



UL 1018

STANDARD FOR SAFETY

Electric Aquarium Equipment

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UL Standard for Safety for Electric Aquarium Equipment, UL 1018

Sixth Edition, Dated April 29, 2011

Summary of Topics

This revision to UL 1018 dated September 17, 2020 includes the following:

Revision to Replace the References to the Standard For Power Conversion Equipment, UL 508C, With Reference to the Standard For Adjustable Speed Electric Power Drive Systems, UL 61800-5-1; [6.6.4.1](#)

Revision for Additional Receptacles Allowed Under Exception No. 2 to [10.1.9](#), [67.8](#) and [68.1.12](#).

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated May 4, 2020 and July 24, 2020.

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UL 1018

Standard for Electric Aquarium Equipment

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Sixth Edition

April 29, 2011

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

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INTRODUCTION

1 Scope

1.1 These requirements cover commercial and household electric equipment for use on or in aquariums in indoor locations at 300 volts or less, in accordance with the National Electrical Code, NFPA 70, such as heaters, pumps, filters, aerators, reflectors, hoods, electrically wired stands, and similar equipment.

1.2 These requirements do not cover:

a) Illuminators or stands not specifically intended for use with aquariums or

b) Aquarium tanks except when part of the tank acts as enclosure or water barrier for fittings, such as, but not limited to, filter, heating, or UV units that are integrated into the base or wall of the aquarium tank.

1.3 Aquarium equipment involving tungsten-halogen or high intensity discharge lamps shall comply with the additional applicable requirements specified in the Standard for Portable Electric Luminaires, UL 153.

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 mentioned in this standard are root-mean-square (rms).

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

4.4 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.

4.5 AQUARIUM APPLIANCE – An appliance falling within the scope of these requirements. Requirements that apply only to specific appliances are identified by reference in the text to such specific appliances.

4.6 AQUARIUM STAND – Equipment intended to support an aquarium. Such a stand may contain lamps for illumination, heater elements to control the temperature of the aquarium, and other aquarium-related appliances and devices.

4.7 AUTOMATICALLY CONTROLLED – An appliance is considered to be automatically controlled under any one or more of the following conditions:

- a) If the repeated starting of the appliance, beyond one complete, predetermined cycle of operation to the point where some form of limit switch opens the circuit, is independent of any manual control.
- b) If, during any single, predetermined cycle of operation, a motor is caused to stop and restart one or more times.
- c) If, upon energizing the appliance, the initial starting of a motor is likely to be intentionally delayed beyond conventional starting.
- d) If, during any single, predetermined cycle of operation, automatic changing of the mechanical load is likely to reduce the motor speed sufficiently to reestablish starting winding connections to the supply circuit.

4.8 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.

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

4.10 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.

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

4.12 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 potential hazard, is considered an operating control. Operating controls are also referred to as “regulating controls”.

4.13 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 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. Protective controls are also referred to as “limiting controls” and “safety controls.”

Note – During the evaluation of the protective control/circuit, the protective functions are verified under normal and single-fault conditions of the control.

4.14 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.

4.15 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.

4.16 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.

4.17 REMOTELY CONTROLLED – An appliance is considered remotely controlled if it is not within sight of the operator at the location of the starting switch or other device.

4.18 USER SERVICING – Any form of servicing of an appliance that may be performed by personnel other than those who have been trained to maintain the particular appliance. Examples include:

- a) Resetting or replacement of circuit breakers, fuses, and lamps that are accessible without the use of tools.
- b) Replacement of removable lamps with or without the use of tools.
- c) Routine operating adjustments necessary to adapt the appliance for different intended functions.
- d) Routine cleaning, and maintenance of components such as filters and diffusers.

4.19 UV EMITTER (UV LIGHT SOURCE) – Radiating source constructed to emit non-ionizing electromagnetic energy at wavelengths of 100 nm to 400 nm. They can be gas-discharge lamp, LED or other technologies.

4.20 UV RADIATION WATER TREATMENT APPLIANCE – Appliance that treats water using electromagnetic energy at wavelengths in the ultraviolet band using UV EMITTER, such as UV Water Filter.

CONSTRUCTION

5 Frame and Enclosure

5.1 General

5.1.1 An appliance shall be formed and assembled so that it shall have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected. There shall be no likelihood 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.

5.1.2 The enclosure of an appliance, other than a reflector, shall be such that water will not contact live parts when the appliance is subjected to the Resistance to Overflow Test, Section [59](#), to simulate conditions that might occur during routine use. All accessories required for operation shall remain in place during the test. The Leakage Current Test, Section [38](#), shall be used to determine whether water has contacted any live part.

