



UL 963

STANDARD FOR SAFETY

Sealing, Wrapping, and Marking Equipment

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UL Standard for Safety for Sealing, Wrapping, and Marking Equipment, UL 963

Fourth Edition, Dated February 26, 2016

Summary of Topics

This new edition of UL 963 is being issued to add requirements for Electronic Circuits to Paragraphs 4.38, 22.2.1, 25.2, 32.15, and to Supplement SA.

The requirements are substantially in accordance with Proposal(s) on this subject dated December 9, 2015.

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MARCH 3, 2016

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UL 963

Standard for Sealing, Wrapping, and Marking Equipment

Prior to the first edition, the requirements for the products covered by this Standard were included in the Standard for Electric Heating Appliances, UL 499, and the Standard for Motor-Operated Appliances, UL 73.

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Fourth Edition

March 3, 2016

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Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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INTRODUCTION

1 Scope

1.1 These requirements cover household, industrial, and commercial sealing, wrapping, and marking equipment rated at 600 volts or less for use in unclassified locations in accordance with the National Electrical Code, NFPA 70, such as laminators, label makers/applicators, stamping machines, taping machines, wrapping machines, shrink tunnels, bag sealers, bag tying machines, heat sealing irons, and vacuum packaging machines.

1.2 These requirements also cover cord-connected units with an integral cigarette lighter connector assembly, or a direct current (DC) input jack for being powered from a separate Vehicle Battery Adapter.

1.3 These requirements do not cover appliances and equipment that are covered by individual requirements that are separate from this standard, such as soldering irons, ink-jet printers, or photographic film printers.

1.4 These requirements do not cover appliances and equipment that are intended for use in marine or aircraft.

2 Units of Measurement

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

2.2 Unless otherwise indicated, all voltage and current values mentioned in this standard are root-mean-square (rms), and all pressures are calculated in per square inch (psi).

3 Undated References

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 Glossary

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

4.2 APPLIANCE COUPLER – A single-outlet, female contact device for attachment to a flexible cord as part of a detachable power-supply cord to be connected to an appliance inlet (motor attachment plug).

4.3 APPLIANCE INLET (MOTOR ATTACHMENT PLUG) – A male contact device mounted on an end product appliance to provide an integral blade configuration for the connection of an appliance coupler or cord connector.

4.4 APPLIANCE (FLATIRON) PLUG – An appliance coupler type of device having a cord guard and a slot configuration specified for use with heating or cooking appliances.

4.5 AUTOMATICALLY CONTROLLED APPLIANCE – An appliance that complies with one or more of the following conditions:

- a) The repeated starting of the appliance is independent of any manual control if, after one complete cycle of operation, a limit device or similar component opens the circuit;
- b) During any single preset cycle of operation, the motor is caused to stop and restart;
- c) When the appliance is energized, the initial starting of the motor may be intentionally delayed beyond intended, conventional starting; and
- d) For an appliance using a motor with a separate starting winding, during any single predetermined cycle of operation, automatic changing of the mechanical load reduces the motor speed sufficiently to re-establish starting-winding connections to the supply circuit.

4.6 AUXILIARY CONTROL – A control that is intended primarily for time, temperature, or pressure regulation under conditions of intended operation, and not for protection against overload or excessive conditions resulting from abnormal operation.

4.7 BRANCH CIRCUIT – That portion of the building wiring system beyond the final overcurrent device on the power-distribution panel protecting the circuit to the field-wiring terminals in a permanently connected unit or to the receptacle outlet for cord-connected units.

4.8 CABINET – Refers to a housing of a unit that prevents access to a part that involves a risk of injury to persons as a result of hazardous moving parts or hot parts. The use of a cabinet to prevent access to a part that involves a risk of fire, electrical energy – high current levels, or electric shock is permitted.

4.9 CIGARETTE LIGHTER CONNECTOR – The male connector provided as part of a Vehicle Battery Adapter for insertion into a cigarette lighter receptacle.

4.10 CONTROL, AUTOMATIC ACTION – A control in which at least one aspect is non-manual.

4.11 CONTROL, AUXILIARY – A device or assembly of devices that provides a functional utility, is not relied upon as an operational or protective control, and therefore is not relied upon for safety. For example, an efficiency control not relied upon to reduce the risk of electric shock, fire, or injury to persons during normal or abnormal operation of the end product is considered an auxiliary control.

