UL 1638

STANDARD FOR SAFETY

Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories

UL Standard for Safety for Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories, UL 1638

Sixth Edition, Dated April 27, 2023

Summary of Topics

This Sixth Edition of ANSI/UL 1638 dated April 27, 2023 has been issued to incorporate changes from proposals dated June 6, 2022 and November 4, 2022.

The new requirements are substantially in accordance with Proposal(s) on this subject dated June 6, 2022 and November 4, 2022.

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VISIBLE SIGNALING DEVICES FOR FIRE ALARM AND SIGNALING SYSTEMS, INCLUDING ACCESSORIES

April 27, 2023

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ANSI/UL 1638-2023

NATIONAL STANDARD OF CANADA
STANDARDS COUNCIL OF CANADA
CONSEIL CANADIEN DES NORMES
NORME NATIONALE DU CANADA

Commitment for Amendments

This Standard is issued jointly by ULSE Inc. (ULSE) and ULC Standards. Amendments to this Standard will be made only after processing according to the Standards writing procedures by ULSE and ULC Standards.

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

This ANSI/UL Standard for Safety consists of the Sixth Edition. The most recent designation of ANSI/UL 1638 as an American National Standard (ANSI) occurred on April 27, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

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

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Preface

This is the common ULSE and ULC Standard for Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories. It is the fifth edition of CAN/ULC 526 and sixth edition of UL 1638.

This common Standard was prepared by UL Standards & Engagement Inc. (ULSE), ULC Standards, and the NEMA Technical Harmonization Committee on Notification Appliances. The standard was formally approved by the ULSE Technical Committee on Signal Appliances and the ULC Technical Committee on Fire Alarm and Life Safety Equipment and Systems. The efforts and support of the NEMA Technical Harmonization Committee, ULSE Technical Committee, and ULC Technical Committee are gratefully acknowledged.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

Annex C is identified as informative and is for informational purposes only.

Annexes A and B are identified as normative and form a mandatory part of this Standard.

Note: Although the intended primary application of this Standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

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INTRODUCTION

1 Scope

1.1 This Standard applies to visual signaling devices intended for indoor and/or outdoor installation:

a) In Canada only: in accordance with CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations; and with ULC-S524, Standard for Installation of Fire Alarm Systems.

b) In the United States only: in accordance with the National Electrical Code, NFPA 70, and the National Fire Alarm and Signaling Code, NFPA 72.

1.2 These requirements cover visible signal devices for use in ordinary (non-hazardous) indoor locations and outdoor locations. This includes:

a) Flashing visual devices used for fire alarm or emergency signaling in both public mode and private mode as defined in the glossary;

b) Emergency warning used to notify occupants that an emergency exists; and

c) Informative type visual signaling devices connected to or controlled by fire alarm or other emergency signaling system equipment, or both.

1.3 This Standard also applies to protective covers and accessories used with visible signals.

1.4 This Standard does not apply to visual signaling devices not intended for emergency signaling applications and intended for operation on Class 2 signal circuits as defined in:

a) In Canada only: CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

b) In the United States only: the National Electrical Code, NFPA 70.

1.5 Visible signaling devices for use in hazardous or corrosive locations shall comply with the requirements of this Standard and the applicable requirements of:

a) In Canada only: CSA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations, with respect to the location hazard.

b) In the United States only: the National Electrical Code, NFPA 70.

NOTE: In the United States, general signaling appliances are covered by UL 464A.

1.6 A supplementary audible signal incorporated as part of a visible signaling device which is intended for fire alarm application shall comply with the requirements of this Standard and the applicable requirements of:

a) The Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories, ULC 525 and UL 464; and

b) The Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories, ULC 541 and UL 1480.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this Standard shall comply with the requirements for that component. See Annex A for a list of Standards covering components generally used in the products covered by this Standard.

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

a) Involves a feature or characteristic not needed in the application of the component in the product covered by this Standard; or

b) Is superseded by a requirement in this Standard.

2.3 A component shall be used in accordance with rating(s) established by its manufacturer for the intended conditions of use.

