

UL 48

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Electric Signs

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The following table lists the future effective dates with the corresponding reference.

Future Effective Date	References
January 2, 2004	Paragraphs, 5.3.3, 10.2.1, 10.2.2, 10.3.1, 16.1A.1, 20.1.8, 20.1.9, 20.1.11, 30A.2, Table 16.1, Figure 20.1

The new and/or revised requirements are substantially in accordance with UL's Bulletin on this subject dated February 4, 2000. The bulletin is now obsolete and may be discarded.

Not all proposals from the February 4, 2000 bulletin have been adopted. Some will be revised and repropose at a later date. Additional revisions, editorial in nature, are included.

The revisions dated July 2, 2001 include a reprinted title page (page 1) for this Standard.

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

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

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover electric signs, referred to as signs, using incandescent lamps, fluorescent lamps, HID lamps, neon tubing and other combinations, for use in accordance with the National Electrical Code, NFPA 70.

1.1 revised July 2, 2001

1.2 The signs covered by these requirements include, and are not limited to, awning signs, channel-letter signs, directional signs, ordinary box signs, recessed signs, trailer-mounted signs, and other similar signs.

1.3 These requirements do not cover units specifically intended for billboard illumination, "EXIT" lights, show-window signs using skeleton neon tubing with exposed wiring, or illuminated clocks in which a potential of 600 volts or less is involved.

1.3 revised July 2, 2001

1.4 These requirements do not cover signs not provided with electrical means for illumination.

1.5 These requirements do not cover signs specifically intended for connection to a circuit of limited power supplied by a Class 2 transformer with 30 volts or less output. These requirements cover signs that incorporate a Class 2 transformer as an integral part of the sign.

1.6 These requirements do not cover the trailer of a trailer-mounted sign.

1.7 These requirements do not cover field-assembled signs for outline lighting. These requirements cover outline lighting that is factory assembled and that is capable of being sectionalized for shipping purposes.

1.8 The following types of signs that do not include words or symbols are also covered by these requirements:

- a) An incandescent-lamp sign provided with a flasher, or means for remote installation of a flasher;
- b) A sign without a face and having a trough, track, or similar parts for field installation of a rigid or a flexible face and advertising material. See 40.1.13;
- c) An illuminated module of a sign used as a spacer between modules containing words or symbols;
- d) An outdoor sign intended for use as outline lighting. See 40.4.1; and
- e) A sign having a blank face that is intended to have advertising material applied prior to the installation of the sign. See 40.1.12.

1.9 These requirements do not cover electronic controls covered by the Standard for Control Centers for Changing Message Type Electric Signs, UL 1433. However, this does not preclude the use of these types of controls in signs when they are used in accordance with 2.1.1.

1.10 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

1.10 revised July 2, 2001

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 A component is not required to comply with a specific requirement that:

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

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

2.1.3 revised July 2, 2001

2.1.4 Specific components are 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.

2.1.4 revised July 2, 2001

2.2 Units of measurement

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

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

2.2.2 added July 2, 2001

2.3 Undated references

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

3 Glossary

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

3.2 ACCESSIBLE PART – A part that is not guarded by its location or by other means and that is capable of being touched by a person.

3.3 AWNING SIGN – A fixed sign having a flexible or rigid plastic face or faces and covering material secured over a supporting frame and which provides protection from weather. Illumination is provided for the signage and may also provide down-lighting on an area intended for pedestrian traffic, a kiosk, or similar types of areas.

3.3 revised July 2, 2001

3.3.1 BARRIER, ACCESSIBILITY– A material provided to limit access to:

- a) Uninsulated live parts,
- b) Dead metal parts that are at a risk of being energized and are not grounded,
- c) Live parts insulated with materials not intended to be subjected to user contact, or
- d) Moving parts that present a risk of injury.

3.3.1 added July 2, 2001

3.3.2 BARRIER, HEAT– A barrier provided to reduce the required spacing, or in place of the required spacing, from a heat producing component.

3.3.2 added July 2, 2001

3.3.3 BARRIER, INSULATING– A barrier provided in place of a required electrical spacing.

3.3.3 added July 2, 2001

3.4 BONDING – The permanent joining of metallic parts to form a positive electrically conductive path that provides electrical continuity between dead metal parts and is capable of conducting any fault current which occurs.

3.5 CANOPY – A device provided with a sign, or separately, that is used to cover an outlet box. A canopy is capable of being secured to an outlet box or to a ceiling.

3.6 CANOPY SIGN – A sign that is supported and suspended from an outlet box by a chain, stem, or cable.

3.7 CIRCUIT TYPES:

a) Class 2 – A circuit involving a potential of not more than 30 volts rms supplied by a primary battery, a Class 2 transformer, or by a combination of a transformer and fixed impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting resistance in series with the supply circuit as a means of limiting the voltage and current is not identified as a Class 2 circuit.

b) Low-Voltage – A circuit involving a potential of not more than 1000 volts, and having characteristics in excess of those of a Class 2 circuit.

c) High-Voltage – A circuit involving a potential of more than 1000 volts.

