UL 962A

Furniture Power Distribution Units

UL Standard for Safety for Furniture Power Distribution Units, UL 962A

Second Edition

Dated December 22, 2008

Summary of Topics

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UL 962A

Standard for Furniture Power Distribution Units

First Edition - September, 2003

Second Edition

December 22, 2008

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at http://csds.ul.com.

INTRODUCTION

1 Scope

1.1 These requirements cover cord-connected, indoor use, furniture power distribution units (FPDU) that consist of single or multiple outlet wiring devices that provide power for and are intended to be installed in commercial or household (residential) portable or stationary furnishings only. These units provide outlet receptacle(s) for computers, audio and video equipment, and other equipment that is mounted on or in commercial or household (residential) portable or stationary furnishings. Furniture power distribution units may also be provided with fuses or other supplementary overcurrent protection, switches, suppression components, EMI filters, uninterruptible power supplies, and/or indicator lights in any combination, or connections for cable communications, telephone and/or antenna. FPDUs are intended to be directly connected to a permanently installed branch circuit receptacle. FPDUs are not intended to be series connected (daisy chained) to other FPDUs, relocatable power taps, or to extension cords.

1.2 These requirements cover products rated 250 V AC or less and 16 A AC or less.

1.3 These requirements do not cover products for use in fixed furnishings.

1.4 Furniture power distribution units are not intended to function as general use relocatable power taps.

1.5 A furniture power distribution unit that employs an electromagnetic interference filter shall also comply with the Standard for Electromagnetic Interference Filters, UL 1283.

1.6 A furniture power distribution unit that employs a transient voltage surge suppressor shall also comply with the Standard for Surge Protective Devices, UL 1449.

1.7 Telephone equipment and communication circuit protectors included in a furniture power distribution unit shall comply with the requirements in the Standard for Information Technology Equipment Safety - Part 1: General Requirements , UL 60950-1, and the requirements in the Standard for Secondary Protectors for Communications Circuits, UL 497A, respectively.

1.8 A furniture power distribution unit that incorporates an antenna discharge unit or provides antenna connections to a television, a high-voltage video product, or antenna shall comply with the applicable requirements in the Standard for Antenna-Discharge Units, UL 452, and the Standard for Audio-Video Products and Accessories, UL 1492.

1.9 A cord-connected product that employs ground-fault protection shall comply with the requirements in the Standard for Ground-Fault Circuit Interrupters, UL 943.

1.10 A product that employs an uninterruptible power supply shall comply with the requirements in the Standard for Uninterruptible Power Systems, UL 1778.

2 Components

2.1 Except as indicated in 2.2, a component of products covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components used in the products covered by this standard.

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 standard, or

b) Is superseded by a requirement in this standard.

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

3.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms).

4 Undated References

4.1 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.

5 Glossary

5.1 For the purpose of this standard the following definitions apply.

5.2 FIXED FURNISHING - A furnishing that is provided with a means for permanent connection to the power supply and is not intended to be moved.

5.3 FURNITURE POWER DISTRIBUTION UNIT (FPDU) - A furniture power distribution unit consists of an attachment plug cap and a length of flexible cord terminated in an enclosure in which are mounted one or more receptacles. This unit is able to include power, phone, data, or video connectors. These units provide outlet receptacle(s) for computers, audio and video equipment, and other equipment. They may also be provided with fuses or other supplementary overcurrent protection, switches, suppression components, EMI filters, uninterruptible power supplies, and/or indicator lights in any combination, or connections for cable communications, telephone and/or antenna.

5.4 OVERCURRENT PROTECTION (OCP) DEVICE - A supplementary protection device provided within a furniture power distributions unit that provides overcurrent and short-circuit protection. It is not intended to be a substitute for branch circuit protection.

5.5 PORTABLE FURNISHING - A cord-connected furnishing capable of being easily moved by hand from place to place in normal use.

5.6 STATIONARY FURNISHING - A cord-connected furnishing that is intended to be fastened in place or located in a dedicated space.

5.7 SUPPLEMENTARY PROTECTION DEVICE - A device intended for use as overcurrent, over-temperature, or over- or under-voltage protection within a FPDU where branch circuit overcurrent protection is already provided.

CONSTRUCTION

6 Enclosure

6.1 General

6.1.1 The enclosure shall be formed and assembled so that it has the strength and rigidity required to resist the abuses to which it is subjected, without resulting in a risk of fire, electric shock, or injury to persons, due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts or other serious defects.

6.1.2 An opening in an enclosure shall have such size and shape - or shall be so covered by screening or barrier or by an expanded, perforated, or louvered panel - that a test rod having a maximum diameter of 1/16 in (1.6 mm) shall be prevented from contacting live parts. See Accessibility Test, Section 37.

6.1.3 A keyhole slot, notch, or similar means for mounting, when provided, shall be located so that the supporting screws or the like cannot damage any electrical insulation or reduce spacings to live parts.

6.1.4 A barrier that covers a mounting hole and thereby forms part of the required enclosure shall be subjected to the Mounting Hole Barrier Tests, Section 37.

6.2 Metallic

6.2.1 A metal enclosure of a FPDU shall have a minimum thickness in accordance with Table 6.1.

Table 6.1

Minimum thicknesses of enclosure metal

Metal	At small, flat unreinforced surfaces and at surfaces of a shape or size to provide adequate mechanical strength		At relatively larger unreinforced flat surfaces	
	inch	(mm)	inch	(mm)
Die-cast metal	3/64	1.2	5/64	2.0
Cast malleable iron	1/16	1.6	3/32	2.4
Other cast metal	3/32	2.4	1/8	3.2
Uncoated sheet steel	0.026	0.66	0.026	0.66
Galvanized sheet steel	0.029	0.74	0.029	0.74
Nonferrous sheet metal	0.036	0.91	0.036	0.91

6.3 Nonmetallic

6.3.1 A polymeric enclosure of a FPDU for use in a portable furnishing shall comply with the flammability requirements in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C, for non-attended, non-intermittent duty portable equipment and shall be marked in accordance with 42.15.

6.3.2 A polymeric enclosure of a FPDU for use in a stationary furnishing shall comply with the flammability requirements in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C, for stationary equipment.

6.3.3 The enclosure shall comply with the strain relief, impact, crush and mold stress-relief test requirements of Sections 30, 32, 33 and 35 respectively, of this standard.

7 Mechanical Assembly

7.1 A FPDU shall be formed and assembled so as to reduce the risk of contact with any sharp edges, fins, burrs or the like that are capable of increasing the risk of injury to persons, or abrade the insulation on conductors or otherwise damage wires.

7.2 A switch, a lampholder, a power-supply cord and its strain-relief bushing, receptacle, or similar component shall be mounted securely and, except as noted in 7.3 and 7.4, shall be restrained from turning. See 7.5.

7.3 The requirement that a switch be restrained from turning is capable of being waived when all of the following conditions are met:

a) The switch is to be of the plunger or other type whose actuator does not tend to rotate when operated (the actuator of a toggle or rocker switch is considered to be subject to forces that tend to turn the switch during operation of the switch).

b) The means of mounting the switch makes it unlikely that operation of the switch loosens it.

c) The spacings are not to be reduced below the minimum acceptable values when the switch rotates.

7.4 A lampholder of a type in which the lamp is not intended to be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, is not required to be restrained from turning when the rotation is not capable of reducing spacings below the minimum acceptable values.

7.5 The means by which the turning specified in 7.2 is prevented is to include more than friction between surfaces. For example, a lockwasher, properly applied, is not prohibited from being used as a means to restrain turning of a device having a single-hole mounting means.

8 Accessibility of Live Parts

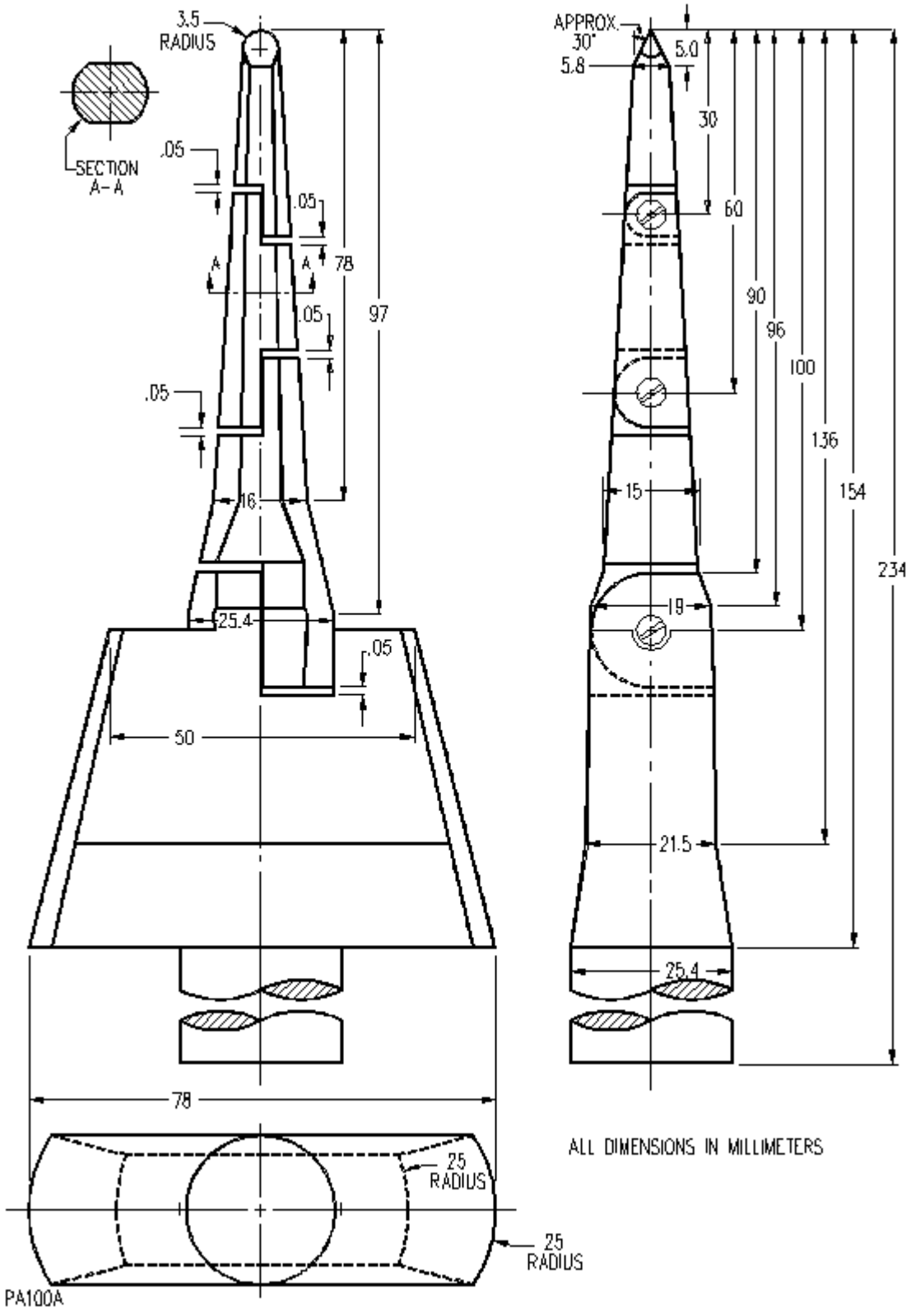
8.1 The electrical parts of a FPDU that do not require use of a tool for access shall be located or enclosed so that persons are protected against inadvertent contact with uninsulated live parts and film-coated magnet wire.

8.2 An opening in the enclosure of a FPDU is not prohibited when an uninsulated live part or film-coated magnet wire is not capable of being contacted by the probe shown in Figure 8.1. The probe shall be applied to any depth that the opening permits, and shall be rotated or angled before, during, and after insertion through the opening to any position that is required to examine the enclosure. The probe shall be applied in any possible configuration; and, when required, the configuration shall be changed after insertion through the opening.

8.3 The probe shall be used as a measuring instrument to evaluate the accessibility provided by an opening, and not as an instrument to evaluate the strength of a material; it shall be applied with the minimum force required to determine accessibility in accordance with the Accessibility Test, Section 37.

Figure 8.1

Accessibility probe



9 Mounting Means

9.1 A FPDU shall be provided with a mounting means.

9.2 The mounting means shall comply with Section 30, Mounting Hole Barrier Test, and Section 35, Adequacy of Mounting Test.

9.3 Adhesive may be used to secure a FPDU when the adhesive complies with the Specialized Applications - General Adhesives, Functional Analysis, and Program of Investigation for Adhesives in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C. When performing the adhesive investigations, the maximum force for the Program of Investigation - End-Product Evaluation of UL 746C shall be the weight of the FPDU. When a suitable adhesive is used to mount the FPDU, the Adequacy of Mounting test is not required to be conducted.

10 Corrosion Protection

10.1 Iron and steel parts or other parts not inherently corrosion resistant shall be protected against corrosion by painting, enameling, galvanizing, plating, or other equivalent means.

Exception: This requirement does not apply to minor parts of iron or steel, such as washers, screws and the like that are not in the grounding conductor path.

