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**Underwriters Laboratories Inc.®**A not-for-profit organization dedicated to public safety
and committed to quality service**November 5, 1993****Revision pages for****Standard for****Home Health Care Signaling Equipment****UL 1637, Second Edition**

Attached to this transmittal notice is a revision of the second edition of UL 1637.

A CHANGE ON A PAGE DATED NOVEMBER 5, 1993 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THESE NEW REQUIREMENTS ARE NOW IN EFFECT.

The new requirements were originally published as revisions to the first edition of UL 1637. These requirements are now issued for, and renumbered in accordance with, the second edition of UL 1637.

Attention is directed to the note on the title page of this standard outlining the procedure to be followed to retain the approved text of ANSI/UL 1637-1992.

Revised and/or additional pages may be issued from time to time.

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

Page	Date
1	November 4, 1993 (Reprinted November 5, 1993)
2	—
3 — 6	November 4, 1993
7	November 5, 1993
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9	November 5, 1993
10 — 84, A1	November 4, 1993

NOVEMBER 4, 1993
(Title Page Reprinted: November 5, 1993)



1

UL 1637

Standard for

Home Health Care Signaling Equipment

First Edition – May, 1989

Second Edition

November 4, 1993

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated November 4, 1993. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI/UL 1637-1992, October 12, 1992

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

ISBN 1-55989-451-2

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(1 — 11/04/93 — 11/05/93)

INTRODUCTION

1 Scope

1.1 These requirements cover the individual units that comprise a home health care system intended for use in ordinary indoor residential locations.

1.2 These requirements also cover a complete home health care system in which a signal initiating device (both routine monitoring and medical emergency signals) may be connected directly or indirectly to receiving equipment at a residence or to continuously monitored receiving equipment at a central supervising station. The system is arranged so that a predetermined change in the status of the signal initiating circuits or devices automatically causes transmission of a signal over a communication channel to receiving equipment at a residence, to a central supervising station, or to a private telephone number.

1.3 The components of the home health care system may include signal initiating devices, control units, transmitters, and digital communicators, all located at the residence, and the receiving, processing, and displaying equipment located at the central supervising station.

1.4 All field wiring extending to signal initiating units located at the residence is intended to be energized from power limited circuits as defined in 2.3(c).

1.5 The units covered by these requirements are intended to be installed in accordance with the requirements of:

- a) The National Electrical Code, NFPA 70;
- b) Other applicable installation codes; and
- c) The local inspection authority having jurisdiction.

1.6 A product that contains features, characteristics, components, materials, or systems new or different from those in use when the standard was developed, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the level of safety for the user of the product as originally anticipated by the intent of this standard.

1.6 added November 5, 1993

2 Glossary

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

2.2 **CENTRAL STATION RECEIVING UNIT** — Equipment located at a central station that receives and displays the information to the operator for action.

2.3 **CIRCUITS, ELECTRICAL** —

- a) **High-Voltage** — A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage power limited circuit.
- b) **Low-Voltage** — A circuit involving a potential of not more than 30 volts ac rms, 42.4 volts ac peak or dc.