5.2 Thickness of metal

5.2.1 For unreinforced, flat surfaces in general, cast metal shall not be less than 1/8 inch (3.2 mm) thick. Malleable iron shall not be less than 3/32 inch (2.4 mm) thick. Die cast metal shall not be less than 5/64 inch (2 mm) thick if the surface is curved, ribbed, or otherwise reinforced, or if the shape or size (or both) of the surface is such that equivalent mechanical strength is provided.

5.2.2 An enclosure of sheet metal other than a hood or reflector shall be evaluated with regard to the size, shape, and thickness of the metal. Consideration shall be given to the intended use of the complete appliance. The use of sheet steel having a thickness of less than 0.026 inch (0.66 mm) if uncoated, or

0.029 inch (0.74 mm) if galvanized, or of nonferrous metal having a thickness of less than 0.036 inch (0.91 mm) is not recommended.

Exception: It is acceptable for a relatively small area or surface that is curved or otherwise reinforced to be less than the specified thickness. A form of construction that uses metal thinner than specified may be used if found to provide equivalent physical strength and protection.

5.2.3 The thickness of sheet metal in an aquarium hood or reflector shall not be less than indicated in [Table 5.1](#).

5.2.4 The maximum dimension specified in [Table 5.1](#) is considered to be:

- a) The diameter of a circular appliance,
- b) The longest diameter of an elliptical appliance,
- c) The longest side of a triangular appliance,
- d) The diagonal of a rectangular appliance, or
- e) The longest diagonal of a multisided appliance.

Table 5.1
Minimum sheet metal thicknesses for aquarium reflectors

Type of metal	Where used	Minimum acceptable thickness when maximum dimension ^a is:			
		36 inches (914 mm) or less,		More than 36 inches (914 mm),	
		inch	(mm)	inch	(mm)
Stainless steel	At lampholders	0.015	0.38	0.018	0.46
	Elsewhere in reflectors	0.013	0.33	0.018	0.46
Plated steel	At lampholders	0.015	0.38	0.018	0.46
	Elsewhere in reflectors	0.015	0.38	0.018	0.46
Aluminum, brass, or copper	At lampholders	0.025	0.64	0.032	0.81
	Elsewhere in reflectors	0.020	0.51	0.025	0.64

^a In accordance with [5.2.4](#).

5.2.5 [Table 5.1](#) applies to any single surface or single flat sheet. A rigid member consisting of 1/2 by 1/2 inch (12.7 by 12.7 mm) 90 degree angle strips formed of sheet steel not less than 0.032 inch (0.81 mm) thick, or flat steel bars not less than 3/8 inch (9.5 mm) wide and 1/8 inch (3.2 mm) thick can be used to reinforce and divide a large area into sections for which lighter metal may be used. Such reinforcement, unless along the longer dimension of the surface, shall be secured to the adjacent sides of the enclosure. A single piece of sheet metal that is corner bent to form an angle of not more than 120 degrees is considered to be reinforced along the bend, and its thickness may be based on the length of the largest flat surface involved.

5.2.6 The thickness of metal is not specified for a purely ornamental part or for a reflector part not relied upon to enclose wiring or support a live part. A part relied upon to reduce the risk of a reflector falling into an aquarium tank is not considered ornamental.

5.2.7 There is no minimum thickness specified for a reflective strip utilized as a heat sink for a reflector; however, the means of adhesion of the strip to the frame shall be investigated as described in [60.1](#) – [60.3](#).

5.3 Barriers

5.3.1 The enclosure of a remotely or automatically controlled appliance, or one intended to operate unattended, shall reduce the risk of molten metal, burning insulation, flaming particles, and the like falling on combustible surfaces or materials, including the surface upon which the appliance is supported.

5.3.2 The requirement in [5.3.1](#) necessitates the use of a barrier of combustion-resistant material:

a) Under a motor unless one of the following items applies:

1) The structural parts of the motor or of the appliance provide what is determined to be the equivalent of such a barrier.

2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the appliance when the motor is energized under each of the following fault conditions:

i) Main winding opened,

ii) Starting winding opened,

iii) Starting switch short circuited, and

iv) For a permanent split capacitor motor the capacitor short circuited. (The short circuit is to be applied before the motor is energized, and the rotor is to be locked.)

3) The motor is provided with a thermal motor protector (a protective device that is sensitive to temperature and current). It shall prevent the temperature of the motor windings from becoming more than 125°C (257°F) under the maximum load conditions under which the motor will run without causing the protector to cycle. It shall also prevent the motor windings from becoming more than 150°C (302°F) with the rotor of the motor locked.

4) The motor complies with the requirements for impedance-protected motors in the Standard for Overheating Protection for Motors, UL 2111.

b) Under wiring, unless it is of the flame retardant type. Neoprene or thermoplastic insulated wires are considered to be flame retardant types.