4.12 CONTROL, MANUAL – A device that requires direct human interaction to activate or rest the control.

4.13 CONTROL, OPERATING – A device or assembly of devices, the operation of which starts or regulates the end product during normal operation. For example, a thermostat, the failure of which, a thermal cutout/limiter or another layer of protection would reduce the risk of electric shock, fire, or injury to persons, is considered an operating control.

4.14 CONTROL, PROTECTIVE – A device or assembly of devices, the operation of which is intended to reduce the risk of electric shock, fire or injury to persons during reasonably anticipated abnormal operation of the appliance.

4.15 CONTROL, TYPE 1 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence has not been declared and tested under this standard.

4.16 CONTROL, TYPE 2 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence have been declared and tested under this standard.

4.17 CORD-CONNECTED UNIT – A unit intended for connection to the branch-circuit power line by means of a power-supply cord. By the nature of its construction, such a unit is intended to be removed for reasons of interchange or realignment of the unit of a system.

4.18 CORD CONNECTOR – A female contact device wired on flexible cord for use as an extension from an outlet to make a detachable electrical connection to an attachment plug or, as an appliance coupler, to an equipment inlet.

4.19 ENCLOSURE – Refers to a housing of a unit that prevents access to a part that involves a risk of fire, electrical energy at high current levels, or electric shock. The use of an enclosure to prevent access to a part that involves a risk of injury to persons which is present from hazardous moving parts or hot parts is permitted.

4.20 FIELD-WIRING TERMINAL – Any terminal to which a supply or other wire is to be connected by an installer in the field, unless the wire is provided as part of the unit and a connector, soldering lug, soldered loop, crimped eyelet, pressure terminal, or other means for making the connection is factory-assembled to the wire.

4.21 FIXED EQUIPMENT – Units that are:

- a) Intended for permanent connection to the branch circuit,
- b) Mechanically secured to the surface on which they are intended to be mounted, and
- c) Neither intended by the manufacturer nor constructed for easy removal by service personnel from their intended location for maintenance and repair.

4.22 FLAMMABLE LIQUID – Any liquid having a flash point in accordance with the Standard for Tests for Comparative Flammability of Liquids, UL 340.

4.23 FLASH POINT – The minimum temperature, corrected to a pressure of 101.3 kPa (14.69 psi), at which a liquid gives off vapor within a test vessel in enough quantity to form an ignitable mixture with air above the surface of the liquid.

4.24 GUARD – Refers to a part inside or outside of the enclosure which prevents access to a component that involves a risk of injury to persons.

4.25 IGNITION TEMPERATURE – The minimum temperature to which any part of an air-vapor mixture must be raised by application of heat to produce self-sustained (autogenous) combustion, as indicated by the appearance of flame.

4.26 INTERNAL BARRIER – Refers to a part inside an enclosure which prevents access to a part that involves a risk of electric shock or injury to persons.

4.27 LINE-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit. See 4.28.

4.28 LOW-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 30 volts (42.4 volts peak) and supplied by:

- a) A battery,
- b) A standard Class 2 transformer, or
- c) A transformer with:
 - 1) A fixed impedance,
 - 2) A fuse,
 - 3) A non-adjustable manual-reset circuit-protective device, or
 - 4) A regulating network

which, as a unit, complies with all of the performance requirements of a Class 2 transformer. A circuit derived from a source of supply classified as a line-voltage circuit and a resistance in series with the supply circuit as a means of limiting the voltage and current is not determined to be a low-voltage circuit.

4.29 LOWER FLAMMABLE LIMIT – The minimum concentration of vapor in air below which propagation of flame does not occur on contact with a source of ignition. The lower flammable limit is expressed in terms of percentage by volume of gas or vapor in air based on atmospheric temperatures and pressures.

4.30 OPERATOR ACCESSIBLE AREA – All external surface areas, all internal areas that are capable of being entered without the use of tools, and all areas that the operator is instructed to enter regardless of whether or not tools are required to gain access.

4.31 OPERATOR SERVICING – Any form of servicing that is capable of being performed by personnel other than those who are trained to maintain the unit. Some examples of operator servicing are:

- a) The installation of accessories by means of attachment plugs and receptacles or by means of other separable connectors.
- b) Replacement of lamps and fuses and resetting of circuit breakers located in an operator-accessible area, unless the lamps, fuses, or circuit breakers are marked to indicate replacement or resetting only by qualified service personnel.
- c) The making of routine operating adjustments required to adapt the unit for its different intended functions.
- d) Routine cleaning or servicing.