11 Insulating Materials

11.1 A barrier or integral part, such as an insulating washer or bushing, and a base or support for the mounting of live parts, shall be of a moisture-resistant material that will not be damaged by the temperature and stresses to which it will be subjected under conditions of actual use.

11.2 An insulating material is to be investigated with regard to its acceptability for the application in accordance with the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C. Materials, such as mica, ceramic, or some molded compounds are capable of being used as the sole support of live parts. When it is required to investigate a material to determine its acceptability, consideration is to be given to such factors as its mechanical strength, resistance to ignition sources, dielectric strength, insulation resistance, and heat-resistant properties in both the aged and unaged

conditions, the degree to which it is enclosed, and any other features affecting the risk of fire and electric shock.

11.3 Vulcanized fiber, industrial laminates, polymeric films or similar materials are capable of being used for insulating bushings, washers, separators, and barriers, but not as sole support for uninsulated live parts. Hard rubber is not to be used.

Exception: Industrial laminates that have been investigated for the purpose are capable of being used as sole support for uninsulated live parts.

12 Power-Supply Cord

12.1 General

12.1.1 The power-supply cord shall be of the grounding type and shall employ one of the following flexible cord Types: SJ, SJE, SJO, SJT, SJTO, or equivalent.

Exception: SPT-3 is not prohibited from being used on a FPDU rated 12 A or less when marked in accordance with 42.14.

12.1.2 A detachable power-supply cord shall not be used.

12.1.3 The minimum conductor size of the power-supply cord shall be as indicated in Table 12.1.

12.1.4 The length of a power-supply cord - as measured from the outside surface of the enclosure of the FPDU to the plane of the face of the attachment plug - shall not exceed 25 ft (7.6 m) nor be less than 3 ft (0.9 m).

12.1.5 A power-supply cord shall have a voltage rating not less than the rated

voltage of the FPDU and have an ampacity not less than the current rating of the FPDU.

Table 12.1

Guide to construction and performance requirements for furniture power distribution units

FPDU rating (A)	Minimum power cord size (AWG)	Number of receptacles	Supplementary OCP required?	Supplementary OCP rating[a] (A)	Temperature test load (A)	Minimum internal wiring size[b] (AWG)
13 - 16	12	<6	NO	20[c]	20	12
13 - 16	12	≥6	YES	20	20	12
12	14	<4	NO	15[c]	15	14
12	14	≥4	YES[g, h]	15	15	14
<12	14	<4	NO	15[c,d]	15[e,f]	14
<12	14	≥4	YES	15[d]	OCP[f]	14

[a] OCP shall not trip when the FPDU is operated at the FPDU marked rated current.

[b] Smaller AWG is not prohibited from being used when an OCP is provided and the results of the Temperature Test (Section 23), the Fault Current Test (Section 27), and the Overcurrent Test (Section 28) comply with the requirements of those tests using the smaller AWG wire.

[c] When provided with an OCP.

[d] Maximum rating. An OCP rated less than 12 A and not less than the FPDU rating complies with the intent of this requirement. See note (a) above.

[e] Test is capable of being conducted at OCP rating when provided.

[f] When the OCP rating is greater than the FPDU rating, conduct the Temperature Test at the OCP rating. The OCP is not prohibited from being bypassed when nuisance tripping occurs. See 23.3.

[g] An OCP is not required for a 12 A FPDU with four receptacles as long as:

a) Internal wiring is 12 AWG;

b) The power-supply cord is 12 AWG;

c) All other components are evaluated for use at 20 A; and d) The Temperature Test load is 20 A.
[h]An OCP is not required for a household (residential) 12 A FPDU with four receptacles and 16 AWG power supply cord as long as: a) Internal wiring is 16 AWG; b) The power-supply cord is 16 AWG; c) All other components are evaluated for use at 15 A; d) The Temperature Test load is 15 A. e) The FPDU is marked in accordance with 42.16.

12.1.6 The power-supply cord shall not include a through-cord switch.

12.2 Bushings

12.2.1 Where the power-supply cord passes through an opening in the enclosure, a smooth, well-rounded surface shall be provided to protect the cord from damage.

12.3 Strain Relief

12.3.1 Strain relief shall be provided so that a mechanical stress on a power-supply cord is not transmitted to terminals, splices, or interior wiring. See Strain Relief Test, Section 30.

12.3.2 The strain relief means shall not damage the insulation or cord jacket. The normal compressive deformation inherent in providing strain relief is not considered to be damage.

12.4 Push Back Relief

12.4.1 Means shall be provided to prevent the supply cord or lead from being pushed into the enclosure of an appliance through the cord-entry hole when such displacement results in:

a) Subjecting the supply cord or lead to mechanical damage;

b) Exposing the supply cord or lead to a temperature higher than that for which it is rated;

c) Reducing spacings (such as to a metal strain-relief clamp) below the minimum required values; or

d) Damaging internal connections or components.

To determine compliance, the supply cord or lead shall be tested in accordance with Section 31, Push Back Relief Test.

13 Receptacles

13.1 The receptacle outlets of a FPDU shall have a current rating of 15 or 20 A and a voltage rating of 125 or 250 V. The contact components of a receptacle shall have a voltage and current rating equal to that of the attachment plug on the power-supply cord.

Exception: A 15 A receptacle is not prohibited from being used with a FPDU rated 16 A with a 20 A attachment plug.

13.2 All of the receptacle outlets of a FPDU shall have the same current rating and shall be of the grounding type. They are not prohibited from being of the same or different slot configurations (locking and non-locking).

13.3 The receptacle outlets of a FPDU shall comply with the applicable requirements in the Standard for Attachment Plugs and Receptacles, UL 498. The grounding contact of the receptacle shall comply with the requirements of the Grounding Contact Test in UL 498.

13.4 The receptacle outlets of a FPDU that also incorporates terminals for coaxial cable (TV/CATV) connection shall be marked in accordance with 42.13.

13.5 A FPDU intended to be mounted on or inside a desk or similar furnishing surface shall be covered or otherwise protected from spillage while not in use and shall comply with the Spill Test, Section 36.

Exception: When the intended use of the FPDU is for it to be mounted above the furnishing surface and oriented such that spilled liquid on the furnishing surface cannot enter any part of the FPDU, these requirements do not apply.

13.6 A FPDU shall be provided with a maximum of eight receptacles.

Exception: A FPDU is able to be provided with more than eight receptacles when the FPDU is provided with a circuit breaker that complies with the requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489, and is in accordance with the National Electrical Code, ANSI/NFPA 70 branch circuit protection.

14 Supplementary Protection

14.1 A FPDU shall be provided with supplementary overcurrent protection as indicated in Table 12.1.

14.2 A supplementary protection device shall not open during the Temperature Test, Section 23.

14.3 A supplementary overcurrent protection device shall be capable of clearing a fault current of not less than that indicated in Table 14.1 and shall comply with the requirements in the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077. The supplementary overcurrent protection device shall have been subjected to the Overload Test in UL 1077, tested for motor starting at 6 times the AC full load current rating.

Exception No. 1: A fuse that is capable of clearing a fault current of not less than that indicated in Table 14.1, and that complies with the requirements in the Standard for Low-Voltage Fuses - Part 14: Supplemental Fuses, UL 248-14, is not prohibited from being used as a supplementary overcurrent protection device.

Exception No. 2: A circuit breaker that complies with the requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489, and is in accordance with the National Electrical Code, ANSI/NFPA 70 for branch circuit protection, is not prohibited from being used in lieu of a supplementary overcurrent protection device.

14.4 A supplementary overcurrent protection device shall be capable of clearing a fault current of not less than that indicated in Table 14.1 and shall comply with the requirements in the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077. The supplementary overcurrent protection device shall have been subjected to the Overload Test in UL 1077, tested for motor starting at 6 times the AC full load current rating.

Exception No. 1: A fuse that is capable of clearing a fault current of not less than that indicated in Table 14.1, and that complies with the requirements in the Standard for Low-Voltage Fuses - Part 14: Supplemental Fuses, UL 248-14, is not prohibited from being used as a supplementary overcurrent protection device.

Exception No. 2: A circuit breaker that complies with the requirements in the Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures, UL 489, and is in accordance with the National Electrical Code, ANSI/NFPA 70 for branch circuit protection, is not prohibited from being used in lieu of a supplementary overcurrent protection device.

14.5 The overcurrent protective device shall be a supplementary protector of the automatic-trip-free, manual-reset type or a replaceable fuse installed in an extractor type fuse holder. An FPDU that is provided with fuses that are intended to be replaced in the field shall be marked in accordance with the requirements in 42.10.

14.6 A single-pole supplementary protection device shall be connected in the ungrounded (line) conductor of the supply circuit only. A double-pole device shall be connected on both the ungrounded and grounded (neutral) conductors such that when it operates, it opens both ungrounded and grounded conductors.

14.7 A supplementary protection device shall not be connected in the grounding conductor.

14.8 The ampere rating of the overcurrent protective device of 15.2 shall not be greater than the ampacity of:

a) The configuration of the receptacles it is to protect; or

b) That of the power-supply cord; or

c) Other electrical components, whichever is lower.

Exception: See note (g) of Table 12.1.

14.9 When a single overcurrent protective device does not protect all receptacle outlets, more than one overcurrent protective device shall be used, and each receptacle outlet shall be marked to indicate the rating of the overcurrent protective device connected to it. See 42.7.

14.10 Thermal cutoff devices, thermal relays, and similar devices, shall not be used as supplementary overcurrent protection devices.

Table 14.1

Circuit capacity of supply source

Rating (VA)	Available fault current (A)
1875 or less	1000
More than 1875 to 3750	2000
More than 3750	3500

15 Switches

15.1 Each switch shall have a voltage and current rating not less than the load it is intended to control. A switch shall open all ungrounded circuit conductors and, in addition, is not prohibited from opening the grounded circuit conductor.

15.2 A switch provided in a FPDU shall comply with the requirements of the Standard for Special-Use Switches, UL 1054 or the Standard for Switches for Appliances - Part 1: General Requirements - UL 61058-1. The switch shall be

rated for use with other than resistive (Res), AC Tungsten filament lamp (L), or AC and DC Tungsten filament lamp (T) loads.

Exception: A switch that complies with the requirements of the Standard for General-Use Snap Switches, UL 20, for a general-use AC switch is not prohibited from being used in a FPDU.

UL 1054 will be withdrawn on June 23, 2015

15.3 Each switch shall indicate to the user when its associated circuit is energized. See 42.9.

Exception: A FPDU is not prohibited from being equipped with indicator or pilot lights, such as neon-series-resistor, LED type, or similar items, to show which receptacles are live, or to indicate that the unit is energized.

16 Live Parts

16.1 Current-carrying parts shall have adequate ampacity, and shall be of copper, a copper-base alloy, or other material determined to be acceptable for the use.

16.2 Uninsulated live parts shall be secured to the base or mounting surface so that they do not turn or shift in position, when such motion results in a reduction of spacings below the minimum acceptable values.

16.3 Friction between surfaces is not to be used as the sole means to prevent shifting or turning of live parts. A lockwasher is not prohibited from being used in such a manner.

17 Internal Wiring

17.1 The internal wiring of a FPDU shall be rated for the voltage, temperature, and other conditions of use as indicated in Table 12.1.

17.2 Internal wiring shall be routed and secured to reduce the risk of mechanical damage to the insulation or stress on wiring terminations. The internal wiring shall be positively routed away from any exposed screw threads.

17.3 Screw threads, including those of sheet metal screws, shall not be exposed for more than 3/16 in (4.76 mm) inside a compartment containing wiring and shall be located so that contact with conductor insulation is unlikely.

17.4 Metal clamps and guides used for routing wiring shall have smooth, well-rounded edges.

17.5 A hole through which insulated wires pass through a sheet-metal wall within the overall enclosure of a FPDU shall be provided with a smooth, well rounded bushing or any surfaces upon which the wire can bear shall be smooth and well-rounded.

17.6 All splices and connections shall be mechanically secure and shall provide sufficient ampacity. A soldered connection shall be made mechanically secure before being soldered.

Exception: Printed-wiring board joints are not required to be mechanically secure before soldering.

17.7 A lead is considered to be mechanically secure when it is:

a) Wrapped at least halfway (180 degrees) around a terminal;

b) Provided with at least one right angle bend when passed through an eyelet or opening; or

c) Twisted with other conductors.

17.8 A splice shall be provided with insulation at least equivalent to the conductor insulation.

17.9 In determining whether splice insulation consisting of coated-fabric,

thermoplastic, or another type of tape or tubing is capable of being used, consideration is to be given to such factors as mechanical strength, dielectric properties, heating and moisture-resistant characteristics, and the equivalent.

17.10 Where stranded wiring is connected to a wire-binding screw, the construction shall be such that any loose strand of wire is prevented from contacting live parts of opposite polarity or dead metal parts that may be grounded. This can be accomplished by use of upturned lugs on the terminal plate, pressure terminal connectors, soldering lugs, crimped eyelets, or equivalent means.

17.11 Soldered stranded (bunch tinned/solder dipped/tinned bonded) wire shall not be used with the terminals of a receptacle unless the receptacle has been investigated for such use.

