



UL 749

STANDARD FOR SAFETY

Household Dishwashers

UL Standard for Safety for Household Dishwashers, UL 749

Twelfth Edition, Dated May 25, 2023

Summary of Topics

This new edition of ANSI/UL 749 dated May 25, 2023 includes the following changes in requirements:

- DW Terminal Blocks***
- Terminal Blocks***
- Remote Operation of Smart Dishwashers***
- Remote Safety Firmware/Software Update Requirements***
- Appliance Filter Requirements***
- Annex D – Alternative Electronic Circuit Requirements***
- Liquid Leaking from an Auxiliary Reservoir Requirements***
- Circuit Interrupters with Fire Extinguishing Agent for Use in Electrical Appliances***
- Leakage Current Detection Requirements***
- Switch Requirements***
- Control Requirement Revisions – (removal of legacy standards)***
- Clarifications to the Control Requirements***
- French Language Requirements***
- Double Insulation Requirements***
- Nichrome Wire Test Clarification***
- Update to NiCr Wire Test***
- Unintentional Operation***
- Miscellaneous Revisions to Clarify the Standard***

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated April 29, 2022, November 11, 2022 and February 17, 2023.

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CSA C22.2 No. 167:23
Ninth Edition



ULSE Inc.
UL 749
Twelfth Edition

Household Dishwashers

May 25, 2023



ANSI/UL 749-2023

Commitment for Amendments

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This ANSI/UL Standard for Safety consists of the Twelfth edition.

The most recent designation of ANSI/UL 749 as an American National Standard (ANSI) occurred on May 25, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

The Department of Defense (DoD) has adopted UL 749 on August 2, 1994. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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Preface

This is the harmonized CSA Group and ULSE standard for Household Dishwashers. It is the ninth edition of CSA C22.2 No. 167 and the twelfth edition of UL 749. This edition of CSA C22.2 No. 167 supersedes the previous editions published in 2018. This edition of UL 749 supersedes the previous edition published in 2018.

This harmonized standard was prepared by CSA Group and ULSE. The efforts and support of the Harmonization Committee for Household Dishwashers and the Association of Home Appliance Manufacturers (AHAM) are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This Standard was reviewed by the CSA Subcommittee on Household and Commercial Dishwashers, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of harmonization

This standard is published as an identical standard for CSA Group and ULSE.

An identical standard is a standard that is exactly the same in technical content except for national differences resulting from conflicts in codes and governmental regulations and basic safety principles and requirements. Presentation is word for word except for editorial changes.

Reasons for Differences From IEC

This standard provides requirements for electric clothes dryers for use in accordance with the electrical installation codes of Canada and the United States. This standard does not employ any IEC standard for base requirements.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

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Household dishwashers

1 Scope

1.1 This Standard applies to electric household dishwashers intended to be used in nonhazardous locations in accordance with CSA C22.1, Canadian Electrical Code, Part I (CE Code, Part I) and the National Electrical Code (NEC), NFPA 70, on circuits having a nominal voltage not exceeding 250 V.

1.2 This standard applies to both cord-connected appliances and permanently-connected appliances.

1.3 This Standard applies to smart-enabled household dishwashers that are intended to receive and respond to communication signals or data relating to power billing rate or demand response, or communication signals from a remote user interface such as a smart phone or computer. See Annex [B](#).

1.4 This standard applies to household dishwashers generating ozone during normal operation. See Annex [C](#).

1.5 This standard does not apply to commercial appliances. Commercial appliances are covered under the scope of the Standard for Commercial Dishwashing Machines, CSA C22.2 No. 168, or the Standard for Commercial Dishwashers, UL 921.

2 Referenced Publications

2.1 Where reference is made to other publications, such reference shall be considered to refer to the latest edition and any revisions thereto.

AHAM DW-2, *Household Electric Dishwashers*

ANSI Z97.1, *Safety Glazing Materials Used in Buildings-Safety Performance Specifications and Methods of Test*

ASME B94.11M, *Twist drills*

ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*

ASSE 1001, *Performance Requirements for Atmospheric Type Vacuum Breakers*

ASTM A90/A90M-13, *Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings*

ASTM A653/A653M-15, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*

ASTM D638, *Standard Test Method for Tensile Properties of Plastics*

ASTM D1822, *Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials*

ASTM E162, *Standard Tests Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*

ASTM E230/E230M, *Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

ASTM G30-97 (2009), *Standard Practice for Making and Using U-Bend Stress-Corrosion Test Specimens*

ASTM G36, *Standard Practice for Evaluating Stress-Corrosion-Cracking Resistance of Metals and Alloys in a Boiling Magnesium Chloride Solution*

CSA B64 Series-11, *Backflow preventers and vacuum breakers*

CSA C22.1, *Canadian Electrical Code, Part I*

CSA C22.2 No. 0-10, *General Requirements – Canadian Electrical Code (CEC), Part II*

CSA C22.2 No. 0.1, *General Requirements for Double-Insulated Equipment*

CSA C22.2 No. 0.2, *Insulation Coordination*

CSA C22.2 No. 0.8, *Safety Functions Incorporating Electronic Technology*

CSA C22.2 No. 0.15, *Adhesive Labels*

CAN/CSA-C22.2 No. 0.17, *Evaluation of Properties of Polymeric Materials*

CSA C22.2 No. 8-13, *Electromagnetic Interference (EMI) Filters*

CSA C22.2 No. 14, *Industrial Control Equipment*

CSA C22.2 No. 18.1, *Metallic Outlet Boxes*

CSA C22.2 No. 18.2, *Nonmetallic Outlet Boxes*

CSA C22.2 No. 18.3, *Conduit, Tubing, and Cable Fittings*

CSA C22.2 No. 18.5, *Positioning Devices*

CSA C22.2 No. 21, *Cord Sets and Power Supply Cords*

CSA C22.2 No. 24, *Temperature-Indicating and -Regulating Equipment*

CSA C22.2 No. 38, *Thermoset-Insulated Wires and Cables*

CSA C22.2 No. 39, *Fuseholder Assemblies*

CSA C22.2 No. 42, *General Use Receptacles, Attachment Plugs, and Similar Wiring Devices*

CSA C22.2 No. 42.1, *Cover Plates for Flush-Mounted Wiring Devices*

CSA C22.2 No. 43, *Lampholders*

CSA C22.2 No. 49, *Flexible Cords and Cables*

CSA C22.2 No. 55, *Special Use Switches*

CSA C22.2 No. 65, *Wire Connectors*

CSA C22.2 No. 66.1, *Low Voltage Transformers – Part 1: General Requirements*

CSA C22.2 No. 66.2, *Low Voltage Transformers – Part 2: General Purpose Transformers*

