UL 429

STANDARD FOR SAFETY

Electrically Operated Valves

UL Standard for Safety for Electrically Operated Valves, UL 429

Seventh Edition, Dated November 6, 2013

Summary of Topics

This revision of UL 429 dated March 19, 2021 includes the addition of Class 120 Insulation Systems and Smaller Conductor Sizes for Class 2 Devices; 14.1.3, 14.2.1, and Table 26.1

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 29, 2021.

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UL 429

Standard for Electrically Operated Valves

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This UL Standard for Safety consists of the Seventh edition including revisions through March 19, 2021.

The Department of Defense (DoD) has adopted UL 429 on August 10, 1989. 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 cover electrically operated general purpose and safety valves rated 600 volts or less and intended for the control of fluids, such as air, gases, oils, refrigerants, steam, water, and the like. Electrically operated valves, other than automotive fuel valves, covered by these requirements are intended to be used in other than hazardous locations as defined by the National Electrical Code, NFPA 70.

1.2 These requirements also cover electrically operated valves intended to be factory installed on or in certain appliances as operating or safety controls.

1.3 These requirements do not cover automatic valves for gas appliances that are covered by the requirements in the Standard for Automatic Valves for Gas Appliances, ANSI Z21.21/CSA 6.5.

1.4 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.

1.5 When the valve assembly includes a pressure or flow regulator, its regulating ability is not covered by requirements in this standard.

1.6 When a mechanically actuated indicator is provided to indicate whether the valve is open or closed, its visibility from any distance is not covered by requirements in this standard.

1.7 In addition to the requirements in this standard, valves intended for fire protection service are required to comply with the Outline of Investigation for Electrically Operated Valves for Fire Protection Service, SU 429A.

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. See Appendix A for a list of standards covering components used in the valves 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.

2.2.2 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 and as noted in 14.1.3, 14.2.6 and 58.4.

2.5 Marine valve

2.5.1 A valve used for marine service shall additionally comply with the requirements in Supplement SA.

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

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

3.4 FLAMMABLE AND COMBUSTIBLE FLUID – A gas or liquid considered to be flammable or combustible, such as acetylene, petroleum base hydraulic oil, fuel oil, gasoline, kerosene, or similar petroleum product, liquefied petroleum gas (LP-Gas), manufactured or natural fuel gas, anhydrous ammonia, or hydrogen.

3.5 GENERAL PURPOSE VALVE – Either a normally open or normally closed valve intended to control the flow of a fluid, but not depended upon to act as a safety valve.

3.6 HAZARDOUS FLUID – A gas or liquid considered to be highly corrosive or toxic, for example, a strong acid or alkali, ammonia, or perchlorethylene. Refrigerants designated other than Class A1 per the Standard for Designation and Safety Classification of Refrigerants, ASHRAE 34 are considered hazardous. Highly Corrosive and Highly Toxic are defined using the Globally Harmonized System of Classification and Labeling Chemicals (GHS) as shown below:

1. Highly Corrosive – Skin Corrosion – Category 1,

2. Highly Toxic Fluid - Any of the following:

    a. Acute Toxicity – Category 1 and 2,

    b. Reproductive Toxicity – Category 1,

    c. Target Organ Toxicity: Single or Repeated Exposure – Category 1.

3.7 HYDRAULIC FLUID POWER SYSTEM – A system that transmits and controls power by use of a pressurized hydraulic fluid within an enclosed circuit.

3.8 INTERLOCK – A switch or control intended to verify the physical state of a required condition, such as proof of closure (that is, supervise the closing of a safety valve) and to furnish that verification to a safety-control circuit by means of a switch contact closure.

3.9 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.

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

3.11 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.

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

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

3.14 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.

3.15 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 43, 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, NFPA 70.

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 may be hand-removable if:

a) The valve is intended for use with nonflammable or nonhazardous fluids only,

b) Leakage becomes apparent to the user before such part is completely disengaged, and

c) The part can be retightened with the valve under rated pressure so as to prevent further leakage.

