UL 1081

STANDARD FOR SAFETY

Swimming Pool Pumps, Filters, and Chlorinators

UL Standard for Safety for Swimming Pool Pumps, Filters, and Chlorinators, UL 1081

Seventh Edition, Dated August 9, 2016

Summary of Topics

This revision of ANSI/UL 1081 dated July 23, 2020 includes the following:

Addition of reference to UL 61800-5-1 as a replacement to UL 508C; 27.2.3.3, 29.11

Addition of reference to UL 62368-1 as an alternative to UL 60950-1; 68.5

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 revised requirements are substantially in accordance with Proposal(s) on this subject dated April 10, 2020.

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The most recent designation of ANSI/UL 1081 as an American National Standard (ANSI) occurred on July 2, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 apply to electric motor-operated water pumps of the nonsubmersible type, pump-filter combinations, and chlorinators for use with swimming pools, hot tubs, and spas, to be used in accordance with the National Electrical Code, NFPA 70. The pump is secured directly to the motor or the pump and motor are factory secured to a common frame.

1.2 These requirements also cover electric pool cleaners for use in swimming pools.

1.3 Swimming pool pumps, pump-filter combinations, and chlorinators covered by these requirements may be permanently connected or cord- and plug-connected to the electrical supply. Permanently-connected units may be covered for indoor use only or for indoor and outdoor use. Cord- and plug-connected units are evaluated under requirements for outdoor use, but may also be used indoors. Swimming pool pumps intended for use with storable pools are provided with a minimum 25-foot (7.6-m) nondetachable power supply cord, are double insulated, have no accessible grounded metal, and have inaccessible dead metal connected to the grounding conductor of the cord. Pumps intended for permanent use may be permanently wired or provided with a maximum 3-foot (0.91-m) nondetachable power supply cord and, in addition, are provided with an accessible wire connector for bonding to all metal parts of the pool, hot tub, or spa structure and to all electrical equipment conduit and piping within 5 feet (1.5 m) of the inside wall of the pool, hot tub, or spa. Hot tub and spa pumps covered by these requirements are not intended for use within an outer enclosure or beneath the skirt of a hot tub or spa, unless so marked.

1.4 Chlorinators covered by these requirements may consist of assemblies such as:

a) A chlorinator and a clock-operated valve for use with a water circulating system;

b) A water circulating pump with additional chlorine injection; or

c) An electrolytic-type chlorinating equipment.

1.5 These requirements do not cover:

a) Pumping equipment for fire service or other products that are covered by individual requirements elsewhere;

b) A pump rated at more than 600 volts;

c) A pump involving a universal motor rated at more than 250 volts: or

d) A sump pump, fountain pump, and aquarium pump, or other products for which individual requirements exist.

2 Units of Measurement

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

2.2 Unless indicated otherwise, 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 BASIC INSULATION (formerly FUNCTIONAL INSULATION) – The insulation applied to live parts to provide basic protection against electric shock. Basic insulation does not necessarily include insulation used exclusively for functional purposes.

4.3 CORD- AND PLUG-CONNECTED UNIT – A unit provided with flexible cord and an attachment plug for connection to the supply source.

4.4 DOUBLE INSULATION – An insulation system comprised of basic insulation and supplementary insulation, with the two insulations physically separated and arranged so that they are not simultaneously subjected to the same deteriorating influences (temperature, contaminants, or the like) to the same degree.

4.5 INDOOR UNIT – A unit investigated for use only where protected from the weather.

4.6 LINE VOLTAGE CIRCUIT – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit or limited-energy circuit.

4.7 OUTDOOR UNIT – A unit that has been investigated and determined to be acceptable for use where exposed to weather.

4.8 PERMANENTLY-CONNECTED UNIT – A unit that is intended for connection to one of the applicable permanent wiring systems in accordance with the National Electrical Code, ANSI/NFPA 70.

4.9 PERMANENTLY-INSTALLED POOL – A pool constructed wholly or partially in the ground, any pool capable of holding water in a depth greater than 42 inches (1.07 m), or any pool installed inside of a building (regardless of water depth), whether or not served by electrical circuits of any nature.

4.10 PERMANENTLY-INSTALLED UNIT – A unit intended to be fastened or secured in position or permanently connected to a water circulating system.

4.11 SAFETY CRITICAL FUNCTION – Control, protection and monitoring functions which are being relied upon to reduce the risk of fire, electric shock or casualty hazards.

4.12 STORABLE POOL – A pool constructed on or above the ground, capable of holding water to a maximum depth of 42 inches (1.07 m), and constructed so that it may be readily disassembled for storage and reassembled to its original integrity, or a pool with nonmetallic, molded polymeric walls or inflatable fabric walls, regardless of dimensions.

