



UL 141

Underwriters Laboratories Inc. Standard for Safety

Garment Finishing Appliances



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UL Standard for Safety for Garment Finishing Appliances, UL 141

Ninth Edition, Dated March 30, 2011

Summary of Topics

Revisions to ANSI/UL 141 have been issued to reflect the latest ANSI approval and to include the following revisions that were proposed on June 10, 2011:

- ***Added requirements for garment finishing machines employing ionization technology.***

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. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The new requirements are substantially in accordance with Proposal(s) on this subject dated June 10, 2011.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

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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 <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover electric garment finishing appliances rated 250 V or less for household and commercial use, in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements do not apply to flatirons, dry-cleaning machines, laundry equipment, revolving clothes racks, or other appliances covered by individual requirements that are separate from this standard.

2 Glossary

2.1 For the purpose of these requirements, the following definitions apply.

2.2 **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).

2.3 **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.

2.4 **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.

2.5 **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.

2.6 **CORD CONNECTOR** – A female contact device wired on flexible cord for use as an extension from an outlet to make a detachable electrical connection to an attachment plug or, as an appliance coupler, to an equipment inlet.

2.7 **CONTROL, AUTOMATIC ACTION** – A control in which at least one aspect is non-manual.

2.8 **CONTROL, AUXILIARY** – A device or assembly of devices that provides a functional utility, is not relied upon as an operational or protective control, and therefore is not relied upon for safety. For example, an efficiency control not relied upon to reduce the risk of electric shock, fire, or injury to persons during normal or abnormal operation of the end product is considered an auxiliary control.

2.9 **CONTROL, MANUAL** – A device that requires direct human interaction to activate or rest the control.

2.10 **CONTROL OPERATING** – A device or assembly of devices, the operation of which starts or regulates the end product during normal operation. For example, a thermostat, the failure of which a thermal cutout/limiter or another layer of protection would reduce the risk of electric shock, fire, or injury to persons, is considered an operating control.

2.11 **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. For example, a thermal cutout/limiter, or any other control/circuit

relied upon for normal and abnormal conditions, is considered a protective control. (During the testing of the protective control/circuit, the protective functions are verified under normal and single-fault conditions of the control.)

2.12 CONTROL, TYPE 1 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence has not been declared and tested under this standard.

2.13 CONTROL, TYPE 2 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence have been declared and tested under this standard.

2.14 HAND-SUPPORTED APPLIANCE – An appliance that is physically supported by the hand of the user during the performance of its intended functions. Reference is to be made to the instruction manual of the appliance in establishing the intended electrically operated functions of the appliance.

2.15 HARD WATER SOLUTION – A solution that consists of distilled water and sodium chloride (NaCl) with a resistivity of 1000 Ω -cm. The resistivity is adjusted by the amount of sodium chloride added.

2.16 LINE-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 250 V and having circuit characteristics in excess of those of a low-voltage circuit.

2.17 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.

2.18 REMOTELY CONTROLLED APPLIANCE – An appliance that is not within sight of the operator at the starting device.

3 General

3.1 Units of measurement

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

3.2 Undated references

3.2.1 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

4 General

4.1 An appliance shall employ materials found by investigation to be acceptable for the intended application.

5 Components

5.1 General

5.1.1 A component of a product covered by this standard shall:

- a) Comply with the requirements for that component as indicated in 5.2 – 5.26;
- b) Be used in accordance with its rating(s) established for the intended conditions of use;
- c) Be used within its established use limitations or conditions of acceptability;
- d) Additionally comply with the applicable requirements of this end product standard; and
- e) Not contain mercury, with the exception of fluorescent lamps.

Exception No. 1: A component of a product covered by this standard is not required to comply with a specific component requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product;*
- b) Is superseded by a requirement in this end product standard; or*
- c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.*

Exception No. 2: A component that complies with a UL component standard other than those specified in 5.2 – 5.26 is acceptable if:

- a) The component also complies with the applicable component standard of 5.2 – 5.26; or*
- b) The UL component standard:*
 - 1) Is compatible with the ampacity and overcurrent protection requirements National Electrical Code, NFPA 70, where applicable;*
 - 2) Considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and*

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3) Any use limitations of the other component standard are identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.

