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1

UL 2875

**Outline of Investigation for Modular Cable System Assemblies and Fittings
for Industrial Control, Signal and Power Distribution**

Issue Number. 1

May 28, 2015

Summary of Topics

This first issue of the Outline of Investigation for Modular Cable System Assemblies and Fittings for Industrial Control, Signal and Power Distribution, UL 2875, covers modular multi-pole connectors and cable systems consisting of electrical cables, field installed or factory assembled modular multi-pole connectors and other associated system devices.

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

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CONTENTS

INTRODUCTION

1 Scope	6
2 Components	7
2.1 General	7
2.2 Requirements for components	8
3 Units of Measurement	13
4 Undated References	13
5 Glossary	13

CONSTRUCTION

6 General	15
7 Accessibility to Uninsulated Live Parts – Connector contact openings	16
8 System Device Enclosure Openings	17
9 Insulating Materials	19
9.1 General	19
9.2 Flammability	19
9.3 Electrical properties	20
10 Live Parts	23
11 Grounding and Dead-Metal Parts	23
12 Terminals	24
13 Strain Relief	26
13.1 Cord entries	26
13.2 Cable fittings	26
14 Spacings	26
14.1 General clearances and creepage distances	26
14.2 Class 2 clearances and creepage distances	27
15 Assembly	28
15.1 General	28
15.2 Polarization	28
15.3 Mating connector interchangeability	28
15.4 Mating connectors and enclosures manufactured of polymeric materials for use in environmental air handling spaces (plenums)	29
15.5 Fittings	29
15.6 Identification and wiring	29
16 Enclosures	30
16.1 Connectors	30
16.2 System device enclosures – frame and enclosure – general	31
16.3 Uninsulated live parts	31
16.4 Metallic enclosures	31
16.5 Enclosure covers	34
16.6 Polymeric material system device enclosures	34
16.7 Environmental rating	36
17 Cable Assemblies	37
18 Mounting	37
19 Outdoor and wet location use	37

PERFORMANCE

20	General	38
21	Mold Stress-Relief Distortion Test	38
22	Moisture Absorption Resistance Test	39
23	Dielectric Voltage-Withstand Test	40
24	Insulation Resistance Test	41
25	Conductor Secureness Test	41
26	Strain-Relief Tests	43
26.1	Cable to connector secureness	43
26.2	Armored cable, metal clad cables, flexible metal conduit to connector secureness test	45
27	Current-Cycling and Vibration Test	49
27.1	General	49
27.2	Current-cycling before vibration test	49
27.3	Vibration test	50
27.4	Current-cycling after vibration test	50
27.5	Calculations	50
28	Temperature Test	50
29	Connectors disconnected under electrical load	52
29.1	Temperature test for mating connectors subject to disconnection under electrical load	52
29.2	Overload – current interrupting – disconnecting under electrical load	53
29.3	Abnormal overload – disconnecting use only	54
30	Polarization Test (Keying)	54
31	Adhesion Test	54
32	Environmental Enclosure Tests	55
33	Grounding- Impedance Test	55
34	Fault Current Tests	55
34.1	Ground trace	55
34.2	Printed circuit board (PWB) conductor overcurrent test	57
35	Strength of Insulation Base Test	58
36	Assembly Test	58
37	Accelerating Aging Tests	58
38	PVC Compounds and Copolymers	59
39	Low Temperature Test	59
40	Glow Wire Test	59
41	High-Current Arc Resistance to Ignition Test	60
42	Mechanical Support Static Load Test	61
43	Tests for Permanence of Flag Type Cable Tag	61
43.1	General	61
43.2	Test conditions	62

RATINGS

44	General	63
----	---------	----

MARKINGS

45	General	63
46	Tap connector	66

INSTRUCTIONS

47	General	66
----	---------	----

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48 Tray Cable 67

INTRODUCTION

1 Scope

1.1 These requirements cover modular multi-pole connectors for use with specific identified cable types and when assembled create a modular cable system that consists of electrical cables, field installed or factory assembled modular multi-pole connectors and other associated system devices. Modular cable system connectors and other system devices are only intended for use with mating connectors and system devices of the same manufacturer as specified in the installation instructions.

