UL 763

STANDARD FOR SAFETY

Motor-Operated Commercial Food Preparing Machines

UL Standard for Safety for Motor-Operated Commercial Food Preparing Machines, UL 763

Fifth Edition, Dated February 28, 2018

Summary of Topics

This revision of ANSI/UL 763 dated November 4, 2022 reissues the November 2, 2022 revisions to include the change to B1.3.

The November 2, 2022 revisions included changes in the following requirements which are noted for reference:

– Addition of Standard Operating Controls Options; 6.4.2.1

– Add References to UL 61800-5-1, Standard For Adjustable Speed Electric Power Drive Systems To Replace All References To UL 508C, Standard For Safety For Power Conversion Equipment; 6.11.14, 6.14.2

– Add References to UL 62368-1 As an Option to Evaluate Power Supplies, Secondary Circuits, and of Motor-Operated Commercial Food Preparing Machines; 6.14.2, A2.1, A7.1

– Clarify the Particular Application of the Switch Requirements and Updating the Requirements to Align with the Latest Edition of UL 61058 Series; 6.19.1.2 – 6.19.1.4, 6.19.1.6, 6.19.1.8,

– Clarify The Application Of Test Requirements To Rechargeable Battery-Powered Food-Preparing Machines With Respect To Accessible Parts; B1.3

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 new and revised requirements are substantially in accordance with Proposal(s) on this subject dated October 8, 2021, December 17, 2021, and September 16, 2022.

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UL 763

Standard for Motor-Operated Commercial Food Preparing Machines

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Fifth Edition

February 28, 2018

This ANSI/UL Standard for Safety consists of the Fifth edition including revisions through November 4, 2022.

The most recent designation of ANSI/UL 763 as an American National Standard (ANSI) occurred on November 2, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 763 on October 3, 1994. 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.

No Text on This Page

CONTENTS

INTRODUCTION

CONSTRUCTION

PROTECTION AGAINST INJURY TO PERSONS

PERFORMANCE

MANUFACTURING AND PRODUCTION-LINE TESTS

RATINGS

MARKINGS

SUPPLEMENT SA – (Normative) – EVALUATION OF ELECTRONIC CIRCUITS

INTRODUCTION

CONSTRUCTION

PERFORMANCE

MANUFACTURING AND PRODUCTION LINE TESTING

SUPPLEMENT SB – THERMOELECTRIC COOLING (PELTIER EFFECT)

APPENDIX A (Informative) Secondary Circuits and the Level of Evaluation Required

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover commercial motor-operated food-preparing machines intended for use in accordance with the National Electrical Code.

1.2 These requirements do not cover machines rated more than 600 V; nor do they cover machines involving universal motors rated more than 250 V.

1.3 These requirements cover coffee grinders, vegetable cutters, food mixers, nonrefrigerated ice cube dispensers, and other motor-operated machines usually found in commercial kitchens, restaurants, food processing establishments, bakeries, or other business establishments where food is prepared or processed.

1.4 A machine that utilizes some other source of energy, such as gas or steam, in addition to electric energy will be investigated under these requirements and under such additional requirements as are applicable to the machine under consideration.

1.5 These requirements also cover portable rechargeable battery-powered appliances for indoor or outdoor use with rechargeable non-user and user-replaceable batteries; see Appendix B.

2 Terminology

2.1 In the following text, a requirement that applies only to a specific type or types of commercial food-preparing machine is identified by a specific reference in the requirement to the type or types of machine involved. Absence of such a specific reference or use of the term machine indicates that the requirement applies to all of the types of equipment covered by this standard.

3 Glossary

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

3.2 APPLIANCE COUPLER – A single-outlet, female contact device for attachment to a flexible cord as part of a detachable power-supply cord to be connected to an appliance inlet (motor attachment plug).

3.3 APPLIANCE INLET (Motor Attachment Plug) – A male contact device mounted on an end product appliance to provide an integral blade configuration for the connection of an appliance coupler or cord connector.

