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UL 977

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Subject 977

1655 Scott Blvd.
 Santa Clara, CA 95050
 December 17, 1996

TO: Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service for Fused Power-Circuit Devices

SUBJECT: Adopted Requirements for the Fourth Edition of the Standard for Fused Power-Circuit Devices, UL 977; ESTABLISHED EFFECTIVE DATES

UL has reviewed all comments received in response to the Subject 977 bulletins dated April 25, 1996 and July 16, 1996, and has decided to adopt the requirements essentially as proposed except for paragraph 36.1, which has been changed to indicate that DC-rated devices are not required to be subjected to the Contact Opening Test. The text of the adopted requirements is shown in Appendix A.

Questions regarding interpretation of requirements should be directed to the responsible UL Staff. Please see Appendix B of this bulletin regarding designated responsibility for the subject product categories.

ESTABLISHED EFFECTIVE DATES

These new and revised requirements are now in effect except for paragraphs 6.1.1, 6.2.1 – 6.2.3, 6.2.6, 6.2.7, 29.4, 50.16, 50.26, 50.27, and 50.27.1 and Table 6.1, which become effective 12 months after the date of publication of this bulletin, as indicated in the small print notes following these requirements.

This bulletin should be kept with your copy of the standard until revision pages incorporating these requirements are issued. UL anticipates issuing revision pages by December, 1996.

UNDERWRITERS LABORATORIES INC.

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APPENDIX A

ADOPTED REQUIREMENTS AND ESTABLISHED EFFECTIVE DATE FOR THE
FOURTH EDITION OF THE STANDARD FOR
FUSED POWER-CIRCUIT DEVICES,
UL 977

1.9 Fused power-circuit devices have continuous current ratings of more than 600 A and voltage ratings of 600 V or less ac, dc, or both. Devices rated ac are intended for use on circuits having maximum available short-circuit currents of 100,000, 150,000, or 200,000 A (rms symmetrical). Devices rated dc are intended for use on circuits having maximum available short-circuit currents of 20,000, 50,000, 100,000, 150,000, or 200,000 A dc.

1.9 revised December 17, 1996

1.11 These requirements cover complete, enclosed fused power-circuit devices in which the switch is integral with the enclosure; open-type fused power-circuit devices intended for mounting in other equipment, such as switchboards or in a separately shipped enclosure; and enclosures intended for mounting open-type fused power-circuit devices.

1.11 revised December 17, 1996

6 Enclosure

6.1 General

6.1.1 An enclosure for a switch shall be of metal and shall be constructed so as to provide the required strength and rigidity. The enclosure shall have one or more of the type designations specified in Table 6.1.

Revised 6.1.1 effective December 17, 1997

Table 6.1
Enclosure types

Type number	Intended use and description	Environmental construction and performance requirements
1	Indoor use primarily to provide a degree of protection against contact with the enclosed equipment.	Corrosion protection as specified in 6.1.5, or the Rust Resistance Test described in the Standard for Enclosures for Electrical Equipment, UL 50.
2	Indoor use to provide a degree of protection against limited amounts of falling water and dirt.	Corrosion protection as specified in 6.1.5, or the Rust Resistance Test described in UL 50, and the Drip Test described in UL 50.
3R	Outdoor use to provide a degree of protection against falling rain, sleet, and external ice formation.	Protective coating as specified in 6.2.3 – 6.2.7, the Water Spray Test described in Section 29, and the Icing Test described in UL 50.

Added Table 6.1 effective December 17, 1997

6.2 Rainproof enclosures

6.2.1 A Type 3R enclosure shall be so constructed as to withstand a simulated beating rain as described in Water Spray Test, Section 29. Any opening associated with an opening handle, shall be shielded from rain. Hinges and other attachments shall be resistant to corrosion. Metals shall not be used in such combinations as to result in galvanic action that affects adversely any part of the device. Any live part shall be located at least 12 inches (305 mm) above the mounting surface on concrete-pad-mounted equipment. See 50.27.1.

