UL 1077

STANDARD FOR SAFETY

Supplementary Protectors for Use in Electrical Equipment

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UL Standard for Safety for Supplementary Protectors for Use in Electrical Equipment, UL 1077

Seventh Edition, Dated June 25, 2015

Summary of Topics

This revision of ANSI/UL 1077 dated November 16, 2021 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated September 3, 2021.

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The most recent designation of ANSI/UL 1077 as a Reaffirmed American National Standard (ANS) occurred on November 16, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

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INTRODUCTION

1 Scope

1.1 These requirements apply to supplementary protectors intended for use as overcurrent, or over- or under-voltage protection within an appliance or other electrical equipment where branch circuit overcurrent protection is already provided, or is not required. Compliance with the following is acceptable for use as a component of an end product.

1.2 The acceptability of a protector in any particular application depends upon its ability to be used continuously under the conditions that prevail in actual service. Accordingly, for a particular application a protector may be affected by the requirements for the equipment it is used in, and it may be necessary to additionally evaluate features or performance characteristics that are not specified in this Standard.

1.3 This Standard also covers accessory devices that may be installed in or on the protector to perform a secondary function. Examples of accessories are alarm and auxiliary switches.

1.4 Devices which ensure a manual restart due to the complete loss of voltage are covered by the Standard for Solid-State Controls for Appliances, UL 244A. Compliance with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

1.5 Automatic reset devices designed to open the circuit automatically on a predetermined value of time versus current or voltage within an appliance or other electrical equipment are covered by the Standard for Solid-State Controls for Appliances, UL 244A. Compliance with the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

2 Glossary

2.1 AUXILIARY SWITCH – A switch that is mechanically operated by the main contact switching mechanism.

2.2 FIELD WIRING TERMINALS – Any terminal to which a supply or other wire can be connected by an installer in the field, unless the wire is provided as part of the appliance or other electrical equipment and a pressure terminal connector, soldering lug, soldered loop, crimped eyelet, or other means for making the connection is factory-assembled to the wire.

2.3 MAGNETIC TRIP PROTECTOR – A protector that is caused to trip by current through a magnet coil.

2.4 OVERCURRENT-TRIP PROTECTOR – A thermal or magnetic trip protector intended to trip the contact circuit when the current through the thermal element or trip coil, which is in series with contact circuit, exceeds a predetermined value.

2.5 OVERVOLTAGE-TRIP PROTECTOR – A magnetic trip protector intended to trip the contact circuit when the voltage across the trip coil rises above a predetermined value.

2.6 RATED CURRENT – For an overcurrent-trip protector, the current that the protector is intended to carry continuously without opening of the circuit.

2.7 SHUNT TRIP PROTECTOR – A protector with a trip mechanism energized by a separate source of voltage or current that is derived from the main contact circuit or from an independent source. The trip mechanism is either of the overcurrent type or the voltage actuated type.

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2.8 SUPPLEMENTARY PROTECTOR – A manually resettable device designed to open the circuit automatically on a predetermined value of time versus current or voltage within an appliance or other electrical equipment. It is permitted to be provided with manual means for opening or closing the circuit.

2.9 THERMAL AND MAGNETIC TRIP PROTECTOR – A combination of 2.3 and 2.4.

2.10 THERMAL TRIP PROTECTOR – A protector that is caused to trip by heat generated from current flowing through a thermal element.

2.11 TRIP CURRENT – The current at which an overcurrent-trip protector is intended to open the contact circuit at a given ambient temperature and a given time.

2.12 TRIP-FREE – A protector designed so that the contacts cannot be held in the closed position by the operating means during trip command conditions.

2.13 TRIP-FREE, CYCLING – A protector designed so that the contacts cannot be held in the closed position by the operating means during trip command conditions, but will reclose when the closing command is maintained. The protector will continue to close momentarily and repeatedly as long as the close command is maintained by the operating means during trip command conditions.

2.14 TRIP MECHANISM – The part of the protector that senses the abnormal condition in the circuit and causes the contact circuit to open.

2.15 TRIP VOLTAGE – The voltage at which an overvoltage protector or undervoltage protector is intended to trip.

2.16 UNDERVOLTAGE-TRIP PROTECTOR – A magnetic trip protector intended to trip the contact circuit when the voltage across the trip coil falls below a predetermined value.

3 Components

3.1 Except as indicated in 3.2, 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 generally used in the products covered by this Standard.