3 Units of Measurement

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

4 Referenced Publications

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

4.2 The following publications are referenced in this Standard:

ASTM B86, *Specifications for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings*

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM E28, *Standard Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus*

CSA C22.1, *Canadian Electrical Code, Part I, Safety Standard for Electrical Installations*

CSA C22.2 No. 0.4, *Bonding of Electrical Equipment*

CSA C22.2 No. 0.15, *Adhesive Labels*

CSA C22.2 No. 0.17, *Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 77, *Motors with Inherent Overheating Protection*

CSA C22.2 No. 198.1, *Extruded Insulating Tubing*

CSA C22.2 No. 60065, *Audio, Video, and Similar Electronic Apparatus – Safety Requirements*

CSA C22.2 No. 60086-4, *Primary Batteries – Part 4: Safety of Lithium Batteries*

IEC 60417, *Graphical symbols for use on equipment*

NFPA 70, *National Electrical Code*

NFPA 72, *National Fire Alarm and Signaling Code*

UL 224, *Extruded Insulating Tubing*

UL 464A, *Audible Signal Appliances for General Signaling Use*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 796, *Printed Wiring Boards*

UL 864, *Control Units and Accessories for Fire Alarm Systems*

UL 969, *Marking and Labeling Systems*

UL 985, *Household Fire Warning System Units*

UL 1004-1, *Rotating Electrical Machines – General Requirements*

UL 1004-2, *Impedance Protected Motors*

UL 1004-3, *Thermally Protected Motors*

UL 1642, *Lithium Batteries*

UL 2054, *Household and Commercial Batteries*

UL 60065, *Audio, Video, and Similar Electronic Apparatus – Safety requirements*

UL 60086-4, *Primary Batteries – Part 4: Safety of Lithium Batteries*

UL 60384-14, *Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains*

UL 464/ULC 525, *Audible Signal Devices for Fire Alarm and Signaling Systems, Including Accessories*

UL 1480/ULC 541, *Speakers for Fire Alarm and Signaling Systems, Including Accessories*

ULC-S142, *Fire Test for Heat and Visible Smoke Release for Discrete Products*

ULC-S524, *Installation of Fire Alarm Systems*

ULC 527, *Control Units for Fire Alarm Systems*

ULC-S545, *Residential Fire Warning System Control Units*

5 Glossary

For the purpose of this Standard, the following definitions apply:

5.1 CANDELA – For the purpose of this Standard, the light output of a flashing light is measured with an integration radiometer and the summation of light intensity over time (Idt) is used in the following equation to determine the effective light intensity. The candela (cd) value assigned to a flashing light is calculated and corresponds to the same value of candela of a fixed light operating under identical conditions of observation, color, size, and shape:

$$cd = \frac{(ldt)}{(0.2 + t_2 - t_1)}$$

In which:

Idt is the measured lumens recorded by the photometer over time for ten consecutive pulses

0.2 is two-tenths of 1 s, the value which represents night-time threshold effective illumination as specified in the Illuminating Engineering Society of North America Lighting Handbook

$t_2 - t_1$ represents the time period of the light pulse.

5.2 CONSTANT TEMPERATURE – Temperature is considered to be constant when three successive readings indicate no change when taken at intervals of 10 % of the previously elapsed duration of the test, but not less than at 5 min intervals.

5.3 CRITICAL ANGLE – The five-degree (5°) dispersion angle that has the lowest ratio of measured light output to minimum required light output for all five-degree increments within the plane of measurement. This angle is identified by comparison of all ratios of measurements obtained within the plane during the tests specified in Section 20, Measurement of Effective Luminous Intensity (Light Output). All ratios of measured light to required minimum light shall be equal to or greater than 1. For example:

Ratio = Measured light/minimum required light

15 cd / 12 cd

5/4 = 1.25

5.4 DUTY CYCLE – The ratio of the sum of all pulse durations to the total period, during a specified period of operation.

5.5 EFFECTIVE LUMINOUS INTENSITY – The quantity of directly perceived light produced by a visible signal device, measured in candela (cd).

5.6 EMERGENCY WARNING – A private mode visual signal used to indicate an emergency situation requiring attention, but not a fire evacuation.

5.7 FIRMWARE – A control program that is embedded in the notification appliance.

5.8 FLASH DURATION – The light pulse duration, as measured between the 10 % of peak amplitude for the leading and trailing edges of the light wave envelope in seconds.

5.9 INFORMATIVE – Textual, visual signaling controlled by fire alarm or other emergency signaling system equipment, or both.

