



UL 3730

STANDARD FOR SAFETY

Photovoltaic Junction Boxes

UL Standard for Safety for Photovoltaic Junction Boxes, UL 3730

First Edition, Dated November 11, 2014

Summary of Topics

This revision of ANSI/UL 3730 dated April 2, 2025 includes the withdrawal and replacement of ANSI/ISA MC96.1, Temperature-Measurement Thermocouples, [21.7](#).

Text that has been changed in any manner or impacted by ULSE'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 February 28, 2025.

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Standard for Photovoltaic Junction Boxes

First Edition

November 11, 2014

This ANSI/UL Standard for Safety consists of the First Edition including revisions through April 2, 2025.

The most recent designation of ANSI/UL 3730 as an American National Standard (ANSI) occurred on April 2, 2025. 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 ULSE at any time. Proposals should be submitted via a Proposal Request in ULSE's Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover photovoltaic junction boxes intended to be attached to photovoltaic modules and panels.

1.2 These requirements cover photovoltaic junction boxes intended for factory and field wiring and may include conduit openings, wiring leads, and/or photovoltaic connectors intended for interconnection of PV modules.

1.3 The products covered by these requirements are intended to be installed in accordance with the National Electrical Code, ANSI/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 [A](#) 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- b) Is superseded by a requirement in this standard.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 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 In the text of this standard, the term "unit" refers to any product covered by this standard. For the purpose of this standard, the definitions in [3.2](#) – [3.18](#) apply.

3.2 AC MODULE – The smallest complete unit that includes solar cells, optics, inverters, and other components, excluding tracking devices, intended to generate ac power from sunlight.

3.3 **BARRIER** – A part inside an enclosure that reduces access to a part that involves a risk of fire, electric shock, injury to persons, or electrical energy-high current levels.

3.4 **ELECTRIC SHOCK - VOLTAGE** – A live part does not involve a risk of electric shock when the maximum voltage of the part to ground does not exceed 30 Vdc.

3.5 **ENCLOSURE** – A surrounding case constructed to provide a degree of protection against:

- a) The accessibility of a part that potentially involves a risk of fire, electric shock or injury to persons, or
- b) The risk of propagation of flame, sparks, and molten metal initiated by an electrical disturbance occurring within.

3.6 **FIELD-WIRING LEAD** – A lead to which a supply, load, or other wire is intended to be connected by an installer.

3.7 **FIELD-WIRING TERMINAL** – A terminal to which a supply, load, or other wire is intended to be connected by an installer.

3.8 **FIXED UNIT** – A unit that is intended to be permanently connected mechanically and electrically and only able to be detached by the use of a tool.

3.9 **GROUNDING CONDUCTOR** – A system or circuit conductor that is intentionally grounded.

3.10 **KNOCKOUT** – A portion of the wall of an enclosure so fashioned that it is capable of being readily removed by a hammer, screwdriver, and pliers at the time of installation in order to provide an opening or hole for the attachment of an auxiliary device, raceway, cable, or fitting.

3.11 **LIVE PART** – An electrically conductive part within a unit that during intended use has a potential difference with respect to earth ground.

3.12 **MAXIMUM SYSTEM VOLTAGE** – The sum of the open-circuit voltage (Voc) of the photovoltaic module or panel multiplied by the temperature correction factor specified in Article 690.7 of the National Electrical Code, ANSI/NFPA 70, for the maximum number of crystalline and multi-crystalline silicon photovoltaic modules and panels in a series string. The maximum system voltage is equal to the sum of the Voc for the maximum number of amorphous silicon and thin film photovoltaic modules and panels in a series string.

3.13 **OPEN-CIRCUIT VOLTAGE (Voc)** – The maximum no load output voltage of a photovoltaic module or panel at standard test conditions (STC).

3.14 **PERMANENTLY CONNECTED UNIT** – A unit connected to the electrical supply by means other than a supply cord and an attachment plug.

3.15 **PRESSURE TERMINAL CONNECTOR** – A terminal that accomplishes the connection of one or more conductors by means of pressure without the use of solder. Examples of pressure terminal connectors are:

- a) Barrel and setscrew type,
- b) Crimp-type barrel, or
- c) Clamping plate and screw type.

3.16 SERVICE PERSONNEL – Trained persons having familiarity with the construction and operation of the equipment and the risks involved.

3.17 STANDARD TEST CONDITIONS (STC) – Test conditions consisting of:

- a) 100 mW/cm² irradiance,
- b) AM 1.5 spectrum, and
- c) 25°C (77°F) cell temperature.

3.18 TOOL – A screwdriver, coin, key, or any other object that is usable to operate a screw, latch, or similar fastening means.

