

UL 1481

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Power Supplies for Fire- Protective Signaling Systems

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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.

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

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INTRODUCTION

1 Scope

1.1 These requirements cover commercial stationary and fixed power supplies for fire-protective signaling systems, having input and output ratings of not more than 300 volts, direct- and alternating-current, (DC and AC), for use in indoor locations in accordance with the following Standards of the National Fire Protection Association:

NFPA 70

National Electrical Code

NFPA 72

National Fire Alarm Code

1.2 These requirements also cover power supply-battery charger combinations used as power supplies, and battery charger units for use as components in fire-protective signaling systems.

1.3 These requirements do not cover power supplies or battery chargers integral with control units or amplifiers intended for fire-protective signaling service.

1.4 These requirements do not cover power supplies for use in hazardous locations, as defined in the National Electrical Code, ANSI/NFPA 70.

1.5 These requirements do not cover commercial power supplies covered by the Standard for Power Units Other Than Class 2, UL 1012, or commercial battery chargers covered by the Standard for Battery Chargers for Charging Engine-Starter Batteries, UL 1236.

1.6 A power supply that is not a complete assembly and depends upon installation in an end product for compliance with the requirements of this standard shall be investigated under the requirements of the standard for that end product.

1.7 The term "product" as used in this standard refers to all power supplies, battery chargers, power supply-battery charger combinations, and battery charger units or any part thereof covered by this standard unless specifically noted otherwise.

1.8 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, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements to determine that the level of safety as originally anticipated by the intent of this Standard is maintained. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Standard shall not be judged to comply with this Standard. Where appropriate, 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. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed 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 recognized rating established for the intended conditions of use.

2.1.4 Specific components are recognized as being 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 specific limits, and shall be used only under those specific conditions for which they have been recognized.

2.2 Units of measurement

2.2.1 When a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

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 AVERAGE VALUE – The sum of all instantaneous values of current (or voltage), averaged over one-half of an alternating cycle.

3.3 BATTERY CHARGER – A product intended to deliver sufficient current to maintain storage batteries in their fully-charged condition while the batteries are not connected to a load. The storage batteries are intended to provide a secondary source of operating power in response to failure of the primary source of operating power.

3.4 CIRCUITS, ELECTRICAL:

a) High-Voltage – A circuit involving a potential of not more than 300 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) Low-Voltage – A circuit involving a potential of not more than 30 volts alternating current (AC) rms, 42.4 volts direct current (DC) or AC peak.

c) Power Limited – A circuit wherein the power is limited as described in Power-Limited Circuits, Section 31.

3.5 GAGES – Wherever they appear in this standard, the abbreviations MSG, GSG, and AWG mean, respectively, Manufacturers' Standard Gage for Steel Sheets, Galvanized Sheet Gage, and American Wire Gage. Reference to sheet metal by gage number is intended only as auxiliary information. Sheet metal of the indicated gage number may not be used if the forming processes have reduced the thickness of the sheet to a point below the specified minimum thickness.

3.6 LINE REGULATION – The change in steady state output resulting from a change in input line voltage.

3.7 LOAD REGULATION – The change in steady state output voltage resulting from a change in output current.

3.8 OPERATOR ACCESS AREA – An area to which, under normal operating conditions, either:

a) Access can be gained without the use of a tool;

b) The means of access is deliberately provided to the operator; or

c) The operator is instructed to enter regardless of whether or not tools are needed to gain access.

3.9 POWER SUPPLY – A source of electrical operating power including the circuits and terminations connecting it to the dependent system components.

a) Fixed – A power supply that is intended to be permanently connected to the electrical supply.

b) Stationary – A power supply that is intended to be fastened in place or located in a dedicated space.

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3.10 POWER SUPPLY-BATTERY CHARGER – A power supply that serves the dual function of providing operating power and charging storage batteries. The power supply is usually permanently connected to storage batteries, and the power supply-battery combination is intended to provide all of the electrical operating power required by the equipment to which the combination is connected, when the equipment is operating in its intended manner.

3.11 RIPPLE – An AC component superimposed on the DC output of a power supply, specified in terms of either its effective value or peak-to-peak value.

INSTRUCTIONS AND DRAWINGS

4 Details

4.1 General

4.1.1 Each product shall include instructions necessary for its intended installation and operation, as described in the following paragraphs.

