

UL 1363

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Relocatable Power Taps

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety for Relocatable Power Taps, UL 1363

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Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective. Revisions identified in the INTRODUCTION section are editorial.

The following table lists the future effective dates with the corresponding reference.

Future Effective Dates	References
October 24, 2002	Paragraphs 7.6, 12.5, and Section 34A

The new requirements are substantially in accordance with UL's Bulletin(s) on this subject dated July 25, 2001. The bulletin(s) is now obsolete and may be discarded.

The revisions dated October 24, 2001 include a reprinted title page (page1) for this Standard.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-6	October 24, 2001
6A-6B	April 23, 1997
7	December 12, 1996
8	April 23, 1997
8A	October 24, 2001
8B	April 23, 1997
9-12A	October 24, 2001
12B	August 24, 1999
13	April 23, 1997
14-15	October 16, 1998
16-16B	February 11, 2000
17-18	August 24, 1999
19-20	December 12, 1996
21-22	October 14, 1997
22A-25	October 16, 1998
26-28	April 23, 1997
29	December 12, 1996
30-31	April 23, 1997
32	December 12, 1996
33-34B	October 14, 1997
35	April 23, 1997
36-36B	October 24, 2001
37-40	December 12, 1996
A1-A2	December 12, 1996
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1

UL 1363

Standard for Relocatable Power Taps

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First Edition – June, 1991

Second Edition

December 12, 1996

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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No Text on This Page

CONTENTS

FOREWORD	4
-----------------------	---

INTRODUCTION

1 Scope	5
2 General	5
2.1 Components	5
2.2 Units of measurement	6
2.3 Undated references	6
3 Glossary	6

CONSTRUCTION

4 General	6A
5 Enclosure	7
5.1 General	7
5.2 Metallic	7
5.3 Nonmetallic	7
6 Mechanical Assembly	8
6A Accessibility of Live Parts	8
7 Temporary Mounting Means	8B
8 Corrosion Protection	9
9 Insulating Materials	9
10 Power-Supply Cord	10
10.1 General	10
10.2 Bushings	10A
11 Strain Relief	10A
12 Receptacles	10A
13 Supplementary Protection	10B
14 Switches	12
15 Live Parts	13
16 Internal Wiring	13
17 Spacings	14
18 Printed-Wiring Boards	15
19 Separation of Circuits	15
20 Grounding	15
20.1 General	15
20.2 Bonding	16A

PERFORMANCE

21 General	16A
22 Temperature Test	17
23 Dielectric Voltage-Withstand Test	18
24 Leakage Current Test	19
24.1 General	19
24.2 Leakage current after humidity conditioning	22
25 Grounding Continuity Test	22
26 Fault Current Test	22A
26.1 General	22A

26.2 Calibration of test circuits .....	.23
27 Grounding Contact Test .....	.24
28 Overcurrent Test .....	.24
29 Mounting Hole Barrier Tests .....	.25
29.1 General .....	.25
29.2 Mounting hole barrier impact test .....	.25
29.3 Mounting hole barrier probe test .....	.25
30 Strain Relief Test .....	.30
31 Impact Tests .....	.30
31.1 General .....	.30
31.2 Drop impact test .....	.30
31.3 Steel sphere impact test .....	.30
31.4 Low-temperature steel sphere impact test .....	.31
32 Crushing Test .....	.34
33 Adequacy of Mounting Test .....	.34
34 Mold Stress-Relief Distortion Test .....	.35
34A Spill Test .....	.36

MANUFACTURING AND PRODUCTION-LINE TESTS

35 Dielectric Voltage-Withstand Test .....	.36A
36 Grounding Continuity Test .....	.38

RATINGS

37 Details38
------------------	-----

MARKINGS

38 Details38
------------------	-----

APPENDIX A

Standards for Components.....	A1
-------------------------------	----

No Text on This Page

FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

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F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover cord-connected, relocatable power taps rated 250 V AC or less and 20 A AC or less. A relocatable power tap is intended only for indoor use as a temporary extension of a grounding alternating-current branch circuit for general use.

1.1 revised December 12, 1996

1.2 A cord-connected product with less than three receptacle outlets that employs an electromagnetic interference filter or a transient voltage surge suppressor is covered under the Standard for Electromagnetic Interference Filters, UL 1283, and the Standard for Transient Voltage Surge Suppressors, UL 1449, respectively.

1.3 A cord-connected product with three or more receptacle outlets that employs an electromagnetic interference filter shall also comply with the Standard for Electromagnetic Interference Filters, UL 1283. A cord-connected product with three or more receptacle outlets that employs a transient voltage surge suppressor shall also comply with the Standard for Transient Voltage Surge Suppressors, UL 1449.

1.4 Telephone equipment and communication circuit protectors included in a relocatable power tap shall comply with the requirements in the Standard for Telephone Equipment, UL 1459, and the requirements in the Standard for Secondary Protectors for Communications Circuits, UL 497A, respectively.

1.5 A relocatable power tap 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 Television Receivers and High-Voltage Video Products, UL 1410.

1.6 A cord-connected product that employs ground-fault protection is investigated under the requirements in the Standard for Ground-Fault Circuit Interrupters, UL 943.

1.7 Deleted October 24, 2001

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product 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.

2.1.1 revised October 24, 2001

2.1.2 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.

2.1.2 revised October 24, 2001

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

2.1.3 revised October 24, 2001

2.1.4 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.

2.1.4 revised October 24, 2001

2.2 Units of measurement

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

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

2.3 Undated references

2.3.1 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.

2.3.1 revised October 24, 2001

3 Glossary

3.1 MEANS FOR TEMPORARY MOUNTING – A mounting method that does not require the use of tools for mounting or dismounting the relocatable power tap and conceals the head of a screw or other fastener so that it cannot be tightened after the relocatable power tap is mounted.

3.2 OVERCURRENT PROTECTION (OCP) DEVICE – A supplementary protection device provided within a RPT that provides overcurrent and short-circuit protection. It is not intended to be a substitute for branch circuit protection.

3.2 revised April 23, 1997

3.3 RELOCATABLE POWER TAP (RPT) – A relocatable power tap consists of an attachment plug cap and a length of flexible cord terminated in an enclosure in which are mounted one or more receptacles. A relocatable power tap may be provided with suitable supplementary overcurrent protection, switches, and indicator lights singly or in any combination. A relocatable power tap containing three or more receptacles may also employ a transient voltage surge suppressor (TVSS) and/or an electromagnetic interference (EMI) filter.

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

3.4 added April 23, 1997

CONSTRUCTION

4 General

4.1 Only materials that are suitable for the particular use shall be used in a RPT.

No Text on This Page

5 Enclosure

5.1 General

5.1.1 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.

5.1.2 The enclosure shall not have any openings or knockouts that are capable of being used for permanent mounting or connection to a permanent wiring system. See Temporary Mounting Means, Section 7.

5.1.3 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 inch (1.6 mm) shall be prevented from contacting live parts.

5.1.4 A keyhole slot, notch, or similar means for temporary 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.

5.1.5 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 29.

5.2 Metallic

5.2.1 A metal enclosure of a RPT shall have a minimum thickness in accordance with Table 5.1.

Table 5.1
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

5.3 Nonmetallic

5.3.1 A polymeric enclosure 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.

5.3.2 The enclosure shall comply with the strain relief, impact, crush and mold stress-relief test requirements of Sections 30, 31, 32 and 34 respectively, of this Standard.

6 Mechanical Assembly

6.1 A RPT 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.

6.2 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 6.3 and 6.4, shall be restrained from turning. See 6.5.

6.3 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.

6.4 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.

6.5 The means by which the turning specified in 6.2 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.

6A Accessibility of Live Parts

6A.1 The electrical parts of a RPT 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.

6A.1 added April 23, 1997

6A.2 An opening in the enclosure of a RPT 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 6A.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.

6A.2 added April 23, 1997

6A.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.

6A.3 added April 23, 1997

7 Temporary Mounting Means

7.1 A RPT may be provided with a means for temporary mounting. A tool shall not be required to dismount a RPT.

7.2 A means for temporary mounting shall provide for secure positioning that requires a positive, deliberate action by the user to dismount it.

7.3 A keyhole slot, notch, or similar means for temporary mounting, shall be located so that the screw head, nail head, hook, or other supporting device is not accessible for further securing of the RPT once it is mounted.

Exception: A temporary mounting means that does not comply with the above requirement is capable of being used when investigated for the purpose.

7.4 When a temporary mounting means is provided, installation instructions shall be furnished with the product. When the mounting means requires special hardware, to comply with the requirements in the Adequacy of Mounting Test, Section 33, or 7.1 – 7.3, the hardware shall be provided with the product.

Exception: Installation instructions are not required to be furnished when it is determined that the mounting means is obvious.

7.5 The temporary mounting means shall comply with the requirements in 5.1.4 and Sections 29 and 33.

7.6 An RPT intended to be mounted on a desk or similar furnishing surface shall comply with the requirements in 12.5 and Section 34A.

Added 7.6 effective October 24, 2002

8 Corrosion Protection

8.1 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: Minor parts of iron or steel, such as washers, screws and the like that are not in the grounding conductor path are not required to comply with this requirement.

9 Insulating Materials

9.1 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.

9.2 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.

9.3 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.