1.2 These modular cable systems are intended for installation within commercial and industrial locations such as material handling distribution systems and wind turbine towers where the conditions of maintenance and supervision ensure that only qualified persons service the installation.

1.3 These modular cabling systems are only intended for use in accessible locations (as applied to wiring methods) and areas not subject to mechanical damage, in dry locations unless identified for damp, wet or outdoor locations, other than hazardous (classified) locations in accordance with the National Electrical Code, NFPA 70^a

^a NFPA 70, National Electrical Code and NEC are registered trademarks of the National Fire Protection Association, Quincy, MA.

1.4 The modular cable system assemblies and fittings for industrial control, signal and power distribution are intended to be connected as permanently installed branch circuits operating at frequencies between 50 – 60Hz, DC (Direct Current) circuits and at operating potentials of Class 1, Class 2, Class 3 and higher power levels not exceeding 1000 volts between conductors.

1.5 The modular cable system fittings and connectors are only to be assembled or molded on the following cable types: TC (Tray Cable), TC-ER, AC and MC cable in accessible locations as specified in the National Electrical Code, NFPA 70^a.

1.6 This outline does not cover male-to-male connector assemblies.

1.7 This outline does not directly apply to the following but may be used in conjunction with the other applicable standards as indicated below:

a) Devices produced integrally with flexible cord or cables that are 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, covered by the Standard for Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type, UL 1682;

d) Devices intended to interconnect industrial machinery and to be installed in accordance with the Electrical Standard for Industrial Machinery, NFPA 79 that are covered by the Outline of Investigation for Multi-point Interconnection Power Cable Assemblies For Industrial Machinery, UL 2237, and

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e) Devices intended for use in an industrial environment to distribute control signals to remote proximity switches or other control circuit devices are to be installed in accordance with Article 725 of the National Electrical Code, NFPA 70, and are covered by the Standard For Safety For Cable Assemblies and Fittings for Industrial Control and Signal Distribution, UL 2238.

2 Components

2.1 General

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this outline shall comply with the requirements for that component as indicated in 2.2.

2.1.2 A component of a product covered by this outline 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,
- b) Is superseded by a requirement in this outline, or
- c) Is separately investigated when forming part of another component, provided the component is used within its established rating and limitations.

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

2.1.4 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable standard(s) that cover devices that provide those functions.

2.1.5 Components not anticipated by the requirements of this outline, not specifically covered by a component standard of 2.2, and which pose a potential risk of electric shock, fire or casualty hazard shall be additionally investigated. Reference to other product standards is appropriate where those standards anticipate normal and abnormal use conditions consistent with the application of this outline.

2.1.6 Junction boxes, enclosures, conduit and cable fittings, connectors and other previously investigated parts of the system that have been separately investigated when forming a part of an assembly are not required to be retested to these requirements when by review of the previous investigation it can be determined to comply with the requirements contained within this outline.

2.1.7 Previously investigated parts of the system that have been separately investigated shall be used with the conductor or cable types specified in their instructions or as marked on the product.

2.2 Requirements for components

2.2.1 Insulated wire, cable and cords

2.2.1.1 A power supply cord shall comply with the Standard for Cord Sets and Power Supply Cords, UL 817.

2.2.1.2 Flexible cord shall comply with the Standard for Flexible Cords and Cables, UL 62. Flexible cord is considered to fulfill this requirement when preassembled in a cord set or power supply cord complying with the Standard for Cord Sets and Power Supply Cords, UL 817.

2.2.1.3 Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758.

Exception No. 1: Insulated conductors complying with the Standard for Thermoset-Insulated Wires and Cables, UL 44, the Standard for Thermoplastic-Insulated Wires and Cables, UL 83, or other types specified in Chapter 3 of the National Electrical Code, NFPA 70 complying with the appropriate standard, is not required to comply with the Standard for Appliance Wiring Material, UL 758.

Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) is not required to comply with UL 758.

2.2.1.4 The requirements for film coated wire and Class 105 (A) insulation systems are not specified.

2.2.1.5 Film coated wire in intimate combination with one or more insulators, and incorporated in an insulation system rated Class 120 (E) or higher, shall comply with the magnet wire requirements in the Standard for Systems of Insulating Materials – General, UL 1446.

2.2.2 Attachment plugs, receptacles, connectors and terminals

2.2.2.1 Attachment plugs and receptacle outlets shall comply with the Standard for Attachment Plugs and Receptacles, UL 498, or as appropriate, the Standard for Plugs, Receptacles and Cable Connectors of the Pin and Sleeve Type, UL 1682.

2.2.2.2 Electrical splices contained within a system device enclosure shall comply with one of the following standards:

- a) The Standard for Electrical Quick – Connect Terminals, UL 310 or;
- b) The Standard for Wire Connectors, UL 486A-486B;
- c) The Standard for Splicing Wire Connectors, UL 486C;
- d) The Standard for Sealed Wire Connector Systems, UL 486D,
- e) The Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

2.2.2.3 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and where appropriate be indicated as suitable for field wiring.

2.2.3 Switches

2.2.3.1 Switches shall comply with the Standard for Switches for General Use Snap Switches, UL 20.

Exception: Circuit breakers that comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489 are considered to fulfill this requirement.

2.2.3.2 Switches located in a secondary circuit shall comply with 2.2.3.1 or with; the Standard for Special Use Switches, UL 1054, or the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1; the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, with the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7; or the Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 773A.

Note: UL 1054 will be withdrawn on June 23, 2015

2.2.3.3 A switching device that is integral to another component (e.g. switched lampholder) shall comply with the standard for that component.

2.2.3.4 A switch intended for use as an emergency stop device (EPO) shall comply with the applicable standard requirements specified below:

- a) The Standard for Industrial Control Equipment, UL 508;
- b) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991;
- c) The Electrical Standard for Industrial Machinery, NFPA 79;
- d) The Standard for Low-Voltage Switchgear and Controlgear – Part 5-5: Control Circuit Devices and Switching Elements – Electrical Emergency Stop Device with Mechanical Latching Function, IEC 60947-5-5;
- e) The Safety of Machinery – Emergency Stop Equipment, Functional Aspects – Principles for Design, EN 418.

2.2.4 Transformers

2.2.4.1 Transformers shall comply with the Standard for Specialty Transformers, UL 506 or, the Standard for Low Voltage Transformers - Part 1: General Requirements, UL 5085-1 and the Standard for Low Voltage Transformers - Part 2: General Purpose Transformers, UL 5085-2.

2.2.5 Light sources and associated components

2.2.5.1 Lampholders and indicating lamps with integral lamp/lampholder (e.g. neon pilot lamp) shall comply with the Standard for Lampholders, UL 496, forming part of a luminaire that complies with an appropriate luminaire standard are considered to fulfill this requirement.

2.2.5.2 Lighting ballasts shall comply with the Standard for Fluorescent-Lamp Ballasts, UL 935, or the Standard for High-Intensity Discharge Lamp Ballasts, UL 1029. Ballasts forming part of a luminaire that complies with an appropriate luminaire standard are considered to fulfill this requirement.

2.2.5.3 LED Drivers shall comply with the Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

2.2.5.4 Light emitting diode (LED) light sources shall comply with the appropriate luminaire standard for the Luminaire type.

2.2.5.5 Luminaires used in system devices covered by this Standard shall comply with one or more of the following requirements:

- a) The Standard for Portable Electric Luminaires, UL 153;
- b) The Standard for Luminaires, UL 1598;
- c) The Standard for Low Voltage Lighting Systems, UL 2108;
- d) The Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products, UL 8750.