3.4 APPLIANCE (FLATIRON) PLUG – An appliance coupler type of device having a cord guard and a slot configuration specified for use with heating or cooking appliances.

3.5 ATTENDED EQUIPMENT – Equipment intended for use where operator presence is required for the equipment to function but is not necessarily required for the equipment to operate. Operator absence is effectively limited to short durations due to one or more characteristics of the equipment such as production of excessive noise or vibration. Examples may include hand-held mixers, meat saws, meat slicers, food processors, and blenders.

3.6 AUTOMATICALLY CONTROLLED MACHINE – A machine is considered to be automatically controlled under any one or more of the following conditions if:

a) The repeated starting of the machine, beyond one complete predetermined cycle of operation to the point where some form of limit switch opens the circuit, is independent of any manual control.

b) During any single predetermined cycle of operation, the motor is caused to stop and restart one or more times.

c) Upon energizing the machine, the initial starting of the motor may be intentionally delayed beyond normal, conventional starting.

d) During any single predetermined cycle of operation, automatic changing of the mechanical load may reduce the motor speed sufficiently to reestablish starting-winding connections to the supply circuit.

3.7 COMPONENT – A device or fabricated part of the appliance covered by the scope of a safety standard dedicated to the purpose. When incorporated in an appliance, equipment otherwise typically field installed (e.g. luminaire) is considered to be a component. Unless otherwise specified, materials that compose a device or fabricated part, such as thermoplastic or copper, are not considered components.

3.8 CONTROL, OPERATING – A device or assembly of devices, the operation of which starts or regulates the end product during normal operation. Operating controls are also referred to as "regulating controls".

3.9 CONTROL, PROTECTIVE – A device or assembly of devices, the operation of which is intended to reduce the risk of electric shock, fire or injury to persons during normal and reasonably anticipated abnormal operation of the appliance. Protective controls are also referred to as "limiting controls" and "safety controls".

3.10 ELECTRONIC DISCONNECTION – non-cycling interruption by an electronic device (a device which produces a dynamic imbalance of electrons) of a circuit for functional disconnection and which provides a disconnection other than by means of an air gap by satisfying certain electrical requirements in at least one pole.

3.11 ENCLOSURE – That part of the machine that:

a) Renders inaccessible all or any parts of the equipment that involve a risk of electric shock or injury to persons, or

b) Precludes propagation of flame initiated by electrical disturbances occurring within.

3.12 INDOOR LOCATION – Inside a building where not normally subjected to the effects of weathering.

3.13 INTERLOCK – A device or arrangement by means of which the functioning of one part is controlled by the functioning of another, for safety purposes.

3.14 LINE-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 600 V and having circuit characteristics in excess of those of a low-voltage circuit.

3.15 LOW-VOLTAGE CIRCUIT – A circuit involving a peak open-circuit potential of not more than 42.4 V supplied by a primary battery, by a Class 2 transformer, or by a combination of a transformer and a fixed impedance that, as a unit, complies with all performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting a 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.

3.16 OUTDOOR LOCATION – In the open and subjected to the full effects of weathering.

3.17 PROTECTED LOCATION – In an area that is partially protected from the effects of weathering through the use of a roof, canopy, marquee, or similar structure.

3.18 REMOTELY CONTROLLED MACHINE – A machine that is out of sight of the operator who is at the starting device.

3.19 STAND-BY CIRCUIT – A circuit that energizes the appliance control though the movable parts of the appliance are not in motion. The appliance is not yet operational until the user presses the START or ON switch (e.g. an appliance that is in stand-by mode is ready-to-operate).

3.20 MOMENTARY CONTACT ON/OFF SWITCH – A switch intended to energize an appliance when pressed. Constant pressure is required to keep the unit energized.