Revised 6.2.1 effective December 17, 1997

6.2.2 A hole for conduit in a Type 3R enclosure shall be threaded unless it is wholly located below the lowest terminal lug or other live part within the enclosure or unless it accommodates a specific hub or closure fitting (see 50.27 and 50.28). A threaded hole for conduit shall be reinforced to provide metal at least 1/4 inch (6.4 mm) thick. There shall be provision for drainage of the enclosure. A threaded hole for conduit shall be provided with a conduit end stop unless the thread is tapered.

Revised 6.2.2 effective December 17, 1997

6.2.3 A Type 3R sheet steel enclosure shall be protected against corrosion by one of the following coatings:

- a) Hot-dipped mill galvanized sheet conforming with the coating Designation G90 in Table I of ASTM Designation A653/A653M-94, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in this ASTM Designation. The weight of the zinc coating is permitted to be determined by any appropriate method; however, in case of question the weight of coating shall be established in accordance with the test method of ASTM Designation A90.

- b) A zinc coating, other than that provided on hot-dipped mill galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00061 inch (0.015 mm) on each surface with a minimum thickness of 0.00054 inch (0.014 mm). The thickness of coating shall be established by the metallic coating thickness test as indicated in Metallic Coating Thickness Test, Section 41. An annealed coating shall comply with 6.2.4.
- c) A zinc coating conforming with item 1 or 2 below and with one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint applied after forming on each surface. The acceptability of the paint is permitted to be determined by consideration of its composition or by corrosion tests when these are determined to be required.
- 1) Hot-dipped mill galvanized sheet steel conforming with the coating Designation G60 or A60 in Table I of ASTM Designation A653/A653M-94, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in this ASTM Designation. The weight of zinc coating is permitted to be determined by any appropriate method; however, in case of question the weight of coating shall be established in accordance with the test method of ASTM designation A90.
 - 2) A zinc coating, other than that provided on hot-dipped mill galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00041 inch (0.010 mm) on each surface with a minimum thickness of 0.00034 inch (0.009 mm). The thickness of the coating shall be established by the metallic coating thickness test as indicated in Metallic Coating Thickness Test, Section 41. An annealed coating shall also comply with 6.2.4.
- d) A cadmium coating not less than 0.0010 inch (0.025 mm) thick on both surfaces. The thickness of coating shall be established by the metallic coating thickness test as indicated in Metallic Coating Thickness, Section 41.
- e) A cadmium coating not less than 0.00075 inch (0.019 mm) thick on both surfaces with one coat of outdoor paint on both surfaces, or not less than 0.00051 inch (0.013 mm) thick on both surfaces with two coats of outdoor paint on both surfaces. The thickness of the cadmium coating shall be established by the metallic coating thickness test as indicated in Metallic Coating Thickness Test, Section 41, and the paint shall be as specified in (c).
- f) Other finishes, including paints, special metal finishes, or combinations of the two are permitted to be accepted when comparative tests with galvanized sheet steel (without annealing, wiping, or other surface treatment) conforming with (a), indicate they provide equivalent protection. Among the factors which are taken into consideration when determining the acceptability of such coating systems are exposure to salt spray, moist carbon dioxide-sulphur dioxide-air mixtures, moist hydrogen sulphide-air mixtures, ultraviolet light, and water.

Revised 6.2.3 effective December 17, 1997

6.2.6 Aluminum in a Type 3R fused power circuit device shall be so located that it is not in contact with the mounting pad.

Revised 6.2.6 effective December 17, 1997

6.2.7 When a Type 3R enclosure has any opening for passage of a wire or bus bar to a switchboard section or to a wireway, auxiliary gutter or busway, a gasket or other means shall be provided that is intended to prevent the entrance of water at such opening. When the opening is for attachment of a busway, the Type 3R enclosure and the busway are to be investigated together to determine that water does not enter along the bus bars.