CSA C22.2 No. 66.3, *Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*

CSA C22.2 No. 72, *Heater Elements*

CSA C22.2 No. 74, *Equipment for Use with Electric Discharge Lamps*

CSA C22.2 No. 75, *Thermoplastic Insulated Wires and Cables*

CSA C22.2 No. 77, *Motors with Inherent Overheating Protection*

CSA C22.2 No. 100, *Motors and Generators*

CSA C22.2 No. 107.1, *General Use Power Supplies*

CSA C22.2 No. 108, *Liquid Pumps*

CSA C22.2 No. 111, *General-Use Snap Switches*

CSA C22.2 No. 127, *Equipment and Lead Wires*

CSA C22.2 No. 139, *Electrically Operated Valves*

CSA C22.2 No. 144, *Ground Fault Circuit Interrupters*

CSA C22.2 No. 153, *Electrical Quick-Connect Terminals*

CSA C22.2 No. 156, *Solid-State Speed Controls*

CSA C22.2 No. 158, *Terminal Blocks*

CSA/ANSI Z83.21:20/CSA C22.2 No. 168, *Commercial Dishwashers*

CSA C22.2 No. 177, *Clock-Operated Switches*

CSA C22.2 No. 182.3, *Special Use Attachment Plugs, Receptacles, and Connectors*

CSA C22.2 No. 188, *Splicing Wire Connectors*

CSA C22.2 No. 190, *Capacitors for Power Factor Correction*

CSA C22.2 No. 197, *PVC Insulating Tape*

CSA C22.2 No. 198.1, *Extruded Insulating Tubing*

CSA C22.2 No. 198.3, *Coated Electrical Sleeving*

CSA C22.2 No. 210, *Appliance Wiring Material Products*

CSA C22.2 No. 223, *Power Supplies with Extra-Low-Voltage Class 2 Outputs*

CSA C22.2 No. 235, *Supplementary Protectors*

CSA C22.2 No. 248.1, *Low-Voltage Fuses – Part 1: General Requirements*

CSA C22.2 No. 250.4, *Portable Luminaires*

CSA C22.2 No. 2459, *Insulated Multi-pole Splicing Wire Connectors*

CSA C22.2 No. 2556, *Wire and cable test methods*

CSA C22.2 No. 4248.1, *Fuseholders – Part 1: General Requirements*

CSA C22.2 No. 4248 series

CSA Component Acceptance Notice No. 5A

CAN/CSA-C22.2 No. 61058-1, *Switches for Appliances – Part 1: General Requirements*

CAN/CSA-C22.2 No. 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

CSA E60730-1, *Automatic electrical controls – Part 1: General requirements*

CAN/CSA-E60730-2-6, *Automatic electrical controls – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

CAN/CSA-E60730-2-7, *Automatic electrical controls – Part 2-7: Particular requirements for timers and time switches*

CAN/CSA-E60730-2-8, *Automatic Electrical Controls for Household and Similar Use – Part 2-8: Particular Requirements for Electrically Operated Water Valves, Including Mechanical Requirements*

CAN/CSA-E60730-2-9, *Automatic Electrical Controls for Household and Similar Use – Part 2-9: Particular Requirements for Temperature Sensing Controls*

CSA-E60384-14, *Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification – Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains*

CSA C22.2 No. 60691, *Thermal Links – Requirements and Application Guide*

CSA C22.2 No. 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 60127-1-06, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

IEC 60335-1, *Safety of Household and Similar Electrical Appliances, Part 1: General Requirements*

IEC 60695-2-11, *Fire Hazard Testing – Part 2-11: Glowing/Hot-Wire Based Test Methods – Glow-Wire Flammability Test Method for End-Products*

IEC 60695-2-13, *Fire Hazard Testing – Part 2-13: Glowing/Hot-Wire Based Test Methods – Glow-Wire Ignitability Test Method for Materials*

IEC 60695-11-10:2013, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 61000-4-2-08, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3-06, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4-12, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5-14, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6-13, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11-04, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-13-02, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

NFPA 70, *National Electrical Code*

UL 20, *General-Use Snap Switches*

UL 44, *Thermoset-Insulated Wires and Cables*

UL 62, *Flexible Cords and Cables*

UL 66, *Fixture Wire*

UL 83, *Thermoplastic-Insulated Wires and Cables*

UL 94, *Test for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 101, *Leakage Current For Utilization Equipment*

UL 157, *Gaskets and Seals*

UL 224, *Extruded Insulating Tubing*

UL 248-1, *Low-Voltage Fuses – Part 1: General Requirements*

UL 248 series

UL 310, *Electrical Quick-Connect Terminals*

UL 355, *Cord Reels*

UL 429, *Electrically Operated Valves*

UL 486A-486B, *Wire Connectors*

UL 486C, *Splicing Wire Connectors*

UL 486E, *Equipment Wiring Terminals For Use With Aluminum And/Or Copper Conductors*

UL 496, *Lampholders*

UL 498, *Attachment Plugs and Receptacles*

UL 499, *Electric Heating Appliances*

UL 508, *Industrial Control Equipment*

UL 510, *Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape*

UL 510A, *Component Tapes*

UL 514A, *Metallic Outlet Boxes*

UL 514B, *Conduit, Tubing, and Cable Fittings*

UL 514C, *Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers*

UL 514D, *Cover Plates for Flush-Mounted Wiring Devices*

UL 635, *Insulating Bushings*

UL 723, *Tests for Surface Burning Characteristics of Building Materials*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746B, *Polymeric Materials – Long Term Property Evaluations*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 746E, *Polymeric Materials – Industrial Laminates, Filament Wound Tubing, Vulcanized Fiber, and Materials Used in Printed Wiring Boards*

UL 758, *Appliance Wiring Material*

UL 778, *Motor-Operated Water Pumps*

UL 796 *Printed Wiring Boards*

UL 810, *Capacitors*

UL 817, *Cord Sets and Power-Supply Cords*

UL 840, *Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*

UL 873, *Temperature-Indicating and -Regulating Equipment*

UL 906, *Outline for Solenoids*

UL 921, *Commercial Dishwashers*

UL 935, *Fluorescent-Lamp Ballasts*

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UL 969, *Marking and Labeling Systems*

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UL 1004-1, *Rotating Electrical Machines – General Requirements*

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UL 1004-3, *Thermally Protected Motors*

UL 1004-7, *Electronically Protected Motors*

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UL 1030, *Sheathed Heating Elements*

UL 1053, *Ground-Fault Sensing and Relaying Equipment*

UL 1059, *Terminal Blocks*

UL 1077, *Supplementary Protectors for Use in Electrical Equipment*

UL 1097, *Double Insulation Systems for Use in Electrical Equipment*

UL 1310, *Class 2 Power Units*

UL 1332, *Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment*

UL 1434, *Thermistor-Type Devices*

UL 1439, *Tests for Sharpness of Edges on Equipment*

- UL 1441, *Coated Electrical Sleeving*
- UL 1446, *Safety Systems of Insulating Materials*
- UL 1565, *Positioning Devices*
- UL 1577, *Optical Isolators*
- UL 1581, *Reference Standard for Electrical Wires, Cables and Flexible Cords*
- UL 1694, *Tests for Flammability of Small Polymeric Component Materials*
- UL 1977, *Component Connectors for Use in Data, Signal, Control and Power Applications*
- UL 1998, *Software in Programmable Components*
- UL 2353, *Single- and Multi-Layer Insulated Winding Wire*
- UL 2459, *Insulated Multi-Pole Splicing Wire Connectors*
- UL 2557, *Membrane Switches*
- UL 4248-1, *Fuseholders – Part 1: General Requirements*
- UL 5085-1, *Low Voltage Transformers – Part 1: General Requirements*
- UL 5085-2, *Low Voltage Transformers – Part 2: General Purpose Transformers*
- UL 5085-3, *Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*
- UL 8750, *Light Emitting Diode (LED) Equipment For Use In Lighting Products*
- UL 60065, *Audio, Video and Similar Electronic Apparatus – Safety Requirements*
- UL 60335-1, *Safety of Household and Similar Electrical Appliances, Part 1: General Requirements*
- UL 60384-14, *Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains*
- UL 60691, *Thermal-Links – Requirements and Application Guide*
- UL 60730-1, *Automatic Electrical Controls – Part 1: General Requirements*
- UL 60730-2-6, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements*
- UL 60730-2-7, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches*
- UL 60730-2-8, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Electrically Operated Water Valves, Including Mechanical Requirements*



UL 60730-2-9, *Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls*

UL 60730-2-15, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls*

UL 60730-2-18, *Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Water and Air Flow Sensing Controls, Including Mechanical Requirements*

UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*

UL 61058-1, *Switches for Appliances – Part 1: General Requirements*

UL 61058-1 series

UL 60692, *Outline of Investigation for Circuit Interrupters with Fire Extinguishing Agent for Use in Electrical Appliances and Components – Issue 1*

UL 60939-3, *Passive Filter Units for Electromagnetic Interference Suppression – Part 3: Passive Filter Units for Which Safety Tests are Appropriate*

3 Definitions

3.1 For the purposes of this standard, where practical, the term “appliance” has been used instead of “dishwasher” or “machine.”