5.1.2 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable UL standard(s) that cover devices that provide those functions.

Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional UL component standard(s) need not be applied.

5.1.3 A component not anticipated by the requirements of this end product standard, not specifically covered by the component standards in 5.2 – 5.26, and that involves a risk of electric shock, fire, or personal injury, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with items (b) – (e) of 5.1.1.

5.1.4 With regard to 5.1.3, 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 the requirements of this end product standard.

5.1.5 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.

5.2 Attachment plugs, receptacles, connectors, and terminals

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

Exception: Attachment plugs and appliance couplers integral to cord sets or power supply cords that are investigated in accordance with the requirements of the Standard for Cord Sets and Power-Supply Cords, UL 817 and need not comply with the Standard for Attachment Plugs and Receptacles, UL 498.

5.2.2 Quick-connect terminals, both connectors and tabs, for use with one or two 22 – 10 AWG copper conductors, having nominal widths of 2.8, 3.2, 4.8, 5.2, and 6.3 mm (0.110, 0.125, 0.187, 0.205, and 0.250 in), intended for internal wiring connections in appliances, or for the field termination of conductors to the appliance, shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310.

Exception: Other sizes of quick-connect terminals shall be investigated with respect to crimp pull out, insertion-withdrawal, temperature rise, and all tests shall be conducted in accordance with the Standard for Electrical Quick-Connect Terminals, UL 310.

5.2.3 Single and multi-pole connectors for use in data, signal, control and power applications within and between electrical equipment, and that are 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 Data, Signal, Control and Power Applications, UL 1977.

5.2.4 Wire connectors shall comply with the Standard for Wiring Connectors, UL 486A-486B.

5.2.5 Splicing wire connectors shall comply with the Standard for Splicing Wire Connectors, UL 486C.

5.2.6 Multi-pole splicing wire connectors that are intended to facilitate the connection of hard-wired utilization equipment to the branch-circuit conductors of buildings shall comply with the Standard for Multi-Pole Splicing Wire Connectors, UL 2459.

5.2.7 Equipment wiring terminals for use with all alloys of copper, aluminum, or copper-clad aluminum conductors, shall comply with Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

5.2.8 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and, if applicable, be suitably rated for field wiring.

Exception: A fabricated part performing the function of a terminal block need not comply with the Standard for Terminal Blocks, UL 1059 if the part complies with the requirements of Wiring Terminals and Leads, 12.1.3; Current-Carrying Parts, Section 14; Electrical Insulation, Section 17; and Spacings, Section 26 of this end product standard.

5.2.9 Female devices (such as receptacles, 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.

5.3 Batteries and battery chargers

5.3.1 A lithium ion (Li-On) single cell battery shall comply with the requirements for secondary lithium cells in the Standard for Lithium Batteries, UL 1642. A lithium ion multiple cell battery and a lithium ion battery pack shall comply with the applicable requirements for secondary lithium cells or battery packs in the Standard for Household and Commercial Batteries, UL 2054.

5.3.2 Rechargeable nickel cadmium (Ni-Cad) cells and battery packs shall comply with the applicable construction and performance requirements of this end product standard.

5.3.3 Rechargeable nickel metal-hydride (Ni-MH) battery cells and packs shall comply with the applicable construction and performance requirements of this end product standard, or the applicable requirements for secondary cells or battery packs in the Standard for Household and Commercial Batteries, UL 2054.

5.3.4 Primary batteries (non-rechargeable) that comply with the relevant UL standard and 5.1 are considered to fulfill the requirements of this standard.

5.3.5 A Class 2 battery charger shall comply with one of the following:

- a) The Standard for Class 2 Power Units, UL 1310; or
- b) The Standard for Information Technology Equipment, Part 1: General Requirements, UL 60950-1 with an output marked "Class 2", or that complies with the limited power source (LPS) requirements and is marked "LPS".

