UL 1241

STANDARD FOR SAFETY

Junction Boxes for Swimming Pool Luminaires

UL Standard for Safety for Junction Boxes for Swimming Pool Luminaires, UL 1241

Seventh Edition, Dated June 11, 2003

Summary of Topics

This revision of ANSI/UL 1241 dated April 12, 2022 includes the following:

– Grounding Terminations; 10.1 – 10.7, 19.5, 19.7

– Impact Test Low Temperature Conditioning; 18.5.4

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 January 21, 2022.

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UL 1241

Standard for Junction Boxes for Swimming Pool Luminaires

Prior to the first edition, junction boxes for swimming pool luminaires were investigated using the first edition of the Standard for Underwater Lighting Fixtures and Junction Boxes for Swimming Pools, UL 676.
The First through Sixth Editions of this standard were titled Junction Boxes for Swimming Pool Lighting Fixtures.

First Edition – April, 1976
Second Edition – November, 1978
Third Edition – January, 1985
Fourth Edition – June, 1989
Fifth Edition – June, 1994
Sixth Edition – October, 1998

Seventh Edition

June 11, 2003

This ANSI/UL Standard for Safety consists of the Seventh Edition including revisions through April 12, 2022.

The most recent designation of ANSI/UL 1241 as an American National Standard (ANSI) occurred on April 12, 2022. 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 cover junction boxes for use with swimming pool luminaires intended for installation and use in accordance with the National Electrical Code, NFPA 70.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix for a list of standards covering components generally used in the products covered by this standard.

2.1.2 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, or

b) Is superseded by a requirement in this standard.

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

2.1.4 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.

2.2 Units of measurement

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

2.3 Undated references

2.3.1 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.

3 Glossary

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

3.2 CONDUIT HUB – A female threaded connector that is integral with the box material for connection of threaded rigid conduit.

3.3 JUNCTION BOX – Any junction box for use with swimming pool luminaires that is covered by this standard.

CONSTRUCTION

4 General

4.1 The construction of a junction box and its cover shall have the strength and rigidity required to resist the abuses to which it will be subjected without increasing any risk of fire, electric shock, or injury to persons due to total or partial collapse with the attendant reduction in spacings, loosening or displacement of parts, or other defects.

4.2 A part that the conductors are capable of contacting in the box shall be free from sharp or rough edges and surfaces that are capable of causing abrasion.

4.3 A box, its cover, and any assembly hardware shall be packaged together as a single unit.

5 Materials and Thicknesses

5.1 General

5.1.1 A box and its cover shall be:

a) Of copper, brass, or other metal inherently resistant to corrosion or

b) Of a polymeric material evaluated for use as an enclosure or cover.

Zinc-base die-cast metal, sheet steel, cast iron, and sheet or cast aluminum are not to be used.

5.1.2 A cast-metal box or cover shall have a wall thickness not less than 3.2 mm (1/8 inch).

Exception: A permanent mold-cast box or cover may have a wall thickness of not less than 2.4 mm (3/32 inch).

5.2 Polymeric material

5.2.1 A polymeric material is not prohibited from being used when, after considering its:

a) Mechanical strength and rigidity;

b) Resistance to impact;

c) Moisture-absorptive properties;

d) Combustibility;

e) Resistance to temperatures and atmospheric conditions likely to be encountered under all conditions of use;

f) Resistance to arcing, sunlight, and hot-wire ignition; and

g) Aging characteristics,

it is able to withstand the temperature and use to which it will be subjected.

5.2.2 When investigating the long-term aging characteristics of a polymeric material as specified in 5.2.1, the relative thermal index shall be at least:

a) 80°C (176°F) for electrical properties and for mechanical properties without impact and

b) 75°C (167°F) for electrical properties and for mechanical properties with impact.

5.2.3 The relative thermal index specified in 5.2.2 shall be determined by the long term thermal aging programs described in the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B.

Exception No. 1: The materials specified in Table 5.1 are not prohibited from being used without conducting a test to determine the relative thermal index.

Exception No. 2: A material that has been previously investigated and determined to be applicable is not required to be tested to determine the relative thermal index.