- c) **Power Limited** – A circuit in which the output is limited to 100 volt-amperes, at a maximum of 30 volts ac, 42.4 volts dc. The power limitation is typically provided by a transformer, a fixed impedance, a noninterchangeable fuse, a nonadjustable manual reset circuit protective device, or a regulating network.
- 2.4 **CORD-CONNECTED UNIT** – A unit intended for connection to the power source by means of a supply cord.
- 2.5 **MEDICAL EMERGENCY SIGNAL** – A signal from an initiating device that requires specific action from the receiver.
- 2.6 **MONITOR SIGNAL** – A signal from a monitor-type initiating device that requires no immediate action.
- 2.7 **NORMAL STANDBY CONDITION** – The ready-to-operate condition that exists prior to any type of signaling condition.
- 2.8 **PERSONAL CALL UNIT** – A device from which the resident may place a call to a central station receiving unit, other receiving unit, or to a private telephone number. This unit may be fixed or portable (carried by the resident). Operation of the unit transmits a medical emergency signal.
- 2.9 **PROGRAM** – A set of instructions that is carried out in a sequential and repetitive manner and that determines the system output signal resulting from system input signal.
- 2.10 **RADIO FREQUENCY** – Electromagnetic radiation 10 kilohertz or higher.
- 2.11 **RESIDENTIAL CONTROL UNIT** – A device that receives input signals from the monitor and personal call units and transmits the information to a central station receiving unit or to a private telephone number. A residential control unit may or may not process the signal.
- 2.12 **SIGNALING UNIT** – All devices and appliances covered by this standard.
- 2.13 **SIGNAL INITIATING UNIT** – A manually or automatically operated device, in which intended operation results in a signal indication to the residential control unit. The signals may be "Medical Emergency," "Monitor," or "Trouble."
- 2.14 **STORED** – The action provided by a memory device used for retaining information, instruction, status, and the like. It may be permanent or volatile.
- 2.15 **SUPERVISION** – Monitoring of a critical circuit for a fault condition, such as an open, ground, short circuit fault, or loss of transmission capability.
- 2.16 **TROUBLE SIGNAL** – A signal that indicates the presence of a fault condition that may impair system operation.
- 2.17 **UNOCCUPIED PERIOD** – Period during which the residence is vacant.

3 General

3.1 Components

- 3.1.1 Except as indicated in 3.1.2, a component of a unit 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 units covered by this standard.

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

- a) Involves a feature or characteristic not needed in the application of the component in the unit covered by this standard, or
- b) Is superseded by a requirement in this standard.

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

3.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits and shall be used only under those specific conditions for which they have been recognized.

3.1.5 If a digital alarm communicator transmitter is used to transmit signals to a remote location and is to be included as a component of the system, it shall comply with the applicable requirements for digital alarm communicator system units, UL 1635. Otherwise the user must be notified that the off-premises transmission method has not been so investigated.

3.1.5 added November 5, 1993

3.2 Units of measurement

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

3.2.2 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.

3.3 Undated references

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

4 Installation and Operating Instructions

4.1 A copy or draft of the installation and operating instructions, related schematic wiring diagrams, and installation drawings intended to accompany the equipment are to be furnished with the sample submitted for investigation and are to be used as a guide in the examination and test of the equipment.

4.2 The instructions and drawings shall include at least the following:

- a) Typical installation drawing layouts and complete representative installation wiring diagram(s) for the signaling unit(s) indicating recommended locations and wiring methods.
- b) A concise description of the operation, testing, and maintenance procedures for the signaling unit(s), and recommended testing frequency.
- c) Replacement parts, such as lamps or batteries, identified in the instructions by a part number, manufacturer's model number, or the equivalent.
- d) A description of the conditions which might be expected to result in unintended signals or impaired operation of the signaling unit(s).

e) A description of any features provided to reduce the risk of fire or electric shock and a warning against bypassing such features.

f) Identification of units that are factory serviceable only. A statement shall be provided indicating that these units should be returned to the manufacturer for service. The manufacturer's name and address shall also be included.

4.3 An installation wiring diagram(s) shall be provided with each signaling unit indicating the field connections to be made. The diagram(s) shall be attached to the residence and receiving units or, if separate, shall be referenced in the marking attached to these units with the diagram number and issue number or date, or both.

4.4 An installation wiring diagram shall show a pictorial view or equivalent of the installation terminals or leads to which field connections are made as they would appear when viewed from the front or normal connecting position. The terminal numbers on the unit shall agree with the numbers on the diagram. An unattached diagram shall be marked with the name or trademark of the manufacturer and an identification number or equivalent.

4.5 If low-voltage, power limited circuit terminal configurations are used that require a special tool for connection, the tool shall be referenced in the instructions.