Revised 6.2.7 effective December 17, 1997

25.1.1 A fused power-circuit device rated for ac or dc shall be investigated for the marked rating by the test program described in 25.1. A fused power-circuit device rated for ac and dc shall be investigated for both ratings. The ac rating is to be verified by the test program described in 25.1. To verify the dc rating, representative samples of the device shall be subjected to the 200 percent overload, close-open, and contact opening tests, each followed by the dielectric voltage-withstand, short-circuit withstand, and closing tests. The dielectric voltage-withstand test is to be performed with ac voltage; all other tests are to be performed with dc voltage.

25.1.1 added December 17, 1996

25.6 The frequency of the ac test voltage in each test in which the switch is energized shall be the rated value, except for the short-circuit test and the closing test when any frequency between 48 – 62 Hz is determined to comply with the intent of this requirement.

25.6 revised December 17, 1996

25.7 The circuit on which the 200 percent overload, close-open, and contact opening tests are conducted shall have a recovery voltage (the normal frequency rms or dc voltage after the circuit has been interrupted and high frequency transients have subsided) equal to the rated voltage of the device, except that the recovery voltage is not required to be determined when the closed circuit voltage is not less than 90 percent of the rated voltage of the device. The open-circuit voltage shall be not more than 110 percent of the rated voltage. However, a higher open-circuit voltage is not prohibited from being used when agreeable to those concerned.

25.7 revised December 17, 1996

29.4 When a Type 3R enclosure is provided with a rubber or rubber-like gasket, the quality of the gasket shall be such that samples subjected to a temperature of 69 – 70°C (156 – 158°F) in circulating air for 168 hours shows a tensile strength of not less than 60 percent and an elongation of not less than 75 percent of the values determined with unaged samples.

Revised 29.4 effective December 17, 1997

32 200-Percent Overload

32.1 A fused power-circuit device shall perform successfully when operated for the number of cycles of operation indicated in Table 32.1 when making and breaking 200 percent of its rated current at the rate specified. The rate of operation of any switch is not prohibited from being increased when agreeable to those concerned. The test is to be conducted at the rated voltage of the switch. For testing ac-rated devices, the power factor shall be from 70 – 80 percent, except that a lower power factor complies with the intent of this requirement when it is agreeable to those concerned, and the switch is to be connected as shown in Figure 32.1. For dc-rated devices, the test is to be conducted with dc, and the device connected so that the enclosure is positive in potential with regard to the nearest arcing point. The dc circuit is to have a time constant not less than 0.003 second. The time constant is the time measured on the oscillogram of the test current where the value is 63.2 percent of the maximum current.

32.1 revised December 17, 1996

34 Close-Open Test

34.1 Except as noted in 34.2, a fused power-circuit device shall be capable of being operated to make and break 600 percent of its rated current for the number of operations indicated in Table 34.1. The contacts of the switch are not prohibited from being serviced. However, the contacts of the switch are not to be replaced after each operation. The test is to be conducted at the rated voltage of the switch. For an ac rating, the switch is to be connected as shown in Figure 32.1 to a circuit as specified

in 34.5. The close-open test is not prohibited from being combined with the contact opening test when agreeable to those concerned as long as the limiting impedance is on the load side of the switch as shown in Figure 32.1. For a dc rating, the switch is to be connected as specified in 32.1 to a circuit having a time constant of not less than 0.003 seconds.