3.7 revised July 2, 2001

3.8 CONVENIENCE RECEPTACLE – A receptacle that is intended for general use.

3.8 revised July 2, 2001

3.9 DEDICATED RECEPTACLE – A receptacle that is intended for the connection of a specific product.

3.9 revised July 2, 2001

3.10 Deleted July 2, 2001

3.10.1 ENCLOSURE– A material provided to enclose electrical parts and components to contain a risk of fire. All or part of the enclosure may also serve as an accessibility barrier, insulating barrier, or water shield.

3.10.1 added July 2, 2001

3.11 EXPOSED PART – A part that is subjected to handling in normal use without removing a part, such as a door, cover, or other part, the removal of which requires the use of a tool. A live part is determined to be exposed to unintentional contact when it is not guarded or isolated from being inadvertently touched by a person.

3.12 Deleted July 2, 2001

3.13 Deleted July 2, 2001

3.14 GROUNDING – A conductive connection between all exposed dead metal parts capable of becoming energized and all dead metal parts within the enclosure that are exposed to contact during any servicing operation of electrical equipment and the earth or some conducting body that serves in place of the earth.

3.15 GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) – A device intended for protection of persons that functions to de-energize a circuit, or portion thereof, within an established period of time when a current to ground exceeds a predetermined value that is less than that required to operate the supply-circuit overcurrent protective device.

3.16 HIGH-INTENSITY DISCHARGE (HID) LAMP – A lamp that produces light from an electric discharge between electrodes in a gas or vapor at low or high pressure. Common types include mercury vapor and metal halide lamps.

3.17 ISOLATED PART – A part not readily accessible to persons unless special means for access are used.

3.18 LAMP – Incandescent, fluorescent, or HID lighting used in a sign.

3.19 LIVE PART – A metal or other conductive part that has a potential difference during operation with respect to ground or any other conductive part.

3.19.1 NEON TUBE – A small diameter glass cylinder, evacuated of air and filled with an inert gas such as neon, which emits light when excited by a high voltage neon transformer or power supply.

3.19.1 revised July 2, 2001

3.20 OUTLET BOX – A box used on a wiring system, usually an outlet. It is provided with means for connection to a wiring system and intended primarily to enclose splices and wiring devices, and, where permitted, is not prohibited from use as the support of a sign or other equipment intended for similar installation. This box is or is not provided with studs or a bar hanger or with clamps for securing cable, tubing, or conduit.

3.21 OUTLINE LIGHTING – An arrangement of incandescent lighting, fluorescent lamps, HID lamps or neon tubing that outlines or calls attention to certain features such as the shape of a building or the decoration of a window.

3.21 revised July 2, 2001

3.22 POLYMERIC MATERIAL – A material made of a chemical compound mixture formed by polymerization and consisting of repeating structural units. Polymeric materials include thermoplastic, thermosetting, and elastomeric materials. A thermoplastic material is capable of being easily softened and resoftened by repeated heating. A thermosetting material cures by chemical reaction when heated and, when cured, cannot be resoftened by reheating. An elastomeric material is capable of being stretched at room temperature to at least twice its length under low stress and returns to its original length when the stress is released.

3.23 PRESSURE WIRE CONNECTOR – A device that secures one or more wires to a terminal plate, stud, or similar device without the use of solder.

3.24 QUALIFIED SERVICING – Any servicing performed by persons trained to repair and operate the equipment, and who are familiar with the risks involved. Some examples of qualified servicing include the replacing of components such as ballasts, lampholders, switches, and neon tubing. See 3.38 for "user servicing" operations.

3.24 revised July 2, 2001

3.25 RACEWAY – An enclosed channel designed for holding wires or cables with additional functions in compliance with this standard.

3.26 RECESSED SIGN – A sign intended to be installed in a cavity behind a wall surface so that part of the sign is behind the wall surface.

3.27 SECTION SIGN – A sign consisting of preassembled sections (for shipping purposes) which, when connected in the field, form a complete sign.

3.28 SIGN – A self-contained, cord- or permanently-connected, electrically illuminated product, usually with advertising or other words, numbers, or symbols, intended for use in a nonresidential environment to convey information or attract attention.

3.29 SIGN, FIXED – A sign intended to be permanently connected to an electrical source of supply.

3.29 revised July 2, 2001

3.30 SIGN, PORTABLE – A sign that has a power-supply cord for connection to a power supply circuit. A portable sign is provided with a concealed, nonpermanent, means for mounting, such as keyhole slots.

3.31 SIGN, STATIONARY – A cord-connected sign that is not portable.

3.32 SIGN BODY – An external portion of a sign that is not relied upon to enclose current-carrying parts as required in 5.1.1 and which is not prohibited from providing protection from the weather.

3.33 Deleted July 2, 2001

3.34 SPLICE – Any point where one wire is connected to another wire. A wire terminating at a pressure wiring terminal, wire binding screw, or electrode lead is not identified as a splice.