4.6 The instructions may be incorporated on the inside of the signaling unit, on a separate sheet, or as part of a manual. If not included directly on the signaling unit, the instructions or manual shall be referenced in the marking information on the signaling unit. See Marking, General, Section 84.

CONSTRUCTION

ASSEMBLY

5 General

5.1 Adhesives used to secure conductive parts

5.1.1 An adhesive that is relied upon to reduce a risk of fire, electric shock, or injury to persons shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

5.1.2 The requirement in 5.1.1 applies to an adhesive used to secure a conductive part, including a nameplate, that may, if loosened or dislodged:

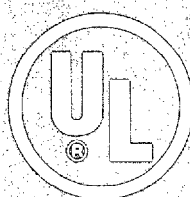
- a) Energize an accessible dead metal part,
- b) Make a live part accessible,
- c) Reduce spacings below the minimum required values, or
- d) Short-circuit live parts.

Standard for Safety

UL 1637

Home Health Care Signaling Equipment

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Standard



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November 4, 1993

Standard for

Home Health Care Signaling Equipment

UL 1637, Second Edition

Accompanying this transmittal notice is a copy of the second edition of UL 1637.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

As indicated on the title page, this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this standard outlining the procedures to be followed to retain the approved text of ANSI/UL 1637-1992.

Revised and/or additional pages may be issued from time to time.

Subscribers to UL's services in the area covered by this standard will receive these revised and/or additional pages automatically. Others may receive such pages by subscribing to UL's subscription service for revisions. See UL's CATALOG OF STANDARDS FOR SAFETY for a description of the revision subscription service, the cost of the service for this standard, and ordering information.

NOVEMBER 4, 1993



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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 differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, 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 the individual units that comprise a home health care system intended for use in ordinary indoor residential locations.

1.2 These requirements also cover a complete home health care system in which a signal initiating device (both routine monitoring and medical emergency signals) may be connected directly or indirectly to receiving equipment at a residence or to continuously monitored receiving equipment at a central supervising station. The system is arranged so that a predetermined change in the status of the signal initiating circuits or devices automatically causes transmission of a signal over a communication channel to receiving equipment at a residence, to a central supervising station, or to a private telephone number.

1.3 The components of the home health care system may include signal initiating devices, control units, transmitters, and digital communicators, all located at the residence, and the receiving, processing, and displaying equipment located at the central supervising station.

1.4 All field wiring extending to signal initiating units located at the residence is intended to be energized from power limited circuits as defined in 2.3(c).

1.5 The units covered by these requirements are intended to be installed in accordance with the requirements of:

- a) The National Electrical Code, NFPA 70;
- b) Other applicable installation codes; and
- c) The local inspection authority having jurisdiction.

2 Glossary

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

2.2 **CENTRAL STATION RECEIVING UNIT** — Equipment located at a central station that receives and displays the information to the operator for action.

2.3 **CIRCUITS, ELECTRICAL** —

- a) **High-Voltage** — A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage power limited circuit.
- b) **Low-Voltage** — A circuit involving a potential of not more than 30 volts ac rms, 42.4 volts ac peak or dc.

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2.14 **STORED** — The action provided by a memory device used for retaining information, instruction, status, and the like. It may be permanent or volatile.

2.15 **SUPERVISION** — Monitoring of a critical circuit for a fault condition, such as an open, ground, short circuit fault, or loss of transmission capability.

2.16 **TROUBLE SIGNAL** — A signal that indicates the presence of a fault condition that may impair system operation.

2.17 **UNOCCUPIED PERIOD** — Period during which the residence is vacant.

3 General

3.1 Components

3.1.1 Except as indicated in 3.1.2, a component of a unit 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 units covered by this standard.

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

- a) Involves a feature or characteristic not needed in the application of the component in the unit covered by this standard, or
- b) Is superseded by a requirement in this standard.

