UL 428A

STANDARD FOR SAFETY

Electrically Operated Valves for
Gasoline and Gasoline/Ethanol Blends
with Nominal Ethanol Concentrations
Up to 85 Percent (E0 – E85)

UL Standard for Safety for Electrically Operated Valves for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations Up to 85 Percent (E0 – E85), UL 428A

First Edition, Dated June 4, 2015

Summary of Topics

This revision of ANSI/UL 428A dated February 3, 2021 is issued to Equate Long Term Exposure Testing Duration – Valve and End Product; 27.3.3

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 November 6, 2020.

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Standard for Electrically Operated Valves for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations Up to 85 Percent (E0 – E85)

Prior to the first edition, the requirements for the products covered by this standard were included in the Outline of Investigation for Electrically Operated Valves for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations Up to 85 Percent (E0 – E85), UL 428A.

First Edition

June 4, 2015

This ANSI/UL Standard for Safety consists of the First Edition including revisions through February 3, 2021.

The most recent designation of ANSI/UL 428A as an American National Standard (ANSI) occurred on January 22, 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 electrically operated general purpose and safety valves rated 600 volts or less and intended for the control of the fluids specified in 1.2. Electrically operated valves, other than automotive fuel valves, covered by these requirements are intended to be used in other than hazardous locations as defined in accordance with the National Electrical Code, NFPA 70.

1.2 Electrically operated valves for use in dispensing devices are intended for use with one or more of the following:

a) Gasoline formulated in accordance with the Standard Specification for Automotive Spark Ignition Fuel, ANSI/ASTM D4814;

b) Gasoline/ethanol blends with nominal ethanol concentrations up to 25 percent ethanol (E25), consisting of gasoline formulated in accordance with the Standard Specification for Automotive Spark Ignition Fuel, ANSI/ASTM D4814, when blended with denatured fuel ethanol formulated to be consistent with the Standard Specification for Denatured Fuel Ethanol for Blending With Gasoline For Use as Automotive Spark Ignition Engine Fuel, ANSI/ASTM D4806; or

c) Gasoline/ethanol blends with nominal ethanol concentrations above 25 percent formulated in accordance with the Standard Specification in item (b) or formulated in accordance with the Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark Ignition Engines, ANSI/ASTM D5798, as applicable.

1.3 These requirements cover valves whose coils are powered by a Class 2 (low-voltage) source. Valves incorporating a high-voltage transformer with a low-voltage secondary as an integral part of the valve assembly, are also covered by these requirements.

1.4 These requirements do not cover valves for use with fluids other than as specified in 1.2.

1.5 These requirements do not cover valves employing electrical parts, including coils, switch contacts and resistance elements, located in the flammable gas containing compartment of a valve. Valves constructed as such shall comply with the requirements in the Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations, UL 913.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a valve covered by this standard shall comply with the requirements for that component.

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.

2.2.2 Unless indicated otherwise all voltage and current values mentioned in this standard are root-mean-square (rms).

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.

2.4 Automotive-fuel valve

2.4.1 An automotive fuel valve shall comply with the requirements applicable to safety valves in the Standard for Electrically Operated Valves, UL 429.

3 Glossary

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

3.2 AUTOMOTIVE-FUEL VALVE – An electrically operated valve rated for use with a direct current (DC) circuit and intended for use as a fuel-line shutoff valve on mobile equipment.

3.3 BLENDING OPTION – Dispensing devices may be provided with an option that blends two specific fuels into one fuel to be dispensed. This blending occurs at the dispenser level and can be in two forms:

a)Fixed blending – Blending at the dispenser level that blends two specific fuels into one fuel to be dispensed, and that fuel to be dispensed is fixed. For example, fixed blending includes blend options where gasoline and denatured fuel ethanol can be blended to achieve E85, which is the actual dispensed fuel.

b)Variable blending – Blending at the dispenser level that blends two specific fuels into the fuel to be dispensed, but the fuel to be dispensed can be any of a number of previously set points. For example, variable blending includes blend options where gasoline and E85 can be blended to achieve E40, E60, and E85 as the actual dispensed fuel.