3.35 STRAIN-RELIEF – A knot, bushing, or other means determined to be equivalent as intended to prevent strain from being transmitted to a wire or cord at a termination point inside a sign.

3.36 TEMPERED GLASS – Glass that has been treated so that, when broken, it dices into fragments not larger than 1 square inch (6.5 cm²), without splintering or producing sharp edges on any piece.

3.37 Revised and relocated as 3.19.1 July 2, 2001

3.38 USER SERVICING – Any servicing that is performed by persons other than those trained to maintain a particular sign. Replacement of neon tubing is not determined to be user servicing. Some examples of user servicing are:

- a) Attaching an accessory by means of separable connectors, or by means of an attachment plug to a dedicated receptacle.
- b) Resetting or replacing a protective device in a sign or a receptacle circuit that is overloaded by the user.
- c) Resetting a circuit breaker or replacing a fuse, automatic starter, or lamp, that is accessible without the use of a tool.
- d) Changing of advertising material and routine cleaning.

3.38 revised July 2, 2001

3.39 WATER SHIELD– A material relied upon to reduce or prevent the entrance of water into a sign or onto current-carrying parts within a sign.

3.39 added July 2, 2001

CONSTRUCTION

4 General

4.1 A portable, cord-connected sign for outdoor use shall use incandescent or fluorescent lamps, or a combination of the two.

4.2 A sign shall be formed and assembled so that it has the strength and rigidity to resist the abuses to which it is to be subjected, without resulting in a 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.

4.3 An enclosure, an opening, a frame, a guard, a knob, a handle, or similar parts, shall not be so sharp as to result in a risk of injury to persons in normal operation and user servicing.

4.4 When the construction of a sign is such that the acceptability of the sign cannot be determined due to potentially combustible materials being in close proximity to heat generating components, the sign shall comply with the Temperature Test, Section 36.

5 Frame and Enclosure

5.1 General

5.1.1 All wiring and each current-carrying part shall be enclosed in metal.

Exception No. 1: Lampholder contacts, fluorescent-lamp starters, and starter-holder contacts, and Class 2 circuitry are not required to be enclosed.

Exception No. 2: The integral leads of a lamp-supported lampholder can be exposed for no greater than 4 inches (101.6 mm).

Exception No. 3: The portion of a power-supply cord that is visible during normal operation of a sign, including relamping or changing advertising material, is not required to be enclosed.

Exception No. 4: A live part inside:

- a) An enclosed ballast of an indoor sign,*
- b) A weather-proof ballast, or*
- c) A Type 2 outdoor ballast*

is not required to be additionally enclosed.

Exception No. 5: Flexible cord as specified in Exception Nos. 1 – 4 of 19.1.3.2, and flexible conductors as specified in 19.1.3.1, are not required to be enclosed.

Exception No. 6: Parts are not prohibited from being enclosed in other material that has been investigated and determined to be capable of being used for the purpose.

5.1.1 revised July 2, 2001

5.1.2 In a canopy sign supply conductors (including conductors from the sign, outlet box, or from a canopy switch) and the splices between these conductors are determined as being enclosed between the canopy and the building wall or ceiling when:

- a) The conductors and splices are concealed when the sign is installed;
- b) The maximum dimension of the canopy (measured as the diameter of a round canopy, the longest side of a triangular canopy, the diagonal of a square or rectangular canopy, or the longest diagonal of a multisided canopy) is not more than 15 inches (380 mm); and
- c) The conductors are of such length that the splices are capable of being located in the outlet box.

5.1.2 revised July 2, 2001

5.1.3 Among the factors that are to be evaluated when determining whether a nonmetallic enclosure or other part of a sign is capable of being used consist of the following:

- a) Mechanical strength,
- b) Resistance to impact,
- c) Moisture absorptive properties,
- d) Combustibility,
- e) Resistance to arcing,
- f) Resistance to temperatures to which the material is subjected under conditions of normal or abnormal use, and
- g) Aging characteristics.

5.1.4 A polymeric enclosure of a sign shall comply with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

5.2 Thickness of sheet metal enclosures

5.2.1 The thickness of sheet metal shall not be less than specified in Table 5.1 when evaluated in accordance with 5.2.2.

5.2.2 The thickness of a sheet is to be determined from five micrometer readings spaced equally across the width edge (usually the short edge) of the full sheet as rolled. No micrometer reading is to be taken within 1 inch (25.4 mm) of either side, length or edge.

5.2.3 A separate enclosure for a transformer or ballast shall have a wall thickness not less than that required for the enclosure of the sign.

5.3 Openings

5.3.1 Caulking compound used to seal an opening in a sign body shall be nonhardening and shall not be used in a location where it is disturbed during relamping when required for the sign to comply with the Exclusion of Water Test, Section 32.

