

UL 775

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Graphics Arts Equipment



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March 4, 1994

Standard for

Graphic Arts Equipment

UL 775, Second Edition

Accompanying this transmittal notice is a copy of the Second edition of UL 775.

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MARCH 4, 1994

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UL 775

Standard for

Graphics Arts Equipment

First Edition – April 27, 1981

Second Edition

March 4, 1994

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

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.

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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 or 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.

GENERAL

1 Scope

1.1 These requirements cover products that are intended for use in printing establishments. Included are such products as sheet-fed, web-fed, and offset presses and controls, composing and typesetting machines, cutting and folding machines, and other products that are used in the preparation of mats. The products covered are for connection to interior wiring systems in accordance with the National Electrical Code, and are rated at 600 V or less.

1.2 These requirements do not cover white printers, photocopy machines, typewriters, or any other product that is covered by individual requirements that are separate from this standard.

1.3 Products that generally would be covered by the requirements in this standard, such as duplicating equipment, are covered by the requirements in the Standard For Office Appliances and Business Equipment, UL 114, if the product is not intended for use in printing establishments.

2 Glossary

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

2.2 **AUTOMATICALLY CONTROLLED PRODUCT** – A product is considered to be automatically controlled under any one or more of the following conditions if:

- a) The repeated starting of the product, beyond one complete predetermined cycle of operation to the point where some form of limit switch opens the circuit, is independent of any manual control.
- b) During any single predetermined cycle of operation, a motor is caused to stop and restart one or more times.
- c) Upon energizing the product, the initial starting of a motor may be intentionally delayed beyond intended, conventional starting.
- d) During any single predetermined cycle of operation, changing of the mechanical load may reduce the motor speed to reestablish starting–winding connections to the supply circuit.

2.3 **CONTINUOUS–DUTY MOTOR** – A motor is considered to be subjected to continuous duty if, under any intended condition of use, it can operate unattended and under load for a period of 3 hours or more.

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

2.5 **LINE–VOLTAGE CIRCUIT** – A circuit involving a potential of not more than 600 V, and having circuit characteristics in excess of those of a low–voltage circuit.

2.6 **LOW–VOLTAGE CIRCUIT** – A circuit involving a peak open–circuit potential of not more than 42.4 V supplied by a primary battery, by a Class 2 transformer, or by a combination of a transformer and a fixed impedance that as a unit complies with all of the performance requirements for a Class 2 transformer. A circuit that is derived from a line–voltage circuit by connecting a resistance in series with the supply circuit as a means of limiting the voltage and current is not considered to be a low–voltage circuit.

2.7 OPERATING SERVICING – Any form of servicing that might be performed by personnel other than those who are trained to maintain the particular product is operator servicing. Some examples of operator servicing are as follows:

- a) The attachment of accessories by means of attachment plugs and receptacles or by means of other separable connectors.
- b) The changing of tapes or ribbons that do not involve complicated operations. See 2.8.
- c) The replacement of recording tapes, disks, program boards, punched cards, or paper forms.
- d) Resetting or replacement of circuit breakers, fuses, and lamps that are accessible without the use of tools; also, replacement of lamps likely to require frequent replacement – such as lamps of the projector type – whether or not the operation requires the use of tools.

2.8 Changing ribbons is considered to be a function of service personnel rather than operator servicing if the act involves extensive disassembly of the product.

2.9 REMOTELY CONTROLLED PRODUCT – A product that is out of sight of the operator.

2.10 SAFETY CIRCUIT – Any primary or secondary circuit that is relied upon to reduce the risk of fire, electric shock, or injury to persons. An interlock circuit, for example, is considered to be a safety circuit.

2.11 SECONDARY CIRCUITS – Secondary circuits are those circuits supplied from the secondary windings of isolating transformers. See 33.1 – 33.10.2.

2.12 TRANSFER SWITCH – A switch so located in a circuit that it cannot be caused to make or break current during normal or abnormal conditions. A voltage selector is an example of a transfer switch.

3 Components

3.1 A component of a product covered by this standard shall comply with the requirements for that component, and shall be used in accordance with its recognized rating and other limitations of use. See Appendix A for a list of standards covering components generally used in the products covered by this standard. A component need not comply with a specific requirement that:

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

4 Units of Measurement

4.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement. SI units are in accordance with the American National Standard for Metric Practice, ANSI/ASTM E380.