18 Spacings

18.1 The spacings of a FPDU shall comply with the requirements of Table 18.1.

Exception: The spacings between the live parts of a receptacle or switch and the intended mounting surface for the receptacle or switch shall not be less than 3/64 in (1.2 mm).

18.2 A barrier or liner of insulating material used in areas where spacings do not comply with the requirements in this standard shall be evaluated and determined to comply with the requirements for internal barriers outlined in the Standard for Polymeric Materials - Use in Electrical Equipment Evaluations, UL 746C, and shall be secured in place or its position fixed by space limitations. An adhesive used to position a barrier shall be investigated for the effects of temperature, humidity, and cyclic conditions outlined in UL 746C.

Table 18.1

Minimum spacings

Potential involved in volts	Minimum spacing, inch (mm)

		51 - 125		126 - 250	
Between any uninsulated live part and an uninsulated live part of opposite polarity, uninsulated grounded part other than the enclosure, or exposed metal part[b]	Through air	1/16	1.6	3/32	2.4
	Over surface	1/16	1.6	3/32	2.4
Between any uninsulated live part and the walls of a metal enclosure[b]	Shortest distance	1/4	6.4	1/4	6.4
[a] A printed-wiring board intended to be completely encapsulated in a suitable potting compound, epoxy, or be conformally coated shall not have any spacing less than 1/32 in (0.8 mm).					
[b] For the purpose of this requirement, a metal piece or component attached to the enclosure is considered to be a part of the enclosure when deformation of the enclosure reduces the spacing between the metal piece or component and uninsulated live parts.					

18.3 Vulcanized fiber not less than 0.028 in (0.71 mm) thick is not prohibited from being used as a barrier or liner.

Exception: Where required spacings are insufficient but at least 1/2 of the required spacing is provided, the vulcanized fiber is not prohibited from being 1/64 in (0.40 mm) thick.

19 Printed-Wiring Boards

19.1 A printed-wiring board shall comply with the requirements in the Standard for Printed-Wiring Boards, UL 796, including direct support criteria, and shall be classed V-0, V-1, or V-2 in accordance with the requirements in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

19.2 A resistor, capacitor, inductor, or other part that is mounted on a printed-wiring board to form a printed-wiring assembly shall be secured to reduce the risk of electric shock or fire as the result of displacement from forces exerted on it during assembly, normal operation, or servicing.

19.3 A FPDU that has a receptacle grounding path through traces on a

printed-wiring board shall comply with the Fault Current Test, Section 27, and the Overcurrent Test, Section 28.

19.4 A FPDU that has a load-current-carrying circuit conductor path through traces on a printed-wiring board shall comply with the Overcurrent Test, Section 28.

20 Separation of Circuits

20.1 Electrical wiring of a FPDU and wiring of communication circuits shall be separated by a permanent barrier or a 2 in (50.8 mm) spacing including lead dress.

Exception No. 1: Conductors that are suitably insulated for the maximum AC power circuit voltage involved are not required to be separated from the AC power circuit conductors, when breakage or loosening of a conductor at a terminal in either circuit cannot result in contact between uninsulated parts of one circuit and uninsulated or inadequately insulated parts of the other circuit.

Exception No. 2: For conductors other than AWM (traces on a printed-wiring board, terminals mounted on insulating blocks, and the like), the minimum separation between communication circuits and the AC power circuits shall be in accordance with Table 18.1.

21 Grounding

21.1 General

21.1.1 A metallic enclosure and other dead metal parts that are exposed to contact by persons shall be conductively connected to the grounding conductor of the power-supply cord.

Exception No. 1: Dead metal parts that are isolated from grounded metal and are not a part of the enclosure are not required to be connected to the grounding conductor of the power-supply cord.

Exception No. 2: A small metal part, such as an adhesive-attached foil label, a screw, or the like, that is on the exterior of the enclosure and separated from all electrical components by grounded metal or is electrically isolated from all components, is not required to be connected to the grounding conductor of the power-supply cord.

21.1.2 A FPDU having a 125/250 V rating shall not use the neutral circuit conductor as the equipment-grounding conductor.

21.1.3 The conductive connection of parts required by 21.1.1 shall be by a clamp, bolt, screw, braze, weld or an equivalent positive means that cannot be loosened from the outside and may include a corrosion resistant strap or jumper; see 21.2.2. Mechanical connections shall be secured. A solder connection is not prohibited from being used when the power-supply cord grounding lead is mechanically secure to the enclosure in accordance with 17.7. A push-in (screwless), quick-connect, or similar friction-fit connector shall not be used for this connection.

21.1.4 Connections in the equipment-grounding conductor path from the receptacle grounding contact to the equipment-grounding conductor of the power-supply cord shall be welded, bolted, mechanically secured and soldered, or made by equivalent positive means. A quick-connect, or similar friction-fit connector shall not be used in the grounding conductor path.

21.1.5 The equipment-grounding conductor of the power-supply cord shall be green with or without one or more yellow stripes and of the same size as the current-carrying conductors. No other lead in the power-supply cord shall be so identified. The equipment-grounding conductor shall be secured to the frame or enclosure of a metallic FPDU by a reliable means, such as a screw, that is not removed during ordinary servicing not involving the power-supply cord. The grounding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel. All conductors in the grounding circuit of a FPDU shall be green with or without one or more yellow stripes.

21.1.6 The yoke or faceplate mounting screws of the receptacle shall not be used to provide or maintain the grounding means of the receptacle or enclosure of a FPDU.

21.1.7 When a receptacle used in a FPDU is provided with a grounding screw, this screw shall be used to provide the ground connection to the receptacle.

21.1.8 An equipment-grounding conductor shall be of copper, copper alloy, or other material that has been investigated for use as an electrical conductor. A ferrous metal part in the grounding path shall be protected against corrosion.

21.1.9 A copper-base-alloy rivet that is used to secure parts in the grounding path, or that forms a part of the grounding path, shall contain not less than 80 percent copper.

21.1.10 The line and neutral circuit conductor path shall not be connected to the grounding circuit conductor path.

Exception: Connection between the line or neutral conductor path and the grounding conductor path are able to be made when the components are investigated for the application (such as an across-the-line capacitor investigated to the Standard for Capacitors and Suppressors for Radio- and Television-Type Appliances, UL 1414, or such as a transient voltage surge suppressor investigated to the Standard for Surge Protective Devices, UL 1449).

21.2 Bonding

21.2.1 Accessible dead-metal or other conductive parts that become energized and not connected directly to the grounding conductor shall be bonded to grounded parts by clamps, rivets, bolts, screws, brazes, welds, or an equivalent positive means that is capable of including a corrosion-resistant strap or jumper.

21.2.2 A corrosion-resistant bonding strap or jumper providing positive electrical connection is capable of being used.

21.2.3 A bonding conductor shall be of copper, copper alloy, aluminum or other material that has been investigated for use as an electrical conductor. A ferrous metal part in the grounding path shall be protected against corrosion.

21.2.4 Metal parts in a bonding path shall be galvanically compatible so as to reduce electrolytic action between dissimilar metals.

21.2.5 A bonding member shall:

a) Be protected from mechanical damage;

b) Not be secured by a removable fastener used for any purpose other than bonding unless the bonding conductor is not omitted after removal or replacement of the fastener; and

c) Have the flexibility required to withstand mechanical stress.

21.2.6 When a bonding means depends on screw thread, two or more screws shall be employed, or at least two full threads of a single screw shall engage metal.

21.2.7 A bonding connection shall penetrate a nonconductive coating such as paint.

21.2.8 A bonding conductor shall not be spliced.

PERFORMANCE

22 General

22.1 When the use of cheesecloth is specified, the cloth to be used is to be a bleached cheesecloth running 14 - 15 yd^2/lb (approximately 26 - 28 m^2/kg) and having what is known as "a count of 32 by 28," that is, for any square inch, 32 threads in one direction and 28 threads in the other direction (for any square centimeter, 13 threads by 11 threads).

22.2 A FPDU shall be subjected to the applicable tests specified in Sections 23 - 35. A separate sample shall be used for each test. Additional samples may

be required for investigations of constructions, such as nonmetallic enclosures or components, that are not covered by this standard.

22.3 For tests in which the FPDU is to be connected to a power-supply circuit, the branch circuit shall be protected by a branch-circuit protective device rated 20 A, and the power-supply voltage is to be the voltage rating of the FPDU.

22.4 The frequency of the power-supply circuit is to be 50 - 60 Hz.

23 Temperature Test

23.1 A FPDU shall be subjected to the temperature test described in 23.2 - 23.14.

23.2 An overcurrent protective device shall not open the circuit during the temperature test specified in 23.4.

23.3 When the OCP rating is greater than the FPDU rating, the temperature test as described in this section is to be conducted at the OCP rating.

23.4 The temperature of a FPDU, tested under the conditions of Table 12.1 shall not adversely affect any materials employed, or exceed the temperatures indicated in Table 23.1.

Table 23.1

Maximum temperatures

Materials and components	°C	°F
1. Varnished-cloth insulation	85	185
2. Fiber, wood, and other similar electrical insulation	90	194
3. Phenolic composition employed as electrical insulation or as a part whose malfunction would result in a risk of fire or electric shock	150[a]	302[a]

4. Insulated wires and cables		60[a]	140[a]
5. On the surface of a capacitor casing:			
	Electrolytic	65[b]	149[b]
	Other types	90[b]	194[b]
6. Receptacle contacts		55	135
7. Fuses other than Class CC, G, J, T		90	194
8. Fuses Class CC, G, J, T		110	230
NOTE - See 23.7.			
[a] The limitations on phenolic composition and on wire insulations do not apply to compounds that have been investigated and determined to be in compliance for higher temperatures.			
[b] A capacitor operating at a temperature higher than indicated is not prohibited from being evaluated on the basis of its marked temperature rating, or when not marked with a temperature rating, is capable of being investigated to determine its compliance at the higher temperature.			

23.5 The FPDU shall be loaded to the rated voltage and current by connecting a resistive load by means of a solid-blade attachment plug to the last receptacle and any other receptacle that attains higher temperatures as determined by their proximity to heat-producing components.

23.6 Measurements are to be made until there is thermal equilibrium as demonstrated by three successive temperature readings indicating no change taken at intervals of 5 min, or more.

23.7 The temperatures specified in Table 23.1 are based on an assumed ambient temperature of 25°C (77°F). A test is capable of being conducted at an ambient temperature within the range of 10 - 40°C (50 - 104°F), and the observed temperature corrected for a room temperature of 25°C (77°F).

23.8 During a test conducted at an ambient temperature of 25°C (77°F), an

observed temperature shall not exceed the required values specified in Table 23.1 and Table 23.2.

Table 23.2

Maximum surface temperatures

Location	Composition of surface	
	Metal	Nonmetallic
Enclosure surface that is contacted in normal use	70°C (158°F)	95°C (203°F)

23.9 When a test is conducted at an ambient temperature other than 25°C (77°F), an observed temperature shall be corrected as described in 23.10.

23.10 An observed temperature is to be corrected by addition [when the ambient temperature is lower than 25°C (77°F)], or subtraction [when the ambient temperature is higher than 25°C (77°F)] of the difference between 25°C (77°F) and the ambient temperature.

23.11 Temperature readings are to be obtained by means of thermocouples consisting of No. 28 - 32 AWG (0.08 - 0.032 mm^2) iron and constantan wires. Number 30 AWG (0.05 mm^2) iron and constantan wires and a potentiometer-type of indicating instrument are to be used whenever referee temperatures are required.

23.12 The thermocouples and related instruments are to be accurate and calibrated in accordance with good laboratory practice. The thermocouple wire is to conform to the requirements listed in the Initial Calibration Tolerances for Thermocouples table in Temperature Measurement Thermocouples, ANSI/ISA MC96.1.

23.13 A thermocouple junction and the adjacent thermocouple lead wire are to be securely held in good thermal contact with the surface of the material whose temperature is being measured. In most cases, acceptable thermal contact results from securely taping or cementing the thermocouple in place but, when a metal surface is involved, brazing or soldering the thermocouple to the metal may be required.

23.14 To facilitate conducting the test on a totally enclosed - encapsulated - component of a FPDU, thermocouples are to be attached to internal components prior to the addition of potting materials and are to be routed through holes made in the enclosure for this purpose.

24 Dielectric Voltage-Withstand Test

24.1 A FPDU shall withstand a potential as follows:

a) For FPDU's rated 125 V AC or less- 1250 V AC or 1768 V DC;

b) For FPDU's rated 250 V AC or less- 1500 V AC or 2121 V DC,

between uninsulated live metal parts and the enclosure - a nonconductive enclosure is to be wrapped in conductive foil - and between live parts of opposite polarity.

24.2 To determine whether a FPDU complies with the requirements in 24.1, the test potential is to be applied as described in 24.4 by means of test equipment having the characteristics outlined in 24.3.