34.1 revised December 17, 1996

Table 34.1
Close-open test operations

Type of switch	Number of operations
Polyphase and dc-rated	3
Single phase	5

Table 34.1 revised December 17, 1996

36 Contact Opening Test

36.1 A fused power-circuit device that is electrically operated or that has an electrical tripping mechanism shall be capable of being operated electrically to break levels of current as indicated in Table 36.1. The number of operations shall be in accordance with Table 34.1. All required operations are to be made using the same test sample. The contacts of the device are not prohibited from being serviced. However, the contacts are not to be replaced after each operation. The test is to be conducted at the rated voltage of the switch. For testing with ac, the switch is to be connected as shown in Figure 32.1, except that a switch that has been tested at 600 percent of rated current in accordance with 34.1 is not prohibited from being connected as shown in Figure 38.1 with the external fuses omitted. The test circuit is to be as specified in 36.2. DC-rated devices are not required to be subjected to the Contact Opening Test.

36.1 revised December 17, 1996

38.2 AC-rated devices shall be tested as described in 38.2.1 and 38.3 – 38.9. DC-rated devices shall be tested in accordance with 38.3, 38.4, and 38.9 – 38.17.

38.2 revised and separated into 38.2 and 38.2.1 December 17, 1996

38.2.1 For the test specified in 38.1:

- The open-circuit voltage of the power-supply circuit is to be not less than the maximum rated voltage of the device.
- The available short-circuit current in amperes (rms symmetrical), is to be not less than the marked withstand current rating of the device.
- The circuit is to be as indicated in Figure 38.1 and is to include the required measuring equipment and fuse-mounting means.
- The power factor of the circuit is to be 0.20 or less.

- e) The enclosure of the device is to be connected through a 30 A nonrenewable, non-time delay fuse, having a voltage rating not less than the rating of the device being tested, to the pole of the switch determined to be the least prone to arc to the enclosure. This connection is to be made to the load side of the limiting impedance by a No. 10 AWG (5.3 mm²) copper wire 4 – 6 feet (1.2 – 1.8 m) long.

38.2 revised and separated into 38.2 and 38.2.1 December 17, 1996

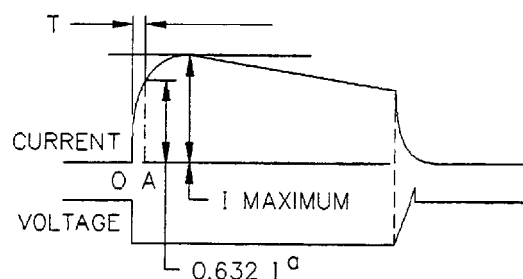
38.10 A fused power-circuit device intended for use on a dc system is to be tested with dc and with the device connected so that the frame and enclosure are positive in potential with regard to the nearest arcing point. The device is to be tested with the enclosure connected as specified in 38.2.1(e).

38.10 added December 17, 1996

38.11 For a dc source, the requirements in 38.12 – 38.17 are to be applied. The time constant of the test circuit is to be determined by the method shown in Figure 38.2 and shall not be less than 0.010 second.

38.11 added December 17, 1996

Figure 38.2
Determination of the short-circuit time constant (oscillographic method)
of dc circuits



SA1046B

^a The value of the time constant is given by the abscissa OA corresponding to the ordinate 0.632 I of the oscillograph of calibration of the circuit.

Figure 38.2 added December 17, 1996

38.12 The dc open-circuit voltage of the test circuit is to be not less than 100 percent nor more than 105 percent of the rated voltage of the unit under test, except that a higher voltage is not prohibited from being used when agreeable to all concerned. In addition, the open-circuit voltage, as determined by the arithmetic average of the maximum and minimum values of the voltage wave read from an oscillogram, is to be within 99 percent and 105 percent of the rated voltage of the device, except that a higher voltage is not prohibited from being used when agreeable to all concerned.

38.12 added December 17, 1996

38.13 The minimum point on the dc voltage wave is to be not less than 90 percent of the rated voltage of the device.

38.13 added December 17, 1996

38.14 The available dc capacity of the test circuit is to be not less than the withstand rating of the device. The prospective current is to be determined with the supply terminals short circuited by measuring the maximum displacement on an oscillogram at a time, after the start of current, of not less than four times the required time constant. Any overshoot above time-current curve (exponential curve) is not to be regarded.

