



UL 924

STANDARD FOR SAFETY

Emergency Lighting and Power Equipment

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UL Standard for Safety for Emergency Lighting and Power Equipment, UL 924

Tenth Edition, Dated May 9, 2016

Summary of Topics

This revision of ANSI/UL 924 dated December 14, 2022 includes the following changes:

- **Scope Clarifications;** [1.4](#), [1.5](#)
- **Definitions;** [4.3](#), [4.19](#)
- **Mounting Means;** [11.1](#), [11.2](#), [Section 70A](#)
- **Installation – wiring connections;** [17.1.1](#) – [17.1.4](#), [17.2.1](#) – [17.2.3](#), [17.3.1](#), [17.3.2](#), [Section 17.5](#), [19.4.4](#)
- **Batteries;** [22.1](#) – [22.2.3](#), [33.1](#), [Section 48A](#), [Section 48B](#), [52.11.1](#)
- **Electronic circuits subject to voltage surge testing;** [23.2](#), [55.1](#), [SE4.7.1](#)
- **Overcurrent protection;** [26.2](#)
- **Definitions and detection thresholds for self-testing/self-diagnostic equipment;** [4.52.1](#), [4.52.2](#), [30.1](#)
- **Maximum permitted time for ELCD operation;** [47.2](#)
- **Temperature test for recessed equipment;** [40.3](#), [52.10](#), [52.17](#), [73A.3.12](#)
- **Markings;** [30.1.1](#), [Sections 44](#), [71](#), [72](#), [73](#), [73A](#), [74.1](#), [74.2](#), [74.7](#) – [74.10](#), [76.6](#)
- **Low frequency inverter battery discharge compliance option;** [78.2.1](#)
- **Expansion of Appendix B content**
- **Emergency Systems;** [Appendix C](#)
- **Editorial Corrections;** [18.4.1](#), [20.2](#), [39.1.1](#), [43.5.1](#), [52.2](#), [52.11](#), [Table SD2.1](#) and [SE4.6.1](#)

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 new and revised requirements are substantially in accordance with Proposal(s) on this subject dated October 21, 2022.

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MAY 9, 2016
(Title Page Reprinted: December 14, 2022)



ANSI/UL 924-2022

1

UL 924

Standard for Emergency Lighting and Power Equipment

The first, second, third, and fifth editions were titled Standard for Emergency Lighting Equipment.

First Edition – December, 1958
Second Edition – May, 1973
Third Edition – October, 1973
Fourth Edition – April, 1977
Fifth Edition – February, 1979
Sixth Edition – March, 1984
Seventh Edition – November, 1990
Eighth Edition – March, 1995
Ninth Edition – February, 2006

Tenth Edition

May 9, 2016

This ANSI/UL Standard for Safety consists of the Tenth Edition including revisions through December 14, 2022.

The most recent designation of ANSI/UL 924 as an American National Standard (ANSI) occurred on December 14, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 924 on November 14, 1982. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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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CONTENTS

INTRODUCTION

1	Scope	9
2	References	10
3	Resistance to Environmental Conditions	10
4	Glossary	10
5	Components	16
6	Units of Measurement	17
7	Radioactive Energy Sources	17

CONSTRUCTION

8	Frame and Enclosure	17
	8.1 General	17
	8.2 Uninsulated live parts	17
	8.3 Metallic enclosures	19
	8.4 Nonmetallic enclosures	21
	8.5 Enclosure openings	22
	8.6 Enclosure covers	23
9	Environmental Rating	24
10	Polymeric Materials	24
	10.1 General	24
	10.2 Enclosures	25
	10.3 Mechanical support	25
	10.4 Barriers	25
	10.5 Grounding or bonding means	26
	10.6 Structural support	26
11	Mounting Means	26
12	Corrosion Resistance	26
13	Insulation Material	27
14	Mounting of Parts	27
15	Operating Mechanisms	28
16	Current-Carrying Parts	28
17	Installation – Wiring Connections	28
	17.1 General	28
	17.2 Wiring terminals	28
	17.3 Field-wiring leads	29
	17.4 Polarity identification	29
	17.5 Termination of wiring systems	30
	17.6 Knockouts	30
18	Cord-Connected Unit Equipment and Luminaires	31
	18.1 General	31
	18.2 Flexible cord	31
	18.3 Alternative connection	32
	18.4 Attachment plug	32
	18.5 Grounding	32
	18.6 Strain relief	32
	18.7 Push-in prevention	32
	18.8 Bushings	33
19	Internal Wiring	33
	19.1 Wires	33
	19.2 Wireways	34
	19.3 Electrical connections	35