5.3.3 The requirement in [5.3.1](#) will also necessitate that a switch, relay, solenoid, or similar device be individually and completely enclosed unless it can be shown that:

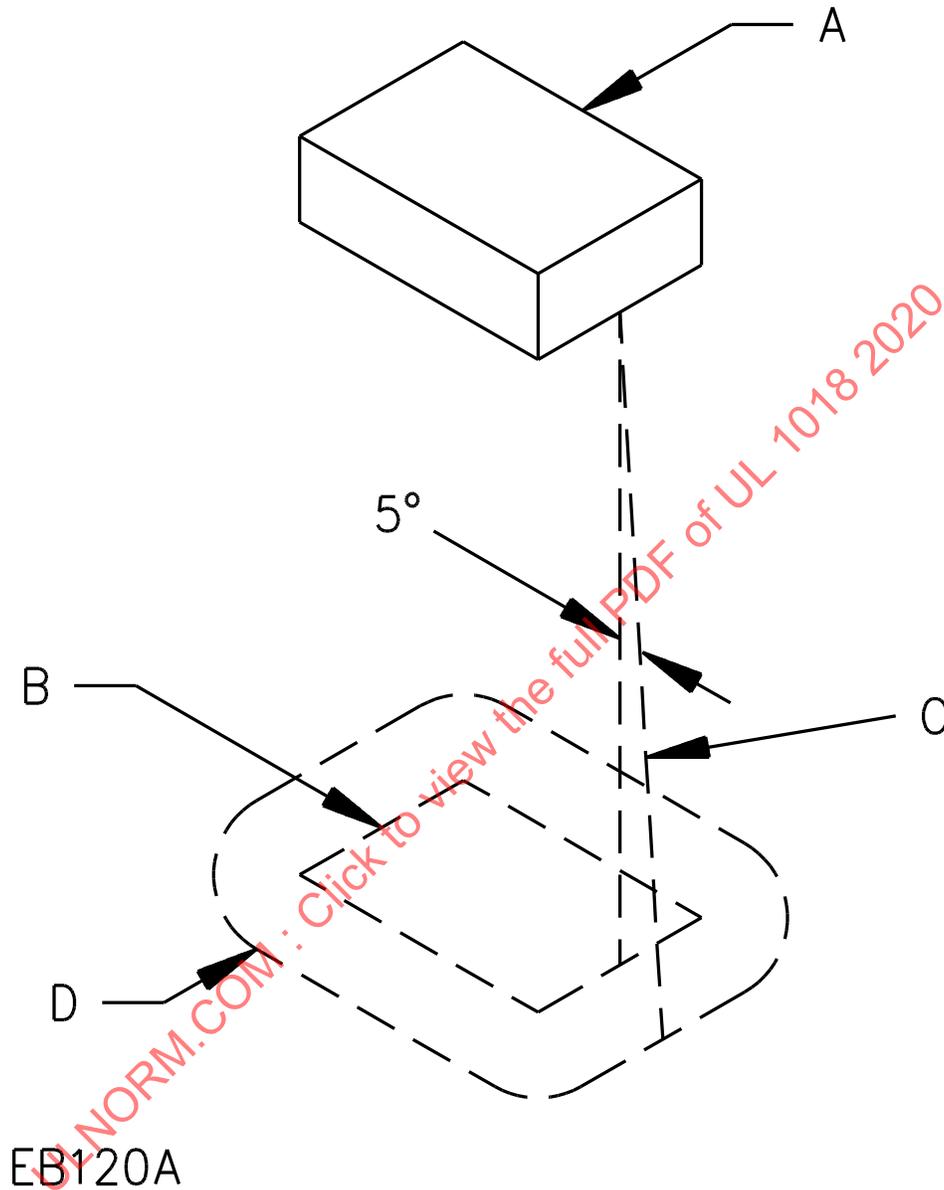
a) Failure of the component would not result in a risk of fire, electric shock, or other injury to persons or

b) There are no openings in the bottom of the appliance overall enclosure.

Exception: A terminal of a switch, relay, solenoid, or a similar device may protrude from such an individual enclosure.

5.3.4 The barrier mentioned in [5.3.2](#) shall be horizontal, shall be located as indicated in [Figure 5.1](#), and shall have an area not less than that shown in the figure. Openings for drainage, ventilation, and similar needs may be provided in the barrier if they do not permit molten metal, burning insulation, or like materials to fall on combustible material.

Figure 5.1
Location and extent of barrier



EB120A

A – Region to be shielded by barrier. This consists of the entire component if it is not otherwise shielded and consists of the unshielded portion of a component which is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line which traces out minimum area of barrier. When moving, the line is always:

- a) Tangent to the component,
- b) 5 degrees from the vertical, and
- c) Oriented so that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

5.4 Polymeric material

5.4.1 A polymeric enclosure material shall be investigated in accordance with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. The ball impact value referred to in UL 746C shall be 5 foot-pounds force (6.78 J) in all cases.