5.3.6 A non-Class 2 battery charger shall comply with one of the following:

- a) The Standard for Power Units Other Than Class 2, UL 1012; or
- b) The Standard for Information Technology Equipment, Part 1: General Requirements, UL 60950-1.

5.4 Boxes and raceways

5.4.1 Electrical boxes and the associated bushings and fittings, and raceways, of the types specified in Chapter 3 of the National Electrical Code, 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, the Standard for Cover Plates for Flush-Mounted Wiring Devices, UL 514D, and 5.1 are considered to comply with the requirements of this end product standard.

5.5 Capacitors and filters

5.5.1 The component requirements for a capacitor are not specified. A capacitor complying with the Standard for Capacitors, UL 810, is considered to comply with the requirements of 19.1.

5.5.2 Electromagnetic interference filters with integral enclosures that comply with one of the following standards, are considered to comply with the requirements of 19.1:

- a) The Standard for Electromagnetic Interference Filters, UL 1283; or
- b) 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.

5.6 Controls

5.6.1 General

5.6.1.1 Auxiliary controls shall be evaluated using the applicable requirements of this end product standard and the requirements in Section 25.

5.6.1.2 Operating (regulating) controls shall be evaluated using the applicable component standard requirements specified in 5.6.2 – 5.6.7 and the parameters in Section 25, unless otherwise specified in this end product standard.

5.6.1.3 Operating controls that rely upon software for the normal operation of the end product where deviation or drift of the operating parameters of the control may result in an increased risk of electric shock, fire, or injury to persons, shall comply with:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; and the Standard for Software in Programmable Components, UL 1998; or
- b) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1.

5.6.1.4 Protective (limiting) controls shall be evaluated using the applicable component standard requirements specified in 5.6.2 – 5.6.7, and if applicable, the parameters in Section 25, unless otherwise specified in this end product standard.

5.6.1.5 Solid-state protective controls that do not rely upon software as a protective component shall comply with:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; or
- b) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, except Controls Using Software.

5.6.1.6 Protective controls that rely upon software as a protective component shall comply with:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; and the Standard for Software in Programmable Components, UL 1998; or
- b) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, except Controls Using Software.

5.6.1.7 An electronic, non-protective control that is simple in design need only be subjected to the applicable requirements of this end-product standard. A control that does not include an integrated circuit or microprocessor, but does consist of a discrete switching device, capacitors, transistors, and resistors, is considered simple in design. See Section 37.

5.6.2 Electromechanical and electronic controls

5.6.2.1 A control, other than as specified in 5.6.3 – 5.6.7, shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- c) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1.

5.6.3 Liquid level controls

5.6.3.1 A liquid level control shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- c) The Standard for Industrial Control Equipment, UL 508; or
- d) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1; and
 - 1) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 2: Particular Requirements for Automatic Electrical Water Level Controls of the Float Type for Household and Similar Applications, UL 60730-2-16A; or
 - 2) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 2: Particular Requirements for Automatic Electrical Water and Air Flow Sensing Controls, Including Mechanical Requirements, UL 60730-2-18.

5.6.4 Motor and speed controls

5.6.4.1 A control used to start, stop, regulate or control the speed of a motor shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- c) The Standard for Industrial Control Equipment, UL 508; or
- d) The Standard for Power Conversion Equipment, UL 508C; or
- e) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1.

5.6.5 Pressure controls

5.6.5.1 A pressure control shall comply with one of the following:

- a) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- b) The Standard for Industrial Control Equipment, UL 508; or
- c) The 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.

5.6.6 Temperature controls

5.6.6.1 A temperature control shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- c) The Standard for Industrial Control Equipment, UL 508; or
- d) The 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.

5.6.6.2 A temperature sensing positive temperature coefficient (PTC) or a negative temperature coefficient (NTC) thermistor, that performs the same function as an operating or protective control shall comply with the Standard for Thermistor-Type Devices, UL 1434.

5.6.6.3 A thermal cutoff shall comply with the Standard for Thermal-Links (Thermal Cutoffs) for Use in Electrical Appliances and Components, UL 60691.