19.4	Separation of circuits	35
19.5	Conductor secureness	36
20	Grounding	36
21	Bonding of Internal Parts.....	37
22	Batteries	39
23	Electronic Circuits	41
24	Capacitors	41
25	Lampholders.....	41
26	Overcurrent (Overload) Protection	41
27	Coil Windings.....	42
28	Derangement Signals	42
29	Test Switch	42
29A	Emergency Lighting Control Devices	43
30	Self-Testing/Self-Diagnostic Equipment	43
31	Disconnect Switches and Fuses	44
32	Transformers	44
33	Impedance Networks.....	44
34	Printed-Wiring Board	44
35	Motors.....	44
36	Equipment Using Simple Reactance Ballasts and Lamps Having Integral Starters.....	45
37	Spacings	45
37.1	General.....	45
37.2	Barriers.....	47
37.3	Insulating barriers	47
38	Field-Wiring Space	48
38.1	General.....	48
38.2	Wire-bending space.....	48
39	Accessibility of Insulated Current-Carrying Parts.....	50
39.1	General	50
39.2	Accessibility determination	50
39.3	Insulated parts.....	50
39.4	Accessibility barriers	51

EXIT SIGN VISIBILITY

40	Exit Sign Construction – General	51
41	Text-Based Exit Signs – Construction.....	52
42	Graphical Symbol Exit Signs – Construction	56
43	Performance	59
43.1	General.....	59
43.2	Observation visibility test.....	60
43.3	Luminance measurement test.....	62
43.4	Non-energized contrast measurement test	70
43.5	Flashing rate and duration between successive light pulse measurements.....	70
44	Markings.....	71

PERFORMANCE

45	General	71
46	Leakage Current Test	71
47	Emergency Lighting Control Functionality (ELCF) Test.....	74
48	Battery Discharge Test.....	75
48A	Lithium Battery Charge Rate Measurement.....	77
48B	Lithium Battery Charging Circuit Abnormal Tests	77
49	Input Test.....	78

50	Determination of Low-Voltage, Limited-Energy Circuit Status	78
51	Determination of Limiting Impedance Circuit Status	79
52	Temperature Test	79
53	Overvoltage Withstand Test	83
54	Undervoltage Recharge Capability Test	83
55	Voltage Surge Test	84
56	Dielectric Voltage-Withstand Test	87
57	Conformal Coating Test Program I	87
	57.1 General.....	87
	57.2 Coating on printed-wiring board in lieu of spacings	88
58	Conformal Coating Test Program II	88
	58.1 General.....	88
	58.2 Samples	88
	58.3 Room ambient conditioning	88
	58.4 Thermal conditioning.....	88
	58.5 Dielectric voltage-withstand test for conformal coating	90
59	Strain Relief Test	90
	59.1 General.....	90
	59.2 Strain.....	90
60	Conductor Secureness Test	90
61	Overtinned Wire Flexibility Test.....	90
62	Bonding Conductor Test.....	90
63	Grounding Continuity Test.....	91
64	Security of Knockout Test.....	91
65	Swivel Torsion and Pull Test	92
66	Component Breakdown Test	92
	66.1 General.....	92
	66.2 General test conditions.....	93
67	Humidity Conditioning Test.....	94
68	Impact Test	94
69	Mechanical Support Static Load Test	95
70	Barrier Strength Test.....	95
70A	Mounting Means Test	96

RATINGS

71	General	96
72	Standby Operation	96

MARKINGS

73	General	96
73A	Markings	96
	73A.1 General	96
	73A.2 Ratings	97
	73A.3 Installation	99
	73A.4 Operation and maintenance	100

INSTRUCTION MANUAL

74	General	102
75	Safety Instructions.....	103
76	Other Instructions	104

LOW-FREQUENCY INVERTERS

77	General	105
78	Performance	105
	78.1 Output load power factor test	105
	78.2 Battery discharge test	105
	78.3 Output voltage and frequency test	106

HIGH-FREQUENCY INVERTERS

79	General	106
80	Performance	106
	80.1 General	106
	80.2 Output voltage and current test	106
	80.3 Abnormal conditions test	107
81	Marking	108

SUPPLEMENT SA – FIELD INSTALLED LUMINAIRE EMERGENCY BATTERY PACKS

SA1	General	109
SA2	Mounting and Installation	109
SA3	Performance	109
SA4	Marking and Instructions	109
SA5	Instruction Manual	110

SUPPLEMENT SB – EMERGENCY LIGHTING AND POWER EQUIPMENT FOR USE IN DAMP LOCATIONS

SB1	General	111
SB2	Construction – Mechanical	111
SB3	Construction – Electrical	111
SB4	Performance – Humidity Conditioning	112
SB5	Markings	112

SUPPLEMENT SC – EMERGENCY LIGHTING AND POWER EQUIPMENT FOR USE IN WET LOCATIONS

SC1	General	113
SC2	Construction – Mechanical	113
	SC2.1 Corrosion protection	113
	SC2.2 Enclosures	114
	SC2.3 Gaskets and bushings	114
	SC2.4 Openings	115
	SC2.5 Polymeric water shields	115
SC3	Construction – Electrical	116
SC4	Performance	116
	SC4.1 General	116
	SC4.2 Tests required	116
	SC4.3 General – test conditions	117
	SC4.4 General – test results	117
	SC4.5 Sprinkler test	117
	SC4.6 Rain test	120
	SC4.7 Thermal conditioning	122
	SC4.8 Gasket adhesion test	123
	SC4.9 Humidity conditioning	123