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

CONSTRUCTION

5 General

5.1 A product shall employ materials that are acceptable for the particular use, as determined by the performance requirements of this standard.

5.2 Metals if depended upon to meet the requirements of this standard shall not be used in such combination as to cause galvanic action that will affect any part of the product.

6 Frame and Enclosure

6.1 A product shall be formed and assembled so that it has the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without presenting 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 defects.

6.2 For unreinforced flat surfaces, cast metal shall not be less than 1/8 inch (3.2 mm) thick, malleable iron shall not be less than 3/32 inch (2.4 mm) thick, and die-cast metal shall not be less than 5/64 inch (2.0 mm) thick. Corresponding thicknesses of not less than 3/32 inch (2.4 mm), 1/16 inch (1.6 mm) and 3/64 inch (1.2 mm), respectively, are acceptable if the surface under consideration is curved, ribbed, or otherwise reinforced, or if the shape, size of the surface, or both are such that acceptable mechanical strength is provided.

6.3 The enclosure of a product shall be complete. Dependence shall not be placed on adjacent walls or adjacent equipment to complete an enclosure.

6.4 An enclosure of sheet metal shall be considered with respect to its size and shape, the thickness of metal, and the particular application, considering the intended use of the product. Sheet steel having a thickness less than 0.026 inch (0.66 mm) if uncoated, or 0.029 inch (0.74 mm) if galvanized, or of nonferrous sheet metal having a thickness less than 0.036 inch (0.91 mm) shall only be used for relatively small areas or for surfaces that are curved or otherwise reinforced. See also 10.2.1.2, in which the thickness requirement is given for metal to which a wiring system is to be attached in the field.

6.5 Among the factors taken into consideration for an enclosure other than that as described in 6.2 or 6.4 are its relative:

- a) physical strength,
- b) resistance to impact,
- c) moisture-absorptive properties,
- d) combustibility,
- e) resistance to corrosion, and
- f) resistance to distortion at the temperatures to which the enclosure is subjected under conditions of intended and unintended use. For a nonmetallic enclosure, all of these factors are also considered with respect to thermal aging.

6.6 Polymeric materials used for the enclosure to (1) render inaccessible parts that present a risk of electric shock or injury to persons or (2) reduce the risk of propagation of flame, shall comply with the requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

6.7 The bottom shall be complete to protect all electrical parts. For the bottom of movable products, consideration shall be given to the possibility of the products being placed on objects that might damage wiring or other components.

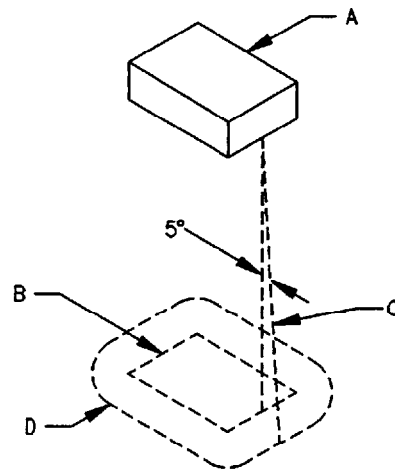
6.8 The enclosure of a product shall be constructed so that molten metal, burning insulation, flaming particles, or the like cannot fall upon combustible materials, including the surface that supports the product.

6.9 The requirement in 6.8 necessitates the use of noncombustible barriers, bottom panels, or protective pans under:

- a) Wire unless it is of the flame-retardant type. Thermoplastic- and neoprene-insulated wires are considered to be of this type.
- b) A switch, relay, solenoid, transformer, motor, or the like unless it can be shown that malfunction of the component would not result in a risk of fire.
- c) Printed-circuit boards.

6.10 The barrier mentioned in 6.9, (1) shall be horizontal or constructed to provide equivalent protection, (2) shall be located as indicated in Figure 6.1, and (3) shall not be smaller in area than indicated in the figure. Openings for drainage, ventilation, and the like may be employed in the barrier if the openings are protected, such as by a baffle or screen, so that molten metal, burning insulation, and the like cannot fall outside the enclosure.