Table 5.1
Relative thermal indices based upon past field test performance and chemical structure

Material	Generic thermal index, °C
Polyamide (Type 6, 11, 12, 66, 610, or 612 nylon)[a]	65
Polycarbonate[a]	75
Polybutylene (polytetramethylene) terephthalate	75
Polypropylene[a]	65
Molded phenolic compounds[b]	150
Molded melamine[b,c]	
specific gravity < 1.55	130
specific gravity ≥ 1.55	150
Molded melamine/phenolic compounds[b,c]	
specific gravity < 1.55	130
specific gravity ≥ 1.55	150
Molded urea[b]	100
Acrylonitrile – butadine – styrene	60
Silicone – molding resin[b,c]	150
Epoxy – molding resin[b,c]	130
Molded diallyl phthalate[b,c]	130
Molded unsaturated polyester[b,c]	
alkyd molding compounds (AMC),	
specific gravity ≥ 1.75	130
Bulk or dough molding compounds (BMC or DMC)	130 (105 electrical)
Cold molded phenolic, melamine, or melamine-phenolic compounds[c]	
specific gravity < 1.55	130
specific gravity ≥ 1.55	150

NOTE – Generic thermal index is for homopolymer resins only unless a specific co-polymer or blend is listed. In the case of alloys, the lowest generic index of any component shall be assigned to the composite.

[a] Includes glass fiber reinforcement and talc, mineral, calcium carbonate, and other inorganic fillers.

[b] Includes only compounds molded by high temperature and high pressure processes, such as injection, compression, transfer molding, and match metal die molding; excludes compounds molded by open mold or low pressure molding processes, such as hand lay-up, spray-on, contact bag, filament winding, rotational molding, and powder coating (fluidized bed, electrostatic spray, hot dip, or flow coating).

[c] Includes materials having filler systems of fibrous (other than synthetic organic) types but excludes fiber reinforcement systems using resins that are applied in liquid form. Synthetic organic fillers may be used at temperatures not greater than 105°C.

5.2.4 Sockets shall comply with the socket requirements in the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C.

6 Gaskets

6.1 A gasket provided between a box and its cover shall be formed of resilient material that has been determined to be resistant to deterioration caused by aging.

6.2 A gasket of neoprene, rubber, neoprene composition, or rubber composition shall comply with 15.1.

6.3 Other gasket material determined to have equivalent strength and resistance to aging is not prohibited from being used. Such a material, after investigation, shall show no visible evidence of deterioration such as softening, hardening, or cracking after flexing.

7 Connections for Wiring

7.1 A hole for the connection of conduit shall be threaded. When the threads are tapped all the way through a hole in an enclosure wall, there shall be at least 3-1/2 threads and not more than five threads in the metal, and the construction shall be such that a conduit bushing can be securely attached. When the threads are not tapped all the way through a hole in an enclosure wall, conduit hub, or the like, there shall not be less than five full threads in the metal, and a smooth, well-rounded inlet hole for the conductors shall be provided to afford protection to the conductors equivalent to that provided by a standard conduit bushing. The hole shall have a throat diameter as specified in Table 7.1.

Exception: The throat diameter is not prohibited from being reduced from the values shown in Table 7.1 when a strain-relief bushing is provided directly above the threaded hub and the bushing is held in place by a compression member that supplies the necessary force to the bushing to provide the required strain relief.

Table 7.1
Conduit and hub dimensional requirements

Trade size of conduit, inches	Actual throat diameter[a]				Hub wall thickness[b] (before threading),		Total diameter of flat area for field-drilled holes,[c]	
	Minimum,		Maximum,					
	mm	(inches)	mm	(inches)	mm	(inch)	mm	(inches)
1/2	14.2	0.560	15.8	0.622	2.77	0.109	28.97	1.14
3/4	18.9	0.742	20.9	0.824	2.87	0.113	36.12	1.42
1	24.0	0.944	26.6	1.049	3.38	0.133	45.24	1.78
1-1/4	31.6	1.242	35.1	1.380	3.56	0.140	57.94	2.28

[a] See 7.1 for requirements for throat diameter.

[b] See 7.2 for requirements for a conduit hub.

[c] See 7.5 for requirements for a hole for the connection of conduit that is to be drilled and tapped in the field.

7.2 A conduit hub shall be threaded and have a wall thickness before threading not less than that specified in Table 7.1 for the corresponding trade size of conduit.

7.3 A conduit hub that is not integrally cast with its enclosure shall not depend upon friction alone to prevent its turning and shall be capable of withstanding the torque specified in 16.1 applied to a short length of rigid metal conduit threaded into the hub in the intended manner without turning and without stripping any thread.

7.4 The joint between a conduit hub and an enclosure shall show a maximum voltage drop of 10 millivolts when tested in accordance with 17.1.

7.5 When a hole for the connection of conduit is to be drilled and tapped in the field, a flat area not less than the appropriate size shown in Table 7.1 shall be provided and the thickness of the box wall where the drilling is contemplated shall not be less than 6.75 mm (17/64 inch). Instructions as described in 20.1(b) shall be included with the part or parts to be field-drilled.

