



# UL 499

## STANDARD FOR SAFETY

### Electric Heating Appliances

UL Standard for Safety for Electric Heating Appliances, UL 499

Fourteenth Edition, Dated November 7, 2014

### **Summary of Topics**

***This revision of ANSI/UL 499 dated November 17, 2025 includes the following changes in requirements:***

- Marking for Outdoor/Wet Rating; [53.52](#), [53.53](#)***
- Intermediate Bulk Container (IBC) Heaters; Supplement [SE](#)***

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated May 16, 2025, August 8, 2025, and September 5, 2025.

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## **UL 499**

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover heating appliances rated at 600 V or less for use in unclassified locations in accordance with the National Electrical Code (NEC), ANSI/NFPA 70.

1.2 These requirements do not cover electric heating equipment or appliances that are covered by individual requirements that are separate from this Standard.

1.3 For the purposes of this Standard, a heating appliance is defined as an electrically energized product that directly or indirectly generates heat to perform its intended function.

1.4 These requirements also cover electrically energized products that generate steam for other than space heating purposes and have an electrical power rating of 15 kW or less per steam generating vessel.

1.5 Except as noted for steam-bath generators, steam generating products of the type described in [1.4](#) having an electrical input power rating of more than 15 kW per steam generating vessel are to be evaluated by the requirements in the Standard for Heating, Water Supply, and Power Boilers – Electric, UL 834.

1.6 Each steam generating vessel in a multi-vessel unit shall comply with these requirements. The unit shall also be provided with the marking in [53.42](#).

1.7 These requirements do not cover:

- a) Charcoal ignitors that have an integral electrically heated vessel; or
- b) Heated floor mats/pads without a metallic or thermoplastics enclosure or similar rigid internal enclosure to enclose electrical parts; except for heated pet mats.

### 2 Glossary

2.0 CHARCOAL IGNITORS – A handheld wand type of appliance with exposed sheath heating element for heating charcoal within a non-electric grill. This does not include charcoal ignitors with an integral electrically heated vessel for charcoal preparation.

2.1 FLEXIBLE PET HEATING MATS/PADS – A pet heating mat/pad which employs a non-metallic enclosure (envelope) and can be easily bent or folded for storage.

2.2 HYBRID ADHESIVE GUN – An adhesive gun which can be operated under mains, battery, and mains-plus-battery inputs. Adhesive guns are also known as “hot melt guns” and “glue guns”. The requirements for hybrid adhesive guns do not currently contemplate battery recharging or trickle charging constructions.

2.3 INSTANTANEOUS WATER HEATER, BARE-ELEMENT – A water heater in which uninsulated heating elements are immersed in the water.

2.4 PET HEATING MATS/PADS – A heating appliance intended to provide warmth to a pet. Such a device may be used with or without additional fabric and fill based bedding.

2.5 RIGIDLY ENCLOSED PET HEATING MATS/PADS – A pet heating mat/pad which employs a stiff thermoplastic enclosure or metal enclosure such that the appliance can not be folded or rolled for storage when not in use.

2.6 SEMI-RIGID PET HEATING MATS/PADS – A pet heating mat/pad which employs a thermoplastic enclosure (envelope) or internal structure that allows the appliance to be rolled but not easily folded for storage.

### 3 Units of Measurement

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

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

### 4 Undated References

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

## CONSTRUCTION

### 5 General

5.1 A heating appliance intended for use in a hazardous location is judged on the basis of its compliance with the requirements in this Standard, and further appropriate examination and tests to determine whether it is acceptable for the purpose.

5.2 Only materials that are acceptable for the particular use shall be used in a heating appliance. A heating appliance shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

5.3 If the operation of a heating appliance involves the generation and confining under pressure of steam or other gas, consideration is to be given to the possibility of risk of explosion incident to such operation. This applies in the case of a product having immersed electrodes, where the electrolysis of water may result in the accumulation of oxygen and hydrogen. The product is not acceptable unless its strength has been investigated with respect to any risk of explosion that may be involved.

5.4 Adhesive guns shall be constructed such that adhesive is not discharged on the user's hand during normal operation.

### 6 Components

#### 6.1 General

6.1.1 Except as indicated in [6.1.2](#), a component of a product covered by this Standard shall comply with the requirements for that component as indicated in [6.2](#).

6.1.2 A component of a product covered by this standard 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,
- 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 rating and limitations.

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

6.1.4 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable Standard(s) that cover devices that provide those functions.

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

6.1.5 Unless they also comply with the requirements of [6.2](#), components complying with standards other than those cited are not acceptable.

*Exception: Other standards for components may fulfill these requirements provided that the standards:*

*a) Are compatible with the ampacity and overcurrent protection requirements in the National Electrical Code, NFPA 70, where appropriate,*

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

*c) Any use limitations of the other standards are identified and appropriately accommodated in this application. For example, components intended for industrial use and complying with relevant standards may assume user expertise not common in consumer applications.*

6.1.6 Components not anticipated by the requirements of this Standard, not specifically covered by a component standard of [6.2](#), and which pose a potential risk of electric shock, fire or casualty hazard shall be additionally investigated. Reference to other product standards is appropriate where those standards anticipate normal and abnormal use conditions consistent with the application of this Standard.

6.1.7 Components shall not contain mercury.

## 6.2 Requirements for Components

### 6.2.1 Insulated Wire, Cable and Cords

6.2.1.1 A cord set or power supply cord shall comply with the Standard for Cord Sets and Power Supply Cords, UL 817.

6.2.1.2 Flexible cord and cables shall comply with the Standard for Flexible Cords and Cables, UL 62. Flexible cord and cables are considered to fulfill this requirement when preassembled in a cord set or power supply cord complying with Standard for Cord Sets and Power Supply Cords, UL 817.

6.2.1.3 Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758.

*Exception No. 1: Insulated conductors complying with the Standard for Thermoset-Insulated Wires and Cables, UL 44, the Standard for Thermoplastic-Insulated Wires and Cables, UL 83, or other types specified in Chapter 3 of the National Electrical Code, NFPA 70 complying with the appropriate standard, need not comply with UL 758.*

*Exception No. 2: Insulated conductors complying with the Standard for Fixture Wire, UL 66, need not comply with UL 758.*

*Exception No. 3: Insulated conductors for specialty applications (e.g. data processing or communications) need not comply with UL 758.*

6.2.1.4 The requirements for film coated wire and Class 105 (A) insulation systems are not specified.

6.2.1.5 Film coated wire in intimate combination with one or more insulators, and incorporated in an insulation system rated Class 120 (E) or higher, shall comply with the magnet wire requirements in the Standard for Systems of Insulating Materials – General, UL 1446.

## **6.2.2 Attachment Plugs, Receptacles, Connectors and Terminals**

6.2.2.1 Attachment plugs (including appliance and flat iron plugs) and receptacles that may be detached during use shall comply with the Standard for Attachment Plugs and Receptacles, UL 498, or as appropriate, the Standard for Plugs, Receptacles and Cable Connectors of the Pin and Sleeve Type, UL 1682.

*Exception No. 1: Attachment plugs that are integral to cord sets and power supply cords need not comply with UL 498 or UL 1682.*

*Exception No. 2: Multi-pole connectors that may be detached during field wiring that comply with the Standard for Insulated Multi-Pole Splicing Wire Connectors, UL 2459 need not comply with UL 498 or UL 1682.*

6.2.2.2 Electrical splices and connections accomplished via devices complying with the Standard for Electrical Quick – Connect Terminals, UL 310.

*Exception: Electrical connections accomplished via devices complying with the Standard for Wire Connectors, UL 486A-486B, the Standard for Splicing Wire Connectors, UL 486C, the Standard for Sealed Wire Connector Systems, UL 486D, or the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.*

6.2.2.3 Insulated splices complying with the Standard for Splicing Wire Connectors, UL 486C, (or the Standard for Electrical Quick-Connect Terminals, UL 310, are considered to fulfill the requirement of Section [16](#).

6.2.2.4 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and where appropriate be indicated as suitable for field wiring.

## **6.2.3 Switches**

6.2.3.1 Switches shall comply with the Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1.

*Exception No. 1: Switches that comply with the Standard for General Use Snap Switches, UL 20; the Standard for Clock-Operated Switches, UL 917; the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, with the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7; or the Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 773A, are considered to fulfill this requirement.*

*Exception No. 2: Circuit breakers that comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489, need not comply with UL 61058-1.*

*Exception No. 3: Switching devices that comply with appropriate standards for specialty applications (e.g. transfer switch equipment), industrial use (e.g. contactors, relays, auxiliary devices) or are integral to another component (e.g. switched lampholder) need not comply with UL 61058-1.*

*Exception No. 4: Switching devices that comply with Sections [26](#) and [43](#) need not comply with UL 61058-1.*

## 6.2.4 Low-Voltage Circuit Transformers

6.2.4.1 A transformer complying with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3, need not comply with [14.4.2](#).

## 6.2.5 Light Sources and Associated Components

6.2.5.1 Lampholders and indicating lamps with integral lamp/lampholder (e.g. neon pilot lamp) shall comply with the Standard for Lampholders, UL 496. Lampholders forming part of a luminaire that complies with an appropriate luminaire standard are considered to fulfill this requirement.

6.2.5.2 Lighting ballasts shall comply with the Standard for Fluorescent-Lamp Ballasts, UL 935, or the Standard for High-Intensity Discharge Lamp Ballasts, UL 1029. Ballasts forming part of a luminaire that complies with an appropriate luminaire standard are considered to fulfill this requirement.

*Exception: Ballasts for other light sources shall comply with the appropriate standard(s) and need not comply with UL 935 or UL 1029.*

6.2.5.3 Light emitting diode (LED) light sources shall comply with the Standard for Light Emitting Diode (LED) Equipment For Use In Lighting Products, UL 8750. LED light sources forming part of a luminaire that complies with an appropriate luminaire standard are considered to fulfill this requirement.

*Exception: Individual LED light sources mounted on printed wiring boards and intended for indicating purposes need not comply with UL 8750.*

## 6.2.6 Heating Devices

6.2.6.1 Insulated heating wire shall comply with the Standard for Appliance Wiring Material, UL 758.

6.2.6.2 Thermistor-type heaters (e.g. PTC heater) shall comply with the Standard for Thermistor-Type Devices, UL 1434.

*Exception: For an indoor household handheld glue gun, the heater endurance is required to comply with a minimum 6,000 cycles with respect to Table 15.1 the Standard for Thermistor-Type Devices, UL 1434.*

6.2.6.3 A flexible heating device shall comply with applicable requirements in the Standard for Electric Heating Pads, UL 130.

## 6.2.7 Controls

6.2.7.1 A thermal cutoff shall comply with the Standard for Thermal-Links – Requirements and Application Guide, UL 60691.

6.2.7.2 Except where superseded in this standard, a temperature control that complies with the construction requirements of the Standard for Temperature-Indicating and -Regulating Equipment, UL 873; the Standard for Limit Controls, UL 353; or the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and the Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9, is considered to comply with the construction requirements of this standard. See Testing of Component Switches and Control Devices, Section [43](#) for performance requirements.

## 6.2.8 Cord Reel

6.2.8.1 A cord reel shall comply with “special use cord reel” requirements of the Standard for Cord Reels, UL 355.

## 6.2.9 Overcurrent Protection

6.2.9.1 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1, and the applicable subsequent part (e.g. UL 248-5). Defined use fuses that comply with UL 248-1 and another appropriate standard for the fuse are considered to fulfill this requirement.

6.2.9.2 Fuseholders shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and applicable subsequent part (e.g. UL 4248-9).

6.2.9.3 Circuit breakers shall comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489.

*Exception: Circuit breakers used in telecommunications circuitry that comply with the Standard for Circuit Breakers For Use in Communications Equipment, UL 489A, need not comply with UL 489.*

6.2.9.4 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

## 6.2.10 Ground-Fault, Arc-Fault and Leakage Current Detectors/Interrupters

6.2.10.1 Ground-fault circuit-interrupters (GFCI) for protection against electrical shock shall comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

6.2.10.2 Appliance-leakage-current interrupters (ALCI) for protection against electrical shock shall comply with the Standard for Appliance-Leakage-Current Interrupters, UL 943B. An ALCI is not considered an acceptable substitute for a GFCI when a GFCI is required by the National Electrical Code, NFPA 70.

6.2.10.3 Equipment ground-fault protective devices shall comply with the Standard for Ground-Fault Sensing and Relaying Equipment, UL 1053, and applicable requirements of the Standard for Ground-Fault Circuit-Interrupters, UL 943.

6.2.10.4 Arc-fault circuit-interrupters (AFCI) shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

6.2.10.5 Leakage-current detector-interrupters (LCDI) and any shielded cord between the LCDI and appliance shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

### 6.2.11 Power Supplies

6.2.11.1 A Class 2 power supply shall comply with the Standard for Class 2 Power Units, UL 1310.

6.2.11.2 A non-Class 2 power supply shall comply with one of the following:

- a) Standard for Power Units Other Than Class 2, UL 1012; or
- b) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1; or
- c) Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1.