2.2.6 Overcurrent protection

2.2.6.1 Fuses shall comply with the Standard for Fuses – Part 1: General Requirements, UL 248-1, and the applicable subsequent part: The basic standard is UL 248-1, "Low-Voltage Fuses - Part 1: General Requirements," in addition to one of the following:

- a) The Standard for Low-Voltage Fuses – Part 3: Class CA and CB Fuses, UL 248-3;
- b) The Standard for Low-Voltage Fuses – Part 4: Class CC Fuses, UL 248-4;
- c) The Standard for Low-Voltage Fuses – Part 5: Class G Fuses, UL 248-5;
- d) The Standard for Low-Voltage Fuses – Part 6: Class H Nonrenewable Fuses, UL 248-6;
- e) The Standard for Low-Voltage Fuses – Part 8: Class J Fuses, UL 248-8;
- f) The Standard for Low-Voltage Fuses – Part 9: Class K Fuses, UL 248-9;
- g) The Standard for Low-Voltage Fuses – Part 10: Class L Fuses, UL 248-10;

h) The Standard for Low-Voltage Fuses – Part 12: Class R Fuses, UL 248-12; or

i) The Standard for Low-Voltage Fuses – Part 15: Class T Fuses, UL 248-15

2.2.6.2 Fuseholders shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and the applicable subsequent part. The basic standard in this category is UL 4248-1 in addition to one of the following:

a) The Standard for Fuseholders – Part 4: Class CC, UL 4248-4;

b) The Standard for Fuseholders – Part 5: Class G, UL 4248-5;

c) The Standard for Fuseholders – Part 6: Class H, UL 4248-6;

d) The Standard for Fuseholders – Part 8: Class J, UL 4248-8;

e) The Standard for Fuseholders – Part 9: Class K, UL 4248-9;

f) The Standard for Fuseholders – Part 12: Class R, UL 4248-12; or

g) The Standard for Fuseholders – Part 15: Class T, UL 4248-15.

2.2.6.3 Circuit breakers shall comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489.

2.2.6.4 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

2.2.7 Ground-fault circuit interrupters

2.2.7.1 Ground-fault circuit-interrupters (GFCI) for protection against electrical shock shall comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

2.2.8 Power supplies

2.2.8.1 Class 2 power supplies shall comply with the Standard for Class 2 Power Units, UL 1310.

2.2.8.2 Power supplies other than Class 2 shall comply with Standard for Power Units Other Than Class 2, UL 1012.

2.2.9 Supplemental insulation, insulating bushings and assembly aids

2.2.9.1 Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441.

2.2.9.2 Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

2.2.9.3 Wire positioning devices shall comply with the Standard for Positioning Devices, UL 1565, or the Standard For Safety For Cable Management Systems – Cable Ties For Electrical Installations, UL 62275.

2.2.9.4 Insulating bushings shall comply with the Standard for Insulating Bushings, UL 635. Tests specified in this standard (e.g. Strain Relief Test) shall be performed to confirm the combination of the insulating bushing and the supporting part are suitable for the intended use.

2.2.10 Gaskets and seals

2.2.10.1 Gaskets and seals shall comply with the Standard for Gaskets and Seals, UL 157.

2.2.11 Printed wiring boards

2.2.11.1 Printed wiring boards shall comply with the Standard for Printed-Wiring Boards, UL 796. Unless otherwise specified, the flammability class shall be that specified for insulating materials.

2.2.12 Conduit, Tubing, and Cable Fittings

2.2.12.1 Conduit, Tubing, and Cable Fittings shall comply with the Standard for Conduit, Tubing, and Cable Fittings, UL514B, and in addition the performance requirements as specified in section 26 of this outline.

2.2.12.2 Armored Cable (AC) shall comply with the Standard for Armored Cable, UL 4.

2.2.12.3 Metal-Clad Cable (MC) shall comply with the Standard for Metal-Clad Cables, UL 1569.

2.2.12.4 Tray Cable shall comply with the Standard for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members, UL 1277, or the Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable, UL 2277.