3.21 WAND-TYPE MIXER (may also be known as an immersion blender) – Is a hand-held, portable appliance that is intended to process foods in a container. It is equipped with a rotating shaft (wand) with a mixing/blending head which is immersed into the food to crush, mix, mash, emulsify, etc. into soups, mashes, purees, sauces, mayonnaise, cream, dairy products and more generally to process all solid, liquid, pasty or powdery foods to obtain a homogeneous fluid. The mixing/blending head is a cutting tool composed of high-speed rotating blades located at the end of the shaft. These appliances may be provided with a whipping or beater whisk attachment. A whipping whisk is comprised of flexible and long wires gathered together around one or several rotating shaft(s) and a beater whisk is identical except comprised of metal strips (bands).

4 Units of Measurement

4.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

5 References

5.1 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.

CONSTRUCTION

6 Components

6.1 General

6.1.1 Except as indicated in 6.1.2, a component of a product covered by this standard shall comply with the requirements for that component, as indicated in 6.2 through 6.19 and the additional component requirements of this standard.

6.1.2 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,

b) Is superseded by a requirement in this standard, or

c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.

6.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

6.1.4 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.

6.1.5 A component not anticipated by the requirements of this standard, not specifically covered by the component standards specified in this standard and that involves a potential risk of electric shock, fire, or personal injury, shall be additionally investigated.

6.1.6 With respect to 6.1.5, reference to construction and performance requirements in another UL end product standard is appropriate where that standard anticipates normal and abnormal use conditions consistent with the application of UL 763.

6.1.7 Unless otherwise specified, components that do not present a risk of electric shock, fire of injury to persons, such as connectors in a low voltage circuit where the power available is limited to 15 W, are not required to meet the specified component standards.

6.2 Attachment plugs, receptacles, connectors, and terminals

6.2.1 Attachment plugs, appliance couplers, receptacles and appliance inlets (motor attachment plugs) shall comply with the Standard for Attachment Plugs and Receptacles, UL 498.

Exception: Attachment plugs and appliance couplers integral to power supply cords are covered under the requirements of the Standard for Cord Sets and Power-Supply Cords, UL 817 and need not comply with UL 498.

6.2.2 Female devices (such as appliance couplers and connectors) that are intended, or that may be used, to interrupt current in the end product, shall be suitably rated for current interruption of the specific type of load, when evaluated with its mating plug or connector. For example, an appliance coupler that can be used to interrupt the current of a motor load shall have a suitable horsepower rating when tested with its mating plug.

6.2.3 Quick-connect terminals, both connectors and tabs, shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310, and shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated, the rated voltage and temperature shall be suitable for the intended use. Quick-connect terminals shall be applied per the installation instructions of the quick-connect terminal manufacturer.

6.2.4 Single and multipole connectors for use in data, signal, control and power applications within the appliance intended for factory assembly to copper or copper alloy conductors or for factory assembly to printed wiring boards, shall comply with the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977.

6.2.5 Wire connectors shall comply with the Standard for Wire Connectors, UL 486A-486B, the Standard for Splicing Wire Connectors, UL 486C, or the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E, and shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated, the rated voltage and temperature shall be suitable for the intended use. Wire connectors shall be applied per the installation instructions of the wire connector manufacturer.

6.2.6 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and, if applicable, be suitably rated for field wiring. A terminal block shall be suitable for the number of conductors per

termination, wire size, type (solid or stranded), conductor material (copper or aluminum), voltage and current of the intended use.

6.2.7 A 15- or 20-A general-use receptacle in a machine provided with a means for grounding shall be of the grounding type. The grounding contact of the receptacle shall be electrically connected to dead metal that will be grounded when the machine is in use.

6.2.8 Each circuit having a receptacle intended for general use, shall have overcurrent protection of not more than 20 A provided as a part of the machine if the overcurrent protection of the branch circuit to which the machine will properly be connected exceeds that acceptable for the receptacles. The overcurrent protection provided shall be of the time-delay type.

6.2.9 A fuseholder provided in accordance with 6.2.8 shall be of Type S construction or shall be of the Edison-base type with a factory-installed nonremovable adapter of Type S construction.