6.2.11.3 Limited Power Source (LPS) power supplies shall comply with the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1.

### 6.2.12 Supplemental Insulation, Insulating Bushings and Assembly Aids

6.2.12.1 The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required to fulfill [14.3.3](#) or a performance requirement of this Standard. In such cases:

- a) Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441,
- b) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

6.2.12.2 Wire positioning devices shall comply with Sections [15](#) and [17](#). A device that complies with the Standard for Positioning Devices, UL 1565, is considered to fulfill this requirement.

6.2.12.3 Insulating bushings that comply with the Standard for Insulating Bushings, UL 635, and [6.1.3](#) are considered to fulfill the requirements of this Standard. Tests specified in this standard (e.g. Strain Relief Test) may still need to be performed to confirm the combination of the insulating bushing and the supporting part are suitable.

### 6.2.13 Gaskets and Seals

6.2.13.1 Gaskets and seals that comply with the Standard for Gaskets and Seals, UL 157, are considered to fulfill the requirements of [36.1.4](#) and [36.1.5](#).

### 6.2.14 Printed Wiring Boards

6.2.14.1 Printed wiring boards shall comply with the Standard for Printed-Wiring Boards, UL 796. Unless otherwise specified, the flammability class shall be that specified for insulating materials.

## 7 Frame and Enclosure

7.1 The frame and enclosure of a heating appliance shall be strong and rigid to resist the abuses to be encountered during intended use. The degree of resistance inherent in the product shall preclude total and partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other defects which alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

7.2 Pet heating mats/pads are evaluated as follows:

- a) Rigidly enclosed pet heating mats/pads are evaluated to the applicable requirements detailed in this Standard.
- b) Semi-rigid pet heating mats/pads are evaluated to the applicable requirements detailed in this Standard including the performance testing of [32.2](#), Sections [36.14](#) and [37](#); and the construction requirements for Envelope and Insulation in Sections 6 and 7 of the Standard for Electric Heating Pads, UL 130. These appliances are for indoor use only.
- c) Flexible pet heating mats/pads are evaluated to the applicable requirements of this Standard including the performance test of Section [37](#); and the Standard for Electric Heating Pads, UL 130. These appliances are for indoor use only.

*Exception: Flexible pet heating mats/pads are not required to comply with the marking requirements in 46.2 – 46.12 in the Standard for Electric Heating Pads, UL 130.*

7.3 A vaporizer water reservoir of glass or similar material that might, upon breaking, cause skin lacerations shall be resistant to thermal-shock and impact.

7.4 A heating appliance shall be provided with an enclosure of material acceptable for the application, that shall house all electrical parts, except a supply cord and a recessed open-wire-element unit as mentioned in [15.3](#), that may result in risk of electric shock or injury to persons under any condition of use. If a heater is for permanent installation (intended for permanent connection to the power supply), the enclosure shall be provided with means for mounting in the intended manner and shall be furnished with any necessary fittings, such as brackets, hangers, or the like.

7.5 If openings for ventilation are provided in the enclosure of a heating appliance or in an externally mounted component intended for permanent connection to the power supply, they shall be so located that they will not vent into concealed spaces of a building structure, such as into false-ceiling space, into hollow spaces in the wall, and the like, when the product is installed.

7.6 Among the factors when an enclosure is being considered for acceptability, 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 may be subjected under conditions of use.

For a nonmetallic enclosure, all of these factors are to be considered with respect to thermal aging.

7.6A With respect to [7.6](#), thermoset materials are considered suitable with respect to thermal aging if:

- a) The thermoset material does not exceed 150°C (302°F) when subjected to the Normal Temperature Test the Normal Temperature Test, Section [36](#); or
- b) The thermoset materials need not be subjected to the relative thermal capability requirements of Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. For a

thermoset material operating at a temperature above its temperature rating, the Thermal Degradation Test of Section [49A](#), shall be conducted.

7.6B A nonmetallic enclosure, shall comply with the enclosure requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. A metal enclosure or shall be tested in accordance with Resistance To Impact Tests, Section [40](#).

7.7 A polymeric enclosure of outdoor use equipment shall comply with requirements contained in the Standard for Polymeric Materials – Use in Electrical Equipment, UL 746C, outdoor use requirements.

*Exception: Enclosures identified as 3R enclosures complying with the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50, or the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E, are considered to comply with this requirement.*

7.8 Outdoor use equipment shall be subjected to the Test of Insulation Resistance and Leakage Current as a Result of Moisture, Section [37](#), with acceptable results.

7.9 The enclosures of semi-rigid enclosed and flexible pet heating mats/pads shall have a minimum V-2 enclosure.

*Exception: Semi-rigid enclosed and flexible pet heating mats/pads may employ a HB enclosure material if they comply with alternative path requirements detailed in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.*

7.10 Rigid molded enclosure parts of a semi-rigid enclosed or flexible pet heating mat/pad shall comply with the requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

7.11 Cast- and sheet-metal portions of the enclosure shall be no thinner than indicated in [Table 7.1](#) unless the enclosure complies with [7.6](#) and [7.12](#).

**Table 7.1**  
**Minimum acceptable thicknesses of enclosure material**

| Metal                                                                                                                                                                         | At small, flat, unreinforced surfaces and at surfaces that are reinforced by curving, ribbing and the like 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 relatively large unreinforced flat surfaces |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------|--------|------------------------------------------------|--------|
|                                                                                                                                                                               | inches                                                                                                                                                                          | (mm)                | inches                                                               | (mm)   | inches                                         | (mm)   |
| Die-cast                                                                                                                                                                      | 3/64                                                                                                                                                                            | (1.2)               | –                                                                    | –      | 5/64                                           | (2.0)  |
| 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 <sup>a</sup>                                                                                                                                                              | (0.66) <sup>a</sup> | 0.032                                                                | (0.81) | 0.026                                          | (0.66) |
| Galvanized sheet steel                                                                                                                                                        | 0.029 <sup>a</sup>                                                                                                                                                              | (0.74) <sup>a</sup> | 0.034                                                                | (0.86) | 0.029                                          | (0.74) |
| Nonferrous sheet metal                                                                                                                                                        | 0.036 <sup>a</sup>                                                                                                                                                              | (0.91) <sup>a</sup> | 0.045                                                                | (1.14) | 0.036                                          | (0.91) |
| <sup>a</sup> Thinner sheet metal may be employed if found to be acceptable when the enclosure is judged under considerations such as those mentioned in <a href="#">7.6</a> . |                                                                                                                                                                                 |                     |                                                                      |        |                                                |        |

7.12 In addition to the factors in [7.6](#), an enclosure of sheet metal is to be considered with respect to its size and shape, the thickness of metal and the intended use of the product.

7.13 Electrical parts of a heating appliance, including open-wire elements, shall be so located or enclosed that protection against unintentional contact with uninsulated live parts will be provided (see also [25.6](#)). Insulated motor brush caps do not require additional enclosure.

7.14 The enclosure shall be such that molten metal, burning insulation, flaming particles, or the like, is not likely to fall on combustible materials, including the surface upon which the enclosure is supported.

7.15 The requirement in [7.14](#) necessitates use of a barrier of metal, phenolic, urea, ceramic or similar material:

a) Under a motor unless:

1) The structural parts of the motor or of the product provide 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) Starting switch short-circuited.

3) The motor is provided with a thermal motor protector (a protective device that is sensitive to both temperature and current) that restricts the temperature of the motor windings from becoming more than 125 °C (257 °F) under the maximum load under which the motor runs without causing the protector to cycle, and from becoming more than 150 °C (302 °F) with the rotor of the motor locked.

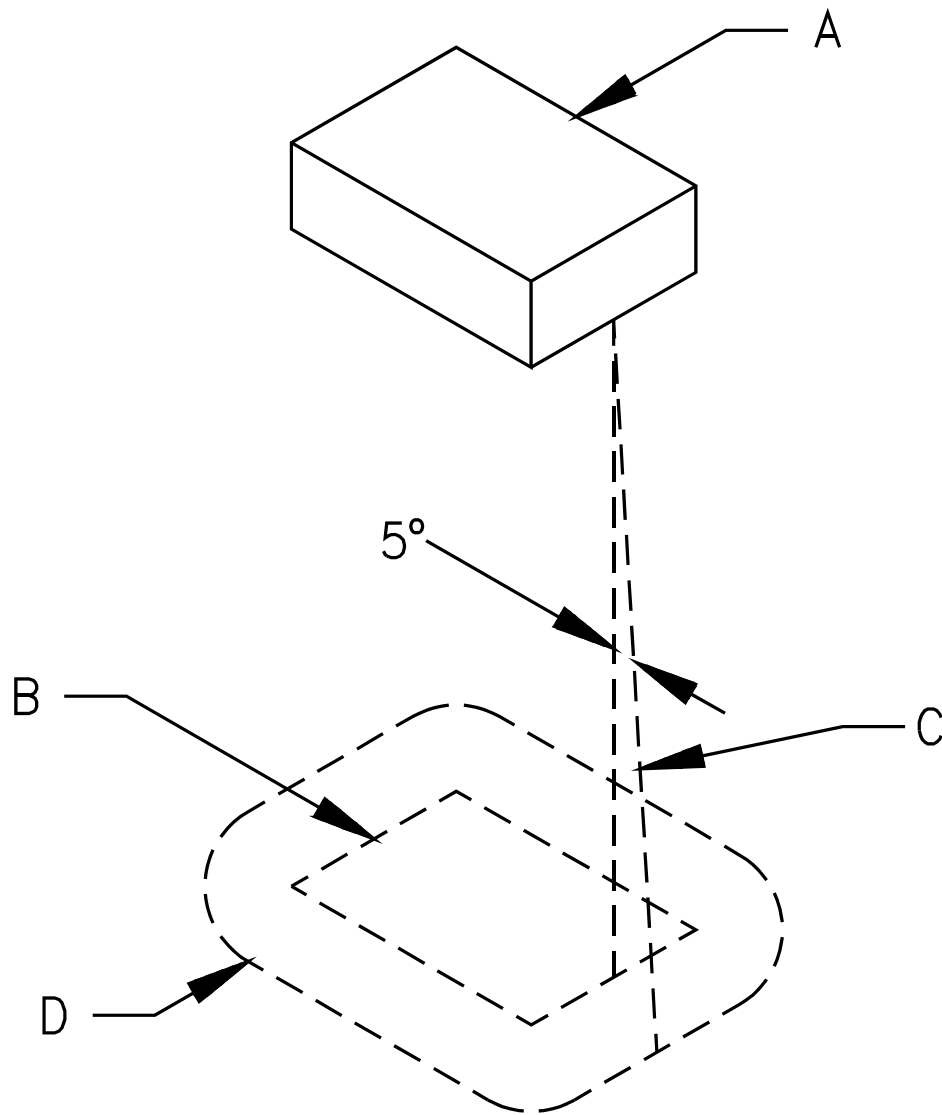
4) The motor complies with the requirements for impedance-protected motors.

b) Under wiring, unless it complies with the VW-1 (Vertical-Specimen) Flame Test described in the Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581.

7.16 The requirement in [7.14](#) also necessitates that a switch, transformer, relay, solenoid, or the like, be individually and completely enclosed except at terminals, unless it can be shown that malfunction of the component is not likely to result in a fire, or unless there are no openings in the bottom of the enclosure. An opening in the bottom of the enclosure is not acceptable if it is located directly below field- or factory-made splices or overload or overcurrent protective devices.

7.17 The barrier mentioned in [7.15](#) shall be horizontal, shall be located as indicated in [Figure 7.1](#), and shall not have an area less than that described in that illustration. Openings for drainage, ventilation, and the like, may be employed provided molten metal, burning insulation, or the like, is not likely to fall through the opening onto combustible material.

**Figure 7.1**  
**Location and extent of barrier**



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**NOTES –**

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.

7.18 The criteria for judging a heating appliance enclosure, other than as described in [7.13](#), are given in [7.20](#) and [7.21](#) and in the following items and related illustrations:

- a) An opening in the enclosure is acceptable if the probe (illustrated in [Figure 7.2](#)), when inserted into the opening, cannot be made to touch any uninsulated live part of film-coated wire that involves a risk of electric shock. The probe is to be applied to any depth that the opening will permit; and shall be rotated and articulated in all possible configurations before, during and after insertion.
- b) An opening that will not prevent entrance of the probe as mentioned in (a) is acceptable under the conditions described in [Figure 7.3](#).

