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OUTLINE OF INVESTIGATION
FOR
DC RATED ATTACHMENT PLUGS AND OUTLET DEVICES INTENDED FOR
USE WITH INFORMATION TECHNOLOGY AND TELECOMMUNICATION
EQUIPMENT INSTALLED IN RESTRICTED ACCESS LOCATIONS

Issue No. 2

April 2, 2013

Summary of Topics

This is the second issue of the Outline of Investigation for DC Rated Attachment Plugs and Outlet Devices Intended for Use with Information Technology and Telecommunication Equipment Installed in Restricted Access Locations which includes revisions to the Printed Wiring Board (PWB) Ground Path Test and deletion of the Printed Circuit Board (PWB) Conductor Overcurrent Test.

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CONTENTS

INTRODUCTION

1 Scope	5
2 Components	6
3 Units of Measurement	6
4 Undated References	6
5 Glossary	6

CONSTRUCTION

6 General	8
7 Insulating Materials	8
7.1 General	8
7.2 Flammability	8
7.3 Electrical properties	9
7.4 Thermal properties	10
8 Current Carrying Parts	10
9 Grounding and Dead-Metal Parts	11
10 Terminals	11
10.1 General	11
10.2 Wire-binding screw terminals	11
10.3 Conductor leads	12
11 Flexible Cord	12
12 Spacings	13
13 Protection from Electric Shock and Energy Hazards	13
14 Mating and Intermateability	16
15 Interlock	16
16 Devices Intended to Accommodate a Fuse	16
17 Printed Wiring Board	17
18 Resistance to Corrosion	17

PERFORMANCE

19 Representative Devices	17
20 Comparative Tracking Index Test	19
21 Glow Wire Test	19
22 Dielectric Voltage-Withstand Test	19
23 Mold Stress Relief Test	20
24 Dielectric Voltage-Withstand Test (Repeated)	21
25 Moisture Absorption Resistance Test	21
26 Security of Blades Test	21
27 Insulation Resistance Test	22
28 Conductor Secureness Test	23
29 Crush Test	23
30 Short-Time Current Test	23
31 Printed Wiring Board (PWB) Ground Path Test	24
32 Overload Test	24
33 Temperature Test	25
34 Dielectric Voltage-Withstand Test	26
35 Resistance to Arcing Test	26

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36 Fuseholder Temperature Test	26
36.1 General	26
36.2 Attachment plugs	27
36.3 Outlet devices	27
36.4 Procedure	27
37 Resistance to Corrosion Test	28

RATINGS

38 General	28
------------------	----

MARKINGS

39 General	29
40 Disconnecting Under Load	29

INTRODUCTION

1 Scope

1.1 This Outline covers attachment plugs and outlet devices rated up to 20 amperes and up to 600 volts dc only, intended exclusively for use with information technology and telecommunication equipment installed indoors, in restricted access locations.

1.2 Attachment plugs and outlet devices covered by this Outline are intended to be interconnected by service personnel only.

1.3 Attachment plugs and outlet devices covered in this Outline are intended for assembly to copper or copper alloy conductors.

1.4 This Outline also covers attachment plugs molded on to flexible cord. In addition to the requirements contained in this Outline, an attachment plug molded on to flexible cord shall also comply with the applicable requirements contained in the Standard for Cord Sets and Power Supply Cords, UL 817.

1.5 This Outline does not cover:

- a) Plugs, receptacles, and cable connectors, of the pin and sleeve type covered by the Standard for Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type, UL 1682;
- b) Attachment plugs, cord connectors, and receptacles covered by the Standard for Attachment Plugs and Receptacles, UL 498;
- c) Single and multi-pole connectors, which may include 3 or more pilot contacts, intended for connection to copper conductors, for use in data, signal, control and power applications within and between electrical equipment, where exposed, that are covered by the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977;
- 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 modular jacks and plugs that are intended for use with telecommunications networks that are covered by the Standard for Information Technology Equipment Safety – Part 1: General Requirements, UL 60950-1, and the Standard for Communications-Circuit Accessories, UL 1863;
- f) Devices such as wire connectors and soldering lugs 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; or
- g) Devices such as quick-connect terminals covered by the Standard for Electrical Quick-Connect Terminals, UL 310.

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.

2.2 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 Outline; or
- b) Is superseded by a requirement in this Outline.

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

2.4 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.

3 Units of Measurement

3.1 In addition to being stated in the inch/pound units that are customary in the USA, each of the requirements in this Outline is also stated in units that make the requirement conveniently usable in countries employing the metric system (practical SI). 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 purposes of this Outline, the following definitions apply.

5.2 ATTACHMENT PLUG – A male contact device for the temporary connection of a flexible cord or cable to a panel outlet device.

5.3 BLADE – The part of an attachment plug intended to be inserted into the contacts of an outlet device (panel outlet) of matching configuration and the integral extension of this part, located within the attachment plug, to which the conductor of a flexible cord is connected.

5.4 ELECTRICAL (FUNCTIONAL) INSULATION – The insulation necessary for the proper functioning of the product and for basic protection against electrical shock. This includes all parts relied upon to support live parts in place, all internal barriers necessary to maintain spacings, and the outlet face portion of a panel outlet device.

5.5 ENCLOSURE – That part of the device that renders inaccessible all or any parts of the device that may otherwise present a risk of electric shock, retards propagation of flame initiated by electrical disturbances occurring within, or both.

5.6 INTERLOCKED OUTLET – An outlet having a device, either electrical or mechanical, that is intended to reduce the likelihood of energizing the contacts before proper engagement with the plug, and that either is intended to reduce the likelihood of the plug being withdrawn while its contacts are energized or de-energizes the line contacts before separation.