38.14 added December 17, 1996

38.15 The time constant of the circuit is the time measured on the oscillogram where the current is 63.2 percent of the prospective current.

38.15 added December 17, 1996

38.16 When the current source has a ripple, measurements are to be made from the midpoint of the ripple.

38.16 added December 17, 1996

38.17 With the device in the fully closed position, the test circuit is to be closed on the device.

38.17 added December 17, 1996

39 Closing Test

39.1 A fused power circuit device shall be closed on a circuit of the maximum fault current for which the device is rated. A device rated for a fault current at more than 100,000 A (rms symmetrical) or dc shall have a reconditioned or previously untested sample also subjected to a closing test on a 100,000 A circuit. After the fault has cleared:

- a) The fuse connected to the enclosure shall not be open,
- b) There shall not be any breakage to the extent that the integrity of the mounting of live parts is impaired,
- c) The door shall be prevented by its latch without bolt or lock installed therein, from being blown open. Deformation of the case alone is not regarded as a result that does not comply with the requirements, and
- d) The device shall be capable of being opened by its regular manual operating means.

39.1 revised December 17, 1996

39.3 The conditions of the closing test are to be the same as for the short circuit withstand test, 38.2 – 38.17, except that the current limiting fuses are always to be used. Complete physical closure of the switch contacts is not required to be established.

39.3 revised December 17, 1996

47 Voltage

47.1 The ac voltage rating of a fused power circuit device shall be in accordance with Table 47.1. The rating shall be indicated by the letters "AC" when the frequency or phase rating is not given. A dc voltage rating shall be one of the following values and shall be indicated as "DC" or "direct-current:" 125, 125/250, 250, 500, or 600 V.

47.1 revised December 17, 1996

48 Withstand

48.1 The ac short-circuit withstand rating of a fused power circuit device shall be 100,000, 150,000, or 200,000 A (rms symmetrical), and the dc rating shall be 20,000, 50,000, 100,000, 150,000, or 200,000 A.

48.1 revised December 17, 1996

MARKING**50 Details**

50.1 A fused power-circuit device, enclosed or open, shall be marked plainly, where it is visible after installation, with:

- a) The manufacturer's name or trademark or other descriptive marking by which the organization responsible for the product is identifiable,
- b) The catalog number or the equivalent,
- c) The electrical rating of the switch, and
- d) The electrical rating of an electrical operator or electrical tripping mechanism when provided.

50.1 revised December 17, 1996

50.1.1 An enclosure intended for the mounting of a fused power-circuit device shall be marked with:

- a) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product is identifiable;
- b) A type number or designation as specified in Table 6.1; and
- c) The maximum electrical rating and catalog number or equivalent of the fused power-circuit device for which the enclosure is to be used. Appropriate neutral markings shall be provided when required. See 50.12.

50.1.1 added December 17, 1996

50.16 A required marking shall be molded, die-stamped, ink-stamped, paint-stenciled; stamped or etched metal that is permanently secured; or indelibly applied lettering on a label secured by adhesive that complies with the requirements in the Standard for Marking and Labeling Systems, UL 969. Normal usage, including likely exposure to weather and other ambient conditions, handling, storage, and the like, of the equipment shall be evaluated in the determination of the acceptability of the application. The need for exposure tests on forms of marking other than labels shall be individually investigated.

Revised 50.16 effective December 17, 1997

50.17 Each fused power-circuit device rated for ac shall be marked to indicate the short-circuit withstand rating: "Suitable for use on a circuit capable of delivering not more than _____ rms symmetrical amperes, _____ volts maximum, use Class L (or Class T) fuses." Each fused power-circuit device rated for dc shall be marked to indicate the short-circuit withstand rating: "Suitable for use on a circuit capable of delivering not more than _____ amperes, _____ volts dc maximum, use Class L

(or Class T) fuses." Each fused power-circuit device rated for ac and dc shall be marked to indicate the short-circuit withstand rating: "Suitable for use on a circuit capable of delivering not more than _____ rms symmetrical amperes, _____ volts ac maximum, and not more than _____ amperes, _____ volts dc maximum, use Class L (or Class T) fuses." See 48.1.