4.13 STORABLE POOL PUMP – A unit intended for use immediately adjacent to storable pools, and may or may not be incorporated in a filter combination.

4.14 SUPPLEMENTARY (PROTECTING) INSULATION – An independent insulation provided in addition to the basic insulation to reduce the risk of electric shock in case of mechanical rupture or

dielectric breakdown of the basic insulation. An enclosure of insulating material may form a part or the whole of the supplementary insulation.

4.15 UNIT – A pump, a pump-filter combination, or a chlorinator.

5 Safety Critical Functions

5.1 Any function involved in the control, protection, and monitoring of safety-related attributes of a pump whereby a loss/malfunction of its functionality would represent an unacceptable risk of fire, electric shock, or casualty hazards would be considered a Safety Critical Function.

5.2 Electronic circuits that manage a Safety Critical Function shall be:

a) Reliable as defined as being able to maintain the Safety Critical Function in the event of single defined component faults and

b) Not susceptible to electromagnetic environmental stresses encountered in the anticipated environments of the appliance.

5.3 Electronic circuits managing Safety Critical Functions shall comply with:

a) Supplement SA; or

b) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 1: General Requirements, UL 60730-1 and its Part 2s as specified in this standard. The function shall be considered Class B. When utilizing UL 60730-1, surge protective devices are defeated for the EMC immunity testing unless they are provided with spark gaps (gas tube surge suppressors).

5.4 Functions specified in Table 5.1 represent the common safety critical circuit functions of pumps. It is not intended to represent all possible Safety Critical Functions.

Table 5.1
Safety Critical Functions

Function (see 5.1)	Hazard	Location of parameters and tests
Motor running overload protection	Risk of fire or electric shock	27.2
Motor locked rotor protection	Risk of fire or electric shock	27.2
Motor short circuit protection	Risk of fire or electric shock	27.2

CONSTRUCTION

6 Component Specifications

6.1 General

6.1.1 Except as indicated in 6.1.2, a component of a product covered by this standard shall comply with the requirements for that component as indicated in this Section.

6.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard,

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

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

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

6.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

6.1.5 Components shall be suitable for the intended use and installation environment. This suitability shall assume the following installation parameters.

a) Outdoor, Pollution Degree III installations

b) Overvoltage Category II as specified in the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840.

6.1.6 Components not anticipated by the requirements of this Standard, not specifically covered by a component standard of Sections 6.2 – 6.5, and which pose a potential risk of electric shock, fire or casualty hazard shall be additionally investigated. Reference to other product standards is appropriate where those standards anticipate normal and abnormal use conditions consistent with the application of this Standard.

6.2 Printed wiring boards

6.2.1 Printed wiring boards shall comply with the Standard for Printed-Wiring Boards, UL 796. A printed wiring board shall have a temperature rating corresponding to the maximum temperature on the board during the Temperature Test of UL 1081. Unless wholly in a Class 2 circuit, it shall comply with the direct support of live parts requirements in UL 796.

6.3 Quick-connect wire connectors

6.3.1 Quick-connect type wire connectors shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated, they shall be rated for the voltage and temperature of the intended use. They shall be applied per the installation instructions of the wire connector manufacturer.

6.3.2 Quick-connect type wire connectors shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310.

6.4 Terminal blocks

6.4.1 Terminal blocks shall comply with:

a) The Standard for Terminal Blocks, UL 1059, or

b) The Standard for Low-Voltage Switchgear And Controlgear – Part 7-1: Ancillary Equipment – Terminal Blocks for Copper Conductors, UL 60947-7-1, or

c) The Standard for Low-Voltage Switchgear and Controlgear – Part 7-2: Ancillary Equipment – Protective Conductor Terminal Blocks for Copper Conductors, UL 60947-7-2, or

d) The Standard for Low-Voltage Switchgear and Controlgear – Part 7-3: Ancillary Equipment – Safety Requirements for Fuse Terminal Blocks, UL 60947-7-3.

6.4.2 The UL 60947-7-x Standards are used in conjunction with the Standard for Low-Voltage Switchgear and Controlgear – Part 1: General Rules, UL 60947-1.

6.4.3 Terminal blocks shall be suitable for the number of conductors per termination, wire size, type (solid or stranded), conductor material (copper or aluminum), voltage and current of the intended use.

6.5 Wire connectors

6.5.1 Wire connectors shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated they shall be suitable for the voltage and current of the intended use. They shall be applied per the installation instructions of the wire connector manufacturer.

