



UL 498E

STANDARD FOR SAFETY

Attachment Plugs, Cord Connectors
and Receptacles – Enclosure Types for
Environmental Protection

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UL Standard for Safety for Attachment Plugs, Cord Connectors and Receptacles – Enclosure Types for Environmental Protection, UL 498E

First Edition, Dated July 29, 2020

SUMMARY OF TOPICS

This First Edition of ANSI/UL 498E dated July 29, 2020 covers an enclosure rating system for attachment plugs, receptacles, inlets, and cord connectors provided with an enclosure intended for use in various environmental applications.

The new requirements are substantially in accordance with Proposal(s) on this subject dated March 27, 2020.

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ANSI/UL 498E-2020

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UL 498E

**Standard for Attachment Plugs, Cord Connectors and Receptacles –
Enclosure Types for Environmental Protection**

First Edition

July 29, 2020

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 498E as an American National Standard (ANSI) occurred on May 28, 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 The requirements cover an enclosure rating system for attachment plugs, receptacles, inlets, and cord connectors provided with an enclosure intended for use in various environmental applications.

1.2 A device with an environmental enclosure shall also comply with the applicable requirements of either UL 498, UL 498D or UL 498F as appropriate, except as modified by these requirements.

1.3 The requirements of this supplement do not cover enclosure type designations for wiring devices for use in hazardous locations as defined by the National Electrical Code, ANSI/NFPA 70.

2 Components

2.1 A component of a product covered by this Standard shall:

- a) Comply with the requirements for that component as specified in this Standard;
- b) Be used in accordance with its rating(s) established for the intended conditions of use; and
- c) Be used within its established use limitations or conditions of acceptability.

2.2 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.

2.3 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.

2.4 A component that is also intended to perform other functions such as overcurrent 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.

3 Units of Measurement

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

4 Referenced Publications

4.1 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.

4.2 The following publications are referenced in this Standard:

ANSI/NFPA 70, *National Electrical Code*

UL 50E, *Standard for Enclosures for Electrical Equipment, Environmental Considerations*

UL 157, *Standard for Gaskets and Seals*

UL 498, *Standard for Attachment Plugs and Receptacles*

UL 498D, *Standard for Attachment Plugs, Cord Connectors and Receptacles with Arcuate (Locking Type) Contacts*

UL 498F, *Standard for Plugs, Socket-Outlets and Couplers with Arcuate (Locking Type) Contacts*

UL 514A, *Standard for Metallic Outlet Boxes*

UL 514C, *Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers*

UL 514D, *Standard for Cover Plates for Flush-Mounted Wiring Devices*

UL 746C, *Standard for Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 969, *Standard for Marking and Labeling Systems*

UL 1682, *Standard for Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type*

5 Glossary

5.1 For the purposes of this supplement, the following definitions apply.

5.2 ENCLOSURE, ENVIRONMENTAL – That portion or those portions of a device intended to provide a degree of protection to the contacts, blades, terminals, and other live parts of that device and of any adjoining devices or components comprising a complete protective system against specified environmental conditions, both when the device is unmated and when it is fully connected to its intended mating device. This may include covers, gaskets, boots, and similar protective means. That portion or portions of a device providing such protection may differ for the unmated and the fully connected conditions.

5.3 GASKET – A deformable material clamped between stationary faces to provide a degree of protection as specified in [Table 9.1](#). This may include surfaces or features formed integrally from parts of the environmental enclosure made of deformable material.

5.4 SEALING MATERIAL – A pourable or extrudable substance, capable of some degree of hardening and bonding to substrates after application and used as a formed-in-place seal of joints or openings to reduce the likelihood of the passage of gases, vapors, or liquids.

CONSTRUCTION

6 All Devices

6.1 When a receptacle or inlet is provided with or integrates into its design an outlet box, cabinet, junction box, or other portion of the environmental enclosure which includes a means for connection to a conduit, raceway, or other wiring system, in addition to the requirements in this supplement, such an outlet box, cabinet, junction box, or the like, shall comply with the applicable construction and performance requirements in UL 514A, UL 514C, or UL 50E, as appropriate.

