shall not permanently distort the assembly or piping to which the strainer is attached.

13 Outlet Pressure Regulation

13.1 A pump assembly for use with or in petroleum product dispensing devices shall incorporate means for the prevention of or the relief of pressures developed by the pump in excess of the maximum discharge pressure of 50 psig (345 kPa) or the marked maximum discharge pressure rating, whichever is less. A pump assembly for use with or in petroleum product dispensing systems shall incorporate means for the prevention of or the relief of pressures developed by the pump in excess of the maximum discharge pressure. See Blocked Outlet Test, Section 47.

13.2 To comply with the requirements in 13.1, a pump assembly is not prohibited from being equipped with:

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

b) A relief valve arranged to be connected between the discharge side and the supply tank through a separate return line. When the relief valve is not provided as part of the pump, it shall be marked as indicated in 74.6;

c) A means to effect an automatic reduction in volumetric capacity upon an increase in pressure at the outlet; or

d) An energy input incapable, because of power or speed, of developing a discharge pressure in excess of the maximum discharge pressure.

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13.3 After the valve or other means for pressure regulation has been adjusted in accordance with the requirements in 13.1, it shall:

a) Be capable of being sealed to discourage tampering;

b) Be located within the pump body and require tools for access; or

c) Be constructed so that the maximum adjustment obtainable does not result in a pressure in excess of the maximum discharge pressure under maximum output conditions.

14 Pressure Relief

14.1 A pump for use with or in petroleum product dispensing devices shall incorporate means for the relief of pressures developed by thermal expansion of the fluid in excess of the maximum discharge pressure of 50 psig (345 kPa). A pump assembly for use with or in petroleum product dispensing systems shall incorporate means for the relief of pressures developed by thermal expansion in excess of the marked maximum discharge pressure. Thermal expansion pressure shall anticipate a temperature rise of 50°F (27.8°C) in an ambient temperature of 75°F (24°C). See the Pressure Relief Test, Section 48.

14.2 To comply with the requirements in 14.1, a pump assembly is not prohibited from being equipped with:

a) A bypass valve connected between the discharge and suction ports and

b) A relief valve arranged to be connected between the discharge side and the supply tank through a separate return line. When the relief valve is not provided as part of the pump, it shall be marked as indicated in 74.6.

14.3 After the valve or other means for pressure relief has been adjusted in accordance with the requirements in 14.1, it shall be:

a) Capable of being sealed to discourage tampering;

b) Located within the pump body and require the use of tools for access; or

c) Constructed so that the maximum adjustment obtainable does not result in a pressure in excess of the maximum discharge pressure.

15 Mounting and Base

15.1 A pump shall be provided with supporting and mounting means independent of liquid-handling pipe connections. A mounting arrangement shall permit anchoring of the pump by bolts or cap screws.

15.2 When a base is furnished as part of a pump assembly, it shall be arranged to permit attachment and alignment of mounted parts and for anchoring to a mounting surface by cap screws or bolts.

16 Guards

16.1 A gear, belt, pulley, or other rotating part shall be enclosed in a metal guard or the pump assembly shall be furnished with an enclosure.

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.

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Exception: Pumps intended for use in installations where pipe fittings incorporate other than NPT type threads shall be permitted to be provided with pipe threads complying with a national pipe thread standard compatible with those fittings. The pipe thread type shall be identified in accordance with 74.1(j).

17.2 Flanges of flange-type pumps shall comply with the appropriate American National Standard for pipe flanges and flanged fittings covering the material from which they are made, or such flanges and flanged fittings shall comply with all of the tests in Sections 41, 42, 43, 49 and 54 as complete assemblies forming part of the pump.

17.3 An opening threaded for attachment to pipe shall be constructed so that a pipe threaded two threads beyond standard construction (for the size in question) is capable of being threaded into the opening without distorting any part of the fitting.

17.4 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
Minimum shoulder distance from beginning of thread

Pipe size, ANSI B36.10M, 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
1-1/2	1-33/64	38.5
3	1-37/64	40.1

17.5 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.

17.6 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, when used, shall be of the ground-joint type or a part that has been determined to be equivalent.

17.7 Tubing is not prohibited from being used where it is protected by its location in the pump assembly or by its intended installation location.

17.8 Tube fittings intended for the tubing utilized 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 not be less than 0.0002 inch (0.005 mm) thick.

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

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Table 17.2
Wall thickness for aluminum copper and steel tubing

Outside diameter,		Minimum wall thickness			
		Aluminum and copper,		Steel,	
inch	(mm)	inch[a]	(mm)[a]	inch[a]	(mm)[a]
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	12.7	0.0315	0.80	0.028	0.71

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

17.10 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.

18 Hose Nozzle Valve, Hose, and Coupling

18.1 If a hose nozzle valve is provided, the hose nozzle valve shall be in accordance with the Standard for Hose Nozzle Valves, UL 2586.