10 Power-Supply Cord

10.1 General

10.1.1 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 RPT rated 15 A or less when marked in accordance with 38.11.

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

10.1.3 The minimum conductor size of the power-supply cord shall be as indicated in Table 10.1.

10.1.4 The length of a power-supply cord – as measured from the outside surface of the enclosure of the RPT to the plane of the face of the attachment plug – shall not exceed 25 ft (7.62 m) nor be less than 1.5 ft (0.46 m).

10.1.5 A power-supply cord shall have a voltage rating not less than the rated voltage of the RPT and have an ampacity not less than the current rating of the RPT.

Table 10.1
Guide to construction and performance requirements for relocatable power taps

Revised Table 10.1 effective February 28, 2001

Relocatable power tap 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)
20	12	<6	NO	20 ^c	20	12
20	12	≥6	YES	20	20	12
15	14	<4	NO	15 ^c	15	14
15	14	≥4	YES ^h	15	15	14
<15	14	<4	NO	15 ^{c,e}	15 ^{f,g}	14
<15	14	≥4	YES	15 ^e	OCP ^g	14

^a OCP shall not trip when the RPT is operated at the RPT 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 22), the Fault Current Test (Section 26), 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 Deleted

^e Maximum rating. An OCP rated less than 15 A and not less than the RPT rating complies with the intent of this requirement. See note (a) above.

^f Test is capable of being conducted at OCP rating when provided.

^g When the OCP rating is greater than the RPT rating, conduct the Temperature Test at the OCP rating. The OCP is not prohibited from being bypassed when nuisance tripping occurs. See 22.3.

Table 10.1 Continued

Relocatable power tap 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)
^h An OCP is not required for a 15 A RPT with four receptacles as long as: <ul style="list-style-type: none"> 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. 						

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

10.2 Bushings

10.2.1 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.

11 Strain Relief

11.1 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.

11.2 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 Receptacles

12.1 The receptacle outlets of a RPT 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 RPT rated 20 A with a 20 A attachment plug.

12.2 All of the receptacle outlets of a RPT 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).

12.3 The receptacle outlets of a RPT shall comply with the applicable requirements in the Standard for Attachment Plugs and Receptacles, UL 498. Each receptacle outlet provided in a RPT that is either equipped with temporary mounting means or intended for use in a fixed application, and having the configuration specified in Figure C1.5 of the Standard for Wiring Device Configurations, UL 1681, shall comply with the requirements of the Grounding Contact Test in UL 498.

Effective date for 12.3 changed from October 23, 1998 to February 28, 2001

12.4 The receptacle outlets of a RPT that also incorporates terminals for coaxial cable (TV/CATV) connection shall be marked in accordance with 38.10.

12.5 An RPT intended to be mounted on 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 34A.

Exception: When the intended use of the RPT 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 RPT, these requirements do not apply.

Added 12.5 effective October 24, 2002

13 Supplementary Protection

13.1 An RPT having No. 14 AWG (2.1 mm²) flexible cord and four to six receptacle outlets, and all RPT's having seven or more receptacle outlets, shall be provided with supplementary overcurrent protection. See Table 10.1.

Revised 13.1 effective February 28, 2001

13.2 A supplementary protection device shall not open during the Temperature Test, Section 22.

Exception: See note (g) of Table 10.1.

13.2 revised April 23, 1997

13.3 An RPT that requires supplementary overcurrent protection shall have a supplementary overcurrent protective device connected between the power-supply cord and the receptacles; see Table 10.1.

Revised 13.3 effective February 28, 2001

13.3.1 A supplementary overcurrent protection device shall be capable of clearing a fault current of not less than that indicated in Table 13.1 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 13.1, 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 70-1999 for branch circuit protection, is not prohibited from being used in lieu of a supplementary overcurrent protection device.

Added 13.3.1 effective February 28, 2001

13.4 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 RPT that is provided with fuses that are intended to be replaced in the field shall be marked in accordance with the requirements in 38.8.

13.4 revised August 24, 1999

13.4.1 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.

13.4.1 added April 23, 1997

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

13.5 revised April 23, 1997

13.6 The ampere rating of the overcurrent protective device of 13.2 shall not be greater than the ampacity of:

- a) The configuration of the receptacles it is to protect;
- b) That of the power-supply cord; or
- c) Other electrical components, whichever is lower.

13.7 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 38.5.

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

13.8 revised August 24, 1999

13.9 Deleted April 23, 1997

Table 13.1
Circuit capacity of supply source

Table 13.1 revised April 23, 1997

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

14 Switches

14.1 Each switch shall have voltage and current ratings 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.

14.1 revised April 23, 1997

14.2 A switch provided in a RPT shall comply with the requirements of the Standard for Special-Use Snap Switches, UL 1054. 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 RPT.

14.2 revised April 23, 1997

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14.3 Each switch shall indicate to the user when its associated circuit is energized. See 38.7.

Exception: A RPT 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.

14.3 revised April 23, 1997

14.4 A RPT is capable of being provided with indicator or pilot lights such as neon-series-resistor, LED type, or the equivalent, to show which receptacles are live or to indicate that the unit is energized.

15 Live Parts

15.1 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.

15.2 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.

15.3 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.

16 Internal Wiring

16.1 The internal wiring of a RPT shall be rated for the voltage, temperature, and other conditions of use as indicated in Table 10.1.

16.2 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.

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

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

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

16.6 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.

16.7 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.

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

16.9 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.

16.10 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.

16.11 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.

17 Spacings

17.1 The spacings of a RPT shall comply with the requirements of Table 17.1.

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 inch (1.2 mm).

17.2 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.

Effective date for 17.2 changed from October 23, 1998 to February 28, 2001

Table 17.1
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 inch (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.					

17.3 Vulcanized fiber not less than 0.028 inch (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 inch (0.40 mm) thick.

18 Printed-Wiring Boards

18.1 A printed-wiring board shall comply with the requirements in the Standard for Printed-Wiring Boards, UL 796, 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.

18.1 revised October 16, 1998

18.2 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.

18.2 revised April 23, 1997

18.3 The receptacle outlets of a RPT shall comply with the applicable requirements in the Standard for Attachment Plugs and Receptacles, UL 498.

18.4 A RPT that has a receptacle grounding path through traces on a printed-wiring board shall comply with the Fault Current Test, Section 26, and the Overcurrent Test, Section 28.

Effective date for 18.4 changed from October 23, 1998 to February 28, 2001

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

Effective date for 18.5 changed from October 23, 1998 to February 28, 2001

19 Separation of Circuits

19.1 Electrical wiring of a RPT and wiring of communication circuits shall be separated by a permanent barrier or a 2-inch (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 17.1.

20 Grounding

20.1 General

20.1.1 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.

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

20.1.3 The conductive connection of parts required by 20.1.1 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 20.2.2. 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 16.7. A push-in (screwless), quick-connect, or similar friction-fit connector shall not be used for this connection.

20.1.4 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.

20.1.5 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 RPT 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 RPT shall be green with or without one or more yellow stripes.

20.1.6 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 RPT.

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

20.1.8 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.

20.1.9 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.

20.1.10 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 UL 1414, Standard for Across-the-Line, Antenna-Coupling, and Line-By-Pass Capacitors for Radio- and Television-Type Appliances).

20.1.10 added February 11, 2000

20.2 Bonding

20.2.1 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.

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

20.2.3 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.

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

20.2.5 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.

20.2.6 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.

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

20.2.8 A bonding conductor shall not be spliced.

PERFORMANCE

21 General

21.1 When the use of cheesecloth is specified, the cloth to be used is to be a bleached cheesecloth running 14 – 15 yd²/lb (approximately 26 – 28 m²/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).

21.2 A RPT shall be subjected to the applicable tests specified in Sections 22 – 34. 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.

21.3 For tests in which the RPT 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 RPT.

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

22 Temperature Test

22.1 A RPT shall be subjected to the temperature test described in 22.2 – 22.14.

22.2 An overcurrent protective device shall not open the circuit during the temperature test specified in 22.4.

22.3 When the OCP rating is greater than the RPT rating, the temperature test as described in this section is to be conducted at the OCP rating. The OCP is not prohibited from being bypassed when nuisance tripping occurs.

22.4 The temperature of a RPT, tested under the conditions of Table 10.1 shall not adversely affect any materials employed, or exceed the temperatures indicated in Table 22.1.

Table 22.1
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 22.7.		
^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.		

22.5 The RPT 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.

22.6 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 minutes, or more.

22.7 The temperatures specified in Table 22.1 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).

22.8 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 22.1 and Table 22.2.

Table 22.2
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)

22.9 When a test is conducted at an ambient temperature other than 25°C (77°F), an observed temperature shall be corrected as described in 22.10.

22.10 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] of the difference between 25°C and the ambient temperature.

22.11 Temperature readings are to be obtained by means of thermocouples consisting of No. 28 – 32 AWG (.08 – .032 mm²) iron and constantan wires. Number 30 AWG (.05 mm²) iron and constantan wires and a potentiometer-type of indicating instrument are to be used whenever referee temperatures are required.

22.12 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 MC96.1-1982.

22.12 revised August 24, 1999

22.13 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.

22.14 To facilitate conducting the test on a totally enclosed – encapsulated – component of a RPT, 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.