6.2 When a receptacle or inlet is provided with or integrates into its design an outlet box cover or cover plate for flush devices, in addition to the requirements in this supplement, such a cover or cover plate shall comply with the applicable construction and performance requirements in UL 514A, UL 514C, or UL 514D, as appropriate.

6.3 The enclosure of an attachment plug, receptacle, inlet, or cord connector marked with an enclosure type designation in accordance with [10.1](#) shall comply with the construction requirements in UL 50E, that correspond to the enclosure type. A device that complies with the requirements for more than one type of enclosure shall comply with the corresponding requirements for each enclosure type. The enclosure type

designation for a device when unmated is not required to be the same as the enclosure type designation of that device when it is fully connected to its intended mating device.

6.4 All parts of an environmental enclosure shall be permanently secured to the wiring device such that they cannot be completely removed without the use of a tool after the device has been installed as intended.

Exception: A part of an environmental enclosure can be completely removable without the use of a tool when the enclosure type designation required in [10.1](#) is marked only on the removable part.

6.5 A Type 2 or 3R enclosure shall have provisions for drainage.

Exception No. 1: A device marked with a Type 2 or 3R enclosure rating that depends on an adjoining device or component comprising the complete environmental enclosure to provide drainage is not required to have provision for drainage on the device itself when the installation instructions or smallest unit container of a device identifies the intended adjoining device or component.

Exception No. 2: A Type 2 or 3R enclosure that is also marked as Type 12, 12K, or 13 shall be shipped with the provision for drainage blocked or closed. Instructions shall be provided with the device to indicate how to unblock or open the provision for drainage.

6.6 For a receptacle or inlet marked with a Type 3, 3S, 4, 4X, 6, 6P, 12, 12K, or 13 enclosure rating, the mounting means shall be external to the cavity containing live parts.

6.7 A receptacle or inlet which is marked with a Type 12K enclosure rating and which includes conduit knockouts or reclosed openings for conductor entry shall have such knockouts or reclosed openings only in the top and bottom enclosure walls.

6.8 A Type 4, 4X, 6, or 6P environmental enclosure comprised of two mateable devices fully connected together shall have enclosure securement means other than blade-and-contact retention alone to resist unintended separation initiated solely by the force of hose-directed water.

6.9 To reduce the risk of unintentional separation while submerged, a Type 6 or 6P environmental enclosure comprised of two mateable devices fully connected together shall:

- a) Employ an enclosure securement means such that the devices cannot be disconnected without the use of a tool after the devices have been installed as intended, fully connected, and submerged, or
- b) Be marked on each device as indicated in [10.7](#).

6.10 The Type 6 or 6P environmental enclosure designation shall be limited to grounding-type attachment plugs, receptacles, cord connectors, and inlets.

7 Polymeric Enclosures

7.1 Polymeric materials used for Types 3, 3R, 3S, 4 and 4X enclosures, or polymeric materials used for fastenings or hinges for these enclosure types shall comply with the Ultraviolet Light Exposure Test in UL 746C.

Exception No. 1: Compliance of elastomeric materials shall be demonstrated by the absence of any permanent damage such as distortion of the boot or fitting, or cracking or splitting of the material, following the exposure to ultraviolet light as described in UL 746C, and the subsequent impact test described in [9.7](#) – [9.8](#).

Exception No. 2: A part fully internal to the environmental enclosure is not required to comply with this requirement.

7.2 Polymeric materials used for Types 6 and 6P enclosures, or polymeric materials used for fastenings or hinges for these enclosure types shall comply with the Ultraviolet Light Exposure Test and the Water Exposure and Immersion Test in UL 746C.