Figure 6.1
Location and extent of barrier



SA0604-1

A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded and will consist of the unshielded portion of a component that is partially shielded by the component enclosure or 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) 5 degrees from the vertical, and (3) so oriented 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.

6.11 If a liquid, powder, or other material that must be replenished, removed, or replaced is present in a product

- a) spilled material shall not contact uninsulated parts that involve a risk of electric shock or fire, and
- b) any other condition that can result in a risk of fire, electric shock, or injury to persons from filling, emptying, storage, intended movement of the product, and the like shall not occur.

6.12 If malfunction of any part that contains, conducts, or otherwise contacts a liquid can result in an unacceptable condition, the part shall be resistant to degradation that may be caused by the liquid involved under any condition of use.

7 Accessibility of Live Parts

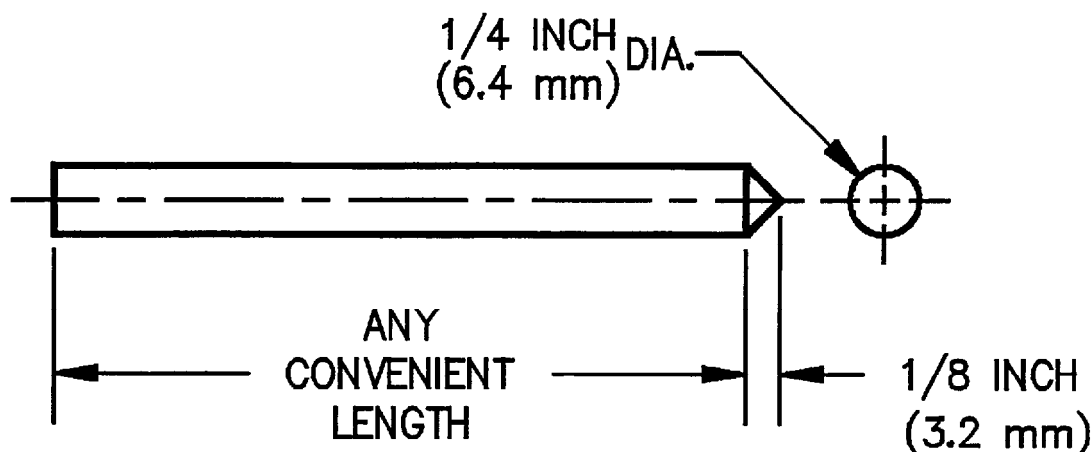
7.1 The electrical parts of a unit shall be so located or enclosed that a person cannot unintentionally contact uninsulated live parts that involve a risk of electric shock. Insulated brush caps do not require an additional enclosure.

7.2 A risk of electric shock is considered likely to occur at any part if the potential between the part and earth ground or any other accessible part is more than 42.4 V peak and the continuous current flow through a 1500 ohm resistor exceeds 5 mA.

7.3 During the examination of a product in connection with the requirements in 7.1, a part of the outer enclosure that may be removed without the use of tools by the user of the product for the attachment of accessories, to allow access to means for making operating adjustments, or for another reason shall be disregarded – that is, it shall not be assumed that the part affords protection against the risk of electric shock.

7.4 An opening (1) anywhere in a hand-supported product or (2) in any portion of a product hand-held in intended use is acceptable if a probe as illustrated in Figure 7.1, when inserted point first as far as possible into the opening, (1) does not enter the opening for a distance of more than 1/8 inch (3.2 mm), and (2) does not touch any uninsulated live part or film-coated wire.

Figure 7.1
Probe for hand-supported enclosure



PA190

7.5 The opening illustrated in Figure 7.4 is acceptable if, within the enclosure, there is no uninsulated live part or film-coated wire (1) less than X distance from the perimeter of the opening, as well as (2) within the volume generated by projecting the perimeter distance X perpendicular to its plane. X equals five times the diameter of the largest round rod that can be inserted through the opening, but not less than 4 inches (102 mm). In evaluating an opening, any barrier located within the volume is to be ignored unless it intersects the boundaries of the volume in a continuous, closed line.

