



UL 1090

STANDARD FOR SAFETY Electric Snow Movers

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UL Standard for Safety for Electric Snow Movers, UL 1090

Seventh Edition, Dated October 5, 2016

Summary of Topics

This new edition is being issued to incorporate the following changes and to reflect the latest ANSI approval date of October 5, 2016 for the standard.

1. Replace Requirements For Battery Operated Snow Movers In UL 1090 With Requirements From The Standard for General Requirements For Battery-Powered Appliances, UL 2595

The new/revised requirements are substantially in accordance with Proposal(s) on this subject dated June 24, 2016.

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OCTOBER 5, 2016



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UL 1090

Standard for Electric Snow Movers

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Seventh Edition

October 5, 2016

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The most recent designation of ANSI/UL 1090 as an American National Standard (ANSI) occurred on October 5, 2016. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

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 cord-connected electrically operated snow movers rated 250 V or less to be employed in accordance with the National Electrical Code, ANSI/NFPA 70.

1.2 These requirements also cover battery-operated snow movers as specified in Battery Powered Gardening Appliances, Supplement SA, in this Standard.

1.3 These requirements do not cover riding-type snow movers or snow movers intended for commercial or industrial use or for use in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70.

1.4 In addition to the requirements in this standard, a snow mover shall comply with 5.1, 5.2.2, 5.2.3, 5.2.5, 6, 7, 10.1 – 10.3, 11.1, and 12 of the Snow Throwers – Safety Specifications, ANSI B71.3.

Exception: Markings shall be considered durable and permanent if they comply with Permanency of Marking, Section 42, of this standard.

2 Units of Measurement

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

2.2 Unless otherwise indicated, all voltage and current values specified in this standard are root-mean-square.

3 Undated References

3.1 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.

4 Glossary

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

4.2 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).

4.3 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.

4.4 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.

4.5 AUTOMATICALLY CONTROLLED PRODUCT – A product is determined to be automatically controlled if it complies with one or more of the following conditions:

- a) The repeated starting of the product is independent of any manual control after one complete cycle of operation, after which some form of limit device opens the circuit.
- b) During any single preset cycle of operation, the motor is caused to stop and restart.
- c) When the product is energized, the initial starting of the motor may be intentionally delayed beyond intended, conventional starting.
- d) For a product employing a motor with a separate starting winding, during any single predetermined cycle of operation, automatic changing of the mechanical load reduces the motor speed sufficiently to reestablish starting-winding connections to the supply circuit.

4.6 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.

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

4.8 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 fire, electric shock, or injury to persons during normal or abnormal operation of the end product is considered an auxiliary control.

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

4.10 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 mitigate the risk of fire, electric shock, or injury to persons, is considered an operating control. Operating controls are also referred to as "regulating controls".

4.11 CONTROL, PROTECTIVE – A device or assembly of devices, the operation of which is intended to reduce the risk of fire, electric shock, or injury to persons during normal and reasonably anticipated abnormal operation of the appliance whereby during the evaluation of the protective control/circuit, the protective functions are verified under normal and single-fault conditions of the control. For example, a thermal cutout/limiter, or any other control/circuit relied upon for normal and abnormal conditions, is considered a protective control. Protective controls are also referred to as "limiting controls" and "safety controls".

4.12 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.

4.13 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.

4.14 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.

4.4.15 DIRECTLY ACCESSIBLE MOTOR – A motor that can be contacted without opening or removing any part, or that is located so as to be accessible to contact.

4.16 ENCLOSURE – That portion of the snow mover that:

- a) Renders inaccessible all parts that may otherwise present a risk of electric shock or injury to persons, or
- b) Prevents propagation of flame initiated by electrical disturbances occurring within, or both.

4.17 GROUND-SUPPORTED SNOW MOVER – A snow mover that, during normal operation, is supported entirely or in part by the ground.

4.18 HAND-SUPPORTED SNOW MOVER – A snow mover that, at some time during normal operation, is intended to be completely supported by the user.

4.19 INDIRECTLY ACCESSIBLE MOTOR – A motor that is accessible only by opening or removing a part of the outer enclosure, such as a guard or panel, that can be opened or removed without using a tool, or that is located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted.

4.20 LEAKAGE CURRENT – All current or currents, including capacitively-coupled current, that may be conveyed between exposed conductive surfaces of a snow mover and ground or other exposed conductive surfaces of the snow mover.