5.6.7 Timer controls

5.6.7.1 A timer control shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The 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 Timers and Time Switches, UL 60730-2-7.

5.7 Cords, cables, and internal wiring

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

5.7.2 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 cord set or power supply cord complying with the Standard for Cord Sets and Power Supply Cords, UL 817.

5.7.3 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 the Standard for Appliance Wiring Material, UL 758 if they comply with one of the following:

- a) The Standard for Thermoset-Insulated Wires and Cables, UL 44;*
- b) The Standard for Thermoplastic-Insulated Wires and Cables, UL 83;*
- c) The Standard for Fixture Wire, UL 66; or*
- d) The applicable UL standard(s) for other insulated conductor types specified in Chapter 3 (Wiring Methods and Materials) of the National Electrical Code, NFPA 70.*

Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit not involving the risk of fire or personal injury need not comply with the Standard for Appliance Wiring Material, UL 758.

5.8 Cord reels

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

5.9 Film-coated wire (magnet wire)

5.9.1 The component requirements for film coated wire and Class 105 (A) insulation systems are not specified.

5.9.2 Film coated wire in intimate combination with one or more insulators, and incorporated in an insulation system rated Class 120 (E) or higher, shall comply with the magnet wire requirements in the Standard for Systems of Insulating Materials – General, UL 1446.

5.10 Gaskets and seals

5.10.1 Gaskets and seals that comply with the Standard for Gaskets and Seals, UL 157, are considered to fulfill the requirements of Section 41.

5.11 Ground-fault, arc-fault, and leakage current detectors/interrupters

5.11.1 Ground-fault circuit-interrupters (GFCI) for protection against electrical shock shall comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943. The following statement, or equivalent, shall be included as a marking near the GFCI, or as an instruction in the manual: "Press the TEST button (then RESET button) every month to assure proper operation."

5.11.2 Appliance-leakage-current interrupters (ALCI) for protection against electrical shock shall comply with the Standard for Appliance-Leakage-Current Interrupters, UL 943B. An ALCI is not considered an acceptable substitute for a GFCI when a GFCI is required by the National Electrical Code, NFPA 70.

5.11.3 Equipment ground-fault protective devices shall comply with the Standard for Ground-Fault Sensing and Relaying Equipment, UL 1053, and applicable requirements of the Standard for Ground-Fault Circuit-Interrupters, UL 943.

5.11.4 Arc-fault circuit-interrupters (AFCI) shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

5.11.5 Leakage-current detector-interrupters (LCDI) and any shielded cord between the LCDI and appliance shall comply with Standard for Arc-Fault Circuit-Interrupters, UL 1699.

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5.12 Heaters, heating elements and pads

5.12.1 Electric resistance heating elements shall comply with the construction requirements of:

- a) The Standard for Electric Heating Appliances, UL 499; or
- b) The Standard for Sheathed Heating Elements, UL 1030.

Exception: Heating wire (e.g. rope heater) that complies with the Standard for Appliance Wiring Material, UL 758, and the requirements of this end product standard are considered to fulfill this requirement.

5.12.2 Thermistor-type heaters (e.g. PTC and NTC heaters) shall comply with the Standard for Thermistor-Type Devices, UL 1434.

5.12.3 A heating pad assembly shall comply with the applicable requirements in the Standard for Electric Heating Pads, UL 130.

5.13 Insulation systems

5.13.1 Materials used in a Class 105 (A) insulation system shall comply with 21.3.

5.13.2 Materials used in an insulation system that operates above Class 105 (A) temperatures shall comply with the Standard for Systems of Insulating Materials – General, UL 1446.

5.13.3 All insulation systems employing integral ground insulation shall comply with the requirements specified in the Standard for Systems of Insulating Materials – General, UL 1446.

5.14 Light sources and associated components

5.14.1 Lampholders and indicating lamps with integral lamp/lampholder (e.g. neon pilot lamp) shall comply with the Standard for Lampholders, UL 496.

Exception: Lampholders forming part of a luminaire that complies with the applicable UL luminaire standard are considered to comply with this requirement.