4.32 PRESSURE-RELIEF DEVICE – A pressure-actuated valve or rupture member intended to relieve excessive pressures automatically.

4.33 PRIMARY CIRCUIT – Wiring and components that are electrically connected to a branch-circuit or an alternating-current or direct-current motor/generator set installed separately from or included as a part of a unit or system.

4.34 RISK OF ELECTRIC SHOCK – A risk of electric shock is determined to occur at any part when the potential between the part and earth ground or any other accessible part is more than 42.4 volts peak or the continuous current flow through a 1500-ohm resistor connected across the potential exceeds 5 milliamperes.

4.35 RISK OF FIRE – A risk of fire is determined to exist at all components and conductors unless the components and conductors are within a circuit which complies with the criteria for Class 2 circuits.

4.36 RISK OF INJURY TO PERSONS – A risk of injury to persons is determined to exist when one or more of the following conditions occur:

- a) Moving parts such as gears and linkages are accessible during intended operation and are capable of resulting in a cut, crush, or laceration.
- b) Sharp edges, burrs, or projections are present that are capable of resulting in injury during use or operator servicing.
- c) The stability of a unit is such that it is capable of resulting in injury to persons.
- d) Moving parts are present for which there is a risk that a part of the body becomes endangered or that clothing becomes entangled by the moving part, resulting in an injury.
- e) Parts maintaining an elevated temperature that are subject to contact by persons by either intentional or casual fashion and capable of causing a burn.

4.37 SAFETY CIRCUIT – Any primary or secondary circuit that is relied upon to reduce the risk of fire, electric shock, injury to persons, or electrical energy at high current levels.

4.38 SAFETY CRITICAL FUNCTION – Control, protection and monitoring functions which are being relied upon to reduce the risk of fire, electric shock or casualty hazards.

4.39 SAFETY INTERLOCK – A means relied upon to prevent access to an area that involves a risk of electric shock, electrical energy at high current levels, or injury to persons until the risk has been removed, or to remove automatically the risk when access is gained.

4.40 SECONDARY CIRCUIT – A circuit supplied from the secondary winding of an isolation transformer and that has no direct connection to the primary circuit (other than through the grounding means). Any circuit that has a direct connection to the line-connected circuit is evaluated as a primary circuit. A secondary circuit is capable of being a low-voltage circuit.

4.41 SUPPLY CORD – A separable cord set or a length of flexible cord, with one end connected to the primary-circuit wiring of the unit and the other end connected to the attachment plug for connection to branch-circuit power.

4.42 TEMPERATURE-LIMITING CONTROL – A control that functions only under conditions that produce abnormal temperatures. The malfunction of such a thermostat is capable of resulting in a risk of fire.

4.43 TEMPERATURE-REGULATING CONTROL – A control that functions only to regulate the temperature of the product under intended conditions of use, and whose malfunction does not result in a risk of fire.

4.44 TEMPERATURE-REGULATING AND -LIMITING CONTROL COMBINATION – A combination temperature-regulating and -limiting control that functions to regulate the temperature of the product under intended conditions of use, and also serves to reduce the risk of fire that results from conditions of abnormal operation.

4.45 THERMISTOR DEVICE – A thermally sensitive semiconductor resistor that is intended to be heated by an electric current and shows a sharp resistance increase over a small temperature range such as Positive Temperature Coefficients (PTC's) and Negative Temperature Coefficients (NTC's).

4.46 TOOL – A screwdriver, wrench, or any other object that is capable of being used to operate a screw, latch, bolt, or similar fastening means.

5 Safety Critical Functions

5.1 Any function involved in the control, protection, and monitoring of safety-related attributes of sealing, wrapping and marking equipment whereby a loss/malfunction of its functionality would represent an unacceptable risk of fire, electric shock, or casualty hazards would be considered a Safety Critical Function.

5.2 Electronic circuits that manage a Safety Critical Function (SCF) shall be:

- a) Reliable as defined as being able to maintain the SCF in the event of single defined component faults and
- b) Not susceptible to electromagnetic environmental stresses encountered in the anticipated environments of the appliance.

5.3 Electronic circuits managing Safety Critical Functions shall comply with:

- a) Requirements for the Evaluation of Electronic Circuits, Supplement SA or
- b) The Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1 and it's Part 2's as specified in this standard. The function shall be considered Class B.