4.21 LIVE PART – A part energized with respect to earth or energized with respect to some other part.

CONSTRUCTION

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 – 5.25;
- 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.

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 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 – 5.25 is acceptable if:

- a) The component also complies with the applicable component standard specified in 5.2 – 5.25; or*
- b) The component standard:*
 - 1) Is compatible with the ampacity and overcurrent protection requirements in the National Electrical Code, ANSI/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*
 - 3) Any use limitations of the other component UL standards 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 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.

5.1.3 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 component UL standard(s) need not be applied.

5.1.4 A component not anticipated by the requirements of this end product standard, not specifically covered by the component standards in 5.2 – 5.25, and that involves a risk of fire, electric shock, or injury to persons, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with 5.1.1 (b) – (d).

5.1.5 With regard to a component being additionally investigated, 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 1090.

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. See 5.2.9.

Exception No. 1: Attachment plugs and appliance couplers integral to cord sets or power supply cords that are investigated in accordance with the requirements in the Standard for Cord Sets and Power-Supply Cords, UL 817, are not required to comply with UL 498.

Exception No. 2: A fabricated pin terminal assembly(ies) need not comply with UL 498 if it complies with Live Parts, Section 11, Electrical Insulation, Section 13, and Spacings, Section 18, of this end product standard.

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 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 UL 310.

5.2.3 Single and multipole 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 Use in Data, Signal, Control and Power Applications, UL 1977. See 5.2.9.

5.2.4 Wire connectors shall comply with the Standard for Wire 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 Insulated Multi-Pole Splicing Wire Connectors, UL 2459. See 5.2.9.

5.2.7 Equipment wiring terminals for use with all alloys of copper, aluminum, or copper-clad aluminum conductors, shall comply with the 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 UL 1059 if the part complies with the requirements of Live Parts, Section 11, Electrical Insulation, Section 13, and Spacings, Section 18, of this end product standard. This exception does not apply to protective conductor terminal blocks.

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.

5.4 Boxes and raceways

5.4.1 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, 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-Devices Boxes, and Covers, UL 514C, the Standard for Cover Plates for Flush-Mounted Wiring Devices, UL 514D) and Components – General, Section 5.1 are considered to comply with the requirements in this end product standard.

5.5 Capacitors and filters

5.5.1 A power capacitor employing a dielectric medium of wax or of liquid other than askarel shall comply with the requirements for protected oil-filled capacitors in the Standard for Capacitors, UL 810, and shall be used within its rated voltage.

5.5.2 An electromagnetic interference filter shall comply with the Standard for Electromagnetic Interference Filters, UL 1283.

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 the Standard for Controls – End Product Test Parameters, Section 20.

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 if applicable, the requirements in Controls – End Product Test Parameters, Section 20, 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 control may result in a risk of fire, electric shock, or injury to persons, such as a speed control unexpectedly changing its output, shall comply with one or both of the following standards:

- 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 Controls – End Product Test Parameters, Section 20, 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 one or both of the following standards:

- 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 for the Controls Using Software requirements.

5.6.1.6 Protective controls that rely upon software as a protective component shall comply with one or both of the following standards:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, and 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.

5.6.1.7 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, or resistors is considered simple in design.

5.6.2 Electromechanical and electronic controls

5.6.2.1 A control, other than as specified in 5.6.2 – 5.6.7, shall comply with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- 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 one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;
- 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 60730-2-15; or

- 2) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Automatic Electrical Water Level Controls of the Float Type for Household and Similar Applications, UL 60730-2-15.

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 one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;
- c) The Standard for Industrial Control Equipment, UL 508;
- 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;
- 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 one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;
- 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 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 – Requirements and Application Guide, UL 60691.

5.6.7 Timer controls

5.6.7.1 A timer control shall comply with one of 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.

5.7 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 comply with this requirement when pre-assembled 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 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, ANSI/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, electric shock or injury to persons need not comply with 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, seals and tubing

5.10.1 Gaskets, o-rings, seals, and tubing the failure of which would increase the risk of fire, electric shock, injury to persons shall comply with the Standard for Gaskets and Seals, UL 157.

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.

5.11.3 With respect to 5.11.2, an ALCI is not considered an acceptable substitute for a GFCI when the National Electrical Code, ANSI/NFPA 70, requires a GFCI.