6.2.10 The face of a receptacle shall:

a) Be flush with or project beyond a nonconductive surrounding surface, or

b) Project at least 0.015 inch (0.38 mm) beyond a conductive surrounding surface.

6.2.11 The terminal or lead of a receptacle intended to be grounded shall be connected to the conductor of the power-supply cord that is intended to be grounded. Table 12.1 identifies the supply cord conductor intended to be grounded.

6.2.12 Receptacles mounted to and supported by a cover shall be secured by more than one screw or shall be a device assembly or box cover intended for securing by a single screw.

6.3 Capacitors and filters

6.3.1 Capacitors that are connected between the ungrounded and grounded conductors (across the line) or from one of these conductors to exposed dead metal of the appliance shall comply with the:

a) Standard for Electromagnetic Interference Filters, UL 1283;

b) 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.

6.3.2 A capacitor provided as a part of a motor and a capacitor connected across the line, such as a capacitor for radio-interference elimination or power-factor correction, shall be housed within an enclosure or container that protects the plates against mechanical damage and prevents the emission of flame or molten material resulting from malfunction or breakdown of the capacitor. The container shall be of metal provided strength and protection not less than 0.020 inch (0.51 mm) thick uncoated steel.

Exception No. 1: The individual container of a capacitor may be of sheet metal less than 0.020 inch (0.51 mm) thick or may be of material other than metal if the capacitor is mounted in an enclosure that houses other parts of the machine and provided that such housing is acceptable for the enclosure of live parts.

Exception No. 2: A capacitor complying with the Standard for Capacitors, UL 810 or an electromagnetic interference filter with an integral enclosure complying with the Standard for Electromagnetic Interference Filters, UL 1283, is considered to be adequately protected.

6.3.3 If a capacitor that is not part of a motor is connected in a machine that is intended to be automatically or remotely controlled so that malfunction or breakdown of the capacitor would result in a risk of fire, electric shock, or injury to persons, thermal or overcurrent protection shall be provided in the machine to preclude such a condition.

6.3.4 A capacitor connected from one side of the line to the frame or enclosure of a machine shall have a capacitance rating of not more than 0.10 microfarad.

6.3.5 A machine that is intended to be controlled by or operated in conjunction with a capacitor or a capacitor/transformer unit shall be supplied with such capacitor or unit.

6.3.6 Under both normal and abnormal conditions of use, a capacitor employing a dielectric medium more combustible than askarel shall not cause a risk of electric shock or fire, as determined by compliance with the applicable tests in this standard intended to stimulate normal use and any forseeable abnormal uses of the machine, and shall be protected against expulsion of the dielectric medium.

Exception: A protected capacitor complying with the Standard for Capacitors, UL 810, or an electromagnetic interference filter complying with the Standard for Electromagnetic Interference Filters, UL 1283, is considered to have adequate protection against expulsion of the dielectric medium.

6.4 Controls

6.4.1 General

6.4.1.1 Components, wiring, printed wiring assemblies, insulation materials, and the like, and associated circuitry employed in controls shall be investigated and found acceptable for the application in accordance with the specific control standards with respect to the risk of electric shock, fire and injury to persons.

6.4.1.2 Where reference is made to the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, this shall include both the Part 1: General Requirements and, where applicable, the relevant Part 2 Particular Requirements.

6.4.2 Operating controls

6.4.2.1 Operating controls shall comply with one of the following:

a) The Evaluation of Electronic Circuits, Supplement SA; or

b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1 and the applicable Part 2; or

c) The Standard for Industrial Control Equipment, UL 508; or

d) The Standard for Low-Voltage Switchgear and Controlgear – Part 1: General Rules, UL 60947-1, with the Standard for Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters, UL 60947-4-1 or Low-Voltage Switchgear and Controlgear – Part 5-1: Control Circuit Devices and Switching Elements – Electromechanical Control Circuit Devices, UL 60947-5-1; or

e) The Standard for Programmable Controllers – Part 2: Equipment Requirements and Tests, UL 61131-2; or

f) The Standard for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements, UL 61010-1 with the Standard for Safety Requirements for Electrical

Equipment for Measurement, Control, and Laboratory Use – Part 2-201: Particular Requirements for Control Equipment, UL 61010-2-201.