6.5.2 Wire connectors shall comply with the Standard for Wire Connectors, UL 486A-486B, or the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

6.6 Button or coin cell batteries of lithium technologies

Relocated to Clause 25.3.

7 Frame and Enclosure

7.1 An appliance shall be provided with an enclosure housing all electrical parts that present a risk of fire, electric shock, or injury to persons under all conditions of use.

7.2 The frame and enclosure of an appliance shall possess the strength and rigidity to resist the abuses to be encountered during service. The degree of resistance inherent in the unit shall preclude total or partial collapse with the 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.

7.3 The enclosure of a unit for outdoor use, when of sheet metal, shall have a thickness of not less than 0.032 inch (0.81 mm) when uncoated or of not less than 0.034 inch (0.86 mm) when galvanized.

7.4 An enclosure of sheet metal, other than that covered in 7.3, is evaluated with regard to its size, shape, and thickness, considering the intended use of the complete unit. Sheet steel shall have a thickness of not less than 0.026 inch (0.66 mm) when uncoated, or 0.029 inch (0.74 mm) when galvanized. Nonferrous sheet metal shall have a thickness of not less than 0.036 inch (0.91 mm).

Exception: Relatively small areas or surfaces that are curved or otherwise reinforced are not prohibited from being thinner than specified.

7.5 An enclosure of cast metal shall not be less than 1/8 inch (3.2 mm) thick at every point, more than 1/8 inch thick at reinforcing ribs and door edges, and not less than 1/4 inch (6.4 mm) thick at tapped holes for conduit.

Exception: Other than at holes for conduit, die-cast metal shall not be less than:

a) 3/32 inch (2.4 mm) thick for an area larger than 24 square inches (155 cm^2) or having any dimension larger than 6 inches (152 mm) or

b) 1/16 inch (1.6 mm) thick for an area of 24 square inches or less and having no dimension larger than 6 inches. This area limitation is capable of being obtained by the provision of reinforcing ribs subdividing a larger area.

7.6 An enclosure of polymeric material shall be investigated with regard to operating temperatures, stress-relief distortion, impact resistance, resistance to abnormal conditions, and flame resistance, both in the original formed condition and after aging in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. Such enclosures for outdoor equipment shall also be investigated with regard to resistance to ultraviolet light and water in accordance with the Resistance to Ultraviolet Light and Water Test, Section 41.

7.7 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.

7.8 An enclosure shall be constructed to restrict water from reducing the effectiveness of the electrical insulation due to breakdown of water connections or shaft seals, flooding onto a mounting surface or within the enclosure, or breakdown of a boot, diaphragm, shaft seal, or similar part, as determined in 40.2.1 – 40.4.2.

7.9 An enclosure of an outdoor unit containing an electrical component, other than for a motor having a sealed housing, shall have provision for drainage if there is a knockout or unthreaded opening in the enclosure or if there is likelihood of the accumulation of condensation.

7.10 The enclosure of a storable pool pump shall be such that the lowest portion of any live part is at least 4 inches (101.6 mm) above the supporting surface. When a separate base is to be used in the field to provide the minimum 4-inch height, the portable unit shall be marked in accordance with 53.17 and provided with installation instructions as specified in 55.4.

Exception: Units complying with the requirements for submersible pumps as specified in the Standard for Motor-Operated Water Pumps, UL 778. Testing shall include, but not be limited to, 30-Day Submersion (under 4 inches of water).

7.11 A unit intended for permanent installation shall be provided with means for mounting or support. Fittings required for intended mounting, such as brackets, hangers, or the like, shall be furnished with the unit.

7.12 The enclosure shall restrict molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including the surface upon which the unit is supported.

Exception: A permanently-installed unit not intended for mounting on a combustible surface is not prohibited from having an open bottom when it is marked in accordance with 53.6.

7.13 The requirement in 7.12 requires that a switch, transformer, relay, solenoid, or similar part be individually and completely enclosed other than at terminals unless it can be shown that malfunction of the component does not result in a risk of fire, or unless there are no openings in the bottom of the enclosure. There shall be no opening in the bottom of the enclosure located directly below field- or factory-made splices or overcurrent protective devices. The requirement in 7.12 also requires the use of a barrier of combustion-resistant material under:

a) A motor, unless:

1) The structural parts of the motor or of the overall unit provide 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 unit when the motor is energized under each of the following four fault conditions, applied separately:

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 locked); or

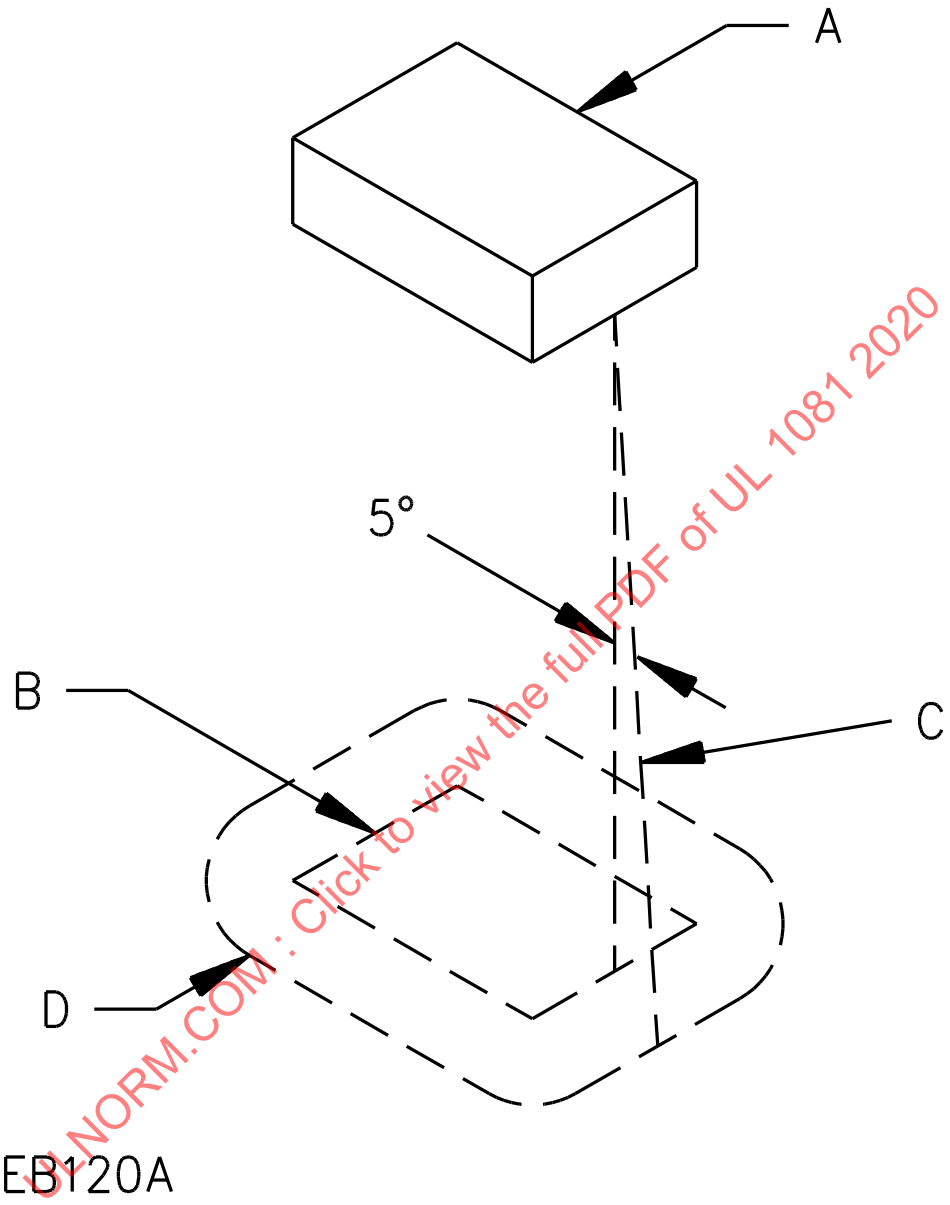
3) The motor is provided with a thermal motor protector (a protective device that is sensitive to both temperature and current) that limits the temperature of the motor windings to not more than 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle, and from becoming more than 150°C (302°F) with the rotor of the motor locked.

b) Wiring, unless it is of the flame-retardant type. Neoprene- or PVC-, TFE-, PTFE-, FEP-insulated wires and wires bearing the surface marking "VW-1" are considered to be of this type.

7.14 The barrier specified in 7.13 shall be horizontal, located as indicated in Figure 7.1, and possess an area not less than that described in the figure. Openings for drainage and ventilation are not prohibited from being used in the barrier, when such openings prevent molten metal, burning insulation, or the like from falling on combustible material.

Figure 7.1

Location and extent of barrier



A – Region to be shielded by barrier. This consists of the entire component (unless otherwise shielded) and of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. When moving, the line is always tangent to the component, 5 degrees from the vertical, and 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.