5.10 LUMINANCE – The luminous intensity per unit area, measured in candela per square meter.

5.11 MANUFACTURER'S PUBLISHED INSTRUCTIONS – Published installation and operating documentation provided for each product or component. The documentation includes directions and necessary information for the intended installation, maintenance, and operation of the product or component.

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5.12 PRIMARY BATTERY – A battery which can only be discharged once. It is not designed to be rechargeable and must be protected from a charging current.

5.13 PRIVATE MODE – Mode of operation intended to notify only those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire-alarm and signaling system.

5.14 PUBLIC MODE – Mode of operation intended to notify occupants or inhabitants in the area protected by the fire-alarm and signaling system.

5.15 REFERENCE AXIS – The "reference axis" of a visible signaling device is a line passing through the reference point coincident with the geometrical axis of the light propagation pattern. For symmetrical structures, the reference axis is usually perpendicular to a plane passing through the edge of the light source.

5.16 REFERENCE POINT – The “reference point” of a visible signaling device is a point on the outside of the visible signal device in line with the geometrical center of the light source projected perpendicular to a plane passing through the edge of the light source.

5.17 RESONANCE – Condition of peak vibratory response where a small change in excitation frequency causes a decrease in system response.

5.18 SECONDARY BATTERY – A battery that is intended to be discharged and recharged many times in accordance with the manufacturer's recommendations.

5.19 SOFTWARE – A program that is used to program a notification appliance’s function and or its performance through the device’s firmware.

5.20 SPECIAL TOOL – A device not normally carried by the public (e.g. a key), normally provided by the manufacturer, to deter unauthorized access to the equipment.

NOTE: This is intended to deter unauthorized access to the equipment, while being available on site either at a defined location or from a "responsible person" familiar with and having knowledge of the equipment.

5.21 TROUBLE SIGNAL – A visual, audible, or transmitted signal indicating a fault condition associated with a notification appliance.

6 Control Unit Interface

6.1 A visible signaling device incorporating circuitry for functional interfacing with a control unit for purposes such as supervision, point addressing, multiplexing, synchronization, wireless communication etc., shall also comply with the applicable functional requirements of standards such as:

a) In Canada only:

1) ULC 527; and

2) ULC-S545.

b) In the United States only:

1) UL 864; and

2) UL 985.

7 Visible Signal Pattern

7.1 Unless otherwise specified, the light output propagation pattern of a visible signaling device shall comply with the application requirements in Section 20, Measurement of Effective Luminous Intensity (Light Output).

CONSTRUCTION

8 General

8.1 The construction of a visible signaling device for fire alarm or emergency use shall comply with the construction requirements contained in this section unless, where permitted by test, the construction is determined to be equivalent to these requirements.

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

9 Enclosures

9.1 General

9.1.1 The frame and enclosure of a visible signaling device shall be sufficiently strong and rigid to resist the abuses to which it is likely to be subjected without adversely affecting its performance due to total or partial collapse with attendant reduction of spacings, loosening or displacement of parts and development of other conditions which could impair operation of the visible signaling device and increase the risk of fire or electrical shock. Refer to Mechanical Strength Tests for Enclosures, Section 38.

9.1.2 Electrical parts or hazardous moving parts of a visible signaling device shall be located or enclosed to provide protection from unintentional contact with uninsulated live parts.

9.1.3 A visible signaling device intended to be installed on an outlet box or similar mounting enclosure, is to be judged with respect to compliance of the combination with the requirements of 9.1.1 and 9.1.2.

9.1.4 An operating part, such as a gear mechanism, light-duty relay, or similar device, shall be protected against mechanical damage and fouling by dust or other material which impairs its intended operation.

9.1.5 The enclosure of a device shall be provided with means for mounting in the intended manner. Any fittings, such as brackets, hangers, or similar hardware required for mounting shall be furnished with the device.

9.1.6 An enclosure shall have provision for the connection of metal-clad cable, conduit, or nonmetallic sheathed cable. Space shall be provided within a terminal or wiring compartment to permit the use of a standard conduit bushing on conduit connected to the compartment when a bushing is required for installation. An enclosure without such provision is permitted when:

a) It is furnished with definite instructions indicating the sections of the enclosure which are intended to be drilled in the field for the connection of raceways; or

b) The device is intended for mounting on a standard outlet box that has been evaluated and or approved for the intended use.