18.1A When the pump manufacturer specifies a hose nozzle valve and/or hose assembly intended for the pump, the function of the locking mechanism and control application, Section 37 and 38 respectively, is to be verified on a representative sample of the pump with that hose nozzle valve and/or hose assembly intended for the pump. Alternate combinations of nozzles and hoses shall be verified by the end user and when instructions as shown in 72.4 are included. Alternately, the marking shown in 74.4 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.

Note – 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.

18.2 When a hose assembly, consisting of hose and couplings, is supplied with the pump assembly, it shall have nonferrous couplings attached and comply with the Standard for Hose and Hose Assemblies for Dispensing Flammable Liquids, UL 330.

19 Conduit Seals

19.1 A factory-installed conduit seal incorporated as part of the product shall comply with the requirements of the Leakage Test, Section 43; the Leakage of Wire Seal Test, Section 44; and the Hydrostatic Strength Test, Section 49.

19.2 When a conduit seal is incorporated with the product, 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 liquids and vapors to which it is capable of being exposed – see the Tests on Sealing Compounds, Section 55;

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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.

The sealing compound used in 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 200°F (93.3°C) when used adjacent to motors having Class A (Class 105) insulation and not less than 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.

19.3 When a nipple is used to retain the sealing compound for lead wires, 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. Depending on the compound, the size of the lead wires, and the construction of the sealing well, a greater depth of sealing compound shall be used as required to form a tight seal. Means shall be provided in the nipple to anchor the sealing compound.

20 Electrical Equipment

20.1 Electrical conduit to be immersed in the liquid to be handled shall be of the rigid, seamless, metallic type or other material that has been determined to be equivalent.

20.2 Electrical equipment and wiring shall be arranged so that the liquid does not drip or drain on them during the intended care and usage of the pump assembly.

20.3 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.

Exception: The housing is not prohibited from being considered the electrical enclosure for intrinsically safe circuit wiring.

20.4 One end of a wireway between two parts that are factory-attached to an assembly is not prohibited from being secured to one of the parts by means of straight threads and, where necessary for security, with a locknut when the other end of the wireway is secured to the other part by tapered threads.

20.5 A compartment enclosing a switch or other part that is capable of producing arcs shall be sealed from any adjacent compartment in which field connections are to be made.

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

20.7 For a vapor-tight fit, the sheath of shielded or multiconductor cables shall be split to enable the seal materials to be poured around the individual conductors.

Exception: Shielded or multiconductor cables that are evaluated in accordance with the Leakage of Wire Seal Test, Section 44, for the cable are not required to be split.

20.8 A terminal box threaded to conduit enclosing wiring sealed against the entry of water, petroleum products, or vapor shall not be subject to turning or require removal to accommodate replacement or

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extraction of parts for maintenance, servicing, or to facilitate the connection of field-installed piping or conduit.

20.9 Upper ends of conduit subject to immersion or to entry of water, liquids, or vapors shall be sealed in the area between the conduit inside diameter and the enclosed wiring. Sealing shall be by means of litharge and glycerine, or with a nonmetallic material which has been successfully evaluated for use in this application. See Tests on Sealing Compounds, Section 55.

20.10 Threaded joints for conduit shall provide for five full-thread engagement. Threads subject to turning during installation or use shall be coated with litharge and glycerine. Threads not subject to turning during installation or use and subject to immersion in petroleum products shall be coated with litharge and glycerine or a gasoline-resistant pipe-joint sealing compound. Threaded joints in a coupling used to join lengths of conduit immersed in petroleum products shall be prevented from turning by leak-tight welding or brazing at the conduit and outside surfaces of couplings or by coating all threads with litharge and glycerine.

20.11 Wiring for motor or other leads subject to accidental immersion in petroleum products shall be of gasoline-resistant wiring material conforming with the construction, performance, and marking requirements in the Standard for Thermoset-Insulated Wires and Cables, UL 44, or the Standard for Thermoplastic-Insulated Wires and Cables, UL 83.

20.12 Grounding of motors and other electrical components and wiring shall be provided in accordance with the provisions of the National Electrical Code, NFPA 70.

20.13 An outlet box or enclosure shall have no unplugged openings other than those to which conduit is always connected when the pump assembly is installed.

20.14 A pump assembly intended for use with a dispensing device that is to be connected to the branch circuit shall not be constructed in such a manner that is required that the outlet box of the product be moved in order to care for the device.

20.15 The size of a junction box in which field installed conductors are to be connected by splicing shall not be less than that specified in Table 20.1. 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 circuits shall not be 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 shall not be smaller than 18 AWG (0.8 mm^2) when the wire size is marked on the installation wiring diagram.

20.16 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 20.1 as the summation of the volumes required for each field furnished conductor plus the volume utilized by the factory installed wiring and terminal block.

Table 20.1
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	8.4	2.7	44.2	3.0	49.2

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