5.4 Functions specified in Safety Critical Functions, Table 5.1 represent the common safety critical circuit functions of microwave ovens. It is not intended to represent all possible safety critical functions.

Table 5.1
Safety critical functions

Function (see 5.1)	Hazard	Location of parameters and tests
Motor running overload protection	Risk of fire or electric shock	Overload protection, 22.2
Motor locked rotor protection	Risk of fire or electric shock	Overload protection, 22.2
Motor short circuit protection	Risk of fire or electric shock	Overload protection, 22.2
Temperature control	Risk of fire or electric shock	25.2
Interlock function to de-energize a motor	Risk of personal injury	Electronic protective controls (limiting controls), 33.4
Loss of phase	Risk of electric shock	Electronic protective Controls (limiting controls), 33.4

CONSTRUCTION

6 General

6.1 Only materials that have been evaluated for the particular use shall be used in these products. A product shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

6.2 When the operation of a product involves the generation and confining under pressure of steam or other gas, risk of explosion incident to such operation shall be evaluated. For example, a product having immersed electrodes, where the electrolysis of water results in the accumulation of oxygen and hydrogen. The product does not comply with the intent of this standard unless its strength has been investigated with regard to any risk of explosion that is capable of occurring.

7 Components

7.1 A component of a product covered by this standard shall:

- a) Comply with the requirements for that component as indicated in the individual section(s) covering that component;
- b) Be used in accordance with its rating(s) established for the intended conditions of use;
- c) Be used within its established use limitations or conditions of acceptability;
- d) Additionally comply with the applicable requirements of this standard; and
- e) Not contain mercury, unless used within a fluorescent, high intensity discharge, or neon lamp bulb.

Exception No. 1: A component of a product covered by this standard is not required to comply with a specific component requirement that:

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

c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.

Exception No. 2: A component complying with a component standard other than those cited in this standard is acceptable if:

a) The component also complies with the applicable component standard indicated in this standard or

b) The component standard:

1) Is compatible with the ampacity and overcurrent protection requirements of the National Electrical Code, ANSI/NFPA 70, where appropriate;

2) Considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and

3) Any use limitations of the other component standard is identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.

7.2 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.

7.3 A component that is also intended to perform other functions, such as:

- a) Overcurrent protection;
- b) Ground-fault circuit-interruption;
- c) Surge suppression;
- d) Any other similar functions; or
- e) Any combination thereof

shall comply additionally with the requirements of the applicable UL standard(s) that cover devices that provide those functions.

Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional component standard(s) need not be applied.

7.4 A component not anticipated by the requirements of this standard, not specifically covered by the component standards noted in this Standard, and that involves a risk of fire, electric shock, or injury to persons, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with 7.1 (b) – (e).

7.5 With regard to a component being additionally investigated, reference to construction and performance requirements in another UL end product standard is suitable where that standard anticipates normal and abnormal use conditions consistent with the application of this standard.

8 Frame and Enclosure

8.1 General

8.1.1 The frame and enclosure of a product shall resist the abuses to be encountered during intended use. The degree of resistance shall reduce the possibility of a condition that results in an increase in the risk of fire, electric shock, or injury to persons.

8.1.2 The strength and rigidity of the frame and enclosure shall comply with the tests described in 67.1 – 67.4, as applicable.

8.1.3 A product shall be provided with an enclosure made of material that has been determined to be capable for use in this application. The enclosure shall house all electrical parts, except a supply cord and a recessed open-wire-element unit as specified in 19.5, that are capable of resulting in a risk of electric shock or injury to persons under any condition of use. When a product is constructed for permanent installation and connection to the power supply, the enclosure shall be provided with means for mounting in the intended manner and shall be furnished with any required fittings, such as brackets or hangers.

8.1.4 When ventilation openings are provided in the enclosure of a product, they shall be located so that they do not vent into concealed spaces of a building structure, such as a false-ceiling space or hollow spaces in the wall when the product is installed.

8.1.5 Among the factors to be determined when evaluating an enclosure are its:

- a) Physical strength,
- b) Resistance to impact,
- c) Moisture-absorptive properties,
- d) Combustibility,
- e) Resistance to corrosion, and
- f) Resistance to distortion at temperatures to which the enclosure is capable of being subjected under conditions of use.

Except for (e), all of the preceding factors shall be used to determine the suitability of a nonmetallic enclosure. A sheet-metal enclosure shall be evaluated with regard to its size, shape, the thickness of metal, and the intended use of the product.