5.14.2 Lighting ballasts shall comply with:

- a) The Standard for Fluorescent-Lamp Ballasts, UL 935; or
- b) The Standard for High-Intensity Discharge Lamp Ballasts, UL 1029.

Exception No. 1: Ballasts forming part of a luminaire that complies with the applicable UL luminaire standard are considered to comply with this requirement.

Exception No. 2: Ballasts for other light sources shall comply with the applicable UL standard(s).

5.14.3 Light emitting diode (LED) light sources shall comply with the Standard for Light Emitting Diode (LED) Light Sources For Use In Lighting Products, UL 8750.

Exception No. 1: LED light sources forming part of a luminaire that complies with the applicable UL luminaire standard are considered to comply with this requirement.

Exception No. 2: Individual LED light sources mounted on printed wiring boards and intended for indicating purposes need not comply with Standard for Light Emitting Diode (LED) Light Sources For Use In Lighting Products, UL 8750, but shall comply with the applicable requirements of this end product standard.

5.15 Marking and labeling systems

5.15.1 A marking and labeling system shall comply with Standard for Marking and Labeling Systems, UL 969, under the specified environmental conditions.

Exception: A marking or labeling system that complies with Section 42 of this standard is considered to fulfill the requirement.

5.16 Motors and motor overload protection

5.16.1 General

5.16.1.1 General-purpose type motors having a NEMA frame size shall comply with the requirements specified in 5.16.2. This includes fractional HP motors rated up to 1 HP (typically NEMA frame sizes 42, 48, or 56), and integral HP motors rated 1 HP and greater (typically NEMA frame sizes 140 – 449T).

5.16.1.2 Motors not enclosed, or partially enclosed, by the end product enclosure shall comply with the requirements specified in 5.16.2.

5.16.1.3 Component type motors completely enclosed within the end product enclosure shall comply with the requirements specified in 5.16.2 or 5.16.3.

5.16.1.4 Motors located in a low voltage circuit are evaluated for the risk of fire and personal injury in accordance with the applicable requirements of this end product standard.

5.16.1.5 Low voltage component fans that comply with the Standard for Electric Fans, UL 507, are considered to fulfill the requirements of Section 21.

5.16.2 General-purpose type motors

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

5.16.3 Component type motors

5.16.3.1 Component type motors shall comply with either 5.16.3.2 or 5.16.3.3.

5.16.3.2 The motor shall comply with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 except as noted in Table 5.1.

Table 5.1
Superseded requirements

UL 1004-1 exempted requirement	Superseded by the requirements in this standard
Current and Horsepower Relation	21.2.4
Cord-Connected Motors	12.2
Factory Wiring Terminals and Leads	Section 15
Electrical Insulation	Section 17
Non-Metallic Functional Parts	Sections 6, 15, 21
Solid-State Controls, 7.2	5.6
Non-metallic enclosure thermal aging, 9.1.4	6.2.2
Motor enclosure (Cast Metal Enclosures, Sheet Metal Enclosures, and Polymeric Enclosures)	Section 6
Grounding	Section 13
Ventilation Openings: only applicable where the openings are on surfaces considered to be the appliance enclosure.	6.2.2
Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts	Section 11
Protection Against Corrosion	Section 10
Available fault current ratings for motor start and running capacitors, 26.6: not applicable for cord and plug connected appliances.	Section 19
Switch: not applicable to centrifugal starting switches	Section 24
With the exception of the Resilient Elastomer Mounting and Electrolytic Capacitor Tests requirements, the performance tests of the Standard for Rotating Electrical Machines – General Requirements UL 1004-1 are not applicable	All applicable performance tests.
Only the following marking requirements are applicable: manufacturer's name or identification; rated voltage; rated frequency; number of phases if greater than 1; and multi-speed motors, other than a shaded-pole or a permanent-split-capacitor motor, shall be marked with the amperes and horsepower at each speed	49.1

5.16.3.3 The motor shall comply with the applicable component requirements in this section, the following construction requirements, and the applicable performance requirements (when tested in conjunction with the end product), of this end product standard:

- a) Protection Against Corrosion, Section 10;
- b) Terminal Compartment, Section 12;

- c) Electrical Insulation, Section 17 and 18;
- d) Internal Wiring, Section 15;
- e) Capacitors, Section 19;
- f) Grounding, Section 13;
- g) Motors, Section 21; and
- h) Spacings, Section 26.