3.2 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.

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

3.4 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.

4 Units of Measurement

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

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5 Undated References

5.1 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.

CONSTRUCTION

6 General

6.1 A protector shall have an integral housing for all mechanisms and live parts, except the operating handle and the wiring terminals, and shall be capable of being operated or reset without opening the housing.

6.2 A protector shall be so formed and assembled that it shall have the strength and rigidity necessary to resist the ordinary abuses to which it is capable of being subjected (including the tests specified in this Standard), without increasing its risk of fire, shock or personal injury due to partial or total collapse with a resulting reduction of spacings, loosening or displacement of parts, or other serious defect.

7 Corrosion Protection

7.1 Iron and steel parts except for thermal elements, magnet pole faces, hardened and polished parts such as latching surfaces, and other similar parts, where such protection is impractical, shall be acceptably protected against corrosion by enameling, galvanizing, plating, or other equivalent means.

7.2 The requirements of 7.1 apply to all housings and to all springs and other parts upon which proper mechanical operation depends. It does not apply to small minor parts of iron or steel such as washers, screws, bolts, and other similar parts that are not current-carrying, or to other parts where the malfunction of such unprotected parts would not be likely to result in a risk of fire, electric shock or personal injury. Parts made of stainless steel, properly polished or treated when necessary, do not require additional protection against corrosion.

8 Insulating Materials

8.1 Insulating material for the support of current-carrying parts shall be strong, not easily ignited, and moisture resistant. A material other than porcelain, phenolic, or one that has not been evaluated for the support of current-carrying parts shall be investigated under conditions of actual service to determine if it has the necessary electrical, mechanical, and flammability properties and otherwise meets the intent of the requirements for the particular application. The properties of the material shall be such that it shall withstand the most severe conditions likely to be met in service.

8.2 A material that is used for the direct support of an uninsulated live part shall comply with the Relative Thermal Index (RTI), Hot Wire Ignition (HWI), High-Current-Arc Resistance to Ignition (HAI), and Comparative Tracking Index (CTI) values indicated in Table 8.1. A material is considered to be in direct support of an uninsulated live part when:

a) It is in direct physical contact with the uninsulated live part; and

b) It serves to physically support or maintain the relative position of the uninsulated live part.

Exception No. 1: A generic material with a Relative Thermal Index (RTI) as shown in the table for Relative Thermal Indices Based Upon Past Field-Test Performance and Chemical Structure, in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C that is not exceeded during the Temperature Test, Section 20, and is provided in such a thickness that damage does not result from tests required by this Standard, is considered suitable for the direct support of uninsulated live parts.

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Exception No. 2: A material without an HWI Performance Level Category (PLC) value or with an HWI PLC value greater (worse) than the value required by Table 8.1 that complies with the end-product Abnormal Overload Test or the Glow-Wire End-Product Test (GWEPT) or the Glow Wire Flammability Index (GWFI) as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, need not comply with the HWI requirements of 8.2.

Exception No. 3: A material without an HAI PLC value or with an HAI PLC value greater (worse) than the value required by Table 8.1 that complies with the Overload Test, Section 21, Endurance, Section 22 and Dielectric strength test, 23.1, need not comply with the HAI requirements of 8.2.

Exception No. 4: A material that is used in a device not incorporating contacts need not comply with the HAI PLC requirements.

Exception No. 5: A material that is used in a device that incorporates contacts but is not used within 1/2 inch (12.7 mm) of the contacts need not comply with the HAI PLC requirements.

Exception No. 6: A material without a CTI PLC value or with a CTI PLC value greater (worse) than the value required by Table 8.1 need not comply with the requirements of 8.2 when:

a) The material complies with the end-product Special Arcing Test specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C;

b) The material has a High-Voltage-Arc Tracking (HVTR) PLC value of 1 or less; or

c) The over surface spacings between the uninsulated live parts are at least 1/2 inch (12.7 mm).

Table 8.1
Minimum material characteristics necessary for the direct support of uninsulated live parts

Flame class rating	RTI	Performance level category (PLC)		
		HWI[b]	HAI[b]	CTI[c]
HB	a	2	1	4
V-2	a	2	2	4
V-1	a	3	2	4
V-0	a	4	3	4

[a] The Relative Thermal Index (RTI) – Mechanical Without Impact, value of a material is to be determined in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, by test or by use of the generic RTI table. This material characteristic is dependent upon the minimum thickness at which the material is being used and shall not be exceeded during the Temperature Test, Section 20.