Table 5.1
Thickness of sheet metal enclosures

Table 5.1 revised July 2, 2001

Type of sign	Minimum thickness					
	Uncoated steel, stainless steel, or terneplate,		Zinc-coated steel,		Aluminum, copper or copper-base alloys,	
	inch	(mm)	inch	(mm)	inch	(mm)
Incandescent lamp other than outline lighting	0.013	0.33	0.016	0.41	0.020	0.51
Fluorescent or HID lamp, or neon tubing with or without incandescent lamps, or a sign for outline lighting ^a	0.016 ^b	0.41	0.019 ^b	0.48	0.025	0.64
	0.020	0.51	0.023	0.58		
Canopy sign having a pull-type canopy switch or a switch knockout in the rim of the canopy	0.025 ^c	0.64	0.025 ^c	0.64	0.025 ^c	0.64
Raised or channel letters supporting any lamp or neon tube ^d						
a) No dimension exceeding 15 inches (381 mm)	0.013	0.33	0.016	0.41	0.020	0.51
b) Any dimension exceeding 15 inches	0.016	0.41	0.019	0.48	0.025	0.64
At a point on a sign where a permanent wiring system (conduit) is to be connected	0.026	0.66	0.029	0.74	0.040	1.02
At a point on a sign where the enclosure acts as a terminal plate for a wire binding screw. See 18.14.	0.050 ^e	1.27	0.050 ^e	1.27	0.050 ^e	1.27
^a For a cord-connected, fluorescent-lamp sign, the thickness of sheet metal provided for other than the electrical enclosure is not prohibited from being less than that specified; and shall not be less than that required for an incandescent-lamp sign. ^b Only when the sheet is ribbed, corrugated, or embossed over its entire surface so as to give strength not less than that of a flat sheet having a minimum thickness of 0.020 inch (0.51 mm). This is accomplished by providing not less than four corrugations per inch and not less than 0.011 inch (0.28 mm) in depth. ^c A lesser thickness is not prohibited from being used when the rim is reinforced by turning: 1) The metal 180 degrees or more or 2) A right-angle flange, 1/8 inch (3.2 mm) or more wide, at the rim.						

Table 5.1 Continued on Next Page

Table 5.1 Continued

Type of sign	Minimum thickness			
	Uncoated steel, stainless steel, or terneplate, inch (mm)	Zinc-coated steel, inch (mm)	Aluminum, copper or copper-base alloys, inch (mm)	
^d When the letter encloses or supports any electrical parts other than neon tubing, the thickness of the metal shall not be less than that specified for the main enclosure. ^e A thickness of 0.030 inch (0.76 mm) is not prohibited from being used when tightening the wire-binding screw with a torque of 20 inch-pounds (2.26 N-m) does not strip the threads from the metal.				

5.3.2 The following types of conduit, tubing, and cable are capable of being used as an enclosure of internal wiring of a sign:

- a) Flexible metallic tubing – only for indoor signs and for wiring operating at a potential of 1000 volts or less,
- b) Flexible metal conduit,
- c) Electrical metallic tubing,
- d) Liquid-tight flexible metal conduit,
- e) Intermediate metal conduit,
- f) Rigid metal conduit,
- g) Rigid nonmetallic conduit – only for indoor incandescent and fluorescent signs unless marked for above-ground use,
- h) Armored cable, and
- i) Metal-clad cable.

5.3.3 Rigid conduit, rigid tubing, flexible conduit, and flexible tubing smaller than 1/2 inch (12.7 mm) trade size, shall not be used.

Exception: Factory installed wiring that is internal to a sign body or enclosure that operates at no more than 1000 volts is not prohibited from being installed in 3/8 inch (9.5 mm) trade size flexible conduit or tubing.

Revised 5.3.3 effective January 2, 2004

5.3.4 Fittings and connectors for the connection of conduit, tubing, and cable, as indicated in 5.3.2 shall be provided and identified for use with the specific type of conduit, tubing, and cable to which they are to be connected.

5.3.5 The conduit, tubing, and cable types specified in 5.3.2 (c) – (g) and (i) are not prohibited from being used within signs in which contact with water occurs as a result of the Exclusion of Water Test, Section 32. Unless intended for wet locations, all fittings shall be located or oriented so that contact with water does not occur.

5.3.6 Rigid nonmetallic conduit within a sign body shall not be exposed to sunlight, or to the illumination from neon tubing or a high-intensity-discharge lamp.

Exception: This requirement does not apply to rigid nonmetallic conduit that is marked as intended for exposure to ultraviolet light or has been investigated and determined to be capable of being used for such exposure.

5.3.6 revised July 2, 2001

5.3.7 The conduit, tubing, and cable types specified in 5.3.2 (c) – (f) and (i) are not prohibited from being used in exposed outdoor applications.

5.3.8 Armored cable types are not prohibited from being used in exposed outdoor applications when identified and marked for such use.

5.3.9 The conduit, tubing, and cable indicated in 5.3.2 shall be supported at intervals not greater than those specified in Table 5.2.