4.2 Installation drawings

4.2.1 Installation instructions and drawings shall include at least the following information:

- a) Typical installation drawing layouts and complete representative installation wiring diagram for the product, indicating field connections, wiring methods in accordance with the National Electrical Code, ANSI/NFPA 70, and input and output ratings.
- b) A concise description of the operation, testing, and proper maintenance procedures for the product(s). The frequency of testing shall be in accordance with the requirements of the authorities having jurisdiction.
- c) Replacement parts shall be identified in the instructions.

4.2.2 The instructions may be incorporated inside the enclosure, on a separate sheet, or as part of a manual. If not included directly on the product, the instructions or manuals shall be referenced in the marking information on the product.

4.3 Operating instructions

4.3.1 Operating instructions shall include at least the following:

- a) A description of the operation of the product and the function of controls and/or adjustments used during intended operation of the product;
- b) Input and output ratings;
- c) A space for the name, address, and telephone number of the local service representative; and
- d) The load with which the product is intended to operate.

4.3.2 With reference to 4.3.1(d), the operating instructions for a power supply-battery charger unit shall include:

- a) The maximum charging current (trickle charge and fast charge) and
- b) The maximum ampere-hour capacity of the battery which the product is intended to charge.

4.3.3 The operating instructions shall appear on the front of the outer enclosure, or on a separate sheet that can be framed and located adjacent to the product.

4.3.4 If provided on a separate sheet in accordance with 4.3.3, the operating instructions shall include the model number (or other specific identification) of the product, and the product marking shall refer to the operating instructions by drawing number, issue number and/or date.

CONSTRUCTION

ASSEMBLY

5 General

5.1 Unless specifically indicated otherwise, the construction requirements specified for a product shall apply also for any remote accessories with which it is to be used.

5.2 The test means shall be constructed and located so as to prevent tampering by unauthorized personnel.

6 Enclosures

6.1 General

6.1.1 The frame and enclosure of a product shall be sufficiently strong and rigid to resist total or partial collapse with attendant reduction of spacings, loosening or displacement of parts and development of other conditions which could impair operation of the product and increase the risk of fire, electric shock, or personal injury.

6.1.2 Electrical parts of a product shall be located or enclosed to provide protection against unintentional contact with uninsulated, high-voltage live parts.

6.1.3 Operating parts, such as light-duty relays and similar devices, shall be enclosed to protect against malfunction from dust or other foreign material which may impair their intended operation.

6.1.4 The mounting means of an enclosure shall be accessible without disassembly of any operating part of the product. Removal of a completely assembled panel to mount the enclosure is not considered to be disassembly of an operating part.

6.1.5 An enclosure containing circuits other than power-limited circuits shall not be open to the floor or other support on which the product rests.

6.2 Openings

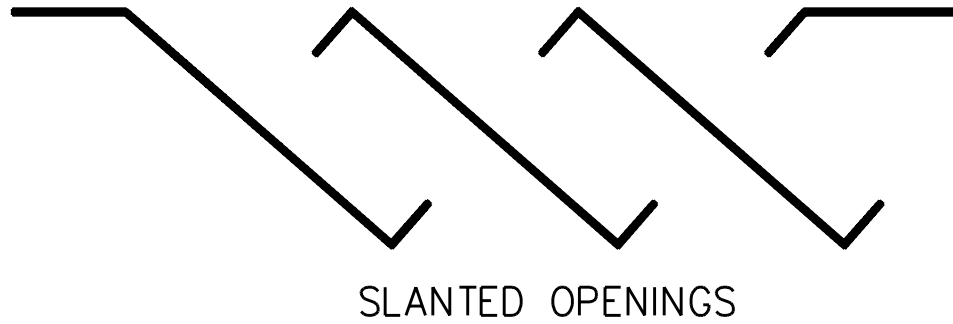
6.2.1 Openings in the top and sides of an enclosure, excluding openings in operator access areas within an enclosure, shall comply with 6.2.2 – 6.2.9, as appropriate.

6.2.2 Openings in the top of an enclosure directly over uninsulated live parts at high voltage shall:

- a) Not exceed 0.187 inch (4.75 mm) in any dimension and
- b) Be constructed so that direct vertical entry of a falling object is prevented from reaching such parts by means of traps or restriction.

See Figure 6.1 for examples of top cover designs that prevent such direct entry.