8 Plugs

8.1 Each opening in excess of two for the connection of conduit shall be closed by a plug.

8.2 A plug shall have a minimum of 3-1/2 threads and shall be of a material as indicated in 5.1.1.

9 Wiring Terminals and Connectors

9.1 Terminals and connectors shall comply with the applicable requirements for the component in:

a) The Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors, UL 486A; or

b) The Standard for Wire Connectors for Use with Aluminum Conductors, UL 486B; or

c) The Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

Exception No. 1: Terminals and connectors used only with grounding and bonding conductors are required to comply with the secureness test, the pullout test, and all applicable construction requirements in the applicable terminal or connector standard. The 10-day moist ammonia-air stress cracking test in the applicable terminal or connector standard is required when a part of the grounding and bonding conductor terminal or connector has a zinc content of more than 15 percent. Terminals and connectors used only with grounding and bonding conductor are not required to comply with the requirements of the terminal or connector standard relating to current-carrying capability and heat testing.

Exception No. 2: Wire-binding screw and stud-and-nut type terminals are not required to comply with the secureness test and the pullout test.

9.2 A sheet-metal screw shall not be used as a wiring terminal or for securing a wiring terminal such as a pressure-wire connector.

10 Grounding and Bonding

10.1 A junction box shall be provided with means of independent termination of the equipment grounding conductors identified in (a) – (d) below. Electrical continuity shall be provided between every metal conduit opening and each grounding termination by means of copper, brass, or other corrosion-resistant metal that is an integral part of the box.

a) One termination for each connected luminaire, sized to accommodate a conductor in the range of 1.3 – 3.3 mm^2 (16 – 12 AWG) inclusive.

Exception: A junction box marked per 19.5 does not require these terminations.

b) One termination for each conduit opening intended for connection to a forming shell or no-niche bracket, sized to accommodate an 8.4 mm^2 (8 AWG) conductor.

Exception: A junction box marked per 19.7 does not require these terminations.

c) One termination for connection to the common bonding grid, sized to accommodate an 8.4 mm^2 (8 AWG) solid copper conductor.

d) One termination for connection to the panelboard, sized to accommodate a conductor in the range of 1.3 – 3.3 mm^2 (16 – 12 AWG) inclusive.

10.2 *Deleted*

10.3 *Deleted*

10.4 *Deleted*

10.5 *Deleted*

10.6 *Deleted*

10.7 The means for securing the conductors specified in 10.1 (a) – (d) shall consist of pressure-wire connectors, wire-binding screws, or studs. A pressure-wire connector shall be of a construction intended for application with ordinary tools and shall be brazed, bolted, or otherwise equivalently secured. A sheet-metal screw shall not be used for this purpose. A wire-binding screw shall:

a) Be a 4.8 mm major diameter (No. 10) or larger size screw;

b) Thread into metal for at least two full threads; and

c) Have a green-colored, slotted, hexagon-shaped head.

Exception: A wire-binding screw shall not be used to secure a conductor larger than 5.3 mm^2 (10 AWG).

10.8 A wire-binding screw or stud shall be provided with a means (such as a cupped washer, upturned lugs, or the like) for retaining the conductor. If a cupped washer is provided and the device is intended for use with a 5.3 mm^2 (10 AWG) or smaller wire, a flat washer or washer-head screw that closely fits the inside of the cupped washer shall also be provided. All parts of a terminating assembly shall be of copper, brass, or other corrosion-resistant material, and the assembly shall be such that it will retain and secure a conductor of the intended size between the cupped washer or upturned lug and the flat washer or washer-head screw.

11 Strain Relief

11.1 Strain-relief means shall be provided to prevent mechanical stress on a flexible cord from a connected luminaire from being transmitted to a terminal or splice in the junction box. The strain-relief means shall comply with the requirements in the Strain-Relief Test, Section 13. Strain-relief means consisting of a gland-and-nut fitting arrangement is not required to be factory installed when shipped with a junction box together with installation instructions in accordance with 20.1(c).

12 Marked Volume Verification

12.1 The volume of a junction box and cover combination marked in accordance with 19.3 and 19.4 shall be verified by any convenient means. When a referee measurement is required, the volume shall be verified as specified in 12.2 – 12.4.

12.2 For box- and cover-volume verification, each cable clamp, grounding pigtail, internal screw, and internal accessory is to be removed from the junction box and its cover. The cover and box are to be assembled as intended, and two small holes are to be drilled into the assembly (one for the entrance of water, the other for ventilation of air).

