

UL 924

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Emergency Lighting and Power Equipment

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety for Emergency Lighting and Power Equipment, UL 924

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

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March 3, 2003	Paragraphs 9.1.1 – 9.1.3, 9.2.1 – 9.2.5, 9.3.1, 9.3.2, 9.4.1, 9.5.1, 9.6.1, 9.7 – 9.14, 13.4, 38A.4.1, 38A.4.2, 62A.1, 62B.1, 71.6, Table 9.1 and Supplement SH

The new and revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated November 22, 2000. The bulletin(s) is now obsolete and may be discarded.

In a previous revision to UL 924 dated August 27, 1996, pages 66 – 76 included requirements which were deleted from the standard. To prevent confusion, page 66 is included in this revision set with the caption "No Text On This Page". However, pages 67 – 76 are still deleted and text continues on page 77.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

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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, Classified, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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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 which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, 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.

INTRODUCTION

1 Scope

1.1 These requirements cover emergency lighting and power equipment for use in ordinary locations, in accordance with the National Electrical Code, ANSI/NFPA 70. Such equipment is intended to supply automatically illumination or power or both to critical areas and equipment in the event of failure of the normal supply or in the event of accident to elements of a system intended to supply, distribute, and control power and illumination essential to safety of human life.

1.2 These requirements also cover auxiliary lighting and power equipment for use in ordinary indoor locations. Auxiliary equipment has not been investigated to determine compliance with Article 700 or 701 of the National Electrical Code, ANSI/NFPA 70.

1.3 These requirements cover unit equipment, automatic battery charging and control equipment, inverters, central station battery systems equipment (including central storage battery banks, automatic battery charging equipment, automatic load control relays, multi-circuit distribution equipment, derangement alarm equipment, and other applicable accessories), remote lamp assemblies, and exit signs intended for installation in accordance with the Life Safety Code, NFPA 101. Exit fixtures, exit lights, unit equipment, and remote lamp assemblies shall also comply with the applicable requirements in the Standard for Fluorescent Lighting Fixtures, UL 1570, or the Standard for Incandescent Lighting Fixtures, UL 1571, except as noted elsewhere in this standard.

1.3 revised July 11, 2001

1.4 These requirements cover emergency lighting fixtures with or without means for transferring from the normal mode of power to the emergency mode. These emergency lighting fixtures shall also comply with the requirements for lighting fixtures.

1.5 These requirements cover equipment intended for permanent connection to branch circuits of 600 volts or less and cord-connected equipment (which as an alternative may be permanently connected) for use on branch circuits of 277 volts maximum.

1.6 These requirements do not cover Uninterruptable Power Systems (UPS) which are investigated under the Standard for Uninterruptable Power-Supply Equipment, UL 1778.

1.7 These requirements do not cover low level path marking and lighting systems. Such equipment is covered by the Standard for Low Level Path Marking and Lighting Systems, UL 1994.

1.7 revised May 21, 1999

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 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.

1.8 revised May 21, 1999

2 References

2.1 Any undated reference to a code or a standard appearing in the requirements in this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Resistance to Environmental Conditions

3.1 Equipment marked with an enclosure type number, such as 4X, shall comply with the following:

- a) The enclosure shall comply with the applicable requirements specified in the Standard for Enclosures for Electrical Equipment, UL 50, and
- b) The equipment shall comply with the requirements in this standard for use in the environment indicated by the enclosure type designation.

4 Glossary

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

4.2 AUTOMATIC BATTERY CHARGING EQUIPMENT – Equipment provided to maintain the central storage battery bank in a charged condition at all times when the normal supply is available.

4.3 AUTOMATIC LOAD CONTROL RELAY – A device intended to energize normally off emergency circuits from an emergency supply in the event of failure of the normal supply, and to de-energize the emergency circuits when the normal supply is restored.

4.4 AUXILIARY LIGHTING AND POWER EQUIPMENT – Equipment of a class included in the scope of this Standard that has not been evaluated for compliance with the minimum output (power or light) requirements or that incorporates other than a legally-required legend.

4.4 revised March 2, 2001

4.5 BATTERY BANK – An enclosed group of batteries intended to supply power to remote lighting or power equipment.

4.6 CENTRAL STATION BATTERY LIGHTING AND POWER SYSTEMS – Systems equipment consisting of a central storage battery bank, automatic battery charging equipment, inverters, automatic control relays, multi-circuit distribution equipment, derangement alarm equipment, and other applicable accessories. Such equipment may be integrally housed in a single overall enclosure or may be separately enclosed for remote connection to a central control unit.

4.7 CENTRAL STORAGE BATTERY BANK – Storage batteries arranged and connected so as to provide the required emergency system voltage.

4.8 CLASS 2 CIRCUIT – A circuit supplied by an isolating source that complies with the Standard for Class 2 Power Units, UL 1310 or the Class 2 requirements of the Standard for Class 2 and Class 3 Transformers, UL 1585.

4.8 revised March 2, 2001

4.9 Deleted March 2, 2001

4.9.1 COMBINATION UNIT – A single piece of equipment that functions as an Exit Light and as Unit Equipment.

4.9.1 added May 21, 1999

4.10 COMPOSITE SOLID STATE SWITCH-INVERTER – Electronic switching circuitry that permits an inverter to function in the emergency mode using only the battery supply.

4.11 CONTINUOUS ILLUMINATED LETTER OR DIRECTIONAL INDICATOR – The letter of a legally required legend or directional indicator that is continuous over its entire illuminated height, width or stroke width. Up to two structural members, each no more than 0.3 inches (8 mm) in width, may be provided in letters with physically disconnected center sections.

4.11 revised March 2, 2001

4.12 DERANGEMENT ALARM EQUIPMENT – Any audible or visible (or both) signaling equipment intended to indicate derangement of one or more of the individual circuits included in the central station battery lighting and power system.

4.13 DUTY CYCLE – As applicable to flashing exit fixtures and exit lights, duty cycle refers to the light pulse duration ("on" time) expressed either as a percentage or fraction of the cycle duration or as both the light pulse duration and duration between successive light pulses ("off" time).

4.13A Deleted May 21, 1999

4.14 ELECTROLUMINESCENT – The emission of light from a phosphor excited by an electromagnetic field.

4.15 EMERGENCY LIGHTING FIXTURE – A fixture provided with:

- a) Two or more lamps intended to be separately connected to a normal and an emergency source of power (no automatic control equipment) or
- b) A means for transferring from the normal to the emergency source of power.

4.16 EXIT FIXTURE – A fixture with one or more lamps intended:

- a) To be permanently connected to only one source of power (normal or emergency) and
- b) To illuminate an integral legally required legend.

4.17 EXIT LIGHT – A complete, enclosed unit assembly arranged for permanent connection, with one or more lamps that illuminate an integral legally required legend upon failure of the normal power supply. An exit light may have an automatic load control device and may be provided with a storage battery. If a battery is used, a means for charging the battery is included.