Figure 6.1
Cross-sections of top cover openings



EC500

6.2.3 Openings in the sides of an enclosure shall either:

- a) Not exceed 0.187 inch (4.75 mm) in any dimension or
- b) Be provided with louvers that are shaped to deflect outward an external vertically falling object.

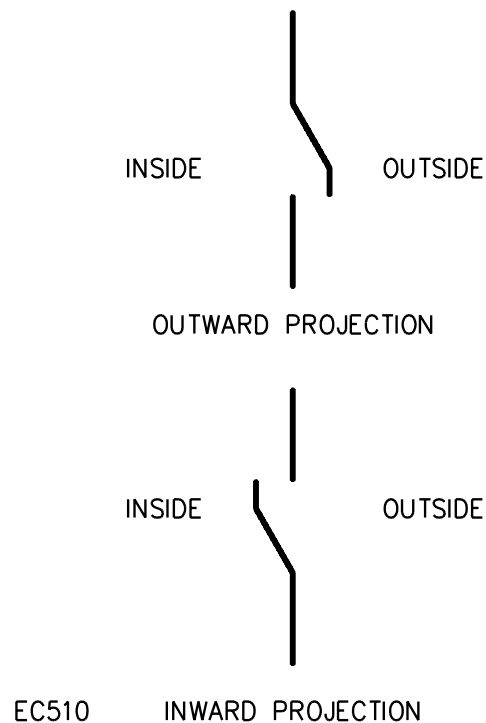
See Figure 6.2 for examples of louver design.

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Figure 6.2
Cross-sections of side louvers



6.2.4 Openings in the enclosure shall not give access to any relays, terminals, controls, or related components that might be subject to tampering.

6.2.5 An opening shall not permit entrance of a 3/4 inch (19.1 mm) diameter rod and shall be sized and arranged so that a probe, as illustrated in Figure 6.3, cannot be made to contact any uninsulated live electrical part, other than low-voltage, when inserted through the opening in a straight or articulated position.

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6.2.6 The probe illustrated in Figure 6.3 is to be applied to any depth that the opening will permit with a force not greater than 1 pound (4.4 N), and is to be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the power supply. The probe is to be applied in any possible configuration and, if necessary, the configuration is to be changed after insertion through the opening.

6.2.7 A guard, baffle, or cover that can be removed without using a tool is to be removed when determining if a part is accessible to the user. A part that can be contacted by the probe illustrated in Figure 6.3 when inserted through an opening in a permanently attached guard or baffle is considered to be accessible to persons.

6.2.8 A part on the back of a component mounting panel and a part located so as to require major disassembly by using a tool are not considered to be accessible to the user.

6.2.9 If a power supply is not intended to be installed in a separate cabinet which has provision for connection to a Class 1 wiring system, as defined by the National Electrical Code, ANSI/NFPA 70, the enclosure of the power supply shall have provision for connection to a Class 1 wiring system.

6.3 Cast metal

6.3.1 The thickness of cast metal for an enclosure shall be as indicated in Table 6.1.

Exception: Cast metal of lesser thickness may be used if, consideration being given to the shape, size, and function of the enclosure, it provides equivalent mechanical strength. See the Impact Test for Enclosures, Section 55.

6.1
Cast-metal enclosures

Use, or dimensions of area involved ^a	Minimum thickness			
	Die-cast metal,		Cast metal of other than the die-cast type,	
	inch	(mm)	inch	(mm)
Area of 24 square inches (155 cm ²) or less and having no dimension greater than 6 inches (152 mm)	1/16	1.6	1/8	3.2
Area greater than 24 square inches or having any dimension greater than 6 inches	3/32	2.4	1/8	3.2
At a threaded conduit hole	1/4	6.4	1/4	6.4
At an unthreaded conduit hole	1/8	3.2	1/8	3.2

^a The area limitation for metal 1/16 inch (1.6 mm) in thickness may be obtained by the provision of reinforcing ribs subdividing a larger area.

6.3.2 Die-cast metal for other than flush boxes may be used if it complies with one of the alloy specifications given in the Standard Specification for Zinc-Alloy Die Castings, ASTM B86-94.

6.3.3 Compliance of a zinc-base alloy die casting with the requirement of 6.3.2 is to be determined by the Standard Specification for Steel Castings, Carbon, for General Application, ASTM A27/A27M-93.