Table 5.2
Maximum distance between supports for conduit, tubing, and cable

Type	Feet	(meters)
Rigid nonmetallic conduit	3	0.91
Flexible metallic tubing	3	0.91
Metal-clad cable	6	1.83
All flexible metal conduit and armored cable	4.5	1.37
All rigid metal conduit	10	3.05
Electrical metallic tubing	10	3.05

6 Ventilating Openings

6.1 Ventilating openings shall not affect the strength and rigidity of a sign.

6.2 An enclosure that is not integral to a ballast, transformer, neon transformer or power supply, motor, clock motor, or other similar part shall:

- Be provided with no ventilation openings when the ballast, transformer, motor, clock motor, or other similar part is an open core-and-coil device or is a neon transformer or power supply with a Type 1 designation or
- Be provided with no ventilation openings on the bottom surface when the ballast, transformer, motor, clock motor, or other similar parts has a coil having its own enclosure (enclosed) or is a neon transformer or power supply with other than a Type 1 designation. The surface identified as the bottom shall be determined with the enclosure in the intended installation orientation.

6.2 revised September 3, 1998

6.3 A ventilating opening is not prohibited from being located in a sign body when the construction complies with the Exclusion of Water Test, Section 32.

6.4 A ventilating opening shall be covered by screening, expanded metal, or other means determined to be equivalent, when the opening is a slot or louver more than 3/8 inch (9.5 mm) wide or more than 1-1/2 square inches (9.68 cm²) in area, or when any other ventilating opening is more than 1/2 inch (12.7 mm) in diameter or 1/4 square inch (1.61 cm²) in area. An opening in the screening, expanded metal, or other means determined to be equivalent shall not permit the passage of a rod having a diameter larger than 1/2 inch.

Exception: The covering is not required when:

- a) The opening does not permit the entrance of a rod with a diameter of 1/2 inch and*
- b) Baffles or overlapping sections of the enclosure, changes in the direction of the path through the opening, orientation of the path, or other means are provided to reduce the likelihood of debris entering the enclosure.*

7 Glass Panels and Letters

7.1 General

7.1.1 Glass panels and letters shall comply with the requirements in 7.1.3 – 7.3.7 or shall have such strength and be supported in a manner determined to be equivalent.

7.1.2 Each glass panel and letter shall be of safety glass or wired glass. See 7.1.3.

Exception: Panels and letters of plain glass are capable of being used when breakage does not permit contact from the exterior with an uninsulated, current-carrying part other than the lamp or contacts of a lampholder.

7.1.3 Glass panels shall not be used in outdoor cord-connected signs to form the enclosure required by 5.1.1.

7.1.4 A sectionalized-glass panel and a leaded-glass panel shall provide strength, rigidity, water exclusion, and protection against corrosion in a manner determined to be equivalent to that of a plain glass panel of the same area.

7.1.5 Glass panels or letters are not required to be mounted in signs prior to shipment but shall be available for inspection.

7.2 Thickness

7.2.1 The thickness of glass used for panels shall not be less than specified in Table 7.1. The glass thickness specified in Table 7.1 is capable of being used as part of any sign enclosure, except as indicated in 7.1.2 and 7.1.3.

Table 7.1
Thickness of glass panels

Maximum size of glass panel				Minimum thickness of glass, ^a			
Any dimension of exposed area,		Exposed area,					
inches	(mm)	square inches	(m ²)	inch	(mm)	inch	(mm)
—	—	150	0.097	0.094	3.2	0.125	3.2
30 ^b	762	500	0.32	0.125	3.2	0.125	3.2
50 ^b	1270	700	0.45	0.188	4.8	0.188	.8
—	—	1000	0.65	0.250	6.4	0.250	6.4
144	3658	3600	2.3	0.250	6.4	0.250	6.4
Over 144	3658	Over 3600	2.3	Investigation required			

^a A minus tolerance of 0.010 inch (0.25 mm) applies to ordinary glass, and a minus tolerance of 0.031 inch (0.79 mm) applies to plate glass.

^b This dimensional limitation does not apply to glass panels in indoor signs unless the thickness is required to be as specified for outdoor signs.

7.2.2 A glass panel that is to be used to form the enclosure, as required by 5.1.1 for an indoor sign, shall be of the thickness specified for outdoor signs in Table 7.1.

7.2.3 The thickness of tempered flat glass, a glass lens, glass that is curved or bent, and glass having a fluted or ribbed surface, shall provide the mechanical strength determined to be equivalent to that of flat glass having the minimum thickness specified in Table 7.1.

7.2.4 The thickness of curved or bent glass shall not be less than that specified in Table 7.1 for the next smaller area range.

7.2.5 The minimum thickness of fluted or ribbed glass is to be measured over the rib unless the dimension of the glass along the rib is less than the dimension transverse to the rib.

7.2.6 The minimum thickness of glass having concentric ribbing is to be measured to the valley and is not to be less than that specified in Table 7.1 for the next smaller area range, and not less than 3/32 inch (2.4 mm).

7.2.7 The thickness of glass used for individually molded letters not more than 30 inches (762 mm) in any dimension shall be 1/8 inch (3.2 mm) or more.