4.18 EXIT SIGN – A general term used to refer to an Exit Light, Exit Fixture, and Self-Luminous or Photoluminescent Exit Sign.

4.18 revised July 11, 2001

4.19 FIELD-WIRING TERMINAL – Any terminal of the equipment as well as any terminal of any component unit (circuit breaker, switch, and the like) in the equipment to which conductors are to be connected in the field.

4.20 FLUORESCENT FIXTURE INVERTER/CHARGER PACK – An enclosed unit assembly equipped with batteries, a charger, high frequency inverter, and control circuitry intended to be installed in a fluorescent fixture to provide an automatic source of power to lamp loads upon failure of normal power sources.

4.21 FULL-SIZE ILLUMINATED LEGEND – A legally required legend that provides illuminated letters of minimum 6 inches (152 mm) high by 2 inches (51 mm) wide (except for the letter "I"), with a 3/4 inch (19.1 mm) stroke width.

4.21 added March 29, 1995

4.22 HIGH-FREQUENCY INVERTER – An arrangement of solid-state circuitry designed to convert direct-current power to high-frequency (greater than 800 hertz), alternating current and the voltage required to operate electric discharge lamps.

4.23 INSTALLATION-WIRING LEAD – Any wire lead to which a supply or other wire is intended to be spliced by an installer in the field.

4.24 INSTALLATION-WIRING TERMINAL – Any terminal to which a supply or other wire is intended to be connected by an installer in the field.

4.24.1 ISOLATED CIRCUIT – A circuit supplied by a source with no direct electrical connection between input and output (such as a transformer or optical isolator). A common grounding means for the input and output does not violate the isolating nature of the source.

4.24.1 added March 2, 2001

4.25 LAMPHEAD – As applicable to unit equipment, a lamp assembly mounted externally to the main enclosure of the equipment with a swivel or equivalent mounting means so as to be adjustable.

4.26 LEGALLY REQUIRED LEGEND – The words "EXIT", "TO EXIT", "STAIR", "TO STAIR", "STAIRS", "TO STAIRS", "FIRE ESCAPE", "TO FIRE ESCAPE", "FIRE EXIT", and "TO FIRE EXIT".

4.26.1 LIMITING IMPEDANCE CIRCUIT – A circuit supplied by an impedance that, when a direct short is applied across the source output:

- a) Has a calculated power dissipation of 15 W or less, and
- b) Does not incur any opened or shorted components.

The limiting impedance shall additionally function as intended under any single fault condition unless it consists of a single resistor, or of a single capacitor that complies with UL 1414.

4.26.1 added March 2, 2001

4.27 LOW-FREQUENCY INVERTER – An arrangement of solid-state circuitry designed to convert direct-current power to low-frequency (50 – 800 hertz), alternating current and the voltage required to operate lighting and power equipment.

4.28 LOW-VOLTAGE, LIMITED-ENERGY CIRCUIT – A circuit supplied by a source of maximum 30 V AC or 42.4 V peak open circuit potential and maximum 8 A available current measured after one minute of operation. See Section 49A.

4.28 revised March 2, 2001

4.29 MULTI-CIRCUIT DISTRIBUTION EQUIPMENT – Any multi-circuit distribution panel incorporating individual branch circuit overcurrent protection. This equipment may be provided with individual branch circuit monitoring control relays.

4.30 NON-CONTINUOUS ILLUMINATED LETTER OR DIRECTIONAL INDICATOR – The letters of a legally required legend, or a directional indicator, that is not continuous over its entire illuminated height, width, or stroke width. Examples of such constructions are exit signs with a series of point light sources (such as light-emitting diodes – LEDs) or illuminated segments separated from each other by nonluminous (opaque) spaces.

4.30 added March 29, 1995

4.31 OTHER ACCESSORIES – Any equipment that may be provided as a component part of a central station battery lighting and power system, other than remotely connected lighting fixtures (such as battery disconnect switching devices, phase monitor equipment, and the like).

4.31.1 PHOTOLUMINESCENT – Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed.

4.31.1 added July 11, 2001

4.32 QUALIFIED SERVICE PERSONNEL – Persons trained in the installation and servicing of the product.

4.33 REDUCED-SIZE ILLUMINATED LEGEND – A legally required legend having full size letters in accordance with 39.5, the illuminated areas of which are smaller with dimensions between 5-1/2 to 6 inches (139.7 to 152.4 mm) high by 1-1/2 to 2 inches (38.1 to 50.8 mm) wide with a 1/4 to 3/4 inch (6.4 to 19.1 mm) stroke.

4.33 revised March 2, 2001

4.34 REMOTE LAMP ASSEMBLY – A unit with one or more lamps intended to be connected to unit equipment or central station battery lighting and power systems.

4.35 RETROFIT – An assembly intended to be permanently field installed in existing equipment.

4.35.1 RISK OF ELECTRIC SHOCK – A risk of electric shock is considered to exist if the open-circuit potential between any two uninsulated parts, or an uninsulated part and ground, is higher than 30 V AC or 42.4 volts peak, and the available current that would flow between the parts, through a 1500-ohm resistance, is more than 5 mA.

4.35.1 added May 21, 1999

4.35.2 RISK OF FIRE – A risk of fire exists in all electrical circuits except:

- a) A Class 2 circuit;
- b) An isolated, low-voltage, limited-energy circuit; or
- c) A limiting impedance circuit.

4.35.2 revised March 2, 2001

4.36 ROUTINE MAINTENANCE – Periodic tasks usually performed to maintain the equipment in proper working order, such as replacing fuses (branch-circuit or load-circuit type), replacing light sources, and battery servicing (operations such as adding water to batteries and checking specific gravity of electrolyte). Replacement of batteries or fuses that protect components are not considered routine

maintenance operations and are expected to be performed by qualified service personnel. An enclosure or compartment is not considered subject to routine maintenance activities when it requires a tool for access and is marked per 68.1.13.1.

4.36 revised May 21, 1999

4.37 ROUTINE OPERATION – Operation of a test switch located inside or outside the overall enclosure, resetting of switches and circuit breakers, and similar operations.

4.38 SEALED BATTERY/CELL – A battery/cell that has no provision for the addition of water or electrolyte or for external measurement of electrolyte specific gravity.

4.39 Deleted March 2, 2001

4.40 SELF-LUMINOUS EXIT SIGN – A sign with an integral legally required legend that is powered continuously by a self-contained energy source other than a battery, such as radioactive tritium gas. Operation of a self-luminous exit sign is independent of external power supplies or other external forms of energy. This definition does not include exit signs dependent upon photoluminescent materials.

4.41 TRANSLUCENT – The property of letting light through without being transparent. As applicable to exit signs, a luminous surface that is not transparent, but provides the same effect as a translucent material that is illuminated from the back is also considered to be translucent. For example, a composite construction consisting of a transparent material applied over a luminous non-transparent surface as in edge-lighted exit sign constructions is considered to be translucent.