24.3 The test equipment for conducting the dielectric voltage-withstand test is to have the following features and characteristics:

a) A means for indicating the test voltage that is being applied to the appliance under test (this is accomplished by sensing the voltage at the test leads or by an equivalent means);

b) An output voltage that has a sinusoidal waveform, a frequency that is within the range of 40 - 70 Hz, and a peak value of the waveform that is not less than 1.3 and not more than 1.5 times the root-mean-square value;

c) A sensitivity of the test equipment that is such that when a resistor of 120,000 Ω is connected across the output, the test equipment does not indicate unacceptable performance for any output voltage less than the specified test voltage, and the test equipment does indicate unacceptable performance for any output voltage equal to or greater than the specified test value. The resistance of the calibrating resistor is to be adjusted as close to 120,000 as instrumentation accuracy provides, but never more than 120,000 Ω.

Exception: The sensitivity of the test equipment is capable of being increased, and a higher value of calibrating resistance is capable of being used, when agreeable to those concerned.

24.4 The method of applying the test voltage to the FPDU is to be such that there are not any transient voltages that result in the instantaneous voltage applied to the FPDU exceeding 105 percent of the peak value of the specified test voltage. The applied potential is to be increased from zero at a substantially uniform rate so as to arrive at the specified test potential in approximately 5 s, and then, is to be maintained at the test potential for 1 min. Manual control of the rate of rise is not prohibited from being used.

24.5 Suppressor elements and across-the-line connected components are to be disconnected or removed during this test.

25 Leakage Current Test

25.1 General

25.1.1 The leakage current of a product rated for a nominal 250 V or less supply, when tested in accordance with 25.1.3 - 25.1.6, shall not be more than 0.5 mA.

25.1.2 Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of the product and ground or other exposed conductive surfaces of the product.

25.1.3 All exposed conductive surfaces and the equipment-grounding conductor paths are to be tested for leakage currents. The leakage currents from exposed conductive surfaces and the receptacle grounding contacts are to be measured to the grounded supply conductor individually as well as collectively where simultaneously accessible, and from one surface to another where simultaneously accessible. Surfaces are considered to be simultaneously accessible when they can be readily contacted by one or both hands of a person at the same time.

25.1.4 When a material other than metal is used for the enclosure or part of the enclosure, the leakage current is to be measured using metal foil having an area of 10 by 20 cm (3.9 in by 7.9 in) in contact with the surface. When the surface has an area less than 10 by 20 cm (3.9 in by 7.9 in), the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to affect the temperature of the product.

25.1.5 The measurement circuit for leakage current is to be as illustrated in Figure 25.1. The measurement instrument is defined in items (a) - (d). The meter that is actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument.

a) The meter is to have an input impedance of 1500 Ω resistive shunted by a capacitance of 0.15 μF.

b) The meter is to indicate 1.11 times the average of the full-wave rectified composite waveform of the voltage across the resistor or current through the resistor.

c) Over a frequency range of 0 - 100 kHz, the measurement circuitry is to have a frequency response - ratio of indicated to actual value of current - equal to the ratio of the impedance of a 1500 Ω resistor shunted by a 0.15 μF capacitor to 1500 Ω. At an indication of 0.5 mA, the measurement is not to have an error of more than 5 percent at 60 Hz.

d) Unless the meter is being used to measure leakage from one part of a product to another, the meter is to be connected between the accessible parts and the grounded power-supply conductor.

25.1.6 A sample of the FPDU is to be tested for leakage current in the as-received condition, without prior energization except as may occur as part of the production-line testing, but with the grounding conductor open at the attachment plug. The power-supply voltage is to be adjusted to the rated voltage of the FPDU. The test sequence, with reference to the measuring circuit in Figure 25.1, is to be as follows:

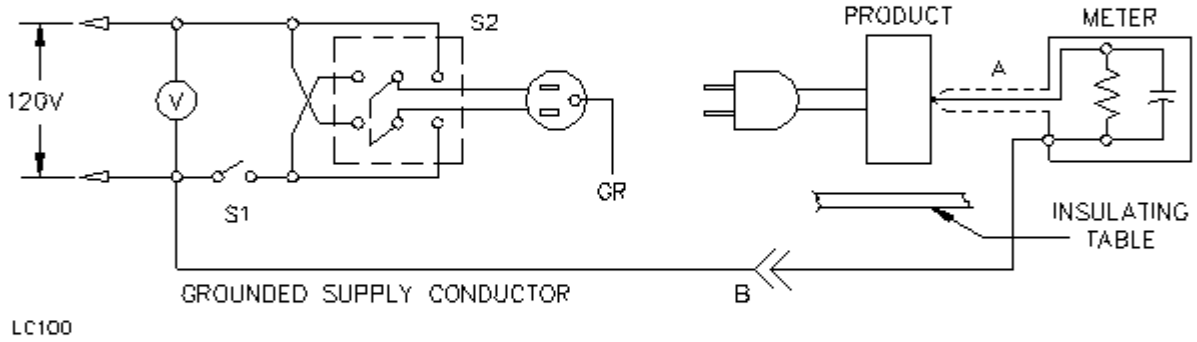
a) With the switch S1 open, the FPDU is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2, and with the FPDU switching devices in all their normal operating positions.

b) Switch S1 is then to be closed, energizing the FPDU, and within 5 s, the leakage current is to be measured using both positions of switch S2 and with the FPDU switching devices in all their normal operating positions.

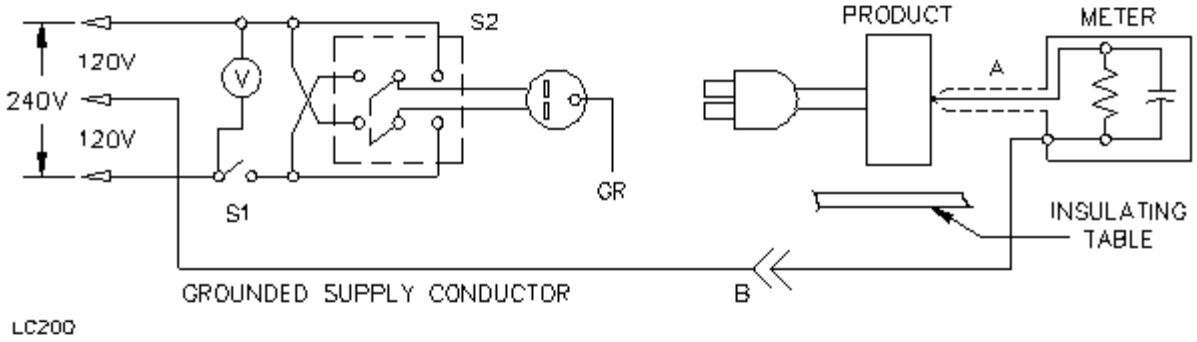
c) The leakage current is to be monitored until thermal stabilization. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operation of the FPDU as in the Temperature Test by loading only the receptacle furthest from the power-supply cord.

Figure 25.1

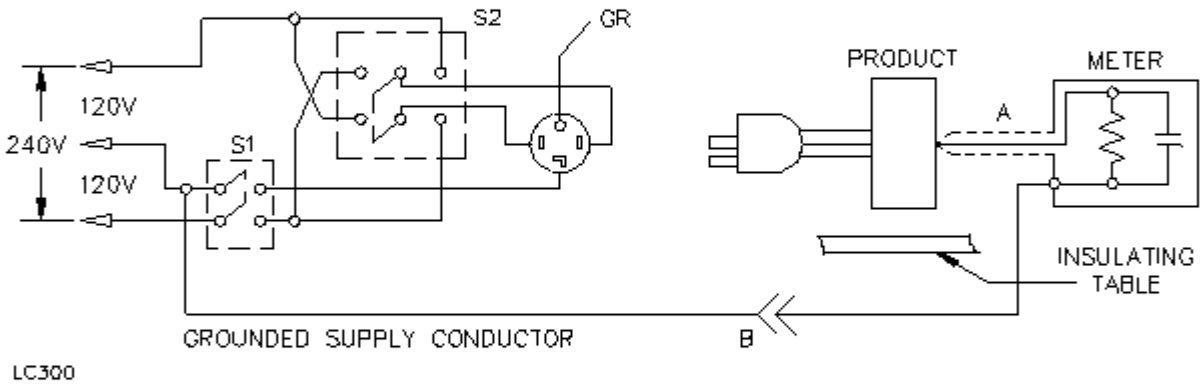
Leakage current measurement circuits



Products intended for connection to a 125-V power supply.


120V
240V
120V
V
S1
S2
GR
PRODUCT
METER
A
INSULATING
TABLE
GROUNDED SUPPLY CONDUCTOR
B
LC200

Product intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.



Product intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.

A - Probe with shielded lead.

B - Separated and used as a clip when measuring currents from one part of a product to another.

25.2 Leakage current after humidity conditioning

25.2.1 At the end of the conditioning period specified in 25.2.2 a sample of a FPDU shall be subjected to the leakage current test specified in 25.1.3 - 25.1.6. The leakage current shall not be more than 0.5 mA.

25.2.2 A sample of a FPDU shall be heated to a temperature just above 34 C (93 F) to reduce the likelihood of condensation of moisture during conditioning. The heated sample is then to be placed in the humidity chamber and conditioned for 48 h in air having a relative humidity of 88 2 percent and a temperature of 32 2 C (90 4 F).

25.2.3 Following the conditioning, the leakage current should be measured, as described in 25.1.6(a), on the sample while it is still in the humidity chamber. See 25.1.4 and 25.1.5.

25.2.4 The sample, either in or immediately after (within 1 min) removal from the humidity chamber, should be energized and tested as described in 25.1.6(b) and (c).

26 Grounding Continuity Test

26.1 A previously untested FPDU is to be subjected to the Grounding

Continuity Test as described in 26.2. A FPDU shall have a grounding-path resistance of 0.1 Ω or less.

26.2 The resistance of the grounding path is to be determined by the use of a resistance measuring instrument or calculated by measuring the voltage drop between the power-supply cord grounding pin and:

a) Each receptacle outlet grounding contact and

b) Any point on a metal enclosure.

Resistance is to be determined with a 25 A, 60 Hz, alternating current being passed from the grounding pin to each receptacle grounding contact or the enclosure, and dividing the measured voltage by the test current. In the event that unacceptable results are recorded using a resistance measuring instrument, the voltage drop method shall be used as the referee method. The current power-supply source shall be at any convenient voltage, not exceeding 6 V.

27 Fault Current Test

27.1 General

27.1.1 When required by note (b) of Table 12.1, or 19.3, three samples of previously untested FPDU's are to be subjected to the Fault Current Test as described in 27.1.2, 27.1.3, and 27.2.1. The FPDU shall comply with the requirements in 27.1.3. Each FPDU shall be tested once.

27.1.2 Each FPDU shall be tested on a circuit calibrated in accordance with 27.2.1. The available current capacity of the circuit is to be as specified in Table 14.1. The frequency of the test circuit is to be 60 ±12 Hz. The grounding or bonding circuit is to be connected in series with a circuit breaker or time-delay non-current limiting fuse that is rated for the maximum ampacity of the circuit in which the FPDU is intended to be installed, suitable for branch circuit protection, and connected directly to the test circuit. The circuit breaker or fuse shall open when the test circuit is closed.

27.1.3 A furniture power distribution unit shall have a grounding-path resistance of 0.1 Ω or less after the test described in 27.1.2. See 26.2. Also, during and following the Fault Current Test, the following conditions shall not occur:

a) Emission of flame, molten metal, or glowing or flaming particles through any openings (pre-existing or created as a result of the test) in the product;

b) Charring, glowing, or flaming of the supporting surface;

c) Ignition of the enclosure;

d) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8; and

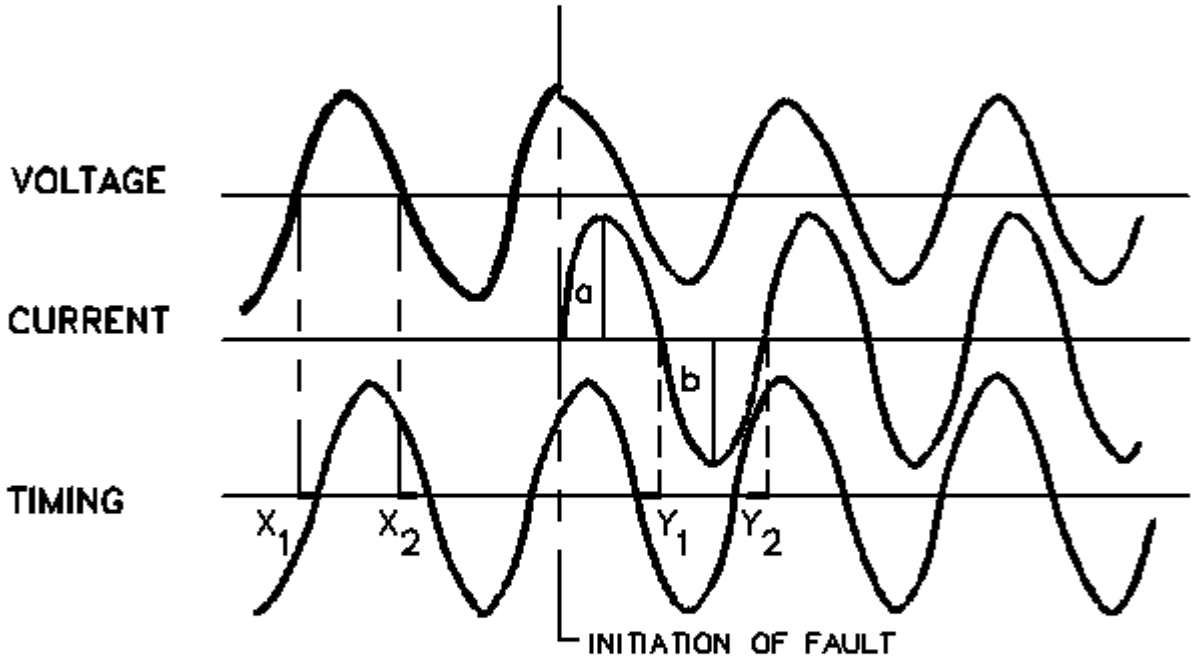
e) There shall not be evidence of degradation or separation of the trace from the printed-wiring board.

