

Subject 541

June 29, 2018

## **SUMMARY OF TOPICS**

***The following changes in requirements to the Standard for Refrigerated Vending Machines, UL 541, are being proposed.***

- 1. Proposed Revisions To Update Requirements For Controls***
- 2. Proposed Revision To And Addition Of Requirements To Prevent Remote Shut-off Of Vending Machines***
- 3. Proposed Revisions To And Addition Of Requirements To Address Switch Mode Power Supply Units Increasingly Used In Refrigerated Vending Machines***
- 4. Proposed Revisions To Clarify Requirements For Vending Machines Having Two Supply Cords***
- 5. Proposed Revisions To Marking Requirements To Clarify Application Of UL 969 Requirements***
- 6. Proposed Revision To Ignition Protection Test Requirements To Provide An Additional Testing Option***
- 7. Proposed Revisions To EMI Filter Requirements To Specify An Alternate Compliance Option***
- 8. Proposed Revisions To Incorporate Editorial Corrections***

**STP BALLOTS AND ALL COMMENTS DUE: August 13, 2018**

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

### **1. Proposed Revisions To Update Requirements For Controls**

## **RATIONALE**

Proposal submitted by: Barry Karnes, UL LLC

On June 23, 2015, UL 1054, Standard for Special Use-Switches was withdrawn and replaced with the UL 61058 series of standards (Standard for Safety for Switches for Appliances). In like manner, in October 2018, UL 353, Standard for Safety for Limit Controls and UL 873 (Standard for Safety for Temperature-Indicating and -Regulating Equipment) will be withdrawn and replaced by the UL 60730 series of standards (Standard for Safety for Automatic Electrical Controls for Household and Similar Use).

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The proposals in this topic reflect the deletion of the option to use controls certified to UL 353, UL 873 and UL 1054. It also removes the references to UL 991, Standard for Safety for Tests for Safety-Related Controls Employing Solid-State Devices, and UL 1998, Standard for Safety for Software in Programmable Components), since UL 60730 and the UL 60335-1 based circuit requirements presently within UL 541 include the relevant requirements for electronic circuits and software.

In the proposed revisions to Paragraph 29.5.2, the 3 V/m field strength value for radiated electromagnetic fields was chosen years ago because UL 60730-1, 3rd edition required this value and it was also the default value in UL 991. Over the years, enhanced technology used in communication circuits and for common household appliances (such as cellular telephones and wireless devices) have pushed the need for higher levels. Therefore, safety standards such as UL 60730-1 and UL 60335-1 have revised their requirements to consider different values based on a wider range of frequencies that are presently in use. Likewise, a proposal to update Paragraph 95.3.4 is being made for this same reason.

The proposals in this topic are intended to align the requirements in UL 541 with those in UL 60730-1 and UL 60335-1, accordingly.

Revisions to Paragraph 29.5.2 are being proposed to document the calibration requirements for motor protective electronic circuits.

Revisions to Paragraphs 30.1.25, 30.1.27, 31.1.4, 58.1, 75.4 and 75.8 are being proposed to clarify the intent of these requirements. New Paragraph 30.1.27.1 is being proposed to clarify the requirement in Paragraph 30.1.27 and new Paragraph 31.1.4.1 is being proposed to clarify the requirement in Paragraph 31.1.3.

The proposed revisions reflect present practice.

**NOTE:** This topic is similar to and directly correlates with Topic No. 1 of the UL 756 bulletin dated June 29, 2018 and Topic No. 1 of the UL 751 bulletin dated June 29, 2018.

## PROPOSAL

29.5.1 A protective electronic circuit providing motor protection in accordance with 29.2, 29.3 or 29.4 shall comply with one of the following:

- a) ~~Item (a) deleted. Tests for Safety-Related Controls Employing Solid-State Devices, UL 991;~~
- b) Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 and the specific applicable UL 60730 Part 2 Standard.
- c) Paragraph 30.1.30 and the Protective Electronic Circuits Tests, Section 95; or,
- d) Not create any risk of fire, electric shock or injury to persons under abnormal conditions with the protective electronic circuit rendered ineffective (open or short-circuited), e.g. use of a redundant circuit or control.