SC5 Markings..... 123

SUPPLEMENT SD – ALTERNATIVE REQUIREMENTS FOR TRANSFORMERS

INTRODUCTION

SD1 Scope..... 125

CONSTRUCTION

SD2 General 125

PERFORMANCE

SD3 General 126
 SD4 Dielectric Voltage-Withstand Test..... 126
 SD5 Induced Potential Test..... 127
 SD6 Abnormal Tests 127
 SD6.1 General..... 127
 SD6.2 Transformer burnout test 128
 SD6.3 Transformer overload test..... 128
 SD7 Test on Transformer Insulating Materials 129

SUPPLEMENT SE – EXIT SIGN RETROFIT KITS

INTRODUCTION

SE1 Scope 131
 SE2 Glossary 131
 SE3 Construction..... 132
 SE3.1 General..... 132
 SE3.2 Frame and enclosure..... 132
 SE3.3 Mounting 132
 SE3.4 Wiring and connections 133
 SE3.5 Assembly..... 133
 SE3.6 Grounding 134
 SE3.7 Adapter 134
 SE3.8 Diffuser 135
 SE4 Performance 135
 SE4.1 Trial installation test..... 135
 SE4.2 Input test 136
 SE4.3 Temperature test..... 137
 SE4.4 Conductor secureness test 137
 SE4.5 Visibility test..... 137
 SE4.6 ELCF test..... 138
 SE4.7 Voltage surge test 138
 SE4.8 Component breakdown test 138
 SE4.9 Base securement test..... 138
 SE4.10 Base conformity test 139
 SE5 Marking..... 139
 SE6 Instruction Manual 142

SUPPLEMENT SF – PHOTOLUMINESCENT EXIT SIGNS

SF1 General..... 145

SF2	Mechanical Construction	145
SF3	Legend dimensions	145
SF4	Performance.....	145
	SF4.1 Sample conditioning	145
	SF4.2 Visibility tests	146
SF5	Markings and Installation Instructions	147

SUPPLEMENT SG – MINIMUM LIGHT OUTPUT FOR EMERGENCY LIGHTING EQUIPMENT

SG1	Introduction.....	149
SG2	Performance	149
SG3	Marking	149

APPENDIX A

Standards for Components	151
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APPENDIX B (informative)

B1	Evaluation of Emergency Lighting Control Functionality (ELCF).....	152
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Appendix C (Informative) Emergency Systems

C1	Purpose	154
C2	System Components.....	154
C3	Construction	155
C4	Performance	155
C5	Markings and Instructions.....	155

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INTRODUCTION

1 Scope

1.1 This Standard applies to emergency lighting and power equipment for use in unclassified locations and intended for connection to branch circuits of 600 volts or less. Such equipment is intended to automatically supply illumination or power or both to critical areas and equipment in the event of failure of the normal supply, in accordance with Article 700 or 701 of the National Electrical Code, NFPA 70, the Life Safety Code, NFPA 101, the Fire Code, NFPA 1, the International Building Code, IBC, and the International Fire Code, IFC.

1.2 Examples of equipment described in [1.1](#) include:

Exit Signs

Emergency Luminaires

Unit Equipment

Central Station Battery Banks

Inverters

Automatic Battery Charging and Control Equipment

Emergency Lighting Control Devices (e.g., Automatic Load Control Relays, Derangement Signals)

1.3 This Standard also applies to auxiliary lighting and power equipment for use in unclassified locations. Auxiliary equipment has not been investigated to determine compliance with the performance requirements of Article 700 or 701 of the National Electrical Code, NFPA 70, the Life Safety Code, NFPA 101, or the International Building Code. Such equipment includes luminaires with an integral battery backup power supply, illuminated directional signs, battery assemblies, and related devices.

1.4 The basic requirements for protection against risk of fire, electric shock, and injury for some equipment within the scope of this standard are addressed in other standards. The primary role of UL 924 in these cases is to validate compliance with emergency system functionality and performance expectations. The investigation of such equipment for UL 924 compliance shall, to the extent practical, adhere to [5.1](#) and [5.2](#) (typically applied to Components). Examples of equipment and their respective safety standards that exhibit this relationship include, but are not limited to, the following:

Luminaires, UL 1598

Low Voltage Lighting Systems, UL 2108

Electric Signs, UL 48

Uninterruptible Power Systems, UL 1778

Energy Storage Systems and Equipment, UL 9540

Branch Circuit Emergency Lighting Transfer Switches, UL 1008

(PoE) Power Source Equipment, UL 60950-1 or UL 62368-1

1.5 Emergency lighting and power equipment intended for installation in Classified (hazardous) Locations, as defined in NFPA 70, shall comply with additional or alternative requirement outside the scope of this standard.

