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UL 4128

**Outline of Investigation for Intercell and Intertier Connectors for Use in
Electrochemical Battery System Applications**

Issue Number: 1

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Summary of Topics

This First issue of the Outline of Investigation for Intercell and Intertier Connectors for Use in Electrochemical Battery System Applications, UL 4128, covers mating halves of intercell and intertier connectors for use in electrochemical battery system applications.

The effective date for UL LLC will be announced through Industry File Review – Announcement Letter.

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INTRODUCTION

1 Scope

1.1 These requirements cover mating halves of intercell and intertier connectors for use in electrochemical battery system applications. Intercell and intertier connectors consist of a cable connector, cable, and mating inlet intended for use in electrochemical battery system applications. These connectors are rated up to a 1000 V dc or less, and not intended for connection or disconnection under load conditions. They are intended for assembly to copper or copper alloy conductors.

1.2 These devices are not intended for use in hazardous locations.

1.3 These devices are intended for factory or field assembly to copper or copper alloy conductors rated 90°C or higher, and may be rated for use in either outdoor or indoor locations.

1.4 This standard does not directly apply to the following devices, but may be used to supplement the requirements within these standards when a device is evaluated to these standards:

- a) Devices produced integrally with flexible cord or cable that is covered by the Standard for Cord Sets and Power-Supply Cords, UL 817;
- b) Devices intended for connection to the branch circuit, such as attachment plugs, cord connectors, receptacles, inlets, and outlets that are covered by the Standard for Attachment Plugs and Receptacles, UL 498;
- c) Devices solely intended for direct connection to the branch circuit in accordance with the National Electrical Code, NFPA 70, and that are provided with contacts of the pin and sleeve type, that are covered by the Standard for Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type, UL 1682;
- d) Devices consisting of wiring terminals and supporting blocks intended for the connection of wiring that are covered by the Standard for Terminal Blocks, UL 1059;
- e) Devices such as wire connectors and soldering lugs that are covered by the Standard for Wire Connectors, UL 486A-486B; the Standard for Splicing Wire Connectors, UL 486C; or the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E;
- f) Devices such as single pole locking-type separable connectors that are covered by the Standard for Single Pole Locking-Type Separable Connectors, UL 1691.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this outline 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.

2.2 A component is not required to 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, or
- b) Is superseded by a requirement in this outline.

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

2.4 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.

3 Units of Measurement

3.1 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.

3.2 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.

4 Undated References

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

5 Glossary

5.1 For the purpose of this outline, the following terms and definitions apply.

5.2 ACCESSIBLE PART – a part so located that it can be contacted by a person, either directly or by means of a probe or a tool, or that is not recessed the required distance behind an opening.

5.3 ENCLOSURE – that part of the connector that:

a) Renders inaccessible all or any parts of the connector that may otherwise present a risk of electric shock, and/or

b) Retards propagation of flame initiated by electrical disturbances occurring within.

5.4 INTERCELL / INTERTIER CONNECTOR – Consists of a cable connector, cable or conductive bar (bus bar) and mating inlet intended to connect cells of a storage battery.

CONSTRUCTION

6 General

6.1 The terminal of an intercell / intertier connector shall comply with the requirements in the Standard for Wire Connectors, UL 486A-486B, as appropriate, and with this standard.

6.2 There shall be no sharp edges or corners on the outer surface of an intercell / intertier connector that can result in damage to the wire insulation.

6.3 A latching intercell / intertier connector shall not require the use of a tool to unlatch mated halves. Latching intercell/ intertier connectors shall incorporate a suitable latching mechanism such as a channel and rib or other latching mechanisms between the mated pair.

6.4 A Locking intercell / intertier connector shall require the use of a tool to unlock the mated halves. A tool can be a specialized device provided by the manufacturer or a standard common device, (i.e. screwdriver). The tool and its operation shall be identified in the manufacturer's assembly instructions, see 20.2.1(d)(7).

7 Current Carrying Parts

7.1 The current-carrying part of an intercell/ intertier connector shall be copper or copper alloy. Current-carrying parts containing more than 15 percent zinc shall comply with stress corrosion/moist ammonia (NH₄) test as described in the Standard for Wire Connectors, UL 486A-486B.

8 Polymeric Materials

8.1 General

8.1.1 Polymeric materials may be used as an enclosure or as insulating materials of an intercell / intertier connector that are in direct contact with or in close proximity to live parts. For the purposes of these requirements, a part that is a distance of 0.8 mm (1/32 in) or less to live parts is considered to be in close proximity. When the same material is used for both purposes, the more stringent requirements shall be applied.

8.1.2 A polymeric material serving as insulation or as the enclosure shall have a relative thermal index (RTI), electrical, mechanical IMP and mechanical STR, as determined in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, not less than 90°C (194°F).

8.1.3 A polymeric material serving as the enclosure of an intercell / intertier connector that is also marked with an enclosure type designation shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, concerning:

- a) Ultraviolet light exposure, and
- b) Water exposure and immersion.

Note: An f1 rating signifies compliance; an f2 rating requires further investigation into its suitability.

8.2 Insulating material

8.2.1 A polymeric material that is in direct contact with or in close proximity [less than 0.8 mm (1/32 in)] to live parts 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.
- b) Have a High-Current Arc Ignition (HAI) performance level category (PLC) in accordance with Table 8.1;
- c) Have a Hot Wire Ignition (HWI) performance level category (PLC) in accordance with Table 8.1;
- d) Have a Comparative Tracking Index (CTI) performance level category (PLC) as defined in Table 8.2;

Exception: 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.

- e) Have an Inclined Plane Tracking (IPT) as defined in Table 8.2; and