5.7 OUTLET DEVICE – A female contact device to be mounted on utilization equipment.

5.8 POLARIZED DEVICE – A device constructed for connection to a mating device only in the position that connects related poles of an electrical circuit.

5.9 RESTRICTED ACCESS LOCATION – Location for equipment where both of the following applies:

- a) Access can only be gained by service personnel who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and
- b) Access is through the use of a lock and key, or other means of security, and is controlled by the authority responsible for the location.

5.10 SERVICE PERSONNEL – Persons having technical training and experience required to be aware of the risks encountered when performing a task and the measures to be taken to minimize the risks to them and other persons.

5.11 TERMINAL, CRIMPED CONNECTION – An electro-mechanical connection made between a blade and a conductor by compressing the portion of the blade termed "the integral extension" in 5.3, against the conductor.

5.12 TERMINAL, PRESSURE-WIRE – A terminal which establishes a connection between a conductor and a terminal plate by means of mechanical pressure without the use of solder. A pressure-wire terminal may be either of the following types:

- a) Clamp-Type – A pressure-wire terminal in which the conductor is held under a pressure plate or saddle clamp by one or more screws. This type of terminal may be provided in combination with a wire-binding screw terminal.
- b) Setscrew-Type – A pressure-wire terminal in which the pressure is applied by the end of the screw bearing on the conductor, either directly or through a wire-protecting pad.

5.13 TERMINAL, WIRE-BINDING SCREW – A terminal in which the conductor is bent around the screw and is clamped directly under the head of the screw when it is tightened.

CONSTRUCTION

6 General

6.1 An attachment plug or an outlet device complying with these requirements is acceptable for use as components in an end product where the acceptability of the combination is to be determined.

6.2 The acceptability of an attachment plug or an outlet device in any particular application depends on its ability to be used under the conditions that prevail in actual service. For a particular application, an attachment plug or an outlet device may be affected by the requirements for the equipment in which it is used, and it may be necessary to additionally evaluate features or performance characteristics that are not specified in this Outline.

7 Insulating Materials

7.1 General

7.1.1 All parts that act as the electrical insulation or enclosure of an attachment plug or an outlet device shall be made of an insulating material intended for the particular application and shall comply with the requirements in 7.2.1 – 7.4.1. Hard rubber shall not be employed.

7.1.2 A polymeric material used for electrical insulation or enclosure of live parts shall be fabricated in accordance with the Standard for Polymeric Materials – Fabricated Parts, UL 746D.

Exception: A polymeric material that is fabricated in the same location where final assembly takes place and where no blending or compounding operations are involved is not required to comply with this requirement.

7.2 Flammability

7.2.1 A polymeric material used for electrical insulation or enclosure of live parts shall have a flame class rating of V-2, V-1, V-0, VTM-2, VTM-1, or VTM-0 in accordance with the requirements of the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. The flame class rating of the material shall be judged at the minimum thickness employed at the walls and barriers in the device which are critical to the functioning of the insulation or enclosure of the device.

Exception: A polymeric material that complies with either the 12 mm or 20 mm (3/4-inch) flame flammability test described in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C, need not have a flammability class rating.

7.2.2 A polymeric material used as the enclosure of a fuse shall have a flame class rating of V-0, V-1, V-2, 5VA, or 5VB in accordance with the requirements of UL 94.

7.3 Electrical properties

7.3.1 A polymeric material used for electrical insulation or enclosure of live parts shall have a Comparative Tracking Index (CTI) rating of 175 V or greater or a performance level class of at least 3.

Exception No. 1: A polymeric material used for electrical insulation or enclosure of live parts is not required to comply with this requirement if it complies with the Comparative Tracking Index Test, Section 20.

Exception No. 2: A polymeric material used in an enclosure that is separated through air by more than 1/32 inches (0.8 mm) from uninsulated live parts and more than 1/2 inch (12.7 mm) from arcing parts is not required to comply with this requirement.

7.3.2 A polymeric material used for electrical insulation or enclosure of live parts shall have Hot Wire Ignition (HWI) and High-Current Arc Resistance to Ignition (HAI) ratings or performance level classes of at least those shown in Table 7.2.1 for the flame class rating determined in accordance with 7.2.1. For materials with other than VTM flammability classifications, the HWI and HAI ratings of the material shall be evaluated using the specimen thickness employed in the end product or nominal 1/8 inch (3.2 mm) thickness, whichever is greater.

Exception: A polymeric material used for electrical insulation or enclosure of live parts is not required to comply with the HWI requirements if it complies with the Glow Wire Test, Section 21.

Table 7.1
Hot wire ignition (HWI) and high-current arc resistance to ignition (HAI) ratings of insulating materials

Flammability classification ^a	HWI ^{b,d}		HAI ^{c,d}	
	Mean ignition time (sec)	PLC	Mean no. of arcs	PLC
V-0, VTM-0	7 and up to 15	4	15 and up to 30	3
V-1, VTM-1 ^e	15 and up to 30	3	15 and up to 30	3
V-2, VTM-2	15 and up to 30	3	15 and up to 30	3

^a Flammability classification – Described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

^b Hot Wire Resistance to Ignition – Described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

^c High-Current Arc Resistance to Ignition – Described in UL 746A.

^d Mean ignition time and mean no. of arcs to be used to evaluate Filament Wound Tubing, Industrial Laminates, Vulcanized Fiber, and similar polymeric materials only. All other materials are to be judged using the performance level class values.

^e A polymeric material subjected to the flammability test with either the 12 mm or 20 mm (3/4- inch) flame in accordance with the Exception to 7.2.1 shall comply with the PLC for a V-1 rating.