3.2 The definitions in [3.3](#) – [3.32](#) apply in this standard.

3.3 APPLIANCE, AUTOMATIC – An appliance equipped with a timer switch or an equivalent control that, after the appliance has been energized, governs the sequence and duration of the various portions of the operating cycle, including its termination.

3.4 APPLIANCE, BUILT-IN – An appliance that is constructed to be permanently installed in a cabinet or wall.

3.5 APPLIANCE, CORD-CONNECTED – An appliance that is connected to the electrical supply by a power-supply cord terminating in an attachment plug of configuration 5-15P or 5-20P.

3.6 APPLIANCE, PERMANENTLY CONNECTED – An appliance that is connected to the electrical supply by means other than a supply cord and an attachment plug.

3.7 BARRIER – A partition for the insulation or isolation of electric circuits, for the isolation of electric arcs, or for the isolation of moving parts or hot surfaces. In this respect, a barrier may serve as a portion of an enclosure and as a functional part.

3.8 CIRCUIT, LINE-VOLTAGE – A circuit having characteristics in excess of those of a low-voltage circuit.

3.9 CIRCUIT, LOW-VOLTAGE – A circuit having limited voltage and energy capacity supplied by the following:

- a) A primary battery having an output voltage of 30 V or less;

- b) A Class 2 transformer; or
- c) A Class 2 power supply.

Note: A circuit that is derived from a circuit that exceeds 30 V by connecting resistance or impedance, or both, in series with the supply circuit to limit the voltage and current is not considered to be a low-voltage circuit.

3.10 CONTROL, OPERATING – Control, the operation of which starts or regulates the appliance during normal operation.

3.11 CONTROL, PROTECTIVE – Control, the operation of which is intended to prevent the risk of electric shock, fire, or injury to persons during abnormal operation of the appliance.

Note: During the evaluation of the protective control, the protective functions are verified under normal and single-fault conditions of the control.

3.12 CURRENT-CARRYING PARTS – Parts carrying current during normal or abnormal operation in line-voltage circuits.

Note: With respect to Separation of Circuits, [21.3](#), this term refers to parts in both low-voltage and line-voltage circuits.

3.13 ELECTRICAL CONNECTION – The physical interface between two points in a circuit such as spade terminals, pin terminals, micro switch contacts, relay contacts, timer contacts, crimped connections, and connections that are welded or soldered.

3.14 ENCLOSURE – A material used to:

- a) Limit accessibility of all or any parts of the product that might otherwise present a risk of electric shock or injury to persons; and
- b) Retard propagation of flame initiated by electrical disturbances that might occur within the product.

3.15 FIELD WIRING TERMINAL – A terminal to which a wire can be connected in the field. A wire that is provided as part of the appliance and is provided with a means of making the connection that is factory-assembled to the wire is not considered a field wiring terminal. The following are examples of means of making wiring connections:

- a) A pressure wire connector;
- b) Soldering lugs;
- c) A soldered loop; or
- d) A crimped eyelet.

3.16 FLAME CYLINDER – A projection of a vertical cylinder having a diameter of 20 mm (0.79 in) and a height of 50 mm (2 in), placed above the center of the connection zone(s) and on top of any polymeric parts that are supporting current-carrying electrical connections as shown in [Figure 30.3](#).

3.17 HEATER ASSEMBLY – An assembly of:

- a) A heating element;
- b) Electrical insulation (e.g., refractory, mica, magnesium oxide); and
- c) A frame or housing (e.g., a metal sheath or the like) that holds the assembly together.

3.18 HEATING ELEMENT – The actual electrical conducting medium that is intended to be heated by an electric current.

3.19 LOCATION, OUTDOOR – An area that is open and subjected to the full effects of weathering. A dishwasher intended for installation in a protected location is required to comply with the requirements for dishwashers intended for installation outdoors.

3.20 LOCATION, PROTECTED – An outdoor location that is partially protected from the effects of weathering by installation in a cabinet or wall or by the use of a roof, canopy, marquee, or similar protective structure.

3.21 LOW-POWER CIRCUIT – Circuits where the power available is limited to 15 watts.

3.22 MEMBRANE SWITCH – A momentary switching device in which at least one contact is on, or made of, a flexible substrate.

3.23 NORMAL CYCLE – The cycle type recommended by the manufacturer for completely washing a full load of normally soiled dishes, including the power-dry feature.

3.24 PART, DECORATIVE – A part used for no other function except appearance. A polymeric control knob or lever may be considered a decorative part.

3.25 PART, FUNCTIONAL – A part used in such a way that deterioration or breakage of the part would result in a risk of fire, electric shock, or injury to persons.

3.26 POWER-DRY FEATURE – That function in a cycle in which electrically generated heat is introduced into the washing compartment for the purpose of improving the drying performance of the appliance.

3.27 RISK OF ELECTRIC SHOCK – For indoor use appliances, a risk of electric shock is considered to exist if, under normal conditions and single component fault conditions, the potential between the part and earth ground or any other simultaneously accessible part is more than:

- a) 30 V rms;
- b) 42.4 V peak;
- c) 60 V dc continuous; or
- d) 24.8 V peak for DC interrupted at a rate of 200 Hz or less with approximately 50 percent duty cycle.

For outdoor use appliances, or appliances used in a protected location, a risk of electric shock is considered to exist if, under normal conditions and single component fault conditions, the potential between the part and earth ground or any other simultaneously accessible part is more than:

- 1) 15 V rms;
- 2) 21.2 Vac peak; or
- 3) 30 V continuous dc.

Note: Either a low-voltage circuit or the secondary circuit of a Class 2 circuit does not involve a risk of electric shock.

3.28 **RISK OF FIRE** – A risk of fire is considered to exist at any two points in a circuit where a power of more than 15 watts can be delivered into an external resistor connected between the two points at the end of 5 seconds.

Note: A low-power circuit does not involve a risk of fire.

3.29 **TEMPERATURE-LIMITING DEVICE** – A device that:

- a) Functions only under conditions that produce abnormal temperatures; and
- b) Is not intended to function during normal operation of the appliance.

3.30 **TEMPERATURE-REGULATING AND -LIMITING DEVICE, COMBINED** – A device that functions to:

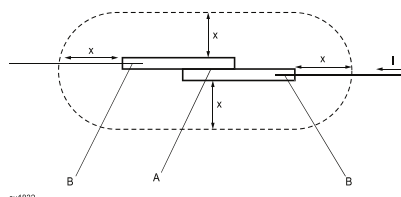
- a) Regulate the temperature under normal conditions of use; and
- b) Limit abnormal temperatures that might result from conditions of abnormal operation of the appliance.

3.31 **TEMPERATURE-REGULATING DEVICE** – A device that:

- a) Regulates temperature; and
- b) Functions during normal operation of the appliance.

3.32 **WITHIN 3MM** – Falling within the dotted boundary formed by the cylinder with hemispherical ends, as shown in [Figure 3.1](#).

Figure 3.1
Definition of “Within 3 mm of an Electrical Connection”



Note: “Within 3 mm of an electrical connection” means falling within the dotted boundary formed by the cylinder with hemispherical ends, as shown in the above drawing.