23 Dielectric Voltage-Withstand Test

23.1 A RPT shall withstand a potential as follows:

- a) For RPT's rated 125 V AC or less– 1250 V AC or 1768 V DC;
- b) For RPT'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.

23.2 To determine whether a RPT complies with the requirements in 23.1, the test potential is to be applied as described in 23.4 by means of test equipment having the characteristics outlined in 23.3.

23.3 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 ohms 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 ohms.

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.

23.4 The method of applying the test voltage to the RPT is to be such that there are not any transient voltages that result in the instantaneous voltage applied to the RPT 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 five seconds, and then, is to be maintained at the test potential for 1 minute. Manual control of the rate of rise is not prohibited from being used.

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

24 Leakage Current Test

24.1 General

24.1.1 The leakage current of a product rated for a nominal 250 V or less supply, when tested in accordance with 24.1.3 – 24.1.6, shall not be more than 0.5 mA.

24.1.2 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.

24.1.3 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.

24.1.4 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 in contact with the surface. When the surface has an area less than 10 by 20 cm, 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.

24.1.5 The measurement circuit for leakage current is to be as illustrated in Figure 24.1. 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.

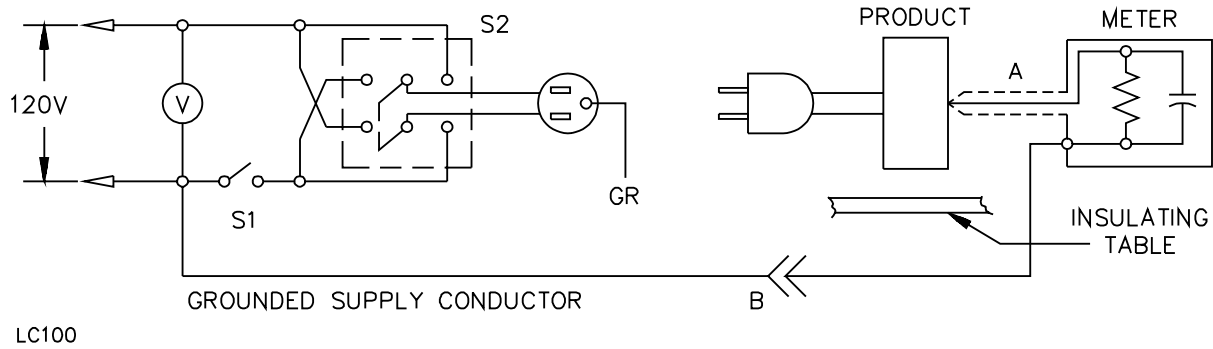
- a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 μ F.
- b) The meter is to indicate 1.11 times the average of the full-wave rectified composite waveform of the voltage across the resistor or current through the resistor.
- c) Over a frequency range 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 ohm resistor shunted by a 0.15 μ F capacitor to 1500 ohms. 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.

24.1.6 A sample of the RPT 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 RPT. The test sequence, with reference to the measuring circuit in Figure 24.1, is to be as follows:

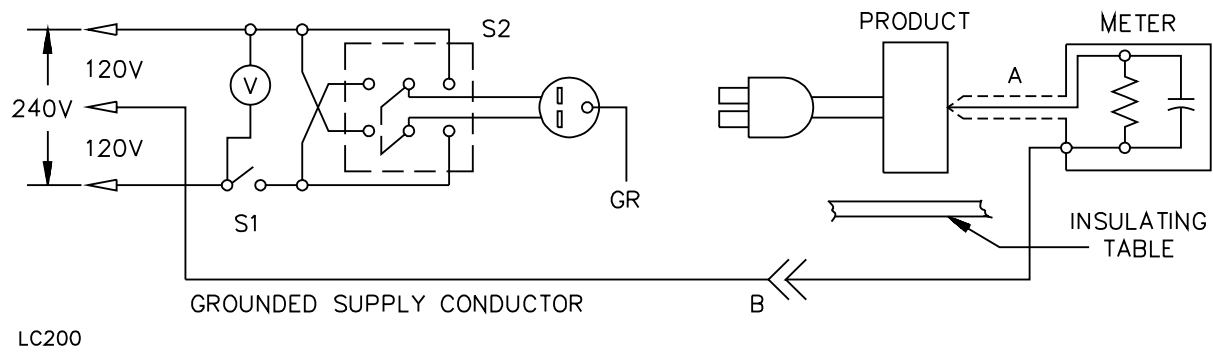
- a) With the switch S1 open, the RPT is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2, and with the RPT switching devices in all their normal operating positions.
- b) Switch S1 is then to be closed, energizing the RPT, and within 5 seconds, the leakage current is to be measured using both positions of switch S2 and with the RPT 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 RPT as in the Temperature Test by loading only the receptacle furthest from the power-supply cord.

Figure 24.1
Leakage current measurement circuits

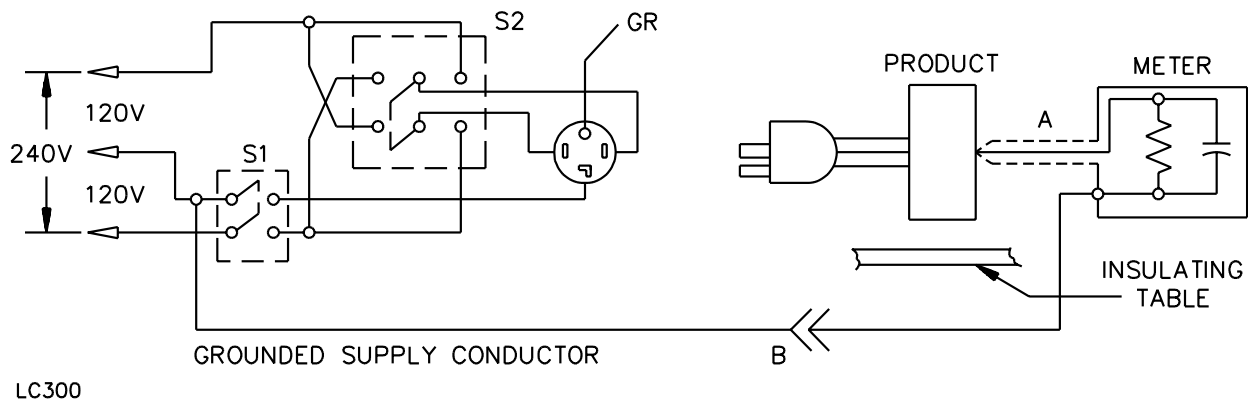
Figure 24.1 revised October 14, 1997



Product intended for connection to a 125-volt power supply



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 a shielded lead.

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

24.2 Leakage current after humidity conditioning

24.2.1 At the end of the conditioning period specified in 24.2.2 a sample of a RPT shall be subjected to the leakage current test specified in 24.1.3 – 24.1.6. The leakage current shall not be more than 0.5 mA.

24.2.2 A sample of a RPT 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 hours in air having a relative humidity of 88 ± 2 percent and a temperature of $32 \pm 2^\circ\text{C}$ ($90 \pm 4^\circ\text{F}$).

24.2.3 Following the conditioning, the leakage current should be measured, as described in 24.1.6(a), on the sample while it is still in the humidity chamber. See 24.1.4 and 24.1.5.

24.2.4 The sample, either in or immediately after (within one minute) removal from the humidity chamber, should be energized and tested as described in 24.1.6 (b) and (c).

25 Grounding Continuity Test

25.1 A previously untested RPT is to be subjected to the Grounding Continuity Test as described in 25.2. A RPT shall have a grounding-path resistance of 0.1 ohm or less.

25.2 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.

26 Fault Current Test

26.1 General

26.1.1 When required by note (b) of Table 10.1, or 18.4, three samples of previously untested RPT's are to be subjected to the Fault Current Test as described in 26.1.3, 26.1.4, and 26.2.2. The RPT shall comply with the requirements in 26.1.4. Each RPT shall be tested once.

Effective date for 26.1.1 changed from October 23, 1998 to February 28, 2001

26.1.2 Effective date for deletion of 26.1.2 changed from October 23, 1998 to February 28, 2001

26.1.3 Each RPT shall be tested on a circuit calibrated in accordance with 26.2.2. The available current capacity of the circuit is to be as specified in Table 13.1. 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 RPT 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.