9.1.7 A visible signaling device intended for either flush or surface mounting in a back box shall use a standard enclosure that has been evaluated for the intended use or an enclosure which complies with the requirements of this Standard.

9.1.8 A visible signaling device need not be furnished with a back box where means for attachment to a standard outlet box are provided and the spacings comply with Section 15, Spacings.

9.1.9 The mounting means of a visible signaling device to an enclosure shall be accessible without disassembly of any components not identified in the manufacturer's published instructions of the visible signaling device. The mounting means shall be independent of those means used for securing components or parts of the assembly. Removal of a complete assembly is not considered to be disassembly of a component.

9.1.10 An enclosure shall be constructed to minimize the possibility of emission of flame, molten metal, flaming or glowing particles, or flaming drops. See Section 28, Abnormal Operation and Burnout Test.

9.1.11 A visible signaling device of less than 23 kg (50.7 lb) mass may be arranged for mounting to an outlet box provided that, if the visible signaling device mass is more than 11 kg (24-1/4 lb), it is plainly marked as specified in Markings, Section 46.

9.1.12 A visible signaling device of more than 23 kg (50.7 lb) mass shall incorporate space or a compartment for field wiring and shall be provided with means for physical mounting and support by other than an outlet box.

9.2 Cast metal enclosures

9.2.1 The thickness of cast metal for an enclosure shall be as indicated in Table 9.1.

Exception: Cast metal of lesser thickness may be employed if, consideration being given to the shape, size, and function of the enclosure, it provides equivalent mechanical strength. See Section 38, Mechanical Strength Tests for Enclosures.

Table 9.1
Cast Metal Enclosures

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

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

9.2.2 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, there shall be not less than 3.5 or more than 5 threads in the metal, and the construction shall be such that a standard conduit bushing can be properly attached.

9.2.3 If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall be not less than 3.5 full threads in the metal and there shall be a smooth, rounded inlet hole which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

9.2.4 A visible signaling device assembly designed to be supported by rigid conduit shall be of sufficient strength to be able to support 5 times the weight of the visible signaling device assembly and comply with Mechanical Strength Test for Enclosures, Section 38. When provided with a conduit hub, or the equivalent, the hub shall have not less than 5 full threads.

9.2.5 Die-cast metal for other than flush boxes is permitted when it complies with one of the alloy specifications given in ASTM B86.

9.3 Sheet metal enclosures

9.3.1 The thickness of sheet metal employed for the enclosure of a visible signaling device shall be not less than that indicated in Table 9.2.

Exception: Sheet metal of lesser thickness may be employed if, consideration being given to the shape, size, and function of the enclosure, it provides equivalent mechanical strength. See Section 38, Mechanical Strength Tests for Enclosures.

Table 9.2
Minimum Thickness of Sheet Metal

Maximum dimensions of enclosure					Minimum thickness of sheet metal					
					Steel				Copper, brass or aluminum,	
Group	Length or width,		Area,		Zinc-coated,		Uncoated,			
	mm	(in)	cm^2	(in^2)	mm	(in)	mm	(in)	mm	(in)
A	76.2	(3)	39[a]	(6)	0.64[b]	(0.025)	0.53[b]	(0.021)	0.58[c]	(0.023)
B	203	(8)	232	(36)	0.76[b,d]	(0.030)	0.69[b,d]	(0.027)	0.91[d]	(0.036)
C	305	(12)	581	(90)	0.86[d]	(0.034)	0.81[d]	(0.032)	1.14[d]	(0.045)

[a] Volume of enclosure not more than 197 cm^3 (12 in^3).

[b] Sheet steel for an enclosure intended for outdoor use (rain-tight) is required to be not less than 0.91 mm (0.036 in) in thickness if zinc coated and not less than 0.81 mm (0.032 in) in thickness if uncoated.

[c] Sheet copper, brass, or aluminum for an enclosure intended for outdoor use (rain-tight) is required to be not less than 0.74 mm (0.029 in) in thickness.

[d] For a cover in Group B or C having a supporting frame or equivalent reinforcing and not intended for outdoor use, the thickness of sheet steel may be less than that specified in the table but shall be not less than 0.53 mm (0.021 in) [00.64 mm (0.025 in) if zinc coated], and the thickness of copper, brass, or aluminum may be less than that specified in the table but shall be not less than 0.74 mm (0.029 in).