8.1.6 Cast and sheet-metal portions of the enclosure shall not have a thickness less than that indicated in Table 8.1 unless the enclosure complies with 8.1.5.

Table 8.1
Minimum thickness of metal enclosure

Metal	At small, flat, unreinforced surfaces, and at surfaces that are reinforced by curving, ribbing, and similar methods (or are otherwise of a shape and/or size to provide physical strength),		At surfaces to which a wiring system is to be connected in the field,		At large, unreinforced flat surfaces,	
	inch	(mm)	inch	(mm)	inch	(mm)
Die-cast	3/64	(1.2)	–	–	5/64	(2)
Cast-malleable iron	1/16	(1.6)	–	–	3/32	(2.4)
Other cast metal	3/32	(2.4)	–	–	1/8	(3.2)
Uncoated sheet steel	0.026 ^a	(0.66 ^a)	0.032	(0.81)	0.026	(0.66)
Galvanized sheet steel	0.029 ^a	(0.74 ^a)	0.034	(0.86)	0.029	(0.74)
Nonferrous sheet metal	0.036 ^a	(0.91 ^a)	0.045	(1.14)	0.036	(0.91)

^a Thinner sheet metal is not prohibited from being used when it has been determined to be suitable for its intended use when the enclosure is evaluated under considerations such as those specified in 8.1.4.

8.1.7 Electrical parts of a product shall be located or enclosed so as to provide protection against unintentional contact with uninsulated live parts.

8.1.8 The enclosure shall be constructed such that molten metal, burning insulation, or flaming particles are not capable of falling on combustible materials, including the surface upon which the enclosure is supported. The product shall be provided with a barrier of metal, phenolic, urea, ceramic, or similar material located:

a) Under a motor unless:

- 1) The structural parts of either the motor or the product are determined to be the equivalent of such a barrier;
- 2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the product when the motor is energized under each of the following fault conditions:
 - i) Open main winding,
 - ii) Open starting winding, and
 - iii) Short-circuited starting switch;
- 3) The motor is provided with a thermal motor protector that limits the motor winding temperature to maximum 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle, and to maximum 150°C (302°F) with the rotor locked; and

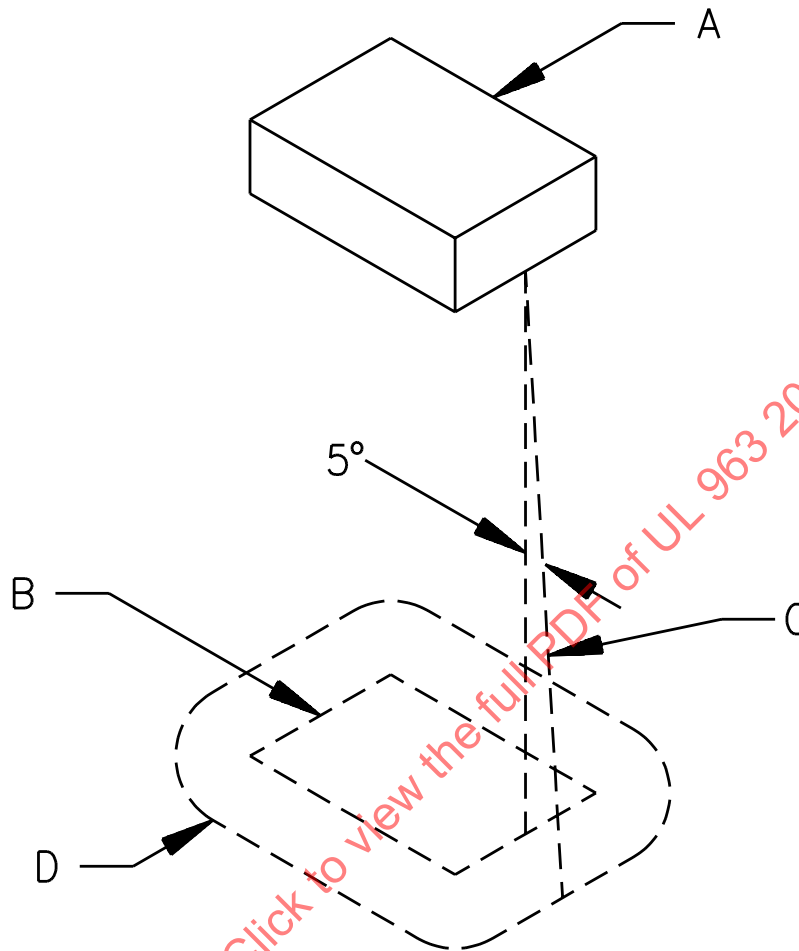
4) The motor complies with the Standard for Thermally Protected Motors, UL 1004-3.

b) Under wiring, unless the wiring complies with the VW-1 flame test in the Standard for Thermoplastic-Insulated Wires and Cables, UL 83.