4.42 UNIT EQUIPMENT – A complete, enclosed unit assembly, consisting of a rechargeable battery, a battery charging means, provisions for one or more lamps either mounted on the equipment or remote or both, and a device arranged to energize the lamps automatically upon failure of the normal supply. Terminals or leads are provided for the connection of remote lamps.

4.43 VENTED BATTERY/CELL – A battery/cell provided with positive openings that permit free interchange of cell gases with the outside atmosphere.

5 Components

5.1 Except as indicated in 5.2, 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.

5.2 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.

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

5.4 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 specified limits, and shall be used only under those specific conditions for which they have been recognized.

5.5 A component not marked with a short-circuit current rating is considered rated for use in a circuit having a maximum available fault current as shown in Table 5.1.

Effective date for 5.5 changed from January 1, 1994 to January 1, 1996

Table 5.1
Assumed maximum short-circuit current rating for unmarked components

Effective date for Table 5.1 changed from January 1, 1994 to January 1, 1996

Component	Short-circuit current rating, kA
1. Circuit breaker (including GFCI type)	5
2. Clock-operated switch	5
3. Fuseholder	10
4. Lighting fixture (circuit) internal	5
5. Miniature fuse	10 ^a
6. Plug fuse	10
7. Industrial control equipment:	
a) Auxiliary device	5
b) Switches (other than mercury tube type)	5
c) Mercury tube switches rated over 60 amperes or over 250 volts	5
8. Meter socket base	10
9. Photoelectric switches	5
10. Receptacle (other than GFCI type)	10
11. Snap switch	5
12. Terminal block	10
13. Thermostat	5

^a The use of these fuses is limited to 125-volt circuits.

5.6 The short-circuit current available in the secondary circuit of a transformer rated 10 kVA or less is considered to be 5,000 amperes or less.

Effective date for 5.6 changed from January 1, 1994 to January 1, 1996

5.7 The short-circuit current available on the load side of a 15 ampere current-limiting circuit breaker or Class CC, G, J, RK-1, RK-5, or T fuse is considered to be 5,000 amperes. In a single-phase 120-volt circuit, the short-circuit current available on the load side of a 20 ampere circuit breaker or Class CC, G, J, RK-1, RK-5, or T fuse is considered to be 10,000 amperes or less.

Effective date for 5.7 changed from January 1, 1994 to January 1, 1996

6 Units of Measurement

6.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

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

7 Radioactive Energy Sources

7.1 Self-luminous exit signs utilizing a radioactive material as the energy source are subject to the requirements of the United States Nuclear Regulatory Commission or Agreement State as applied to a generally licensed device.

CONSTRUCTION

8 Frame and Enclosure

8.1 General

8.1.1 A frame and enclosure shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without increasing the risk of fire, electric shock, or injury to persons due to total or partial collapse, with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

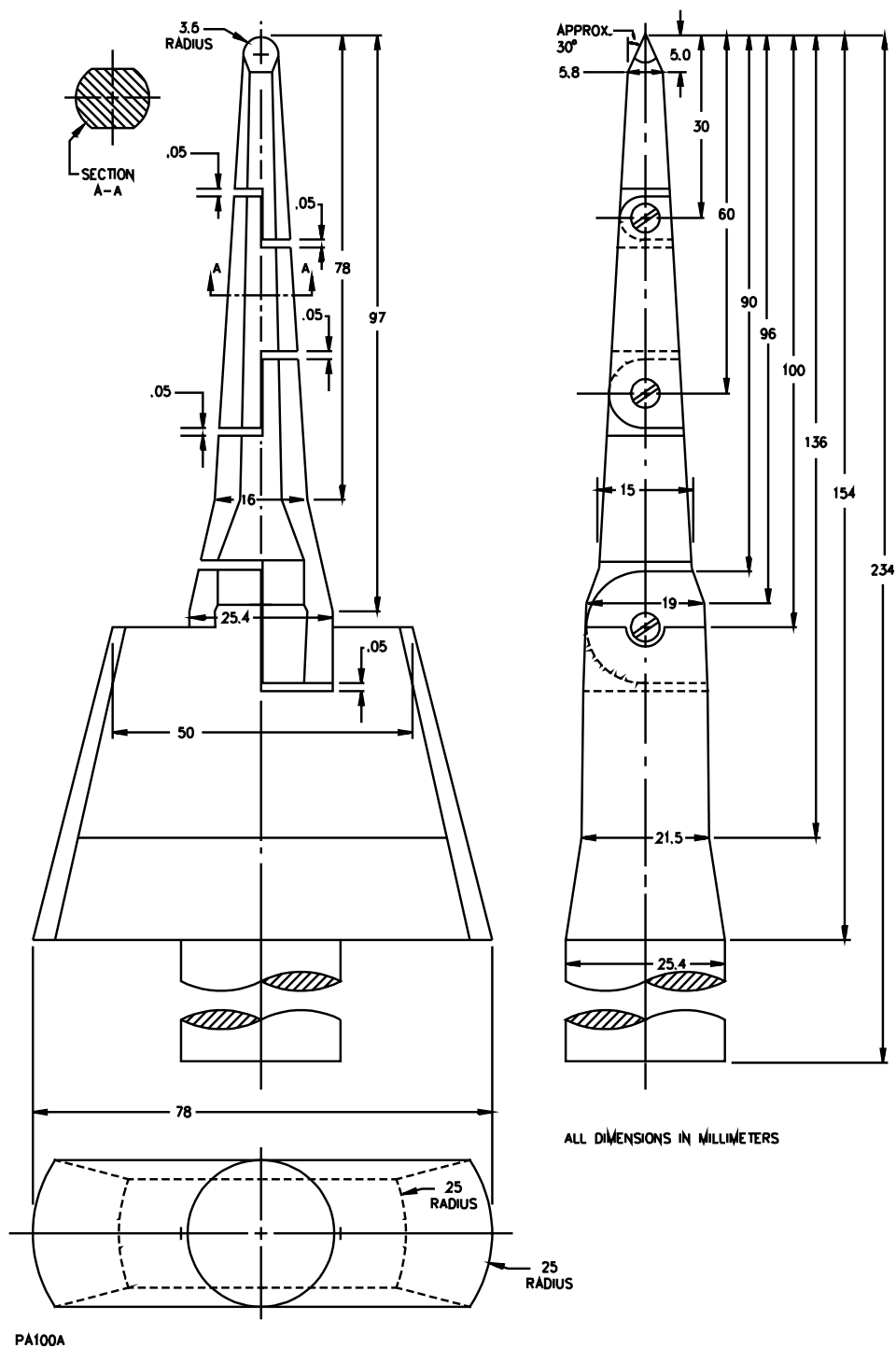
8.1.2 An operating part, such as a relay and similar devices, shall be protected against dust or other material that may adversely affect the intended operation.

8.2 Uninsulated live parts

8.2.1 Uninsulated electrical parts that pose a risk of electric shock shall be located or enclosed to reduce the risk of contact. The probe illustrated in Figure 8.1 shall be used to determine if an uninsulated live part can be contacted under the conditions described in 8.2.2 – 8.2.5.