12.3 Using modeling clay, putty, glazing compound, or a similar material, each hole in the sides and bottom of the sample is to be filled flush with the inside surface of the assembly; and an internal hub, when tapped through, is to be filled flush with the inside surface of the hub; a bushed opening is to be filled flush with the conduit stop.

12.4 By using a clean, graduated vessel (pipette or the equivalent) having a volume equal to or greater than the marked volume of the combined box and cover assembly and filled with water at room temperature, water is to be transferred to the test sample through the hole specified in 12.2 drilled for the purpose. The result is in compliance when the test sample holds a volume of water equal to or greater than the marked volume.

PERFORMANCE

13 Strain-Relief Test

13.1 To determine compliance with 11.1, a 22.7-kg (50-pound) weight is to be suspended by the flexible cord for 1 minute, with the force applied in the direction normal to the plane of the fitting through which the cord enters the box. The cord conductors are to be severed immediately adjacent to the terminal or splice to which they would be connected when it is likely that the permitted movement of the cord will result in stress on the terminal or splice. There shall not be movement of the cord of more than 3.2 mm (1/8 inch) at its point of exit from the box.

13.2 The strain-relief test specified in 13.1 is to be conducted with the type of flexible cord specified by the manufacturer and with the strain-relief device either:

a) Factory installed or

b) Installed in accordance with the instructions packed with the junction box or cover.

14 Watertightness Test

14.1 No water shall enter a junction box after it has been submerged under a 305-mm (1-foot) head of water for 24 hours. See 14.2 – 14.4 for test method.

14.2 Prior to immersion, all threaded openings in the box are to be closed with threaded plugs, using a tightening torque of 90.4 N·m (800 pound-inches) for the 1/2- and 3/4-inch trade sizes, and 113.0 N·m (1000 pound-inches) for the 1- and 1-1/4-inch trade sizes. The cover and gasket are to be in place as intended.

14.3 A screw that can be tightened by means of a screwdriver, including a small hex-head bolt with a screwdriver slot, is to be tightened with a torque of 2.15 N·m (19 pound-inches).

Exception: A 4.2 mm major diameter (No. 8) screw is to be tightened with a torque of 1.8 N·m (16 pound-inches).

14.4 After 24 hours of immersion, the junction box is to be removed from the water and the outside surface dried carefully. The cover is to be removed and the interior examined for the presence of water. In the case where no water is present, the cover and gasket are to be re-assembled as intended and the 24-hour immersion in a 305-mm (1-foot) head of water repeated. At the end of the repeat immersion period,

the outside of the box is to be dried and the interior again inspected for the presence of water. No water shall be present inside the junction box after the repeated immersion period.

15 Gasket Test

15.1 A gasket of neoprene, rubber, neoprene composition, or rubber composition shall be tested for the effects of aging as follows. The material is to be conditioned for 70 hours in an air-circulating oven at a temperature of 100 ±2°C (212 ±3.6°F). There shall be no visible signs of deterioration following this conditioning, such as softening, hardening, or cracking after flexing.

16 Turn Prevention Test

16.1 To determine compliance with 7.3, the enclosure shall be securely and rigidly mounted and supported, and the torque shown in Table 16.1 is to be applied to a short length of conduit installed in the hub. The torque is to be applied in the direction tending to tighten the conduit in the hub. There shall be no turning of the conduit hub or stripping of any thread.

Table 16.1
Test torque for the turn prevention test

Trade size of conduit, mm (inches)	Torque, N·m	Torque, (pound-inches)
12.7 and 19 (1/2 and 3/4)	90.4	800
25.4 and 31.8 (1 and 1-1/4)	113.0	1000

17 Bonding Millivolt Drop Test

17.1 When assembled as described in 12.2, a conduit hub shall not show a voltage drop of more than 10 millivolts between the hub and the enclosure when a current of 30 amperes is flowing through the connection. This voltage drop is to be measured between two points:

a) On the outside of the enclosure 1.6 mm (1/16 inch) from the edge of the hub and

b) On the conduit 1.6 mm from the hub.

18 Polymeric Materials Tests

18.1 General

18.1.1 In addition to the tests described in 18.2.1 – 18.5.8, a box, cover, or part of polymeric material shall be subjected to the applicable tests described in Sections 13 – 17.

18.2 Mold stress investigation

18.2.1 Three samples of a polymeric part of a swimming pool junction box or cover are to be exposed to thermal conditioning in a full draft circulating air oven for 7 hours at a stable temperature of 90 ±2°C (194 ±4°F). The results are in compliance when there is no softening of the material as a result of the conditioning, as determined by handling immediately after removal from the oven, and no shrinkage, warpage, or other distortion of the material that will allow water to enter during a watertightness test as described in 14.1.