[b] The High Current Arc Resistance to Ignition (HAI) and Hot Wire Ignition (HWI) value of a material is to be determined by test in accordance the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A. This material characteristic is dependent upon the minimum thickness at which the material is being used.

[c] The Comparative Tracking Index (CTI) PLC value of a material is to be determined by test in accordance with UL 746A. This material characteristic is not dependent upon the minimum thickness at which the material is being used.

8.3 Insulating material, including barriers between parts of opposite polarity or material, subject to the influence of the arc formed by the opening of contacts, shall be acceptable for the particular application.

9 Current-Carrying Parts

9.1 Current-carrying parts shall be of silver, copper, a copper alloy, stainless steel or other metals such as plated iron or plated steel acceptable for the particular application with regard to plating, temperature, and other similar factors.

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9.2 Unplated iron and steel used in bimetallic elements and heaters is not prohibited.

9.3 Current-carrying parts, including terminals, shall be secured to their supporting surfaces so that they are restricted from rotating or shifting in position when such motion results in reduction of spacings to less than those required elsewhere in this Standard. The security of contact assemblies shall be such as to provide for the continued alignment of contacts.

9.4 Friction between surfaces shall not be used as the sole means to restrict movement of current-carrying parts. Movement is to be restricted by use of:

a) Two screws or rivets;

b) Shoulder or mortises;

c) Pin;

d) Lug;

e) Offset;

f) Connecting strip or clip fitted to an adjacent part; or

g) Some other equivalent method.

9.5 When current-carrying parts are held together by screws, a threaded part shall have not less than two full, clean-cut threads engaged in metal. When the screw does not extend all the way through the threaded parts, the taper or lead and the first full thread are to be disregarded in the determination of the number of threads engaged.

9.6 Aluminum conductors, insulated or uninsulated, used for internal-wiring interconnections between current-carrying parts shall be terminated at each end by a method acceptable for the combination of metals involved at the connection point.

9.7 When a wire-binding-screw construction or a pressure-wire connector is used as a terminating device, as pertains to 9.6, it shall be investigated for use with aluminum under the conditions involved (for example, temperature, heat cycling, vibration).

10 Wiring Terminals

10.1 Terminal parts by which connections are made shall restrict connections from loosening even under hard usage.

10.2 Terminals intended for field wiring shall be pressure wire connectors, terminal leads or wire binding screws that comply with Sections 11, 12 or 13 and shall be rated for use with the conductor size in Table 10.1 based on the applicable current.

10.3 A dc rated supplementary protector intended to have poles wired in series shall have specific instructions as to the correct wiring of the device. If specific hardware or parts are required they shall be:

a) Assembled to the supplementary protector;

b) Shipped with the supplementary protector as a kit with instructions for assembly; or

c) Made available separately as a kit.

See also 18.12 – 18.17, and 34.7.

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Table 10.1
Terminal current and conductor size

Terminal current in Amperes[a]	Copper conductor			Aluminum or copper-clad aluminum conductor		
	Number of conductors	Size AWG or kcmil		Number of conductors	Size AWG or kcmil	
		60°C	75°C		60°C	75°C
15 or less	1	14	14	1	12	12
20	1	12	12	1	10	10
25	1	10	10	1	10	10
30	1	10	10	1	8	8
40	1	8	8	1	6	8
50	1	6	8	1	4	6
60	1	4	6	1	3	4
70	1	4	4	1	2	3
80	1	3	4	1	1	2
90	1	2	3	1		2
100	1	1	3	1		1
110	1		2	1		1/0
125	1		1	1		2/0
150	1		1/0	1		3/0
175	1		2/0	1		4/0
200	1		3/0	1		250
225	1		4/0	1		300
250	1		250	1		350
275	1		300	1		500
300	1		350	1		500
325	1		400	2		4/0
350	1		500	2		4/0
400	2		3/0	2		250
	1		500	1		750
450	2		4/0	2		300
500	2		250	2		350
550	2		300	2		500
600	2		350	2		500
700	2		500	3		350
800	3		300	3		400
1000	3		400	4		350
				3		600
1200	4		350	4		500
	3		600			
1400	4		500	5		500
1600	5		400	5		600
	4		600			
2000	6		400	6		600
	5		600			
2500	8		400	8		600
	7		500	7		750