A Terminal connection zone

B Wire crimp connection zone

I Current through the connection

X Distance from the connection

4 General Requirements

4.1 The values given in SI (metric) units shall be normative. Any other values given shall be for information purposes only.

4.2 In Canada, general requirements applicable to this standard are given in CSA C22.2 No. 0 and grounding and bonding requirements are given in C22.2 No. 0.4.

5 General Conditions for the Tests

5.1 Voltage and frequency

5.1.1 Unless otherwise specified in the requirements, all tests shall be conducted with the appliance connected to a supply circuit with a rated frequency and a voltage (V_s) of:

- a) 120 V for an appliance rated from 110 to 120 V;
- b) 240 V for an appliance rated from 220 to 240 V; or
- c) The maximum rated voltage of the appliance for an appliance rated other than as specified in (a) or (b).

5.1.2 The test voltage (V_t) used during the heating tests of Section 12 and the abnormal operation tests of Section 17 shall be adjusted so that the calculated (see formula below) heating circuit input (W_t) is achieved during the heated wash cycle of the appliance. This compensates for heating elements with inputs at V_s (see 5.1.1) that are different than their rated (marked) inputs.

$$W_t = W_m (V_s / V_m)^2$$

where

W_t = the calculated heating circuit input, W

W_m = the heating element rated (marked) input, W

V_s = the supply circuit voltage specified in 5.1.1

V_m = the heating element rated (marked) input, V

5.1.3 If it is necessary to increase the heater test voltage as specified in 5.1.2 through a separate circuit, the rest of the appliance shall be supplied at the voltage specified in 5.1.1.

5.1.4 If an appliance is rated for more than one frequency, testing shall be conducted at the frequency that would result in the highest temperature condition.

5.2 Cheesecloth for heating and abnormal tests

5.2.1 Whenever cheesecloth is required for a test in this standard, the cloth shall be bleached cheesecloth measuring approximately 34 g/m² (lbs-/ft²) with a thread count in the range of 10 – 13 × 9 – 12 threads/cm.

5.3 Test temperature

5.3.1 The tests shall be conducted in a draft-free location and, unless otherwise specified, at an ambient temperature in the range of 10 – 40 °C (50 – 104 °F).

5.4 Thermocouples

5.4.1 Thermocouples shall consist of wires not larger than 24 AWG (0.21 mm²). The thermocouple wire shall conform with the requirements for special thermocouples as specified in the Initial Calibration Tolerances for Thermocouples table in ASTM E230/E230M.

5.5 Dishwashing detergent

5.5.1 If a dishwashing detergent is required for a test in this standard, it shall:

a) Have the following formula by mass:

Sodium carbonate	40 %
Sodium tripolyphosphate	25 %
Sodium sulfate	15 %
Water	10 %
Sodium silicate solids	8 %
Nonionic surfactant (low-foaming alcohol alkoxylate)	1 %
Sodium dichloroisocyanurate	1 %

or

b) Be a powdered dishwashing detergent as specified in AHAM DW-1, or any other powdered dishwashing detergent having similar properties.

5.6 Rinse agent

5.6.1 If a rinse agent is required for a test in this standard, it shall be a rinse agent recommended by the manufacturer.

5.7 Place setting

5.7.1 If a test load or a place setting is required for a test in this standard, the place setting shall consist of dishes and cutlery as specified in AHAM DW-2.

5.8 High-sudsing detergent

5.8.1 If a high-sudsing detergent is required for a test in this standard, it shall be any commercially available liquid handwashing dish soap.

5.9 Water temperature

5.9.1 If a test in this standard requires that an appliance be connected to a water supply, an appliance shall be connected to a hot-water supply with a nominal water temperature of 60 ±2 °C (140 ±3.6 °F).

5.9.2 For an appliance with a water-heating feature intended to be connected to a cold-water supply in accordance with the installation instructions of [8.3.5](#), testing shall be repeated with the appliance connected to a cold-water supply with a nominal temperature of 15 ± 5 °C (59 ± 9 °F), unless the water temperature does not affect the test results.

5.9.3 For an appliance with a water-heating feature intended to be connected to a hot-water supply in accordance with the installation instructions of [8.3.5](#), testing shall be repeated with the appliance connected to a hot-water supply with a nominal temperature of 50 ± 2 °C (122 ± 3.6 °F), unless the water temperature does not affect the test results.

6 Classification

6.1 Appliances shall be grounded or double-insulated with respect to electric shock.

6.2 Appliances shall have the appropriate degree of protection against ingress of water that might introduce a risk of fire or electric shock (see [15.5](#)).

7 Marking

Advisory Note: In Canada, there are two official languages, English and French. Therefore, it is necessary to have CAUTION, WARNING, and DANGER markings in both English and French. Annex [E](#) provides acceptable examples of French translations of the markings specified in this standard. Markings required by this standard may have to be provided in other languages to conform with the language requirements of the country where the product is to be used.

7.1 General

7.1.1 A marking that is required to be permanent shall be moulded, die-stamped, paint-stencilled, stamped, or etched metal that is permanently secured or indelibly stamped on a pressure-sensitive label secured by adhesive. Adhesive labels shall comply with CSA C22.2 No. 0.15 and UL 969. If adhesive labels will be exposed to detergents or rinse agents, they shall also comply with [7.1.2](#) and [7.1.3](#).

7.1.2 After being conditioned as described in [7.1.3](#), an adhesive label, immediately following removal from each test medium, and after being exposed to room temperature for 24 h following removal from each medium, shall:

- a) Demonstrate good adhesion and not have curled edges;
- b) Resist defacement or removal, as demonstrated by scraping across the test panel with a flat metal blade 0.81 mm (0.03 in) thick held at right angles to the test panel; and
- c) Be legible and resist defacement when rubbed with thumb or finger pressure.

7.1.3 Three samples of the label specified in [7.1.2](#) shall be applied to test surfaces as intended in the application and shall be conditioned for 24 h in a controlled atmosphere maintained at 23 ± 2 °C (73.4 ± 3.6 °F) with a 50 ± 5 percent relative humidity. The samples shall then be immersed for 48 h in a solution representative of the solution used during a normal cycle, maintained at the temperature the solution would attain during a normal cycle, but not less than 23 ± 2 °C (73.4 ± 3.6 °F).

7.1.4 A marking on a readily removable part shall not be acceptable.

7.1.5 A cautionary marking that is required to be permanent shall be located on a part that:

- a) Requires the use of a tool for removal;

- b) Cannot be removed without impairing the operation of the appliance; or
- c) Is not removed during routine servicing of the appliance.

7.1.6 A cautionary marking may be located on a front panel that is removed for routine servicing, if a tool is required to remove the panel.

7.1.7 A cautionary marking intended to instruct the operator shall be legible and visible by the operator during the normal operation of the appliance. A marking giving servicing instructions shall be legible and visible when such servicing is being performed.

7.1.8 A cautionary marking shall be prefixed by the word "CAUTION", "WARNING", or "DANGER" in letters not less than 3.2 mm (0.13 in) high. The remaining letters of such a marking shall not be less than 1.6 mm (0.06 in) high.

7.2 Appliance markings

7.2.1 An appliance shall be rated in V and Hz.

7.2.2 A permanently connected appliance or a cord-connected undercounter appliance having a motor load:

- a) Of 93 W (output) or less shall have a single current rating in A. For an appliance with a full-load power factor of 0.80 or more, the rating may be in W or kW; or
- b) Of more than 93 W shall have the following ratings clearly identified:
 - 1) The current rating of the motor in A; and
 - 2) The rating of the total load other than the motor load (heater load, lighting load, and the like) in A, or in W or kW.