5.4.2 A polymeric material used for parts other than the enclosure in aquarium equipment shall be evaluated in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

5.4.3 Among the factors that shall be taken into consideration when judging the acceptability of magnesium and nonmetallic material are resistance to:

- a) Mechanical damage,
- b) Impact,
- c) Moisture absorption,
- d) Combustion,
- e) Distortion at temperatures to which the material may be subjected under conditions of normal or abnormal use, and
- f) Aging, where the material may be exposed to ultraviolet light (from an ultraviolet lamp bulb, for example), or other similar exposure.

5.4.4 A polymeric appliance material enclosing uninsulated live parts or live parts having insulation less than 0.028 inch (0.71 mm) thick or equivalent, shall comply with the Polymeric Enclosure Tests (mold stress, impact, strain relief, etc.) detailed in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C and shall have a flammability class determined in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94 as follows:

- a) Class 5VA for fixed or stationary appliances or for an appliance that is permanently installed.

Exception: In lieu of the required 5VA flame rating for stationary or permanently installed appliances, the polymeric enclosure may be subjected to the 127 mm end-product flame test in accordance with UL 746C.

- b) Class V-2 minimum for all other aquarium appliances.

Exception No. 1: In lieu of the required V2 flame rating for all other aquarium appliances, the polymeric enclosure may be subjected to the 12 mm or 20 mm end-product flame test in accordance with UL 746C.

Exception No. 2: In lieu of the required V2 flame rating for household aquarium appliances, the polymeric enclosure may be comprised of HB rated materials if the household aquarium equipment is found to comply with the requirements for UL 746C, Portable Unattended Household Equipment - Alternate Path. The appliance shall be marked to indicate it is suitable for household use only.

5.4.5 The polymeric housing of a component is not considered to be an appliance enclosure unless this part is the sole insulation (excluding air) between a live part and an external surface of the appliance.

6 Component Specifications

6.1 General

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

- a) Comply with the requirements for that component as indicated in [6.2](#) – [6.25](#);
- 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. Fluorescent lamps are exempt.

Note – 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.

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; or*
- 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 complying with a UL component standard other than those cited in [6.2](#) – [6.25](#) is acceptable if:

- a) *The component also complies with the applicable component standard of [6.2](#) – [6.25](#); or*
- b) *The component standard:*
 - 1) *Is compatible with the ampacity and overcurrent protection requirements of the National Electrical Code, ANSI/NFPA 70, where appropriate;*
 - 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 standard is 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.*

6.1.2 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 component standard(s) need not be applied.

6.1.3 A component not anticipated by the requirements of this standard, not specifically covered by the component standards of [6.2](#) – [6.25](#), and that involves a potential risk of electric shock, fire, or personal injury, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with [6.1.1](#) (b) – (d).

6.1.4 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 this Standard.

6.2 Attachment plugs, receptacles, connectors, and terminals

6.2.1 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 [6.2.9](#).

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

Exception No. 2: A fabricated pin terminal assembly(ies) need not comply with UL 498 if it complies with Current-Carrying Parts, Section [16](#), Insulating Material, Section [18](#), and Spacings, Section [22](#).

6.2.2 Quick-connect terminals, both connectors and tabs, for use with one or two 22 – 10 AWG copper conductors, having nominal widths of 0.110, 0.125, 0.187, 0.205, and 0.250 inch (2.8, 3.2, 4.8, 5.2, and 6.3 mm), 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 UL 310.

6.2.3 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 [6.2.9](#).

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

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

6.2.6 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 [6.2.9](#).

6.2.7 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.

6.2.8 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 Wiring terminals and leads, [10.3.3](#), Current-Carrying Parts,

Section [16](#), *Insulating Material*, Section [18](#), and *Spacings*, Section [22](#). This exception does not apply to protective conductor terminal blocks.

6.2.9 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.

6.3 Batteries and battery chargers

6.3.1 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.

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

6.3.3 Rechargeable nickel metal-hydride (Ni-MH) battery cells and packs shall comply with 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.

6.3.4 Primary batteries (non-rechargeable) that comply with the relevant UL Standard and Component Specifications, General, [6.1](#), are considered to fulfill the requirements of this Standard.

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

a) Standard for Class 2 Power Units, UL 1310 or

b) Standard for Information Technology Equipment – Safety – 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".

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

a) Standard for Power Units Other Than Class 2, UL 1012 or

b) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1.

6.4 Boxes and raceways

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

6.5 Capacitors and filters

6.5.1 The component requirements for a capacitor are not specified. A capacitor complying with the Standard for Capacitors, UL 810, is considered to fulfill the requirements of [29.1](#).