8.2.1 revised May 21, 1999

Figure 8.1
Articulate probe with web stop



8.2.2 The probe referred to in 8.2.1 may be articulated into any configuration and may be rotated or angled to any position before, during, or after insertion into the area being investigated.

8.2.3 If battery charger output leads involve a risk of electric shock as specified in 8.2.1 or in Exception No. 2 to 31.1, the leads shall be disconnected from the battery terminals before applying the articulate probe.

8.2.4 An uninsulated live part considered to be a source of electric shock in a compartment that is intended to be opened for routine maintenance or routine operation shall be located or guarded so as to reduce the risk of inadvertent contact with such a part. Any barrier or guard provided to shield a live part during routine maintenance or routine operation shall remain in place while applying the probe for the purpose of this requirement.

Exception: This requirement does not apply to the lamp contacts of a lampholder or automatic starter holder to which a lamp or automatic starter connects.

Revised 8.2.4 effective August 1, 1998

8.2.5 If a live part would be exposed as a result of personnel removing a barrier or guard to perform routine maintenance, the barrier or guard shall be removed prior to applying the probe.

8.3 Metallic enclosures

8.3.1 The sheet metal enclosure of a unit equipment and a unit equipment or component power supply shall have a minimum thickness of: 0.029 inch (0.74 mm) if of zinc-coated steel, 0.026 inch (0.66 mm) if of uncoated steel, and 0.036 inch (0.91 mm) if of aluminum.

Exception No. 1: Sheet metal for the enclosure of the connection to a wiring system shall have a minimum thickness of: 0.034 inch (0.86 mm) if of zinc-coated steel, 0.032 inch (0.81 mm) if of uncoated steel, and 0.045 inch (1.14 mm) if of aluminum.

Exception No. 2: The sheet metal enclosure of a unit equipment electric discharge lighting fixture with integral component power supply shall comply with the requirements for electric lighting fixtures.

8.3.2 The thickness of the sheet metal enclosure of emergency equipment shall be no less than indicated in Tables 8.1 and 8.2.

Exception No. 1: The enclosure of an exit light, a remote lamp assembly, or an emergency lighting fixture shall comply with the requirements for electric lighting fixtures.

Exception No. 2: The sheet metal enclosure of a central station storage battery with integral automatic battery charging equipment shall have an average thickness of no less than: 0.045 inch (1.14 mm) if of zinc-coated steel, 0.042 inch (1.07 mm) if of uncoated steel, and 0.058 inch (1.47 mm) if of aluminum.

Exception No. 3: The sheet metal enclosure of a unit equipment electric discharge lighting fixture with integral power supply shall comply with the requirements for electric lighting fixtures.

Exception No. 4: Lesser thicknesses may be used if the construction is shown by investigation to provide equivalent mechanical strength.

8.3.3 Tables 8.1 and 8.2 are based on a uniform deflection of the enclosure surface for any given load concentrated at the center of the surface regardless of metal thickness.

8.3.4 The thickness of cast metal for an enclosure shall be as indicated in Table 8.3.

Exception: Cast metal of lesser thickness may be used if, upon investigation (consideration being given to the shape, size, and function of the enclosure), it is found to have equivalent mechanical strength.

8.4 Nonmetallic enclosures

8.4.1 A nonmetallic enclosure or enclosure part shall have mechanical strength and durability, shall be formed so that operating parts will be protected against damage, and shall resist the abuses likely to be encountered during installation and intended use and service. The mechanical strength shall be at least equivalent to a sheet metal enclosure of the minimum thickness specified in Table 8.1. The enclosure or enclosure part shall protect persons from a risk of electric shock, and the material shall not create or contribute to a risk of fire, electric shock, or injury to persons.

8.4.2 Among the factors considered when evaluating an enclosure or frame of nonmetallic material are:

- a) Mechanical strength;
- b) Resistance to damage from impact;
- c) Moisture-absorptive properties;
- d) Flammability;
- e) Resistance to arcing;
- f) Resistance to temperatures to which the material may be subjected under the conditions of use; and
- g) Aging characteristics.

8.4.2 revised May 21, 1999

8.4.3 An enclosure made of a polymeric material shall comply with the requirements specified in Polymeric Enclosures, Section 9.

Effective date for 8.4.3 changed from August 1, 1995 to August 1, 1998

Table 8.1
Minimum thickness of sheet metal for electric enclosures carbon steel or stainless steel

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness	
Maximum width, ^b inches	Maximum length, ^c (cm)	Maximum width, ^b inches	Maximum length, ^c (cm)	Uncoated, inches (mm)	Zinc coated, inches (mm)
4.0	10.2	Not limited	6.25 15.9	0.020	0.51
4.75	12.1	5.75 14.6	6.75 17.1	8.25	21.0
6.0	15.2	Not limited	9.5 24.1	0.026	0.66
7.0	17.8	8.75 22.2	10.0 25.4	12.5	31.8
8.0	20.3	Not limited	12.0 30.5	0.032	0.81
9.0	22.9	11.5 29.2	13.0 33.0	16.0	40.6
12.5	31.8	Not limited	19.5 49.5	0.042	1.07
14.0	35.6	18.0 45.7	21.0 53.3	25.0	63.5
18.0	45.7	Not limited	27.0 68.6	0.053	1.35
20.0	50.8	25.0 63.5	29.0 73.7	36.0	91.4
22.0	55.9	Not limited	33.0 83.8	0.060	1.52
25.0	63.5	31.0 78.7	35.0 88.9	43.0	109.2
25.0	63.5	Not limited	39.0 99.1	0.067	1.70
29.0	73.7	36.0 91.4	41.0 104.1	51.0	129.5
33.0	83.8	Not limited	51.0 129.5	0.080	2.03
35.0	88.9	47.0 119.4	54.0 137.2	66.0	167.6
42.0	106.7	Not limited	64.0 162.6	0.093	2.36
47.0	119.4	59.0 149.9	68.0 172.7	84.0	213.4
52.0	132.1	Not limited	80.0 203.2	0.108	2.74
60.0	152.4	74.0 188.0	84.0 213.4	103.0	261.6
63.0	160.0	Not limited	97.0 246.4	0.123	3.12
73.0	185.4	90.0 228.6	103.0 261.6	127.0	322.6

^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 such torsional rigidity as 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 that 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 not supported along one side (for example, side panels of boxes), the length of the unsupported side shall be limited to the dimensions specified.

Table 8.2
Minimum thickness of sheet metal for electric 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, inches	(cm)
3.0	7.6	Not limited		7.0	17.8	Not limited	
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	
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	
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	
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	
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	
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	
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	
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	
60.0	152.4	74.0	188.0	130.0	330.2	160.0	406.4

^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 such torsional rigidity as 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 that 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 not supported along one side (for example, side panels of boxes), the length of the unsupported side shall be limited to the dimensions specified.