6.4.2.2 A control regulating the motor speed, limiting the operating time during normal operation, or starting or stopping the motor, and any other control not relied upon for compliance with this standard shall be evaluated as an operating control.

Exception: An electronic control serving as the motor control switch in accordance with 28.3 or acting as an interlock required for compliance with this standard, shall be evaluated as a protective control.

6.4.2.3 When evaluating an operating control to UL 60730-1, the minimum test parameters specified in Table 6.1 shall be applied.

Table 6.1
Operating control parameters

Operating control parameter	Minimum specification
FMEA	Conduct a failure-mode and effect analysis (FMEA) to identify component failures which may result in a risk of electric shock or fire.
Operating Ambient	Determined via the Normal Temperature Test on the appliance (Section 36)
Endurance Testing	6000 cycles of operation required for controls starting or stopping the motor
Overvoltage Category	As specified in Table 18.2
Pollution Degree	As specified in Table 18.1
Enclosure Flammability	V-2 for portable appliances or 5VB for other appliances

6.4.3 Protective controls

6.4.3.1 Protective controls shall comply with:

a) The Evaluation of Electronic Circuits, Supplement SA; or

b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1 and the applicable Part 2.

6.4.3.2 In addition to the standards referenced in 6.4.3.1, electronic protective controls shall also be evaluated for reliability in accordance with:

a) The Evaluation of Electronic Circuits, Supplement SA of this Standard; or

b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and the applicable Part 2, except Clause H 11.12 (Controls using software).

6.4.3.3 In addition to the standards referenced in 6.4.3.1, electronic protective controls relying upon software as a protective component shall also comply with:

a) The Evaluation of Electronic Circuits, Supplement SA of this Standard; or

b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1 and the applicable Part 2.

6.4.3.4 A control serving as motor overload protection required in accordance with 6.11, serving as the motor control switch in accordance with 28.3, limiting the operating time under abnormal operating conditions or acting as an interlock required for compliance with this standard, and any other control relied upon for compliance with this standard shall be evaluated as a protective control.

Exception: If the appliance complies with this standard with the control defeated, the control shall be evaluated as an operating control.

6.4.3.5 When evaluating a protective control to UL 60730-1, the minimum test parameters specified in Table 6.2 shall be applied.

Table 6.2
Protective control parameters

Protective control parameter	Minimum specification
FMEA	Conduct a failure-mode and effect analysis (FMEA) to identify component failures which may result in a risk of electric shock, fire or injury and confirming protective function continues to operate as intended.
Operating Ambient	Determined via the Normal Temperature Test on the appliance (Section 36)
Endurance Testing	• 100,000 cycles of operation for interlocks, • 50 cycles for manual reset motor overload protection, • 15 days for automatic reset motor overload protection • 6000 cycles of operation required for controls starting or stopping the motor
Overvoltage Category	As specified in Table 18.2
Pollution Degree	As specified in Table 18.1
Enclosure Flammability	V-2 for portable appliances or 5VB for other appliances
Conducted Disturbances	Test Level 3
Radiated Electromagnetic Fields	Test Level 3
Fast Transient Bursts	Test Level 3 applied for 2 minutes in each polarity
Surge Immunity	Installation Class 2
Electrostatic Discharge	Test Level 3
Thermal Cycling	Temperature range: 10.0 ± 2 °C to the Operating Ambient
Software Class	Software Class B (See 6.4.3.3)

6.5 Cords, cables, and internal wiring

6.5.1 A power supply cord shall comply with the Standard for Cord Sets and Power-Supply Cords, UL 817.

6.5.2 Flexible cords and cables shall comply with the Standard for Flexible Cords and Cables, UL 62. Flexible cord and cables are considered to fulfill this requirement when preassembled in a power supply cord complying with the Standard for Cord Sets and Power Supply Cords, UL 817.