2.2.13 Cable trays

2.2.13.1 Nonmetallic Cable Trays shall comply with the Standard for Nonmetallic Cable Tray Systems, UL 568.

2.2.13.2 Metal cable trays shall comply with Article 392 of the National Electrical Code (NEC), NFPA 70.

3 Units of Measurement

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

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 definitions apply.

5.2 CABLE ASSEMBLY – A length of previously certified cable of a type specified within the National Electrical Code provided with a factory or field installed assembly of a male connector as a line connector and a female connector as a load fitting.

5.3 CABLE TAG (FLAG LABEL) – An adhesive backed label that is wrapped around the cable and secured to itself forming a flag that protrudes from the cable. A label without adhesive that is secured to the cable using a securement strap such as a cable tie is also considered a cable tag.

5.4 CABLE TAP CONNECTOR – A type of connector provided with a means to electrically connect to current carrying conductors within a cable without cutting the electrical conductors.

5.5 CAP – A device used to close off the contact openings of a female connector to prevent inadvertent contact with live parts and to maintain the environmental rating of the connector when not mated.

5.6 CONNECTOR – An insulated enclosure with male or female contacts intended for connection to or interconnection of electrical conductors.

5.7 CRIMP – A terminal in which an electro-mechanical connection is made between the terminal lug and a conductor by compressing the lug onto the conductors.

5.8 ENCLOSURE – That part of the device that renders inaccessible all or any parts of the device that otherwise present a risk of electric shock and contain propagation of flame initiated by electrical disturbances occurring within.

5.9 FEED-THROUGH CONNECTOR – A male and female device directly connected through the contacts. This device is not assembled on to a cable.

5.10 FEMALE CABLE CONNECTOR – A female contact device intended to be molded or assembled to the cable to make an electrical connection to the current carrying conductors.

5.11 FITTING – A means for securing conduit or cable to a connector, enclosure or raceway system.

5.12 GROUNDED CONDUCTOR – The circuit conductor that is intentionally grounded.

5.13 GROUNDING-CONDUCTOR PATH – An electrically conductive path between the grounding contact or terminal and earth ground.

5.14 INLET – A male contact device intended to be mounted on equipment where the conductors are internal to the equipment enclosure to provide an integral means for the connection of a female cable connector.

5.15 INSULATION, BASIC – Insulation applied to electrically energized parts to provide basic protection against a risk of electric shock. This insulation does not necessarily include insulation used exclusively for functional purposes.

5.16 INSULATION, FUNCTIONAL – The insulation necessary for the proper functioning of the connector and for basic protection against a risk of electric shock. This includes all parts relied upon to support live parts in place, all internal barriers necessary to maintain spacing, and the outlet face portion of all female connectors.

5.17 KEYED – A device constructed for connection to a mating connector only in the position that connects corresponding like poles of an electrical circuit.

5.18 MALE CABLE CONNECTOR – A male contact device intended to be molded or assembled to the cable to make an electrical connection to a female connector.

5.19 OUTLET – A female contact device intended for connection of utilization equipment.

5.20 PANEL-MOUNTED CONNECTOR – A connector provided with a means to secure to a panel or enclosure. These connectors may be provided with leads or terminals for connection within the enclosure.

5.21 RECEPTACLE OUTLET – An outlet that complies with the requirements in the Standard for Attachment Plugs and Receptacles, UL 498 and with the dimensional requirements of Wiring Devices-Dimensional Specifications, NEMA WD 6.

5.22 SMALL PARTS – A small part is considered to be not more than 0.122 in³ (2 cm³) in volume.

5.23 SPLITTER – A male connector that terminates in two or more female outlets.

5.24 TAP CONNECTOR – Connector provided with contacts for feed-through connection together with either a female connector to connect to a cable assembly or field wiring terminals to connect to a cable or flexible cord.