50.17 revised December 17, 1996

50.24 *Deleted date of publication.*

50.26 An enclosure marked "Type 3R" is also allowed to be additionally marked "Rainproof."

Revised 50.26 effective December 17, 1997

50.27 An enclosure marked "Type 3R" and provided with means to accommodate one or more separable conduit hubs and closure fittings shall be marked with the name or trademark of the manufacturer and with the conduit size and corresponding catalog designation of those fittings found to be evaluated for use with that enclosure.

Revised 50.27 effective December 17, 1997

50.27.1 A Type 3R enclosure intended to be mounted on a concrete pad shall be marked to indicate that live parts are to be located at least 12 inches (305 mm) above the mounting surface.

Added 50.27.1 effective December 17, 1997

A P P E N D I X B

DESIGNATED RESPONSIBILITY FOR UL
PRODUCT CATEGORIES
IYSR, FUSED POWER-CIRCUIT DEVICES
IYSR7, FUSED POWER-CIRCUIT DEVICES CERTIFIED FOR CANADA

The individuals shown in the following table are involved with the investigation of products covered under the subject categories. The Primary Designated Engineer (**shown in UPPERCASE letters**) coordinates the establishment and uniform interpretation of UL requirements applicable to the product categories. The Designated Engineers (**shown in lowercase letters**) work with the Primary Designated Engineer to interpret requirements and maintain standards.

Should you have questions regarding the interpretation of the requirements adopted in this bulletin or any adopted requirements that affect your product, you are encouraged to contact the individual at the office to which you normally submit your products.

The Industry Advisory Conference (IAC) Chairman for the subject categories is Donald J. Talka at UL's Melville office. The IAC Chairman oversees the significant interpretations made by the Primary Designated Engineer and arbitrates any differences regarding interpretation of UL requirements.

CCN	Office/Subsidiary	Responsible Engineer	Extension
IYSR, IYSR7	Melville	ARNOLD SCHAEFFER	22225
	Northbrook	Gunars Salenieks	42993
	RTP	Robert Osborne	11559
	Santa Clara	Bob Nguyen	32757



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August 2, 1995

Revision pages for

Standard for

Fused Power-Circuit Devices

UL 977, Fourth Edition

Attached to this transmittal notice is a revision of the fourth edition of UL 977.

THIS REVISION IS BEING ISSUED TO CORRECT THE TITLE PAGE AND TO INCLUDE PAGE 58, WHICH WAS INADVERTENTLY OMITTED FROM THE STANDARD. THE REQUIREMENTS ARE NOW IN EFFECT.

Attention is directed to the note on the title page of this standard identifying that the Department of Defense has adopted the text of UL 977.

Revised and/or additional pages may be issued from time to time.

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

Page	Date
1	November 30, 1994 (Reprinted August 2, 1995)
2 – 57	November 30, 1994
58	August 2, 1995
A1	November 30, 1994

NOVEMBER 30, 1994

(Title Page Reprinted: August 2, 1995)

1

UL 977

Standard for

Fused Power-Circuit Devices

First Edition – June, 1973

Second Edition – October, 1976

Third Edition – June, 1984

Fourth Edition

November 30, 1994

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

The Department of Defense (DoD) has adopted UL 977 on June 26, 1984. The publication of revised pages or a new edition of this standard will not invalidate the DoD adoption.

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 published set of revision pages.