7.6 In the enclosure of a product other than one described in 7.4:

- a) An opening through which a 3/4-inch (19.1-mm) diameter round rod cannot pass is acceptable if:
 - 1) A probe as illustrated in Figure 7.2 cannot touch any uninsulated live part when inserted through the opening, and
 - 2) A probe as illustrated in Figure 7.3 cannot touch film-coated wire when inserted through the opening.
- b) An opening through which a 3/4-inch (19.1 mm) diameter round rod can pass is acceptable under the conditions described in Figure 7.4.

Figure 7.2
Probe for uninsulated live part

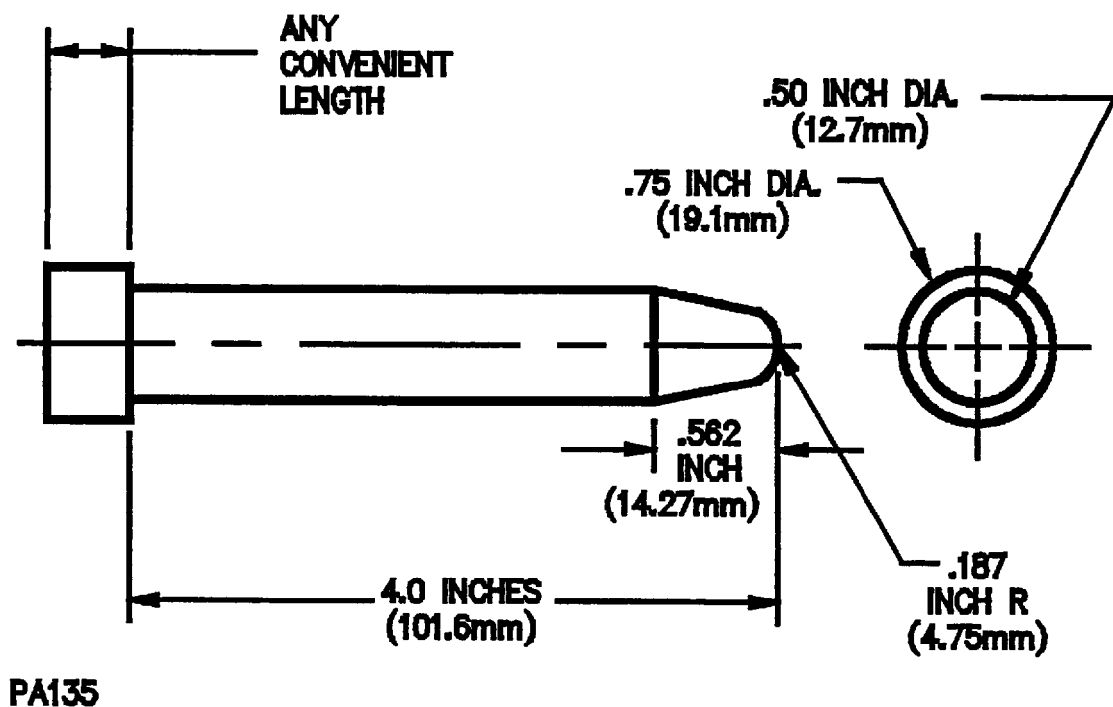
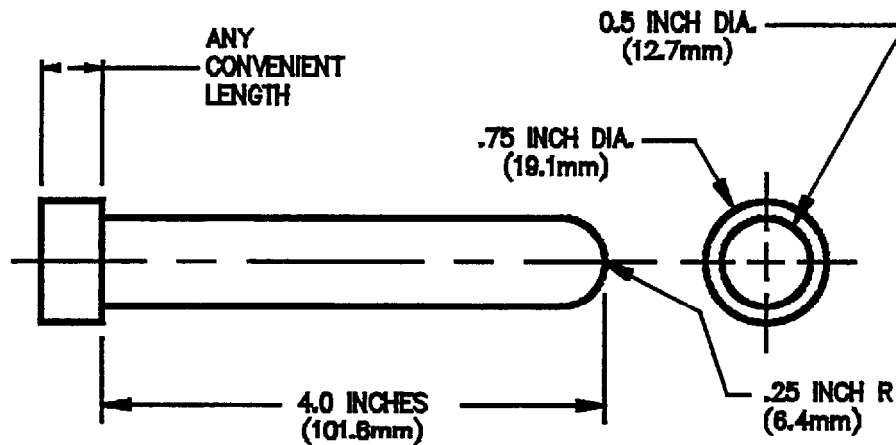