Table 8.3
Thickness of cast metal enclosures

Use, or dimension of area involved	Minimum thickness			
	Die-cast metal, ^a		Cast metal other than die-cast-type,	
	inch	(mm)	inch	(mm)
Area of 24 square inches (155 cm ²) or less having no dimension greater than 6 inches (152 mm)	1/16 ^b	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 Die-cast metal may be used if, upon investigation, it is found to have such mechanical strength as to withstand conditions likely to be encountered in service.				
^b The area limitations for metal 1/16 inch (1.6 mm) thick may be obtained by the provision of reinforcing ribs subdividing a larger area.				

8.5 Battery compartment ventilation

8.5.1 A compartment containing storage batteries shall not be sealed in such a manner as to prevent the dissipation of hydrogen gas. Any compartment joint that is not tightly closed and gasketed (or similarly sealed) is considered sufficient for the dissipation of hydrogen gas.

Exception: A compartment that is gasketed or has no obvious means for the dissipation of hydrogen gas but complies with the Battery Compartment Ventilation Test, Section 48, is considered acceptable.

8.5.1 revised March 2, 2001

8.5.2 Deleted May 21, 1999

8.5.3 Deleted May 21, 1999

8.6 Enclosure openings

8.6.1 A ventilating opening in an enclosure, including a perforated hole, louver, and an opening protected by means of wire screening, expanded metal, or perforated cover, that has a minor dimension of less than 1 inch (25.4 mm) is acceptable if a probe as illustrated in Figure 8.1, inserted through the opening, cannot be made to touch any uninsulated live part or film-coated wire that involves the risk of electric shock. The probe shall be applied in all possible articulated positions before, during, and after insertion.

8.6.2 An opening of a type as described in 8.6.1 that is 1 inch (25.4 mm) or larger in an enclosure, as illustrated in Figure 8.2, is acceptable if, within the enclosure, there is no uninsulated live part or film-coated wire less than R distance from the inside edge of the perimeter of the opening and X distance from the plane of the opening. T equals the enclosure thickness, R equals X minus T, and X equals 5 times the diameter of the largest round rod that can be inserted through the opening but no less than 6-1/16 inches (154 mm).

8.6.3 The thickness of perforated sheet steel and sheet steel used for expanded-metal mesh shall be in accordance with the values in Table 8.4.

Exception: The thickness of expanded steel mesh may be less than specified in Table 8.4, but no less than specified in Table 8.5, if:

a) The indentation of a guard or enclosure will not:

- 1) Alter the clearance between uninsulated movable live parts and grounded metal, such that performance would be adversely affected or*
- 2) Reduce spacings below the minimum values given in 37.1.1 – 37.2.6; and*

b) Either:

- 1) Exposed mesh or any one side or surface of the protected device has an area of no more than 72 square inches (465 cm²) and has no dimensions greater than 12 inches (305 mm) or*
- 2) The width of a protected opening is no greater than 3-1/2 inches (89 mm).*

8.6.4 The wires of screen shall be no smaller than No. 16 AWG (1.3 mm²) if the screen openings are 1/2 square inch (3.23 cm²) or less in area, and shall be no smaller than No. 12 AWG (3.3 mm²) for larger screen openings.

Figure 8.2
Opening in enclosure

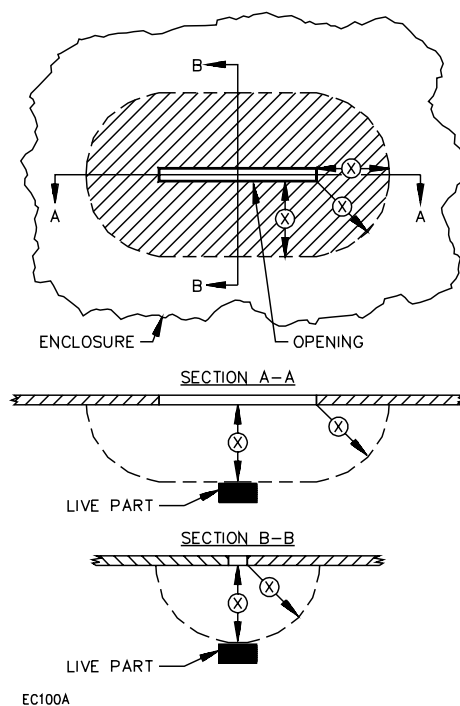


Table 8.4
Minimum thickness of expanded metal mesh

Openings	Uncoated,		Zinc-coated,	
	inch	(mm)	inch	(mm)
Maximum 1/2 square inch (3.23 cm ²)	0.042	1.07	0.045	1.14
More than 1/2 square inch	0.080	2.03	0.084	2.13
NOTE – In accordance with 8.6.3.				

Table 8.5
Minimum thickness of expanded metal mesh

Uncoated,		Zinc-coated,	
inch	(mm)	inch	(mm)
0.020	0.51	0.024	0.61

NOTE – In accordance with conditions given in the Exception to 8.6.3.

8.6.5 An enclosure housing a fuse or any other overload protective device and provided with a ventilating opening shall afford protection against the emission of flame or molten metal.

8.6.6 An enclosure of an electrical part that presents a risk of fire shall not have unused openings through which molten or burning particles could pass directly to the floor or to the mounting surface. This may be accomplished by the use of a barrier or baffle that is resistant to combustion. An opening for battery compartment ventilation, if provided, shall be located so that it will not vent into concealed spaces of a building structure when the equipment is installed as intended.

Exception No. 1: An exit fixture; an exit light without batteries; an exit sign without a printed circuit board; a remote lamp assembly; an emergency lighting fixture; and a unit equipment electric discharge lighting fixture with integral component power supply may alternatively comply with the enclosure and opening requirements in the Standard for Incandescent Lighting Fixtures, UL 1571.

Exception No. 2: Deleted

Exception No. 3: An enclosure that can only be mounted directly over an outlet box may have unused opening(s) facing the mounting surface, when all such openings fall within the 2-inch wide by 3 inches high, cross-sectional area of the smallest standard, single, gang-box pattern.

8.6.6 revised May 21, 1999

8.7 Enclosure covers

8.7.1 An enclosure cover shall be hinged if:

- a) It gives access to a fuse or any other overload protective device the intended functioning of which requires renewal or resetting or
- b) It is necessary to open the cover in connection with the routine operation or routine maintenance of the unit.

Exception: A cover, panel, door, or other part of the enclosure that, by its function or size, obviously must be in place to complete the overall enclosure need not be hinged.

8.7.1 revised October 31, 1997

8.7.2 Routine operation of the unit, as specified in 8.7.1(b), is any operation or similar operation as defined in 4.37. Routine maintenance of the unit as specified in 8.7.1(b) is any maintenance, or maintenance as defined in 4.36.

8.7.2 revised October 31, 1997

8.7.3 A hinged cover shall be provided with a positive means for latching.

8.7.4 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the cover in place and that would require some effort on the user's part to open, is considered to be a means for holding the cover in place as required in 8.7.3. Gravity alone is not considered to be a means for holding the cover in place.