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** – An Emergency Lighting Control Device (ELCD) that switches dimmed or off emergency luminaires to full illumination output when the normal supply fails, and returns the luminaires to the previous status when the normal supply is restored. These devices are not transfer switches, but instead transmit power only from a single upstream source (typically, the emergency source) to specific loads. They connect to a second (typically, the normal) source of power only for monitoring purposes.

4.4 **AUXILIARY LIGHTING AND POWER EQUIPMENT** – Equipment associated with or related to, but not interconnected with or required as part of a facility's emergency lighting or power system. This equipment is not evaluated for compliance with the minimum output (power or light) requirements of the National Electrical Code, ANSI/NFPA 70, the Life Safety Code, NFPA 101, or the International Building Code, and is so marked.

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 intended to supply power for emergency lighting equipment, typically 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 either the Standard for Low Voltage

Transformers – Part 1: General Requirements, UL 5085-1 and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3, or the Limited Power Source Test of the Standard for Household and Commercial Batteries, UL 2054.

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

4.10 COMBUSTION – The decomposition of materials from solid to vapor state, through the application of heat, typically evidenced by flames, smoldering, charring, or mechanical deformation.

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

4.12 CONTINUOUS ILLUMINATED LETTER OR DIRECTIONAL INDICATOR – A letter 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.

4.13 DERANGEMENT ALARM – An audible or visible (or both) signal to indicate disruption or failure in an emergency power circuit.

4.13.1 DIRECTLY CONTROLLED EMERGENCY LUMINAIRE – A luminaire with ALCR functionality to automatically override any control setting (such as dim or “off”) and restore full (or some other pre-set) illumination level upon loss of normal power. The ALCR functionality can be integral to the luminaire or through a control signal input from a remote ELCD.

4.14 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).

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

4.16 EMERGENCY BALLAST – An assembly with batteries, a charger, high frequency inverter, and ELCD (or ELCF circuit) intended to provide emergency power to one or more fluorescent lamps upon loss of normal power.

4.17 EMERGENCY BATTERY PACK – A term used within this standard to refer to both an emergency ballast and an emergency LED driver.

4.18 EMERGENCY LED DRIVER – An assembly with batteries, a charger, LED driver, and ELCD (or ELCF circuit) intended to provide emergency power to one or more LED lamps or arrays upon loss of normal power.

4.18.1 EMERGENCY LIGHTING CONTROL DEVICE (ELCD) – A separate or integral device intended to perform one or more EMERGENCY LIGHTING CONTROL FUNCTIONS. Upon loss of normal power, an ELCD defaults to a position that does not disrupt the flow of emergency power to any controlled emergency load.

4.18.2 EMERGENCY LIGHTING CONTROL FUNCTION (ELCF) – An activity related to the performance of an emergency lighting system, including but not necessarily limited to one or more of the following:

- a) Sensing normal power status and transmitting a normal power status signal to a separate or integral device;
- b) Interpreting a normal power status signal (receiving and translating to some other type of signal);
- c) Controlling the lighting output level (e.g., changing “off” to “on”; “dim” to “full”);
- d) Distributing emergency power or control signals among connected devices;
- e) Simulating a loss of normal power (for manual testing or self-test/self-diagnostic purposes).

Each function is subject to performance validation in accordance with the Emergency Lighting Control Functionality (ELCF) Test, Section [47](#).

4.19 EMERGENCY LUMINAIRE – An illumination source with:

- a) Two or more lamps intended to be separately connected to a normal and an emergency source of power (no automatic control equipment),
- b) One or more lamps and an integral ELCD, or
- c) An emergency battery pack.

4.20 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 text or graphical symbol legend.

4.21 EXIT LIGHT – A complete, enclosed unit assembly arranged for permanent connection, with one or more lamps that illuminate an integral text or graphical symbol 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.

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

4.23 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.

4.24 FLOOR PROXIMITY EXIT SIGN – An exit sign intended to be mounted with the bottom edge no less than 6 inches (150 mm) and no more than 18 inches (455 mm) above floor grade.

4.25 FULL-SIZE ILLUMINATED LEGEND – A text-based legend whose dimensions conform to [Table 41.2](#), or a graphical symbol legend whose dimensions conform to [Figure 42.2](#) and [Figure 42.3](#).

4.26 GRAPHICAL SYMBOL – A pictorial representation (also known as a pictogram) serving as a non-language based visual indicator of meaning. Graphical symbols within the context of this Standard are as described in the Standard for Fire Safety Symbols, NFPA 170.

4.27 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.

4.28 ILLUMINANCE – The amount of light imposed on the surface of a material or object, measured in foot-candles or lux.

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

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

4.31 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.