5.16.4 Motor overload protection

5.16.4.1 Thermal protection devices integral with the motor shall comply with:

- a) The Standard for Overheating Protection for Motors, UL 2111; or
- b) The Standard for Thermally Protected Motors, UL 1004-3; or
- c) The 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 Thermal Motor Protectors, UL 60730-2-2; in conjunction with the Standard for Thermally Protected Motors, UL 1004-3 (to evaluate the motor-protector combination).

5.16.4.2 Impedance protection shall comply with:

- a) The Standard for Overheating Protection for Motors, UL 2111; or
- b) The Standard for Impedance Protected Motors, UL 1004-2.

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

5.16.4.4 Except as indicated in 5.16.4.3, electronically protected motor circuits shall comply with one of the following. See 5.6.4 for basic control requirements.

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991. When the protective electronic circuit is relying upon software as a protective component, it shall comply with the requirements in the Standard for Tests for Software in Programmable Components, UL 1998. If software is relied upon to perform a safety function, it shall be considered software Class 1; or
- b) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1. If software is relied upon to perform a safety function, it shall be considered software Class B; or
- c) The Standard for Power Conversion Equipment, UL 508C.

Exception: Compliance with this requirement is not required for an electronically protected motor circuit if there is no risk of fire, electric shock, or personal injury during abnormal testing with the motor electronic circuit rendered ineffective; compliance with the applicable requirements of this end product standard is then required.

5.17 Overcurrent protection

5.17.1 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1, and the applicable Part 2 (e.g. the Standard for Low-Voltage Fuses – Part 5: Class G Fuses, UL 248-5). Defined use fuses that comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1 and another applicable standard for the fuse are considered to comply with this requirement.

5.17.2 Fuseholders shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and applicable Part 2 (e.g. the Standard for Fuseholders – Part 9: Class K, UL 4248-9).

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

Exception: Circuit breakers used in telecommunications circuitry that comply with the Standard for Circuit Breakers For Use in Communications Equipment, UL 489A, need not comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489.

5.17.4 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

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

5.17.6 Fusing resistors shall comply with the Standard for Fusing Resistors and Temperature-Limited Resistors for Radio- and Television-Type Appliances, UL 1412.

5.18 Polymeric materials and enclosures

5.18.1 Unless otherwise specified in this end product standard, polymeric electrical insulating materials and enclosures shall comply with the applicable requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

5.18.2 Metallized or painted 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 exterior surfaces of polymeric enclosure materials or parts provided that the metallized coating or paint does not offer a continuous path for an internal flame to propagate externally.

5.19 Power supplies

5.19.1 A Class 2 power supply shall comply with one of the following:

- a) The Standard for Class 2 Power Units, UL 1310; or
- b) The Standard for Information Technology Equipment, Part 1: General Requirements, UL 60950-1, with an output marked "Class 2", or that complies with the limited power source (LPS) requirements and is marked "LPS".

5.19.2 A non-Class 2 power supply shall comply with one of the following:

- a) The Standard for Power Units Other Than Class 2, UL 1012; or
- b) The Standard for Information Technology Equipment, Part 1: General Requirements, UL 60950-1.

5.20 Printed wiring boards

5.20.1 Printed wiring boards, including the coatings, shall comply with the Standard for Printed-Wiring Boards, UL 796.

Exception: A printed-wiring board in a Class 2 nonsafety circuit is not required to comply with the bonding requirements in the Standard for Printed-Wiring Boards, UL 796 if the board is separated from parts of other circuits such that loosening of the bond between the foil conductor and the base material will not result in the foil conductors or components coming in contact with parts of other circuits of the control or of the end-use product.

5.20.2 A printed-wiring board containing circuitry in a line-connected circuit or a safety circuit shall comply with the direct-support requirements for insulating materials in Sections 17 and 18 of this end product standard.