Otherwise, such parts 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 Valves intended for oxygen service shall be free of oil, grease, and other foreign substances that are not compatible with oxygen. Thread sealing compounds and lubricants shall be compatible with oxygen.

5.2 Safety valves

5.2.1 A safety valve shall not depend on an external source of energy, such as electricity, pneumatic or hydraulic pressure 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 is permitted to 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 function as intended 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.

5.3 Class 2 valves

5.3.1 Valves whose coils are powered by a Class 2 source shall comply with the construction requirements defined in Table 5.1 and the performance requirements defined in Table 24.3.

Table 5.1
Construction requirements applicable to valves supplied only from a Class 2 source

Requirement	Type of valve or fluid handled		
	General purpose Nonhazardous / Nonflammable	General purpose Hazardous / Flammable / Combustible	Safety Valve
Section 4	Applies	Applies	Applies
Sections 5 – 11	All apply, note exception in 6.1.5	All apply, note exception in 6.1.5	All apply, exception in 6.1.5 is not applicable
Sections 12	Not required	Not required	Not required
Section 13 and 14	13.2.3 and all of sections 13.4, 13.8 and 13.9 are applicable. Section 14 applies.	13.2.3 and all of sections 13.4, 13.8 and 13.9 are applicable. Section 14 applies.	13.1.1, 13.1.2, 13.2.3 and all of sections 13.4, 13.8 and 13.9 are applicable. Section 14 applies.
Sections 15 – 18	Section 15 is not applicable. 16.2 – 16.4 are applicable. Section 17 is not applicable. 18.1 and 18.6 are applicable.		
Section 19	19.1 is applicable		
Section 20	Applies	Applies	Applies
Sections 21 and 22	Not required	Not required	Applies

6 Materials

6.1 All valves

6.1.1 A part in contact with the fluid to be handled shall be resistant to the action of the fluid.

6.1.2 Zinc, copper, and copper base alloys such as brass are subject to rapid destructive action by ammonia in the presence of water and shall not be used in contact with ammonia.

6.1.3 Iron and steel parts, except bearings, thermal elements, laminated relay cores, and the like, where such protection is impracticable, shall be protected against corrosion by enameling, galvanizing, sherardizing, plating, or other means that have been determined to be equivalent.

6.1.4 The requirement in 6.1.3 applies to enclosing cases whether of sheet steel or cast iron, to current-carrying parts, and to other parts upon which intended mechanical operation may depend. It does not apply to small minor parts of iron or steel, such as washers, screws, bolts, and the like, that are not current-carrying, if malfunction of such unprotected parts does not introduce a risk of injury to persons.

6.1.5 Vulcanized fiber may be used for insulating bushings, washers, separators, and barriers, but not as the sole support for uninsulated current-carrying parts of other than Class 2 nonsafety circuits.

6.1.6 A nonmetallic material that is used for the valve body or as a fluid-confining part of a general purpose pneumatic (air) valve shall comply with the following:

a) The material shall have a minimum Relative Thermal Index (Mech RTI) of 50°C or an RTI in accordance with UL 746B that is not less than the maximum rated ambient fluid temperature, or the maximum operating temperature measured on the valve body or other fluid-confining part of the valve during the Temperature Test, Section 26, whichever is greater.

b) Samples of the complete valve assembly shall be subjected to the additional tests outlined in Table 24.2.

6.1.7 Glass covering an observation opening in the fluid containing body shall be subjected to the Sight Glass Impact, Section 49 and Sight Glass Temperature Shock, Section 50 requirements.

6.2 Safety valves and general purpose valves for flammable, combustible and hazardous fluids

6.2.1 A fluid-confining or operating part of a valve, if malfunction of such a part will allow leakage or introduce a risk of injury to persons, shall have the strength and durability for intended service of the parts and the assembly.

6.2.2 With reference to the requirements in 6.2.1, a material (except a valve disc or soft seat, an epoxy seal, a seal ring, a diaphragm, or a gasket) shall have a melting point (solidus temperature) of not less than 510°C (950°F) and a tensile strength of not less than 10,000 psi (69 MPa) at 204°C (400°F).