4.32 LAMP – A light source of any configuration (e.g., bulb, tube, LED array or module, etc.), replaceable or not, intended to illuminate portions of the equipment (such as a lamp inside an exit sign that illuminates the legend) or to illuminate the environment where the equipment is located (such as the lamps on unit equipment).

4.33 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.

4.34 LEGEND – Text (in English or other languages as appropriate for the installation site) or graphical symbols intended to transmit a specific message associated with life safety, in accordance with an adopted building or fire code.

4.35 LIMITING IMPEDANCE CIRCUIT – A circuit supplied by an impedance that, under any load condition including 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 under any single fault condition unless it consists of a single resistor, or of a single capacitor that complies with the Standard for Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14. See Determination of Limiting Impedance Circuit Status, Section [51](#).

4.36 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.

4.37 LOW-VOLTAGE, LIMITED-ENERGY CIRCUIT – A circuit supplied by a source of open circuit potential below the risk of electric shock and maximum 8 A, or 150/V amps for circuits operating between 30 – 60 Vdc, measured after one minute of operation. See Section [50](#).

4.38 LUMINANCE – The amount of light emitted from a surface, measured in foot-lamberts or candelas per square meter.

4.39 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.

4.40 NON-CONTINUOUS ILLUMINATED LETTER OR DIRECTIONAL INDICATOR – A letter or 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.

4.40.1 OPEN TYPE DEVICE – A component or subassembly with instructions that limit installation to within enclosures of metal or nonmetallic materials suitable for fire containment and that limits user access to parts representing a risk of electric shock. See [74.9](#).

4.41 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).

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

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

4.44 REDUCED-SIZE ILLUMINATED LEGEND – A legend having full size letters in accordance with [41.1](#), 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.

4.45 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.

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

4.47 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 as shown in [Table 4.1](#), and the available current that would flow between the parts, through a 1500-ohm resistance, is more than 5 mA.

Table 4.1
Voltage limits for risk of electric shock

Waveform type ^a	Maximum voltage	
	Dry and damp locations	Wet locations
Sinusoidal ac	30 V _{rms}	15 V _{rms}
Non-sinusoidal ac	42.4 V _{peak}	21.2 V _{peak}
dc ^{b,c}	60 V	30 V

^a For a combined ac + dc waveform, the wet location voltage limit shall be the non-sinusoidal ac limit where the dc voltage is no more than 10.4 V, and shall be (16 + 0.45*dc voltage) V where the dc voltage is between 10.4 V and 30 V. The dry and damp location voltage limit shall be twice these amounts.

^b If the peak-to-peak ripple voltage on a dc waveform exceeds 10 percent of the dc voltage, the waveform shall be considered a combined waveform per footnote a above.

^c DC waveforms interrupted at frequencies between 10 – 200 Hz shall be limited to 24.8 V in dry and damp locations, and 12.4 V in wet locations.

4.48 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.

4.49 ROUTINE MAINTENANCE – Periodic tasks to maintain the equipment in proper working order and intended to be performed by other than qualified service personnel. Examples are, replacing fuses (branch-circuit or load-circuit type), replacing light sources, adding water to batteries and checking specific gravity of electrolyte. An enclosure or compartment is not considered subject to routine maintenance activities when it requires a tool for access and is marked per [73A.4.9](#).

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

4.51 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.

4.52 SELF-LUMINOUS EXIT SIGN – A sign with an integral 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.

4.52.1 SELF-DIAGNOSTIC ONLY EQUIPMENT – Equipment that automatically performs tests not related to its readiness to provide emergency lighting functionality.

4.52.2 SELF-TESTING/SELF-DIAGNOSTIC EQUIPMENT – Equipment that automatically performs tests, and provides visual (or other) reporting on those tests, related to its readiness to provide emergency lighting functionality in accordance with this Standard.

4.53 SERVICE – Tasks intended to be performed on-site by qualified personnel and that requires either a tool to access any compartment or specialized knowledge for performance of the task.

4.54 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.

4.55 UNFILTERED – In the context of a luminaire intended to activate a photoluminescent exit sign, the lack of a lens or diffuser that removes any appreciable portion of the UV spectrum.

4.56 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 an ELCD (or ELCF circuit) to energize the lamps automatically upon failure of the normal supply. Terminals or leads are provided for the connection of remote lamps.

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

4.58 VISIBLE – Legible (as pertains to text) and distinguishable from other text or symbols.

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 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. Load control devices shall be rated for the type(s) of loads controlled.

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.

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

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.

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.

5.8 Emergency power equipment intended for connection to a supply source capable of more than 5,000 amperes capacity shall comply with the requirements for short circuit current ratings for industrial control panels in Supplement SB of the Standard for Industrial Control Panels, UL 508A.

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.