**Figure 7.2**  
**Articulate probe with web stop**

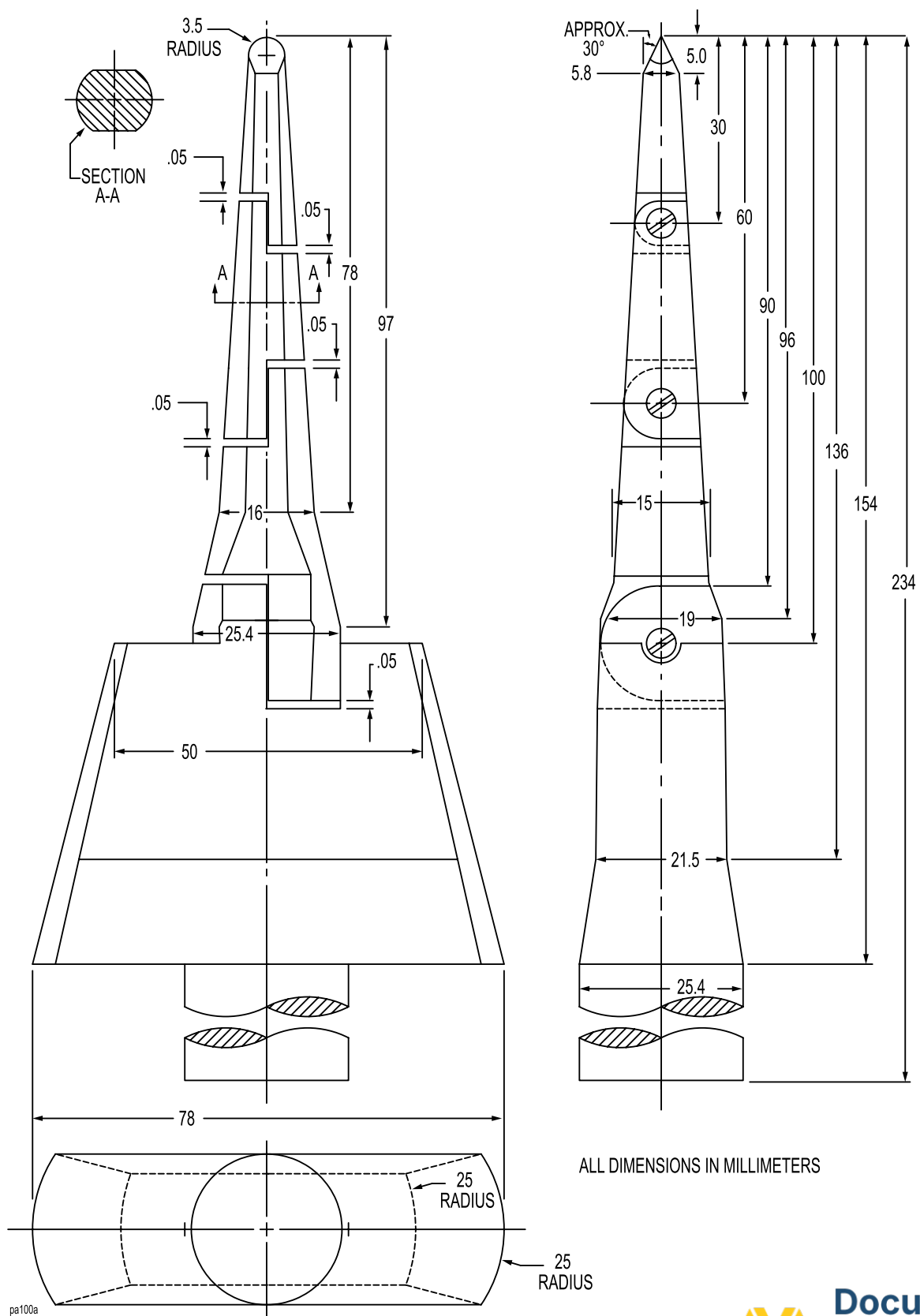
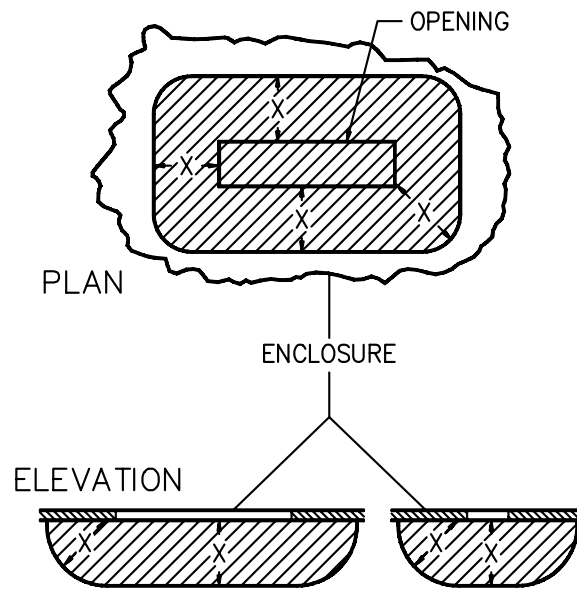


**Figure 7.3**  
**Opening in enclosure**



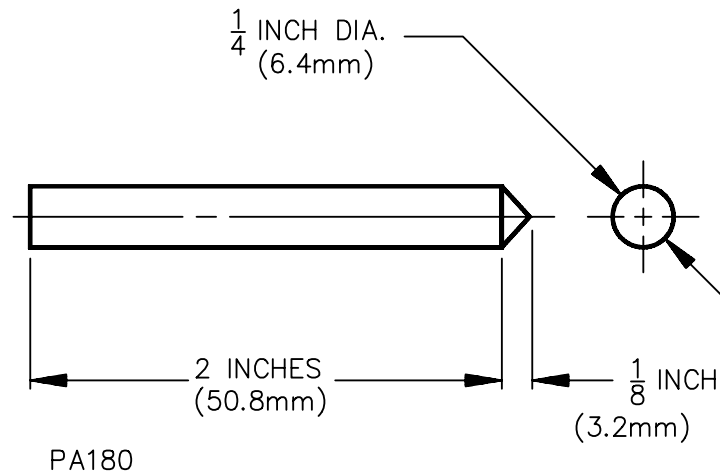
proportions exaggerated for clarity

7.19 The opening illustrated in [Figure 7.3](#) is acceptable if, within the enclosure, there is no uninsulated live part or enamel-insulated wire less than  $X$  distance from the perimeter of the opening, as well as within the volume generated by projecting the perimeter  $X$  distance perpendicular to its plane.  $X$  equals five times the diameter of the largest diameter rod which can be inserted through the opening, but not less than 4 inches (102 mm). In evaluating an opening, any barrier located within the volume usually is ignored unless it intersects the boundaries of the volume in a continuous, closed line.

7.20 Although meeting the requirements in [7.18](#), an opening is unacceptable:

- a) Anywhere in the enclosure of a hand-supported product; or
- b) In any portion of a product hand-held during use if a probe as illustrated in [Figure 7.4](#), when inserted point first a maximum distance of 2 inches (50.8 mm) into the opening touches any uninsulated live part or touches any enamel-insulated wire.

**Figure 7.4**  
**Probe for hand-supported enclosure**



7.21 If a marking draws the user's attention to a hole of any size in the enclosure for the adjustment of a thermostat or for a similar activity, it shall not be possible to damage insulation or contact uninsulated live parts through the hole with a 1/16 inch (1.6 mm) diameter rod.

7.22 During the examination of a heating appliance in connection with the requirements in [7.13](#) – [7.18](#), 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, for access to means for making operating adjustments, or for other reasons) is to be disregarded – that is, it is not to be assumed that the part in question affords protection against risk of electric shock. A warning marking, such as that specified in [53.6](#) is not considered to eliminate this risk of electric shock.

7.23 Any moving parts, such as rotors of motors, chains, pulleys, belts, and gears, shall be enclosed or guarded to reduce the risk of injury to persons.

7.24 With reference to the requirement in [7.23](#), the degree of protection required of the enclosure depends upon the general design and intended use of the product. The factors to be taken into consideration in judging the acceptability of exposed moving parts are:

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

7.25 The door or cover of an enclosure shall be provided with a means for securing it in place in the closed position.

7.26 The door or cover of an enclosure shall be hinged or otherwise attached in an equivalent manner if it gives access to any overload protective device whose functioning requires renewal, or if it is necessary

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 the equivalent, and shall be tight-fitting or shall overlap the surface of the enclosure around the opening.

7.27 A component of a heating appliance that is likely to need inspection, replacement, cleaning, or other servicing shall be as accessible as possible. Except as noted in [7.28](#), the component shall be readily accessible without the use of special tools – tools not available to other than service personnel – if it is intended to be manually operated or adjusted or periodically serviced.

7.28 If a product is intended primarily for use in public places, such as gas stations, theaters, bus terminals, or the like:

- a) The construction may be such that special tools are required to gain access to components that are likely to need inspection, replacement, cleaning, adjustment, or other servicing.
- b) A door or cover giving access to an overload protective device need not be provided with a hinge, latch, or equivalent if the cover intended must be in place to perform its function.

7.29 The bulb and capillary tube of a thermostat shall be protected from physical damage if such damage of the tube or bulb may result in a risk of fire.

7.30 The mounting means of a wall-mounted insecticide vaporizer shall be such that:

- a) The product will be secured against tipping or dislodgement as a result of unintentional contact with the body of the product itself or with the power-supply cord; and
- b) The removal of the vaporizer can be accomplished readily, if it is necessary that the vaporizer be removed from its mounting for cleaning, refilling, or other servicing.

7.31 With reference to the requirement in [7.30](#), a simple keyhole slot or hanger ring is not acceptable as a mounting means unless other provisions are made, such that spillage of the insecticide will not result from tipping or dislodgement of the product.

7.32 If the enclosure of an insecticide vaporizer for wall mounting is of porcelain, glass, or other similarly brittle material, it shall not break or crack to the extent that uninsulated live parts will be exposed to contact, when dropped on a hardwood surface. The height through which the product is to be dropped is to be 8 ft (2.44 m) for a commercial-type vaporizer, and 6 ft (1.83 m) for a household product.

7.33 The sheath employed to enclose the heating element of an immersion-type heater for use with fuel oil shall be of steel, stainless steel, or other metal resistant to corrosion in fuel oil; brass, bronze, or copper is not considered acceptable for this application. The sheath employed to enclose the heating element of an immersion-type water heater shall be of a metal resistant to corrosion in water.

7.34 Openings provided in a soldering tool, such as for ventilating purposes, shall be of such size and orientation with respect to the soldering tip that entry of falling or dripping molten solder, or unintentional insertion of solder wire is not likely to contact, bridge, or otherwise reduce the spacings between uninsulated live parts of opposite polarity, or uninsulated live parts and accessible dead metal parts. Consideration shall be given to the orientation of the soldering tool during use.

7.35 A cord-connected product that is provided with keyhole slots, notches, hanger holes, or the like, for mounting the product on a wall shall be constructed in such a manner that the mounting means shall not be accessible without removing the product from the supporting means.

7.36 When determining compliance with [7.35](#), any part of the enclosure or barriers that can be removed without the use of tools to gain access to the mounting means are to be removed.

7.37 A keyhole slot, notch, or hanger hole shall be located so that the supporting screws or the like cannot damage any electrical insulation or contact uninsulated current-carrying parts of the product.

## 8 Assembly

8.1 A soldering iron, or other cord-connected heating appliance that is likely to be laid on combustible material shall be provided with a stand of noncombustible material upon which it may be placed when not in use, unless the temperature attained by the product is not high enough to cause the ignition of the combustible material.

8.2 The stand may be a separate device or attached to the product, except that an integral type of stand is required for a charcoal ignitor.

8.3 A switch, lampholder, attachment-plug receptacle, or plug-type connector provided as a part of a heating appliance shall be secured so that it is not likely to turn.

8.4 Uninsulated live parts shall be so secured to the base or surface that they are not likely to turn or shift in position as the result of stresses if such motion results in a reduction of spacings below the minimum required in [27.1.1.1](#) – [27.1.1.4](#).

8.5 Friction between surfaces is not acceptable as a means to keep live parts or components from shifting or turning. A lock washer, properly applied, is acceptable for this purpose.

## 9 Stability

9.1 The stability of a heating appliance shall be such that it will not be overturned readily during use.

*Exception No. 1: A heating appliance that is completely hand supported, without the need of stand in normal use, need not be tested.*

*Exception No. 2: A heating appliance that is intended to be mounted to a supporting surface such as the floor, wall, or ceiling need not be tested.*

*Exception No. 3: An upright-type portable appliance that is hand guided while in use need not be tested. An upright-type appliance provided with facilities for non-hand guided operation, such as a hose, shall be tested with the appliance arranged for such non-hand guided operation.*

9.2 An appliance shall be placed on a plane inclined at an angle of 10 degrees to the horizontal, except, a portable household heating appliance in which liquid is heated to a temperature greater than 115 °F (46 °C) is to be placed on a plane inclined at an angle of 15 degrees to the horizontal. The product is to be positioned and loaded with whatever combination of separable components, liquid, or other media (material) that results in the maximum tendency to overturn under conditions of intended use. A product intended to hold liquid shall contain at least 5 oz (148 mL) of liquid. The product is to be prevented from sliding on the inclined surface. The product shall not overturn as a result of this test.

9.3 To determine if a vaporizer in which water is heated complies with the requirements of [9.1](#), the product shall not overturn when subjected to the test described in [9.4](#).

9.4 The vaporizer is to be placed at any position of use on a plane inclined at an angle of 30 degrees to the horizontal. For this test the product is to be assembled and filled with liquid in any condition simulating operating conditions, so as to result in the maximum tendency to overturn. The product is to be supported so that it does not slide on the inclined plane.

## 10 Corrosion Protection

10.1 Except as noted in [10.2](#), iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other means, if the deterioration of such unprotected parts would be likely to result in risk of fire or electric shock.

10.2 In certain equipment where the oxidation of steel is not likely to be accelerated due to the exposure of metal to air and moisture or other oxidizing influence – thickness of metal and temperature also being factors – surfaces of sheet steel within an enclosure may not be required to be protected against corrosion. Cast-iron parts are not required to be protected against corrosion. A sheath employed on a heating element operating in air and terminal parts attached directly to the heating element need not be protected against corrosion.

10.3 The aging characteristics of plating or other finish used in a heating appliance shall be such that deterioration of the finish will not result eventually in unacceptable performance of the product.

## 11 Supply Connections – Permanently-Connected Products

### 11.1 General

11.1.1 Except as noted in [11.1.2](#) and [12.1.5](#), a product intended for permanent connection electrically to the power supply shall have provision for connection of one of the wiring systems that in accordance with the National Electrical Code, ANSI/NFPA 70, would be acceptable for the product.

11.1.2 An insecticide vaporizer intended for wall mounting may employ a flexible cord for connection to the power supply, provided that the length of the cord is not more than 3 ft (0.9 m) for a commercial product and not more than 6 ft (1.8 m) for a household product.

11.1.3 The location of a terminal box or compartment in which power-supply connections to a heating appliance intended to be permanently connected electrically are to be made shall be such that these connections may be readily inspected after the product is installed as intended.

11.1.4 A terminal compartment intended for the connection of a supply raceway shall be so attached to the product that it shall not turn with respect to the product.

11.1.5 An electrical component shall not be mounted on a part, such as the cover of a wiring-terminal compartment, that must be removed for the purpose of making or inspecting field-wiring connections.

*Exception: A single electrical component, such as a switch, a pilot light, or the like, may be mounted on a wiring compartment cover provided that:*

- a) The component connecting leads are of such length to provide for the making, and examination, of field-wiring connections;*
- b) None of the component connections is to be field wired;*
- c) Strain relief is provided to prevent stress from being transmitted to the component wiring terminations, and complies with the strain relief test in [44.2](#);*
- d) The minimum size of the component leads is 18 AWG (0.82 mm<sup>2</sup>); and*
- e) Wiring terminations on the component are recessed or protected by barriers of insulating material or the equivalent that will provide protection from contact with wiring installed in the box, or unintentional contact during installation or inspection of field wiring.*

## 11.2 Wiring terminals

11.2.1 A heating appliance intended for permanent connection to the power supply shall be provided with wiring terminals or leads for the connection of conductors having an ampacity of not less than 125 percent of the current rating of the product when the load is continuous (3 hours or more) and not less than the current rating of the product when the load will be intermittent.

11.2.2 For the purpose of these requirements, wiring terminals are considered to be terminals to which power-supply or control connections will be made in the field when the product is installed. It is to be assumed that 60 °C (140 °F) wire will be used for connections to a continuous-load type of heating appliance rated at 80 A or less and an intermittent-load type of heating appliance rated at 100 A or less. Wire rated for 75 °C (167 °F) will be assumed to be used with product rated in excess of these values.

11.2.3 A wiring terminal shall be provided with a soldering lug or with a pressure wire connector securely fastened in place for example, bolted or held by a screw, except that a wire-binding screw may be employed at a wiring terminal intended to accommodate a 10 AWG (5.3 mm<sup>2</sup>) or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in position.

11.2.4 A wiring terminal shall not turn or shift in position. Friction between surfaces is not an acceptable means. An acceptable means may be by the use of two screws or rivets, by square shoulders or mortises, by a dowel pin, lug or offset, by a connecting strap or clip fitted into an adjacent part, or by some other equivalent method.

11.2.5 A wire-binding screw at a wiring terminal shall not be smaller than No. 10, except that a No. 8 screw may be used at a terminal intended only for the connection of a 14 AWG (2.1 mm<sup>2</sup>) or smaller conductor, and a No. 6 screw may be used for the connection of a 16 or 18 AWG (1.3 or 0.82 mm<sup>2</sup>) control-circuit conductor.

11.2.6 A terminal plate tapped for a wire-binding screw shall be of metal not less than 0.050 inch (1.3 mm) thick, except that a plate not less than 0.030 inch (0.8 mm) thick is acceptable if the tapped threads have acceptable mechanical strength. There shall be two or more full threads in the metal, which may be extruded if necessary to provide the threads.

11.2.7 Upturned lugs or a cupped washer shall be capable of retaining a conductor of the size mentioned in [11.2.1](#), but not smaller than 14 AWG (2.1 mm<sup>2</sup>), under the head of the screw or the washer.

11.2.8 A wire-binding screw shall thread into metal.

11.2.9 A heating appliance intended for connection to a grounded power-supply conductor and employing:

- a) A lampholder or element holder of the Edison-screw-shell type;
- b) A single-pole switch; or
- c) A single-pole automatic control

shall have one terminal or lead identified for connection of the grounded conductor of the supply circuit. The identified terminal or lead shall be the one that is connected to screw shells of lampholders or element holders, and with no connection to single-pole switches or single-pole automatic controls, except as noted in [26.2](#).

11.2.10 A terminal provided for the connection of a grounded circuit conductor shall be made of or plated with a metal white in color, or have the word "white" located adjacent to the terminal and shall be readily

distinguishable from the other terminals, or proper identification of that terminal shall be clearly shown in some other manner, such as on an attached wiring diagram. A lead intended for the connection of a grounded circuit conductor shall be finished to show a white or gray color and shall be distinguishable from the other leads.

11.2.11 Except as noted in [11.2.12](#), the free length of a lead inside an outlet box or wiring compartment shall be 6 inches (152 mm) or more if the lead is intended for field connection to an external circuit.

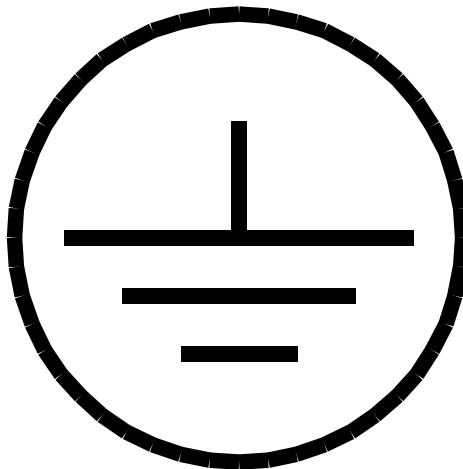
11.2.12 A lead may be less than 6 inches (152 mm) in length if it is evident that the use of a longer lead might result in a risk of fire or electric shock.

11.2.13 The surface of an insulated lead intended solely for the connection of an equipment-grounding conductor shall be green with or without one or more yellow stripes, and no other lead in the field wiring area shall be so identified.

11.2.14 A wire-binding screw intended for the connection of an equipment-grounding conductor shall be identified by:

- a) Use of a green-colored head that is slotted or hexagonal, or both; or
- b) The grounding symbol illustrated in [Figure 11.1](#) on or adjacent to the terminal or on a wiring diagram provided on the product.

**Figure 11.1**  
**Grounding symbol**



11.2.15 A pressure-wire connector intended for connection of such a conductor shall be plainly identified by:

- a) Being marked "G", "GR", "GND", "Ground", "Grounding" or the like;
- b) A marking on the wiring diagram provided on the heating appliance; or
- c) The grounding symbol illustrated in [Figure 11.1](#) on or adjacent to the terminal or on a wiring diagram provided on the product.

11.2.16 The wire-binding screw or pressure-wire connectors shall be so located that it is unlikely to be removed during the servicing of the product.

11.2.17 A terminal intended solely for connection of an equipment-grounding conductor shall be capable of securing a conductor of the size acceptable for the particular product, in accordance with the National Electrical Code, ANSI/NFPA 70.

## 12 Supply Connections – Cord Connected Products

### 12.1 General

12.1.1 A cord-connected heating appliance shall be provided with a length of attached flexible cord and an attachment plug for connection to the supply circuit, or shall have male pin terminals that accommodate a detachable power-supply cord. The length of the cord shall be within the limits indicated in [Table 12.1](#). All detachable power-supply cords and permanently-connected power-supply cords shall comply with the requirements of the Standard for Cord Sets and Power-Supply Cords, UL 817.

**Table 12.1**  
**Lengths and types of cord connection**

| Type of heating appliance                                                                                                      | Kind of cord connection                       | Minimum acceptable length <sup>a</sup> |                    | Maximum acceptable length <sup>a</sup> |       |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------|--------------------|----------------------------------------|-------|
|                                                                                                                                |                                               | ft                                     | (m)                | ft                                     | (m)   |
| Counter-top, bench-top, or table-top appliances intended for household use                                                     | Attached cord or detachable power-supply cord | 2.0 <sup>b</sup>                       | (0.6) <sup>b</sup> | 7.0                                    | (2.1) |
| Soldering iron, guns, wood burning pencils                                                                                     | Attached cord                                 | 4.5                                    | (1.4)              | –                                      | –     |
| Soldering station                                                                                                              | Attached cord or detachable power-supply cord | 2.5 <sup>b</sup>                       | (0.8) <sup>b</sup> | –                                      | –     |
| Stock tank water heater (except floatation type), bucket heater, deicer and similar appliances used out of doors <sup>c</sup>  | Attached cord                                 | 2.0                                    | (0.6)              | 6.0                                    | (1.8) |
| Dedicated location instantaneous water heaters                                                                                 | Attached cord or detachable power-supply cord | 2.0                                    | (0.6)              | 6.0                                    | (1.8) |
| Adhesive guns (hot melt) <sup>d</sup> , brooders, incubators, water stills                                                     | Attached cord                                 | 5.0                                    | (1.5)              | –                                      | –     |
| All other heating appliances intended for outdoor use                                                                          | Attached cord or detachable power-supply cord | 1.0 <sup>e</sup>                       | (0.3) <sup>e</sup> | –                                      | –     |
| All heating appliances not covered above                                                                                       | Attached cord or detachable power-supply cord | 6.0                                    | (1.8)              | –                                      | –     |
| <sup>a</sup> Measured external to the appliance and including the fittings but excluding the blades on the attachment plug.    |                                               |                                        |                    |                                        |       |
| <sup>b</sup> See <a href="#">53.12</a> when cord length is less than 4.5 ft (1.4 m).                                           |                                               |                                        |                    |                                        |       |
| <sup>c</sup> See <a href="#">12.1.19</a> for specialty use cord sets for bucket heaters, bucket de-icers and heated pet bowls. |                                               |                                        |                    |                                        |       |
| <sup>d</sup> Hybrid adhesive guns may be provided with a detachable power-supply cord.                                         |                                               |                                        |                    |                                        |       |
| <sup>e</sup> See <a href="#">53.38</a> when cord length is less than 6 ft (1.8 m).                                             |                                               |                                        |                    |                                        |       |

12.1.2 A hand-supported indoor use heating appliance employing a detachable power-supply cord shall include a positive means for retaining the appliance coupler body to the appliance during use. Typical retaining means may include a friction type fit coupled with a rib-type construction, snap-type fit or similar techniques. Friction type fit alone does not meet the intent of the requirement.

*Exception: A hand-supported indoor use heating appliance is not required to employ a retaining means if it complies with the requirements for Appliance Coupler Retention, Section [48](#).*

12.1.3 A hand-supported outdoor use heating appliance shall employ a permanently attached supply cord.

12.1.4 Hand-supported heating appliances provided with detachable power supply cords, including hand-supported appliances likely to be disconnected while under load, shall not pose a risk of electric shock, fire or injury when mated or disconnected under any orientation or polarity permitted by the construction. The mating connector shall be held securely in place and shall not be allowed to rotate. Compliance is determined by the connector current interruption test in Section [49](#).

12.1.5 A cord-connected heating product intended to be fastened in place or located in a dedicated space may be acceptable if provided with a short length of flexible cord and an attachment plug for supply connection. The investigation of such a feature will include consideration of the utility of the product and the necessity of having it readily detachable from its source of supply by means of the attachment plug.

12.1.6 For a cord-connected heating appliance, the rating (both current and voltage) of the cord and the fittings, for a product rated at 15 A or less, shall not be less than that of the product. For a product rated at more than 15 A, the ampacity of the cord and fittings shall not be less than the current rating of the product. The current rating of the attachment plug shall not be less than 125 percent of the current rating of the product when the load will constitute a continuous load (3 hours or more), except that a 20-A attachment plug is acceptable for a product rated at no more than 4000 W at 240 V.

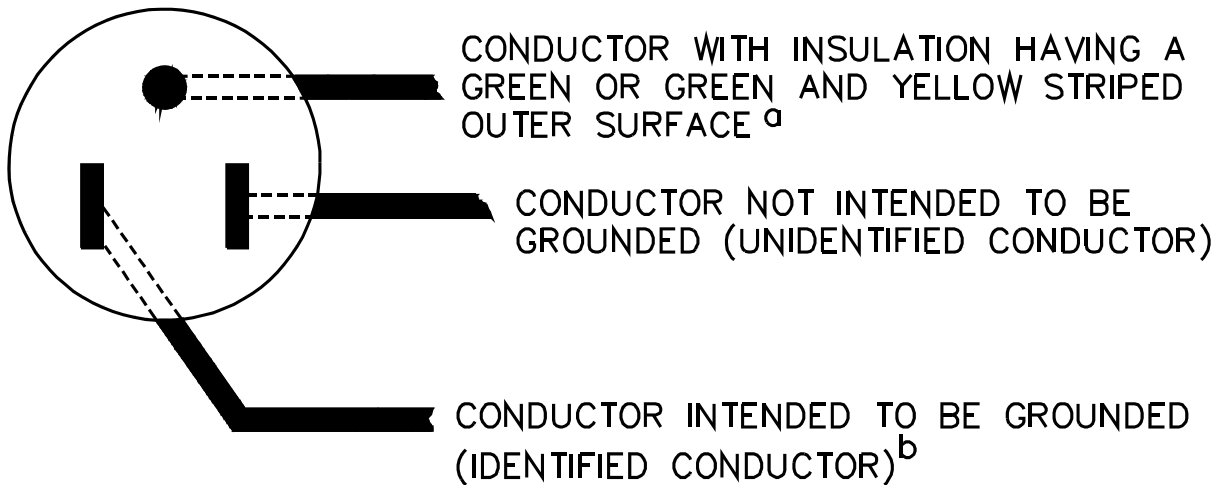
12.1.7 The attachment plug of the power-supply cord of an appliance provided with a 15- or 20-ampere general-use receptacle shall be of the 3-wire grounding type. The attachment plug of the power-supply cord of an appliance provided with either a manually operated, line-connected, single pole switch for appliance on-off operation or an Edison-base lampholder shall be of the 2-wire polarized or 3-wire grounding type.

12.1.8 If a 3-wire grounding-type attachment plug or a 2-wire polarized attachment plug is provided, the attachment plug connections shall comply with [Figure 12.1](#) and the polarity identification of the flexible cord shall comply with [Table 12.2](#).

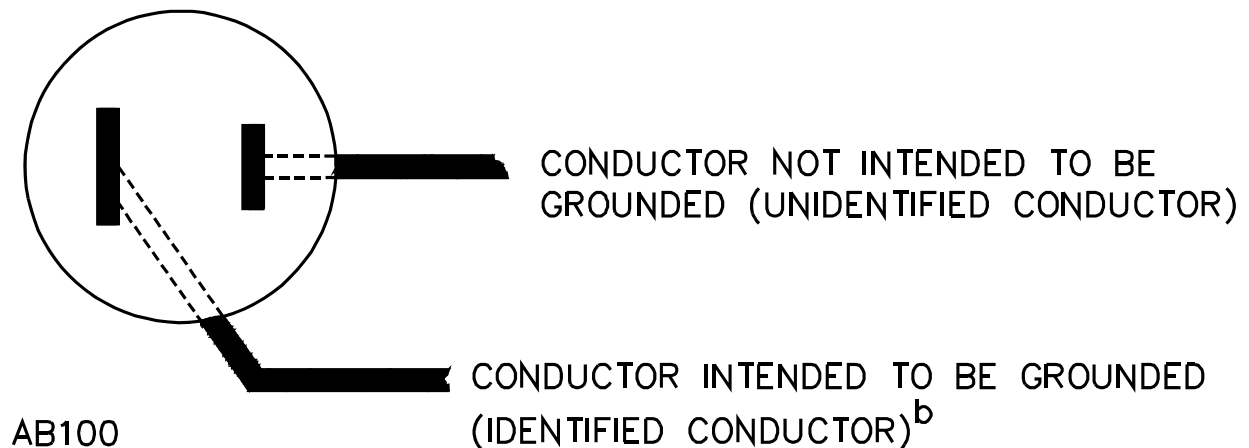
Figure 12.1

## Connection to attachment plugs

## CONNECTIONS OF CORD CONDUCTORS TO GROUNDING – TYPE ATTACHMENT PLUG (FACE OF PLUG REPRESENTED)



## CONNECTIONS OF CORD CONDUCTORS TO POLARIZED ATTACHMENT PLUG (FACE OF PLUG REPRESENTED)



## NOTES –

- 1) The blade to which the green conductor is connected may have a U-shaped or circular cross section.
- 2) Signifies a conductor identified in accordance with [Table 12.2](#).

**Table 12.2**  
**Polarity identification of flexible cords**

| Method of identification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Acceptable combinations                                                 |                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Wire intended to be grounded <sup>a</sup>                               | All other wires <sup>a</sup>                                |
| Color of braids on individual conductors                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | A Solid white or gray – without tracer                                  | Solid color other than white or gray – without tracer       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | B Color other than white or gray, with tracer in braid                  | Solid color other than white or gray – without tracer       |
| Color of insulation on individual conductors                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | C <sup>b</sup> Solid white or gray                                      | Solid color other than white or gray                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | C1 <sup>c</sup> Light blue                                              | Solid color other than light blue, white, or gray           |
| Color of separators                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | D <sup>d</sup> White or gray                                            | Color other than white or gray                              |
| Other means                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | E <sup>e</sup> Tin or other white metal on all strands of the conductor | No tin or other white metal on the strands of the conductor |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | F A stripe, ridge, or groove on the exterior surface of the cord        |                                                             |
| <sup>a</sup> A wire finished to show a green color with or without one or more yellow stripes or tracers is to be used only as an equipment grounding conductor. See <a href="#">12.1.8</a> and <a href="#">Figure 12.1</a> .<br><sup>b</sup> Only for cords – other than Types SP-1, SP-2, and SPT-1– having no braid on any individual conductor.<br><sup>c</sup> For jacketed cord.<br><sup>d</sup> Only for Types SP-1, SP-2, SPT-1, and SPT-2 cords.<br><sup>e</sup> Only for Types SPT-1 and SPT-2 cords. |                                                                         |                                                             |

12.1.9 The conductor of the power-supply cord that is intended to be grounded, identified by [Table 12.2](#), shall have the following items connected to it:

- a) The screw shell of an Edison-base lampholder; and
- b) The terminal or lead of a receptacle intended to be grounded.

12.1.10 A cord-connected product that is provided with keyhole slots, notches, hanger holes, brackets, or the like, for mounting to a wall shall be considered as not intended to be moved.

12.1.11 If a commercial-type heating appliance intended for cord connection does not have an attached cord, the male pins shall not accommodate a conventional flatiron or appliance plug, see [12.3.7](#) and [Table 12.4](#), and a detachable power-supply cord shall be provided with the product.

12.1.12 An attached power-supply cord and the cord in a detachable power-supply cord that is provided with a heating appliance shall be of a type indicated in [Table 12.3](#), or shall have such properties that it will be at least as serviceable for the particular application.

**Table 12.3**  
**Acceptable types of cord and applicable limitations of their use**

| Appliance on which the cord is to be used                                                                                                                                                                             | Cords acceptable where temperatures are more than 121 °C (250 °F) on any surface that the cord is likely to touch when the appliance is used as intended                                            | Cords acceptable where temperatures are 121 °C (250 °F) or less on any surface that the cord is likely to touch when the appliance is used as intended                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Except as noted below, household heating appliances that are not intended for use outdoors                                                                                                                            | HPD, HPN, HSJ, HSJOO, or HSJO                                                                                                                                                                       | HPD, HPN, HSJ, HSJOO, HSJO, SP-2, SPE-2, SPT-2, SV, SVO, SVE, SVOO, SVT, SVTO, SVTOO, SJ, SJO, SJE, SJOO, SJT, SJTO, or SJTOO                                                                       |
| Except as noted below, poultry incubators and brooders, sterilizers, glue pots, solder pots, tire vulcanizers, insecticide vaporizers, and other commercial heating appliances that are not intended for use outdoors | HSJ, HSJOO, or HSJO                                                                                                                                                                                 | HSJ, HSJOO, HSJO, SJ, SJO, SJE, SJOO, SJT, SJTO, SJTOO, S, SO, SE, SOO, ST, STO, or STOO                                                                                                            |
| Counter- or table-top laboratory appliances that are not intended for use outdoors, and have a mass not exceeding 1-1/4 lb (0.567 kg) <sup>a</sup>                                                                    | HPN, HSJ, HSJOO, HSJO                                                                                                                                                                               | HPN, HSJ, HSJOO, HSJO, SV, SVO, SVE, SVOO, SVT, SVTO, or SVTOO                                                                                                                                      |
| Barbecue-spit motor                                                                                                                                                                                                   | SJO, SJE, SJOO, SJT, SJTO, or SJTOO                                                                                                                                                                 | SJO, SJE, SJOO, SJT, SJTO, or SJTOO                                                                                                                                                                 |
| Wood-burning appliances (pencils), and 1/2 lb (0.227 kg) and lighter soldering irons, guns or adhesive guns (hot melt) <sup>a</sup>                                                                                   | TP or TPT maximums: 8 ft (2.4 m) cord, 50 W, and 1/2 lb (0.227 kg)                                                                                                                                  | TP or TPT maximums: 8 ft (2.4 m) cord and 50 W                                                                                                                                                      |
|                                                                                                                                                                                                                       | SP-1, SPE-1, or SPT-1 (36 AWG or 0.127 mm strands are required)                                                                                                                                     | SP-1, SPE-1, or SPT-1 (36 AWG or 0.127 mm strands are required)                                                                                                                                     |
|                                                                                                                                                                                                                       | HPD                                                                                                                                                                                                 | HPD                                                                                                                                                                                                 |
|                                                                                                                                                                                                                       | XT (36 AWG or 0.127 mm strands, 20 AWG cord, and the parallel 2-conductor construction are required)<br>XTW (0.125 mm strands, 20 AWG cord, and the parallel 2-conductor construction are required) | XT (36 AWG or 0.127 mm strands, 20 AWG cord, and the parallel 2-conductor construction are required)<br>XTW (0.125 mm strands, 20 AWG cord, and the parallel 2-conductor construction are required) |
| Soldering irons or guns and adhesive guns (hot melt), heavier than 1/2 lb (0.227 kg) <sup>a</sup>                                                                                                                     | SP-2, SPE-2, or SPT-2 (36 AWG or 0.127 mm strands are required)                                                                                                                                     | SP-2, SPE-2, or SPT-2 (36 AWG or 0.127 mm strands are required)                                                                                                                                     |
|                                                                                                                                                                                                                       | SV, SVO, SVE, SVOO, SVT, SVTO, or SJTOO                                                                                                                                                             | SV, SVO, SVE, SVOO, SVT, SVTO, or SVTOO                                                                                                                                                             |
|                                                                                                                                                                                                                       | HPD, HPN, SJ, SJO, SJE, SJOO, SJT, SJTO, or SJTOO                                                                                                                                                   | HPD, HPN, SJ, SJO, SJE, SJOO, SJT, SJTO, or SJTOO                                                                                                                                                   |
| Heat-sealing irons                                                                                                                                                                                                    | HPD, HPN, HSJ, HSJOO, or HSJO                                                                                                                                                                       | HPD, HPN, HSJ, HSJOO, HSJO, SJ, SJO, SJE, SJOO, SJT, SJTO, or SJTOO                                                                                                                                 |
| Household vaporizers                                                                                                                                                                                                  | HPN, HSJ, HSJOO, or HSJO                                                                                                                                                                            | HPN, HSJ, HSJOO, HSJO, SP-1, SPE-1, SPT-1, SP-2, SPE-2, or SPT-2                                                                                                                                    |
| <sup>a</sup> The weight of the appliance is to be determined without the power-supply cord and, for an adhesive gun, with the adhesive installed.                                                                     |                                                                                                                                                                                                     |                                                                                                                                                                                                     |

**Table 12.4**  
**Pins of appliance and flatiron plugs**

| Type and rating of plug that accommodates the pins                                                  | Configuration of pins |                                            |                                    | Dimensions of pins          |                             |
|-----------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------|------------------------------------|-----------------------------|-----------------------------|
|                                                                                                     | Number                | Arrangement                                | Spacing between centers, inch (mm) | Diameter, inch (mm)         | Length, inch (mm)           |
| Appliance plug rated 5 A at 250 V and 10 A at 125 V                                                 | 2                     | In line                                    | 1/2 (12.7)                         | 0.156 ±0.005<br>(4.0±0.13)  | 9/16 – 5/8<br>(14.3 – 15.9) |
| Flatiron plug rated 5 A at 250 V and 10 A at 125 V                                                  | 2                     | In line                                    | 11/16 (17.5)                       | 0.188 ±0.005<br>(4.8 ±0.13) | 3/4 – 7/8<br>(19.0 – 22.2)  |
| Jumbo appliance plug rated 10 A at 250 V and 15 A at 125 V                                          | 2                     | In line                                    | 1-1/16 (27.0)                      | 0.188 ±0.005<br>(4.8 ±0.13) | 3/4 – 7/8<br>(19.0 – 22.2)  |
| Reversible plug (for two-heat control) rated 10 A at 250 V and 15 A at 125 V <sup>a</sup>           | 3                     | In line                                    | 7/8 (22.2)                         | 0.188 ±0.005<br>(4.8 ±0.13) | 3/4 – 7/8<br>(19.0 – 22.2)  |
| Reversible plug (for two- or three-heat control) rated 10 A at 250 V and 15 A at 125 V <sup>a</sup> | 3                     | One pin at apex of an equilateral triangle | 7/8 (22.2)                         | 0.188 ±0.005<br>(4.8 ±0.13) | 3/4 – 7/8<br>(19.0– 22.2)   |

<sup>a</sup> Usually this plug is made without a contact in one of the holes.

12.1.13 A vaporizer intended for use with glycol shall not employ thermoplastic-insulated flexible cord if the construction is such that the cord is likely to be exposed to the vapor.

12.1.14 The flexible cord provided with a stock tank de-icer, poultry water heater, or comparable heating appliance intended or likely to be used out of doors shall be suitable for outdoor use and have a type letter suffix of "W".

12.1.15 Supplementary insulation, if employed on a flexible cord, shall not extend more than 1/2 inch (13 mm) outside the product – unless provided with additional mechanical protection – shall not fray or unravel, and shall not affect adversely the means for providing strain relief.

12.1.16 An attachment plug having an Edison screw shell shall not be supplied with a cord-connected product rated at more than 6 A or 660 W.

12.1.17 If the power source for a product is electrically separable from the product, both the power source and the product shall be marked in accordance with [53.30](#).

12.1.18 In addition to the requirement in [12.1.17](#), if the power source is not provided with a special connector, or if it is not permanently attached to the product, the power source shall comply with the applicable requirements for that power equipment.

12.1.19 Stock tank deicers, pond deicers, heated pet mats, bucket heaters, bucket deicers and heated pet bowls may be provided with a special use detachable power supply cord provided all the following conditions are met:

a) The special use detachable power supply cord is found to comply with the Standard for Cord Sets and Power-Supply Cords, UL 817, and is suitable for outdoor use;

b) The special use detachable power supply cord is constructed such that there is a barrier or equivalent to prevent ingress of moisture, rain, snow and ice from coming into contact with electrical connection including the mating point between the power supply cord plug of the appliance and the special use detachable power supply cord. The combination of the special use

power supply cord and appliance is to be tested in accordance with [37.3](#), [37.6](#), [37.13](#), and Section [40](#);

c) Thermoplastic constructions used to comply with item (b) shall additionally comply with the following requirements detailed in the Standard Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, Table 4.1 as summarized in [Table 12.5](#);

d) Thermoplastic materials used to comply with item (b) above shall be constructed of a plastic material designated f(1) or evaluated in accordance with the Standard Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, UV Resistance per 25.1 and Water Exposure and Immersion, Section 26;

e) The special use detachable power supply cord connection point to the appliance power supply cord shall be provided with a means for mounting the connection point off the ground, such as a minimum 3/8 inch (9.5 mm) diameter mounting hole, detachable type stake with a minimum length of 12 inches (305 mm) and maximum length of 32 inches (813 mm) or equivalent means found suitable for the purpose. After completion of installation, the connector shall be maintained a minimum of 6 inches (152 mm) above the ground. Installation instructions shall be provided describing the intended use and mounting means. The instructions shall comply with [53.18](#) and should include the following or equivalent “After complete installation, the connector shall be maintained a minimum of 6 inches above the ground.”;

f) Gasket and Seals employed to meet item (b) shall comply with the applicable requirements of the Standard Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C and be suitable for use in the application;

g) The special use detachable power supply cord and appliance shall be provided with the markings and instructions of [53.15](#), [53.16](#) and [53.18](#);

h) The length of the special use detachable supply cord shall not exceed 25 ft for household application and 100 ft for other than household use;

i) A special use detachable power supply cord longer than 25 ft shall also be provided with the markings and instructions of [53.19](#);

j) The gauge of the special use detachable supply cord shall comply with the requirements for Outdoor-Use Cord Sets – Flexible Cords in the Standard for Cord Sets and Power-Supply Cords, UL 817.

**Table 12.5**  
**Thermoplastic constructions**

| Minimum flammability rating                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V <sup>b,d</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Material Properties per Table 6.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes              |
| Impact Test per Section 22 including cold impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Yes              |
| Crush resistance per 21.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Yes              |
| Mold Stress Relief Distortion per Section 29.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Yes <sup>e</sup> |
| Strain Relief Test per 31.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Yes <sup>f</sup> |
| <sup>b,d</sup> V = V-0, V-1, V-2 classed materials or the enclosure complies with the 12 mm or 20 mm end-product flame tests described in Sections 15 and 16 respectively.<br><sup>e</sup> Mold-Stress Relief. For V enclosures that comply with the 12 mm or 20 mm end-product flame tests as described in Sections 15 and 16 respectively use Section 61.1.<br><sup>f</sup> This test is only required if the strain-relief means is secured to the enclosure or is an integral part of the polymeric enclosure |                  |

## 12.2 Strain relief

12.2.1 Strain relief shall be provided to restrict a mechanical stress on an attached power-supply cord from being transmitted to terminals, splices, or interior wiring.

12.2.2 If wood, pressed board, or other fibrous material is used to secure the strain-relief assembly, the fibrous material shall be secured to the product by a pin, setscrew, or other positive means.

12.2.3 Means shall be provided to restrict an attached power-supply cord from being pushed into the enclosure of a product through the cord-entry hole. To determine compliance, the supply cord shall be tested in accordance with the Push-Back Relief Test, Section [45](#).

12.2.4 If a knot serves as strain relief in an attached power-supply cord, any surface with which the knot may come in contact shall be free from projections, sharp edges, burrs, fins, and the like, that may cause abrasion of the insulation on the conductors.

## 12.3 Pin terminals

12.3.1 If a heating appliance is provided with pin terminals, the construction of the product shall be such that live parts will not be exposed to unintentional contact both during and after the placement of the plug on the pins, in the intended manner.

12.3.2 A pin guard is required, such that:

a) A straight edge placed in any position, across and in contact with edges of the plug opening without the plug in place, cannot be made to contact any current-carrying pin.

b) With the plug aligned with the pins and the face of the plug in a plane located perpendicular to the end or ends of the farthest projecting current-carrying pin, the probe illustrated in [Figure 7.4](#) should not touch any current-carrying pin while the probe is inserted through any opening with the product in any position.

12.3.3 The plug used in [12.3.2\(b\)](#) is to be the plug supplied with the product.

12.3.4 If a heating appliance employs three or more pin terminals designed for use with a plug that covers all the pins, the terminals shall be so spaced that they will not accommodate a flatiron or appliance plug or cord connector. The plug which these pins will accommodate shall be acceptable for the particular application.

12.3.5 A pin terminal shall be securely mounted by means other than friction between surfaces, and shall not shift in position.

12.3.6 The requirement in [12.3.5](#) is intended primarily to provide for the maintenance of spacings as given in [27.1.1.1](#) and [Table 27.1](#) and [Table 27.2](#) and to provide for the maintenance of proper spacings between pin terminals. Under this requirement, consideration is also to be given to the means for locking terminals in position to maintain tightness.

12.3.7 For a household-type heating appliance, the dimensions of pins and their center-to-center spacings – including the corresponding spacings of the female contacts of general-use plugs that these arrangements of pins will accommodate are as indicated in [Table 12.4](#).

12.3.8 If a vaporizer is provided with pin terminals, they may be affected adversely by the steam spray or careless filling of the reservoir, consideration is to be given to:

- a) The material on which the pins are mounted;
- b) The proximity of the vapor outlet to the terminals;
- c) The direction of the vapor spray; and
- d) The likelihood of water being present but not necessarily visible at the terminals.

## 12.4 Bushings

12.4.1 At a point where a flexible cord passes through an opening in a wall, barrier, or enclosing case, there shall be a bushing or the equivalent that shall be secured in place, and shall have a smooth, well-rounded surface against which the cord may bear. If Type SP-1, SPT-1, SP-2, SPT-2, or other cord lighter than Type HSJ is employed, if the wall or barrier is of metal, and if the construction is such that the cord may be subjected to strain or motion, an insulating bushing shall be provided. The heat- and moisture-resistant properties of the bushing material shall be such that the bushing is acceptable for the particular application.

12.4.2 If the cord hole is in wood, porcelain, phenolic composition, or other nonconducting material, a smooth, well-rounded surface is considered to be equivalent to a bushing.

12.4.3 Ceramic materials and some molded compositions are acceptable generally for insulating bushings, but a separate bushing of wood, hot-molded shellac and tar composition, or rubber material (other than in a motor) is not acceptable. Vulcanized fiber may be employed if the bushing is not less than 3/64 inch (1.2 mm) thick and if it is so formed and secured in place that it will not be affected adversely by moist conditions.

12.4.4 A separate soft-rubber, neoprene, or polyvinyl chloride bushing may be employed in the frame of a motor or in the enclosure of a capacitor physically attached to a motor – but not elsewhere in a heating appliance, except as indicated in [12.4.5](#) – provided that:

- a) The bushing is not less than 3/64 inch (1.2 mm) thick; and
- b) The bushing is so located that it will not be exposed to oil, grease, oily vapor, or other substance having a deleterious effect on the compound employed.

12.4.5 A bushing of any of the materials mentioned in [12.4.4](#) may be employed at any point in a product if used in conjunction with a type of cord for which an insulating bushing is not required, and if the edges of the hole in which the bushing is mounted are smooth and free from burrs, fins, and the like.

12.4.6 An insulated metal grommet is acceptable in place of an insulating bushing if the insulating material used is not less than 1/32 inch (0.8 mm) thick, and completely fills the space between the grommet and the metal in which it is mounted.

## 13 Current-Carrying Parts

13.1 Each current-carrying part shall be made of metal that is acceptable for the particular application.

13.2 Current-carrying parts made of corrosion-resistant alloys, for example, stainless steel, are acceptable regardless of temperature. Current-carrying parts made of ordinary iron and steel are not acceptable unless they are rendered corrosion-resistant by a coating and, even then, they are acceptable only as follows:

- a) Pin terminals.

- b) Terminals and other parts of a motor and its governor (if any).
- c) Parts whose normal operating temperature is higher than 100 °C (212 °F).
- d) Parts of a component that the requirements referred to in [6.1.1](#) indicate as being acceptable with coated iron and steel parts.

13.3 A heating appliance that is provided with a reservoir (intended to hold a liquid), shall have all live parts so located or otherwise protected so that they will not be subject to wetting if the reservoir were to leak.

*Exception: Live parts need not be so located or protected if the reservoir:*

- a) Is resistant to corrosion from the liquid intended for use in it; and*
- b) Complies with the applicable requirements in Resistance to Impact, Section [40](#).*

## 14 Internal Wiring

### 14.1 General

14.1.1 The internal wiring of a heating appliance shall consist of wires of a size and type or types that are acceptable for the particular application, when considered with respect to:

- a) The temperature and voltage to which the wiring is likely to be subjected;
- b) Its exposure to oil or grease; and
- c) Other conditions of service to which it is likely to be subjected.

14.1.2 There is no temperature limit applicable to glass fiber, beads of inorganic material, or the equivalent employed as conductor insulation.

14.1.3 Thermoplastic-insulated wire employed for the internal wiring of a heating appliance shall be standard building wire, fixture wire, or appliance-wiring material acceptable for the particular application.

### 14.2 Protection of wiring

14.2.1 The wiring and connection between parts of a heating appliance shall be protected or enclosed, except that a length of flexible cord may be employed for external connections, or for internal connections that may be exposed during servicing, if flexibility of the wiring is essential. A bare conductor or a conductor with beads for insulation shall not be used outside an enclosure.

14.2.2 Internal wiring which is exposed through an opening in the enclosure of a heating appliance is considered to be protected as required in [14.2.1](#) if, when judged as if it were enamel-insulated wire, the wiring would be acceptable according to [7.13](#) – [7.18](#). Internal wiring within an enclosure is acceptable if, even though it can be touched with the probe, it is so protected or guarded that it cannot be grasped or hooked in such a manner that it could be subjected to stress.

14.2.3 Internal terminals and wiring of a vaporizer may be adversely affected by the steam spray or careless filling of the reservoir. Accordingly, the items mentioned in [12.3.8](#) should be given consideration.

14.2.4 If the wiring of a heating appliance is so located that it may be in proximity to combustible material or may be subjected to mechanical injury, it shall be armored cable or in rigid metal conduit, electrical metallic tubing, metal raceway, or shall otherwise be protected.

14.2.5 Wires within an enclosure, compartment, raceway, or the like, shall be so located or protected that damage to conductor insulation cannot result from contact with any rough, sharp, or moving part.

14.2.6 A hole by means of which insulated wires pass through a sheet-metal wall within the overall enclosure of a heating appliance shall be provided with a smooth, well-rounded bushing or shall have smooth, well-rounded surfaces upon which the wires may bear, so as not to abrade the insulation. A flexible cord used for external interconnection as mentioned in [14.2.1](#) shall be provided with a strain relief and bushings in accordance with [12.2.1](#) – [12.2.4](#) and [12.4.1](#) – [12.4.6](#) unless the construction is such that the cord will be protected from stress or motion.

14.2.7 Insulated wires may be bunched and passed through a single opening in a metal wall within the enclosure of a heating appliance.

### 14.3 Splices

14.3.1 All splices and connections shall be mechanically secure and shall provide good electrical contact. A soldered connection shall be made mechanically secure before being soldered if breaking or loosening of the connection may result in risk of fire or electric shock.

14.3.2 A splice shall be provided with insulation equivalent to that of the wires involved if permanence of spacing between the splice and other metal parts of the product is not reliably maintained.

14.3.3 Insulation consisting of two layers of friction tape, two layers of thermoplastic tape, or of one layer of friction tape on top of one layer of rubber tape, is acceptable on a splice if the voltage involved is not more than 250 V. In determining whether splice insulation consisting of coated fabric, thermoplastic, or other type of tubing is acceptable, consideration is to be given to such factors as its dielectric properties, heat-resistant and moisture-resistant characteristics. Thermoplastic tape wrapped over a sharp edge is not acceptable.

14.3.4 Where stranded internal wiring is connected to a wire-binding screw, loose strands of wire shall not contact any other uninsulated live part that is not always of the same polarity as the wire, and shall not contact any dead metal part. This may be accomplished by the use of pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or other reliable means.

### 14.4 Separation of circuits

#### 14.4.1 General

14.4.1.1 Unless provided with insulation rated for the highest voltage involved, insulated conductors of circuits connected to separate sources of supply shall be separated by barriers or segregated. Except as described in [14.4.1.3](#), an insulated conductor of one circuit shall be separated or segregated from any uninsulated live parts of a different circuit.

14.4.1.2 Segregation of insulated conductors may be accomplished by clamping, routing, or an equivalent means that provides permanent separation from insulated or uninsulated live parts of a different circuit.

14.4.1.3 Field-installed conductors of any circuit shall be segregated by barriers from:

- a) Field-installation and factory-installed conductors connected to any other circuit, unless the conductors of both circuits are or will be insulated for the maximum voltage of either circuit; and
- b) Uninsulated live parts of any other circuit of the product, and from any uninsulated live parts whose short-circuiting would result in a risk of fire or electric shock except that:

1) A construction in which field-installed conductors may make contact with wiring terminals is acceptable provided that Type THHN, TF, or equivalent conductors are or will be installed; and

2) A construction in which field-installed conductors that do or may have insulation less than the types of wire mentioned in (1) may make contact with low-voltage wiring terminals (see [14.4.2.1](#)) is acceptable, provided that the short-circuiting of such terminals would not result in a risk of fire or electric shock.

14.4.1.4 With respect to [14.4.1.3\(a\)](#), if the intended uses of a product are such that in some applications a barrier is required, a removable barrier or one having opening for the passage of conductors may be employed provided instructions for the use of the barrier are a permanent part of the product, and complete instructions in conjunction with a wiring diagram may be acceptable instead of a barrier if, upon investigation, the combination is found to be adequate.

14.4.1.5 Segregation of field-installation conductors from other field-installation conductors and from uninsulated live parts of a product connected to different circuits may be accomplished by arranging the location of the openings in the enclosure for the various conductors – with respect to the terminals or other uninsulated live parts – so that there is no likelihood of the intermingling of the conductors or parts of different circuits. If the number of openings in the enclosure does not exceed the minimum required for the proper wiring of the product, and if each opening is located opposite a set of terminals, it is to be assumed – for the purpose of determining whether the product complies with the requirement in [14.4.1.3](#) – that the conductors entering each opening will be connected to the terminals opposite the opening. If more than the minimum number of openings are provided, the possibility of conductors entering at points other than opposite the terminals to which they are intended to be connected and contacting insulated conductors or uninsulated current-carrying parts connected to a different circuit is to be investigated. To determine whether the product complies with the requirement in [14.4.1.3](#), it is to be wired as it would be in service, and in doing so, a reasonable amount of slack is to be left in each conductor, within the enclosure, and no more than average care is to be exercised in stowing this slack in the wiring compartment.

## 14.4.2 Low-voltage circuit

14.4.2.1 Except as noted in [14.4.2.1.1](#), a low-voltage circuit is one supplied by a primary battery, by a standard Class 2 transformer, or by an impedance which, as a unit, complies with all of the performance requirements for a Class 2 transformer with a voltage not exceeding:

- a) 30 V rms,
- b) 42.4 V peak, or
- c) 60 V dc continuous.

14.4.2.1.1 For appliances where the skin of the operator is expected to be wet in normal use of the appliances, the corresponding voltage limits are:

- a) 15 V rms,
- b) 21.2 V peak,
- c) 30 V dc continuous.

14.4.2.2 A circuit derived from a source of supply classified in [14.4.3.1](#) as a line-voltage circuit, by connecting 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 as described in [14.4.2.1](#).

### 14.4.3 Line-voltage circuit

14.4.3.1 A line-voltage circuit is one involving a potential of not more than 600 V and having circuit characteristics in excess of those of a low-voltage circuit.

### 14.4.4 Barriers

14.4.4.1 If a barrier is used to provide separation between the wiring of different circuits, it shall be of metal or of insulating material, of adequate mechanical strength if exposed or otherwise likely to be subjected to mechanical damage, and reliably held in place. Unclosed openings in a barrier for the passage of conductors shall not be larger in diameter than 1/4 inch (6.4 mm) and shall not exceed in number, on the basis of one opening per conductor, the number of wires that will need to pass through the barrier. The closure for any other opening shall present a smooth surface wherever an insulated wire may be in contact with it, and the area of any such opening, with the closure removed, shall not be larger than required for the passage of the necessary wires.

14.4.4.2 A metal barrier shall have a thickness at least as great as the minimum acceptable thickness of the enclosure metal. A barrier of insulating material shall not be less than 0.028 inch (0.71 mm) thick and shall be of greater thickness if its deformation may be readily accomplished so as to defeat its purpose.

## 15 Heating Elements

15.1 A heating element shall be supported in an acceptable manner. It shall be protected against mechanical damage and contact with outside objects.

15.2 In determining whether a heating element is acceptably supported, consideration is to be given to sagging, loosening, and other adverse conditions of the element resulting from continuous heating.

15.3 An open-wire element – that is, uninsulated resistance wire – may be used in heating appliances provided it is enclosed or protected by barriers or covers that require tools for removal, and it complies with the accessibility of live parts requirements outlined in [7.18](#) – [7.22](#).

15.4 An instantaneous water heater with an open-wire element immersed in water shall additionally comply with the requirements of Sections [11](#), [27](#), [29](#) and [35](#). It shall not employ a power supply cord or plug.

15.5 A heating appliance in which the heating element is constructed for use only in an air blast shall be so wired or controlled that the element can be operated only while under the cooling effect of the blast. A product in which the cooling effect of the motion of a part is necessary to limit temperatures shall be so wired or controlled that the element cannot be operated without such motion.

## 16 Electrical Insulation

16.1 Insulating washers, bushings, and the like, that are integral parts of a heating appliance and bases or supports for the mounting of current-carrying parts shall be of a moisture-resistant material that will not be damaged by the temperatures to which they will be subjected under conditions of actual use. Molded parts shall be so constructed that they will have the mechanical strength and rigidity necessary to withstand the stresses of actual service.

16.2 Insulating material employed in a heating appliance is to be judged with respect to its acceptability for the particular application. Materials, such as mica, some molded compounds, and certain refractory materials are usually acceptable for use as the sole support of live parts, and some other materials that are not acceptable for general use, such as magnesium oxide, may be acceptable if used in conjunction with other more acceptable insulating materials or if so located and protected such that it is not subject to

mechanical damage and the absorption of moisture is minimized. When it is necessary to investigate a material to determine whether it is acceptable, consideration is to be given to its mechanical strength, dielectric properties, insulation resistance, heat-resistant qualities, the degree to which it is enclosed or protected, and any other features having a bearing on the risk of fire or electric shock involved, in conjunction with conditions of actual service. All of these factors are considered with respect to thermal aging.

16.3 In the mounting or supporting of small, fragile insulating parts, screws or other fastenings should not be tight enough to cause cracking or breaking of these parts with expansion and contraction. Generally, such parts should be slightly loose.

## 17 Thermal Insulation

17.1 Thermal insulation, if employed, shall be of such a nature and so located and mounted or supported that it will not be affected by any intended operation of the product. See [36.1.22](#).

17.2 Combustible or electrically conductive thermal insulation shall not make contact with uninsulated live parts of a heating appliance.

17.3 Some types of mineral-wool thermal insulation contain conductive impurities in the form of slag, which make its use unacceptable if in contact with uninsulated live parts. See [37.1](#).

## 18 Motors

18.1 A motor shall be acceptable for the particular application, and shall be capable of handling its maximum intended load without risk of fire, electric shock, or injury to persons.

18.2 A motor winding shall resist the absorption of moisture and shall be formed and assembled in a workmanlike manner.

18.3 With reference to the requirement in [18.2](#), enameled wire is not required to be additionally treated, but fiber slot liners, cloth coil wrap, and similar moisture-absorptive materials should be provided with impregnation or otherwise treated.

## 19 Overcurrent Protection of Conductors and Heating Elements

19.1 Except as noted in [19.2](#) and [19.3](#), each bus bar and insulated wire, including those in heater, motor, and control circuits, in a heating appliance rated at more than 40 A shall be protected by an overcurrent protective device provided as a part of the product. If the product is intended for connection to more than one branch circuit, each section of the product intended for connection to a different branch circuit is to be considered individually in applying the foregoing requirement. The rating of the overcurrent protective device shall be in accordance with [Table 19.1](#).

**Table 19.1**  
**Largest acceptable protective device**

| Kind of conductor | Conductor protected within the appliance |          | Current rating of largest acceptable overcurrent protective device |
|-------------------|------------------------------------------|----------|--------------------------------------------------------------------|
|                   | Copper                                   | Aluminum |                                                                    |
| Wires             | 18 – 14 AWG                              | 12 AWG   | 50 A                                                               |

Table 19.1 Continued on Next Page

Table 19.1 Continued

| Kind of conductor | Conductor protected within the appliance                                         |          | Current rating of largest acceptable overcurrent protective device                                                                         |
|-------------------|----------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                   | Copper                                                                           | Aluminum |                                                                                                                                            |
|                   | 12                                                                               | –        | 60                                                                                                                                         |
|                   | –                                                                                | 10       | 80                                                                                                                                         |
|                   | 10                                                                               | 8        | 90                                                                                                                                         |
|                   | 8                                                                                | 6        | 125                                                                                                                                        |
|                   | 6                                                                                | 4        | 175                                                                                                                                        |
|                   | 4                                                                                | 3        | 200                                                                                                                                        |
| Busbars Solid     | Copper                                                                           |          | Low enough to limit the current density in the busbar to 3000 A/in <sup>2</sup> (4.650 A/mm <sup>2</sup> ) of busbar cross section         |
|                   | Electrical-conductor (EC) grade of aluminum (conductivity is 61 percent of IACS) |          | Low enough to limit the current density in the busbar to 2000 A/in <sup>2</sup> (3.100 A/mm <sup>2</sup> ) of busbar cross section         |
|                   | Aluminum having a conductivity of 55 percent of IACS                             |          | Low enough to limit the current density in the busbar to 1776 A/in <sup>2</sup> (2.753 A/mm <sup>2</sup> ) of busbar current cross section |

19.2 The requirement in [19.1](#) does not apply to a conductor:

- a) That is not longer than 10 ft (3.05 m);
- b) That is completely within the enclosure of the product;
- c) That terminates at its load end in one or more overcurrent protective devices; and
- d) That has an ampacity according to the 60 °C (140 °F) tables in the National Electrical Code, ANSI/NFPA 70, not less than 80 percent of the combined ratings of the one or more overcurrent protective devices supplied by the conductor.

19.3 No overcurrent protective device is required as a part of the product if it is determined that equivalent or better protection will be obtained from the branch-circuit overcurrent protective device through which the product will be supplied.

19.4 The rating of the branch-circuit overcurrent protective device shall be 150 percent of the rating of the product unless the product is marked to specify the use of a protective device having a lower rating. Standard ampere ratings for overcurrent protective devices are 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, and 200. If 150 percent of the rating of the product does not equal one of the standard overcurrent-protective-device ratings mentioned above, then the next lower rating or setting of overcurrent protective device shall be employed.

19.5 The overcurrent protection mentioned in [19.1](#) – [19.4](#), [19.6](#) and [19.7](#) shall be of a type intended for branch-circuit protection. A fuse used for this purpose shall be a Class CC, G, H, J, K, R, or T cartridge fuse or a plug fuse.

19.6 A product that employs resistance-type heating elements and is rated at more than 48 A shall have the heating elements subdivided. Each subdivided load shall not exceed 48 A and shall be protected at not more than 60 A.

*Exception No. 1: Open coil or exposed sheathed-coil types of surface elements in commercial-type heating appliances shall be protected by overcurrent protective devices at not more than 50 A.*

*Exception No. 2: Infrared lamp commercial and industrial heating appliances shall have overcurrent protection not exceeding 50 A.*

*Exception No. 3: Water heaters employing resistance-type immersion electric heater elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into circuits not exceeding 120 A and protected at not more than 150 A.*

*Exception No. 4: Fixed industrial process heating equipment employing resistance-type electric heater elements shall be permitted to be subdivided into circuits not exceeding 120 A and protected at not more than 150 A provided one of the following is met:*

- a) Elements are intended to be installed and enclosed within the industrial process heating equipment;*
- b) Elements are completely contained within a suitable enclosure; or*
- c) Elements are completely contained within an ASME-rated and stamped vessel.*

19.7 The overcurrent protective devices required in [19.6](#) shall be provided as an integral part of the product or shall be provided by the product manufacturer as a separate assembly, for independent mounting, for use with the product. See [53.31](#).

19.8 The supplementary overcurrent protective devices required in [19.6](#) shall be factory-installed within or on the heater enclosure or provided as a separate assembly by the heating appliance manufacturer, shall be accessible, and shall be suitable for branch circuit protection.

19.9 The main conductors supplying these overcurrent protective devices required in [19.6](#) shall be considered to be branch-circuit conductors.

## 20 Motor-Running Overload Protection

20.1 The following heating appliances in which a 1 hp or smaller motor is used shall incorporate thermal or overload protection so that the motor shall not attain excessively high temperatures under any operating conditions:

- a) A remotely or automatically controlled product.
- b) A permanently connected, continuous-duty, manually started product.

An impedance-protected motor is not required to have additional thermal or overload protection.

20.2 A heating appliance intended to be automatically or remotely controlled and employing a motor rated at more than 1 hp shall incorporate thermal or overcurrent protection.

20.3 Fuses shall not be used in motor-overload-protective devices unless the motor is protected by the largest size of fuse that can be inserted in the fuseholder.

## 21 Motor and Power-Transformer Short-Circuit and Ground-Fault Protection

21.1 A motor or power transformer in a heating appliance rated at more than 16 A shall be protected against short circuits and grounding by an overcurrent device having a maximum ampere rating in accordance with the National Electrical Code, ANSI/NFPA 70. Such overcurrent protection shall be provided as a part of the heating appliance unless it can be determined in accordance with [19.3](#) that equivalent overcurrent protection would be incorporated as the branch-circuit protective device.

21.2 The overcurrent protection mentioned in [21.1](#) shall be of a type indicated as being acceptable for branch-circuit protection.

## 22 General (Short-Circuit and Ground-Fault) Overcurrent Protection

22.1 Overcurrent protection at not more than 20 A shall be provided by means of a circuit breaker or fuse, as a part of a heating appliance, for each general-use receptacle circuit and each lampholder circuit independent of a heating element, included in the product, unless the product would be properly connected to a branch circuit rated at 20 A or less.

22.2 The overcurrent protection mentioned in [22.1](#) shall be of a type indicated as being acceptable for branch-circuit protection.

22.3 A fuseholder or circuit breaker provided as a part of a heating appliance shall not be accessible without opening a door or cover. However, the operating handle of a circuit breaker, and a removable end cap of a fuseholder, except on a household product, see [22.4](#), may project outside of the enclosure. A fuseholder shall be so installed that no uninsulated live parts other than the screw shell or clips of the fuseholder are exposed to contact by a person removing or replacing a fuse. If the fuseholder is intended to be accessible only to service personnel, uninsulated live parts other than the screw shell or clips may be exposed if they are guarded, or the fuseholder is so located such that these live parts shall not be subjected to unintentional contact.

22.4 A removable end cap of a fuseholder in a product intended for household use shall not be accessible from the outside of the product.

## 23 Thermal Cutoffs

23.1 If a heating appliance is provided with a thermal cutoff, it shall be secured in place and shall be so located that it will be accessible for replacement without damaging other connections or internal wiring. See [53.6](#).

23.2 If a heating appliance is provided with a thermal cutoff, it shall be capable of opening the circuit in the intended manner without causing the short-circuiting of live parts and without causing live parts to become grounded to the enclosure when the product is connected to a circuit of voltage in accordance with [36.1.13](#), and operated in a normal position to cause abnormal heating.

23.3 To determine whether a thermal cutoff complies with the requirement in [23.2](#), the product is to be operated with separate cutoffs five times as described above while any other thermally operated control devices in the product are short-circuited. Each cutoff is required to perform acceptably. During the test, the enclosure is to be connected through a 3-A fuse to a supply conductor not containing the cutoff.

## 24 Lampholders

24.1 If a heating appliance intended for permanent connection to the power supply or a heating appliance equipped with a polarized attachment plug is intended to be connected to the identified (grounded) conductor of a power-supply circuit, a lampholder supplied as a part of the product shall be so wired that the screw shell is connected to the identified conductor.

24.2 Except as noted in [24.3](#), a lampholder shall be so constructed and installed that uninsulated live parts other than the screw shell will not be exposed to contact by persons removing or replacing lamps.

24.3 The requirement in [24.2](#) does not apply if, in order to remove or replace a lamp, it is necessary to dismantle the product by means of tools.

24.4 A medium-base lampholder or screw-shell receptacle shall not be used as a holder for a heating element rated at more than 6 A or 660 W, except that a screw shell with a left-handed thread may be used with a heating element rated at not more than 10 A.

24.5 Except as noted in [24.6](#), a screw-shell lampholder for an infrared lamp shall be of the unswitched, medium-base type and shall be used with a 300-W or smaller lamp.

24.6 A lamp-and-lampholder combination need not comply with the requirement in [24.5](#) if no unacceptable temperature is produced on any of the components in the normal-temperature test, and if the switching mechanism of a switched lampholder is capable of performing acceptably without undue burning, pitting, and the like.

24.7 A female screwshell used as a holder for a heating element shall be of copper or of a copper-base alloy and shall be plated with nickel or equivalent oxidation-resistant metal.

*Exception: Aluminum (plated or unplated), unplated copper, or unplated copper alloy may be used provided the temperature rise does not exceed 175 °C (315 °F), based upon a room ambient temperature of 25 °C (77 °F), as measured with the product operating under the most adverse conditions of normal operation until thermal equilibrium is attained. All temperature regulating controls, if provided, shall be set at the maximum setting. Unplated aluminum shall only be used in equipment intended for indoor dry locations.*

## 25 Switches

25.1 A switch or other control device provided as a part of a heating appliance shall be of a type intended for the particular application and shall have a current and voltage rating not less than that of the circuit (load) that it controls.

25.2 A switch employed on a heating appliance shall be so located or protected that it will not be subjected to mechanical damage during use.

25.3 It is recommended that all switches be of an indicating type.

25.4 A switch on a cord-connected heating appliance or the flow actuated switch of an instantaneous water heater, either of which incorporating an open-wire heating element construction, shall be of such a type and so connected that it will disconnect the element or elements that it controls from all conductors of the supply circuit.

*Exception: The switch need not disconnect the open-wire heating element from all conductors if:*

- a) The construction is such that the open-wire element cannot be made to contact user accessible metal under normal conditions;*
- b) In the event of a breakage of the element, no part of the open-wire element is able to contact user accessible metal parts; and*
- c) The open-wire element is secured in place by reliable means.*

25.5 The requirement in [25.4](#) applies to a switch in the off position or any other setting in which the element is not heated, and also to a through-cord switch or a plug in which a switch is incorporated in an attached or detachable power-supply cord that is provided with such a heating appliance.

25.6 A switch or other device controlling one or more elements of a heating appliance intended for permanent connection to the power supply shall be so arranged that the opening of the switch with

disconnect all of the ungrounded conductors of the supply circuit, unless there will be no live parts exposed to unintentional contact when the switch is open or unless the fact that such parts are alive is definitely apparent.

25.7 A switch or other means of control intended to provide for the use of a limited number of elements at one time shall be so located or of such a type that the user cannot change the connections to energize more elements than intended.

25.8 A switch controlling a lampholder shall be acceptable for use with tungsten-filament lamps.

25.9 Except as noted in [25.10](#), a switch shall not be incorporated in a wooden handle or in other combustible material unless enclosed in metal or insulating material.

25.10 In a small, low-wattage product such as a wood burning pencil, a switch may be acceptable in a wooden handle.

25.11 If a heating appliance that is intended for connection to the supply circuit by means of flexible cord and an attachment plug employs a motor rated at more than 1/3 hp, a manually operated motor controller shall be provided in the product.

25.12 A manually operated, line-connected, single pole switch, or other control device, intended for appliance on-off operation shall be connected to the ungrounded conductor of the power-supply cord. [Table 12.2](#) specifies the polarity identification of the power-supply cord conductors.

## 26 Automatic Controls and Control Circuits

26.1 A control circuit shall comply with the requirements in [14.4.1.1](#) – [14.4.2.2](#).

26.2 The operation of an auxiliary control device in a heating appliance shall disconnect the element or elements that it controls from all ungrounded conductors of the supply circuit, unless there will be no live parts exposed to unintentional contact when the auxiliary control device is open or unless the fact that such parts are alive is apparent.

26.3 An auxiliary control is considered to be one that is intended primarily for time, temperature or pressure regulation, and the like, under conditions of intended operation, and not for protection against overload or excessive temperature conditions resulting from abnormal operation.

26.4 A device intended to reduce the risk of fire or electric shock shall be operative whenever the product is connected to its power supply. Except for the inherent thermal protector of a motor, the control of a product intended to be permanently connected electrically that has exposed live parts shall disconnect the element or elements it controls from all ungrounded conductors of the supply circuit. The operation of such a control shall comply with the requirements in [26.2](#). A controlled contactor shall comply with the endurance requirement for a limiting control if it is a part of the limiting-control circuit.

26.5 A control device shall not be constructed to deliberately overload the branch-circuit protective device as a means of disconnecting the product from the supply.

26.6 A contactor or similar device, such as a silicon controlled rectifier, required for use with a limit control shall be provided by the manufacturer of the product, but need not be mounted on the product. See [53.31](#).

26.7 The terminals of a device mentioned in [26.4](#) within the enclosure of a heating appliance shall be so located or further enclosed that they will be protected against unintentional short circuiting and damage.

26.8 Except where superseded in this standard, a temperature control that complies with the construction requirements of:

- a) the Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- b) the Standard for Limit Controls, UL 353; or
- c) the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and the Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9

is considered to comply with the construction requirements of this standard. See Section [43](#) for performance requirements.

26.9 Instantaneous water heaters shall be equipped with a temperature-limiting means in addition to its control thermostat to disconnect all ungrounded conductors. Such temperature-limiting means shall be installed to sense maximum water temperature and be a trip-free, manually reset type.

*Exception: Instantaneous water heaters with a capacity of 4 liters or less that comply with all applicable requirements of this standard are not required to be provided with a temperature-limiting means.*

## 27 Spacings

### 27.1 Line-voltage circuits

#### 27.1.1 General

27.1.1.1 Except as noted in [27.1.1.2](#) – [27.1.1.4](#), the spacings in a heating appliance shall be in accordance with [Table 27.1](#) and [Table 27.2](#).

**Table 27.1**  
**Minimum acceptable spacings at field-wiring terminals<sup>a,b</sup>**

| Parts involved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Potential involved in volts | Through air<br>inch (mm) | Over the surface<br>inch (mm)         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------|---------------------------------------|
| Between live parts of opposite polarity and between a live part and a dead metal part, other than the enclosure, which may be grounded                                                                                                                                                                                                                                                                                                                                                                               | 0 – 250                     | 1/4 (6.4)                | 3/8 (9.5)                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 251 – 600                   | 3/8 (9.5)                | 1/2 <sup>c</sup> (12.7 <sup>c</sup> ) |
| Between a live part and the enclosure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0 – 600                     | 1/2 (12.7)               | 1/2 (12.7)                            |
| <sup>a</sup> These spacings do not apply to connecting straps or busses extending away from wiring terminals. Such spacings are to be judged under <a href="#">Table 27.2</a> .<br><sup>b</sup> Applies to the sum of the spacings involved where an isolated dead part is interposed.<br><sup>c</sup> A spacing of not less than 3/8 inch (9.5 mm), through air and over the surface, is acceptable at wiring terminals in a wiring compartment or terminal box if the compartment or box is integral with a motor. |                             |                          |                                       |