6.2.3 A brazing material used for joining fluid-confining parts of a valve for LP-Gas shall have a melting point (solidus temperature) of not less than 538°C (1000°F). Brazing involving copper or copper base alloys shall not be used on valves intended for use with ammonia.

6.3 Synthetic rubber materials

6.3.1 A synthetic rubber part in contact with one of the fluids indicated in Table 6.1 shall not show excessive volume change or loss of weight, when considered on the basis of its intended function, following immersion for 70 hours in the specified test liquid. See the Immersion-Volume Change Test, Section 46, and the Immersion-Extraction Test, Section 47. The immersion-extraction test is not to be conducted with Reference Fuel A or IRM Oil No. 903.

Table 6.1
Test fluid for synthetic rubber materials

Fluid handled	Test liquid
Anhydrous ammonia	Liquid anhydrous ammonia
Manufactured, natural fuel gases, and LP-Gas	IRM Oil No. 903 (ASTM D471) and n-Hexane
Fuel oils	IRM Oil No. 903 (ASTM D471)
Gasoline	IRM Oil No. 903 (ASTM D471) and Reference Fuels A and C (ASTM D471)
Hydraulic oils	IRM Oil No. 903 (ASTM D471)
Caustic, corrosive, toxic	Fluid handled
Refrigerants (excluding ASHRAE Class A1), Refrigeration system oils	Specific refrigerant and refrigerant oil combinations

6.3.2 With reference to the requirements in 6.3.1, the change in volume shall not be more than 25 percent swelling (40 percent in Reference Fuel C or H) or 1 percent shrinkage, and the weight loss (extraction) shall not be more than 10 percent.

6.3.3 If the limits for volume change or weight loss in 6.3.1 are exceeded, a complete valve assembly is to be filled with the appropriate test liquid for 70 hours. Following the conditioning the liquid shall be drained and the valve assembly permitted to dry in free air for 70 hours at any ambient temperature in the range of 10 – 40° C (50 – 104° F). The valve shall then comply with the requirements for the External Leakage Test, Section 29, the Seat Leakage Test, Section 30, and the Hydrostatic Strength Test, Section 34 as appropriate for the type of seal and valve.

6.3.4 External seal parts, and operating parts of safety valves affecting the closing of the valve and made of synthetic rubber shall not crack or show visible evidence of deterioration after being subjected to hand flexing following exposure as specified in the accelerated air-oven aging test in the Standard for Gaskets and Seals, UL 157. The oven temperature is based on the maximum normal operating (service) temperature of the seal or operating part. The oven temperature shall not be less than 60°C (140°F).

Exception No. 1: Oxygen bomb test for valves rated for oxygen service.

Exception No. 2: When a synthetic rubber material only used as a static seal cracks or shows visible evidence of deterioration following exposure as specified in the accelerated air-oven aging test, new samples of the synthetic rubber material are to be tested in the complete valve assembly, or as an alternative, new samples of the synthetic rubber material are to be tested in a test setup, which simulates the seal or gasket in the valve. After the accelerated air-oven aging testing, the samples shall comply with the requirements for the External Leakage Test, Section 29 and the Hydrostatic Strength Test, Section 34. For accelerated air-oven aging testing on the valve assembly, other seals or gaskets for which the valve assembly oven aging test is not intended, may be removed from the valve assembly before the accelerated air-oven aging test and then installed prior to the External Leakage Test and the Hydrostatic Strength Test.

6.3.5 External seal parts, and operating parts of safety valves affecting the closing of the valve made of a thermoplastic material in contact with one of the fluids listed in Table 6.1 shall be subjected to the Dimensional Stability Test in Section 51.

6.3.6 External seal parts, and operating parts of safety valves affecting the closing of the valve made of elastomeric and synthetic rubber material in contact with Hydrogen gas at pressures greater than 75 psig shall be subjected to the Accelerated Hydrogen-Pressure Aging Test, Section 54.