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

3.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits and shall be used only under those specific conditions for which they have been recognized.

3.2 Units of measurement

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

3.2.2 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.

3.3 Undated references

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

4 Installation and Operating Instructions

4.1 A copy or draft of the installation and operating instructions, related schematic wiring diagrams, and installation drawings intended to accompany the equipment are to be furnished with the sample submitted for investigation and are to be used as a guide in the examination and test of the equipment.

4.2 The instructions and drawings shall include at least the following:

- a) Typical installation drawing layouts and complete representative installation wiring diagram(s) for the signaling unit(s) indicating recommended locations and wiring methods.
- b) A concise description of the operation, testing, and maintenance procedures for the signaling unit(s), and recommended testing frequency.
- c) Replacement parts, such as lamps or batteries, identified in the instructions by a part number, manufacturer's model number, or the equivalent.
- d) A description of the conditions which might be expected to result in unintended signals or impaired operation of the signaling unit(s).

e) A description of any features provided to reduce the risk of fire or electric shock and a warning against bypassing such features.

f) Identification of units that are factory serviceable only. A statement shall be provided indicating that these units should be returned to the manufacturer for service. The manufacturer's name and address shall also be included.

4.3 An installation wiring diagram(s) shall be provided with each signaling unit indicating the field connections to be made. The diagram(s) shall be attached to the residence and receiving units or, if separate, shall be referenced in the marking attached to these units with the diagram number and issue number or date, or both.

4.4 An installation wiring diagram shall show a pictorial view or equivalent of the installation terminals or leads to which field connections are made as they would appear when viewed from the front or normal connecting position. The terminal numbers on the unit shall agree with the numbers on the diagram. An unattached diagram shall be marked with the name or trademark of the manufacturer and an identification number or equivalent.

4.5 If low-voltage, power limited circuit terminal configurations are used that require a special tool for connection, the tool shall be referenced in the instructions.

4.6 The instructions may be incorporated on the inside of the signaling unit, on a separate sheet, or as part of a manual. If not included directly on the signaling unit, the instructions or manual shall be referenced in the marking information on the signaling unit. See Marking, General, Section 84.

CONSTRUCTION

ASSEMBLY

5 General

5.1 Adhesives used to secure conductive parts

5.1.1 An adhesive that is relied upon to reduce a risk of fire, electric shock, or injury to persons shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

5.1.2 The requirement in 5.1.1 applies to an adhesive used to secure a conductive part, including a nameplate, that may, if loosened or dislodged:

- a) Energize an accessible dead metal part,
- b) Make a live part accessible,
- c) Reduce spacings below the minimum required values, or
- d) Short-circuit live parts.

5.1.3 Whether the conditions specified in 5.1.2 (a) – (d) can occur is to be considered with respect to both:

- a) A part inside the device, and
- b) A part on the outside of the device that may affect equipment in which the device is to be installed.

5.2 Accessibility of uninsulated live parts

5.2.1 An opening shall not permit entrance of a 1/2-inch (12.7-mm) diameter rod and shall be sized and arranged so that a nonmetallic probe, as illustrated in Figure 5.1, cannot be made to contact any uninsulated live electrical part (other than a low-voltage part) when inserted through the opening in a straight or articulated position.

5.3 Protection of service personnel

5.3.1 An uninsulated live part of a high-voltage circuit within the enclosure shall be located, guarded, or enclosed so as to reduce the risk of accidental contact by persons performing service functions that may be performed while the equipment is energized.

5.3.2 During the examination of a signaling unit in connection with the requirements in 5.3.1, a part of the outer enclosure that may be removed without the use of tools, or part of the outer enclosure that may be removed by the user to allow access for making intended operating adjustments, is to be disregarded; it will not be assumed that the part in question affords protection against electric shock.

5.3.3 An electrical component requiring examination, replacement, adjustment, servicing, or maintenance while the signaling unit is energized shall be located and mounted with respect to other components and with respect to grounded metal so that it is accessible for such service without subjecting service personnel to the risk of electric shock from adjacent uninsulated high-voltage live parts.