7.2.3 If an appliance is required to have a dual rating in accordance with [7.2.2\(b\)](#), and if the appliance is controlled so that the motor load and the load other than the motor load are never connected simultaneously, the appliance may also be marked to indicate the maximum load that will be connected at one time.

7.2.4 A portable appliance shall be rated in A. For an appliance with a full-load power factor of 0.80 or more, the rating may be in W or kW.

7.2.5 Appliances having field wiring terminals shall be marked with one of the following:

- a) "Use copper conductors only", if the terminal is acceptable only for connection to copper wire;
- b) "Use aluminum conductors only", if the terminal is acceptable only for connection to aluminum wire;
- c) "Use copper or aluminum conductors" or "Use copper, copper-clad aluminum, or aluminum conductors", if the terminal is acceptable only for connection to either copper or aluminum wire; or
- d) "Use copper or copper-clad aluminum conductors", if the terminal is acceptable only for connection to either copper or copper-clad aluminum wire.

7.2.6 An appliance requiring the use of supply conductors rated above 60 °C (140 °F) shall be marked with the following statement, or the equivalent, at or near the point where the supply connections are to be made and located so that it will be readily visible during and after installation:

“USE SUPPLY CONDUCTORS RATED FOR AT LEAST ____ °C (____ °F).”

7.2.7 The marking specified in [7.2.6](#) shall include both °C and °F. The temperature rating of the conductors required by the heating test (see Section [12](#)) shall be placed in the marking.

7.2.8 An appliance that will not start and operate normally when connected to a circuit protected by a 15 A fuse of other than the time-delay type, but that will start and operate normally when connected to a circuit protected by a time-delay fuse (see [10.2](#)), shall be plainly and permanently marked, in a location that is visible during installation and inspection, with the following or the equivalent:

“If connected to a circuit protected by fuses, use time-delay fuses with this appliance.”

Note: A portable appliance is limited to 1500 W and a 15 A circuit. See [11.4](#).

7.2.9 A heating element rated more than 1 A and intended to be replaceable in the field shall be marked with:

- a) Its rating in V and A or in V and W;
- b) The manufacturer's part number; or
- c) An equivalent means of identification.

7.2.10 The marking specified in [7.2.9](#) shall withstand the environmental conditions to which the heating element is subjected.

7.2.11 If an appliance employs a non-current-carrying metal part that is not grounded as specified in [25.1.6](#) and [25.5](#), the appliance shall be permanently marked with the following or equivalent:

“WARNING: Certain internal parts are intentionally not grounded and may present a risk of electric shock only during servicing. Service Personnel – Do not contact the following parts while the appliance is energized: (list of ungrounded parts).”

7.2.12 The marking specified in [7.2.11](#) shall be located close to each ungrounded part, and it shall be readily visible before or when the part becomes accessible for servicing.

7.2.13 If all approaches to ungrounded parts can be adequately covered by one marking, then only one marking as specified in [7.2.11](#), at the approach to the ungrounded parts, shall be required.

7.2.14 If the marking specified in [7.2.11](#) is located on the ungrounded part, only one marking shall be required.

7.2.15 If a manufacturer produces or assembles appliances at more than one factory, each finished appliance shall have a distinctive marking, which may be in code, by which it can be identified as the product of a particular factory.

7.2.16 An appliance shall have a permanent, legible marking that will be readily visible after the appliance has been installed as intended without the necessity of moving the appliance. The markings shall include the following:

- a) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified – hereinafter referred to as the manufacturer's name;
- b) Catalogue or model number, type, or the equivalent;

c) Electrical rating; and

d) Date of manufacture by week, month or quarter, and year, which may be abbreviated or in an established or otherwise acceptable code.

7.2.17 An appliance that is shipped from the factory with any of its outer enclosure panels uninstalled or omitted (e.g., kick or toe panel, side panels, or back) shall be plainly and permanently marked, at such a location that the marking will be visible when connections to the power-supply circuit are made, with the following or equivalent:

“WARNING: To reduce the risk of electric shock, fire, or injury to persons, the installer must ensure that the dishwasher is completely enclosed at the time of installation.”

7.2.18 An appliance provided with double insulation that complies with [25.1.3](#) shall be permanently marked with the words:

“DOUBLE INSULATION – When servicing, use only identical replacement parts.”

The words

“DOUBLE INSULATED”

may be used instead of

“DOUBLE INSULATION”

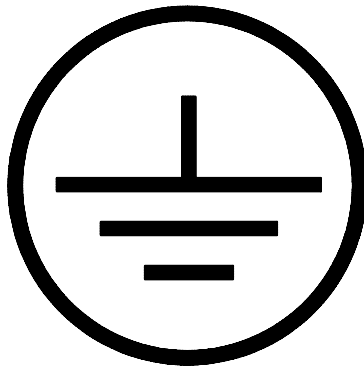
7.2.19 An appliance shall not be marked with a double-insulation symbol (a square within a square), the words “DOUBLE INSULATION”, or the equivalent unless the appliance complies with [25.1.3](#).

7.2.20 If an appliance can be readily adapted upon installation for connection to a supply circuit of either of two voltages, complete instructions, including identification of terminals, for making the connections for the different voltages shall be included in the permanent marking of the appliance. If the appliance employs an attachment plug, instructions shall be provided to indicate the type of plug that should be used if the appliance is reconnected for the alternative voltage. The information required by this clause may be shown on a circuit diagram.

7.2.21 An appliance that has plug-in provisions for the installation of an electrical accessory shall be plainly and permanently marked with the name and model number of the accessory. Instructions for the installation of the accessory shall be marked on the accessory or shall be included in literature supplied with the accessory.

7.2.22 With reference to [25.4.3](#), a pressure terminal connector intended for connection of an equipment-bonding conductor shall be identified by being marked “G,” “GR,” “GND,” “Ground,” or “Grounding,” with the grounding symbol illustrated in [Figure 7.1](#), or a similar marking, or by a marking on the wiring diagram provided on the appliance.

Figure 7.1
Grounding Symbol



IEC417, Symbol 5019

7.2.23 A dishwasher intended for installation outdoors (either in a protected location or outdoor location) shall be marked, on or adjacent to the marked electrical rating, with one of the following statements as applicable:

- a) "Suitable for Protected Locations – See Installation Instructions"; or
- b) "Suitable for Outdoor Locations".

8 Instructions

Advisory Note: In Canada, there are two official languages, English and French. Therefore, it is necessary to have CAUTION, WARNING, and DANGER instructions in both English and French. Annex E provides acceptable examples of French translations of the instructions specified in this standard. Instructions required by this standard may have to be provided in other languages to conform with the language requirements of the country where the product is to be used.

8.1 General

8.1.1 Instructions providing information equivalent to the marking required by 7.2.17 shall be packed with an appliance that is shipped from the factory with any of its outer enclosure panels uninstalled or omitted (e.g., kick or toe panel, side panels, or back).

8.1.2 An appliance that can be converted from cord-connected to permanently connected shall be provided with instructions for such conversion. These instructions may be packed inside the appliance.

8.1.3 An appliance shall be provided with legible instructions pertaining to the following:

- a) A risk of fire, electric shock, or injury to persons associated with use of the appliance as specified in 8.2;
- b) Installation as specified in 8.3;
- c) Operation as specified in 8.4; and
- d) If applicable, user maintenance as specified in 8.5.

8.1.4 The instructions required by [8.1.3](#) shall be:

- a) In separate manuals; or
- b) Combined in one or more manuals, if the instructions pertaining to a risk of fire, electric shock, or injury to persons are emphasized and in a separate format to distinguish them from the rest of the text.