Effective date for 26.1.3 changed from October 23, 1998 to February 28, 2001

26.1.4 A relocatable power tap shall have a grounding-path resistance of 0.1 ohm or less after the test described in 26.1.3. See 25.2. Also, during and following the Fault Current Test, the following conditions shall not occur:

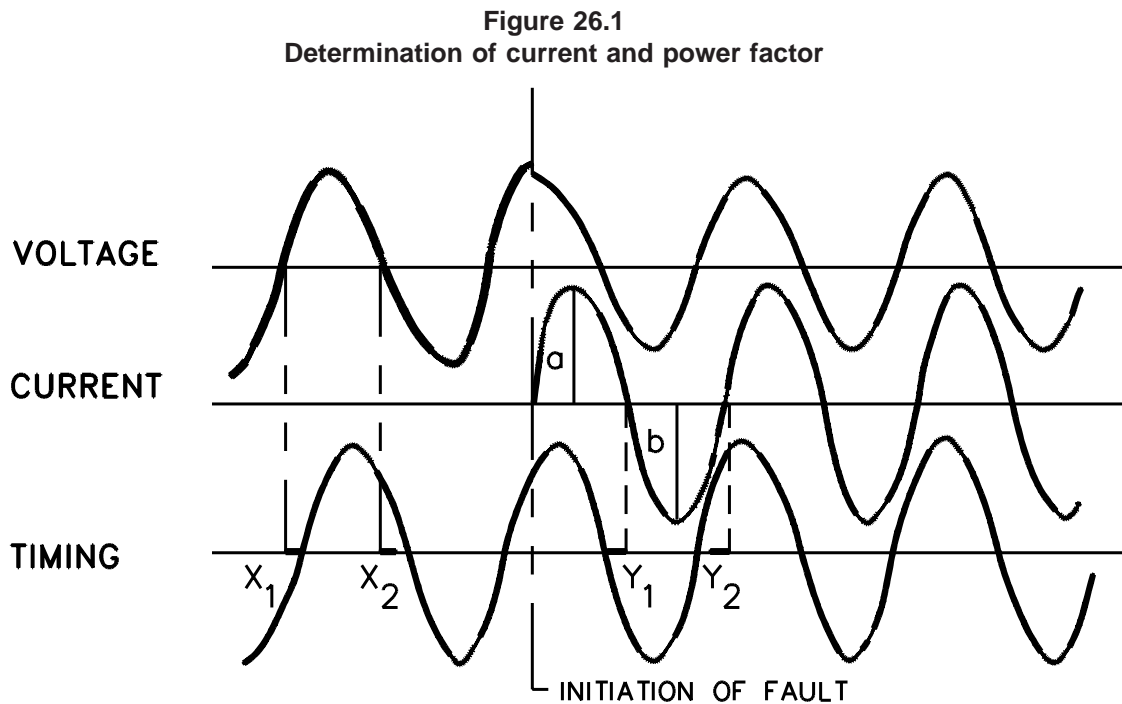
- a) Emission of flame, molten metal, or glowing or flaming particles through any openings (pre-existing or created as a result of the test) in the product;
- b) Charring, glowing, or flaming of the supporting surface;
- c) Ignition of the enclosure;
- d) Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 6A; and
- e) There shall not be evidence of degradation or separation of the trace from the printed-wiring board.

Effective date for 26.1.4 changed from October 23, 1998 to February 28, 2001

26.2 Calibration of test circuits

26.2.1 *Effective date for deletion of 26.2.1 changed from October 23, 1998 to February 28, 2001*

26.2.2 The current is to be the rms value of the first complete cycle – see Figure 26.1 – 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.



SB0740

27 Grounding Contact Test

Effective date for deletion of Section 27 changed from October 23, 1998 to February 28, 2001

28 Overcurrent Test

28.1 When required by note (b) of Table 10.1, 18.4 or 18.5, three previously untested RPT's are to be subjected to the Overcurrent Test as described in 28.2.1 – 28.6. The RPT shall comply with the requirements in 28.6 and 28.7. Each RPT shall be tested once.

Effective date for 28.1 changed from October 23, 1998 to February 28, 2001

28.2 Effective date for deletion of 28.2 changed from October 23, 1998 to February 28, 2001

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

Effective date for 28.2.1 changed from October 23, 1998 to February 28, 2001

28.2.2 The resistance of each circuit conductor path as specified in 18.4 and 18.5 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.

Effective date for 28.2.2 changed from October 23, 1998 to February 28, 2001

28.3 The RPT is to be mounted so as to provide free air flow around all sides and the top. The ambient temperature is to be $25 \pm 5^{\circ}\text{C}$ ($77 \pm 9^{\circ}\text{F}$). The load current and time duration is to be as indicated in 28.4. Rated frequency is to be used. Any voltage not higher than the rated voltage is not prohibited from being used.

28.3 revised April 23, 1997

28.4 For a RPT with integral overcurrent protection, the overload current is to be 200 percent of the overcurrent device rating. For a RPT 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 RPT is intended to be connected. The overcurrent test current is to be applied for 2 minutes.

Effective date for 28.4 changed from October 23, 1998 to February 28, 2001

28.5 Effective date for deletion of 28.5 changed from October 23, 1998 to February 28, 2001

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 6A; and
- e) There shall be no evidence of degradation or separation of the trace from the printed-wiring board.

Effective date for 28.6 changed from October 23, 1998 to February 28, 2001

28.7 After the sample has cooled to room temperature, the resistance of each circuit conductor path is to be determined as specified in 28.2.2. 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 ohm.

Effective date for 28.7 changed from October 23, 1998 to February 28, 2001

29 Mounting Hole Barrier Tests

29.1 General

29.1.1 When penetration or deflection of a barrier behind a mounting hole of the RPT increases the risk of fire, electric shock, or injury to persons, the RPT 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 6A;
- b) A reduction of spacings below the values specified in Spacings, Section 17;
- 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 RPT; and
- e) Any other condition that increases the risk of electric shock.

29.1.1 revised April 23, 1997

29.2 Mounting hole barrier impact test

29.2.1 The RPT 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 RPT is to be mounted using a No. 8 x 3/4-inch wood screw. When the screws are resting against the barrier there is to be 1/4 inch (6.35 mm) clearance between the back of the enclosure and the mounting surface. See Figure 29.2

29.2.1 revised April 23, 1997

29.2.2 Each mounting hole configuration of the RPT shall be subjected to a single impact of 5 ft-lbf (6.8 J) to the RPT 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 RPT with the specified impact as shown in Figure 31.2. Each impact shall be applied to a point on the RPT 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 RPT shall withstand a force of 20 pounds (89 N). The force is to be applied by means of the barrier probe shown in Figure 29.3.

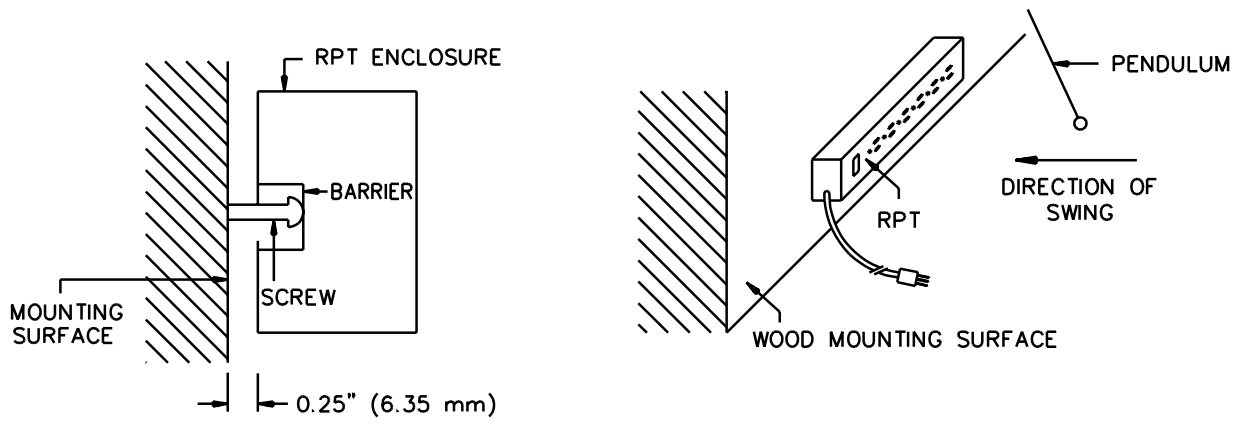
Figure 29.1
Articulated accessibility probe

Figure 29.1 relocated as Figure 6A.1 April 23, 1997

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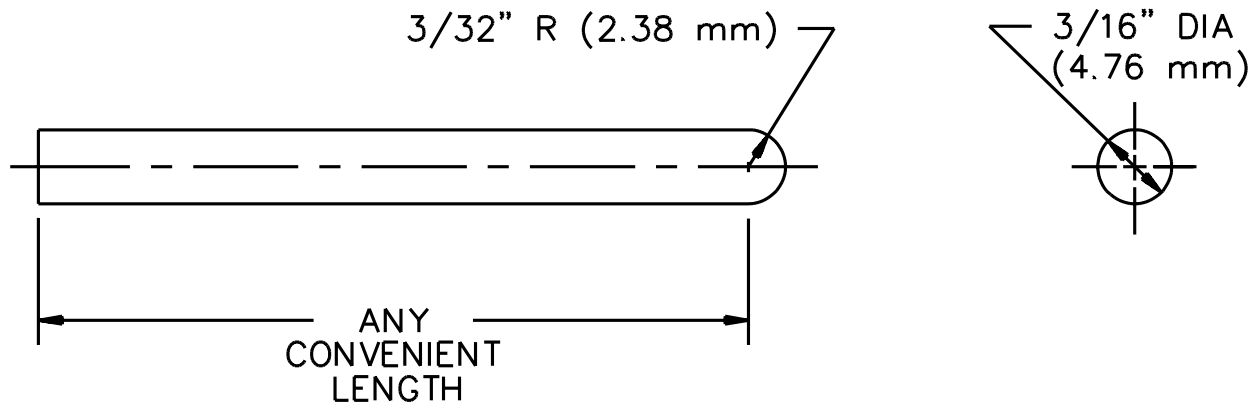
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Figure 29.2
Test set-up for mounting hole barrier impact test



S3611B

Figure 29.3
Barrier probe



PA 251

30 Strain Relief Test

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

30.2 The RPT 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 minute without sufficient movement of the power-supply conductors at the cut end to indicate transmission of stress to internal connections.