8.1.9 The barrier specified in 8.1.8 shall be horizontal and shall be located and sized as indicated in Figure 8.1. Openings for drainage or ventilation are not prohibited as long as molten metal, burning insulation, or flaming particles are not capable of falling through the opening onto combustible material.

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Figure 8.1
Location and extent of barrier



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A – Region to be shielded by barrier. This consists of the entire component when it is not otherwise shielded and is to consist of the unshielded portion of a component that is partially shielded by the component enclosure or part that has been determined to be equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. The line is always:

- 1) Tangent to the component,
- 2) Five (5) degrees from the vertical, and
- 3) Oriented so that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

8.1.10 A component such as a switch, transformer, relay, solenoid, or similar components shall be individually and completely enclosed unless it is determined that malfunction of the component does not result in a fire, electric shock, or risk of injury to persons, or unless there are no openings in the bottom of the enclosure. An opening in the bottom of the enclosure does not comply with the intent of this requirement when it is located directly below field or factory-made splices or overload or overcurrent protective devices.

8.2 Accessibility

8.2.1 To reduce the risk of unintentional contact of uninsulated live parts or film-coated wire that is capable of involving a risk of electric shock or injury to persons, an opening in an enclosure shall comply with either of the following items:

- a) For an opening that has a minor dimension less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the articulate probe illustrated in Figure 8.2 or
- b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 8.2.

See 8.2.3 for a definition of the minor dimension of an opening.

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Table 7.2
Minimum distance from an opening to a part that involves a risk of electric shock or injury to persons

Minor dimension of opening, ^a		Minimum distance from opening to part,	
inches ^b	(mm) ^b	inches	(mm)
1	(25.4)	6-1/2	(165)
1-1/4	(31.8)	7-1/2	(190)
1-1/2	(38.1)	12-1/2	(318)
1-7/8	(47.6)	15-1/2	(394)
2-1/8	(54.0)	17-1/2	(444)
6 ^c	(152.0 ^c)	30	(762)

^a See 8.2.3.
^b Between 1 and 2-1/8 inches, interpolation is to be used to determine a value between values specified in the table.
^c More than 2-1/8 inches, but not more than 6 inches (152 mm).

8.2.2 Unless otherwise specified, the probe illustrated in Figure 8.2 shall be applied to any depth that the opening permits, and shall be rotated or angled before, during, and after insertion through the opening to any position that is required to examine the enclosure. The probe shall be applied in any possible configuration; and, when required, the configuration shall be changed after insertion through the opening.

8.2.3 The minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that is capable of being inserted through the opening.

8.2.4 The probe illustrated in Figure 8.2 shall be used as a measuring instrument to evaluate the accessibility provided by an opening, and not as an instrument to evaluate the strength of a material; it shall be applied with the minimum force required to determine accessibility.

8.2.5 During the examination of the product for compliance with the requirements in this section, a part of the outer enclosure that is capable of being removed by the user without the use of tools is to be disregarded, that is, it is not to be assumed that the part in question affords protection against the risk of electric shock. A warning marking, such as that specified in 75.2, is not determined to eliminate this risk of electric shock.

8.2.6 A marking shall not draw the user's attention to an opening in the enclosure for the adjustment of a component or control when a 1/16 inch (1.6 mm) diameter rod is capable of contacting insulation or uninsulated live parts.

8.2.7 Moving parts shall be enclosed or guarded to reduce the risk of injury to persons. The degree of protection required of the enclosure depends upon the general construction and intended use of the product. The factors to be taken into consideration in evaluating the acceptability of exposed moving parts are:

- a) The degree of exposure;
- b) The sharpness of the moving parts;
- c) The risk of unintentional contact with the moving parts;
- d) The speed of movement of those parts; and

- e) The risk of fingers, arms, or clothing being drawn into the moving parts, such as at points where gears mesh, where belts travel onto a pulley, or where moving parts close in a pinching or shearing action.