27.2 Calibration of test circuits

27.2.1 The current is to be the rms value of the first complete cycle - see Figure 27.1 - when the circuit is closed to produce a symmetrical current waveform. The direct-current component is not to be added to the value obtained when measured as illustrated. In order to obtain the required symmetrical waveform of a single-phase test circuit, controlled closing is recommended although random closing methods may be used. The power factor is to be determined by referring the open-circuit voltage wave to the two adjacent zero points at the end half of the first complete current cycle by transposition through a required timing wave. The power factor is to be computed as an average of the values obtained by using the two current zero points.

Figure 27.1

Determination of current and power factor



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28 Overcurrent Test

28.1 When required by note (b) of Table 12.1, 19.3 or 19.4, three previously

untested FPDU's are to be subjected to the Overcurrent Test as described in 28.2 - 28.6. The FPDU shall comply with the requirements in 28.6 and 28.7. Each FPDU shall be tested once.

28.2 All integral supplementary protection devices are to be shunted out of the circuit for this test.

28.3 The resistance of each circuit conductor path as specified in 19.3 and 19.4 is to be determined by measuring the voltage drop when a current of 25 A, derived from a 60 Hz source with a no-load voltage not exceeding 6 V, is passed between the input port and output port connectors of each conductor path.

28.4 The FPDU is to be mounted so as to provide free air flow around all sides and the top. The ambient temperature is to be 25 ±5°C (77 ±9°F). The load current and time duration is to be as indicated in 28.5. Rated frequency is to be used. Any voltage not higher than the rated voltage is not prohibited from being used.

28.5 For a FPDU with integral overcurrent protection, the overload current is to be 200 percent of the overcurrent device rating. For a FPDU without integral overcurrent protection, the overload current is to be 200 percent of the current rating of the maximum size branch circuit to which the FPDU is intended to be connected. The overcurrent test current is to be applied for 2 min.

28.6 During and following this test, the following conditions shall not occur:

a) Emission of flame, molten metal, or glowing or flaming particles through any openings (pre-existing or created as a result of the test) in the product;

b) Charring, glowing, or flaming of the supporting surface;

c) Ignition of the enclosure;

d) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8; and

e) There shall be no evidence of degradation or separation of the trace from the printed-wiring board.

28.7 After the sample has cooled to room temperature, the resistance of each circuit conductor path is to be determined as specified in 28.3. The resistance of each conductor path shall not increase by more than 10 percent. Additionally, the resistance of the grounding circuit shall not exceed 0.1 Ω.

29 Mounting Hole Barrier Tests

29.1 General

29.1.1 When penetration or deflection of a barrier behind a mounting hole of the FPDU increases the risk of fire, electric shock, or injury to persons, the FPDU is to be subjected to the Mounting Hole Barrier Tests as described in 29.2.1 - 29.3.1 without any occurrence of the following due to the penetration or deflection of the barrier:

a) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8;

b) A reduction of spacings below the values specified in Spacings, Section 18;

c) Transient distortion that results in contact with live parts causing energization of a metallic enclosure;

d) Any condition that is capable of affecting the intended mechanical performance of the FPDU; and

e) Any other condition that increases the risk of electric shock.

29.2 Mounting hole barrier impact test

29.2.1 The FPDU is to be mounted on a vertical surface using the hardware supplied or the hardware recommended by the manufacturer. When no

hardware is supplied or recommended, the FPDU is to be mounted using a No. 8 x 3/4-in wood screw. When the screws are resting against the barrier there is to be 1/4 in (6.35 mm) clearance between the back of the enclosure and the mounting surface. See Figure 29.1.

29.2.2 Each mounting hole configuration of the FPDU shall be subjected to a single impact of 5 ft-lbf (6.8 J) to the FPDU mounted as specified in 29.2.1. This impact is to be produced by a steel sphere, 2 inches (50.8 mm) in diameter and weighing 1.18 lb (0.535 kg), suspended by a cord and swung as a pendulum, dropping through a vertical distance of 51 inches (1.29 m) to cause it to strike the FPDU with the specified impact as shown in Figure 32.2. Each impact shall be applied to a point on the FPDU surface that is evaluated as being the most severe for the mounting hole configuration under test.

29.3 Mounting hole barrier probe test

29.3.1 Each barrier of an untested sample of a FPDU shall withstand a force of 20 lbf (89 N). The force is to be applied by means of the barrier probe shown in Figure 29.2.

Figure 29.1

Test set-up for mounting hole barrier impact test

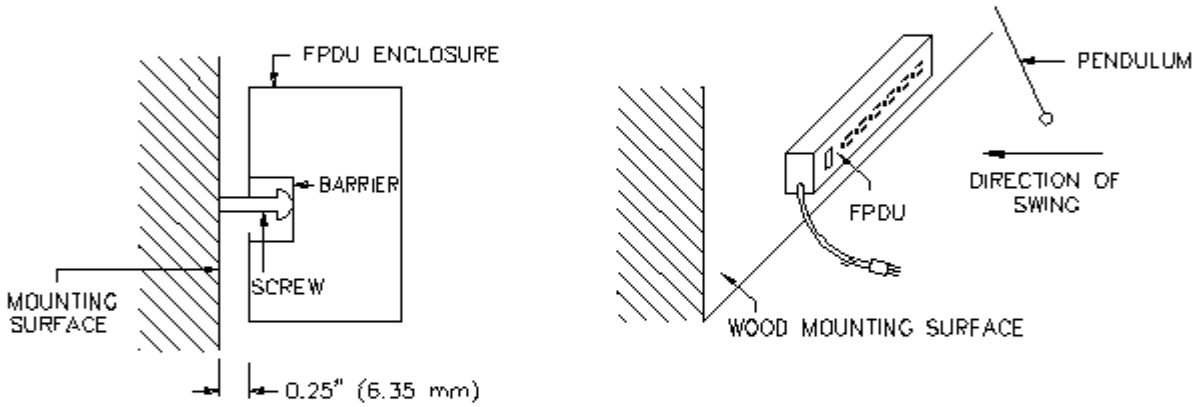
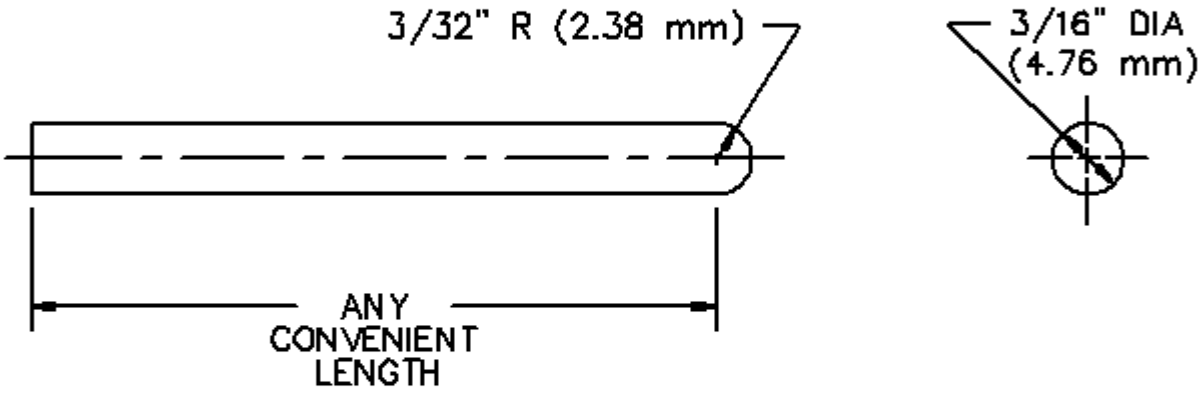


Figure 29.2

Barrier probe



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30 Strain Relief Test

30.1 A FPDU shall be tested for strain relief as described in 30.2.

30.2 The FPDU shall be held securely in place in a position that allows a pull on the cord in directions that produce the most severe stresses on the strain relief. The product is to be secured in a manner that does not affect the test results, and the power-supply conductors shall be cut at their terminations. The power-supply cord is to withstand a direct pull of 35 lbf (158 N) applied to the cord for 1 min without sufficient movement of the power-supply conductors at the cut end to indicate transmission of stress to internal connections.

31 Push Back Relief Test

31.1 With reference to 12.4.1, a FPDU shall be tested in accordance with 31.2 without occurrence of any of the following conditions:

a) Mechanical damage to the supply cord or lead;

b) Exposure of the supply cord or lead to a temperature higher than that for which it is rated;

c) Reduction of spacings (such as to a metal strain-relief clamp) below the minimum required values; or

d) Damage to internal connections or components.

31.2 The supply cord or lead is to be held 25 mm (1 in) from the point where the cord or lead emerges from the product and is then to be pushed back into the product. When a removable bushing which extends further than 25 mm (1 in) is present, it is to be removed prior to the test. When the bushing is an integral part of the cord, the test is to be carried out by holding the bushing. The cord or lead is to be pushed back into the product in 25-mm (1-in) increments until the cord buckles or the force to push the cord into the product exceeds 27 N (6 lbf). The supply cord or lead within the product is to be manipulated to determine compliance with 31.1.

32 Impact Tests

32.1 General

32.1.1 A FPDU employing a metallic or polymeric enclosure is to be subjected to the impact tests described in 32.2.1 - 32.4.1 without any occurrence of the following:

a) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8;

b) Any condition that is capable of affecting the intended mechanical performance of the FPDU;

c) Any other condition that increases the risk of electric shock; and

d) Spacings shall not be less than those described in Spacings, Section 18.

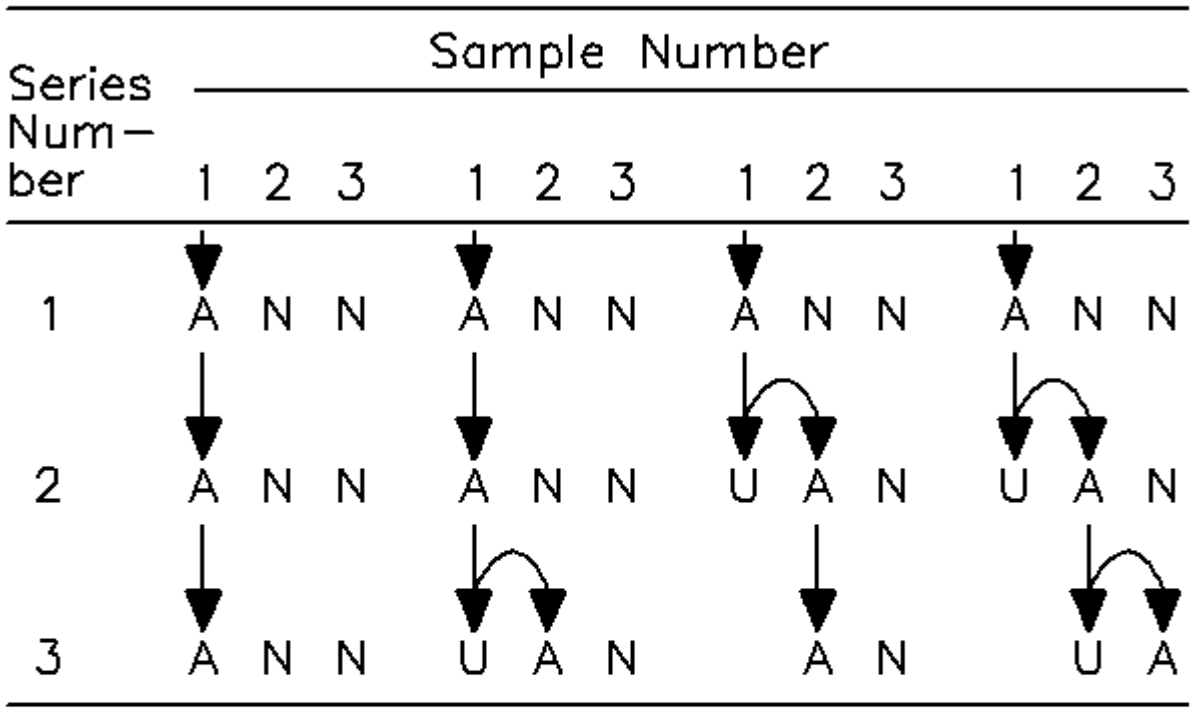
32.1.2 With reference to 32.1.1(b), there shall not be cracking or denting of the enclosure that affects the function of any features such as overcurrent protective devices or strain relief. Cracking or denting of the enclosure is not to result in exposure of moving parts capable of causing injury to persons.