CONSTRUCTION

4 Enclosure and Materials

4.1 General

4.1.1 Photovoltaic junction boxes shall be considered an enclosure or be provided with an enclosure that houses all current-carrying parts. The enclosure shall protect the various parts of the unit against mechanical damage from forces external to the unit. The parts of the enclosure that are required to be in place to comply with the requirements to reduce the risk of fire, electric shock, injury to persons shall comply with the applicable enclosure requirements specified in this standard.

4.1.2 The frame or chassis of a junction box shall not be relied upon to carry current during normal operation.

4.1.3 A part, such as a nameplate that is a part of the enclosure shall comply with the enclosure requirements.

4.1.4 Sheet-metal screws threading directly into metal shall not be used to attach a cover, door, or other part that is to be removed to install field wiring or for operation of the equipment. Machine screws, self-tapping machine screws, and thread forming screws are able to thread directly into sheet-metal when they allow for at least two full threads of screw engagement.

4.1.5 Sheet-metal screws mounting internal components that are not removed for installation or operation are able to thread directly into metal.

4.2 Nonmetallic enclosures and polymeric materials

4.2.1 A polymeric enclosure or polymeric part of an enclosure shall comply with Sections 7 and 34 in the Standard for Flat-Plate Photovoltaic Modules and Panes, UL 1703, except as noted by the following.

4.2.2 With reference to paragraph 7.2 (c) of the Standard for Flat-Plate Photovoltaic Modules and Panes, UL 1703, a polymeric material serving as the support or insulation of a live part as defined in Table 6.1 of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, shall have a Comparative Tracking Index performance level category (PLC) as determined in accordance with the Standard for Polymeric Materials - Short Term Property Evaluations, UL 746A, and as defined in [Table 4.1](#), when the system voltage rating is 600 V or less.

Exception No. 1: The CTI rating is not required for a polymeric material serving as the support or insulation of a live part as defined in UL 746C, Table 6.1, when both the material and live part are completely

encapsulated by the potting material such that there is no surface upon which tracking may occur, and the potting material has been evaluated according to UL 746C, Table 6.1, for Electric Strength, Resistance to Electrical Ignition Sources (HAI and HWI), and Thermal Endurance.

Exception No. 2: The CTI rating is not required for a polymeric material serving as the support or insulation of a live part as defined in UL 746C, Table 6.1, when both the material and live part are completely coated by a conformal coating that has been evaluated to the requirements of UL 746C, Section 43, at the rated thickness such that there is no surface upon which tracking may occur.

Exception No. 3: Silicone based RTV when applied in accordance with Exception No. 2 is considered a suitable conformal coating without further evaluation.

Table 4.1
Determination of comparative tracking index performance level category (PLC)

Voltage	Creepage distance	IPT 1 hr rating required	CTI PLC of 2 or better required
0 – 30	Any	No	No
> 30 – 600	< 12.7 mm	No	Yes
> 30 – 600	≥ 12.7 mm	No	No
> 600 – 1000	< 16.0 mm	Yes	No
> 600 – 1000	≥ 16.0 mm	No	No
> 1000 – 1500	< 24.0 mm	Yes	No
> 1000 – 1500	≥ 24.0 mm	No	No

Note – Voltage is determined as follows:

- Between live parts: the maximum potential difference during normal use
- Between live parts and dead metal parts that may be grounded in service: maximum system voltage
- Between live parts and any surface exposed to contact: maximum system voltage

4.2.3 With reference to paragraph 7.2 (d) of the Standard for Flat-Plate Photovoltaic Modules and Panes, UL 1703, a polymeric material serving as the support or insulation of a live part as defined in Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, Table 6.1, shall have an Inclined Plane Tracking (ASTM D2303) rating of 1 hour using the time to track method at the higher of system voltage or 1000 V when the system voltage is in the range of 601 – 1000 V as specified in [Table 4.1](#).

Exception No. 1: The 1 hr rating is not required for a polymeric material serving as the support or insulation of a live part as defined in UL 746C, Table 6.1, when both the material and live part are completely encapsulated by a potting material such there is no surface upon which tracking may occur, and the potting material has been evaluated according to UL 746C, Table 6.1, for Electric Strength, Resistance to Electrical Ignition Sources (HAI and HWI), and Thermal Endurance.

Exception No. 2: The 1 hr rating is not required for a polymeric material serving as the support or insulation of a live part as defined in UL 746C, Table 6.1, when both the material and live part are completely coated by a conformal coating that has been evaluated to the requirements of UL 746C, Section 43, at the rated thickness such that there is no surface upon which tracking may occur.

Exception No. 3: Silicone based RTV when applied in accordance with Exception No. 2 is considered a suitable potting material without further evaluation.