5.3.4 The following are not considered to be uninsulated live parts:

- a) Coils of relays and solenoids, and transformer windings, if the coils and windings are provided with insulating overwraps rated for the potentials encountered;
- b) Terminals and splices having insulation rated for the potential encountered; and
- c) Insulated wire.

5.3.5 If the linear distance from a component requiring servicing to all uninsulated current-carrying parts in excess of 30 volts rms, 42.4 volts peak, 60 volts dc, is less than 6 inches (152 mm), protection shall be provided by insulating tape, barriers, or the equivalent.

Exception: Compliance with this requirement may be achieved by use of:

- a) *An interlock provided on the cover that de-energizes all live parts in the enclosure when the cover is removed, or*
- b) *The following or equivalent permanent and prominent marking provided on the cover front: "CAUTION — Risk of Electrical Shock, De-Energize Unit Prior To Servicing." This marking may be located on a rear panel or at the point of entry if the equipment is factory serviceable only.*

6 Enclosures

6.1 General

6.1.1 The frame and enclosure of a signaling unit shall have the strength and rigidity to resist total or partial collapse and the subsequent reduction of spacings, or loosening or displacement of parts. See the Mechanical Strength Tests for Enclosures, Section 51.

6.1.2 An enclosure containing other than power limited circuits shall be constructed to reduce the risk of emission of flame, molten metal, flaming or glowing particles, or flaming drops.

6.1.3 The requirement in 6.1.2 necessitates either a nonflammable bottom in accordance with 6.6.2 or a protective barrier as illustrated in Figure 6.1 under all areas containing combustible materials.

Exception: The bottom of the enclosure under areas containing only materials classified as 94V-1 or less flammable, may have openings no larger than 1/16 square inch (40.3 mm²).

6.1.4 A construction employing individual barriers under components, groups of components, or assemblies, as specified in Figure 6.1 is also considered to comply with the requirement in 6.1.2.

6.2 Cast metal

6.2.1 The thickness of a cast metal enclosure shall be as specified in Table 6.1.

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 to metal of the thickness specified in the table. See the Mechanical Strength Tests for Enclosures, Section 51.

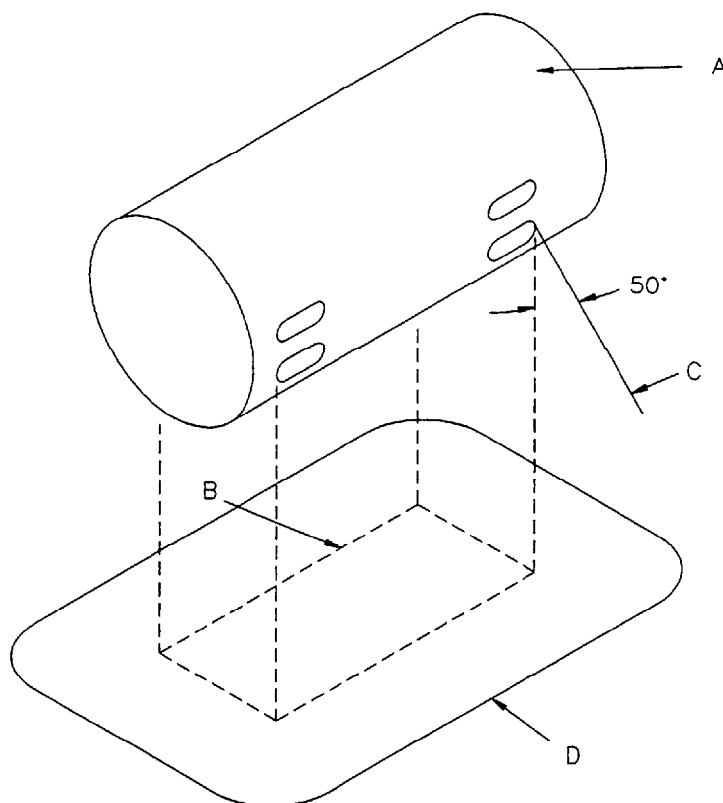
6.3 Sheet metal

6.3.1 The thickness of sheet metal for an enclosure shall be not less than that indicated in Table 6.2 or 6.3, whichever applies.