8A Environmental Rating

8A.1 An enclosure shall not be marked with a type designation unless it has been determined to comply with the requirements applicable to that designation(s) as specified in the Standard for Enclosures for Electrical Equipment, UL 50.

8A.1 added May 21, 1999

8A.2 An enclosure shall not be marked "raintight," "rainproof," "watertight," or with other similar terms suggesting suitability for specific environmental conditions, unless the enclosure has been determined to comply with the requirements applicable to the corresponding type designation(s) specified in the Standard for Enclosures for Electrical Equipment, UL 50.

8A.2 added May 21, 1999

8A.3 The integrity of an enclosure marked with a type designation shall not be compromised by the introduction of openings or by the penetration of unevaluated fittings or component parts through the enclosure wall. Only fittings or component parts that have been evaluated and marked with a type designation equal to or better than that of the enclosure shall be used and installed in accordance with the part manufacturer's instructions. The enclosure type designation shall be removed in all other circumstances unless the completed assembly is reevaluated and found to comply with the applicable requirements in the Standard for Enclosures for Electrical Equipment, UL 50.

8A.3 added May 21, 1999

8A.4 Equipment intended for use in damp or wet locations, or for use in an ambient other than 20 – 30°C (68 – 86°F), shall be evaluated for compliance with Supplements SC or SD, as applicable.

8A.4 added May 21, 1999

9 Polymeric materials

9.1 General

9.1.1 Polymeric materials used for the purposes covered by 9.2 – 9.6 shall comply with the applicable requirements of this section. When a material is used for more than one purpose, compliance with all relevant properties is required. Materials that are deficient in any performance characteristic shall comply with the applicable alternative evaluation program of UL 746C.

Added 9.1.1 effective March 3, 2003

9.1.2 When there are any uninsulated live parts that represent a risk of fire located within 0.032 inches (0.8 mm) of a polymeric material covered by this section, the material shall additionally have hot-wire ignition (HWI) and high-current arc resistance to ignition (HAI) ratings of 3 or less.

Added 9.1.2 effective March 3, 2003

9.1.3 When there are any arcing parts, such as unenclosed switch contacts, located within 0.5 inches (13 mm) of a polymeric material covered by this section, the material shall additionally have a hot-wire ignition (HWI) rating of 3 or less.

Added 9.1.3 effective March 3, 2003

9.2 Enclosures

9.2.1 A polymeric enclosure shall:

- a) Have a minimum 5VA flammability rating for fixed or stationary equipment, or minimum V-2 rating for portable auxiliary equipment;
- b) Have a mechanical or generic temperature index equal to or greater than the maximum temperature measured on the part during the normal temperature test;
- c) Comply with the Resistance to Impact requirements of UL 746C;
- d) Comply with the Mold Stress-Relief Distortion, UL 746C requirements of when molded or constructed of formed thermoplastic;
- e) Comply with the UV Light Exposure requirements of UL 746C when the product is intended for (outdoor) wet locations or contains internal fluorescent light sources.

For the Resistance to Impact test on equipment marked for use in ambients of 0°C (32°F) or below, the cold conditioning prior to impact shall be at 5°C below the marked low ambient temperature.

Added 9.2.1 effective March 3, 2003

9.2.2 Snap-fit parts that become dislodged as a result of the impact test of 9.2.1(c) shall be able to be properly reattached to the product without the use of tools.

Added 9.2.2 effective March 3, 2003

9.2.3 An enclosure intended for connection to rigid metallic conduit (such as products provided with circular openings or knockouts) shall comply with the Polymeric Enclosure Rigid Metallic Conduit Connection Tests of the Standard for Enclosures for Electric Equipment, UL 50.

Added 9.2.3 effective March 3, 2003

9.2.4 An enclosure intended for use with rigid non-metallic conduit – cemented or threaded – shall comply with the applicable requirements in Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C.

Added 9.2.4 effective March 3, 2003

9.2.5 When an enclosure is provided with knockouts but has not been evaluated in accordance with both 9.2.3 and 9.2.4, appropriate information shall be provided in the installation instructions as described in 71.6.

Added 9.2.5 effective March 3, 2003

9.3 Mechanical Support

9.3.1 A polymeric part used to suspend another part shall have:

- a) A minimum HB flammability rating and
- b) A mechanical or generic temperature index equal to or greater than the maximum temperature measured on the part during the normal temperature test.

Added 9.3.1 effective March 3, 2003

9.3.2 When the suspended part weighs more than 2 lbs. (0.9 kg), the polymeric part shall be additionally capable of supporting four times the weight of the suspended part for one minute without distortion. The test shall be performed in a chamber maintained at 10°C above the maximum temperature measured on the part during the normal temperature test. The polymeric part under evaluation shall be installed as intended. The part shall be allowed to acclimate to the temperature in the chamber for one hour prior to application of the weight, which shall then be gradually applied and evenly distributed.

Added 9.3.2 effective March 3, 2003

9.4 Barriers

9.4.1 A polymeric material used as a barrier shall:

- a) Have a minimum HB flammability rating;
- b) Have a mechanical or generic temperature index equal to or greater than the maximum temperature measured on the part during the normal temperature test;
- c) Comply with the Mold Stress-Relief Distortion UL 746C requirements of when molded or constructed of formed thermoplastic; and
- d) Withstand for one minute without breaking or cracking a force of 10 lbs. (44.5 N) applied over an area of 1 in²(6.45 cm²).

Added 9.4.1 effective March 3, 2003

9.5 Grounding or Bonding Means

9.5.1 A polymeric material that affects the integrity of a grounding or bonding means shall:

- a) Have a minimum HB flammability rating;
- b) Have a mechanical or generic temperature index equal to or greater than the maximum temperature measured on the part during the normal temperature test; and
- c) Comply with the Mold Stress-Relief Distortion requirements of UL 746C followed by the Grounding Continuity test of Section 61A when molded or constructed of formed thermoplastic.

Added 9.5.1 effective March 3, 2003

Table 9.1
Material flammability requirements

Table 9.1 deleted effective March 3, 2003

9.6 Structural Support

9.6.1 A polymeric material that is relied upon for providing structural support related to compliance with the performance requirements of this Standard shall:

- a) Have a mechanical or generic temperature index equal to or greater than the maximum temperature measured on the part during the normal temperature test;
- b) Comply with the Mold Stress-Relief Distortion requirements of UL 746C when molded or constructed of formed thermoplastic; and
- c) Be subjected to the Resistance to Impact test of UL 746C. Results shall be considered complying if the relevant performance feature of the end-product is not significantly impaired.

Added 9.6.1 effective March 3, 2003

9.7 Deleted effective March 3, 2003

9.8 Deleted effective March 3, 2003

9.9 Deleted effective March 3, 2003

9.10 Deleted effective March 3, 2003

9.11 Deleted effective March 3, 2003

9.12 Deleted effective March 3, 2003

9.13 Deleted effective March 3, 2003

9.14 Deleted effective March 3, 2003

10 Mounting Means

10.1 Means for permanent mounting of equipment shall be provided.

Exception No. 1: Cord-connected auxiliary lighting and power equipment need not be provided with means for permanent mounting.