5.25 TERMINAL, INSULATION-DISPLACEMENT – A terminal having a contacting member that forces the conductor insulation aside and presses to contact the current-carrying conductor.

5.26 TERMINAL, PIN TYPE (INSULATION-PIERCING) – A terminal having a contact pin that punctures the conductor insulation to contact the current-carrying conductor.

5.27 TERMINAL, PRESSURE WIRE – A terminal that establishes a connection between one or more conductors and a terminal plate by means of mechanical pressure without the use of solder. The terminal is one of the following types:

a) CLAMP-TYPE – A 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 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.

5.28 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.

5.29 UNIT CONTAINER – The smallest carton, package, or container, in which a fitting or connector is packaged. A unit container may contain more than one fitting or connector if the devices are not intended to be removed from the container for individual sale.

CONSTRUCTION

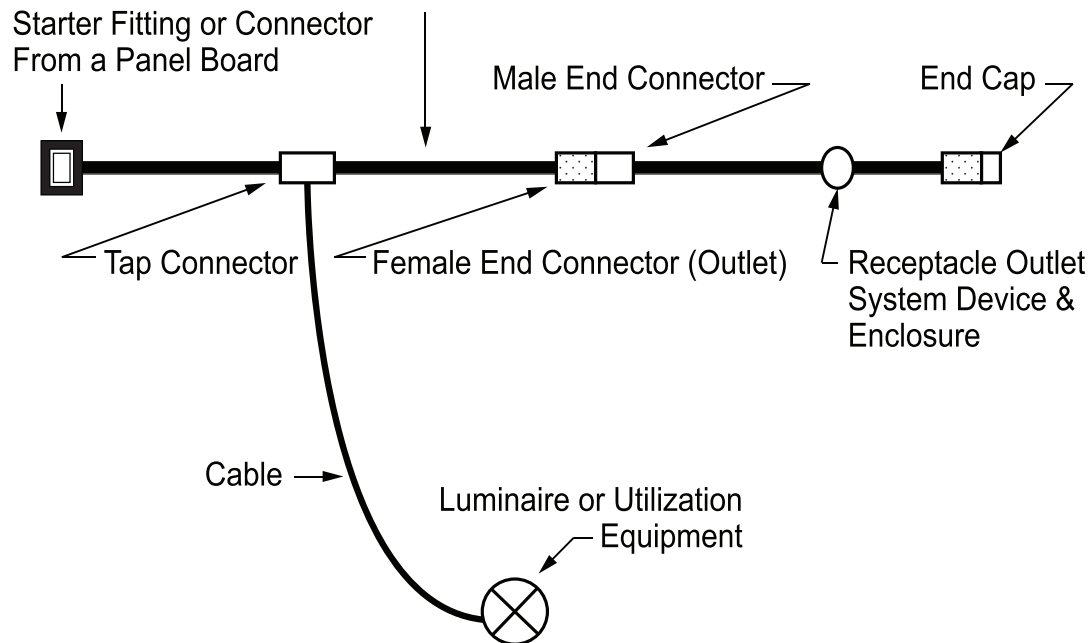
6 General

6.1 Connectors and system devices shall be sized for connection to conductors based on the branch circuit overcurrent device rating as required in the National Electrical Code, NFPA 70.

6.2 Systems provided with cable shall conform to the size requirements as specified in the National Electrical Code, NFPA 70.

6.3 Reduction in conductor size from the branch circuit conductor requirements in 6.1 and 6.2 shall only occur as allowed for the specific application as specified in the National Electrical Code, NFPA 70.