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 to metal of the thickness specified in the table. See the Mechanical Strength Tests for Enclosures, Section 51.

6.3.2 A sheet metal member to which a wiring system is to be connected in the field shall be at least 0.032 inch (0.81 mm) thick if of uncoated steel, 0.034 inch (0.86 mm) thick if of galvanized steel, and 0.045 inch (1.14 mm) thick if of nonferrous metal.

Figure 6.1
Protective barrier



EB110A

A – The entire component under which a barrier (flat or dished with or without a lip or other raised edge) of noncombustible material is to be provided. The sketch above is of a metal enclosed component with ventilating openings to show that the protective barrier is required only for those openings from which flaming parts might come. If the component or assembly does not have its own noncombustible enclosure, the area to be protected would be the entire area occupied by the component or assembly.

B – Projection of the outline of the area A that needs a bottom barrier vertically downward onto the horizontal plane of the lowest point on the outer edge (D) of the barrier.

C – Inclined line that traces out an area (D) on the horizontal plane of the barrier. Moving around the perimeter of the area (B) which needs a bottom barrier, this line projects at a 5-degree angle from the line extending vertically at every point around the perimeter of (A) and oriented to trace out the largest area, except that the angle may be less than 5 degrees if the barrier or portion of the bottom cover contacts a vertical barrier or side panel of noncombustible material, or if the horizontal extension of the barrier (B) to (D) would exceed 6 inches (152 mm).

D – Minimum outline of the barrier, except that the extension B – D need not exceed 6 inches (152 mm) (flat or dished with or without lip or other raised edge). The bottom of the barrier may be flat or formed in any manner provided that every point of area (D) is at or below the lowest point on the outer edge of the barrier.

Table 6.1
Cast-metal electrical enclosures

Use, or dimensions of area involved ^a	Minimum thickness, inch (mm)	
	Die-cast metal	Cast metal of other than the die-cast type
Area of 24 square inches (115 cm ²) or less and having no dimensions greater than 6 inches (152 mm)	1/16 (1.6)	1/8 (3.2)
Area greater than 24 square inches (155 cm ²) or having any dimension greater than 6 inches (152 mm)	3/32 (2.4)	1/8 (3.2)
At a threaded conduit hole	1/4 (6.4)	1/4 (6.4)
At an unthreaded conduit hole	1/8 (3.2)	1/8 (3.2)
^a The area limitation for metal 1/16 inch (1.6 mm) in thickness may be obtained by the provision of reinforcing ribs subdividing a larger area.		

6.4 Nonmetallic

6.4.1 Among the factors to be taken into consideration when determining the acceptability of a nonmetallic enclosure are:

- Mechanical strength;
- Resistance to impact;
- Moisture-absorptive properties;
- Flammability and resistance to ignition from electrical sources;
- Dielectric strength, insulation resistance, and resistance to arc tracking; and
- Resistance to distortion and creeping at temperatures to which the material may be subjected under any conditions of use.

All these factors are to be considered with respect to aging in accordance with the Polymeric Materials Tests, Section 52. See the Mechanical Strength Tests for Enclosures, Section 51.

6.5 Doors and covers

6.5.1 An enclosure cover shall be hinged, sliding, or similarly attached so it cannot be removed if it gives access to fuses or any other overcurrent protective devices, the intended functioning of which requires renewal; or is necessary to open the cover in connection with the intended operation of the unit.

Exception: If its position is supervised by a tamper contact connected in the closed protective circuit, an enclosure cover need not comply with these requirements.