6.5.3 Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758.

Exception No. 1: Insulated conductors need not comply with UL 758 if they comply with:

a) The Standard for Thermoset-Insulated Wires and Cables, UL 44;

b) The Standard for Thermoplastic-Insulated Wires and Cables, UL 83; or

c) The Standard for Fixture Wire, UL 66.

Exception No. 2: Insulated conductors located in a low-voltage circuit not involving the risk of fire or personal injury need not comply with UL 758.

6.6 Cord reels

6.6.1 A cord reel shall comply with the special-use cord reel requirements of the Standard for Cord Reels, UL 355.

6.7 Field wiring boxes and raceways

6.7.1 Electrical boxes and the associated bushings and fittings, and raceways, of the types specified in Chapter 3, Wiring Methods and Materials, of the National Electrical Code, ANSI/NFPA 70 and that comply with the relevant UL standard (such as the Standard for Metallic Outlet Boxes, UL 514A, the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C, or the Standard for Cover Plates for Flush-Mounted Wiring Devices, UL 514D) and the requirements in General, Section 6.1 are considered to comply with the requirements in this end product standard.

6.8 Heating elements

6.8.1 Heating elements shall comply with the following standards, as applicable:

a) Standard for Sheathed Heating Elements, UL 1030, for sheath-type heating elements;

b) Standard for Appliance Wiring Material, UL 758, for heating wire (rope heaters); or

c) Standard for Electric Heating Appliances, UL 499, for other heating elements.

6.8.2 The voltage rating of a heating element employed in a machine shall not be less than that specified in Table 6.3.

Table 6.3
Rating of heating element

Nominal voltage of circuit	Minimum rating of heating element, volts
120	110
208	208
240	220
277	277
480	430
More than 480	Rating of circuit

6.9 Lampholders, indicating lamps and lighting ballasts

6.9.1 Lampholders and indicating lamps shall comply with the Standard for Lampholders, UL 496.

6.9.2 Light emitting diode (LED) light sources shall comply with the Standard for Light Emitting Diode (LED) Equipment For Use In Lighting Products, UL 8750, unless the LED light source forms a part of a

luminaire complying with the appropriate UL Standards. Individual light emitting diodes mounted on the printed wiring board of a control and intended for indicating purposes shall be evaluated with the control.

6.9.3 Lighting ballasts shall comply with the Standard for Fluorescent-Lamp Ballasts, UL 935, or the Standard for High-Intensity-Discharge Lamp Ballasts, UL 1029, unless the ballast forms a part of a luminaire complying with the appropriate UL Standard.

6.9.4 The screw shell of an Edison-base lampholder shall be connected to the terminal or lead that is intended to be connected to the grounded conductor of the power-supply circuit. Table 12.1 identifies the supply cord conductor intended to be grounded.

6.10 Motors

6.10.1 A motor shall be acceptable for the application, and shall be capable of handling the maximum normal load of the machine as described in 33.2 and 36.2.1 – 36.20.5 without introducing a risk of fire, electric shock, or injury to persons.

6.10.2 A motor shall comply with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1.

Exception: A motor located in a Low Voltage Circuit may be evaluated only for the Risk of Fire and Personal Injury in accordance with the applicable requirements of this standard.

6.10.3 With respect to evaluation of a motor to the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1, the following exceptions shall be applied:

a) Motor controls shall be evaluated in accordance with 6.4.

b) Parts of phenolic material in contact with live parts, other than magnet wire, such as brush holders or commutator insulation, shall be considered suitable without further evaluation of the material's electrical insulating properties if the material has:

1) A flammability rating of at least HB, and

2) A suitable relative thermal index (RTI) for the temperatures obtained during the Normal Temperature Test.

c) Parts of other materials in contact with live parts, other than magnet wire, shall be evaluated in accordance with 14.2.

d) For motors utilizing alternative spacings specified in the Standard for Insulation Coordination including Clearances and Creepage Distances for Electrical Equipment, UL 840, conditions and requirements as specified in Section 18, Alternate Spacings – Clearances and Creepage Distances shall be applied.