8.1.5 The instructions and warning statements required by [8.1.1](#) through [8.1.3](#) shall be provided as printed material. If any electronic media instructions are provided, the instructions and warning statements required by [8.1.1](#) through [8.1.3](#) shall also be included within the electronic media instructions. All other instructions may be provided in electronic read-only media format only, such as CD-ROM.

8.1.6 The printed instruction material referenced in [8.1.5](#) shall contain detailed instructions of how to obtain a printed copy of the material contained in electronic format.

8.1.7 The headings and statements required by [8.2.2](#), [8.2.3](#), [8.3.1](#), [8.4.2](#), and [8.5.2](#) and cautionary prefixes, such as "WARNING" and "DANGER", required by [8.2.3](#) and [8.2.4](#) shall be entirely in upper-case letters or otherwise emphasized to distinguish them from the rest of the text.

8.1.8 The text of all required instructions shall be in the words specified or words that are equivalent, clear, and understandable. However, there shall be no substitutes for the words "WARNING" or "DANGER".

8.1.9 An illustration may be used with a required instruction to clarify the intent, but it shall not replace the written instruction.

8.2 Instructions pertaining to a risk of fire, electric shock, or injury to persons

8.2.1 The instructions pertaining to a risk of fire, electric shock, or injury to persons shall warn the user of the potential risks and state the precautions that should be taken to reduce such risks.

8.2.2 The heading "IMPORTANT SAFETY INSTRUCTIONS" or the equivalent shall precede the list of instructions required by [8.2.3](#), and the statement "SAVE THESE INSTRUCTIONS" or the equivalent shall either precede or follow the list (see [8.1.7](#)).

8.2.3 The instructions required by [8.2.1](#) shall include the items in the following list, as applicable, and any other instructions the manufacturer considers to be necessary for the appliance (see [8.1.7](#)).

IMPORTANT SAFETY INSTRUCTIONS

WARNING – When using your dishwasher, follow basic precautions, including the following:

- a) Read all instructions before using the dishwasher.
- b) Use the dishwasher only for its intended function.
- c) Use only detergents or wetting agents recommended for use in a dishwasher and keep them out of the reach of children.
- d) When loading items to be washed:
 - 1) Locate sharp items so that they are not likely to damage the door seal; and
 - 2) Load sharp knives with the handles up to reduce the risk of cut-type injuries.

e) Do not wash plastic items unless they are marked "dishwasher safe" or the equivalent. For plastic items not so marked, check the manufacturer's recommendations.

Note: This statement may be omitted for an appliance that employs a heating element that is located or guarded such that melted plastic items are not likely to contact it.

f) Do not touch the heating element during or immediately after use.

g) Do not operate your dishwasher unless all enclosure panels are properly in place.

h) Do not tamper with controls.

i) Do not abuse, sit on, or stand on the door or dish rack of the dishwasher.

j) To reduce the risk of injury, do not allow children to play in or on a dishwasher.

k) Under certain conditions, hydrogen gas might be produced in a hot-water system that has not been used for two weeks or more. HYDROGEN GAS IS EXPLOSIVE. If the hot-water system has not been used for such a period, before using the dishwasher turn on all hot-water faucets and let the water flow from each for several minutes. This will release any accumulated hydrogen gas. As the gas is flammable, do not smoke or use an open flame during this time.

l) Remove the door to the washing compartment when removing an old dishwasher from service or discarding it.

SAVE THESE INSTRUCTIONS

8.2.4 The instructions pertaining to a risk of fire, electric shock, or injury to persons shall include (a), (b), or (c) below, as applicable. As an alternative, (a) or (b) may be included in the installation instructions, and (c) may be included in the user-maintenance instructions. If the instructions in (a) or (b) are included in the installation instructions, and if (c) is included in the user-maintenance instructions, a reference to these instructions shall be included as a separate item in the list required by [8.2.3](#) (see [8.1.7](#)).

a) For a grounded, cord-connected appliance:

GROUNDING INSTRUCTIONS

This appliance must be grounded. In the event of a malfunction or breakdown, grounding will reduce the risk of electric shock by providing a path of least resistance for electric current. This appliance is equipped with a cord having an equipment-grounding conductor and a grounding plug. The plug must be plugged into an appropriate outlet that is installed and grounded in accordance with all local codes and ordinances.

WARNING – Improper connection of the equipment-grounding conductor can result in a risk of electric shock. Check with a qualified electrician or service representative if you are in doubt whether the appliance is properly grounded. Do not modify the plug provided with the appliance, if it will not fit the outlet, have a proper outlet installed by a qualified electrician.

b) For a permanently connected appliance:

GROUNDING INSTRUCTIONS

This appliance must be connected to a grounded metal, permanent wiring system, or an equipment-grounding conductor must be run with the circuit conductors and connected to the equipment-grounding terminal or lead on the appliance.

c) For a double-insulated, cord-connected appliance:

SERVICING A DOUBLE-INSULATED APPLIANCE

In a double-insulated appliance, two systems of insulation are provided instead of grounding. No grounding means is provided on a double-insulated appliance, nor should a means for grounding be added to the appliance. Servicing of a double-insulated appliance requires extreme care and knowledge of the system and should be done only by qualified service personnel. Replacement parts must be identical to those parts being replaced. A double-insulated appliance is marked with the words "DOUBLE INSULATION" or "DOUBLE-INSULATED." The double-insulation symbol (a square within a square) may also be marked on the appliance.

8.3 Installation instructions

8.3.1 The installation instructions shall include all the information needed to install the appliance for use as intended and shall be preceded by the heading "INSTALLATION INSTRUCTIONS" or the equivalent.

8.3.2 Where the installation instructions for a built-in dishwasher specify that the appliance can be connected by means of a power-supply cord not already attached to the appliance by the manufacturer, the instructions shall specify that a power-supply cord kit marked for use with dishwashers shall be used. The cord kit shall comply with [23.6](#). The part or model number of the power-supply cord kit shall be included in the appliance installation instructions.

8.3.3 The installation instructions provided with a cord-connected undercounter appliance shall include the following instructions or equivalent information:

- a) The power-supply receptacle for the appliance shall be installed in a cabinet or on a wall adjacent to the undercounter space in which the appliance is to be installed;
- b) There shall be an opening through the partition between the compartments specified in (a) that is large enough for the attachment plug to pass through. The longest dimension of the opening shall not be more than 38 mm (1.5 in);
- c) The edges of the opening specified in (b) shall, if the partition is wood, be smooth and rounded, or, if the partition is metal, be covered with an edge protector provided for this purpose by the manufacturer; and
- d) Care shall be exercised, when the appliance is installed or removed, to reduce the likelihood of damage to the power-supply cord.

8.3.4 The installation instructions provided with an appliance having a water-supply hose that is intended to be connected to the sink faucet shall include the following or the equivalent:

"A hose that attaches to a sink spray can burst if it is installed on the same water line as the dishwasher. If your sink has one, it is recommended that the hose be disconnected and the hole plugged."

8.3.5 With reference to [5.9.2](#) and [5.9.3](#), an appliance with a water-heating feature shall be identified as such by a marking on the appliance or indicated in the installation instructions provided by the manufacturer. In addition, the installation instructions shall identify whether the appliance is intended for connection to a cold- or hot-water supply.

8.3.6 Complete installation instructions shall be provided with a dishwasher intended for outdoor location. For dishwashers intended for use in a protected location, the instructions shall include the manufacturer's recommendations concerning installation of the dishwasher in a cabinet or wall or the use or installation of any canopy, marquee, shelter, or similar structure, intended for the protection of the machine from the effects of weather. The manufacturer's instructions shall be located where they are accessible without removing a panel, a cover, an accessory, a subassembly, or similar component. Manufacturer's instructions that are located inside the machine and accessible through a door on the front of the machine meet the intent of this requirement.