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

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

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

5.12 Insulation systems

5.12.1 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.

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

5.13 Light sources and associated components

5.13.1 Lampholders and indicating lamps 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.

5.13.2 Lighting ballasts shall comply with one of the following:

- 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 an 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).

5.13.3 Light emitting diode (LED) light sources shall comply with the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

Exception No. 1: LED light sources forming part of a luminaire that complies with an 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 UL 8750, but shall comply with the applicable requirements of this end product standard.

5.14 Marking and labeling systems

5.14.1 A marking and labeling system shall comply with the Standard for Marking and Labeling Systems, UL 969, under the specified environmental conditions. See Permanency of Marking, Section 42.

5.15 Motors and motor overload protection

5.15.1 General

5.15.1.1 General-purpose type motors having a NEMA frame size shall comply with the requirements specified in General Purpose-Type Motors, Section 5.15.2. 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).

5.15.1.2 Motors not enclosed, or partially enclosed, by the end product enclosure shall comply with the requirements specified in 5.15.2.

5.15.1.3 Component type motors completely enclosed within the end product enclosure shall comply with the requirements specified in General-Purpose Type Motors, Section 5.15.2 or Component Type Motors, Section 5.15.3.

5.15.1.4 Motors located in a low voltage circuit are evaluated for the risk of fire, electric shock, or injury to persons in accordance with the applicable requirements of this end product standard.

5.15.1.5 Low voltage component fans that comply with the Standard for Electric Fans, UL 507, are considered to comply with the requirements for Motors, Section 14.

5.15.2 General-purpose type motors

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

5.15.3 Component type motors

5.15.3.1 Component type motors shall comply with either 5.15.3.2 or 5.15.3.3.

5.15.3.2 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 UL 1090 requirements
Current and Horsepower Relation, Section 6	32.4
Cord-Connected Motors, Section 15	Section 10, Supply Connections
Factory Wiring Terminals and Leads, Section 17	Section 12, Internal Wiring
Electrical Insulation, Section 22	Section 14, Motors
Non-Metallic Functional Parts, Section 28	Section 6, Frame and Enclosure, Section 43, Polymeric Enclosures, Section 44, Polymeric Materials Classed Other Than HB, Section 45, Polymeric Materials Classed HB
Solid-State Controls, 7.2	5.2.6
Non-metallic enclosure thermal aging, 9.1.4	Section 5.18, Polymeric Materials
Motor enclosure, 9.2 – 9.4	Section 6, Frame and Enclosure
Grounding, Sections 10 and 11	Section 19, Grounding
Ventilation Openings, Section 12: only applicable where the openings are on surfaces considered to be the appliance enclosure.	Section 6, Frame and Enclosure
Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts, Section 13	Section 7, Accessibility of Uninsulated Live Parts and Film-Coated Wire
Protection Against Corrosion, Section 14	Section 9, Protection Against Corrosion
Available fault current ratings for motor start and running capacitors, Clause 26.6: not applicable for cord and plug connected appliances.	Section 17, Capacitors
Switch, Section 27 is not applicable to centrifugal starting switches	Section 39, Switches and Controls
With the exception of Sections 35 and 40 (Resilient Elastomer Mounting and Electrolytic Capacitor Tests, respectively), the performance tests in the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 are not applicable	All applicable performance tests
Only the following marking requirements specified in 43.1 of UL 1004-1 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	Section 50, Identification and Rating

5.15.3.3 The motor shall comply with the applicable component requirements for Components, Section 5, 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 9;
- b) Internal Wiring, Section 12;
- c) Electrical Insulation, Section 13;
- d) Motors, Section 14;
- e) Capacitors, Section 17;
- f) Spacings, Section 18; and

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- g) Grounding, Section 19.

5.16 Motor overload protection

5.16.1 Thermal protection devices integral with the motor shall comply with one of the following:

- a) The Standard for Overheating Protection for Motors, UL 2111;
- 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).