Figure 6.1
Typical system components



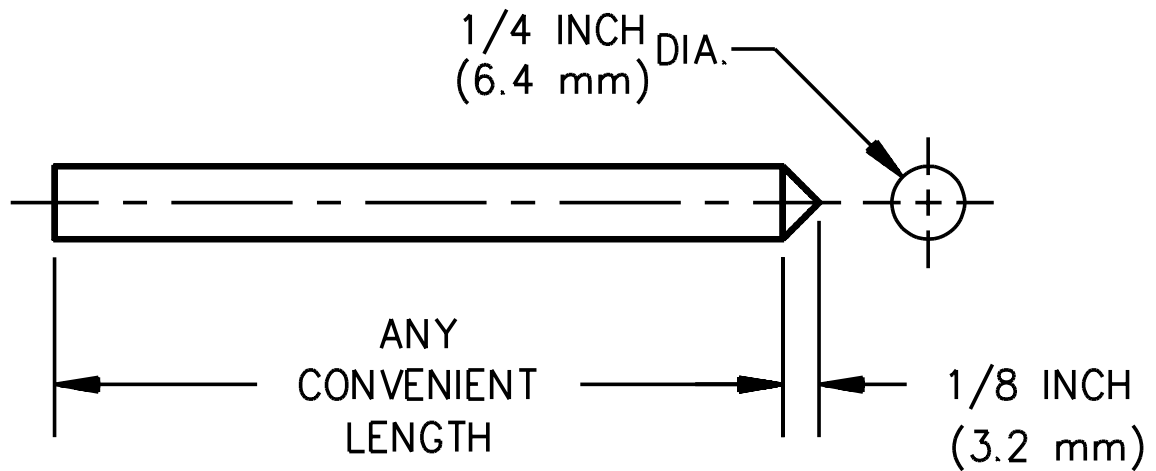
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7 Accessibility to Uninsulated Live Parts – Connector contact openings

7.1 Contacts and associated live parts in the contact opening of a female connector shall not be able to be contacted by the probe illustrated in Figure 7.1. The probe in Figure 7.1 is to be inserted point first as far as possible into the opening without distorting the perimeter of the opening.

Exception: A connector utilized with a capping system to close off an unmated connector is not required to comply with 7.1. The connector shall be marked as specified in 45.17.

Figure 7.1
Probe



PA190

8 System Device Enclosure Openings

8.1 Uninsulated live parts, other than connector contact openings as specified in Section 7 shall not be accessible to contact by the probe illustrated in Figure 8.1. The probe is to be applied with a force of 3 lbf (13.3 N). The probe is to be used as a measuring instrument to investigate the accessibility and not as an instrument to determine the strength of a material. The probe is to be rotated, changed in configuration, or angled; before, during, and after application to the opening.

8.2 An enclosure or portion of the enclosure shall be opened or removed if it can be opened or removed without the use of tools.

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9 Insulating Materials

9.1 General

9.1.1 A part that functions as electrical insulation or as an enclosure of a device shall be made of insulating material rated for the particular application.

9.1.2 Vulcanized fiber shall not be used as the sole support of live parts. Vulcanized fiber is acceptable for insulating washers, separators, and barriers. Vulcanized fiber shall comply with Moisture Absorption Resistance Test, Section 22.

9.1.3 Tubing used to enclose live parts shall have a flammability rating of VW-1 in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. The tubing shall be rated for voltage and temperature for the conditions of use.

9.1.4 A polymeric material used for electrical insulation or an enclosure 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.

9.2 Flammability

9.2.1 A polymeric material used for electrical insulation or enclosure of live parts shall have a flammability classification of HB, V-2, V-1, V-0, VTM-2, VTM-1, VTM-0, 5VA, or 5VB in accordance with 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 determined 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 No. 1: This requirement does not apply to a small part:

- a) With a volume that does not exceed 0.122 in³ (2 cm³);*
- b) With no dimension exceeding 1.18 in (3 cm); and*
- c) That is located such that the part does not propagate flame from one area to another or act as a bridge between a source of ignition and other ignitable parts.*

Exception No. 2: This requirement does not apply to fiber or similar material that is 0.010 inch (0.25 mm) or less thick.

Exception No. 3: A material that has been subjected to the horizontal or vertical burning test (bar sample testing) as described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, is not required to have a flame rating.