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CONTENTS

FOREWORD

INTRODUCTION

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

CONSTRUCTION

5 General	6
6 Enclosure	8
7 Ventilation	10
8 Sheet-Metal Enclosures	11
9 Doors and Covers	11
10 Hinges	12
11 Latches	12
12 Operating Mechanism	13
13 Ground Fault Protection	15
14 Insulating Material	16
15 Current-Carrying Parts	17
16 Wiring Terminals	18
17 Control Circuit	18
18 Lockout	19
19 Fusing	19
20 Spacings	22
21 Wiring Space	24
22 Disconnecting Means	27
23 Provision for Grounding	28
24 Provision for Bonding	28

PERFORMANCE

25 General	29
26 Temperature Test	31
27 Strength of Insulating Base and Support	34
28 Overvoltage Test	34
29 Water Spray Test	34
30 Operation Test	37
31 Endurance Test	37
32 200-Percent Overload	38
33 Dielectric Voltage-Withstand Test	40
34 Close-Open Test	40
35 Dielectric Voltage-Withstand (Repeated) Test	41
36 Contact Opening Test	41

50.23 If a fused power-circuit device is marked "Suitable for use as service equipment", a "Service Disconnect" marking shall be provided in a form of pressure sensitive markings in an envelope or card with instructions to apply near the disconnect handle or button when the equipment is used as service equipment.

50.24 If a fused power-circuit device and its enclosure are to be shipped separately, both the switching unit and the enclosure shall be marked to indicate that they are to be used together.

50.25 A marking shall be provided to indicate installation instructions when a load-end fuse terminal base is not mounted in the final assembled position when shipped. See 5.7.

50.26 An enclosure that has been investigated and found to be rainproof shall be marked "Rainproof."

50.27 An enclosure marked "Rainproof" and provided with means to accommodate one or more separable conduit hubs and closure fittings shall be marked with the name or trademark of the manufacturer and with the conduit size and corresponding catalog designation of those fittings found to be acceptable for use with that enclosure.

50.28 A separable conduit hub and a closure fitting shall be marked with the manufacturer's name or trademark and catalog number or the equivalent. Such a hub or fitting may be shipped separately, and any gaskets, hardware, and instructions necessary for installation shall be shipped with the fitting or be properly packaged with the enclosure.

50.29 If an insulating barrier as outlined in 5.8 is needed, a marking shall be provided indicating the need for the barrier and giving all pertinent information, including its size and location. This information shall be provided as part of the same installation instructions as required in 50.15 or shall be marked on the device.

50.30 In accordance with 5.9, if an accessory is shipped from the factory separate from the fused power-circuit device with which it is intended to be used,

a) The accessory shall be marked with its own catalog number or the equivalent and with the name or trademark of the manufacturer.

b) The fused power-circuit device shall be marked to indicate the catalog number or the equivalent of any accessory that is acceptable for use with it.

50.31 If a marking, related to the application, on the ground-fault sensing or relaying equipment is not visible from the front of the service equipment with a cover removed, a separate marking such as on a wiring diagram shall be provided on the equipment.

50.32 If a transformer or other circuit component providing control voltage is connected to the line side of the fused power-circuit device, the device shall be marked "DANGER – Operation of the fused power-circuit device does not disconnect control and instrument circuits".

50.33 In a fused power-circuit device with ground fault protection, that part of the neutral bus for load termination shall be marked "WARNING" and with the following or equivalent statement: "Do not connect grounding conductors to these or any other neutral load terminals; to do so will defeat ground-fault protection". The markings shall be located on or adjacent to the portion of the neutral for load terminals.

50.34 If the ground-fault protection sensors or relaying equipment or both are located in a separate enclosure as covered in the exception for 13.1, the fused power-circuit device shall be marked with the manufacturer's name and catalog number of the ground-fault protection equipment, and with instructions covering the interconnections.

50.35 A device marked for service equipment use, not providing ground fault protection in accordance with Exception No. 2 of 13.1 shall be marked "For use only to supply a continuous industrial process."