3.4 ELECTRICAL CIRCUITS –

a) Class 2 Circuit – A circuit involving a potential of not more than 42.4 volts peak supplied by:

1) An isolating source that complies with the requirements in the Standard for Class 2 Power Units, UL 1310, or the requirements in 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

2) A dry cell battery having output characteristics no greater than those of an inherently limited Class 2 transformer; or

3) A combination of a rechargeable battery and a fixed impedance or regulating network that complies with the applicable performance requirements for an inherently limited Class 2 transformer.

b) Low-Voltage Circuit – A circuit involving a potential of not more than 30 volts ac (42.4 volts peak or direct current) and supplied from transformer output windings which are electrically isolated (i.e. insulated from ground). 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. Unless the isolating transformer is provided as part of the valve or marked per 49.7, the circuit shall be considered a high voltage circuit.

c) 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 circuit.

d) Intrinsically Safe Circuit – A circuit in which any spark or thermal effect produced either normally or in specified fault conditions, is incapable of causing ignition of a mixture of flammable or combustible material in air in the mixtures most easily ignited concentration under the test conditions specified in the Standard for Intrinsically Safe Apparatus and Associated Apparatus, for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations, UL 913.

e) Safety-Control Circuit – A circuit involving one or more safety controls.

3.5 GASOLINE/ETHANOL BLENDS – Blended fuels composed of a gasoline component and an ethanol component. The numerical value corresponding to the ethanol component determines the blend rating (such as E85 for 85% ethanol, 15% gasoline).

3.6 GENERAL PURPOSE VALVE – Either a normally open or normally closed valve intended to control the flow of a fluid.

3.7 MAXIMUM OPERATING PRESSURE DIFFERENTIAL– The maximum difference between the pressure at an inlet port and the pressure at an outlet port against which an electrically operated valve is intended to operate.

3.8 MAXIMUM RATED PRESSURE – The maximum pressure to which the valve assembly may be subjected as specified by the manufacturer.

3.9 MINIMUM OPERATING PRESSURE DIFFERENTIAL – The minimum difference between the pressure at an inlet port and the pressure at an outlet port required for operation of the valve.

3.10 RAINPROOF ENCLOSURE – An enclosure that prevents rain from interfering with the intended operation of apparatus within the enclosure.

3.11 RAINTIGHT ENCLOSURE – An enclosure that, when exposed to a beating rain, does not permit water to enter the enclosure.

3.12 SAFETY VALVE – A normally closed valve intended to be actuated by a safety control or by an emergency device to prevent the delivery of a fluid that can result in risk of fire.

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

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

3.15 SWITCH – A contact device actuated by the valve mechanism and intended to control electrical loads that are internal or external to the valve.

a) Safety Switch – A switch that opens and closes a safety-control circuit, or one intended for use as an interlock in a safety-control circuit.

b) Nonsafety Switch – A switch not associated with a safety-control circuit.

3.16 WATERTIGHT ENCLOSURE– An enclosure that, when subjected to the application of a hose stream as described in the Hosedown Test, Section 40, does not permit water to enter the enclosure.

CONSTRUCTION

4 General

4.1 Valves shall be constructed so that they comply with the rules for installation and use of such equipment as given in the National Electrical Code, ANSI/NFPA 70.

4.2 Fluid confining parts, except gaskets and seals, shall be constructed of metallic materials.

5 Assembly

5.1 All valves

5.1.1 A valve shall include all the components necessary for its intended function and installation. The components shall be constructed for assembly as a unit.

5.1.2 Two or more subassemblies intended to be assembled in the field as a unit shall be capable of being joined together without requiring any of the subassemblies to be cut, drilled, welded, or otherwise altered.

5.1.3 If two or more valves or actuating devices, or both, are intended to be used together as one unit, the entire assembly is to be considered and tested as one valve.

5.1.4 The construction of a valve shall be such that parts can be reassembled after being dismantled to the extent needed for servicing.

5.1.5 A screwed cap or cover that constitutes a fluid-confining part, and that is intended to be removed for servicing a valve, shall require the use of a tool for removal.

5.1.6 A seat disc shall be attached to its poppet or holder or be otherwise assembled to prevent it from becoming dislocated under service conditions. The disc may be secured by crimping, staking, or the equivalent, or by means of a chemical bond achieved by vulcanization in a controlled molding process. Cement or adhesive shall not be used as the sole means for securing a disc.

5.1.7 The valve assembly shall withstand the stresses and vibration of intended operation, as determined by compliance with the Endurance Test, Section 29.