6.11 Motor overload protection

6.11.1 An machine shall incorporate thermal or overload protection in accordance with 6.11.4 if it is:

a) Permanently connected, continuous duty, and manually started, employing a motor rated at 1 hp (746 W output) or less,

b) A machine with load characteristics likely to result in an overload or stalled condition that will not be evident to the user, or

c) Remotely or automatically controlled.

6.11.2 A motor intended to move air only by means of an air-moving fan that is integrally attached, keyed, or otherwise fixed to the motor shaft is not required to have running-overload protection.

6.11.3 A shaded-pole motor with a 2:1 or smaller ratio between locked-rotor and no-load currents and a 1 A or smaller difference between no-load and locked-rotor currents is considered to have acceptable overload protection if it is protected against locked-rotor conditions only.

6.11.4 Motor-overload protection required for an appliance shall consist of one of the following:

a) Thermal motor protection complying with 6.11.6.

b) Impedance motor protection complying with 6.11.7, when the motor is tested as used in the appliance under locked-rotor conditions.

c) Electronic motor protection complying with 6.11.8.

d) Other protection that is shown by test to be equivalent to the protection as specified in (a).

6.11.5 With respect to 6.11.4, for an appliance that includes a control that positively and reliably limits the length of the time the appliance can operate under normal operation, the duration of the temperature test and the endurance test, both under locked-rotor conditions, may be less than that specified but shall not be less than the time the appliance can operate. If an electronic control operates only under abnormal conditions to end the test or limit the motor temperatures, the control shall be evaluated as electronic motor protection per 6.11.4(c) or the test shall be repeated with the electronic control defeated.

6.11.6 Thermal motor protection shall comply with the:

a) Standard for Thermally Protected Motors, UL 1004-3; or

b) Standard for Thermal Links – Requirements and Application Guide, UL 60691.

6.11.7 Impedance motor protection shall comply with the Standard for Impedance Protected Motors, UL 1004-2.

6.11.8 Electronic motor protection shall comply with the Standard for Electronically Protected Motors, UL 1004-7.

6.11.9 With respect to the evaluation of electronic motor protection in accordance with 6.11.8, the control shall be evaluated in accordance with 6.4 as a protective control.

6.11.10 The functioning of a motor-protective device provided as part of an appliance (whether such device is required or not) shall not result in a risk of fire, electric shock, or injury to persons.

6.11.11 Fuses employed for motor-running overcurrent protections shall be located in each ungrounded conductor; and for a 3-wire, 3-phase, alternating-current motor, in each of the three phases.

6.11.12 Overload devices employed for motor-running overcurrent protection, other than those that are inherent in a motor, shall be located in at least one ungrounded conductor of a single-phase supply system and in each ungrounded conductor of a 3-phase supply system.

6.11.13 With reference to 6.11.4(d), an overcurrent-protective device conforming with the National Electrical Code, is considered to be an overcurrent device that is responsive to motor current and is rated or set as indicated in Column A of Table 6.4. If the rating of the motor-running overcurrent protection determined in accordance with the foregoing does not correspond to a standard size or rating of fuses, nonadjustable circuit breakers, thermal cutouts, thermal relays, or heating elements of thermal-trip motor

switches, the next higher size, rating, or setting may be used, but not more than that specified in Column B of Table 6.4. For a multispeed motor, each winding connection is to be considered separately.