31 Impact Tests

31.1 General

31.1.1 A RPT employing a metallic or polymeric enclosure is to be subjected to the impact tests described in 31.2.1 – 31.4.1 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 6A;
- b) Any condition that is capable of affecting the intended mechanical performance of the RPT;
- c) Any other condition that increases the risk of electric shock; and
- d) Spacings shall not be less than those described in Spacings, Section 17.

31.1.1 and 31.4.2 revised and combined as 31.1.1 April 23, 1997

31.1.2 With reference to 31.1.1(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.

31.1.3 With reference to 31.1.1(c), the RPT is to comply with the Dielectric Voltage-Withstand Test, Section 23, after being subjected to the impact tests described in this section.

31.2 Drop impact test

31.2.1 Each of three samples of the RPT is to be subjected to an impact that results from the sample being dropped three times (a series) through a distance of 3 feet from the bottom of the RPT (0.91 m) to strike a concrete 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 31.2 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.

31.3 Steel sphere impact test

31.3.1 Each of three samples of the RPT 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 pounds (0.535 kg), from a height that produces the specified impact as shown in Figure 31.3.

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 31.3. 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 31.2 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.

31.4 Low-temperature steel sphere impact test

31.4.1 For a RPT with a polymeric enclosure, three samples of a RPT shall be cooled to a temperature of $0.0 \pm 2.0^{\circ}\text{C}$ ($32.0 \pm 3.6^{\circ}\text{F}$) and maintained at this temperature for 24 hours. While the unit is still cold, within one minute after removal from the temperature chamber, the samples are to be subjected to the impact described in 31.3.1.

31.4.2 31.1.1 and 31.4.2 revised and combined as 31.1.1 April 23, 1997

**Figure 31.1
Procedure for impact tests**

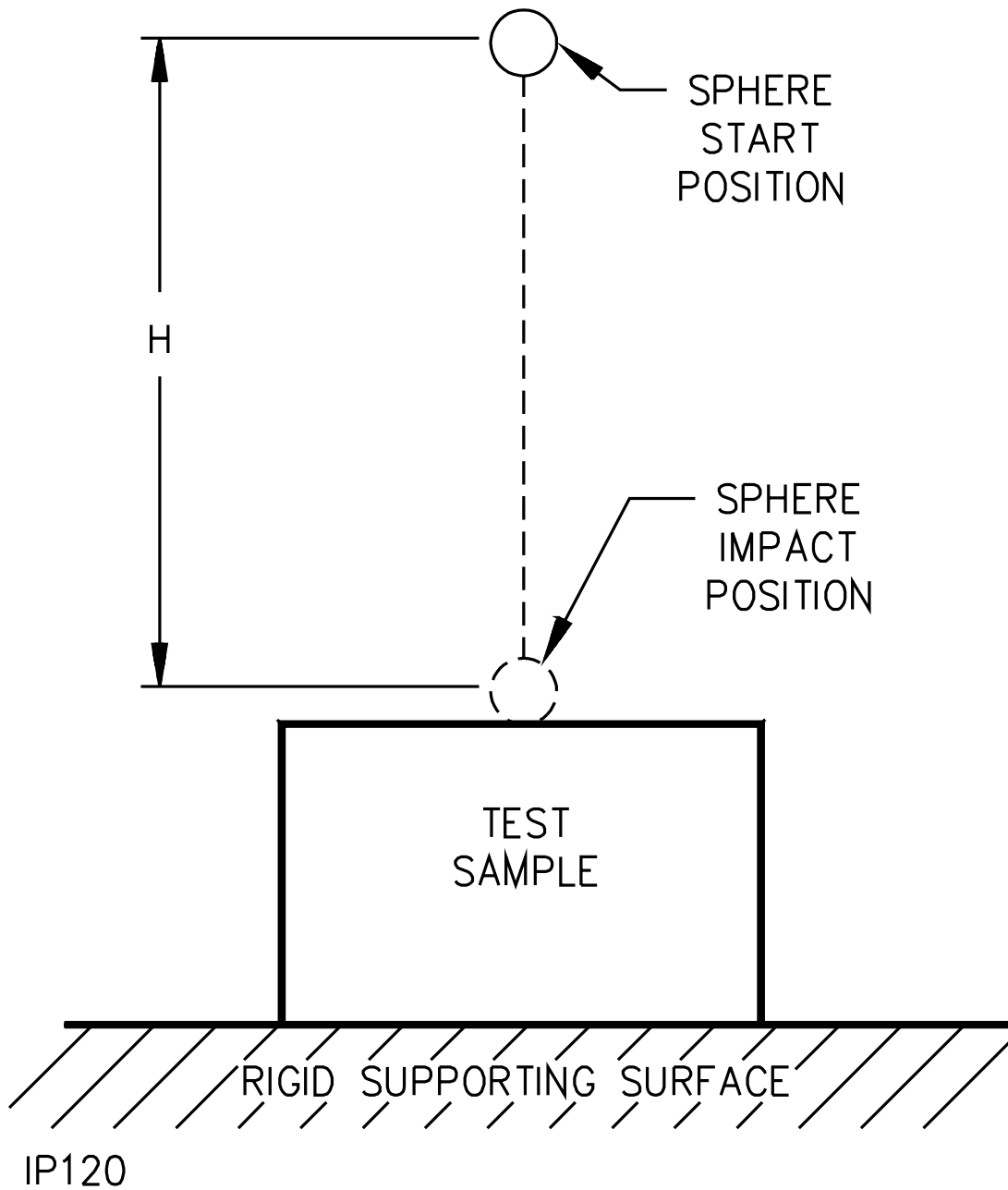
Series Number	Sample Number											
	1	2	3	1	2	3	1	2	3	1	2	3
1	↓ A	N	N	↓ A	N	N	↓ A	N	N	↓ A	N	N
2	↓ A	N	N	↓ A	N	N	↓ U	↓ A	N	↓ U	↓ A	N
3	↓ A	N	N	↓ U	↓ A	N	↓ A	N		↓ U	↓ A	

Arrows indicate sequence of test procedure
 A – Acceptable results from drop
 U – Unacceptable results from drop
 N – No test necessary

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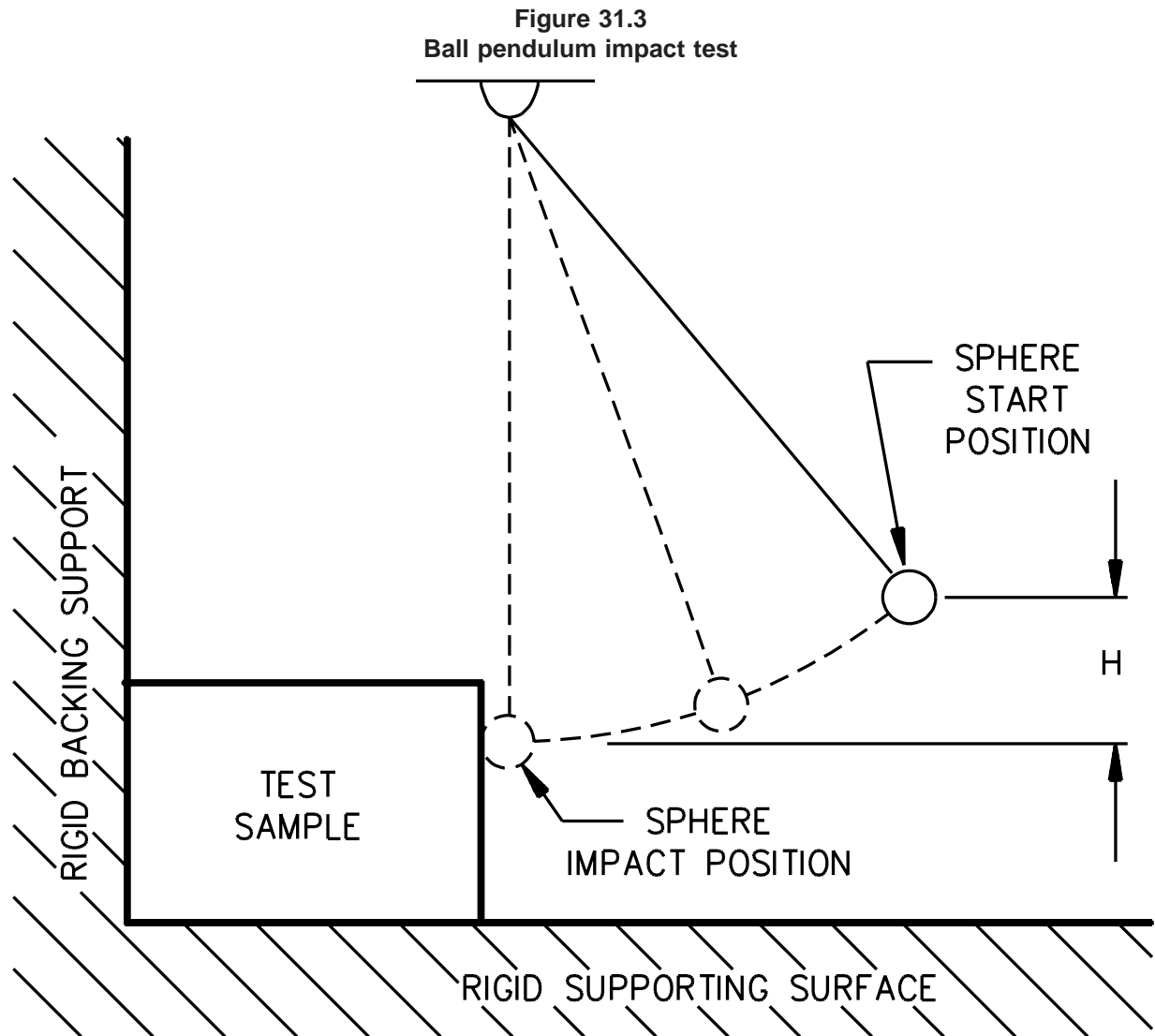
Each series consists of three drops or one ball impact as applicable.