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

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

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

- 1) Single sheet with single formed flanges (formed edges),
- 2) A single sheet that 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 that are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a continuous flange at least 1/2 inch (12.7 mm) wide.

Table 6.3
Minimum thickness of sheet metal for electrical enclosures —
aluminum, copper, or brass

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

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

- 1) Single sheet with single formed flanges (formed edges),
- 2) A single sheet that 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.

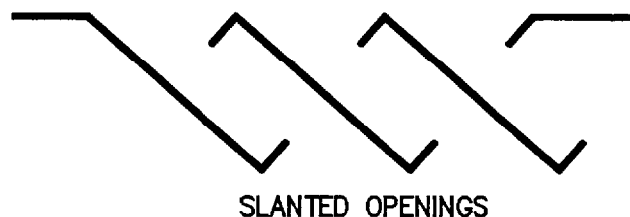
^c For panels that are not supported along one side, for example, side panels of boxes, the length of the unsupported side shall be limited to the dimensions specified unless the side in question is provided with a continuous flange at least 1/2 inch (12.7 mm) wide.

6.5.2 Fasteners requiring the use of a tool or key shall be used for all enclosures if access is not required for operation of the signaling unit.

6.6 Enclosure openings

6.6.1 Openings in the enclosure shall be constructed and sized so that foreign objects cannot enter the enclosure directly. See also 5.2.1. See Figure 6.2 for examples of top cover constructions that are considered to comply with this requirement. See also Figure 6.3 for side openings.

Figure 6.2
Cross sections of top cover constructions



EC500

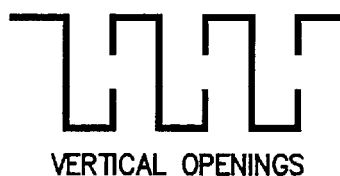
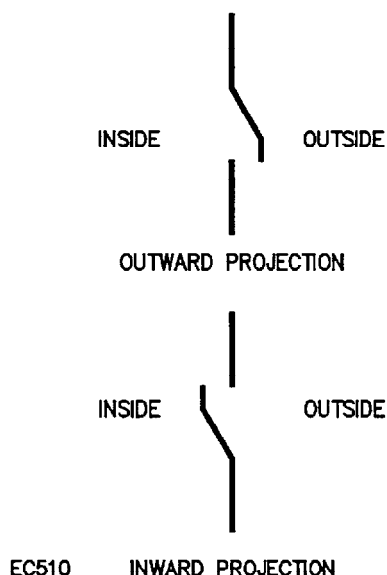


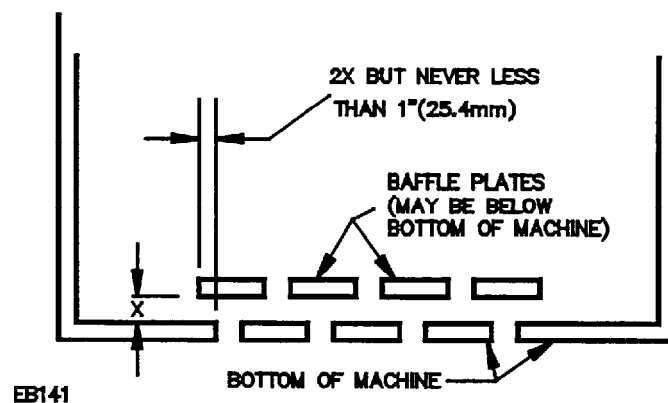
Figure 6.3
Cross sections of side openings



EC510

6.6.2 Openings may be provided in the bottom panels or protective pans under areas containing materials not classified as 94V-1, in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, if constructed so that materials cannot fall directly from the interior of the signaling unit onto the supporting surface or any other location under the signaling unit. Figure 6.4 illustrates a type of baffle that complies with this requirement. A second acceptable construction is a 0.040 inch (1.02 mm) sheet-steel bottom panel in which 5/64 inch (2.0 mm) maximum diameter holes are spaced no less than 1/8 inch (3.2 mm) center-to-center. Other constructions are acceptable if they comply with the requirements in the Abnormal Operation Test, Section 48.