5.2 Safety valves

5.2.1 A safety valve shall not depend on an outside source of energy, such as electricity, to function as a safety shutoff.

5.2.2 A safety valve shall close independently of the energy supplied by the medium flowing. However, the medium flowing may be used to exert supplementary closing forces on the valve seat.

5.2.3 A safety valve shall not be equipped with a bypass or with a means to prevent it from closing completely. This requirement does not apply to a feature provided to permit a takeoff to recirculate fluid or to supply a pilot or other individually controlled outlet.

5.2.4 An automatic shutoff mechanism shall be guarded to prevent unintended obstruction of moving parts.

5.2.5 A safety valve shall also function as a safety shutoff if intended to function as a safety shutoff, regardless of the position of any damper or external operating lever or any reset device. The manipulation of a manual-reset device shall not cause the valve to function as an automatic-reset valve.

5.2.6 A safety valve shall not be equipped with means for manually latching the valve in the open position if such latching may prevent the valve from functioning as a safety shutoff.

5.2.7 The appropriate positions or the direction of movement for a manual operating lever or reset handle included in a safety valve shall be clearly indicated.

5.2.8 If a mechanically actuated indicator is provided to indicate whether the main valve is open or shut, the indicator shall be visible from a distance of at least 5 feet (1.5 m).

5.3 Class 2 (low-voltage) valves

5.3.1 Valves whose coils are powered by a Class 2 (low-voltage) source shall comply with the construction and testing requirements defined in this standard, Section 19.

6 Materials

6.1 Metallic materials

6.1.1 General

6.1.1.1 A metallic part, in contact with the fuels anticipated by these requirements, shall be resistant to the action of the fuel if degradation of the material will result in leakage of the fuel or if it will impair the function of the device. For all fuel ratings, see Corrosion due to fluid, 6.1.2.1. For valves rated for gasoline/ethanol blends with nominal ethanol concentrations greater than 40%, see Metallic materials – system level, 6.1.3.

6.1.1.2 The exposed surfaces of metallic parts shall be resistant to atmospheric corrosion if this corrosion will lead to leakage of the fluid or if it will impair the function of the device. The material shall comply with the requirements in Atmospheric corrosion, 6.1.2.2.

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

6.1.2 Metallic materials – material level

6.1.2.1 Corrosion due to fluid

6.1.2.1.1 All metallic materials used for fluid confining parts shall be resistant to corrosion caused by the fuels anticipated by these requirements. In addition, metallic materials, used internally in fluid confining parts, that are required to operate in some manner to address safety (e.g. plunger on a valve) shall be resistant to corrosion caused by these fuels. Compliance is verified by the Long Term Exposure Test, Section 27.

6.1.2.1.2 A coating or plating, applied to a base metal, shall be resistant to the action of the fuels anticipated by these requirements as determined by the Long Term Exposure Test, Section 27.

6.1.2.2 Atmospheric corrosion

6.1.2.2.1 Metallic materials used for fluid confining parts shall be resistant to atmospheric corrosion. Ferrous materials of the thickness specified in the following items are acceptable for the preceding when uncoated:

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

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

6.1.2.2.2 A protective coating shall provide resistance against atmospheric corrosion to a degree not less than that provided by the protective coatings specified in 6.1.2.2.3.

6.1.2.2.3 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 considered to comply with 6.1.2.2.1 when they are protected against atmospheric corrosion by:

a) Hot dipped, mill galvanized sheet steel complying with the coating designation G90 in Table I of 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.

6.1.2.2.4 A metallic material other than as described in 6.1.2.2.1 – 6.1.2.2.3 shall be painted or protected in a manner that has been determined to be equivalent.

6.1.3 Metallic materials – system level

6.1.3.1 Combinations of metallic materials in products rated for use with gasoline/ethanol blends with nominal ethanol concentrations greater than 40% shall be chosen to reduce degradation due to galvanic corrosion in accordance with 6.1.3.2 – 6.1.3.4.

6.1.3.2 Table 6.1 shows the galvanic series for metallic materials exposed to a conductive solution of sea water. The most active material in a given combination will experience increased levels of corrosion, while the most passive material in the combination will experience reduced levels of corrosion. The greater the separation of the materials are in the galvanic series of Table 6.1, the more pronounced the effects would