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

a) 0.36 mm (0.014 in) for steel or 0.43 mm (0.017 in) for nonferrous metal for a hole having a 6.4 mm (1/4 in) maximum dimension; and

b) 0.69 mm (0.027 in) for steel or 0.81 mm (0.032 in) for nonferrous metal for a hole having a 35 mm (1-3/8 in) maximum dimension.

9.3.3 A hole larger than 35 mm (1-3/8 in) diameter shall have a closure whose thickness is not less than that required for the enclosure of the visible signaling device or shall have a standard knockout seal. Such plates or plugs shall be securely mounted.

9.3.4 A knockout in a sheet metal enclosure shall be secured but shall be capable of being removed without undue deformation of the enclosure. See Section 38, Mechanical Strength Tests for Enclosures.

9.3.5 A knockout shall be provided with a surrounding surface area of sufficient size to permit seating of a conduit bushing, and shall be so located that a bushing employed at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those indicated under Section 15, Spacings.

9.3.6 A sheet metal member to which a wiring system is to be connected in the field shall have a thickness not less than 0.81 mm (0.032 in) for uncoated steel, of not less than 0.86 mm (0.040 in) for galvanized steel, and not less than 1.14 mm (0.045 in) for nonferrous metal.

9.3.7 At any point where conduit or metal-clad cable is to be attached, sheet metal shall be of such thickness or shall be so formed or reinforced that it has a stiffness at least equivalent to that of an uncoated flat steel sheet having a minimum thickness of 1.35 mm (0.053 in).

9.3.8 An enclosure intended for recessed mounting shall have no nonfunctional openings on any of the enclosed sides.

9.4 Nonmetallic enclosures

9.4.1 An enclosure or parts of an enclosure of nonmetallic material shall have the mechanical strength and durability and be so formed that operating parts will be protected against damage. The mechanical strength of the enclosure shall be at least equivalent to a sheet metal enclosure of the minimum thickness specified in Table 9.2. Refer to Section 38, Mechanical Strength Tests for Enclosures.

9.4.2 The continuity of any grounding system to which an appliance is capable of being connected shall not rely on the dimensional integrity of the nonmetallic material.

9.4.3 Among the factors taken into consideration when judging the acceptability of a nonmetallic enclosure are the following:

a) The mechanical strength;

b) Resistance to impact;

c) Moisture-absorptive properties;

d) Flammability and resistance to ignition from electrical sources;

e) Dielectric strength, insulation resistance, and resistance to arc tracking; and

f) Resistance to distortion and creeping at temperatures to which the material may be subjected.

NOTE: All these factors are considered with respect to aging in accordance with Section 37, Tests on Polymeric (Plastic) Materials.

9.5 Outdoor use enclosures

9.5.1 The enclosure of a visible signaling device intended for outdoor use shall incorporate the following:

a) Means for mounting designed to prevent water spray from entering the enclosure. See Section 34, Water Spray Test;

b) Holes for conduit that shall be threaded unless they are located below the lowest termination point or other live part within the enclosure. If knockouts or unthreaded holes are provided, there shall be provision for drainage of the enclosure.

9.5.2 A surface mount enclosure intended for outdoor use shall be provided with external means for mounting.

Exception: Internal means for mounting may be employed if constructed so as to prevent water from entering the enclosure.

9.5.3 For outdoor use, an enclosure of sheet steel less than 3.04 mm (0.12 in) in thickness, 3.18 mm (0.125 in) or less if zinc coated, shall be galvanized by the hot-dip process after forming and assembly, or shall be made from hot-dipped sheets, or shall be provided with a coating which is at least the equivalent, with respect to corrosion protection, of zinc applied by the hot-dip process.

9.6 Openings

9.6.1 Openings in the top of the enclosure shall be so constructed and shall be of such size that the entry of foreign objects is prevented.

9.6.2 To ensure compliance with 9.6.1, openings directly over uninsulated live parts or operating parts shall not exceed 5 mm (0.20 in) in any dimension unless the configuration of the opening prevents entry of foreign objects. See Figure 9.1 for examples of acceptable top cover designs.