

STANDARD INFORMATION

Standard Number: UL 541

Standard Name: Refrigerated Vending Machines

Standard Edition and Issue Date: 9th Edition Dated April 21, 2016

Date of Revision: October 2, 2018

Date of Previous Revision of Standard: May 23, 2018

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **October 2, 2020**

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement: A review of all Listing Reports is necessary to determine which products comply with new/revise requirements and which products will require re-evaluation. **NOTE:** Effective immediately, this revised standard will be exclusively used for evaluation of new products unless the Applicant requests in writing that current requirements be used along with their understanding that their listings will be withdrawn on Effective Date noted above, unless the product is found to comply with new/revise requirements.

Overview of Changes:

- Revisions to Update Requirements for Controls
- Revision to And Addition of Requirements to Prevent Remote Shut-off of Vending Machines
- Revision to And Addition of Requirements to Address Switch Mode Power Supply Units Increasingly Used in Refrigerated Vending Machines
- Revisions to Requirements for Vending Machines Having Two Supply Cords
- Revisions to EMI Filter Requirements to Specify an Alternate Compliance Option

Specific details of new/revise requirements are found in table below.

If the applicable requirements noted in the table are not described in your report(s), these requirements will need to be confirmed as met and added to your report(s) such as markings, instructions, test results, etc. (as required).

Client Action:

Information – To assist our Engineer with review of your Listing Reports, please submit technical information in response to the new/revise paragraphs noted in the attached or explain why these new/revise requirements do not apply to your product (s).

Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.



STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown lined out below.</i>
12	Info	Accessories
		<i>New clause added;</i>
12.1.1		A vending machine shall comply with all the requirements of this standard with or without the accessory installed.
		The installation of accessories shall:
12.2		a) Be restricted to an arrangement that can be accomplished by means of receptacles and plug-in connectors; and <u>b) Not require the cutting of wiring or the soldering of connections.</u>
		<i>New clause added;</i>
12.4.1		Unless correct connections are evident, the wiring connections for the accessory shall be identified on both the accessory and on the vending machine.
		<i>New clause added;</i>
		The accessory mounting location shall be:
12.4.2		a) Identified on the vending machine; or b) Fixed due to the function of the accessory and its arrangement within the vending machine. In this case, the accessory installation instructions shall specify the mounting location of the accessory.
		<i>New clause added;</i>
		Accessories intended for connection to a source of field power supply independent of that of the vending machine shall comply with the requirements in:
12.4.3		a) Section 14, Supply Connections for Permanently Connected Venders, if intended to be a permanently connected accessory. A permanently connected accessory shall not be used with any supply cord connected equipment; b) Section 15, Supply Connections for Cord Connected Venders, if intended to be a cord-connected accessory.



CLAUSE	VERDICT	COMMENT
15	Info	Supply Connections for Cord Connected Venders <i>New clause added;</i> A cord connected vending machine and any intended accessory(ies) provided with more than one power supply cord shall comply with all of the following: a) The equipment shall consist of two separate units joined together; b) Not more than two cords shall be provided; c) Each cord shall be of the type and rating specified in 15.9 and provided with an equipment grounding conductor in accordance with 15.18; d) Each attachment plug shall be as specified in 15.6 – 15.8; f) The markings specified in 103.27.1(a) and (c) shall be provided; and g) The instructions shall contain the information specified in 106.7.
15.17.1		
15.17.2		<i>New clause added;</i> In reference to 15.17.1, if the combined rated current input to both supply cords exceeds 80 percent of the branch circuit to which the equipment will be connected, then the unit or cord with the highest rated current input shall be marked adjacent to the supply cord in accordance with 103.27.1(b).
21	Info	Capacitors A motor-starting or running capacitor shall be housed within a cabinet, enclosure or other similar container which will protect the plates against mechanical damage and which will prevent the emission of flame or molten material resulting from failure of the capacitor. The container shall be: c) <u>Protected against expulsion of the dielectric medium when tested in accordance with the applicable performance requirements of this standard, including faulted overcurrent conditions as specified in the Limited Short-Circuit Test, Section 81. The conditions for the Limited Short- Circuit Test shall be:</u> <u>1) Based on the circuit on which the capacitor is used; or,</u> <u>2) If the available fault current is limited by other components in the circuit, such as a motor start winding, the capacitor may be tested using a fault current less than the test current specified in Table 81.1 but not less than the current established by dividing the circuit voltage by the impedance of the other component(s).</u>
21.2		