Table 10.1 Continued on Next Page

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Table 10.1 Continued

Terminal current in Amperes[a]	Copper conductor			Aluminum or copper-clad aluminum conductor		
	Number of conductors	Size AWG or kcmil		Number of conductors	Size AWG or kcmil	
		60°C	75°C		60°C	75°C
	6		600	9		500
3000	9		400	10		500
	8		500	9		600
	7		600	8		750

[a] For terminal current other than indicated, the next higher rating is to be used – for example, if rated 35 A, enter at 40 A.

mm^2	2.1	3.3	5.3	8.4	13.3	21.1	26.7	33.6	42.4	53.5
AWG	14	12	10	8	6	4	3	2	1	1/0
mm^2	67.4	85.0	107.2	127	152	177	203	253	304	380
AWG or kcmil	2/0	3/0	4/0	250	300	350	400	500	600	750

11 Pressure Wire Connectors

11.1 A pressure wire connector intended for field wiring shall comply with the requirements in the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

12 Wiring Leads

12.1 Field wiring leads to be connected to a power circuit shall not differ from the wire size that would correspond to the rating of the protector by more than two sizes. The wire size shall not be smaller than 14 AWG (2.1 mm^2).

12.2 Field wiring leads to be connected to a control circuit shall be 22 AWG (0.32 mm^2) minimum.

12.3 Field wiring leads shall consist of general-use wire or appliance wiring material acceptable for the particular application when considered with regard to the temperature, voltage and conditions of service.

12.4 A field wiring lead shall be constructed so as to withstand the stress of normal handling without damage to itself or to the protector and shall comply with Section 26.

12.5 Green coloring with or without one or more yellow stripes and white or gray coloring shall not be used for the covering of a lead unless intended for connection to grounding and grounded conductors respectively.

12.6 The free length of a field wiring lead shall be at least 6 inches (152 mm).

13 Wire-Binding Screw Terminals

13.1 A wire-binding screw terminal is acceptable only for field wiring of a 10 AWG (5.3 mm^2) or smaller wire. The wire binding screw terminal shall consist of clamps or binding screws with terminal plates having upturned lugs or the equivalent to hold the wire in position.

13.2 A wire-binding screw to which field-wiring connections are made shall not be smaller than No. 8 (4.2 mm diameter), except that a No. 6 (3.5 mm diameter) screw is capable of being used for a terminal to which 14 AWG (2.1 mm^2) or smaller wire is intended to be connected.

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13.3 A terminal plate tapped for a wire-binding screw shall be of metal not less than 0.030 inch (0.76 mm) thick for a 14 AWG (2.1 mm^2) or smaller wire, and not less than 0.050 inch (1.27 mm) thick for a wire larger than 14 AWG. In either case there shall not be fewer than two full threads in the metal.

Exception: A terminal plate formed from stock having the minimum required thickness, may have the metal extruded at the tapped hole for the binding screw to provide two full threads; except that two full threads are not required when the threads do not strip upon application of a 20 lbf-in (2.26 N·m) torque value.

14 Mounting

14.1 Provision shall be made for mounting a protector in its normal operating position.

15 Operating Mechanism

15.1 A multipole protector intended to control a 3-phase load shall be so constructed that all poles make and break simultaneously, when operated manually or automatically.

15.2 A multipole protector with one manually operated actuating member shall be so constructed that all poles make and break simultaneously, when operated manually or automatically.

15.3 A multipole protector, with more than one manually operated actuating member that is externally interconnected by a clip or rod to cause all poles to be manually operated simultaneously, is considered to have one manually operated actuating member and shall comply with 15.2.

15.4 The means for manual operation for a protector shall be such that the contacts cannot be held in the closed position when the protector is tripped automatically – that is, the protector shall be trip-free from the operating handle. There are two types of trip-free as defined by 2.12 and 2.13. See also 19.11.

15.5 A protector shall be so sealed that tampering with the calibration or interference with the automatic operation requires dismantling of the device or the breaking of a seal. A protector may be provided with a calibration adjustment when this adjustment moves the trip current downward only towards the rated current.

15.6 An operating handle, when constructed of conducting material extending into the housing, shall have provision for being grounded.

16 Spacings

16.1 The spacings of a protector shall comply with the end-product requirements or shall not be less than those indicated in Table 16.1. The inherent spacings of a component supplied as part of a protector, such as a snap switch, are investigated under the requirements for that component. The spacings from such a component to another component or to grounded metal shall be as specified in Table 16.1.

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