5.20.3 Unless otherwise specified, the flammability class and temperature rating shall be that specified for insulating materials in Sections 17 and 18 of this end product standard.

5.21 Semiconductors and small electronic components

5.21.1 A power switching semiconductor device that is relied upon to provide isolation to ground shall comply with the Standard of Safety for Electrically Isolated Semiconductor Devices, UL 1557. The dielectric voltage withstand tests required by the Standard of Safety for Electrically Isolated Semiconductor Devices, UL 1557 shall be conducted applying the criteria of Section 35 of this end product standard.

5.21.2 An optical isolator that is relied upon to provide isolation between primary and secondary circuits or between other circuits as required by this end product standard shall comply with the Standard for Safety for Optical Isolators, UL 1577. The dielectric voltage withstand tests required by the Standard for Safety for Optical Isolators, UL 1577 shall be conducted applying the criteria of Section 35 of this end product standard.

5.21.3 Except as specified in 5.21.4, component requirements are not specified for small electronic components on printed wiring boards, including diodes, transistors, resistors, inductors, integrated circuits, and capacitors not directly connected to the supply source.

5.21.4 Where an electronic component is determined to be a critical component during the testing of the Abnormal Operation Test, Section 37, one of the following standards shall be applied. See 25.4 for the test parameters to be used.

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; and as applicable, the Standard for Software in Programmable Components, UL 1998 for controls that rely upon software as a protective component; or
- b) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1.

5.21.5 With reference to 5.21.4, a critical component is a component that performs one or more safety-related functions whose failure results in a condition, such as the risk of fire, electric shock, or injury to persons, in the end product application.

5.21.6 With reference to 5.21.4, a critical component may also be identified using a failure-mode and effect analysis (FMEA) in accordance with the Failure-Mode and Effect Analysis (FMEA) of the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991.

5.21.7 With reference to 5.21.4, portions of a circuit comprised of a microcontroller or other programmable device that performs a back-up, limiting, or other safety function intended to reduce the risk of fire, electric shock, or injury to persons shall comply with the Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1, Annex H.

5.22 Supplemental insulation, insulating bushings, and assembly aids

5.22.1 The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required to fulfill 15.3.6 or a performance requirement of this standard. In such cases:

- a) Insulating tape shall comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510;
- b) Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441;
- c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

5.22.2 Wire positioning devices shall comply with Electrical Insulation, Section 17. A device that complies with the Standard for Positioning Devices, UL 1565, is considered to fulfill this requirement.

5.22.3 Insulating bushings that comply with 5.1 and the Standard for Insulating Bushings, UL 635, are considered to fulfill the requirements of this standard. Tests specified in this standard (e.g. Strain Relief Test) may still need to be performed to confirm the combination of the insulating bushing and the supporting part are suitable.

5.23 Switches

5.23.1 Switches shall comply with one of the following, as applicable:

- a) The Standard for Special-Use Switches, UL 1054;
- b) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1;
- c) The Standard for General Use Snap Switches, UL 20; or
- d) The Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 733A.

Exception: Switching devices that comply with the applicable UL standard for specialty applications (e.g. transfer switch equipment), industrial use (e.g. contactors, relays, auxiliary devices), or are integral to another component (e.g. switched lampholder) need not comply.

5.23.2 A clock-operated switch, in which the switching contacts are actuated by a clock-work, by a gear-train, by electrically-wound spring motors, by electric clock-type motors, or by equivalent arrangements shall comply with one of the following:

- a) The Standard for Clock-Operated Switches, UL 917; or
- b) The 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 Timers and Time Switches, UL 60730-2-7.

5.23.3 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, shall comply with the requirements for an operating control with Type 1 action for 6,000 cycles of operation, or as a manual control for 5,000 cycles of operation, in accordance with the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The 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 Timers and Time Switches, UL 60730-2-7.

5.23.4 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, that functions as a protective control, shall comply with the requirements for a protective control; see 5.6.1.3.

5.24 Transformers

5.24.1 General-purpose transformers shall comply with the Standard for Low Voltage Transformers: General Requirements, UL 5085-1; and the Standard for Low Voltage Transformers: General Purpose Transformers, UL 5085-2.