Exception No. 1: Compliance of elastomeric materials shall be demonstrated by the absence of any permanent damage such as distortion of the boot or fitting, or cracking or splitting of the material, following the exposure to ultraviolet light and water as described in UL 746C, and the subsequent impact test described in [9.7](#) – [9.8](#).

Exception No. 2: A part fully internal to the environmental enclosure is not required to comply with this requirement.

8 Gaskets

8.1 The requirements in this section apply to gaskets that are required for an electrical enclosure to maintain a tight fit or to comply with the enclosure performance requirements when the wiring device is unmated or fully connected to its intended mating device.

8.2 A gasket shall be secured with adhesive or by mechanical means, including force-fit or the combination of the gasket's shape and elastomeric properties. The gasket and its securing means shall not be damaged when the cover is opened.

8.3 The gasket material shall comply with UL 157.

PERFORMANCE

9 General

9.1 The enclosure of a device shall comply with the requirements and tests specified in [Table 9.1](#) for the particular environmental enclosure type appropriate for the intended use and description of the device. Requirements and test descriptions are contained in UL 50E, except as modified in this section. All tests are to be conducted using:

- a) One set of representative devices unmated, with shrouds and flap or screw covers in place, and
- b) One set of representative devices fully connected to their intended mating devices with any enclosure securement means engaged or in place. This set of devices consists of connected combinations of either attachment plugs and receptacles, cord connectors and inlets, or attachment plugs and cord connectors.

Table 9.1
Environmental Enclosure Types

Type	Intended use and description	Requirements or qualification tests from UL 50E
2	Indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	Corrosion protection (7.2) or Rust Resistance Test
		Drip Test
		Gaskets

Table 9.1 Continued on Next Page

Table 9.1 Continued

Type	Intended use and description	Requirements or qualification tests from UL 50E
		Gasket Tests
3	Outdoor use primarily to provide a degree of protection against rain, sleet, wind blown dust and damage from external ice formation.	Rain Test
		Dust Test or the hose test described in the Hose and Hosedown Tests
		Icing Test
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Gaskets
		Gasket Tests
3R	Outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation.	Rain Test
		Icing Test
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Gaskets
		Gasket Tests
3S	Outdoor use primarily to provide a degree of protection against rain, sleet, windblown dust and to provide for operation of external mechanisms when ice laden.	Rain Test
		Outdoor method of the Dust Test or the hose test described in the Hose and Hosedown Test
		Icing Tests
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Gaskets
		Gasket Tests
4	Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water and damage from external ice formation.	Hosedown test described in the Hose and Hosedown Tests
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Icing Test
		Gaskets
		Gasket Tests
4X	Indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water and damage from external ice formation.	Hosedown test described in the Hose and Hosedown Tests
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Corrosion Resistance Test
		Icing Test
		Gaskets
		Gasket Test
5	Indoor use primarily to provide a degree of protection against settling airborne dust, falling dirt, and dripping noncorrosive liquids.	Corrosion protection (7.2) or Rust Resistance Test
		Drip Test

Table 9.1 Continued on Next Page

Table 9.1 Continued

Type	Intended use and description	Requirements or qualification tests from UL 50E
		Indoor settling airborne dust method of the Dust Test or the Atomized Water Test – method B of the Atomized Water Test
		Gaskets
		Gasket Tests
6	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, and the entry of water during occasional temporary submersion at a limited depth and damage from external ice formation.	Hosedown test described in the Hose and Hosedown Tests
		Icing Tests
		Submersion Tests
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Gaskets
		Gasket Tests
6P	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, the entry of water during prolonged submersion at a limited depth and damage from external ice formation.	Hosedown test described in the Hose and Hosedown Tests
		Icing Test
		Outdoor Enclosures
		Indoor Enclosures
		Corrosion Resistant Enclosures
		Air Pressure Test
		Gaskets
		Gasket Tests
12, 12K	Indoor use primarily to provide a degree of protection against circulating dust, falling dirt, and dripping noncorrosive liquids.	Corrosion protection (7.2) or Rust Resistance Test
		Drip Test
		Indoor circulating airborne method of the Dust Test or the Atomized Water Test – method A of the Atomized Water Test
		Gaskets
		Gasket Tests
13	Indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.	Corrosion protection (7.2) or Rust Resistance Test
		Oil Test
		Gaskets
		Gasket Test