Figure 31.2
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 inch (19 mm) plywood. The oak flooring is nominally 3/4 inch thick (actual size 3/4 by 2 1/4 inches 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.



IP 160

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 inch (19 mm) plywood. The oak flooring is nominally 3/4 inch thick (actual size 3/4 by 2 1/4 inches 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 inch (19 mm) plywood over a rigid surface of concrete. An equivalent nonresilient backing surface is not prohibited from being used.

32 Crushing Test

32.1 A RPT employing a metallic or polymeric enclosure is to be subjected to the crush test described in 32.4 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 6A;
- b) Any condition that is capable of affecting the intended mechanical performance of the RPT; and
- c) Any other condition that increases the risk of electric shock.

32.1 revised April 23, 1997

32.2 With reference to 32.1(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.

32.3 With reference to 32.1(c), the RPT is to comply with the Dielectric Voltage-Withstand Test, Section 23, after being subjected to the crush tests described in this section.

32.4 A previously untested sample of a RPT shall be placed on a 1/2-inch (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 RPT by means of a horizontal 3/4-inch (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 RPT, perpendicular to the long axis of the RPT. 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 one minute. The crushing force is not to be applied to protruding members of receptacles, switch toggles/triggers, indicator lamps and OCP reset members.

32.5 At the end of the tests described in 32.1 – 32.4, spacings shall not be less than those described in Spacings, Section 17.

33 Adequacy of Mounting Test

33.1 To determine compliance with 33.2 and 33.3, a RPT provided with a means for temporary mounting is to be mounted in accordance with manufacturer's installation instructions on any secure wall.

Exception: When the RPT is not provided with installation instructions, the RPT shall be tested in the most severe mounting configuration.

33.2 After the RPT has been installed according to manufacturer's instructions, a weight of four times the weight of the RPT or 5 lbs (2.27 kg), whichever is greater, is to be hung from the center of the RPT as shown in Figure 33.1 for each mounting configuration.

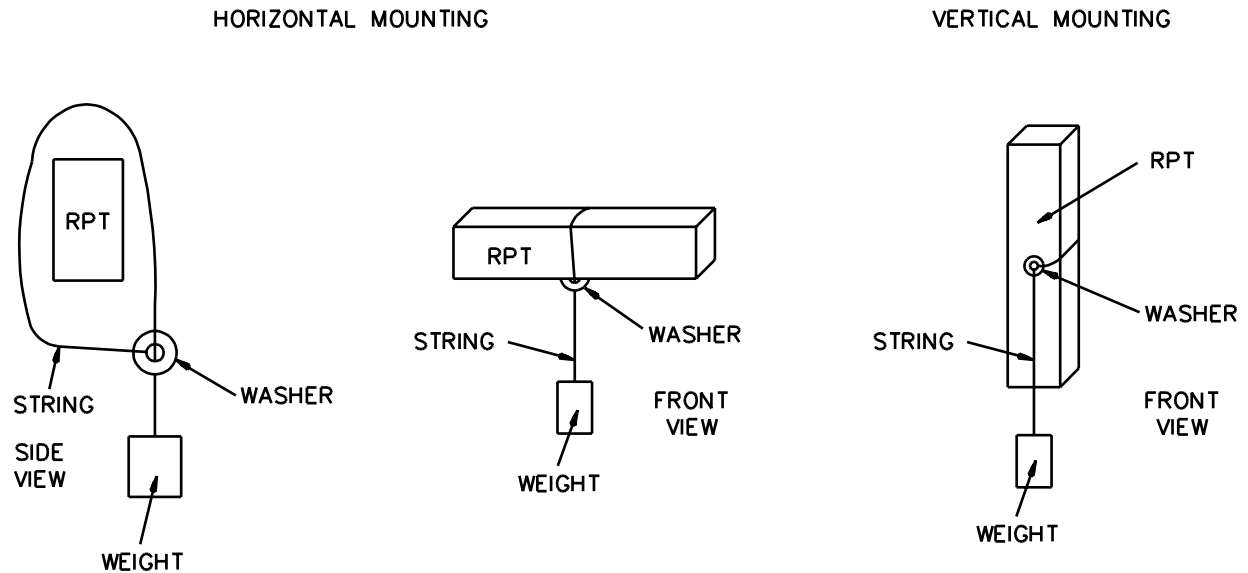
33.3 There shall be no occurrence of the following as a result of this test:

- 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 6A;
- b) Any condition that is capable of affecting the intended mechanical performance of the RPT;
and
- c) Any other condition that increases the risk of electric shock.

33.3 revised April 23, 1997

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Figure 33.1
Test method for adequacy of mounting test



S3612B

34 Mold Stress-Relief Distortion Test

34.1 For a RPT with a polymeric enclosure, conditioning of the equipment as described in 34.2 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:

- 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 17;
- Creation of any openings in the enclosure that result in accessibility of live parts, when evaluated in accordance with Accessibility of Live Parts, Section 6A, or defeating the integrity of the enclosure so that the required mechanical protection is not afforded to internal parts of the equipment;
- A condition that results in the equipment not complying with the Strain Relief Test, Section 30, when applicable; and
- Interference with the intended operation or servicing of the equipment.

Exception: The conditioning described in 34.2 is not required for rigid thermosetting materials or for low-pressure, foamed molded parts.

34.2 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 hours. After its careful removal from the oven and return to room temperature, the sample is to be investigated for compliance with 34.1.
- 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 hours. After its careful removal from the test cell, the sample is to be investigated for compliance with 34.1.

34A Spill Test

34A.1 An RPT intended to be mounted on a desk or similar furnishing surface shall be subjected to the test described in this section and, after the testing, shall be subjected to the Dielectric Voltage-Withstand Test, Section 23 with acceptable results.

Added 34A.1 effective October 24, 2002

34A.2 The RPT 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.

Added 34A.2 effective October 24, 2002

34A.3 A three-inch (76.2-mm) diameter container, 4 inches (101.6 mm) in height, is to be filled with eight fluid ounces (0.24 L) of saline solution, consisting of 8 grams 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 23 is to be conducted 1 minute after the container is tipped over.

Added 34A.3 effective October 24, 2002

MANUFACTURING AND PRODUCTION-LINE TESTS

35 Dielectric Voltage-Withstand Test

35.1 Each RPT 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 RPT that employs a component that can be damaged by the dielectric potential.

35.2 The production-line test is to be in accordance with any of the alternatives of Table 35.1.

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

Table 35.1
Production-line dielectric withstand test conditions for relocatable power taps

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

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35.4 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 one second, the output voltage is to be maintained within the specified range when:
 - 1) Only a voltmeter having an input impedance of at least 2 megohms 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 one minute, the output voltage is to be maintained within the specified range (by manual or automatic means) throughout the one-minute duration of the test or until there is an indication of unacceptable performance.

35.5 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.

35.6 In addition to the characteristics indicated in 35.4, 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 ohms is connected across the output, the test equipment is to indicate an unacceptable performance within 0.5 second. A resistance of more than 120,000 ohms 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.

35.7 There shall not be any transient voltage applied to the RPT under test that results in the instantaneous voltage applied to the RPT 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 RPT and the time that the voltage is removed from the RPT.

36 Grounding Continuity Test

36.1 Each RPT 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 RPT 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.

36.2 Compliance with 36.1 is determined by any appropriate device, such as an ohmmeter or a battery and buzzer combination, applied between the point of connection of the RPT grounding means and the metal parts in question.

RATINGS

37 Details

37.1 A RPT 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 20 A, the ampacity of the power-supply cord, nor the highest rating of the overcurrent protective device that is provided.

MARKINGS

38 Details

38.1 Unless otherwise indicated, all markings shall be clearly visible, readily legible, and placed on the outside of the enclosure.

38.2 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. Ordinary usage, handling, storage, and the like of the unit are to be evaluated in determining whether a marking is permanent.

38.3 A RPT 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 RPT electrical rating in volts and amperes; 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.

38.3 revised December 12, 1996

38.4 When a manufacturer produces or assembles a RPT at more than one factory, each RPT 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.

38.5 With regard to 13.7, a receptacle outlet or group of outlets of a RPT shall be marked to indicate the rating of the overcurrent protective device that protects the receptacle outlet.