7.2.8 The thickness of a letter larger than 30 inches (762 mm) in any dimension shall be such that it is at least as strong as a 30-inch letter that is 1/8 inch (3.2 mm) thick.

7.3 Support

7.3.1 There shall not be less than one clip on each side of a glass panel for each 6-inch (152-mm) length of glass, and clips shall not be spaced more than 3 inches (76.2 mm) nor less than 1-1/2 inches (38.1 mm) from corners of a glass panel.

Exception No. 1: An indoor sign having an exposed area of a glass panel of not more than 1000 square inches (0.64 m²), with the panel not relied on to provide the enclosure required by 5.1.1, is capable of using one clip for each 8 inches (203 mm) of edge, as determined by dividing the perimeter of the panel in inches by eight. The distance between adjacent edges of any two clips shall be 16 inches (406 mm) or less. A double clip, having a pair of fingers, each of which complies with the requirements in 7.3.3 is identified as being two clips.

Exception No. 2: For clips used with a raised-glass letter that is constructed to fit closely into an opening cut in the sheet-metal face, the spacing between clips is capable of being increased so that one clip is provided for each 8 inches of glass edge. Clips are not prohibited from being omitted on a side edge that is not more than 8 inches long. One clip is capable of being used on a side edge that is not more than 10 inches (254 mm) long. One clip is capable of being used on a top edge and on a bottom edge that is not more than 12 inches (304 mm) long, when each side edge is provided with a clip for every 6 inches of glass edge.

7.3.2 A clip or trough for securing an individually-molded letter in a sign shall overlap the glass not less than 1/2 inch (12.7 mm). The thickness of the clip or trough shall be as indicated in Table 7.2 or 7.3 for an indoor sign having an exposed area of glass of less than 1000 square inches (0.64 m²).

Exception: A raised-glass letter of the 6-inch (152-mm) trade size or smaller and constructed to fit closely into an opening cut in the sheet metal is capable of being held by clips having a 1/4 inch (6.4 mm) overlap when one clip is provided on each edge.

7.3.3 The dimensions of clips for securing glass panels in signs shall be as specified in Table 7.2.

7.3.4 Clips of materials other than steel, copper, aluminum, or alloys of these metals are capable of being used when investigated and determined to comply with the requirements for support.

Table 7.2
Dimensions of clips

Type of sign	Exposed area of glass panel, square inches (m ²)		Minimum dimensions									
			Thickness						Width, inch (mm)		Overlap, inch (mm)	
			Zinc-coated steel,		Uncoated steel,		Aluminum or copper,					
	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
Indoor ^a	150 or less	0 – 0.097	0.017	0.43	0.016	0.41	0.020	0.51	3/32	2.4	3/16	4.8
	151 – 500	0.097 – 0.32	0.017	0.43	0.016	0.41	0.020	0.51	1/4	6.4	1/4	6.4
	501 – 1000	0.32 – 0.65	0.017	0.43	0.016	0.41	0.020	0.51	1/2	12.7	1/2	12.7
Outdoor	500 or less	0 – 0.32	0.017	0.43	–		0.020	0.51	1/2	12.7	1/2	12.7
	Over 500	Over 0.32	0.036	0.91	–		0.043	1.09	1/2	12.7	1/2	12.7

^a Shall be as specified for outdoor signs when the panel is relied on to form the enclosure required by 5.1.1.

Table 7.3
Dimensions of troughs

Type of sign	Exposed area of glass panel, square inches (m ²)		Minimum thickness							
			Zinc-coated steel,		Uncoated steel,		Aluminum or copper,		Minimum overlap,	
			inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
Indoor ^a	150 or less	0 – 0.097	0.017	0.43	0.016	0.41	0.020	0.51	3/16	4.8
	151 – 500	0.097 – 0.32	0.017	0.43	0.016	0.41	0.020	0.51	1/4	6.4
	501 – 1000	0.32 – 0.65	0.017	0.43	0.016	0.41	0.020	0.51	1/2	12.7
	Over 1000	Over 0.65	0.025	0.64	–	–	0.035	0.89	1/2	12.7
Outdoor	500 or less	0 – 0.32	0.017	0.43	–	–	0.020	0.51	3/8	9.5
	Over 500	Over 0.32	0.025	0.64	–	–	0.035	0.89	1/2	12.7

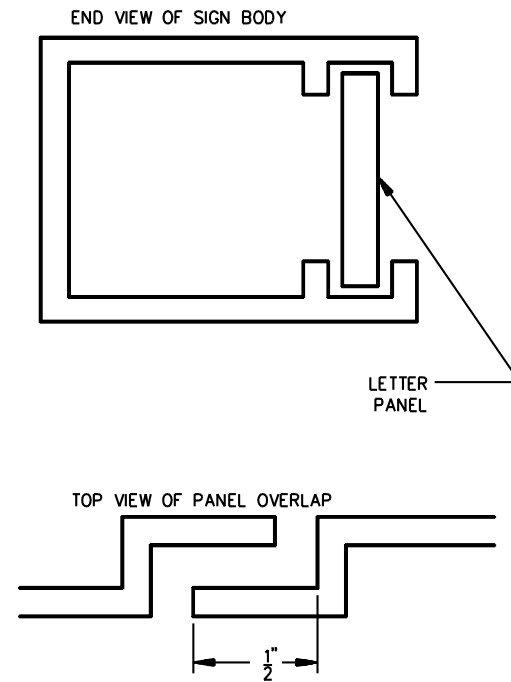
^a The dimensions of troughs for securing glass panels or letters are to be as specified for outdoor signs when the panel or letters form the enclosure required by 5.1.1.