29.5.2 With reference to 29.5.1, the following items shall be considered when evaluating ~~judging the acceptability of a motor protective electronic circuit; when applying the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991 the following Items (a) – (h) shall be considered. When applying the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 or the requirements in 30.1.30 and Protective Electronic Circuit Tests, Section 95, the following Items (a) – (k) shall be considered:~~

- a) A failure-mode and effect analysis (FMEA);
- b) Electrical supervision of critical components resulting in a trouble indication;
- c) Temperature ranges are as follows:
  - 1) Indoor Use: 0.0 +/-2°C (32.0 +/-3.6°F) and 40.0 +/-2°C (104 +/-3.6°F);
  - 2) Protected Locations and Outdoor Use: -35.0 +/-2°C (-31.0 +/-3.6°F) and 40.0 +/-2°C (104 +/-3.6°F);
- d) Cycling Test duration shall be 14 days;
- e) Endurance Test duration shall be 100,000 cycles;
- f) Radio-frequency electromagnetic field immunity: radiated electromagnetic fields – Evaluate in accordance with 95.3.4 and 95.3.2 ~~field strength of 3 V/m;~~
- g) Exposure to humidity with the following conditions:
  - 1) Indoor use: 21.1 – 26.7°C (70 – 80°F) and minimum 50 percent relative humidity;
  - 2) Protected Locations and Outdoor Use: minimum 98 percent relative humidity;
- h) Electrical Fast Transient/Burst Immunity Test:
  - 1) Indoor Use: Test Level 3;
  - 2) Protected Locations and Outdoor Use: Test Level 4;
- i) Radio-frequency electromagnetic field immunity: conducted disturbances – Test Level 3;
- j) Surge Immunity Test:
  - 1) Indoor Use: Class 3;
  - 2) Protected Locations and Outdoor Use: Class 4;
- k) Electrostatic Discharge Test – Severity Level 3 for:
  - 1) Control discharge of up to 6 kV for accessible metal;
  - 2) Air discharge of up to 8 kV for accessible metal parts of insulating material.
- l) Voltage Dips and Interruptions - Evaluate in accordance with 95.3.8 and 95.3.2;

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- m) Harmonics and Interharmonics - Evaluate in accordance with 95.3.9 and 95.3.2; and
- n) Calibration (deviation and drift): Evaluate in accordance with 30.1.21 for a temperature protective control or 30.1.22 for a pressure protective control.

29.5.3 Software in a protective electronic circuit required as part of a motor protective device or system shall comply with one of the following:

- a) Item (a) deleted. Standard for Software in Programmable Components, UL 1998 and be software Class 1;
- b) Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 as well as the specific applicable Part 2 and be software Class B.
- c) Software Evaluation, Annex R in the Standard for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements, UL 60335-1 and be software Class B; or
- d) Not create any risk of fire, electric shock or injury to persons under abnormal conditions with the software rendered ineffective, e.g. use of independent redundant protective devices.

30.1.14 A protective control, other than a motor or motor-compressor overload protective device as specified in Motor-Operated Protection, Section 29, shall comply with one of the following:

- a) Item (a) deleted. Standard for Temperature-Indicating and Regulating Equipment, UL 873. The control shall comply with the endurance cycle requirements for safety controls in Table 46.1 of UL 873;
- b) Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements, UL 60730-2-6. The endurance cycle requirements in Table AA.1DV of UL 60730-2-6 for cut-outs shall be applied.
- c) Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9. The endurance cycle requirements in Table CC.2 of UL 60730-2-9 for cut-outs shall be applied.
- d) Item (d) deleted; Standard for Limit Controls, UL 353;
- e) Standard for Industrial Control Equipment, UL 508;
- f) Item (f) deleted; Standard for Special-Use Switches, UL 1054;
- g) Standard for Switches for Appliances – Part 1 General Requirements, UL 61058-1; or
- h) Paragraph 30.1.29 and the Protective Electronic Circuits Tests, Section 95.

30.1.25 An operating control that complies with 30.1.17 shall also comply with the following:

- a) For electronic controls – Installation Class 2 for electromagnetic compatibility (EMC) shall be in accordance with the voltage surge testing in 95.3.6 and comply with the results specified in 95.3.2 Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test, IEC 61000-4-5;
- b) Category II shall be the overvoltage category;
- c) Insulating materials shall have a minimum comparative tracking index (CTI) of 100 (Material Group III);
- d) The applicable pollution degree shall be as specified in 52.3(a) – (d); and
- e) The endurance cycle requirements specified by either:
  - 1) Table CC.2 of the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9, with the operating control (limiters) endurance cycle requirements being applied; or,
  - 2) The Overload and Endurance Test – Switching Devices, Section 75.