Figure 7.3
Probe for film-coated wire



PA145

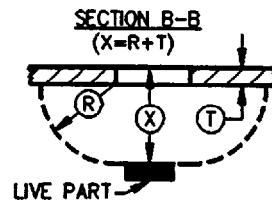
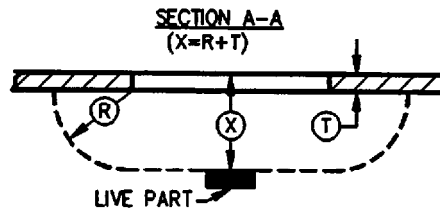
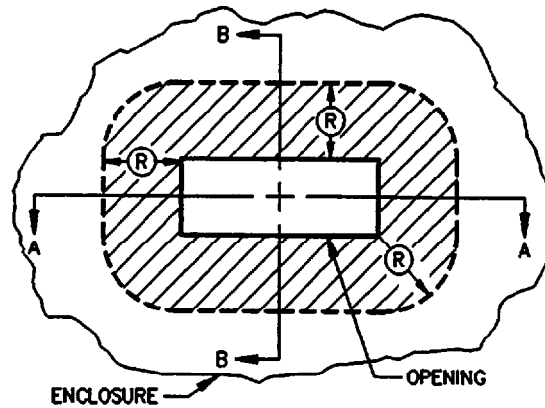
7.7 The probes mentioned in 7.4 and 7.6 are to be applied without the part in place in any part of the enclosure:

- a) Must be opened or removed for operator servicing with or without the use of tools, or
- b) Can be opened or removed without the use of tools.

7.8 For a floor-mounted product, the probes mentioned in 7.6 are to be applied to every part of the bottom of the enclosure that is accessible without tipping, turning over, or otherwise moving the product from its intended installed position. Any other product is to be moved in whatever way is necessary to make the entire bottom of the enclosure accessible for application of the probes.

Figure 7.4
Opening in enclosure

Proportions exaggerated for clarity



SB0610-1

7.9 An interlock provided for the purpose of protecting personnel shall open all current carrying conductors of a cord-connected product and all ungrounded conductors of a permanently connected product. See 7.10.

7.10 An interlock switch that opens all conductors in the area in which the interlock provides protection is acceptable even though conductors outside the protected area remain energized.

7.11 Unless the product is marked in accordance with 62.1.7, lampholders, fuseholders, and circuit breakers shall be so located and installed that persons servicing the lamps, fuses, or circuit breakers cannot unintentionally contact an uninsulated part that involves risk of electric shock or fire other than the screw shells or the clips of fuseholders.

7.12 A door or cover that is accessible from outside of the enclosure shall be hinged or otherwise permanently attached to the product if it gives access to any type of overload protective device other than a type that does not require an additional enclosure.

Exception: A cover, panel, door, or other part of the enclosure that, by its function or size, obviously must be in place if the product is to operate as intended need not be permanently attached.

7.13 Means shall be provided for holding the door to cover over a fuseholder in a closed position. The door or cover shall be tight fitting.

8 Mechanical Assembly

8.1 Parts of the product shall remain in position and shall not be affected in an unacceptable manner by vibration of intended operation.

8.2 A switch, fuseholder, lampholder, attachment–plug receptacle, motor–attachment plug, or other component that is handled by the user shall be mounted securely and shall not turn.

Exception No. 1: If turning of a switch is possible, all four of the following conditions shall be met:

- a) The switch shall be of a plunger, slide, or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch during intended operation of the switch.*
- b) The means for mounting the switch makes it unlikely that operation of the switch may loosen it.*
- c) The spacings are not reduced below the minimum acceptable values if the switch rotates.*
- d) The intended operation of the switch is by mechanical means rather than by direct contact by persons.*

Exception No. 2: A lampholder of the type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, may turn if rotation cannot reduce spacings below the minimum acceptable value.

8.3 Friction between surfaces is not acceptable for securing the position of the parts mentioned in 8.2. A lock washer is acceptable as a means to secure the position of a device having a single–hole mounting means.

8.4 A product that is shipped from the factory disassembled or unassembled to the degree necessary to facilitate shipment shall comply with each of the following:

- a) All parts shall be furnished by the manufacturer.
- b) Electrical continuity shall be maintained between field-assembled parts.
- c) The product shall be such that the field assembly can be accomplished without the necessity of drilling, cutting, threading or any alteration other than for permanent connection to the power supply.
- d) The assembly arrangement, location, and orientation of the separate parts shall be established at the time of manufacture and shall not be dependent on the installer.

9 Protection Against Corrosion

9.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, if corrosion of unprotected parts can result in a risk of fire, electric shock, or injury to persons.

Exception No. 1: Surfaces of sheet-steel and cast iron parts within an enclosure need not be protected against corrosion if oxidation of the metal due to exposure to air and moisture is not likely to weaken the parts to result in a condition of risk. The thickness of metal and temperature are also to be considered.

Exception No. 2: Bearings, laminations, or minor parts of iron or steel such as washers, screws, and the like.

9.2 If deterioration of a liquid container provided as a part of a product can result in a risk of fire or electric shock, the container shall be of a material that is resistant to corrosion by the liquid intended to be used therein.

10 Supply Connections

10.1 General

10.1.1 A product intended for permanent connection to the building structure shall be provided with a means for permanent connection to the branch-circuit supply.

10.2 Permanently connected product

10.2.1 General

10.2.1.1 A product intended for permanent connection to the branch-circuit supply shall have provision for the connection of one of the wiring methods in accordance with the National Electrical Code, ANSI/NFPA 70.

10.2.1.2 Sheet metal of the product to which a wiring system is to be connected in the field shall have a thickness not less than 0.032 inch (0.81 mm) if uncoated steel, not less than 0.034 inch (0.86 mm) if galvanized steel, and not less than 0.045 inch (1.14 mm) if nonferrous.

10.2.2 Terminal compartment

10.2.2.1 A terminal box or compartment in which power–supply connections to a permanently connected product are to be made shall be located so that the connections may be inspected after the product is installed as intended.

10.2.2.2 A terminal compartment intended for connection of a supply raceway shall be attached to the product so that it cannot turn.

10.2.3 Wiring terminals and leads

10.2.3.1 A permanently connected product shall be provided with wiring terminals for the connection of conductors having an ampacity acceptable for the product, or the product shall be provided with leads for such connections.

10.2.3.2 A field–wiring terminal is considered to be a terminal to which a wire may be connected in the field, unless (1) the wire and (2) a means of making the connection – a pressure terminal connector, soldering lug, soldered loop, crimped eyelet, and the like – factory–assembled to the wire, are provided as a part of the product.

10.2.3.3 The free length of a lead inside a terminal box or wiring compartment shall be 6 inches (150 mm) or more if the lead is intended for field connection to an external circuit.

Exception: The lead may be less than 6 inches (150 mm) long if it is evident that the use of a longer lead might result in a risk of fire or electric shock.

10.2.3.4 A field–wiring terminal shall be prevented from turning by some means other than friction, such as a properly applied lock washer.

10.2.3.5 A field–wiring terminal shall be provided with a soldering lug or pressure terminal connector firmly bolted or held by a screw; except that a wire–binding screw may be employed at a wiring terminal intended to accommodate a No. 10 AWG (5.3 mm²) or smaller conductor if upturned lugs, cupped washers, or the equivalent are provided to hold the wire in position.

10.2.3.6 Upturned lugs or cupped washers shall be capable of retaining a supply conductor of the size indicated in 10.6 under the head of the screw or washer.

10.2.3.7 A wire–binding screw at a wiring terminal shall not be smaller than No. 10.

Exception No. 1: A No. 8 screw may be used at a terminal intended only for the connection of a No. 14 AWG (2.1 mm²) conductor.

Exception No. 2: A No. 6 screw may be used for the connection of a No. 16 or 18 AWG (1.3 or 0.82 mm²) conductor.

10.2.3.8 As a 14 AWG (2.1 mm²) conductor is the smallest that can be used for branch–circuit wiring, this is the smallest conductor that is to be anticipated at a terminal for connection of a branch–circuit conductor.

10.2.3.9 A wire–binding screw shall thread into metal.