7.3.5 Continuous troughs or glazing angles shall be used when the exposed glass area is more than 1000 square inches (0.64 m²).

7.3.6 The dimensions of a continuous trough for securing a glass panel in a sign shall be as specified in Table 7.3.

7.3.7 Individual sheet-metal sections supporting glass letters or panels, such as are used in signs with interchangeable letters where end clips are not feasible, shall be supported at top and bottom edges by troughs in the sign body. Each letter panel shall have an offset not less than 1/2 inch (12.7 mm) wide extending the length of one vertical edge so as to form a closely fitting overlap with the adjacent panel. See Figure 7.1.

Figure 7.1
Details of panel mounting



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8 Panels and Diffusers Other Than Glass

8.1 General

8.1.1 A diffuser or panel of thermoplastic material shall be securely supported.

8.1.2 A support clip or trough of material other than steel, copper, aluminum, or an alloy of these metals is capable of being used when investigated and determined to comply with the requirements.

8.2 Decorative and structural parts other than glass

8.2.1 Rigid external decorations, letters, and panels of a sign are capable of being of thermoplastic material, wood, or of other material at least as resistant to combustion when all of the following conditions are met:

- a) The material does not contact any neon tube, fluorescent lamp, or fluorescent-lamp starter.
- b) Combustible material is not subjected to temperature higher than the maximum limit; wood shall not be subjected to a temperature of more than 90°C (194°F).
- c) The material is maintained not less than 2 inches (50.8 mm) from a lampholder, starter-holder, the inside of the rim of an electrode receptacle, live metal, incandescent lamp, and other parts that are a source of heat or arcing.

Exception No. 1: In an indoor sign using fluorescent lamps only, the spacing shall not be less than 1/2 inch (12.7 mm).

Exception No. 2: In an indoor cord-connected sign using both fluorescent and incandescent lamps, the spacing from a fluorescent-lamp lampholder only to the material shall not be less than 1/2 inch.

Exception No. 3: A heat barrier of nonabsorptive material that has been determined to be at least as resistant to combustion as phenolic or similar thermosetting material is capable of being used instead of the required spacing when the heat barrier is not removable or constructed so that it must be replaced after repairing or relamping of the sign.

Exception No. 4: A polymeric material that has been investigated and determined to comply with the requirements for polymeric tube supports in 21.3.1 and 21.3.2, is capable of being spaced closer to, or in direct contact with, a neon tube, fluorescent lamp, fluorescent-lamp starter, or other source of heat.

Exception No. 5: The material is capable of being spaced 1 inch (25.4 mm) from a transformer, power supply or ballast when there is only one transformer, power supply or ballast within an enclosed compartment, or spaced 1/2 inch from a transformer, power supply or ballast when the transformer, power supply or ballast is not within an overall enclosure.

8.2.1 revised July 2, 2001

8.2.2 A flexible polymeric material used as external decorations, letters, and panels of a sign shall:

- a) Comply with the requirements in 5.1.3 and 5.1.4 and
- b) Be secured to the sign along the entire periphery of the material.

Exception: A non-continuous clamping or tensioning system for flexible material is not prohibited from being used when the system has been separately investigated and determined to be capable of being used for the application and is resistant to deterioration by aging.

9 HID Lamp Signs

9.1 A HID lamp sign shall comply with the Temperature Test, Section 36, unless all of the following conditions are met.

- a) All ballasts, wiring, and similar components are enclosed in metal. Also see Ballasts and Transformers, Section 27.
- b) The lamp watts-per-cubic foot does not exceed 26 watts per cubic foot (918 W/m³) and is to be determined by the following formula:

$$W/ft^3 = \frac{\text{Total Lamp Watts}}{\text{Length} \times \text{Width} \times \text{Height}}$$

(inside dimensions of lamp compartment)

- c) Spacing between a HID lamp and a polymeric material, between a HID lamp and an adjacent ballast, or a HID lamp and other components, complies with the clearances specified in Table 9.1.
- d) A light diffuser/heat barrier does not have openings exceeding 3/4 inch (19.1 mm) in any direction and has an opening-to-metal ratio not exceeding 1:1.
- e) No individual HID lamp exceeds 400 watts.