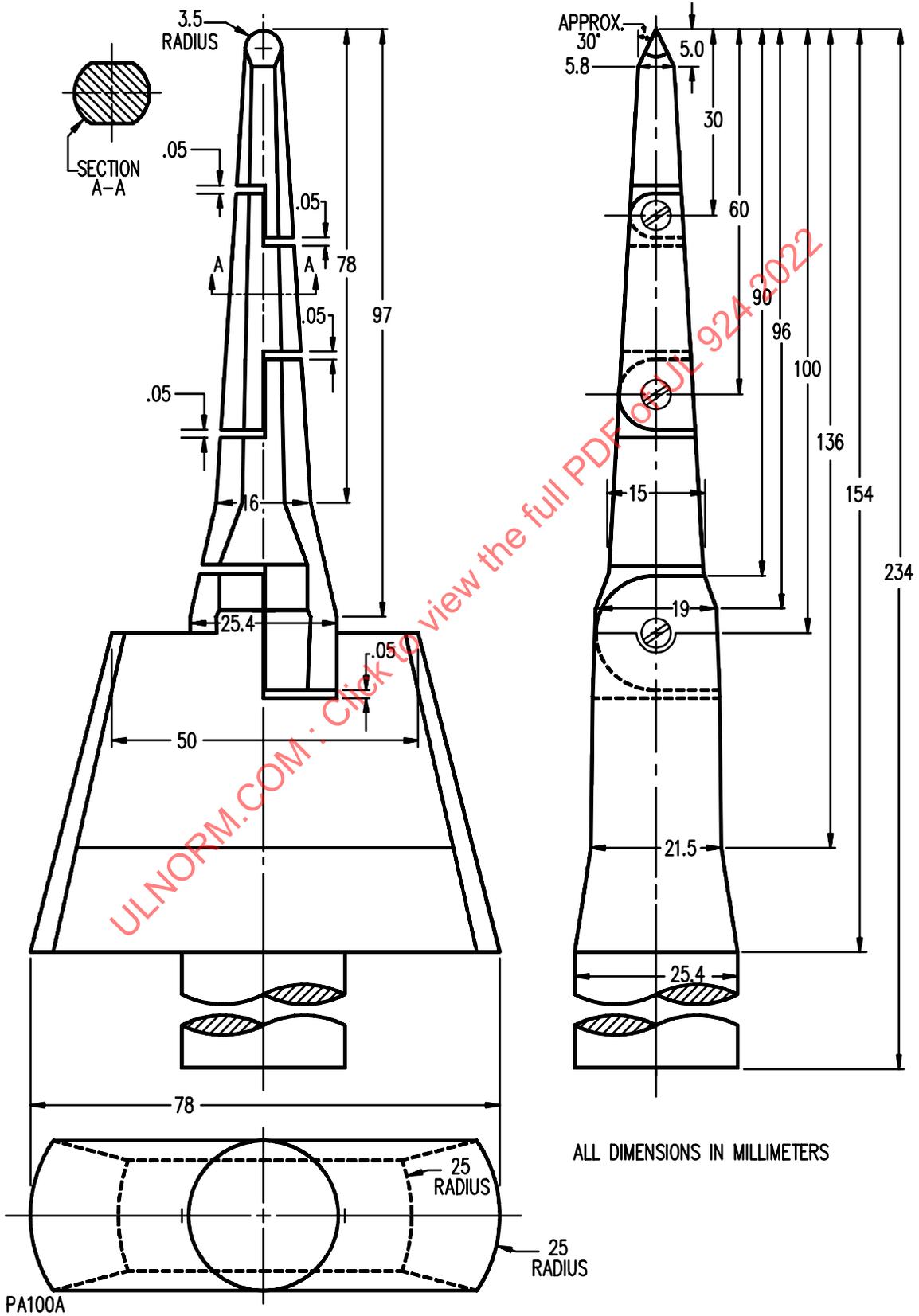
8.1.2 An operating part, such as a relay and similar devices, shall be protected against dust or other material that may adversely affect the intended operation.

8.2 Uninsulated live parts

8.2.1 Uninsulated electrical parts that pose a risk of electric shock shall be located or enclosed such that they are not able to be contacted by the probe illustrated in [Figure 8.1](#), with the probe articulated into any configuration and rotated or angled to any position before, during, or after insertion into the area being investigated.

Exception: Open type devices (see [4.40.1](#)).

Figure 8.1
Articulate probe with web stop



8.2.2 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.

8.3 Metallic enclosures

8.3.1 The thickness of a sheet metal enclosure shall be as indicated in [Table 8.1](#) or [Table 8.2](#). These Tables 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.

Exception No. 1: The enclosure thickness for unit equipment exit signs and luminaires is permitted to be in accordance with the Standard for Luminaires, UL 1598.

Exception No. 2: Lesser thicknesses may be used if the construction is shown by investigation to provide equivalent mechanical strength.

