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SUBJECT 6703

OUTLINE OF INVESTIGATION

FOR

CONNECTORS FOR USE IN PHOTOVOLTAIC SYSTEMS

Issue Number: 3

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Summary of Topics

The third issue of the Outline of Investigation for Connectors for Use in Photovoltaic Systems, Subject 6703, includes the following revision:

- *Revised TPE maximum compression set value in Table 9.2.*

The UL Foreword is no longer located within the UL Outline of Investigation. For information concerning the use and application of the requirements contained in this Outline of Investigation, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net.ul.com/ulforeword.html>

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INTRODUCTION

1 Scope

1.1 This Outline covers latching or locking type PV connectors rated 1000 V dc or less. These connectors are intended for use in wiring methods detailed in Part IV of Article 690 – Solar Photovoltaic Systems of the National Electrical Code, NFPA 70.

1.2 PV connectors are suitable for the termination of single, insulated, stranded copper type USE-2 or Photovoltaic Wire (PV Wire) rated 90°C, 105°C, 125°C, or 150°C dry; 90°C wet; 600, 1000, or 2000 V.

2 General

2.1 Units of measurement

2.1.1 The requirements in this outline are stated in metric units that make the requirement conveniently useable in countries employing the various metric systems (practical SI and customary). In addition to being stated in metric units, the inch/pound units, that are customary in the USA, are also provided. The values given in SI (metric) units shall be normative, except for AWG conductor sizes. Any other values given are for information purposes only.

2.1.2 Equivalent – although, not necessarily exactly identical – results are to be expected from applying a requirement in USA or metric terms. Equipment calibrated in metric units is to be used when a requirement is applied in metric terms.

2.2 References

2.2.1 Any undated reference to a code or standard appearing in the requirements of this Outline of Investigation shall be interpreted as referring to the latest edition of that code or standard.

3 Components

3.1 Except as indicated in 3.2, a component of a product covered by this Outline of Investigation 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 Outline of Investigation.

3.2 A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this Outline of Investigation, or
- b) Is superseded by a requirement in this Outline of Investigation.

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

3.4 Specific components are recognized as being 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 for which they have been recognized.

CONSTRUCTION

4 General

4.1 Only materials that are acceptable for the particular use shall be employed in a PV connector. PV connectors shall be made and finished with the degree of uniformity and grade of workmanship that are practicable in a well-equipped factory.

4.2 A PV connector shall comply with the requirements in the Standard for Wire Connectors, UL 486A-486B, as appropriate, and with this Outline of Investigation.

4.3 There shall be no sharp edges or corners on the outer surface of a PV connector that can result in damage to the PV wire insulation that the connector contacts.

4.4 Latching connectors shall not require the use of a tool to unlatch. Latching connectors shall incorporate a suitable latching mechanism such as ribs, twisting action, or other latching mechanisms between the mated pair.

4.5 Locking connectors shall require the use of a tool to unlock.

5 Current Carrying Parts (Contacts)

5.1 The current-carrying part of a connector shall be copper or copper alloy.

6 Insulating Materials and Enclosure

6.1 Polymeric materials may be used as enclosure materials and in direct support of live parts. When the same material is used for both purposes, the more stringent requirements shall be applied.

6.2 A polymeric material serving as the enclosure of a part involving a risk of fire or electric shock shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, concerning:

- a) Ultraviolet light exposure,
- b) Water exposure and immersion, and
- c) Hot-wire ignition (HWI).

6.3 A polymeric material serving as the enclosure shall have a minimum flammability classification of V-0, VTM-0 or 5VA as determined by tests described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. The material thickness for determining the flammability shall be measured at the thinnest points of the enclosure.

6.4 With reference to 6.3, a material other than V-0, VTM-0 or 5VA may be used when the enclosure of the PV wire connector complies with the requirements for the equivalent flame test as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.5 A polymeric material serving as the support or insulation of a part involving a risk of fire or electric shock shall:

a) Have a flammability classification of HB, V-2, V-1, or V-0 as determined in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. The material thickness for determining the flammability shall be measured at points supporting live parts or within 6 mm (0.236 in) of live parts, whichever is less;

b) Have a minimum High-Current Arc Ignition (HAI) performance level category (PLC) in accordance with Table 6.1;

c) Have a Comparative Tracking Index (CTI) performance level category (PLC) as defined in Table 6.2;

Exception: A material not having a CTI rating may be used when the material complies with the requirements for the Performance Tracking Index test (PTI) test as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

d) Have an Inclined Plane Tracking (IPT) as defined in Table 6.2; and

e) Comply with the requirements for exposure to ultraviolet light as determined in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, when exposed to light during normal operation of the product. Polymeric materials that are exposed to direct sunlight but are protected by glass, or other transparent medium, may be tested with an equivalent layer of that medium attenuating the ultraviolet light exposure during the test.

Table 6.1
Minimum HAI PLC values

Flammability classification	High-current arc ignition, PLC
HB	1
V-2	2
V-1	2
V-0	3