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

38.7 A switch employed on a RPT, without an associated pilot light and as indicated in 14.3, shall be marked "on"/"off", "1"/"0", or the equivalent, to indicate to the user when the receptacles are energized when the RPT is connected to a power-supply. The marking shall be either on the switch or on an adjacent part of the enclosure.

38.8 A RPT 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 RPT 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 inch (2.4 mm) high. These markings shall be located adjacent to the fuseholder so as to be visible during fuse replacement.

38.9 A RPT 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 inch (2.4 mm) high.

38.10 A RPT 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 and shall comply with the antenna connection instruction requirements of the Standard for Television Receivers and High-Voltage Video Products, UL 1410.

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

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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

Antenna-Discharge Units – UL 452
Attachment Plugs and Receptacles – UL 498
Cord Sets and Power-Supply Cords – UL 817
Filters, Electromagnetic Interference – UL 1283
Flexible Cord and Fixture Wire – UL 62
Fuses for Supplementary Overcurrent Protection – UL 198G
Insulating Materials – General, Systems of – UL 1446
Lampholders, Edison-Base – UL 496
Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of – UL 94
Polymeric Materials – Fabricated Parts – UL 746D
Polymeric Materials – Long Term Property Evaluations – UL 746B
Polymeric Materials – Short Term Property Evaluations – UL 746A
Polymeric Materials – Use in Electrical Equipment Evaluations – UL 746C
Printed-Wiring Boards – UL 796
Protectors, Secondary, for Communications Circuits – UL 497A
Protectors, Supplementary, for Use in Electrical Equipment – UL 1077
Receptacles and Switches Intended for Use with Aluminum Wire – UL 1567
Sleeving, Coated Electrical – UL 1441
Switches, General-Use Snap – UL 20
Switches, Special-Use – UL 1054
Tape, Polyvinyl Chloride, Polyethylene, and Rubber Insulating – UL 510
Telephone Equipment – UL 1459
Temperature-Indicating and -Regulating Equipment – UL 873
Terminal Blocks – UL 1059
Terminals, Quick-Connect, Electrical – UL 310
Thermal Cutoffs for Use in Electrical Appliances and Components – UL 1020
Transient Voltage Surge Suppressors – UL 1449
Tubing, Extruded Insulating – UL 224
Wire Connectors for Use with Aluminum Conductors – UL 486B
Wire Connectors and Soldering Lugs for Use with Copper Connectors – UL 486A
Wires and Cables, Rubber-Insulated – UL 44
Wires and Cables, Thermoplastic-Insulated – UL 83
Wires, Cables, and Flexible Cords, Electrical – UL 1581

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**Superseded requirements for
the Standard for
Relocatable Power Taps
UL 1363, Second Edition**

The requirements shown are the current requirements that have been superseded by requirements in revisions issued for this Standard. To retain the current requirements, do not discard the following requirements until the future effective dates are reached.

**Table 10.1
Guide to construction and performance requirements for relocatable power taps**

Relocatable power tap 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 ^c (AWG)
20	12	<6	NO	20 ^d	20	12
20	12	≥6	YES	20	20	12
15	14	<4	NO	15 ^d	15	14
15	14	≥4	YES ^h	15	15	14
<15	14 ^g	<4	NO	15 ^{d,e}	15 ^{b,f}	14 ^g
<15	14	≥4	YES	15 ^e	OCP rating ^f	14

^a OCP shall not trip when the RPT is operated at the RPT 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 22), the Fault Current Test (Section 26), and the Overcurrent Test (Section 28) comply with the requirements using the smaller AWG wire.

^c When provided with an OCP.

^d 16 AWG that is used for the power-supply cord or internal wiring of a RPT rated 13 A or less with 3 outlets or less complies with the intent of this requirement.

^e Maximum rating. An OCP rated less than 15 A and not less than the RPT rating complies with the intent of this requirement. See note (a) above.

^f Test is not prohibited from being conducted at OCP rating when provided.

^g When the OCP rating is greater than the RPT rating, conduct the Temperature Test at the OCP rating. The OCP is not prohibited from being bypassed when nuisance tripping occurs. See 22.3.

^h An OCP is not required for a 15 A RPT with four receptacles as long as:

- Internal wiring is 12 AWG;
- The power-supply cord is 12 AWG;
- All other components are evaluated for use at 20 A; and
- The Temperature Test load is 20 A.

12.3 The receptacle outlets of a RPT shall comply with the applicable requirements in the Standard for Attachment Plugs and Receptacles, UL 498.

13.1 A RPT having No. 14 AWG (2.1 mm²) flexible cord and four to six receptacle outlets, and all RPT's having seven or more receptacle outlets, shall be provided with overcurrent protection. See Table 10.1.

13.3 A RPT that requires overcurrent protection shall have an overcurrent protective device connected between the power-supply cord and the receptacles; see Table 10.1. The overcurrent protective device shall comply with the requirements in the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077, for use with motor loads. Its short-circuit capacity shall be a minimum of 1000 A and it shall have the following calibration at 77°F (25°C): 100 percent hold, 125 percent/135 percent trip.

17.2 When a barrier or liner of insulating material is used in areas where spacings are otherwise insufficient, it shall be resistant to moisture absorption, 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 the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

18.4 An RPT that has a receptacle grounding path through traces on a printed-wiring board shall be subjected to the Fault Current Test, Section 26, and the Overcurrent Test, Section 28. There shall be no evidence of separation of the trace from the printed wiring board as a result of these tests.

26 Fault Current Test

26.1 General

26.1.1 When required by note (b) of Table 10.1, or 18.4, a previously untested RPT is to be subjected to the Fault Current Test as described in 26.1.2 – 26.2.2. The RPT shall not show evidence of ignition, cracking, breaking, or similar physical damage upon completion of this test. Each RPT shall be tested once.

26.1.2 A relocatable power tap shall have a grounding-path resistance of 0.1 ohm or less prior to the test as described in 26.1.3. See 25.2.

26.1.3 Each RPT is to be tested on a circuit capable of delivering 1000 A with a power factor of 0.70 – 0.80 through shorted bus bars. The grounding or bonding circuit is to be connected in series with a 20 A circuit breaker suitable for branch circuit protection. The circuit shall be completed by the insertion into the energized RPT of a grounding-type Hospital Grade attachment plug with a 2-foot (0.61-m) length of flexible cord having No. 14 (2.1 mm²) conductors twisted and soldered together. The branch circuit conductor or OCP, when provided, shall operate when the test circuit is closed.

26.1.4 A relocatable power tap shall have a grounding-path resistance of 0.1 ohm or less after the test as described in 26.1.3. See 25.2.

26.2 Calibration of test circuits

26.2.1 The available current capacity of the circuit is to be at least 1000 amperes. The frequency of the test circuit is to be 60 ±12 hertz.

26.2.2 The current is to be the rms value of the first complete cycle – see Figure 26.1 – when the circuit is closed to produce an essentially 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 desired symmetrical waveform of a single-phase test circuit, controlled closing is recommended although random closing methods are not prohibited from being 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 suitable timing wave. The power factor is to be computed as an average of the values obtained by using the two current zero points.

27 Grounding Contact Test

27.1 Each receptacle outlet of a RPT having a standard configuration with a U-shaped grounding pin clearance opening, and intended to receive an attachment plug grounding pin of 0.184 – 0.190 inch (4.67 – 4.83 mm) diameter by 0.843 inch (21.41 mm) maximum length, is to be subjected to the tests indicated in this section.

27.2 Each RPT is to be supported so that the face of the receptacle outlet under test remains in a vertical plane during each of the 1-minute contact conditioning periods. Previously untested samples are to be used.

27.3 With the receptacle oriented to create the maximum grounding contact displacement (possible distortion of contact affecting its contact ability), the test pin A, specified in Figure 27.1, is to be fully inserted in the grounding contact. A 5 lb (2.27 kg) weight is to be gradually suspended from the test pin 6 inches (152 mm) from the face of the receptacle. The weight is to be applied for one minute, following which, the weight is to be removed. The application of the weight is then to be repeated with the receptacle under test 90, 180, and 270 degrees so that a total of four applications of the test force are applied to each receptacle grounding contact. The test is not prohibited from being started with the grounding pin opening directly above, below or on either side of the line slots.

27.4 As a result of the test described in 27.3, there shall be no breakage of the outlet face of the receptacle that exposes live parts to contact by a 1/16 inch (1.60 mm) diameter rod. In addition, there shall be no breakage or distortion of the insulating body of the receptacle that results in a reduction of electrical spacings to values less than those required for the receptacle. The conditioning pin shall remain in place without extraneous support for the required 1 minute in each position.

27.5 Each sample shall then be retested for electrical continuity between each receptacle grounding contact and the fully inserted test pin B, Figure 27.2. There shall be no loss of contact while the pin is moved by hand, without exerting undue pressure, so as to touch all internal walls and surfaces. The stop ring of the pin shall remain continuously in contact with the face of the receptacle. An indicating device, such as an ohmmeter, a battery-and-buzzer combination, or similar part, is to be used.

27.6 Each sample shall then be positioned with the receptacle outlet facing down in a horizontal position. Each receptacle grounding contact shall support the 2- and 4-oz (57- and 113-g) grounding pin illustrated in Figure 27.3 and 27.4, for 1 minute each when fully inserted in the grounding pin opening.