Exception No. 1: A transformer that is completely enclosed within the end product enclosure, and that meets the applicable construction and performance requirements of this end product standard when tested in conjunction with the end product, meets the intent of this requirement.

Exception No. 2: A transformer that complies with the Standard for Transformers and Motor Transformers for Use in Audio-, Radio-, and Television-Type Appliances, UL 1411, and that is used in a circuit involving an audio or video component, meets the intent of this requirement.

5.24.2 Class 2 and Class 3 transformers shall comply with the Standard for Low Voltage Transformers: General Requirements, UL 5085-1; and the Standard for Low Voltage Transformers: Class 2 and Class 3 Transformers, UL 5085-3.

Exception: Transformers located in a low voltage circuit that do not involve a risk of fire or personal injury need not comply with this requirement.

5.25 Valves (electrically operated) and solenoids

5.25.1 Electrically operated valves shall comply with:

- a) The Standard for Electrically Operated Valves, UL 429; or
- b) The 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 Electrically Operated Water Valves, Including Mechanical Requirements, UL 60730-2-8.

Exception: Automatic valves intended for use with natural gas, manufactured gas, LP-gas or LP-gas-air mixtures shall comply with the Standard for Automatic Valves for Gas Appliances, ANSI Z21.21a/CSA 6.5a.

5.25.2 Solenoids shall comply with the applicable construction and performance requirements of this end product standard, or with the Outline of Investigation for Solenoids, UL Subject 906.

5.26 Video and audio components

5.26.1 A video component (e.g. a television or video) or an audio component (such as a CD player, radio, MP3 player, or audio sound system) provided with a garment finishing machine shall comply with the following:

- a) The Standard for Audio, Video, and Similar Electronic Apparatus-Safety Requirements, UL 60065; or
- b) The Standard for Information Technology Equipment, Part 1: General Requirements, UL 60950-1.

5.26.2 The location, orientation, and intended use of a video or audio component shall be evaluated with the garment finishing machine to ensure that the component(s) does not increase the risk of shock, fire, or personal injury. Examples include, but are not limited to, the mechanical mounting of the component, and the effect of the audio and video component on the overall leakage current of the machine.

6 Enclosure

6.1 General

6.1.1 An appliance shall be provided with an enclosure that will house all electrical parts other than the power-supply cord or the terminal pins.

6.1.2 An appliance shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it may be subjected, without increasing the risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

6.1.3 The following factors shall be considered when determining the acceptability of magnesium and nonmetallic enclosure materials. For a nonmetallic enclosure, all of these factors are considered with respect to thermal aging. The enclosure materials shall be resistant to:

- a) Mechanical damage,
- b) Impact,
- c) Moisture-absorption,
- d) Combustion,
- e) Corrosion, and
- f) Distortion at temperatures to which the material may be subjected under conditions of normal or abnormal use.

6.1.4 In addition to being considered with reference to factors as mentioned in 6.1.3, an enclosure of sheet metal shall be judged with respect to size and shape, thickness of metal, and acceptability for the application, considering the intended use of the appliance.

6.1.5 For unreinforced, flat surfaces in general, cast metal shall not be less than 1/8-in (3.2-mm) thick, except that malleable iron may be not less than 3/32 in (2.4 mm) and die-cast metal may be not less than 5/64-in (2.0-mm) thick. Corresponding thicknesses of not less than 3/32, 1/16 (1.6 mm), and 3/64 in (1.2 mm), respectively, may be acceptable if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape or size, or both, of the surface is such that the necessary mechanical strength is provided.

6.1.6 An enclosure of sheet metal shall be judged with respect to its size and shape, the thickness of metal, and the application, considering the intended use of the complete appliance. The use of sheet steel less than 0.026-in (0.66-mm) thick if uncoated or 0.029-in (0.74-mm) thick if galvanized, or of nonferrous sheet metal less than 0.036-in (0.91-mm) thick, is not acceptable except at relatively small areas or for surfaces that are curved or otherwise reinforced.