9.2 An attachment plug or cord connector is to be wired with the appropriate size and type of flexible cord in accordance with the manufacturer's instructions. The free ends of flexible cord are to be sealed against moisture ingress. When assemblies consist of either an attachment plug or cord connector unmated or of an attachment plug and cord connector fully connected together, the assemblies are to be mounted to a horizontal board using clamps on the flexible cord within 4 – 10 inches (101 – 250 mm) of the strain relief of the device.

9.3 A receptacle or inlet is to be mounted to the appropriate representative outlet box, wall or panel surface and connected to a wiring system in accordance with the manufacturer's instructions. If the device is provided with a knockout or hub, a short length of the appropriate type of conduit or tubing with its free end sealed to reduce the likelihood of entrance of moisture is to be connected to the device. To equalize the pressure between the enclosure cavity interior and exterior during the Rain Test, the Hose and Hosedown Tests, and the Submersion Test in UL 50E, the conduit or tubing is permitted to be vented to an area outside of where moisture may enter through the vent. Prior to subjecting the receptacle or inlet to the Rain Test or the Hose and Hosedown Tests, a self-closing cover that requires positioning or movement in

normal use shall remain functional and comply with the requirements of the Rain Test after 1000 cycles of operation.

9.4 When conducting the Rain Test, the Drip Test, the Hose and Hosedown Tests, and the Submersion Test in UL 50E, talcum powder, a moisture-indicating paste, or other similar moisture indicator is to be used. The moisture indicator is to be placed within the environmental enclosure in any area where moisture can come into contact with live parts, and between the faces of the mated devices. Moisture on exposed blades is acceptable only for an unmated attachment plug or inlet that is not provided with a means to maintain the integrity of the specified enclosure type in the blade area. Water is permitted on the face of the device as a result of the Rain Test, the Drip Test, the Hose and Hosedown Tests, and the Submersion Test.

9.5 The Rain Test and the Drip Test are not required to be conducted when the enclosure complies with the Hose and Hosedown Tests. [Table 9.2](#) lists other acceptable substitutes for specific qualification tests from UL 50E.

Table 9.2
Acceptable Test Substitutes

Qualification test from UL 50E	Acceptable substitute for the qualification test	Special conditions
Rain Test	Hose or Hosedown Test	None
Drip Test	Hose or Hosedown Test	None
Dust Test (Outdoor method)	Hose test described in Hose or Hosedown Test	None
Dust Test (Indoor circulating airborne method)	Atomized Water Test – Method A or the Hose or Hosedown Tests	None
Dust Test (Indoor circulating airborne method and indoor settling airborne method)	Atomized Water Test – Method B or the Hose or Hosedown Tests	None
Dust Test	Submersion Test	Enclosure tested without pipe thread sealing compound
Dust Test	Oil Test	None
Drip Test	Oil Test	None
Air Pressure Test	Submersion Test	Enclosure does not have connections for pressurizing the interior and the duration of the submersion is increased from 30 minutes to 24 hours

9.6 The Dust Test is not required to be conducted when the enclosure complies with the Submersion Test. For the devices covered by this supplement, the Submersion Test is not an acceptable substitute for the Hose and Hosedown Tests.

9.7 An attachment plug, receptacle, inlet, or cord connector shall also comply with the Crushing Resistance Test described in UL 746C. An inlet or receptacle shall also comply with the ball impact test described in the Resistance to Impact Test contained in UL 746C while an attachment plug or cord connector shall comply with the Impact Test (Plugs and Connectors) described in UL 1682.

9.8 The ball impact test mentioned in [9.7](#) is to be conducted:

- a) At room temperature for all devices,