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Figure 27.1
Test pin A

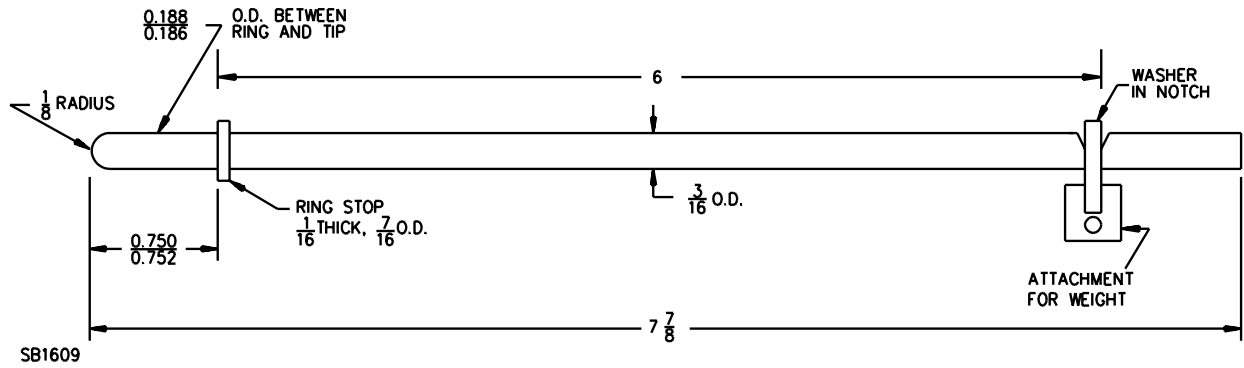


Figure 27.2
Test pin B

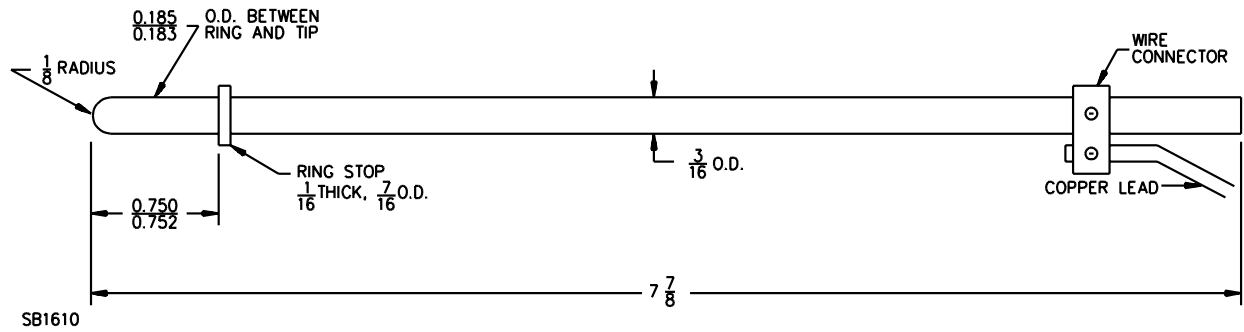
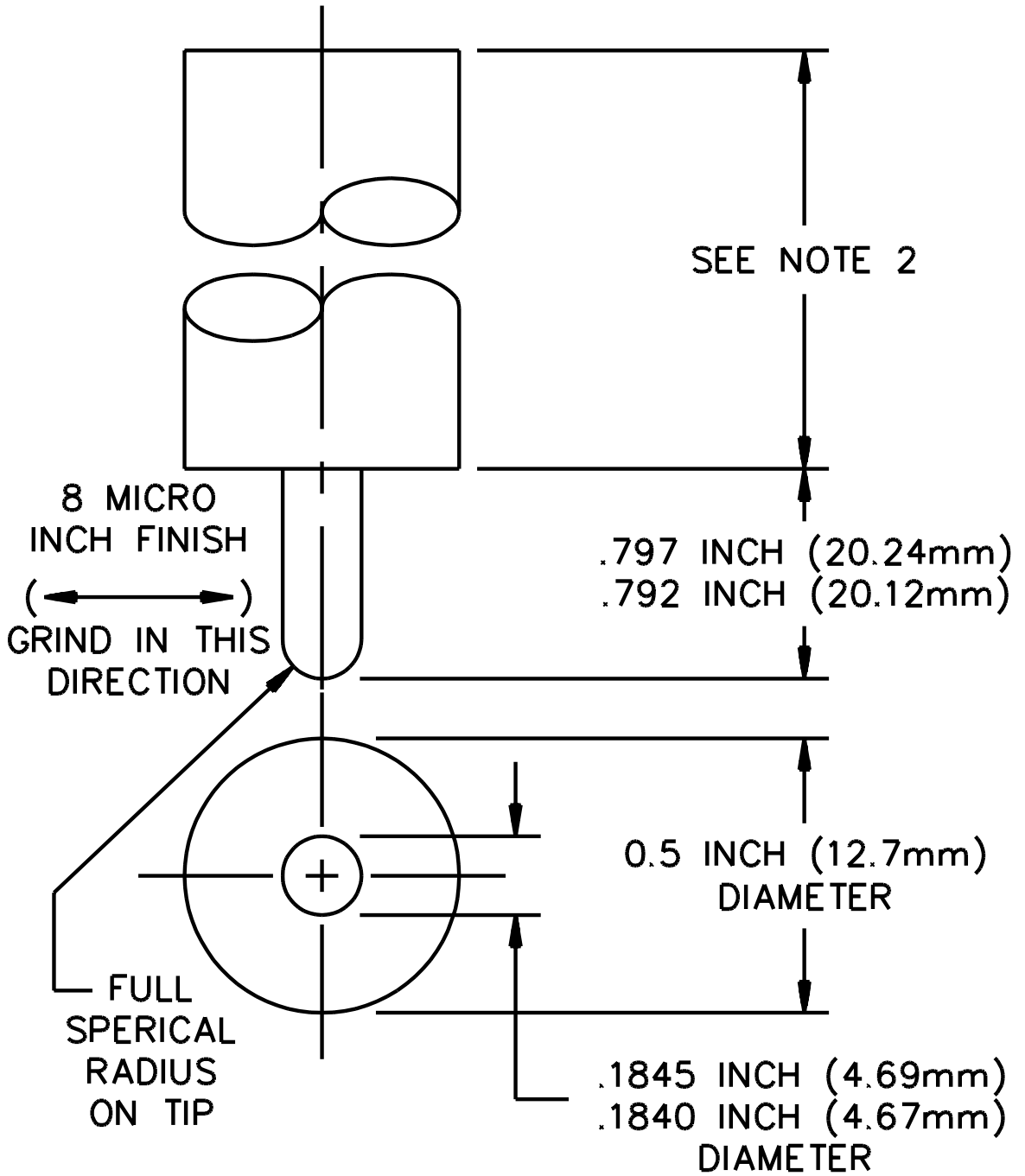
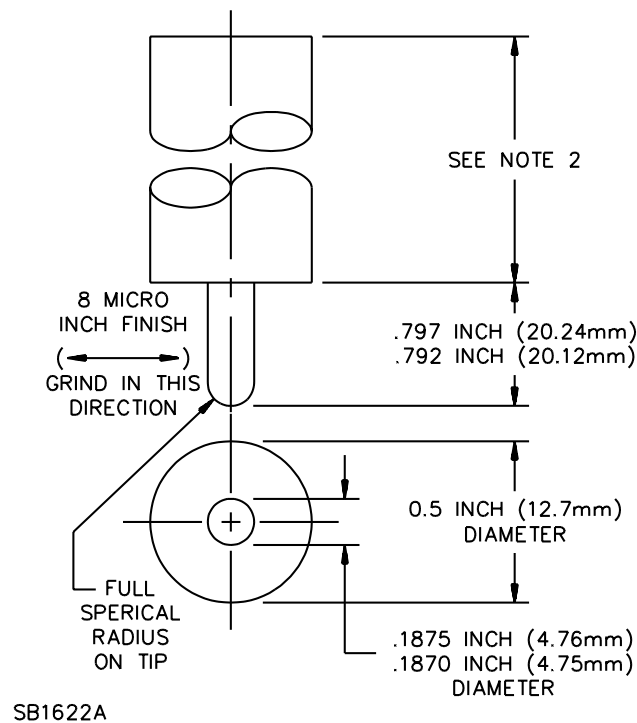


Figure 27.3
2-oz (57-g) Ground pin



SB0704A

Figure 27.4
4-oz (113-g) Ground pin



28 Overcurrent Test

28.1 When required by note (b) of Table 10.1 or 18.4, a previously untested RPT is to be subjected to the Overcurrent Test specified in 28.2 – 28.5. Each RPT shall be tested once. The RPT shall not show evidence of ignition, cracking, breaking, or similar physical damage upon completion of this test.

28.2 A relocatable power tap shall have a grounding-path resistance of 0.1 ohm or less prior to the test as described in 28.3 – 28.4. See 25.2.

28.4 For a RPT with integral overcurrent protection, the overload current is to be 200 percent of the overcurrent device rating. For a RPT 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 RPT can be properly connected. The overload test current is to be applied for 2 minutes. The integral overcurrent protective device is to be shunted out of the circuit for this test.

28.5 A relocatable power tap shall have a grounding-path resistance of 0.1 ohm or less after the test as described in 28.3 – 28.4. See 25.2.

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