30.1.27 If an operating control complying with 30.1.17 indirectly controls a the load through a switching device, the switching device endurance cycle requirements in ~~30.1.25(e)~~ shall be as specified in: applied to the switching device:

- a) 30.1.24(b) if the switching device controls a motor-compressor; or
- b) 30.1.25(e) if the switching device controls a load other than a motor-compressor.

30.1.27.1 If an operating control referenced by 30.1.24 indirectly controls a motor-compressor through a switching device, the switching device endurance cycle requirements shall comply with 30.1.24(b).

31.1.4 A thermal cutoff shall comply with the requirements of the Standard for Thermal-Links – Requirements and Application Guide, UL 60691. ~~A manual or automatic resetting thermal protector shall have an endurance rating of not less than 6000 cycles and shall comply with the Standard for Temperature-Indicating and Regulating Equipment, UL 873, pertaining to the calibration of temperature limiting controls.~~

*Exception: In reference to 58.1(c), pressure-limiting controls are not required to comply with UL 873 if they comply with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 as well as the specific applicable Part 2.*

31.1.4.1 In reference to 31.1.3, a manual or automatic-reset thermal protector shall comply with 30.1.17 and 30.1.25. The calibration of the thermal protector shall comply with 30.1.21.

58.1 A pressure limiting device designed to automatically stop the operation of the compressor shall:

- a) Be installed on all vending machines vender with a system containing more than 22 pounds-mass (10 kg) of refrigerant; and.
- b) Comply with 30.1.14(b) and 30.1.22. ~~Be able to withstand not less than 100,000 cycles of operation under load; and~~
- c) ~~Comply with the refrigeration pressure-limiting controls requirements in the Standard for Temperature Indicating and Regulating Equipment, UL 873 pertaining to the calibration of pressure-limiting controls.~~

*Exception: In reference to 58.1(c), pressure-limiting controls are not required to comply with UL 873 if they comply with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 as well as the specific applicable Part 2.*

75.4 The switching device is to be mounted and subjected to the ambient temperature as intended in service. The test cycle is to be 1 second ON and 9 seconds OFF unless a slower rate is required by the design of the vender. A faster rate may be used if agreeable to all concerned.

75.8 In addition to the tests described in 75.5, 75.6, or 75.7, a switching device shall be capable of performing acceptably when subjected to an endurance test consisting of making and breaking 100 percent of the connected load current. The endurance test for 6000 cycles of operation, at a rate of 6 cycles per minute, when connected to a voltage supply shall be as indicated in 60.1.1 and the cycling shall consist of making and breaking the connected load for:-

- a) 6000 cycles of operation with 1 second ON and 9 seconds OFF for a switching device other than one used to control a motor-compressor; or,
- b) 24,000 cycles of operation with 1 second ON and 9 seconds OFF followed by 6,000 cycles of operation with 1 second ON and 59 seconds OFF for a switching device used to control a motor-compressor.

95.3.4 Radiated fields shall be applied in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-3: Testing and Measurement Techniques – Radiated, Radio-Frequency, Electromagnetic Field Immunity Test, IEC 61000-4-3, test level 3 being applicable. The frequency ranges tested shall be 80 MHz to 1000 MHz, test level 3; and 1.4 GHz to 2.0 GHz , test level 3; and 2.0 GHz to 2.7 GHz, test level 2. The dwell time for each frequency shall be sufficient to observe a possible malfunction of the protective electronic circuit.

## 2. Proposed Revision To And Addition Of Requirements To Prevent Remote Shut-off Of Vending Machines

### RATIONALE

Proposal submitted by: Barry Karnes, UL LLC

A vending machine is often intended to store and vend refrigerated or frozen food. If the food is “potentially hazardous”, a change in temperature—which might occur by remotely and unintentionally de-energizing the vending machine—might cause the food to spoil and become a hazard to a person who may eventually eat the food. Without being physically nearby a vending machine to see/hear it operating, an operator may not know that the vending machine has been inadvertently and remotely de-energized.

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