32.1.3 With reference to 32.1.1(c), the FPDU is to comply with the Dielectric Voltage-Withstand Test, Section 24, after being subjected to the impact tests described in this section.

32.1.4 For the impact tests, the rigid supporting surface is to consist of a layer of nominal 25 mm (1 in) tongue-and-groove oak flooring (actual size 18 by 57 mm or 3/4 by 2-1/4 in mounted on two layers of nominal 19 mm (3/4 in) plywood. The assembly is to rest on a concrete floor or an equivalent nonresilient floor during the test. The rigid backing surface is to consist of 19 mm (3/4 in) plywood over a rigid surface of concrete. An equivalent nonresilient backing surface may be used.

Figure 32.1

Procedure for impact test



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32.2 Drop impact test

32.2.1 Each of three samples of the FPDU is to be subjected to an impact that

results from the sample being dropped three times (a series) through a distance of 3 ft (0.91 m) from the bottom of the FPDU to strike a hardwood surface in the positions that produce adverse results. In each drop, the sample is to strike in a position on the enclosure different from those of each of the other two drops in the series.

Exception: When agreeable to those concerned, fewer samples are not prohibited from being used in accordance with Figure 32.2 wherein each series consists of three drops of the sample. The overall performance is acceptable upon completion of any one of the sequences represented in the figure.

32.3 Steel sphere impact test

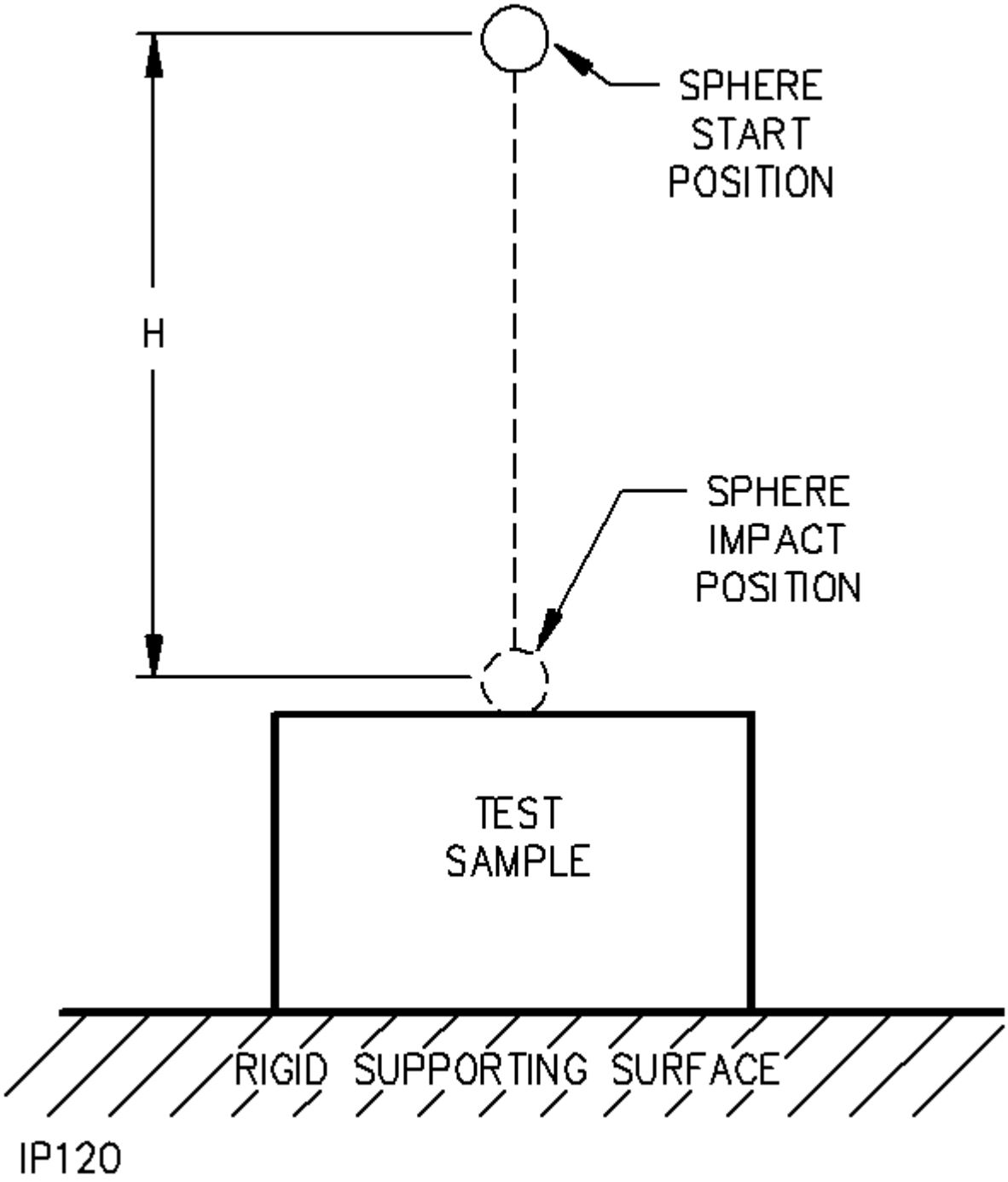
32.3.1 Each of three samples of the FPDU shall be subjected to a single impact of 5 ft lbf (6.8 J). Each impact shall be applied to an enclosure surface not impacted previously in the test sequence. Each impact is to be imparted by dropping a steel sphere 2 inches (50.8 mm) in diameter, and weighing 1.18 lb(0.535 kg), from a height that produces the specified impact as shown in Figure 32.3.

The ball shall not impact on a receptacle face, overcurrent protective device, switch, pilot light or similar component. For surfaces other than the top on an enclosure, the steel sphere is to be suspended by a cord and swung as a pendulum, dropping through the vertical distance required to cause it to strike the surface with the specified impact as shown in Figure 32.3. Three samples are to be used for the tests in the equipment restrained mode.

Exception: When agreeable to those concerned, fewer than three samples are not prohibited from being used for the tests in accordance with Figure 32.2 in which each series of impacts is to consist of one impact. The overall performance is acceptable upon completion of any one of the sequences represented in the figure.

Figure 32.2

Ball drop impact test



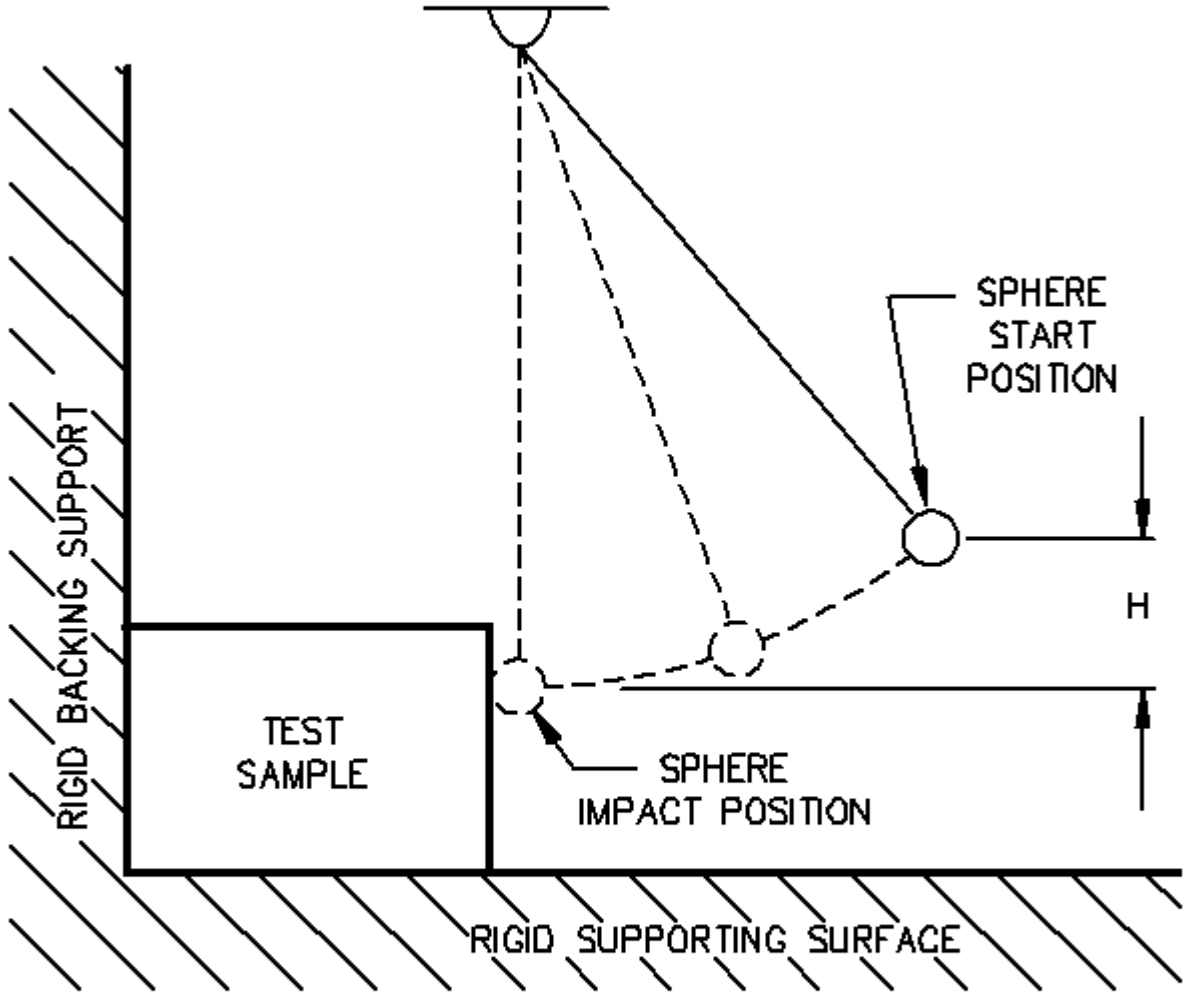
1 - H indicates the vertical distance the sphere must travel to produce the desired impact.

2 - The supporting surface is to consist of a layer of tongue-and-groove oak flooring mounted on two layers of 3/4 in (19 mm) plywood. The oak flooring is nominally 3/4 in thick (actual size

3/4 by 2 1/4 in or 19 by 57 mm). The assembly is to rest on a concrete floor. An equivalent non-resilient supporting surface is not prohibited from being used.

Figure 32.3

Ball pendulum impact test



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1 - H indicates the vertical distance the sphere must travel to produce the desired impact.

2 - For the ball pendulum impact test the sphere is to contact the test sample when the string is in the vertical position as shown.

3 - The supporting surface is to consist of a layer of tongue-and-groove oak flooring mounted on two layers of 3/4 in(19 mm) plywood. The oak flooring is nominally 3/4 in thick (actual size 3/4 by 2-1/4 in or 19 by 57 mm). The assembly is to rest on a concrete floor. An equivalent non-resilient supporting surface is not prohibited from being used.

4 - The backing surface is to consist of 3/4 in (19 mm) plywood over a rigid surface of concrete. An equivalent nonresilient backing surface is not prohibited from being used.

32.4 Low-temperature steel sphere impact test

32.4.1 For a FPDU with a polymeric enclosure, three samples of a FPDU shall be cooled to a temperature of 0.0 ±2.0°C (32.0 ±3.6°F) and maintained at this temperature for 24 h. While the unit is still cold, within 1 min after removal from the temperature chamber, the samples are to be subjected to the impact described in 32.3.1.

33 Crushing Test

33.1 A FPDU employing a metallic or polymeric enclosure is to be subjected to the crush test described in 33.4 without any occurrence of the following:

a) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8;

b) Any condition that is capable of affecting the intended mechanical performance of the FPDU; and

c) Any other condition that increases the risk of electric shock.

33.2 With reference to 33.1(b), the enclosure shall not crack or dent or affect the function of any features such as overcurrent protective devices or strain relief. Cracking or denting of the enclosure is not to result in exposure of moving parts capable of causing injury to persons.

33.3 With reference to 33.1(c), the FPDU is to comply with the Dielectric

Voltage-Withstand Test, Section 24, after being subjected to the crush tests described in this section.

33.4 A previously untested sample of a FPDU shall be placed on a 1/2-in (12.7-mm) thick, horizontal maple board, and a crushing force of 150 lbf (667.2 N) is to be applied to three different locations of the FPDU by means of a horizontal 3/4-in (19.1-mm) diameter steel rod. The rod is to be placed across the center of the smaller dimension of the test surface of the FPDU, perpendicular to the long axis of the FPDU. The length of the rod is to span the smaller dimension of the surface being tested. Force is to be gradually applied and maintained for a period of 1 min. The crushing force is not to be applied to protruding members of receptacles, switch toggles/triggers, indicator lamps and OCP reset members.

33.5 At the end of the tests described in 33.1 - 33.4, spacings shall not be less than those described in Spacings, Section 18.