8.3.7 The installation instructions for a cord-connected dishwasher intended for installation outdoors (either in a protected location or outdoor location) shall include the following statement, or equivalent: "WARNING – Risk of Electric Shock. Do Not Use an Extension Cord. Connect Dishwasher Cord Directly to a Dedicated Outlet Suitable for Installation in Damp or Wet Locations and Protected by a Ground-Fault Circuit-Interrupter (GFCI) in Accordance with Local Codes. If an Outlet is Not Provided, Contact a Qualified Electrician for Proper Installation".

8.4 Operating instructions

8.4.1 The operating instructions shall include all information needed to operate the appliance as intended. Instructions and warnings provided in accordance with the requirements of [8.2](#) may be omitted from the operating instructions if there is a reference to the applicable instructions and warnings in the operating instructions.

8.4.2 The heading "OPERATING INSTRUCTIONS" or the equivalent shall precede the instructions required by [8.4.1](#).

8.4.3 For a front-opening countertop appliance with a capacity of no more than six place settings, the maximum number of place settings shall be specified in the operating instructions provided with the appliance.

8.4.4 The operating instructions for a dishwasher employing an Equipment Protective Device in accordance with [20.2.3\(a\)](#) that is provided with Test and Reset buttons shall identify the location of the protective device and be provided with the following: "Press the TEST button (then the RESET button) every month to assure proper operation."

8.5 User-maintenance instructions

8.5.1 User-maintenance instructions shall include all information needed for cleaning and servicing operations, such as removing deposits from the heating element, lubrication, and adjustments, that are intended to be performed by the user.

8.5.2 The heading "USER-MAINTENANCE INSTRUCTIONS" or the equivalent shall precede the instructions required by [8.5.1](#).

9 Protection Against Accessibility to Current-Carrying Parts

9.1 General

9.1.1 An appliance shall be provided with an enclosure of suitable material to isolate all parts that could present a risk of fire, electric shock, or injury to persons under any condition of normal use.

9.1.2 When determining accessibility of live parts for a built-in dishwasher intended for installation outdoors, [9.2](#) shall be applied.

9.2 Enclosures for other than built-in appliances

9.2.1 Enclosures of appliances other than built-in appliances and enclosures for appliances intended for installation outdoors shall prevent access to internal current-carrying parts as specified in [9.2.3](#) to [9.2.10](#).

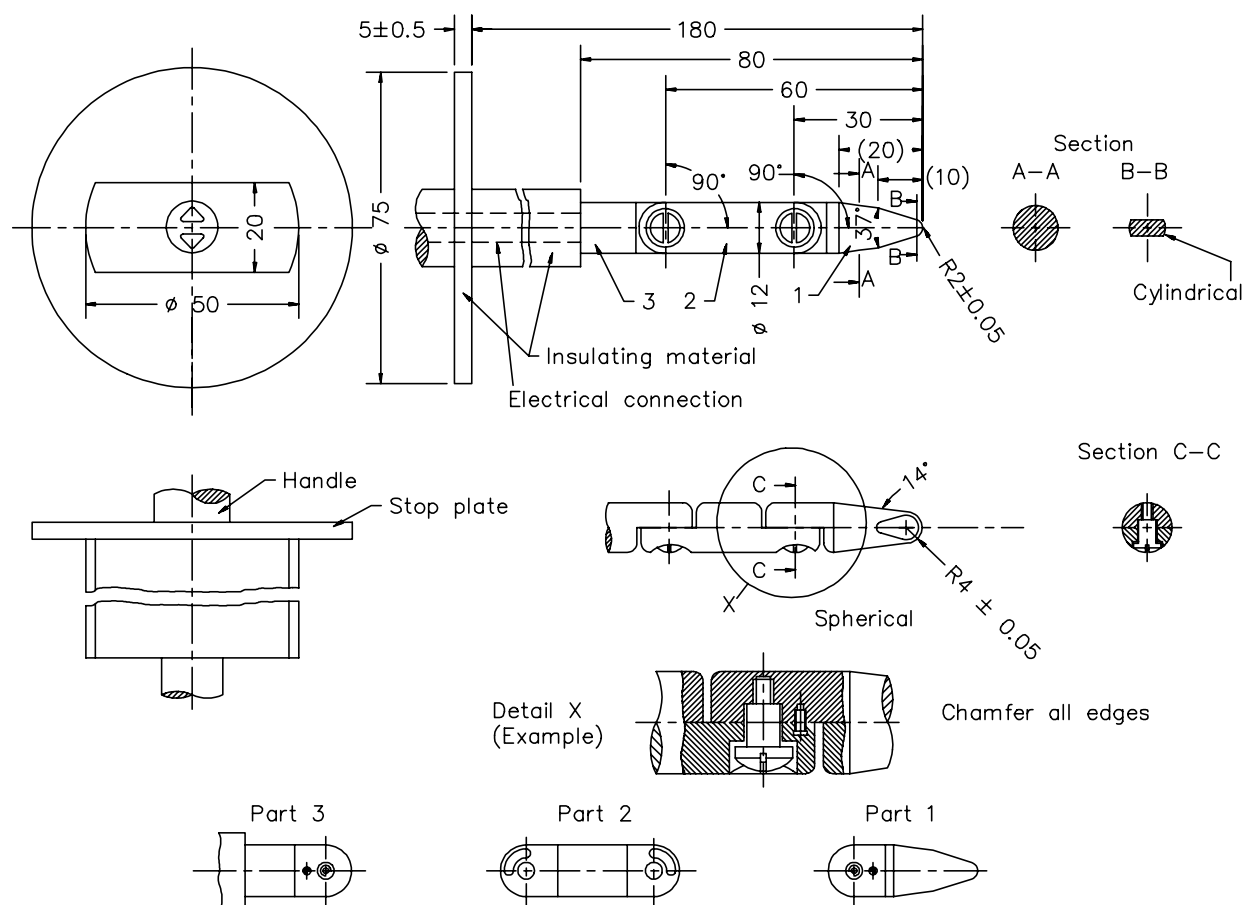
9.2.2 Appliances intended for protected locations and outdoor location shall be provided with a complete enclosure.

9.2.3 Enclosures shall prevent a probe as shown in the following:

- a) [Figure 9.1](#) from touching insulated internal wiring, other than as specified in [9.4.5](#); and
- b) [Figure 9.2](#) from:
 - 1) Touching an uninsulated current-carrying part or film-coated wire; and
 - 2) Relocating any non-current-carrying metal parts such that:
 - i) The parts touch an uninsulated current-carrying part or film-coated wire; or
 - ii) Electrical spacings are reduced below the minimum values specified in Sections [27](#) and [28](#).

