



UL 497

STANDARD FOR SAFETY

Protectors for Paired-Conductor Communications Circuits

UL Standard for Safety for Protectors for Paired-Conductor Communications Circuits, UL 497

Seventh Edition, Dated April 25, 2001

Summary of Topics

This revision of ANSI/UL 497 dated July 25, 2022 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 May 6, 2022.

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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 cover protectors for paired-conductor communications circuits to be used in accordance with Article 800 of the National Electrical Code, NFPA 70.

1.2 As covered by these requirements, a communications circuit protector consists of single- and multiple-pair air gap arresters, gas tube arresters, or solid state arresters, with or without fuses or other voltage-limiting devices. A circuit protector is intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents in telephone lines caused by lightning, contacts with power conductors, power induction, and rises in ground potential.

1.3 This standard does not cover the following:

- a) Lightning protective devices for the protection of secondary distribution wiring systems and equipment.
- b) Antenna discharge units for radio- and television-receiving appliances.
- c) Lightning conductor and air terminals for connection of lightning rods for building protection.
- d) Protectors for fire alarm signaling circuits that are covered by the Standard for Protectors for Data Communications and Fire-Alarm Circuits, UL 497B.
- e) Secondary Protectors for Communications Circuits, UL 497A.
- f) Transient Voltage Surge Suppressors, UL 1449.

1.4 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.

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.

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.

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

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.

2.2 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.

3 Glossary

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

3.2 **APPLIQUÉ ARRESTER ASSEMBLY** – An assembly containing two 2-electrode or one 3-electrode gas tube arresters intended for factory or field connection on a protector block across a pair of carbon arresters. It is intended to reduce maintenance of carbon arresters by discharging lightning-induced voltages that can cause deterioration of carbon arresters. An appliqué arrester may be constructed to shunt the telephone circuit to earth ground or remove itself from the telephone circuit by fusing open, thus permitting operation of parallel arresters during sustained abnormal line voltage.

3.3 **ARRESTER** – An overvoltage component or assembly of components which permits current flow through it when a designed voltage limit is reached. The arrester may consist of a spark gap, gas tube, solid-state component, or the like, coupled with other hardware which serves to support, position, and align the current-carrying components that make up the arrester.

3.4 **ARRESTER RATING** – The breakdown voltage rating specified by the manufacturer.

3.5 **DIRECT CURRENT (DC) BREAKDOWN VOLTAGE** – The voltage at which an arrester changes from non-conduction to conduction when the DC potential is increased at a rate not greater than 2000 volts per second.

3.6 **FUSE, INSTRUMENT (FUSE, SNEAK CURRENT)** – A fuse connected in series between the equipment side of an arrester and the telephone equipment that is intended to limit "sneak currents."

3.7 **FUSE, LINE** – A fuse connected in series between a telephone entrance conductor and an arrester and the telephone equipment that is intended to open during a sustained power fault and prevent the protector and ground wire from overheating. The equipment side of the fuse is connected to an arrester.

3.8 **FUSE WIRE** – A conductor inserted in the telephone outside plant (OSP) if fuseless protectors are installed. The fuse wire is inserted into the connections of the telephone distribution plant between the telephone wire on the pole and the aerial drop wire leading to the building protector.

3.9 **FUSIBLE ELEMENT** – A portion of an arrester assembly composed of a eutectic alloy that melts on occurrence of a sustained fault, such as a power line contact fault, and permanently shorts the arrester to

ground. Other mechanisms that operate and provide a short-circuit mode are also considered fusible elements.

3.10 GAS TUBE SURGE ARRESTER – A gap or series of gaps in an enclosed discharge medium, other than air at atmospheric pressure, designed to protect apparatus or personnel or both from high transient voltages.

3.11 GLOW MODE – The conductive mode of a gas arrester that exists after breakdown when the circuit impedance limits the current to a value less than the glow-to-arc transition current. In the glow mode the gas in the arrester is not completely ionized and the voltage across the arrester is greater than the arc voltage but less than the breakdown voltage.

3.12 HEAT COIL – A protection device that is used to detect low current fault conditions that flow through the protector to the equipment side when the abnormal voltage is insufficient to cause the overvoltage device to shunt the abnormal current to ground. It is comprised of a small gauge wire wound on a metallic bobbin with a shorting pin. When the coil is heated above a predetermined temperature and melts the eutectic alloy holding the pin in position, it grounds or opens the circuit.

3.13 LINE CONDUCTOR – A conductor that terminates on the outside plant or field side of the protector.

3.14 PROTECTOR, FUSED – A protector containing arresters and line fuses.

3.15 PROTECTOR, FUSELESS – A protector containing arresters, but no line fuses.

3.16 PROTECTOR, MULTIPLE PAIR – A protector intended for connection of more than one telephone circuit.

3.17 PROTECTOR, SINGLE PAIR – A protector intended for connection of only one telephone circuit.

3.18 SHORT-CIRCUIT MODE – A resulting mode whereby the voltage across the line contact and ground contact point of a protector assembly will not exceed 50 volts when subjected to the DC breakdown and surge voltage measurement procedure described in this standard.

3.19 SNEAK CURRENT – An abnormal current on a telephone conductor that is not sufficient to open a fuse wire or line fuse and that is not driven by a voltage that is high enough to cause an arrester to operate.

3.20 STATION CONDUCTOR – A conductor that terminates on the inside plant or house side of the protector.

CONSTRUCTION

4 General

4.1 A communications circuit protector shall be constructed to withstand, without damage, its intended installation and use and shall comply with the performance requirements specified in Sections [11](#) – [44](#).

4.2 A fuseless protector shall consist of an assembly comprising:

- a) An insulating base containing two or more arresters or the equivalent;
- b) Provision for connecting one or more pairs of telephone line conductors and a corresponding number of station conductors; and

- c) Provision for connecting at least one grounding conductor.

An arrester shall be connected between each line conductor and ground. The connection or connections for the grounding conductor shall be conductively connected to the ground electrodes of the several arresters. A cover may be provided over the assembly.

4.3 A fused protector shall consist of an assembly comprising:

- a) An insulating base containing two or more arresters or the equivalent;
- b) Provision for mounting two or more line fuses;
- c) Provision for connecting one or more pairs of telephone line conductors and a corresponding number of station conductors; and
- d) Provision for connecting at least one grounding conductor.

The fuses shall be mounted so that one fuse is connected in series between each incoming line termination and the corresponding station termination. The connection or connections for the grounding conductor or conductors shall be conductively connected to the ground electrodes of the several arresters. The arresters shall be connected to the station termination ends of the fuses. A cover may be provided over the assembly.

4.4 An arrester shall not have provision for adjustment of the electrode gap.

5 Enclosures

5.1 General

5.1.1 An enclosure for protectors shall have the strength and rigidity to resist total or partial collapse with attendant reduction of spacings, loosening or displacement of parts, or other conditions that could impair the operation of the product and increase the risk of fire, electric shock, or injury to persons.

5.1.2 Enclosures for individual components, outer enclosures, and combinations of the two are considered in determining compliance with [5.1.1](#).

5.1.3 Protector enclosures shall have provision for mounting.

5.1.4 A protector intended for outdoor use shall be provided with a watertight cover or enclosure.

5.2 Sheet metal

5.2.1 The thickness of sheet metal used for an enclosure of a protector shall not be less than the applicable value specified in [Table 5.1](#) or [Table 5.2](#).

Exception: Sheet metal of lesser thickness is not prohibited from being used when, considering the shape, size, and function of the enclosure, it is determined to provide equivalent mechanical strength.

Table 5.1
Minimum thickness of sheet metal for electrical enclosures – carbon steel or stainless steel

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness	
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Uncoated, inches (mm) [MSG]	Metal coated, inches (mm) [GSG]
4.0 (10.2)	Not limited	6.25 (15.9)	Not limited	0.020 (0.51)	0.023 (0.58)
4.75 (12.1)	5.75 (14.6)	6.75 (17.1)	8.25 (21.0)	[24] [24]	
6.0 (15.2)	Not limited	9.5 (24.1)	Not limited	0.026 (0.66)	0.029 (0.74)
7.0 (17.8)	8.75 (22.2)	10.0 (25.4)	12.5 (31.8)	[22] [22]	
8.0 (20.3)	Not limited	12.0 (30.5)	Not limited	0.032 (0.81)	0.034 (0.86)
9.0 (22.9)	11.5 (29.2)	13.0 (33.0)	16.0 (40.6)	[20] [20]	
12.5 (31.8)	Not limited	19.5 (49.5)	Not limited	0.042 (1.07)	0.045 (1.14)
14.0 (35.6)	18.0 (45.7)	21.0 (53.3)	25.0 (63.5)	[18] [18]	
18.0 (45.7)	Not limited	27.0 (68.6)	Not limited	0.053 (1.35)	0.056 (1.42)
20.0 (50.8)	25.0 (63.5)	29.0 (73.7)	36.0 (91.4)	[16] [16]	
22.0 (55.9)	Not limited	33.0 (83.8)	Not limited	0.060 (1.52)	0.063 (1.60)
25.0 (63.5)	31.0 (78.7)	35.0 (88.9)	43.0 (109.2)	[15] [15]	
25.0 (63.5)	Not limited	39.0 (99.1)	Not limited	0.067 (1.70)	0.070 (1.78)
29.0 (73.7)	36.0 (91.4)	41.0 (104.1)	51.0 (129.5)	[14] [14]	
33.0 (83.8)	Not limited	51.0 (129.5)	Not limited	0.080 (2.03)	0.084 (2.13)
38.0 (96.5)	47.0 (119.4)	54.0 (137.2)	66.0 (167.6)	[13] [13]	
42.0 (106.7)	Not limited	64.0 (162.6)	Not limited	0.093 (2.36)	0.097 (2.46)
47.0 (119.4)	59.0 (149.9)	68.0 (172.7)	84.0 (213.4)	[12] [12]	
52.0 (132.1)	Not limited	80.0 (203.2)	Not limited	0.108 (2.74)	0.111 (2.82)
60.0 (152.4)	74.0 (188.0)	84.0 (213.4)	103.0 (261.6)	[11] [11]	
63.0 (160.0)	Not limited	97.0 (246.4)	Not limited	0.123 (3.12)	0.126 (3.20)
73.0 (185.4)	90.0 (228.6)	103.0 (261.6)	127.0 (322.6)	[10] [10]	

NOTE – Sheet steel for an enclosure intended for outdoor use (watertight) shall be at least 0.036 inch (0.91 mm) thick when zinc-coated and at least 0.032 inch (0.81 mm) thick when uncoated.

^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal that is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and that has sufficient torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure that is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- 1) A single sheet with single formed flanges (formed edges),
- 2) A single sheet which is corrugated or ribbed, and
- 3) An enclosure surface loosely attached to a frame, for example, with spring clips.

^b The width is the smaller dimension of a rectangular sheet metal piece which is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side (for example, side panels of boxes) the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

Table 5.2
Minimum thickness of sheet metal for electrical enclosures – aluminum, copper, or brass

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness, inches (mm)
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	
3.0 (7.6)	Not limited	7.0 (17.8)	Not limited	0.023 (0.58)
3.5 (8.9)	4.0 (10.2)	8.5 (21.6)	9.5 (24.1)	
4.0 (10.2)	Not limited	10.0 (25.4)	Not limited	0.029 (0.74)
5.0 (12.7)	6.0 (15.2)	10.5 (26.7)	13.5 (34.3)	
6.0 (15.2)	Not limited	14.0 (35.6)	Not limited	0.036 (0.91)
6.5 (16.5)	8.0 (20.3)	15.0 (38.1)	18.0 (45.7)	
8.0 (20.3)	Not limited	19.0 (48.3)	Not limited	0.045 (1.14)
9.5 (24.1)	11.5 (29.2)	21.0 (53.3)	25.0 (63.5)	
12.0 (30.5)	Not limited	28.0 (71.1)	Not limited	0.058 (1.47)
14.0 (35.6)	16.0 (40.6)	30.0 (76.2)	37.0 (94.0)	
18.0 (45.7)	Not limited	42.0 (106.7)	Not limited	0.075 (1.91)
20.0 (50.8)	25.0 (63.5)	45.0 (114.3)	55.0 (139.7)	
25.0 (63.5)	Not limited	60.0 (152.4)	Not limited	0.095 (2.41)
29.0 (73.7)	36.0 (91.4)	64.0 (162.6)	78.0 (198.1)	
37.0 (94.0)	Not limited	87.0 (221.0)	Not limited	0.122 (3.10)
42.0 (106.7)	53.0 (134.6)	93.0 (236.2)	114.0 (289.6)	
52.0 (132.1)	Not limited	123.0 (312.4)	Not limited	0.153 (3.89)
60.0 (152.4)	74.0 (188.0)	130.0 (330.2)	160.0 (406.4)	

NOTE – Sheet copper, brass, or aluminum for an enclosure intended for outdoor use (watertight) shall not be less than 0.029 inch (0.74 mm) thick.

^a A supporting frame is a structure of angle or channel or a folded rigid section of sheet metal which is rigidly attached to and has essentially the same outside dimensions as the enclosure surface and which has sufficient torsional rigidity to resist the bending moments which may be applied via the enclosure surface when it is deflected. Construction that is considered to have equivalent reinforcing may be accomplished by designs that will produce a structure which is as rigid as one built with a frame of angles or channels. Construction considered to be without supporting frame includes:

- 1) A single sheet with single formed flanges (formed edges),
- 2) A single sheet which is corrugated or ribbed, and
- 3) An enclosure surface loosely attached to a frame, for example, with spring clips.

^b The width is the smaller dimension of a rectangular sheet metal piece which is part of an enclosure. Adjacent surfaces of an enclosure may have supports in common and be made of a single sheet.

^c For panels which are not supported along one side (for example, side panels of boxes) the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a flange at least 1/2 inch (12.7 mm) wide.

5.3 Nonmetallic

5.3.1 An enclosure of nonmetallic material for a single or multiple pair protector shall have a mechanical strength and durability intended for the application and be formed so as to cover all current-carrying parts.

5.4 Arrester well sizes

5.4.1 The dimensions of arresters employing Types A and B wells in single- and multiple-pair protectors shall comply with the specifications in [Table 5.3](#). Other well sizes may be used depending on protector design.