Figure 6.4
Baffle



6.6.3 The bottom of the enclosure under areas containing only materials classified as 94V-1 or less flammable may have openings not larger than 1/16 square inch (40.3 mm²).

6.6.4 Openings are acceptable, without limitation on either size or number of openings, in areas:

- a) Containing only CTFE, FEP, PVC, TFE, and neoprene insulated wire or cable;
- b) Containing plugs and receptacles; and
- c) Underneath impedance protected or thermally protected motors.

6.6.5 Openings in the enclosure shall not give access to any relays, terminals, controls, or related components that might be subject to tampering by hand or with tools.

6.7 Screens and expanded metal

6.7.1 Screens and expanded metal used as a guard, enclosure, or part of an enclosure, shall comply with the requirements in 6.7.2 and 6.7.3 and with the Mechanical Strength Tests for Enclosures, Section 51.

6.7.2 Perforated sheet steel and sheet steel employed for expanded metal mesh shall be not less than 0.042 inch (1.07 mm) thick [0.045 inch (1.14 mm) if zinc coated] if the mesh openings or perforations are 1/2 square inch (323 mm²) or less in area, and shall be not less than 0.080 inch (2.03 mm) thick [0.084 inch (2.13 mm) if zinc coated] for larger openings. The largest dimension shall not exceed 4 inches (102 mm).

Exception: If the indentation of a guard or the enclosure will not alter the clearance between uninsulated live parts and grounded metal so as to impair performance or reduce spacings below the minimum required values, see Spacings, General, Section 24, 0.020 inch (0.51 mm) expanded steel mesh or perforated sheet steel [0.023 inch (0.58 mm) if zinc coated] may be employed, provided that:

- a) The exposed mesh on any one side or surface of the signaling unit protected has an area of not more than 72 square inches (465 cm²) and has no dimension greater than 12 inches (305 mm), or
- b) The width of an opening so protected is not greater than 3-1/2 inches (89 mm).

6.7.3 The wires of a screen shall be not less than No. 16 AWG (1.3 mm diameter) steel if the screen openings are 1/2 square inch (323 mm²) or less in area, and shall be not less than No. 12 AWG (2.1 mm diameter) steel for larger screen openings.

6.8 Enclosure mounting

6.8.1 An enclosure shall have mounting means that are accessible without disassembly of any operating part of the signaling unit. Removal of a completely assembled panel to mount the enclosure is not considered to be disassembly of an operating part.

6.9 Battery compartment (unsealed batteries)

6.9.1 A compartment for storage batteries shall have a total volume not less than twice the volume occupied by the batteries. Ventilating openings shall be provided and located so as to permit circulation of air for dispersion of gas while the battery is being charged at the highest rate permitted by the means incorporated in the control unit.

6.9.2 The interior of a storage battery compartment shall be protected so that it will be resistant to detrimental action by the electrolyte.

7 Corrosion Protection

7.1 Iron and steel parts, other than bearings and the like where such protection is impracticable, shall be protected against corrosion by enameling, galvanizing, sherardizing, plating, or other equivalent means. Bearing surfaces shall be of such materials and construction as to resist binding due to corrosion.

7.2 The requirement in 7.1 applies to all enclosures of sheet steel or cast iron, and to all springs and other parts upon which intended mechanical operation may depend.

Exception No. 1: This requirement does not apply to parts, such as washers, screws, bolts, and the like, if corrosion of such unprotected parts would not be likely to result in a risk of fire, electric shock, or unintentional contact with moving parts that may cause injury to persons, or to impair the operation of the unit.

Exception No. 2: Parts made of stainless steel, polished or treated if necessary, do not require additional protection against corrosion.