34 Adequacy of Mounting Test

34.1 To determine compliance with 34.2 and 34.3, a FPDU is to be mounted in accordance with manufacturer's installation instructions on any secure wall.

Exception No. 1: When the FPDU is not provided with installation instructions, the FPDU shall be tested in the most severe mounting configuration.

Exception No. 2: This test is not required when the FPDU is mounted with an adhesive that complies with 9.3.

34.2 After the FPDU has been installed according to manufacturer's instructions, a weight of four times the weight of the FPDU or 5 lbs (2.27 kg), whichever is greater, is to be hung from the center of the FPDU as shown in Figure 34.1 for each mounting configuration.

34.3 There shall be no occurrence of the following as a result of this test:

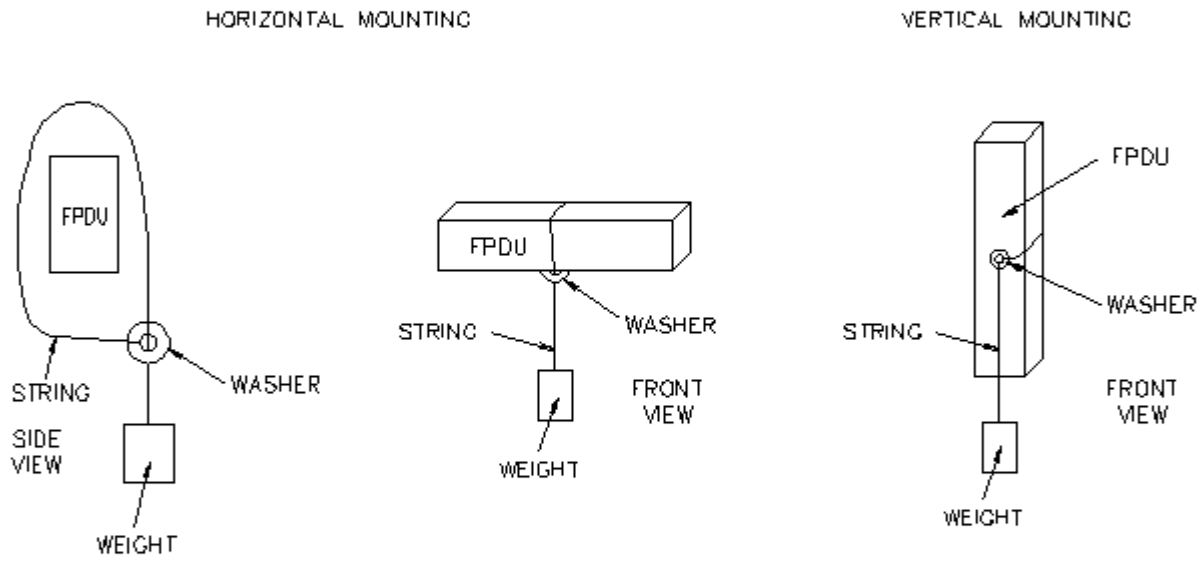
a) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8;

b) Any condition that is capable of affecting the intended mechanical performance of the FPDU; and

c) Any other condition that increases the risk of electric shock.

Figure 34.1

Test method for adequacy of mounting test



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35 Mold Stress-Relief Distortion Test

35.1 For a FPDU with a polymeric enclosure, conditioning of the equipment as

described in 35.2 shall not result in softening of the material as determined by handling immediately after the conditioning, nor shall there be shrinkage, warpage, or other distortion as evaluated after cooling to room temperature, that results in any of the following:

a) Reduction of spacings between uninsulated live parts of opposite polarity, and uninsulated live parts and accessible dead or grounded metal below the minimum values specified in Spacings, Section 18;

b) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 8, or defeating the integrity of the enclosure so that the required mechanical protection is not afforded to internal parts of the equipment;

c) A condition that results in the equipment not complying with the Strain Relief Test, Section 30, when applicable; and

d) Interference with the intended operation or servicing of the equipment.

Exception: The conditioning described in 35.2 is not required for rigid thermosetting materials or for low-pressure, foamed molded parts.

35.2 For equipment that has a polymeric enclosure, one sample of the equipment shall be conditioned in accordance with either (a) or (b) below:

a) One sample of the complete equipment (in the case of an enclosure) or the part under consideration, is to be placed in a full-draft, circulating-air oven maintained at a uniform temperature at least 10°C (18°F) higher than the maximum temperature of the material measured under actual operating conditions, but not less than 70°C (158°F) in any case. The sample is to remain in the oven for 7 h. After its careful removal from the oven and return to room temperature, the sample is to be investigated for compliance with 35.1.

b) One sample of the complete equipment is to be placed in a test cell. The circulation of air within the cell is to simulate actual room conditions. The air temperature within the cell, as measured at the supporting surface of the equipment, is to be maintained at 60°C (140°F). The equipment is to be operated in the same way as for the temperature test except for equipment that is not loaded or is not continuously loaded during the normal temperature test. Such equipment, although unloaded, shall be connected to 106 percent or 94 percent of normal rated voltage, whichever results in higher temperatures.

In any case, the equipment is to be operated for 7 h. After its careful removal from the test cell, the sample is to be investigated for compliance with 35.1.

36 Spill Test

36.1 A FPDU shall be subjected to the test described in this section and, after the testing, shall be subjected to the Dielectric Voltage-Withstand Test, Section 24 with acceptable results.

Exception: When the intended use of the FPDU is for it to be mounted above the furnishing surface and oriented such that spilled liquid on the furnishing surface cannot enter any part of the FPDU, these requirements do not apply.

36.2 The FPDU is to be mounted as intended by the manufacturer. Any cover is to be opened to the position that allows the greatest egress of liquid. A cover that is self-closing or tends to close itself is to be allowed to fall to its natural resting position. If more than one receptacle is enclosed by such a self-closing cover, then a single power-supply cord is to be mated with one of the receptacles and the cord is to exit through the wiring channel from behind the cover as intended.

36.3 A 3-in (76.2-mm) diameter container, 4 inches (101.6 mm) in height, is to be filled with 8 fl oz (0.24 L) of saline solution, consisting of 8 g of table salt per liter of distilled water, and placed on the supporting surface of the RPT immediately adjacent to the receptacles. The container is then to be tipped over and an effort is to be made to direct the spill toward the area of the assembly that allows the greatest egress of liquid. The Dielectric Voltage-Withstand Test, Section 24 is to be conducted 1 min after the container is tipped over.

37 Accessibility Tests

37.1 Enclosure accessibility test

37.1.1 The enclosure of a FPDU shall be subjected to the test in 37.1.2. As a

result of the test, the test probe shall not contact any uninsulated current-carrying parts.

37.1.2 A straight test rod having a maximum diameter of 1.6 mm (1/16 in) and of any convenient length is to be inserted into each opening in the enclosure and rotated in any possible direction.

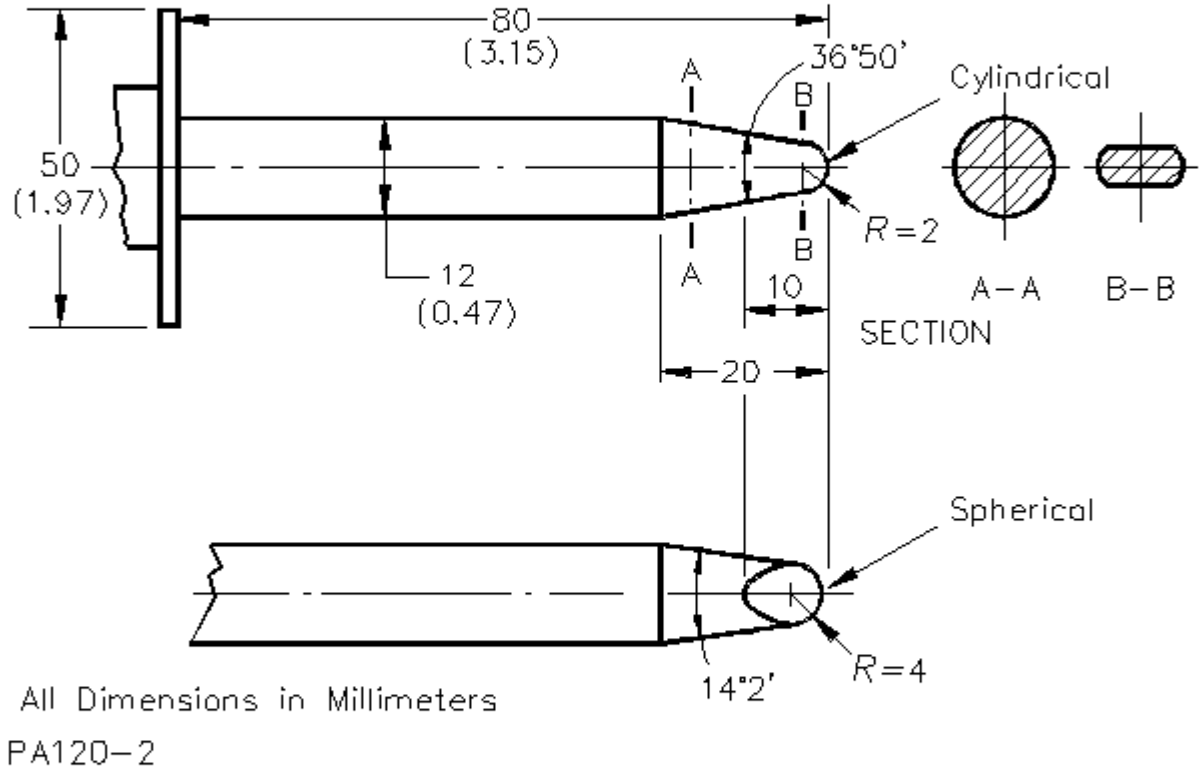
37.2 Accessibility of live parts test

37.2.1 An enclosure of a FPDU which prevents unintentional contact of current-carrying parts or of film-coated magnet wire in the enclosure of a FPDU shall be subjected to the test in 36.2. As a result of the test, the probes described in Figures 8.1 and 37.1 shall not touch the current-carrying part or magnet wire.

37.2.2 The articulate probe, Figure 8.1, is to be inserted through any opening and rotated with movable sections straight and in any possible position resulting from bending one or more section in the same direction. The rigid probe, Figure 37.1, is to be applied with a maximum force of 30 N (6.75 lbf).

Figure 37.1

International electrotechnical commission (IEC) rigid accessibility probe



38 Test for Permanence of Cord Tag

38.1 General

38.1.1 To determine compliance with 42.3 and 42.4, representative tags that have been subjected to the tests described in 38.2.1 - 38.3.1 shall meet the following requirements:

a) The tag shall resist tearing for longer than 1/16 in (1.6 mm) at any point;

b) The tag shall not separate from the cord set. A hang-type tag shall not separate from the securement strap, and the securement strap shall not separate from the cord set;

c) The tag or securement strap shall not slip or move along the length of the cord set more than 1/2 in (13 mm) and there shall not be any visible damage to the cord;

d) There shall not be any permanent shrinkage, deformation, cracking, or any other condition that will render the marking on the tag illegible; and

e) Overlamination, if provided, shall remain in place and shall not be torn or otherwise damaged. The printing shall remain legible.

38.2 Test conditions

38.2.1 For each type of conditioning mentioned in 38.2.2 - 38.2.4, three tags applied to the cord sets in the intended manner are to be used. If tags are applied by an adhesive, tests are to be conducted no sooner than 24 h after application of the tag.

38.2.2 Each of three tags is to be tested as received.

38.2.3 Each of three tags is to be tested after 30 min of conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, following 240 h of conditioning in an air-circulating oven at 60 ±1°C (140 ±1.8°F).

38.2.4 Each of three tags is to be tested within 1 min after being exposed for

72 h to a relative humidity of 85 ±5 percent at a temperature of 32.0 ±2.0°C (89.6 ±3.6°F).

38.2.5 If the tag is intended to be applied to outdoor cord (W) it is to be conditioned as follows and in 38.2.6 - 38.2.8. Each of three tags is to be tested after 24 h of exposure conditioning at 23 ±2°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by 48 h of immersion to a depth of not less than 1/8 inch (3.2 mm) in demineralized water at a temperature of 23°C (73.4°F).

38.2.6 Each of three tags is to be tested after 24 h of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by 10 d of exposure in an air-circulating oven at a temperature of 60°C (140°F).

38.2.7 Each of three tags is to be tested after 24 h of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by 7 h of exposure in a cold box at a temperature of -10 ±2°C (14.0 ±3.6°F).

38.2.8 Each of three tags is to be tested after 24 h of exposure conditioning at 23.0 ±2.0°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, followed by exposure to ultraviolet light and water spray with ultraviolet light by using either of the following apparatus:

a) A Twin-Enclosed Carbon-Arc Weatherometer, (Type D or DH), as described in the Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials, ASTM G152 and Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for

Exposure of Nonmetallic Materials, ASTM G153. Each of the tags is to be exposed to 720 h of ultraviolet light and water spray with ultraviolet light. The operating cycle is to be 20 min; 17 min of ultraviolet light only and 3 min of water spray and ultraviolet light.

b) A Xenon-Arc Weatherometer, (Type B or similar apparatus), as described in the Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials, ASTM G155. Each of the tags is to be exposed to 1000 h of ultraviolet light and water spray with ultraviolet light. The exposure shall be in accordance with Method A, with continuous exposure to ultraviolet light and intermittent water spray with ultraviolet light, using a programmed cycle of 120 min (102 min ultraviolet light exposures and an 18 min exposure to water spray with ultraviolet light). The apparatus shall include a 6500 W, water-cooled xenon-arc lamp, borosilicate glass inner and outer optical filters, a spectral irradiance of 0.35 W/m^2 at 340 nm and a black-panel temperature of 63.0 ±3.0°C (145.0 ±5.4°F).

38.2.9 If the tag is intended to be applied to indoor or outdoor cord that is oil resistant (Type O or OO) it is to be conditioned as follows. Each of three tags is to be tested within 2 h after being immersed for 48 h in Fuel Oil No. 1 at a temperature of 23.0 ±2.0°C (73.4 ±3.6°F).

38.3 Test method

38.3.1 Each test is to be performed on a length of cord set to which the tag has been applied. The cord set, with the attachment plug pointing up, is to be held taught in a vertical plane. A force of 5 lbf (22.2 N), which includes the weight of the clamp, is to be applied for 1 min to the uppermost corner of the tag farthest from the cord set, within 1/4 in (6.4 mm) of the vertical edge of the tag. The force is to be applied by affixing a C-clamp with a pad diameter of 3/8 in (9.5 mm) to the tag and securing the weight to the C-clamp. The force is to be applied vertically downward in a direction parallel to the major axis of the cord. To determine compliance with 38.1.1(d), manipulation is permissible, such as straightening of the tag by hand. To determine compliance with 38.1.1(e), each tag is to be scraped 10 times vertically across printed areas and edges, with a force of approximately 2 lbf (9 N), using the edge of a 5/64 in (2.0 mm) thick steel blade held at a right angle to the test surface. The edges of the steel blade are to be just rounded so as not to be sharp.

MANUFACTURING AND PRODUCTION-LINE TESTS

39 Dielectric Voltage-Withstand Test

39.1 Each FPDU shall be capable of withstanding without electrical breakdown, as a routine production-line test, the application of a potential between uninsulated live parts and accessible, dead-metal parts that become energized.

Exception: This requirement does not apply to a FPDU that employs a component that can be damaged by the dielectric potential.

39.2 The production-line test is to be in accordance with any of the alternatives of Table 39.1.

39.3 The test shall be conducted when the FPDU is complete (fully assembled). It is not intended that the FPDU be unwired, modified, or disassembled for the test.

Table 39.1

Production-line dielectric withstand test conditions for furniture power distribution units

Rating	Alternative A		Alternative B		Alternative C		Alternative D	
	Potential (V AC)	Time (s)	Potential (V AC)	Time (s)	Potential (V DC)	Time (s)	Potential (V DC)	Time (s)
125 V or less AC	1250	60	1500	1	1768	60	2121	1
125/250 V AC and 250	1500	60	1800	1	2121	60	2545	1

V AC or less								

39.4 The test equipment when adjusted for production-line testing, is to produce an output voltage that is not less than the factory test value specified, nor is the magnitude of the test voltage to be greater than 120 percent of the specified test potential when the tester is used in each of the following conditions:

a) When the test duration is 1 s, the output voltage is to be maintained within the specified range when:

1) Only a voltmeter having an input impedance of at least 2 MΩ and a specimen of the product being tested are connected to the output terminals; and

2) A relatively high resistance is connected in parallel with the voltmeter and the product being tested, and the value of the resistance is gradually reduced to the point where an indication of unacceptable performance just occurs.

b) When the test duration is 1 min, the output voltage is to be maintained within the specified range (by manual or automatic means) throughout the 1-min duration of the test or until there is an indication of unacceptable performance.

39.5 The specified control of the applied voltage, manual or automatic, shall be maintained under conditions of varying line voltage. Higher test potentials are not prohibited from being used when the higher dielectric stress does not adversely affect the insulating systems of the product.

39.6 In addition to the characteristics indicated in 40.4, the test equipment is to have the following features and characteristics:

a) A means of indicating the test voltage that is being applied to the appliance under test. This is accomplished by sensing the voltage at the test leads or by an equivalent means.

b) An output voltage that has a sinusoidal waveform, a frequency that is within the range of 40 - 70 Hz, and a peak value of the waveform that is not to be less than 1.3 and not more than 1.5 times the root-mean-square value.

c) A means of effectively indicating unacceptable performance. The indication is to be:

1) Auditory, when it can be readily heard above the background noise level;

2) Visual, when it commands the attention of the operator; or

3) A device that automatically rejects an unacceptable product. When the indication of unacceptable performance is auditory or visual, the indication is to remain active and conspicuous until the test equipment is reset manually.

d) When the test equipment is adjusted to produce the test voltage, and a resistance of 120,000 Ω is connected across the output, the test equipment is to indicate an unacceptable performance within 0.5 s. A resistance of more than 120,000 Ω is not prohibited from being used to produce an indication of unacceptable performance when the manufacturer elects to use a tester having higher sensitivity.

Exception: The sensitivity of the test equipment - and a lower value of resistance - is not prohibited from being used when testing an appliance intended to be permanently wired.

39.7 There shall not be any transient voltage applied to the FPDU under test that results in the instantaneous voltage applied to the FPDU exceeding 120 percent of the peak value of the test voltage that the manufacturer elects to use for this test. This requirement applies for the entire duration of the test, including the time that the voltage is first applied to the FPDU and the time that the voltage is removed from the FPDU.

40 Grounding Continuity Test

40.1 Each FPDU shall be tested, as a routine production-line test, to determine grounding continuity between the grounding pin or terminal of the attachment plug and the accessible, dead-metal parts of the FPDU that become energized. The grounding contact of each receptacle, grounding pin of a supply-cord attachment plug, and other means for grounding on the load side are included in this test.

40.2 Compliance with 40.1 is determined by any appropriate device, such as

an ohmmeter or a battery and buzzer combination, applied between the point of connection of the FPDU grounding means and the metal parts in question.

RATINGS

41 Details

41.1 A FPDU shall be rated in maximum AC current and AC voltage. The voltage rating shall not be higher than 250 V. The current rating shall not be higher than 16 A, the ampacity of the power-supply cord, nor the highest rating of the overcurrent protective device that is provided.

MARKINGS

42 Details

42.1 Unless otherwise indicated, all markings shall be clearly visible, readily legible, and placed on the outside of the enclosure in lettering not less than 3/32 in (2.4 mm) high.

42.2 Markings required by this standard shall be permanent. A permanent marking shall be molded, die-stamped, or paint-stenciled; stamped or etched metal that is permanently secured; or indelibly stamped on a pressure-sensitive label secured by adhesive that complies with the Standard for Marking and Labeling Systems, UL 969 or provided on a cord tag that complies with 42.3. Ordinary usage, handling, storage, and the like of the unit are to be evaluated in determining whether a marking is permanent.

42.3 Markings may be on one of the following:

a) Printed on a doughnut-, flat-, or bracelet-type label.

b) Printed on a tag of tough paper, cloth, or the equivalent (of any color) having a hole large enough to accommodate the cord, and not resembling the shapes described in item c. The tag is not to be slit from the edge of the hole to the edge of the tag. The cord is to be passed through the hole in the tag prior to assembly to the FPDU.

c) Printed in a contrasting color on a background of a solid color other than blue, green, or yellow on one of the following:

1) A ring-shaped (doughnut) tag of tough paper, cloth, or the equivalent having a hole large enough to accommodate the cord. The tag is not to be slit from the edge of the hole to the edge of the tag. The cord is to be passed through the hole in the tag prior to the assembly to the FPDU.

2) A flag-type tag with an adhesive back. The tag is to be wrapped around and adhere to the cord, and the ends of the tag are to adhere to each other and project as a flag.

3) A bracelet wrapped around and affixed to the cord with an adhesive.

42.4 A tag in accordance with 43.3 used for markings required in Section 42 shall be attached in a manner that it cannot be easily removed. The tag shall have the added marking in letters not less than 3/32 in (2.4 mm) high "Do not remove this tag."

42.5 A FPDU shall be marked with:

a) The manufacturer's name, trade name, trademark, or other descriptive marking by which the organization responsible for the product is identified;

b) The distinctive catalog number or equivalent;

c) The FPDU electrical rating in volts, amperes, and frequency; and

d) The date or other dating period of manufacture not exceeding any three consecutive months. Abbreviation of the date of manufacture complies with the intent of this requirement.

Exception: The date of manufacture that appears in a nationally-accepted conventional code or in a code affirmed by the manufacturer complies with the intent of this requirement when the code does not repeat in less than 10 years and does not require reference to the production records of the manufacturer to determine when the product was manufactured.

42.6 When a manufacturer produces or assembles a FPDU at more than one factory, each FPDU shall have a distinctive marking, that is not prohibited from being in code, by which it is identified as the product of a particular factory.

42.7 With regard to 14.9, a receptacle outlet or group of outlets of a FPDU shall be marked to indicate the rating of the overcurrent protective device that protects the receptacle outlet.

42.8 A receptacle outlet or group of outlets of a FPDU that is energized (relay or electronically activated) by the presence of a load in another outlet of the FPDU shall be marked to indicate that they are so controlled.

42.9 A switch employed on a FPDU, without an associated pilot light and as indicated in 16.3, shall be marked "on"/"off", "1"/"0", or the equivalent, to indicate to the user when the receptacles are energized when the FPDU is connected to a power-supply. The marking shall be either on the switch or on an adjacent part of the enclosure.

42.10 A FPDU having a fuse that is intended to be replaced in the field shall be marked to indicate the type, ampere, and voltage rating of the replacement fuse. In addition, the FPDU shall be marked with the word "WARNING" and the following or equivalent: "For continued protection against risk of fire, replace only with same type and rating of fuse." Lettering shall not be less than 3/32 in (2.4 mm) high. These markings shall be located adjacent to the fuseholder so as to be visible during fuse replacement.

42.11 A FPDU shall be marked to indicate that the product is intended for indoor use only, with the word "CAUTION:" and the following or equivalent: "To Reduce the Risk of Electric Shock - Use Only Indoors". Lettering shall not be less than 3/32 in (2.4 mm) high. This marking may appear on a cord tag that complies with Section 38, Test for Permanence of Cord Tag, permanently attached to the power supply cord.

42.12 A FPDU that incorporated terminals for secondary telecommunication equipment shall be marked to indicated "In" and "Out" or equivalent (such as "Wall", "Equip". or "Equipment") adjacent to the terminals.

42.13 A FPDU that incorporates terminals for coaxial cable (TV/CATV) connection shall be marked with (or provide on the smallest unit package) installation instructions for connection to the antenna system in accordance with the National Electrical Code, ANSI/NFPA 70 and shall comply with the antenna connection instruction requirements of the Standard for Audio-Video Products and Accessories, UL 1492.

42.14 A FPDU that employs SPT-3 flexible cord for the power-supply cord shall be marked on the FPDU and on smallest unit package with the following or equivalent wording: "For Household Use Only".

42.15 A FPDU for use in a portable furnishing shall be marked "For use only in a portable furnishing." See 6.3.1.

42.16 A FPDU rated 12 A employing 4 receptacles and 16 AWG power supply cord without supplementary overcurrent protection shall be marked "Suitable for Household (Residential) use only." See Table 12.1 subnote i.

APPENDIX A

Standards for Components

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard - UL Standard Designation

Attachment Plugs and Receptacles - UL 498

Capacitors - UL 810

Cord Sets and Power-Supply Cords - UL 817

Double Insulation Systems for Use in Electrical Equipment - UL 1097

Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors - UL 486E

Flexible Cords and Cables - UL 62

Fuses, Low-Voltage - UL 248 Series

Fuseholder - UL 512

Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment - UL 840

Marking and Labeling Systems - UL 969

Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of - UL 94

Polymeric Materials - Long Term Property Evaluation - UL 746B

Polymeric Materials - Short Term Property Evaluation - UL 746A

Polymeric Materials - Use in Electrical Equipment Evaluations - UL 746C

Printed-Wiring Boards - UL 796

Protectors for Use in Electrical Equipment, Supplementary - UL 1077

Sleeving, Coated Electrical - UL 1441

Switches, General Use Snap - UL 20

Switches, Special-Use - UL 1054 or

Switches for Appliances - Part 1: General Requirements - UL 61058-1

Tape, Polyvinyl Chloride Polyethylene and Rubber Insulating - UL 510

Terminal Blocks - UL 1059

Terminals, Electrical Quick-Connect - UL 310

Tests for Sharpness of Edges on Equipment - UL 1439

Thermal-Links - Requirements and Application Guide - UL 60691

Transformers, Specialty - UL 506

Tubing, Extruded Insulating - UL 224

Wire Connectors - UL 486A-486B

Wire Connectors, Splicing - UL 486C

Wires and Cables, Thermoset-Insulated - UL 44

Wires and Cables, Thermoplastic-Insulated - UL 83