5.16.2 Impedance protection shall comply with one of the following:

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

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

5.16.4 Except as indicated in 5.16.3, electronically protected motor circuits shall comply with one of the following. See Motor and Speed Controls, 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;
- 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 the above standards is not required for an electronically protected motor circuit if there is no risk of fire, electric shock, or injury to persons 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 UL 248 Part 2 (e.g. the Standard for Low-Voltage Fuses – Part 5: Class G Fuses, UL 248-5). Defined-use fuses that comply with UL 248-1 and another applicable UL standard for fuses 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 the applicable Part 2 (e.g. the Standard for Fuse Holders – 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 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

5.18.1 Polymeric enclosure materials or a polymeric device which provides mechanical support or electrical insulation or separation whose deterioration would reduce spacings between uninsulated live parts or could result in a risk of fire, electric shock, or injury to persons shall comply with the following standards unless superseded by the requirements in this end product standard:

- a) The Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A;
- b) The Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and
- c) The Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

5.18.2 Polymeric materials molded or fabricated by a source other than the manufacturer, shall be identified according to the Standard for Polymeric Materials – Fabricated Parts, UL 746D.

5.19 Power supplies

5.19.1 A Class 2 power supply shall comply the Standard for Class 2 Power Units, UL 1310.

5.19.2 A non-Class 2 power supply shall comply with the Standard for Power Units Other Than Class 2, UL 1012.

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 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 of live parts requirements.

5.20.3 Unless otherwise specified, a printed-wiring board shall have a minimum flame classification of V-2.

Exception: A printed-wiring board located in a secondary circuit that complies with the requirements for Class 2 or limited voltage/current circuits have a minimum flame Class of HB.

5.21 Semiconductors and small electrical and electronic components

5.21.1 A power switching semiconductor device that is relied upon to provide isolation to ground shall comply with the Standard for Electrically Isolated Semiconductor Devices, UL 1557.

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 Optical Isolators, UL 1577.

5.21.3 Except as otherwise specified in this standard, component requirements are not specified for small electrical parts 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 Abnormal Operation Test, Section 35, in this standard, the circuit shall comply with one or both of the following standards. See Protective Controls (Limiting Controls), Section 20.4, for the test parameters to be used.

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

5.21.5 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 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) requirements in the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991.

5.21.7 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 Controls Using Software requirements in 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 comply with a performance requirement of this standard. In such cases, the insulation or device shall comply with the following applicable standards:

- 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; or
- c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

5.22.2 Wire positioning devices required to comply with the requirements of this end product standard shall comply with the Standard for Positioning Devices, UL 1565.

5.22.3 Insulating bushings shall comply with the Standard for Insulating Bushings, UL 635, and be suitable for the application with respect to the hole size and shape, maximum use temperature and wire size or type. To determine if the hole size and shape is suitable for the bushing, the applicable test(s) specified in this standard (e.g. Strain Relief Test, Section 37, Push-Back Relief Test, Section 38, Mold Stress Evaluation, 44.1) shall be conducted.

5.23 Switches

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

- a) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1;
- b) The Standard for General-Use Snap Switches, UL 20; or
- c) The Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 773A.

Exception: Switching devices that comply with the applicable UL standards 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 with this requirement.

5.23.2 Clock-operated switches, and time switches, including timers, 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, that functions as a protective control, shall comply with the requirements for a protective control. See 5.6.1.4.

5.24 Transformers

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

Exception: 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 complies with the intent of this requirement.

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

Exception: Transformers located in a low voltage circuit, and that do not involve a risk of fire, electric shock or injury to persons need not comply with this requirement.

5.25 Valves (electrically operated) and solenoids

5.25.1 Electrically operated valves shall comply with the:

- 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.

6 Frame and Enclosure

6.1 General

6.1.1 The frame and enclosure of a snow mover shall have the necessary strength and rigidity to resist the abuses likely to be encountered during routine service. The degree of resistance inherent in the snow mover shall preclude total or partial collapse with attendant reduction of spacings, loosening or displacement of parts, and other serious defects that alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

6.1.2 Among the factors taken into consideration when a frame or enclosure is evaluated are:

- a) Mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Combustibility and resistance to ignition from electrical sources;
- e) Resistance to corrosion;
- f) Resistance to distortion at temperatures to which the enclosure may be subjected under conditions of normal or abnormal use; and
- g) Dielectric properties, insulation resistance, and resistance to arc tracking.

A frame or enclosure that will be exposed to oil, acids, solvents, reagents, cleaning agents or ozone as part of the use or application of the snow mover shall not be adversely affected by these materials as determined by appropriate tests.