CLAUSE	VERDICT	COMMENT
		<i>New clause added;</i>
21.8		Across-the-line capacitors, antenna-coupling components, line-bypass components and fixed capacitors for use in electronic equipment shall comply with the UL 60384-14.
		<i>New clause added;</i>
		In reference to 21.8, a capacitor complying with UL 60384-14 shall have specifications as follows:
21.9		<ul style="list-style-type: none"> a) Operating voltage – Not less than 110 percent of the vending machine rated voltage; b) For capacitors connected across the line (phase-to-phase)– Subclass X1 (≤ 4.0 kV) or X2 (≤ 2.5 kV) for impulse voltage (based on minimum Overvoltage Category of II); c) For capacitors connected from line to ground – Subclass Y1 or Y2 for any vending machines having a rated voltage not exceeding 500 volts; or as an alternate, subclass Y4 if a vending machine has a rated voltage not exceeding 150 volts; d) Upper category temperature – Based on the maximum capacitor surface temperature measured during the Temperature and Pressure Test, Section 63 or the Heating Test, Section 65, whichever is higher, but not less than 185°F (85°C); e) Lower category temperature – Based on the minimum surface temperature for which the capacitor has been designed to operate when installed within a vending machine as intended, but not greater than 14°F (-10°C); f) Duration of the damp-heat steady-state test – Not less than 21 days; and g) Passive flammability category B or C. As an alternate, a polymeric capacitor case shall have a V-0 flame rating as described in the UL 94.
		<i>New clause added;</i>
		In reference to 21.8, a capacitor shall consist of a single Class Y1 capacitor or two Class Y2 capacitors connected in series if it is connected between:
21.10		<ul style="list-style-type: none"> a) Two line conductors in a primary circuit; b) One line conductor and the neutral conductor; c) Primary and accessible secondary circuits; or d) The primary circuit and protective earth (equipment grounding conductor connection).
29	Info	Motor Overload Protection
29.5	Info	Protective electronic circuits
		A protective electronic circuit providing motor protection in accordance with 29.2, 29.3 or 29.4 shall comply with one of the following:
29.5.1		<ul style="list-style-type: none"> a) UL 991 b) 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.



CLAUSE	VERDICT	COMMENT
29.5.2		<p>With reference to 29.5.1, the following items shall be considered when evaluating the acceptability of a motor protective electronic circuit: when judging the acceptability of a motor proactive 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 Proactive Electronic Circuit Tests, Section 95, the following items (a) – (k) shall be considered:</p> <p>f) Radio-frequency electromagnetic field immunity: radiated electromagnetic fields – field strength of 3 V/m Evaluate in accordance with 95.3.4 and 95.3.2; l) Voltage Dips and Interruptions – Evaluate in accordance with 95.3.8 and 95.3.2; 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.</p>
30	Info	Switches and Controllers
30.1	Info	General
30.1.14		<p>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:</p> <p>a) UL 873 b) UL 60730-1 and UL 60730-2-6. The endurance cycle requirements in Table AA.1DV of UL 60730-2-6 for cut-outs shall be applied. c) UL 60730-1 and UL 60730-2-9. The endurance cycle requirements in Table CC.2 of UL 60730-2-9 for cut-outs shall be applied. d) UL 353 e) UL 508; f) UL 1054 g) UL 61058-1; or h) Paragraph 30.1.29 and the Protective Electronic Circuits Tests, Section 95.</p>
30.1.25		<p>An operating control that complies with 30.1.17 shall also comply with the following:</p> <p>a) For electronic controls – Installation Class 2 for electromagnetic compatibility (EMC) shall be in accordance with Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test, IEC 61000-4-5 <u>the voltage surge testing in 95.3.6 and comply with the results specified in 95.3.2;</u></p>



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30.1.27		<p>If an operating control complying with 30.1.17 indirectly controls a load through a switching device, the switching device endurance cycle requirements shall be <u>as specified in:</u></p> <p><u>a) 30.1.24(b) if the switching device controls a motor-compressor; or</u> <u>b) 30.1.25(e) if the switching device controls a load other than a motor-compressor.</u></p>
<i>New clause added;</i>		
30.1.27.1		<p>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).</p>
30.3	Info	Remotely operated venders
30.3.5		<p>A control that operates in response to remote operation commands, external communication or data signals shall not introduce an operating condition or state that could result in a risk of fire, electric shock or injury to persons. In addition, such a control shall not:</p> <p><u>e) Allow remote shut-off of a vending machine intended for use with potentially hazardous foods; or</u></p>
31	Info	Transformer Protection
31.1	Info	High-voltage transformers
<i>New clause added;</i>		
31.1.4.1		<p>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.</p>
41	Info	Optical Isolators and Semiconductor Devices
<i>New clause added;</i>		
41.1.1		<p>In addition to complying with 41.1, an optical isolator relied upon to provide feedback between primary and secondary circuits of a switch mode power supply unit shall have a minimum isolation voltage of 1500V.</p>
41.2		<p>A power switching semiconductor device that is relied upon to provide isolation to ground shall comply with UL 1557. <u>If the switching semiconductor is used as part of a switch mode power supply unit, it shall have a minimum isolation voltage of 1500V.</u></p>
43	Info	Power Supplies
43.1		<p>A power supply shall comply with one of the following:</p> <p>a) For a Class 2 Power Supply, UL 1310 or UL 60950-1; b) For a power supply that is other than Class 2, UL 1012 or UL 60950-1; or</p>



CLAUSE	VERDICT	COMMENT
		c) For a switch mode power supply unit not complying with (a) or (b), the relevant requirements in this Standard, including the <u>Switch Mode Power Supply Units – Overload Test, Section 81A</u> , shall be applied.
58	Info	Pressure Limiting Devices
		A pressure limiting device designed to automatically stop the operation of the compressor shall:
58.1		a) Be installed on all vending machines with a system containing more than 22 pounds-mass (10 kg) of refrigerant; and b) Comply with UL 873 <u>30.1.14(b) and 30.1.22</u> . c) Deleted
75	Info	Overload and Endurance Test – Switching Devices
		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 <u>100 percent of the connected load current</u> . <u>The endurance test voltage supply shall be as indicated in 60.1.1 and the cycling shall consist of making and breaking the connected load for: for 6000 cycles of operation at a rate of 6 cycles per minute, when connected to a voltage supply as indicated in 60.1.1</u>
75.8		a) <u>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</u> b) <u>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.</u>
		<i>New section added;</i>
81A		Switch Mode Power Supply Units – Overload Test The test applies to switch mode power supply units as specified in 43.1(c) (see standard for details).
95	Info	Protective Electronic Circuit Tests
95.3	Info	Electromagnetic compatibility (EMC) tests
		Radiated fields shall be applied in accordance with IEC 61000-4-3. The frequency ranges tested shall be 80 MHz to 1000 MHz, <u>test level 3</u> ; 1.4 GHz to 2.0 GHz, <u>test level 3</u> ; and 2.0 GHz to 2.7 GHz, <u>test level 2</u> . The dwell time for each frequency shall be sufficient to observe a possible malfunction of the protective electronic circuit.
		<i>New section added;</i>
100A		Protective Electronic Circuit Test



CLAUSE	VERDICT	COMMENT
100A.1		The manufacturer shall periodically conduct a test of the protective electronic circuit to verify the device is functional for protecting against conditions that could cause risk of fire, electric shock or injury to persons.
103	Info	<p>Electrical Ratings</p> <p><i>New clause added;</i></p> <p>The following or equivalently worded markings shall be provided on vending machines having two power supply cords. Each marking shall be visible after installation.</p> <p>a) "CAUTION – Risk of Electric Shock. This vending machine has two power supply cords. Unplug all cords before moving or servicing this vending machine." This marking applies as specified in 15.17.1(f).</p> <p>b) "CAUTION – Risk of Electric Shock. This vending machine has two power supply cords. Connect this plug to a single outlet circuit." This marking applies as specified in 15.17.2.</p> <p>c) The vending machine nameplate electrical rating shall be specified separately for each supply cord. This marking applies as specified in 15.17.1(f).</p> <p>d) "CAUTION – This vending machine has more than one disconnect switch." or the equivalent, on cord-connected vending machines with more than one disconnect switch. This marking shall be provided adjacent to each disconnect switch or control.</p>
106	Info	<p>Installation Instructions</p> <p><i>New clause added;</i></p> <p>The instructions for a vending machine, and any intended accessory(ies), having two power supply cords:</p> <p>a) Shall indicate that the vending machine uses two cords and caution against unplugging only one cord during movement, testing or repair of the product; and</p> <p>b) That may have different attachment plugs shall state that different attachment plugs are used and shall specify the electrical rating of each plug. If individual branch circuits are involved, the instructions shall state that individual branch circuits are to be employed to supply the product and electrical ratings of each branch circuit shall be specified.</p>
<p>CUSTOMERS PLEASE NOTE: This Table and column "Verdict" can be used in determining how your current or future production is or will be in compliance with new/revised requirements.</p>		