8.2.8 The door or cover of an enclosure shall be provided with a means for securing it in place in the closed position. The door or cover of an enclosure shall be hinged or otherwise attached in a manner that has been determined to be equivalent when it gives access to any overload protective device whose functioning requires renewal, or when it is required to open the cover in connection with the operation of the protective device. Such a door or cover shall be provided with a latch or device that has been determined to be equivalent, and shall be tight-fitting or shall overlap the surface of the enclosure around the opening.

8.2.9 A component that requires inspection, replacement, cleaning, or other servicing shall be as accessible to the user as possible. The component shall be readily accessible without the use of special tools (those not available to other than service personnel) when it is intended to be manually operated or adjusted or periodically serviced.

8.2.10 When a product is intended primarily for use in public places, such as grocery stores or theaters:

- a) The construction is such that special tools are required to gain access to components that require inspection, replacement, cleaning, adjustment, or other servicing and
- b) A door or cover giving access to an overload protective device is not required to be provided with a hinge, latch, or part that has been determined to be equivalent when the cover must be in place to perform its function.

8.2.11 The bulb and capillary tube of a thermostat shall be protected from physical damage when such damage of the tube or bulb is capable of resulting in a risk of fire.

8.2.12 A cord-connected product that is provided with slots, notches, or holes for mounting the product on a wall shall be constructed in such a manner that the mounting means (screws, bolts, and similar parts) shall not be accessible without removing the product from the wall.

8.2.13 When determining compliance with 8.2.12, any part of the enclosure or barrier that is capable of being removed without the use of tools to gain access to the mounting means is to be removed prior to conducting an examination.

8.2.14 An opening in a product provided for mounting shall be located or guarded so that a nail or hook:

- a) Does not displace a part that creates a risk of fire or electric shock and
- b) Does not contact uninsulated live parts, magnet wire, internal wiring, moving parts, or other parts that create a risk of fire or electric shock.

8.2.15 A enclosure or part relied upon for compliance with this standard, when fabricated from polymeric materials, shall have clear traceability as to composition, ingredients, and processing for the fabricated part to the extent that the composition, ingredients, or process impacts the compliance of the product. Fabricated parts complying with the Standard for Polymeric Materials – Fabricated Parts, UL 746D meets this requirement.

8.3 External materials

8.3.1 Material such as steel, aluminum, glass, plastic, or other similar materials are not prohibited from being used for the enclosure, guard, or cabinet of a unit. Glass shall be heat-resistant, tempered, wired, or laminated.

8.3.2 Plastic materials used for part or all of an enclosure shall comply with the requirements in this section and with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. In applying the requirements in UL 746C, movable units having a mass less than 40 lbs (18.1 kg) shall be treated as portable equipment; other movable units shall be treated as stationary equipment.

8.3.3 Plastic materials used for a cabinet, a part of a cabinet, and for other external parts which do not serve as an enclosure, guard, or barrier shall have a minimum flame rating of HB. Small external parts that contribute a negligible amount of fuel to a fire are not required to be investigated.

8.3.4 An external surface of combustible material having an exposed area greater than 10 square feet (0.93 m²) or a single dimension larger than 6 feet (1.83 m) shall have a flame spread rating of 200 or less when tested in accordance with one of the following:

- a) The Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723, or
- b) The requirements of the radiant panel flame spread test in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

8.3.5 The dimension limits specified in 8.3.4 refer to the exposed surface area of a single unbroken section. When two sides of a single unbroken section are exposed, only the larger side is to be evaluated in computing the area.

8.3.6 Conductive coatings applied to surfaces such as the inside surface of a cover or enclosure shall comply with the requirements for Metallized Parts described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, unless it is determined that flaking or peeling of the coating is not capable of resulting in the reduction of spacings or the bridging of live parts that is capable of presenting a risk of electric shock or fire.

8.4 Internal materials

8.4.1 All combustible materials used within an enclosure shall have a minimum flame rating of V-2 or HF-2.

Exception No. 1: The following materials may have a minimum flame rating of HB:

- a) *Electrical components within Class 2 circuits, other than printed-wiring boards employing only Class 2 circuits;*
- b) *Tubing for air or fluid systems and containers for powders; and*
- c) *The combustible material is completely enclosed within enclosure of portable attended household equipment.*

Exception No. 2: Foamed plastics are not prohibited from having a minimum flame rating of HBF.

Exception No. 3: The following materials are not required to have an established flame rating: