

Standard Information

Standard Number: UL 621

Standard Name: Ice Cream Makers

Standard Edition and Issue Date: 7th Edition Dated May 7, 2010

Date of Revision: February 15, 2017

Date of Previous Revision of Standard: 7th Edition Revised December 11, 2015

Effective Date of New/Revised Requirements

Effective Date: July 31, 2019

Impact, Overview, and Action Required

Impact Statement: A review of all Listing Reports is necessary to determine which products comply with new/revised 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requests in writing that current requirements be used along with their understanding that their listings will be withdrawn on Effective Date noted above, unless the product is found to comply with new/revised requirements.

Overview of Changes: *Revisions to Supplement SA for the Addition of UL 60335-1 based requirements for the Evaluation of Electronic Circuits.* Specific details of new/revised 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 Required:

Information – To assist our Engineer with review of your Listing Reports, please submit technical information in response to the new/revised paragraphs noted in the attached or explain why these new/revised 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 – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records.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.

Description of New/Revised Technical Requirements

Clause	Verdict	Comment
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown lined-out below.</i>
-	Info	CONSTRUCTION
SA4	Info	Components
SA4.1	Info	Capacitors
SA4.1.1		A capacitor connected between two line conductors in a primary circuit, or between one line conductor and the neutral conductor or between primary and accessible secondary circuits or between the primary circuit and protective earth (equipment grounding conductor connection) shall comply with one of the subclasses of the Standard for Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14 and shall be used in accordance with its rating. <i>Note: Details for damp heat, steady state test can be found in 4.12 of IEC 60384-14.</i>
SA4.2	Info	Isolation devices
SA4.2		An optical isolator that is relied upon to provide isolation between primary and secondary circuits or between other circuits as required by this Standard shall be constructed in accordance with the Standard for Optical Isolators, UL 1577, and shall be able to withstand for 1 minute, without breakdown, an ac dielectric voltage withstand potential of 2500 volts as specified in 35.1 between the input and output circuits.
SA4.2		A power switching semiconductor device that is relied upon to provide isolation to ground shall be constructed in accordance with the Standard for Electrically Isolated Semiconductor Devices, UL 1557. The dielectric voltage withstand tests required by UL 1557 shall be conducted at a dielectric potential of 2500 volts as specified in 35.1 for 1 minute.
SA4.2		A power switching semiconductor device that is relied upon to provide isolation between primary and secondary circuits or between other circuits shall be a device (such as a solid state motor controller) that complies with the Standard for Industrial Control Equipment, UL 508. <i>Exception: A power switching semiconductor device located within a component that has been separately evaluated to the requirements for that component is not required to be further evaluated, provided the component is used within its established ratings and limitations.</i>
SA4.2		A relay that is relied upon to provide isolation between primary and secondary circuits shall comply with the Standard for Industrial Control Equipment, UL 508.
SA4.3		Switch mode power supplies
SA4.3.1		Bridging components – switch mode power supplies

Clause	Verdict	Comment
SA4.3.1.1		<u>Components connected between the primary and secondary circuits of an isolating device such as a switching transformer or between primary and secondary earth reference points shall be evaluated to provide the specified level of isolation for the application under normal and abnormal (single component fault) conditions.</u>
SA4.1.2		<u>A capacitor connected between primary and accessible secondary circuits shall comply with Capacitors, Section SA4.1. This shall consist of a single Class Y1 capacitor or two Class Y2 capacitors connected in series.</u>
SA4.3.2		<u>Switch mode power supply insulation system</u>
SA4.3.2.1		<u>Insulation used within a transformer of switch mode power supply shall comply with the Standard for Systems of Insulating Materials – General, UL 1446, for the specified temperature class of the insulation system or the Standard for Single- and Multi-Layer Insulated Winding Wire, UL 2353.</u>
SA4.4	Info	<u>Temperature sensing, thermistor devices</u>
SA4.4.1		<u>A temperature sensing device, such as a positive temperature coefficient (PTC) thermistor and a negative temperature coefficient (NTC) thermistor, that is used in combination with an electronic control and that together with the control manages a Safety Critical Function shall comply with the Standard for Thermistor-Type Devices, UL 1434.</u>
SA5	Info	<u>Identification of Safety Critical Circuit Functions</u>
SA5.1	Info	<u>General</u>
SA5.1.1		<u>Electronic circuits or parts of circuits shall be analyzed to determine if the function of the control is necessary for compliance with this Standard. A function is considered a Safety Critical Function (SCF) if failure (loss or malfunction) of its functionality would result in the risk of fire, electric shock, mechanical hazard or a Dangerous Malfunction.</u>
SA5.1.2		<u>Safety Critical Functions shall be identified as either Protective Electronic Circuits as detailed in SA5.2 or as those of operating circuits that mitigate Dangerous Malfunctions as detailed in Section SA5.3.</u>
SA5.1.3		<u>In the evaluation of electronic circuits, all the contacts of relays or contactors that cycle during the Normal Temperature Test shall be simultaneously short-circuited. If more than one relay or contactor operates, each relay or contactor is short-circuited in turn.</u>
SA5.2	Info	<u>Protective electronic circuits</u>
SA5.2.1		<u>An electrical component shall not be connected across the contacts of a Protective Electronic Circuit. <i>Exception: Electrical components may be connected across the contacts provided that any single component fault does not result in a loss of protective function.</i></u>
SA5.2.2		<u>Protective Electronic Circuit functions unique to ice cream makers are as specified in Table 17.5.</u>
SA5.3		<u>Operating circuits that mitigate a dangerous malfunction of the appliance</u>
SA5.3.1		<u>The suitability of stand-by or electronic disconnect circuits shall be as specified in this Standard.</u>

Clause	Verdict	Comment
<u>SA5.3.2</u>		<u>An electronic disconnection circuit whose failure could result in a Dangerous Malfunction shall have at least two components whose combined operation provides the load disconnection.</u>
<u>SA6</u>	Info	<u>Evaluation of the Different Types of Electronic Circuits</u>
<u>SA6.1</u>	Info	<u>All types of circuits</u>
<u>SA6.1.1</u>		<u>All circuit functions mandated by this standard shall be validated. This includes operating functions not designated as Safety Critical Functions.</u>
<u>SA6.1.2</u>		<u>All circuits shall be evaluated to determine the effects of electronic circuit faults.</u>
<u>SA6.1.3</u>		<u>When the applicable component/hardware faults specified in SA10.10 are imposed one at a time they shall not result in:</u> a) <u>The appliance presenting a risk of fire, electric shock or mechanical hazard, or</u> b) <u>The loss of any Safety Critical Function either in that circuit or others.</u>
<u>SA6.1.4</u>		<u>The risk of electrically generated fire from the faults of Section SA10 is considered to be mitigated in Low-Power Circuits.</u>
<u>SA7.</u>	Info	<u>Circuits That Provide Safety Critical Functions</u>
<u>SA7.1</u>		In addition to the requirements of Section SA6, circuits that provide Safety Critical Functions shall incorporate measures to control the fault/error conditions that would impair the safety functions.
<u>SA7.2</u>		The evaluation of the programmable component shall be in accordance with Annex R of the Standard for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements, UL 60335-1, Edition 5.
<u>SA7.3</u>		Circuits that provide Safety Critical Functions that rely upon a programmable component for one or more of its safety functions shall be subjected to the test of the Programmable Component Reduced Supply Voltage Test, Section SA11, unless restarting at any point in the operating cycle after interruption of operation due to a supply voltage dip will not result in a hazard. The test is carried out after removal of all batteries and other components intended to maintain the programmable component supply voltage during mains supply voltage dips, interruptions and variations.
<u>SA7.4</u>		Circuits that provide Safety Critical Functions shall maintain their required functions when subjected to the EMC related stresses specified in the Electromagnetic Compatibility (EMC) Requirements – Immunity, Section SA12.
<u>SA7.5</u>		The tests of Section SA12 are carried out with surge protective devices disconnected, unless they incorporate spark gaps.
-	Info	PERFORMANCE
<u>SA8</u>	Info	General Conditions for the Tests
<u>SA8.1</u>	Info	Details
<u>SA8.1.1</u>		An electronic control shall be tested in the appliance under the Performance test conditions and order of tests specified in this Standard. <i>Exception: Except as noted elsewhere in this Supplement, upon the agreement of the manufacturer and with due consideration of the relevant compliance criteria, an electronic control may be tested outside of the appliance.</i>

Clause	Verdict	Comment
SA8.1.2		Cumulative stress resulting from successive tests on electronic circuits is to be avoided. It may be necessary to replace components or to use additional samples.
SA8.1.3		User adjustable electronic controls shall be adjusted to their most unfavorable setting.
SA8.2	Info	Intentionally weak parts
SA8.2.1		If a conductor of a printed circuit board or other component becomes open-circuited, the appliance is considered to have withstood the particular test, provided both of the following conditions are met: a) The base material of the printed circuit board withstands the test of Needle-Flame Test (NFT) of Annex E of the Standard for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements, UL 60335-1, and b) Any loosened conductor does not reduce electrical spacings (clearances or creepage distances) between live parts and accessible metal parts below the values specified in this Standard. c) The same result is obtained when the test is run three times. <i>Exception: The base material of the printed wiring board need not comply with the Needle-Flame Test of</i> <i>(a) if the base material has a flammability rating of V-0 and a CTI of minimum 100.</i>
SA8.2.2		Fuses other than as noted in SA8.3.2 are considered to be Intentionally Weak Parts in accordance with SA8.2.
<u>SA8.3</u>	Info	<u>Test results determined by overcurrent protection operation</u>
<u>SA8.3.1</u>		<u>If compliance with these requirements under any of the fault conditions depends on the operation of an overcurrent device incorporated within the electronic control, the fuse and/or circuit breaker shall comply with the requirements for that component.</u>
<u>SA8.3.2</u>		<u>If compliance with the requirements of this standard depends upon the operation of a miniature fuse-link complying with IEC 60127-1 – Miniature Fuses – Part 1 Definitions for miniature fuses and general requirements for miniature fuse-links, during any of the fault conditions specified in SA10.10, the test is repeated but with the miniature fuse-link replaced by an ammeter. If the current measured:</u> <u>a) Does not exceed 2.1 times the rated current of the fuse-link, the circuit is not considered to be adequately protected and the test is carried out with the fuse-link short-circuited;</u> <u>b) Is at least 2.75 times the rated current of the fuse-link, the circuit is considered to be adequately protected;</u> <u>c) Is between 2.1 times and 2.75 times the rated current of the fuse-link, the fuse link is shortcircuited and the test is carried out:</u> <u>1) For the relevant period or for 30 minutes, whichever is the shorter, for quick acting fuselinks; or</u> <u>2) For the relevant period or for 2 minutes, whichever is the shorter, for time lag fuselinks.</u>
<u>SA8.3.3</u>		<u>In case of doubt, the maximum resistance of the fuse-link has to be taken into account when determining the current.</u>

Clause	Verdict	Comment
SA8.3.4		The verification whether the fuse-link acts as a protective device is based on the <u>fusing characteristics specified in the Standard for Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links, IEC 60127-1, which also gives the information necessary to calculate the maximum resistance of the fuse-link.</u>
SA9	Info	<u>Low-Power Circuits</u>
SA9.1	Info	<u>Low-power circuit determination</u>
SA9.2		The appliance shall be supplied at rated voltage and a variable resistor, adjusted to its maximum resistance, is connected between the point to be investigated and the opposite pole of the supply source. The resistance is then decreased until the power consumed by the resistor reaches a maximum. Points closest to the supply source at which the maximum power delivered to this resistor does not exceed 15 W at the end of 5 seconds are called Low-Power Points. The part of the circuit farther from the supply source than a low-power point is considered to be a Low-Power Circuit. See Figure SA9.1.
SA9.3		The measurements shall be made from only one pole of the supply source, preferably the one that gives the fewest low-power points.
SA9.4		When determining the low-power points, measurements shall start with points close to the supply source.
SA9.5		The power delivered to the variable resistor shall be measured by a wattmeter.
SA9.6		If power is interrupted to parts of circuits by Intentionally Weak Parts, the test shall be repeated two more times to confirm a consistent result.
Figure SA9.1		<p style="text-align: center;">Example of an electronic circuit with low-power points</p> <p style="text-align: center;">su0085</p> <p>D is a point farthest from the supply source where the maximum power delivered to external load exceeds 15 W.</p> <p>A and B are points closest to the supply source where the maximum power delivered to external load does not exceed 15 W. These are low-power points.</p>
SA10	Info	<u>Abnormal Operation and Fault Tests</u>
SA10.1		Electronic controls shall be constructed so that the compliance criteria for risk of <u>fire, electric shock and injury to persons as a result of abnormal operating conditions of the appliance specified in this Standard are fulfilled.</u>

Clause	Verdict	Comment
<u>SA10.2</u>		<u>Unless otherwise specified, the tests are continued until a non-self-resetting thermal cutout operates or until steady conditions are established. If an intentionally weak part becomes permanently open-circuited, the relevant test is repeated on two additional samples.</u>
<u>SA10.3</u>		<u>Unless otherwise specified, only one abnormal condition is simulated at any one time. If more than one of the tests is applicable to the same appliance, these tests are carried out consecutively after the appliance has cooled down to room temperature.</u>
<u>SA10.4</u>		<u>Fault condition SA10.10(f) is applied to encapsulated and similar components if the circuit cannot be assessed by other methods.</u>
<u>SA10.5</u>		<u>For application of the fault conditions, the appliance is operated under the conditions specified in Section 63A.</u>
<u>SA10.6</u>		<u>When any of the fault conditions are simulated, the duration of the test is until ultimate results are known but no longer than as specified for the Normal Temperature Test, Section 43, of this Standard. In each case, the test is ended if a non-self-resetting interruption of the supply occurs within the appliance.</u>
<u>SA10.7</u>		<u>If an electronic timer or programmer must operate to ensure compliance with the test before the maximum period under the conditions of the test is reached, it shall be additionally investigated as a Protective Electronic Circuit.</u>
<u>SA10.8</u>		<u>The contacts of relays, contactors or other devices that cycle during the Normal Temperature Test, Section 43, shall be short-circuited.</u>
<u>SA10.9</u>		<u>Unless otherwise specified, any electronic control that limits the temperature during the Normal Temperature Test, Section 43, of this Standard is short-circuited for abnormal operation tests. If the appliance incorporates more than one control, they are short-circuited, or rendered inoperative, in turn.</u>
<u>SA10.10</u>		<p><u>Electronic circuit faults as specified in (a) – (g) shall be considered. If considered necessary they shall be applied one at a time.</u></p> <ul style="list-style-type: none"> <u>a) Short circuit of spacings if clearances or creepage distances are less than the required values;</u> <u>b) Open circuit at the terminals of any component;</u> <u>c) Short circuit of capacitors, unless they comply with UL 60384-14;</u> <u>d) Short circuit of any two terminals of an electronic component, other than an integrated Circuit. This fault condition is not applied between the two circuits of an optocoupler that complies with UL 1577;</u> <u>e) Failure of triacs in the diode mode;</u> <u>f) Failure of microprocessors and integrated circuits except components such as thyristors and triacs. All possible output signals are considered for faults occurring within the component. If it can be shown that a particular output signal is unlikely to occur, then the relevant fault is not considered; and</u> <u>g) Failure of an electronic power switching device in a partial turn-on mode with loss of gate (base) control.</u> <p><u>Exception No. 1: Positive temperature coefficient thermistors are not short-circuited</u></p>

Clause	Verdict	Comment
		<u>if they are used within the manufacturer's specification and comply with the Standard for Thermistor-Type Devices, UL 1434, or the Requirements for thermistor elements and controls using thermistors, Annex J of the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1. However, PTC-S thermistors are short-circuited unless they comply with 14.5.3 of the Standard for Audio, Video and Similar Electronic Apparatus – Safety Requirements, UL 60065. Exception No. 2: Components in Low-Power Circuits whose failure also does not result in the loss of a Safety Critical Function.</u>
<u>SA10.11</u>		<u>The fault conditions of SA10.10 (a) – (g) shall be applied, one at a time to the components on the supply side of the Low-Power Points determined in SA9.1. The control shall not become a Hazard of Itself.</u>
<u>SA10.12</u>		<u>If the appliance incorporates a Protective Electronic Circuit which operates to ensure compliance with an abnormal test, the relevant test is repeated with a single fault simulated in the PEC, as indicated in (a) – (g) of SA10.10. During this test, the appliance shall not emit flames or molten metal, and the appliance shall be subjected to a repeated dielectric withstand test.</u>
<u>SA10.13</u>		<u>In a power supply circuit, regulating components that limit the output voltage or current are to be faulted. If the ultimate results are not immediately evident, the test shall be continued for a minimum of two hours. After ultimate conditions have been obtained and/or after the two hour period, the effect on the safety related functionality is to be determined.</u>
<u>SA10.14</u>		<u>Each Low-Power Point identified by the test of SA10.1 shall be individually tested. It shall be shorted or loaded to the maximum available between the point and the supply return used for the 15 watt determination. The control shall not become a Hazard of Itself.</u>
<u>SA11</u>	Info	<u>Programmable Component Reduced Supply Voltage Test</u>
<u>SA11.1</u>		<u>The appliance is supplied at rated voltage and operated under normal operation. After approximately 60 seconds, the power supply voltage is reduced to a level such that the appliance ceases to respond to user inputs, or parts controlled by the programmable component cease to operate, whichever occurs first. This value of supply voltage is recorded. The appliance is then supplied at rated voltage and operated under normal operation. The voltage is then reduced to a value of approximately 10 percent less than the recorded voltage. It is held at this value for approximately 60 seconds and then increased to rated voltage. The rate of decrease and increase of the power supply voltage is to be approximately 10 V/s. The appliance shall continue to either operate normally from the same point in its operating cycle at which the voltage decrease occurred or a manual operation shall be required to restart it.</u>
<u>SA11.2</u>		<u>This test may be performed on a control outside the appliance provided that the conditions of test appropriately represent the control environment within the appliance.</u>

Clause	Verdict	Comment
SA12	Info	<u>Electromagnetic Compatibility (EMC) Requirements – Immunity</u>
SA12.1		<p><u>Protective Electronic Controls and control with functions necessary to prevent Dangerous Malfunctions shall continue to provide their desired safety function when subjected to the EMC related stresses specified in (a) – (g), applied one at a time.</u></p> <p><u>a) The appliance is subjected to electrostatic discharges in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test , IEC 61000-4-2, test level 4 being applicable. Ten discharges having a positive polarity and ten discharges having a negative polarity are applied at each preselected point.</u></p> <p><u>b) The appliance is subjected to radiated fields 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 dwell time for each frequency is to be sufficient to observe a possible malfunction of the protective electronic circuit.</u></p> <p><u>c) The appliance is subjected to fast transient bursts in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test, IEC 61000-4-4. Test level 3 is applicable for signal and control lines. Test level 4 is applicable for the power supply lines. The bursts are applied for 2 minutes with a positive polarity and for 2 minutes with a negative polarity.</u></p> <p><u>d) The power supply terminals of the appliance are subjected to voltage surges in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test, IEC 61000-4-5, five positive impulses and five negative impulses being applied at the selected points. Test level 3 is applicable for the line-to-line coupling mode, a generator having a source impedance of 2 Ω being used. Test level 4 is applicable for the line-to-earth coupling mode, a generator having a source impedance of 12 Ωbeing used. In addition,</u></p> <p><u>1) Grounded heating element sheaths in grounded appliances are disconnected during this test.</u></p> <p><u>2) For appliances having surge arresters incorporating spark gaps, the test is repeated at a level that is 95 percent of the flashover voltage.</u></p> <p><u>e) The appliance is subjected to injected currents in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6, test level 3 being applicable. During the test, all frequencies between 0.15 MHz to 80 MHz are covered. The dwell time for each frequency is to be sufficient to observe a possible malfunction of the Protective Electronic Circuit.</u></p> <p><u>f) The appliance is subjected to the class 3 voltage dips and interruptions in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage</u></p>

Clause	Verdict	Comment
		<u>variations immunity tests, IEC 61000- 4-11. The values specified in Table 1 and Table 2 of IEC 61000-4-11, are applied at zero crossing of the supply voltage.</u> <u>g) The appliance is subjected to mains signals in accordance with the Standard for Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signaling at a.c. power port, low frequency immunity tests, IEC 61000-4-13, test level class 2 being applicable.</u>
<u>SA12.2</u>		<u>The tests are carried out with the appliance supplied at rated voltage, the device being set in the off position or in the stand-by mode.</u>
<u>SA12.3</u>		<u>The tests of SA12.1 are carried out after the Protective Electronic Circuit has operated during the relevant Abnormal Operation Tests of this standard. However, appliances that are attended during use are not subjected to the tests for electromagnetic phenomena.</u>
		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.