Table 9.1
Minimum clearances between HID lamps and components

Maximum lamp size, watts	Interposed metal light diffuser/heat barrier	Clearance,	
		inches	(mm)
250 or less	No	9.0	229
250 or less	Yes	7.0	178
400	No	12.0	305
400	Yes	9.0	229
NOTE – A minimum clearance of 24 inches (610 mm) is required between an HID lamp and combustible material located directly above the lamp.			

9.2 A HID lamp compartment shall be provided and shall be constructed of:

- a) 1/8 inch (3.2 mm) thick minimum tempered glass;
- b) 1/8 inch thick minimum material having a flammability classification of 5VA, 5VB, V-0, or V-1, when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94;

Exception: Any 1/8-inch thick minimum polymeric material is capable of being used when it is positioned such that pieces of a ruptured lamp cannot come to rest on the material.

- c) A metal screen having maximum 1/16 inch (1.6 mm) openings; or
- d) A flexible polymeric material that complies with the requirements of 8.2.2.

9.2 revised May 14, 1999

10 Resistance to Moisture

10.1 Exclusion of water

10.1.1 The sign body, enclosure and doors of an outdoor sign shall exclude water. Seams are not required to be soldered or otherwise treated, and shall be tight and formed to shed water. Openings to accommodate neon tubing or neon tubing receptacles, or bushings shall not be located in the top of the enclosure unless the construction complies with the Exclusion of Water Test, Section 32.

10.1.1 revised July 2, 2001

10.2 Drain openings

10.2.1 An outdoor sign shall be provided with a drain opening at:

- a) The bottom of each of the lowest points of the sign,
- b) Isolated sections of a sign,
- c) Both sides of the pole for pole mounted signs, and
- d) Horizontal troughs or retainers for supporting sign faces, panels or letters.

Additionally, within isolated sections of a sign the distance between drain openings shall not exceed 4 feet (1.22 m) on center.

Exception: The sign body of a sign without a sign face is not required to have drain openings.

Revised 10.2.1 effective January 2, 2004

10.2.2 Each drain opening shall be positioned such that there are no external or internal obstructions and shall be free from burrs. The drain opening shall be on the bottom or bottom edge of the back surface. When circular in shape, a drain opening shall have a diameter of 1/4 – 1/2 inch (6.4 – 12.7 mm). When not circular in shape, a drain opening shall have a minimum dimension of not less than 1/4 inch (6.4 mm) and an area of 0.05 – 0.20 square inch (32.3 – 129.0 mm²). When a drain opening is located at the bottom edge of the back surface of a wall-mounted sign, the construction shall be such that the opening is located at least 1/2 inch (12.7 mm) from the mounting surface of the sign or the sign shall be provided with instructions as specified in Instructions, Section 41, and marked as specified in 40.1.15.

Exception: A barrier provided to block light from exiting the sign through a drain opening shall be spaced at least 1/4 inch (6.4 mm) from the surface provided with the drain opening. The method of securement of the barrier shall not reduce the area of the space between the barrier and the sign to less than the area of the drain opening.

Revised 10.2.2 effective January 2, 2004

10.3 Drain holes

10.3.1 Deleted effective January 2, 2004

10.4 Gaskets

10.4.1 A gasket used to seal a joint so that a sign complies with the requirement in 32.1 shall be of a material that is at least as strong and as resistant to aging as the materials described in 10.4.2.

10.4.2 Neoprene, rubber, neoprene-composition, and rubber-composition gasket materials are capable of being used when they have been separately investigated and determined to be:

- a) Rated or capable of being used for the application and
- b) Resistant to aging. See 33.1.

10.4.3 The gasket shall be secured so that it does not loosen from the mounting means.

10.4.4 The gasket of a gasketed joint that must be opened in order to relamp or change advertising material shall be secured in place by:

- a) Rivets, screws, or similar mechanical means or
- b) Adhesive that has been determined to be capable of being used after an evaluation of the flexibility, exposure resistance, shear strength, and peel resistance of the adhesive.

10.4.5 The gasket and securement of the gasket shall not be damaged when the joint is opened.

11 Provisions for Mounting and Support

11.1 Fixed signs

11.1.1 Each fixed sign or section of such a sign forming a complete assembly shall be provided with means for attaching it to a building or to a support or hanging rig.

11.1.1 revised July 2, 2001

11.1.2 The requirement in 11.1.1 requires the use of channel iron, strap iron, or similar reinforcement at points where attachment is to be made.

11.1.3 A canopy sign weighing 50 pounds (22.7 kg) (including lamps) or less shall be provided with supporting means, such as a strap or crossbar not more than 1-1/2 inches (38 mm) wide, or with one or two pairs of holes or keyhole slots for mounting the sign directly to a 3-1/2 inch (89 mm) or 4 inch (102 mm) outlet box.

11.2.1 revised and relocated as 11.1.3 July 2, 2001

11.1.4 A supporting strap or crossbar shall be secured to the sign by two or more fastenings, and shall not be less than 0.053 inch (1.35 mm) thick when of steel or 0.075 inch (1.91 mm) thick when of other metal.