INSTALLATION TEST PROCEDURES

51 Details

51.1 To provide for system performance testing as required by the National Electrical Code, ANSI/NFPA No. 70, each ground fault relay or apparatus incorporating a ground fault relay or its functions shall be provided with information sheets describing system testing instructions, and with a test form. The form shall include a space for the date the test was performed and the results, and shall state that the form should be retained by those in charge of the building's electrical installation in order to be available to the authority having jurisdiction. The instruction shall include the following items and shall basically prescribe only that information necessary to perform the tests. The instructions shall be separate and apart from any more elaborate test detail that the manufacturer may wish to provide. The instructions shall specify that:

- a) The interconnected system shall be evaluated in accordance with the manufacturer's detailed instructions, and that this evaluation is to be undertaken by qualified personnel.
- b) The proper location of the sensors around the bus of the circuit to be protected shall be determined. This can be done visually, with knowledge of which bus is involved.
- c) The grounding points of the system shall be verified to determine that ground paths do not exist that would bypass the sensors. The use of high-voltage testers and resistance bridges may be suggested.
- d) A simulated fault current is to be generated by a coil around the sensors, by means of a separate test winding in the sensor, or by equivalent means. The reaction of the circuit-interrupting device is to be observed for correct response.
- e) The results of the test are to be recorded on a test form provided with the instructions.

Standard for Safety

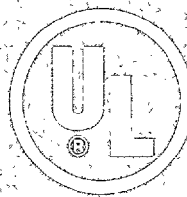
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Fused Power-Circuit Devices



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November 30, 1994

Standard for

Fused Power-Circuit Devices

UL 977, Fourth Edition

Accompanying this transmittal notice is a copy of the Fourth edition of UL 977.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

Revised and/or additional pages may be issued from time to time.

NOVEMBER 30, 1994

1

UL 977

Standard for

Fused Power-Circuit Devices

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Second Edition – October, 1976
Third Edition – June, 1984

Fourth Edition

November 30, 1994

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 published set of revision pages.

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CONTENTS**FOREWORD****INTRODUCTION**

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

CONSTRUCTION

5 General	6
6 Enclosure	8
7 Ventilation	10
8 Sheet-Metal Enclosures	11
9 Doors and Covers	11
10 Hinges	12
11 Latches	12
12 Operating Mechanism	13
13 Ground Fault Protection	15
14 Insulating Material	16
15 Current-Carrying Parts	17
16 Wiring Terminals	18
17 Control Circuit	18
18 Lockout	19
19 Fusing	19
20 Spacings	22
21 Wiring Space	24
22 Disconnecting Means	27
23 Provision for Grounding	28
24 Provision for Bonding	28

PERFORMANCE

25 General	29
26 Temperature Test	31
27 Strength of Insulating Base and Support	34
28 Overvoltage Test	34
29 Water Spray Test	34
30 Operation Test	37
31 Endurance Test	37
32 200-Percent Overload	38
33 Dielectric Voltage-Withstand Test	40
34 Close-Open Test	40
35 Dielectric Voltage-Withstand (Repeated) Test	41
36 Contact Opening Test	41

37 Dielectric Voltage-Withstand (Repeated) Test	42
38 Short-Circuit Withstand Test	43
39 Closing Test	46
40 Low-Level Dielectric Voltage-Withstand Test	46
41 Metallic Coating Thickness Test	46

INSTRUMENTATION AND CALIBRATION OF HIGH-CAPACITY CIRCUITS

42 Galvanometers	48
43 Circuit Measurement Verification	49
44 Calibration of Test Circuit	49

MANUFACTURING AND PRODUCTION TEST

45 Operation	53
--------------------	----

RATINGS

46 Current	53
47 Voltage	53
48 Withstand	54
49 Control Circuit	54

MARKING

50 Details	55
------------------	----

INSTALLATION TEST PROCEDURES

51 Details	58
------------------	----

APPENDIX A

Standards for Components	A1
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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 employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

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.