Exception No. 2: Equipment that weighs 100 lbs or more need not be provided with means for permanent mounting.

10.1 revised October 31, 1997

10.2 Keyhole slots for mounting screws may be provided if:

- a) There is at least one round hole sized to accommodate a permanent mounting screw or
- b) The heads of the permanent mounting screws are accessible for tightening during installation.

Exception: Cord-connected auxiliary lighting and power equipment need not be provided with round hole(s), or the screw heads made accessible during installation for permanent mounting.

Revised 10.2 effective August 1, 1998

11 Corrosion Resistance

11.1 Iron and steel parts shall be made resistant to corrosion by enameling, galvanizing, sherardizing, plating, or equivalent means. This requirement applies to all enclosure cases whether of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation may depend. Bearing surfaces should be of such materials and design as to inhibit binding due to corrosion.

Exception: The following need not be made corrosion-resistant:

- a) A bearing, and the like, where such protection is impracticable;*
- b) A minor part (such as a washer, a screw, a bolt, and the like) if the malfunction of such an unprotected part would not be likely to result in a risk of fire, electric shock, injury to persons, or result in adverse operation of the equipment; and*
- c) A part made of stainless steel (polished or treated if necessary).*

11.2 The interior of a storage battery compartment shall be protected so that it will not be adversely affected by contact with the electrolyte.

Exception: A compartment for a sealed battery need not be so protected.

12 Insulation Material

12.1 An uninsulated live part shall be mounted on material of porcelain or phenolic composition, or on an equivalent insulation material.

12.2 Vulcanized fiber may be used as an insulation bushing, washer, separator, or barrier, but not as the sole support for an uninsulated live part if shrinkage, current leakage, or warpage can introduce an adverse condition. In the investigation of material used for the sole support of an uninsulated live part, consideration is to be given to mechanical strength and rigidity, resistance to heat, resistance to flame propagation, dielectric withstand capability, and other properties needed for the application.

12.3 A molded part shall have such mechanical strength and rigidity as to withstand the stresses likely to be encountered in service.

12.4 A countersunk live part shall be covered to a depth of not less than 1/8 inch (3.2 mm) with a waterproof insulation compound that will not soften at a temperature 15°C (27°F) higher than the maximum intended operating temperature of the assembly, and not less than 90°C (194°F) in any case. The softening point of the compound is determined in the Standard Test Methods for Softening Point by Ring-and-Ball Apparatus, ASTM E28.

12.4 revised May 21, 1999

13 Mounting of Parts

13.1 All parts of equipment shall be mounted in position and prevented from loosening or turning, if such movement may interfere with the intended performance of the equipment, or may result in a risk of fire, electric shock, or injury to persons.

13.1.1 Adhesive-secured parts shall be investigated for compliance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C if loosening of the parts(s) could cause a risk of fire or electric shock, or result in the equipment being unable to function as intended. The initial (as received) adhesive strength shall be four times the force applied to the part during normal operation (four times the weight of the part if only subjected to gravitational forces). The “reduced number of specimens” program of UL 746C shall be considered for this evaluation.

13.1.1 added March 2, 2001

13.2 An uninsulated live part, other than a pressure wire connector as covered in 36.1.7, shall be secured to its supporting surface so that it will be prevented from turning or shifting in position if such movement may result in a reduction of spacings to less than those indicated in Table 36.1. The security of contact assemblies shall be such as to provide continued alignment of contacts.

13.3 The means for preventing the turning, loosening, or shifting of a part, as required in 13.1 and 13.2, shall consist of more than friction between surfaces – for example, a lock washer, correctly applied, is considered an equivalent means for preventing the turning of a small stem-mounted switch or other device having a single-hole mounting means.

13.4 Lampheads mounted on unit equipment shall be adjustable in the vertical and horizontal planes. When installed as intended, the assembly shall comply with the Swivel Torsion and Pull Test, Section 62A.

Lamphead rotation shall be limited by:

- a) A setscrew or the equivalent or
- b) A mechanical stop mechanism that limits rotation to no more than 370 degrees and complies with the Rotational Stop Test of Section 62B.

Revised 13.4 effective March 3, 2003

14 Operating Mechanisms

14.1 A part of an operating mechanism shall be constructed of material that has the mechanical strength to withstand the stresses of intended use.

14.2 The assembly of an operating mechanism shall be such that it will not be affected adversely by any condition of intended operation.

14.3 A moving part (lamphead swivel, hinge, and the like) shall have sufficient play at bearing surfaces to restrict binding.

14.4 Provision shall be made so that an adjusting screw or similar adjustable part will not loosen under the conditions of intended use.

14.5 A manually-operated part shall have sufficient strength to withstand the stresses to which it will be subjected in operation.

14.6 An electromagnetic device shall be designed so as to provide positive electrical and mechanical performance under all conditions of intended operation.

15 Current-Carrying Parts

15.1 A current-carrying part shall have mechanical strength and ampacity for the intended service, and shall be of metal that is required for the particular application.

15.2 A bearing, hinge, or the like is not sufficient for carrying current between interrelated fixed and moving parts.

16 Installation – Wiring Connections

16.1 General

16.1.1 Emergency lighting equipment intended for permanent connection to the power supply shall be provided with either leads for the connection of conductors or wiring terminals, of at least the size required for 60°C (140°F) wire, corresponding to the ratings of the unit.

16.1.2 Unless equipment is marked to indicate the required size, wiring terminals intended for the connection of the remote lamps or fixtures shall be sized to accommodate at least one size larger than required in 16.1.1.

16.2 Terminals

16.2.1 A terminal part by which a connection is made shall provide an effective connection even under hard usage. Soldering lugs or solderless (pressure) wire connectors shall be used.

Exception: For No. 10 AWG (5.3 mm²) or smaller wire, a part to which wiring connections are made may consist of a clamp or a binding screw with a terminal plate having upturned lugs or the equivalent to hold the wires in position.

16.2.2 A wiring terminal shall be prevented from turning.

16.2.3 A wire-binding screw to which field-wiring connections are made shall be no smaller than No. 8 (4.2 mm major diameter).

Exception: A No. 6 (3.5 mm major diameter) screw may be used for a terminal to which No. 14 AWG (2.1 mm²) or smaller wire is intended to be connected.

16.2.4 A terminal plate tapped for a wire-binding screw shall be of metal no less than 0.050 inch (1.27 mm) thick and shall have no fewer than two full threads in the metal.

Exception: A terminal plate less than 0.050 but no less than 0.030 inch (0.76 mm) thick may be used if the tapped threads are determined to have equivalent mechanical strength.

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16.2.5 A terminal plate formed from stock having the minimum required thickness, as given in 16.2.4, may have the metal extruded at the tapped hole for the wire-binding screw so as to provide two full threads.