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		Maximum length, ^c		Maximum width, ^b		Maximum length, ^c		Uncoated,		Zinc coated,	
inches	(cm)	inches	(cm)	inches	(cm)	inches	(cm)	inches	(mm)	inches	(mm)
4.0	(10.2)	Not limited		6.25	(15.9)	Not limited		0.020 ^d	(0.51 ^d)	0.023 ^d	(0.58 ^d)
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)	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)				
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)				
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)				
18.0	(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)				
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)				
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)				
33.0	(83.8)	Not limited		51.0	(129.5)	Not limited		0.080	(2.03)	0.084	(2.13)
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)	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)				
52.0	(132.1)	Not limited		80.0	(203.2)	Not limited		0.108	(2.74)	0.111	(2.82)

Table 8.1 Continued on Next Page

Table 8.1 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a				Minimum thickness					
Maximum width, ^b		Maximum length, ^c		Maximum width, ^b		Maximum length, ^c		Uncoated,		Zinc coated,	
inches	(cm)	inches	(cm)	inches	(cm)	inches	(cm)	inches	(mm)	inches	(mm)
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)	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)				

^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.

^d At point of connection for wiring systems, minimum 0.026 inch (0.66 mm) for uncoated and minimum 0.029 inch (0.74 mm) for zinc coated.

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,			
Maximum width, ^b		Maximum length, ^c		Maximum width, ^b		Maximum length, ^c		Minimum thickness,	
inches	(cm)	inches	(cm)	inches	(cm)	inches	(cm)	inch	(mm)
3.0	(7.6)	Not limited		7.0	(17.8)	Not limited		0.023 ^d	(0.58 ^d)
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 ^d	(0.74 ^d)
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)		

Table 8.2 Continued on Next Page

Table 8.2 Continued

Without supporting frame ^a		With supporting frame or equivalent reinforcing ^a		Minimum thickness,	
Maximum width, ^b	Maximum length, ^c	Maximum width, ^b	Maximum length,		
inches	(cm)	inches	(cm)	inches	(mm)
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)	

^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.

^bThe 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.

^d At point of connection for wiring systems, minimum 0.036 inch (0.91 mm).

8.3.2 The thickness of a cast metal 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.

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.

8.4 Nonmetallic enclosures

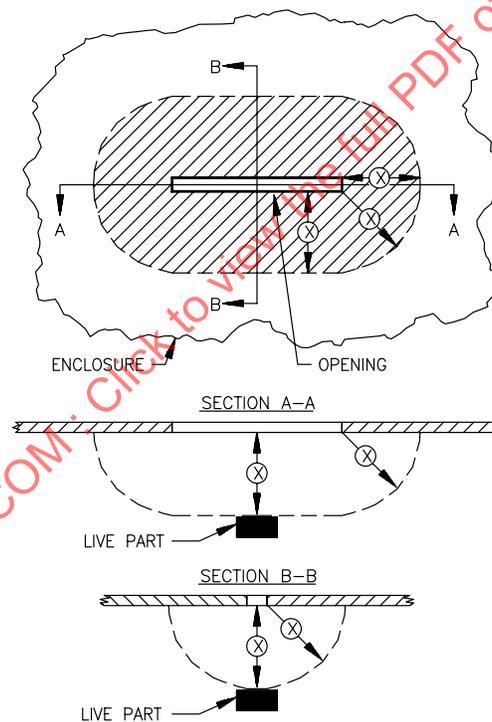
8.4.1 An enclosure made of a polymeric material shall comply with the requirements specified in Polymeric Materials, Section [10](#).

8.5 Enclosure openings

8.5.1 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.

8.5.2 An opening of a type as described in [8.5.1](#) that has a minor dimension of 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).

Figure 8.2
Opening in enclosure



EC100A

8.5.3 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 [38.1.1](#) – [38.2.6](#); 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).

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 [8.5.3](#).

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 [8.5.3](#).

8.5.4 The wires of screen shall be no smaller than 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 12 AWG (3.3 mm²) for larger screen openings.

8.5.5 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.

8.5.6 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: Surface mounted emergency luminaires, unit equipment, and exit signs that comply with the enclosure opening requirements for surface mounted luminaires in the Standard for Luminaires, UL 1598, are permitted.

Exception No. 2: 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 (50.8 mm) wide by 3 inches (76.2 mm) high, cross-sectional area of the smallest standard, single, gang-box pattern.

8.6 Enclosure covers

8.6.1 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.

8.6.2 A hinged cover shall be provided with a positive means for latching, such as 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. Gravity alone is not considered to be a positive means for holding the cover in place.

9 Environmental Rating

9.1 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.

9.2 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.

9.3 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.

9.4 Equipment intended for use in damp or wet locations shall be evaluated for compliance with Supplements [SB](#) or [SC](#), as applicable.

10 Polymeric Materials

10.1 General

10.1.1 Polymeric materials used for the purposes covered by [10.2](#) – [10.6](#) 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 have not been identified as conforming to any required performance characteristic shall comply with the applicable alternative evaluation program of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

10.1.2 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.

10.1.3 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.

10.2 Enclosures

10.2.1 A polymeric enclosure that serves to contain a risk of fire or limit access to a risk of electric shock 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 the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. Equipment marked for use in ambients of 0°C (32°F) or below are subject to the cold conditioning prior to impact at 5°C below the marked low ambient temperature. Equipment marked for use in ambients no less than 5°C are subject to the cold conditioning prior to impact at their lowest rated ambient temperature;
- d) Comply with the Mold Stress-Relief Distortion requirements of UL 746C 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.

10.2.2 Snap-fit parts are permitted to become dislodged as a result of the impact test of [10.2.1\(c\)](#) if they are able to be properly reattached to the product without the use of tools.

10.2.3 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.

10.2.4 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.

10.2.5 When an enclosure is provided with knockouts but has not been evaluated in accordance with both [10.2.3](#) and [10.2.4](#), appropriate information shall be provided in the installation instructions as described in [76.5](#).

10.3 Mechanical support

10.3.1 A polymeric part used to suspend another part, the failure of which would result in a risk of fire or electric shock, shall have a mechanical or generic temperature index equal to or greater than the maximum temperature measured on the part during the normal temperature test.

10.3.2 A polymeric part used to suspend another part that weighs more than 2 lbs (0.9 kg) shall comply with the Mechanical Support Static Load Test, Section [69](#).

10.4 Barriers

10.4.1 A polymeric material used as a barrier 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 the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C when molded or constructed of formed thermoplastic; and

c) Comply with the Barrier Strength Test, Section [70](#).

10.5 Grounding or bonding means

10.5.1 A polymeric material that affects the integrity of a grounding or bonding means 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; and

b) Comply with the Mold Stress-Relief Distortion requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C followed by the Grounding Continuity Test of Section [63](#) when molded or constructed of formed thermoplastic.

10.6 Structural support

10.6.1 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 the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, 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.

11 Mounting Means

11.1 Equipment that weighs less than 100 lbs (45 kg), and not intended to be placed at grade level or on a rack (or shelf), shall be provided with mounting means that requires the use of tools for relocation. Keyhole slots for mounting screws comply if there is at least one round hole sized or all screwheads will be accessible for tightening during installation.

11.2 Wall or ceiling-mounted equipment (surface or recessed) that weighs more than 50 lbs (22.5 kg) shall be provided with special mounting hardware and comply with the Mounting Means Test of Section [70A](#).

12 Corrosion Resistance

12.1 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).

12.2 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.

13 Insulation Material

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

13.2 Vulcanized fiber used as an insulation bushing, washer, separator, or barrier, shall not also serve as the sole mechanical support for an uninsulated live part if shrinkage, current leakage, or warpage would degrade its mechanical support or insulating capabilities.

13.3 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 shall be determined by the Standard Test Methods for Softening Point by Ring-and-Ball Apparatus, ASTM E28.

14 Mounting of Parts

14.1 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.

14.2 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 part(s) could cause a risk of fire or electric shock, or result in the equipment being unable to function as required by this Standard. 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.

14.3 An uninsulated live part, other than a pressure wire connector as covered in [37.1.7](#), 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 37.1](#). The security of contact assemblies shall be such as to provide continued alignment of contacts.

14.4 The means for preventing the turning, loosening, or shifting of a part, as required in [14.1](#) and [14.3](#), 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.

14.5 Lamphoods that are subject to pulling or torsional forces during unpacking, installation, maintenance, or service shall comply with the Swivel Torsion and Pull Test, Section [65](#).

15 Operating Mechanisms

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

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

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

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

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

16 Current-Carrying Parts

16.1 A current-carrying part shall have sufficient mechanical strength and ampacity for the intended service.

16.2 A bearing, hinge, or the like shall not be used for carrying current between fixed and moving parts.

17 Installation – Wiring Connections

17.1 General

17.1.1 Emergency lighting equipment shall be provided with either lead wires or wiring terminals.

Exception No. 1: See [18.1.3](#).

Exception No. 2: Equipment supplied by communication cables with RJ45 fittings (i.e., PoE) and whose installation instructions declare it to be installed where access to the supply connection is restricted to authorized personnel is permitted to use appropriately configured ports to serve as the supply wire terminals.

17.1.2 Deleted

17.1.3 Equipment shall have provision for the connection of one of the wiring systems required for the equipment. Field drilling of the enclosure for connection of a raceway is permitted if the instructions specifically identify an area suitable for drilling.

17.1.4 Field wiring connections for emergency circuits shall be physically separated, either by location or by barriers, from connections for normal power circuits. If no barrier is provided, separation shall be minimum 1/2 inch (12.7 mm). If a barrier is relied upon, it shall be of metal or a polymeric material that complies with [10.4](#).

17.2 Wiring terminals

17.2.1 Wiring terminals shall provide a secure connection and be prevented from turning. Soldering lugs or solderless (pressure) wire connectors shall be used for larger than 10 AWG (5.3 mm²) wire. Smaller