Table 6.4
Maximum rating of setting of overcurrent-protective device

Type of motor	Ampere rating of device as a percentage of motor full-load current rating	
	A	B
Motor with marked service factor of 1.15 or more	125	140
Motor with marked temperature rise of 40°C (72°F) or less	125	140
Any other motor	115	130

6.11.14 With reference to 6.11.4(d), power conversion equipment is considered equivalent to thermal or impedance protection if it has been evaluated to the Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal, and Energy, UL 61800-5-1, incorporates motor overload protection, and is suitably rated for use with the motor employed.

6.11.15 Fuses shall not be used as motor-overload protective devices unless the motor is protected by a time-delay fuse of the highest ampere rating that can be inserted in the fuseholder.

6.11.16 Motor-overload protection in which contacts control a relay coil in a motor starter shall comply with the requirements in 6.11.4.

6.11.17 For a multispeed motor of any of the types mentioned in 6.11.1 that employs a separate overload protective device to provide running overload protection, the requirement in that paragraph applies at all speeds at which the motor is intended to operate.

6.12 Overcurrent protection

6.12.1 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1; and the applicable Part of the UL 248 Series for the specific fuse type.

6.12.2 Fuseholders shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and the applicable Part of the UL 4248 Series for the specific fuseholder type.

6.12.3 Supplementary protectors shall comply with the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077.

6.12.4 Circuit breakers shall comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489.

6.12.5 Contactors and overload relays shall comply with the Standard for Industrial Control Equipment, UL 508, or the Standard for Low-Voltage Switchgear and Controlgear – Part 1: General Rules, UL 60947-1, with the Standard for Low-Voltage Switchgear and Controlgear – Part 4-1: Contactors and Motor-Starters – Electromechanical Contactors and Motor-Starters, UL 60947-4-1.

6.12.6 A protective device shall be wholly inaccessible from outside the appliance except that the operating handle of a circuit breaker, the operating button of a manually operable motor protector, and similar parts may project outside the appliance enclosure.

6.12.7 If an appliance is provided with a single-pole overcurrent protective device and is required to employ a polarized plug, the overcurrent protective device shall be connected to the ungrounded conductor of the power-supply cord of an appliance. Table 12.1 specifies the polarity identification of the power-supply cord conductors.

Exception: For portable, non-automatically starting appliances employing a motor rated 1-hp or less intended to be operated on a nominal 120 volts branch circuit and employing a plug rated at 15-amperes, an overcurrent protective device within the appliance is not prohibited from being located in either conductor of the power-supply cord, when the overcurrent protective device acts only as a supplementary overcurrent protector.

6.12.8 If the current rating of a machine is more than 40 A, and there are subdivided circuits within the machine feeding two or more power-consuming components – motors, motor-control circuits, electric heating elements – connected in parallel with each other across any pair of main-supply terminals or leads, overcurrent protection shall be provided as a part of the machine for the conductors of each terminal circuit.

Exception: Additional overcurrent protection is not required as a part of the machine for the conductors of the subdivided circuits described below:

a) For each separate motor or heating-element circuit supplied by insulated conductors having an ampacity at least one-third that of the protective device in the branch circuit to which the machine will properly be connected.

b) For each separate motor-control circuit supplied by insulated conductors having an ampacity at least one-fifth that of the protective device in the branch circuit to which the machine will properly be connected.

6.13 Polymeric materials and enclosures

6.13.1 Polymeric materials shall have:

a) A suitable flammability rating in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C;

b) A suitable Functional-Use Temperature Index, Generic Thermal Index, or Relative Thermal Index (RTI) in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C; and

c) Comply with the performance requirements as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

See also Section 14, Insulating Material, for polymeric insulating materials and Section 8, Frame and Enclosure, for polymeric enclosures.

Exception: If the deterioration of a part formed of polymeric material does not result in noncompliance with this standard, the thermal index need not be determined.

6.13.2 Metallized polymeric parts or enclosures shall comply with the applicable requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. This requirement is not applicable to metallized coating applied only to the exterior surfaces of the appliance such that flaking of the coating is not likely to enter the electrical enclosure of the appliance.