Exception No. 4: This requirement does not apply to devices rated 8 A or less and 30 V_{rms} (42 V_{peak}) or less when marked in accordance with 45.11.

Exception No. 5: A polymeric material is not required to have a flame rating for the thinnest measured thickness when the molded material complies with the 3/4 inch (12 mm or 20 mm) end-product flame tests described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

9.3 Electrical properties

9.3.1 Electrical cable connectors – general

9.3.1.1 A polymeric material used for electrical insulation or enclosure of live parts of a connector shall comply with 9.3.2 – 9.3.4.

Exception No. 1: The requirements in 9.3.2 – 9.3.4 do not apply to devices rated 8 A or less and 30 V (42 V_{peak}) or less.

Exception No. 2: Small parts that are made from polymeric or epoxy type materials that do not come into contact with live parts or are totally encapsulated due to their design and do not track between parts of opposite polarity and/or any other uninsulated metal parts of different polarities do not have to comply with the requirements of 9.3.2 – 9.3.4. A small part is considered to be not more than 0.122 in³ (2 cm³) in volume.

9.3.2 Comparative tracking index (CTI)

9.3.2.1 A polymeric material used for electrical insulation or enclosure of live parts of a connector shall have a comparative tracking index (CTI) performance level category (PLC) rating of 0, 1, 2, or 3 determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

Exception: A polymeric material used in over-mold applications to form the enclosure of live parts or within contact with live parts not to exceed 0.039 inch (1 mm) in length shall not require a comparative tracking index (CTI) rating.

9.3.3 Hot wire ignition (HWI)

9.3.3.1 A polymeric material used for electrical insulation or an enclosure of live parts of a connector shall have a hot wire ignition (HWI) performance level category (PLC) rating less than specified in Table 9.1 determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A. For a material with other than a VTM flammability classification, the acceptability of the material shall be determined using the material thickness employed in the end-use product or a nominal 1/8 inch (3.2 mm) thickness, whichever is greater. (The minimum thickness employed in the device which is critical to the functioning of the insulation of live parts.)

Exception No. 1: This requirement does not apply to the following:

- a) A polymeric material used in an enclosure of an attachment plug or cord connector; or*
- b) A polymeric material that encloses insulated live parts with an insulation thickness greater than 0.025 inch (0.5 mm).*

Exception No. 2: 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 Glow Wire Test in Section 40.

Table 9.1
Hot-wire ignition (HWI) ratings

Flammability Classification ^a	HWI ^b	
	Mean ignition time ^c s	PLC ^d
V-0, VTM-0	7 and up to 15	4
V-1, VTM-1, 5VA, 5VB	15 and up to 30	3
V-2, VTM-2	30 and up to 60	2
HB	30 and up to 60	2
^a Flammability classification – Determined in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.		
^b HWI – Hot wire ignition (HWI) determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.		
^c Mean ignition time is to be used to determine the acceptability of filament wound tubing, industrial laminates, vulcanized fiber, and similar polymeric materials only. All other materials are to be investigated using the performance level category values.		
^d PLC – performance level category.		

9.3.4 High-current arc ignition (HAI)

9.3.4.1 A polymeric material used for electrical insulation of live parts of a connector shall have a high-current arc ignition (HAI) performance level category (PLC) rating less than specified in Table 9.2 as determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A. For a material with other than a VTM flammability classification, the acceptability of the material shall be determined using the material thickness employed in the end-use product or a nominal 1/8 inch (3.2 mm) thickness, whichever is greater.

Exception No. 1: This requirement does not apply to the following:

- a) A polymeric material used in over-mold applications to form the enclosure of live parts; and*
- b) A polymeric material used within contact with live parts not to exceed 0.039 inch (1 mm) in length.*

Exception No. 2: A polymeric material used for electrical insulation or enclosure of live parts of a connector is not required to comply with this requirement if it complies with the High-Current Arc Resistance to Ignition Test in Section 41.