16.2.6 A wire-binding screw shall thread into metal.

16.3 Field-wiring leads

16.3.1 Field-wiring leads provided for splice connections shall be no smaller than No. 18 AWG (0.82 mm²) and shall be rated for the current, voltage, temperature, and conditions of use (dry, damp, or wet locations) to which they will be subjected.

16.3.1 revised March 2, 2001

16.3.2 The free length of an installation wiring lead shall be no less than 6 inches (152 mm).

16.4 Polarity identification

16.4.1 A field-wiring terminal for connection of a grounded power supply conductor shall be of, or plated with, a metal white in color. Such a terminal shall be distinguishable from the other terminals, or identification of that terminal shall be shown in some other manner, such as on a wiring diagram adjacent to the terminal.

16.4.2 The surface of a lead intended for field connection of a grounded power supply conductor shall be white or natural gray, and that lead shall be distinguishable from the other leads.

16.4.3 The color-coding requirement in 16.4.2 does not apply to internal wiring that is not visible in a wiring compartment in which field connections are to be made.

16.4.4 In equipment having a rating more than 51 volts and intended to be connected to a grounded supply circuit, and using a lampholder of the Edison screw-shell type, or a single-pole switch or overcurrent protective device other than an automatic control, one terminal or lead shall have identification for the connection of the grounded conductor of the supply circuit. That terminal or lead shall be the one that is connected to screw shells of lampholders and not to any switch or overcurrent protective device of the single-pole type.

16.4.5 With regard to the requirement in 16.4.4, an automatic control is considered to be a device having automatic resetting contacts that are normally closed and having no means for manual control.

16.5 Termination of wiring systems

16.5.1 Equipment shall have provision for the connection of one of the wiring systems required for the equipment. Separate openings shall be provided for the entrance of emergency circuit wiring and for the wiring of any other circuits.

Exception No. 1: The equipment enclosure may be used if instructions are furnished with it indicating the sections of the unit intended to be drilled in the field for the connection of raceways.

Exception No. 2: An exit light or emergency lighting fixture supplied from two sources, and provided with means intended for mounting to an outlet box, may be provided with a single opening.

16.6 Knockouts

16.6.1 The requirements specified in 16.6.2 – 16.6.6 apply to knockouts intended for field connection of a wiring system in accordance with the National Electrical Code, ANSI/NFPA 70.

16.6.2 A knockout in a metal enclosure shall be secured in place, but shall be removable in accordance with the manufacturer's instructions without deformation of the enclosure that would result in damage to electrical components or reduction in electrical spacings.

16.6.3 A knockout in a metal or polymeric enclosure shall remain in place when tested as described in the Security of Knockout Test, Section 62.

Added 16.6.3 effective August 1, 1998

16.6.4 The diameter of a knockout shall be as specified in Table 16.1 for the trade size conduit or cable fitting intended to be used.

16.6.5 A knockout shall be provided with a flat area surrounding the opening for seating of a conduit bushing and be located so that installation of a bushing 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 required by this standard.

16.6.6 In measuring a spacing between an uninsulated live part and a bushing installed in a knockout, it is to be assumed that a bushing having the dimensions indicated in Table 16.1 is in place, in conjunction with a single locknut installed on the outside of the enclosure.

Table 16.1
Knockout or hole sizes and dimensions of bushings

Trade size of conduit		Knockout or hole diameter,		Bushing dimensions			
Nominal size, inches	Outside diameter, (mm)			Overall diameter,		Height,	
		inches	(mm)	inches	(mm)	inches	(mm)
1/2	21.3	7/8	22.2	1	25.4	3/8	9.5
3/4	26.7	1-3/32	27.8	1-15/64	31.4	27/64	10.7
1	33.4	1-23/64	34.5	1-19/32	40.5	33/64	13.1
1-1/4	42.2	1-23/32	43.7	1-15/16	49.2	9/16	14.3
1-1/2	48.3	1-31/32	50.0	2-13/64	56.0	19/32	15.1
2	60.3	2-15/32	62.7	2-45/64	68.7	5/8	15.9
2-1/2	73.0	3	76.2	3-7/32	81.8	3/4	19.1
3	88.9	3-5/8	92.1	3-7/8	98.4	13/16	20.6
3-1/2	101.6	4-1/8	104.8	4-7/16	112.7	15/16	23.8
4	114.3	4-5/8	117.5	4-31/32	126.2	1	25.4
4-1/2	127.0	5-1/8	130.2	5-35/64	140.9	1-1/16	27.0
5	141.3	5-5/8	142.9	6-7/32	158.0	1-3/16	30.2
6	168.3	6-3/4	171.5	7-7/32	183.4	1-1/4	31.8

17 Cord-Connected Unit Equipment

17.1 General

17.1.1 Emergency lighting unit equipment having integral lampheads only, rated at no more than 18 amperes, 277 volts, and constructed in accordance with the requirements in 17.1.1 – 17.8.6 and applicable requirements elsewhere in this standard, may be provided with flexible cord for connection to the supply circuit.

17.1.2 Auxiliary lighting and power equipment may be provided with flexible cord.

17.1.3 Deleted May 21, 1999

17.2 Flexible cord

17.2.1 Flexible cord shall be one of the types specified in Table 17.1 and shall be a 3-conductor grounding cord terminating in an attachment plug. The cord shall be no longer than 36 inches (914 mm) measured from the face of the plug to the point at which the cord enters the unit.

Table 17.1
Cord types

SPT-3 ^a , SP-3 ^a , SPE-3 ^a	SJT	SO
SJ	SJTO	SOO
SJE	SJTOO	ST
SJO	S	STO
SJOO	SE	STOO

^a These cords are for use only with permanently mounted equipment.

17.2.2 The cord shall have an ampacity no less than the current rating of the equipment.

17.3 Alternative connection

17.3.1 If it is intended that the power supply cord can be removed from the unit and permanent connection made to the supply circuit, the compartment in which the connections of the cord are made shall be constructed in accordance with 17.3.2 – 17.3.4.

17.3.2 The cord shall enter the wiring compartment through a 7/8 inch (22.2 mm) diameter hole that, after the cord and any bushing or fitting provided have been removed, provides an opening for the attachment of the intended wiring system.

17.3.3 The power supply cord shall be connected to the internal wiring by a device such as a terminal block, terminal leads, pressure cable connector, or the like, that will accommodate permanent wiring of the correct size for the unit.

17.3.4 The internal wiring terminals and leads for connection to the power supply shall have identification in accordance with 16.4.1, 16.4.2, 19.5, and 19.11.

17.4 Attachment plug

17.4.1 The rating of the attachment plug shall be at least equivalent to the electrical rating of the equipment. If the equipment is adaptable for use at different voltages by field alteration of internal connections, the attachment plug provided shall be rated for the voltage to which the equipment is intended to be connected when shipped from the factory. The attachment plug shall be of the 3-blade, grounding type, and may be of the locking type.