6.3.4 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, there shall not be less than 3-1/2 nor more than five threads in the metal, and the construction shall be such that a standard conduit bushing can be properly attached.

6.3.5 If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall not be less than 3-1/2 full threads in the metal, and there shall be a smooth, rounded inlet hole which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

6.3.6 A product constructed to be supported by rigid conduit shall be provided with conduit hubs, or the equivalent, having not less than five full threads.

6.4 Sheet metal

6.4.1 The thickness of sheet metal used for the enclosure of a product shall not be less than that indicated in Tables 6.2 and 6.3.

Exception: Sheet metal of lesser thickness may be used if, consideration being given to the shape, size, and function of the enclosure, it provides equivalent mechanical strength.

Table 6.2
Minimum thickness of sheet metal for enclosures— carbon steel or stainless steel

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness uncoated, inch (mm) [MSG]	Minimum thickness metal coated, inch (mm) [GSG]
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)		
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]

Table 6.2 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness uncoated, inch (mm) [MSG]	Minimum thickness metal coated, inch (mm) [GSG]
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)		
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]

^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.

6.3

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, inch (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	

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Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness, inch (mm)
Maximum width, ^b inches (cm)	Maximum length, ^c inches (cm)	Maximum width, ^b inches (cm)	Maximum length, inches (cm)	
60.0 152.4	74.0 188.0	130.0 330.2	160.0 406.4	0.153 3.89

^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.

6.4.2 A plate or plug closure for an unused conduit opening or other hole in the enclosure shall have a thickness not less than:

a) 0.014 inch (0.4 mm) for steel or 0.019 inch (0.5 mm) for nonferrous metal for a hole having a 1/4 inch (6.4 mm) maximum dimension.

b) 0.027 inch (0.7 mm) for steel or 0.032 inch (0.8 mm) for nonferrous metal for a hole having a 1-3/8 inch (34.9 mm) maximum dimension.

6.4.3 A hole larger than 1-3/8 inch (34.9 mm) diameter shall have a closure whose thickness is not less than that required for the enclosure of the product or shall have a standard knockout seal. Such plates or plugs shall be securely mounted.

6.4.4 A knockout in a sheet metal enclosure shall be secured but shall be capable of being removed without undue deformation of the enclosure.

6.4.5 A knockout shall be provided with a surrounding surface area of sufficient size to permit seating of a conduit bushing, and shall be located so that a bushing used at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those indicated under Spacings, Section 26.

6.4.6 An enclosure intended for recessed mounting and whose front panel is to be flush with the surface of the wall, shall have no openings that vent into concealed spaces of a building structure, such as into hollow spaces in the wall, when the power supply is mounted as intended.

6.4.7 The requirement in 6.4.6 does not apply to an opening for a mounting screw or nail or for a manufacturing operation (such as paint drainage) provided:

- a) No such opening has a dimension greater than 17/64 inch (6.75 mm) or an area greater than 0.055 square inch (35 mm²) and
- b) There is not more than one mounting screw for each 12 inches (305 mm) of length of mounting surface.

6.4.8 A sheet metal member to which a wiring system is to be connected in the field shall have a thickness of not less than:

- a) 0.032 inch (0.81 mm) if of uncoated steel;
- b) 0.034 inch (0.86 mm) if of galvanized steel; and
- c) 0.045 inch (1.14 mm) if of nonferrous metal.

6.5 Nonmetallic

6.5.1 An electrical enclosure or parts of an electrical enclosure of nonmetallic material shall comply with applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.6 Doors and covers

6.6.1 An enclosure cover shall be hinged, sliding, or similarly attached so as to prevent its being removed if:

- a) It gives access to fuses or to any other overcurrent protective device, the intended functioning of which requires renewal or
- b) It is necessary to open the cover in connection with the intended operation of the unit.

Exception: A hinged cover is not required if the only fuse(s) enclosed is intended to provide protection to portions of internal circuits such as may be used on a separate printed-wiring board or circuit subassembly, to prevent excessive circuit damage resulting from a fault. Such a fuse(s) may be used if the following or equivalent marking is indicated on the cover: "Circuit Fuse(s) Inside – Disconnect Power Prior To Servicing."

6.6.2 An unhinged cover shall be securely held in place by screws, or the equivalent.

Exception: Fasteners requiring the use of a tool or a key shall be used if access is not required for intended operation of the product.