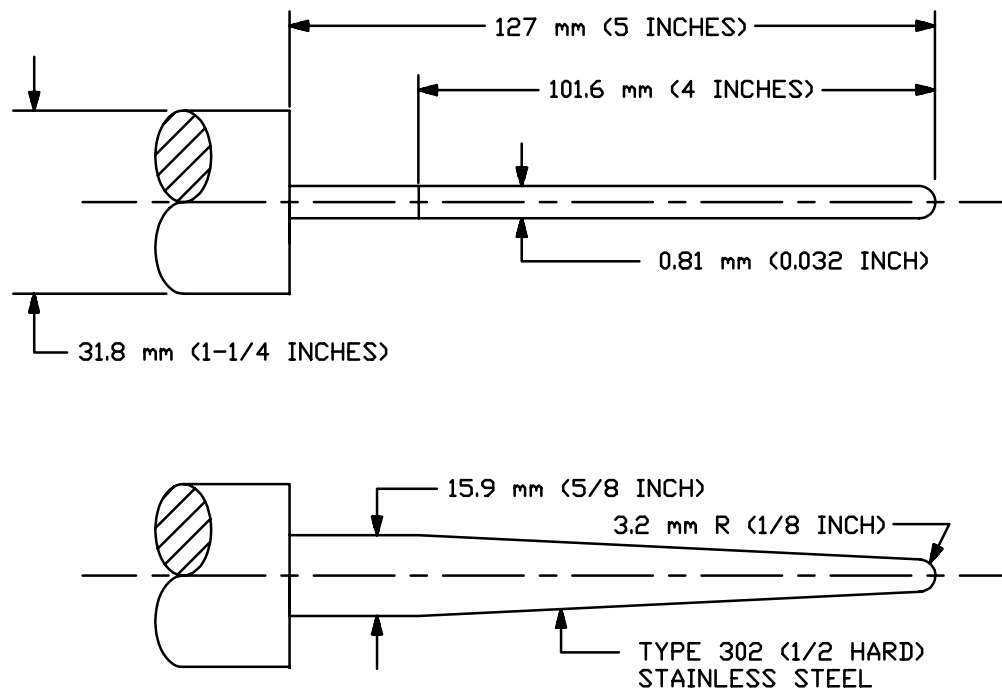
Figure 9.1
IEC Articulate Probe

Note: All dimensions are in millimeters.



SA1788B

Figure 9.2
Knife Probe



SB0504A

9.2.4 The enclosure openings located in the top, back, sides, and front of the appliance and the interior surfaces of the washing compartment, including the door, that are accessible when the loading door is open shall comply with the requirements of [9.2.3](#), [9.2.8](#), and [9.2.9](#), as applicable.

9.2.5 During the examination of the dishwasher interior surfaces, the dish racks shall be moved to any normal position giving the greatest accessibility to the probe, but shall not be removed from the appliance.

9.2.6 During the use of the probe on appliances weighing 22 kg (48.5 lb) or less when empty, there shall be sufficient clearance from supporting and other adjacent surfaces for unrestricted use of the probe (e.g., the appliance can be tipped over).

9.2.7 During the use of the probe on appliances weighing more than 22 kg (48.5 lb), if the front, sides, and back of the appliance can be positioned no more than 38.1 mm (1.5 in) above the surface upon which the appliance rests, the tip of the probes shall be inserted up to 150 mm (5.9 in) inside the plane of the opening created between the bottom edge of the appliance and the supporting surface. If the distance between the bottom edge of the appliance and supporting surface is greater than 38.1 mm (1.5 in), accessibility through the opening created between the bottom of the appliance and the supporting surface shall be evaluated in accordance with [Table 9.1](#).

Table 9.1
Minimum Acceptable Distance from an Opening to a Part that Could Involve a Risk of Electric Shock

Minor dimensions of opening ^a		Minimum distance from opening to part	
mm	(in)	mm	(in)
19.1	(0.7)	114.0	(4.49)
25.4	(1.0)	165.0	(6.50)
31.8	(1.2)	190.0	(7.48)
38.1	(1.5)	318.0	(12.52)
47.6	(1.9)	394.0	(15.51)
54.0	(2.1)	444.0	(17.48)
> 54.0 – 152.0	(> 2.1 – 6.0)	762.0	(30.00)

^a See [9.2.6](#) to [9.2.10](#)

Notes:

1) Between 19.1 mm (0.75 in) and 54.0 mm (2.12 in), interpolation is used to determine a value between values specified in the table.

2) Any dimension less than 25.4 mm (1 in) applies to a motor only.

9.2.8 Where an opening in an enclosure has a minor dimension (see [9.2.10](#)):

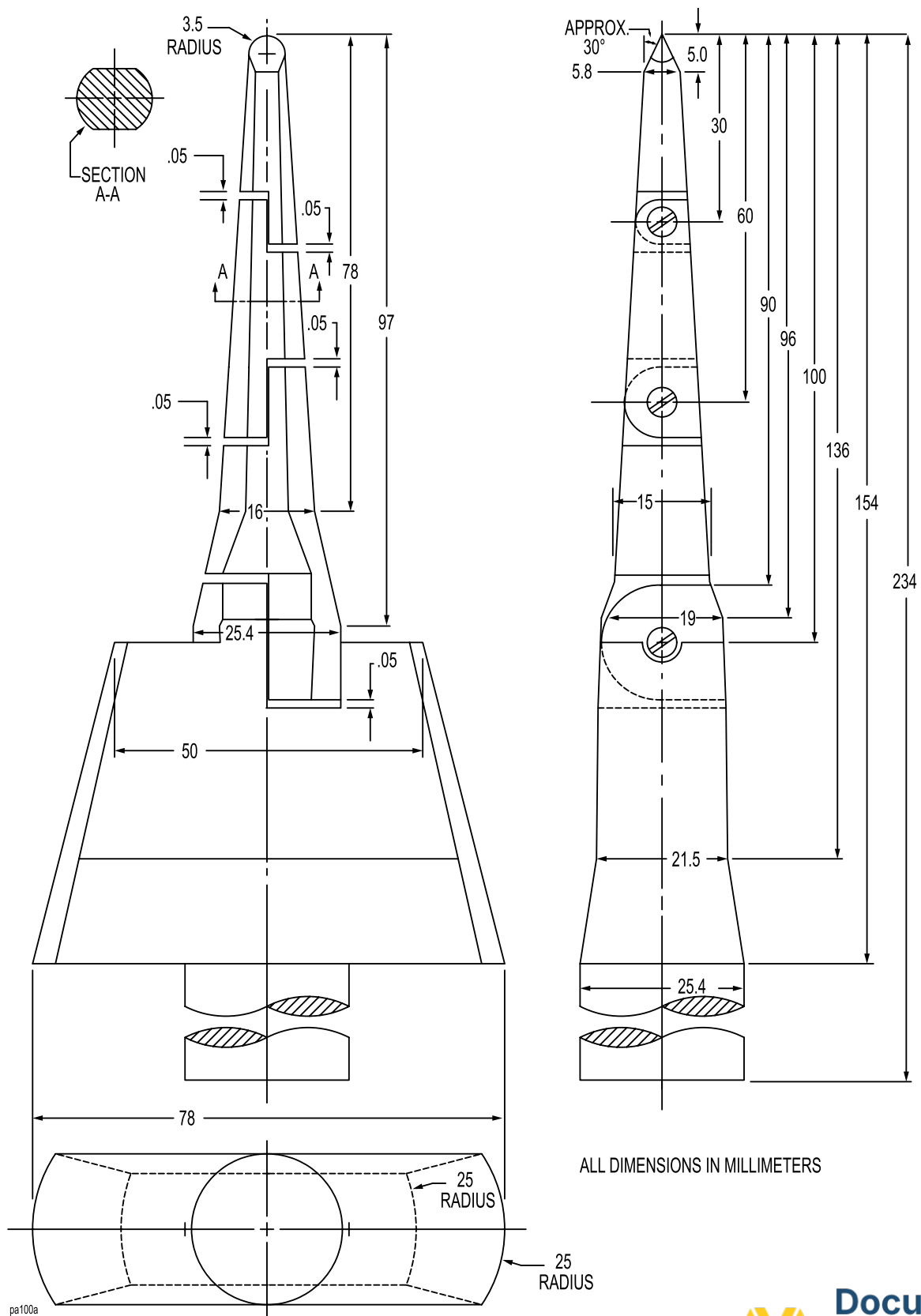
a) Less than 25.4 mm (1 in);

1) An uninsulated current-carrying part shall not be contacted by the probe illustrated in [Figure 9.3](#); and

2) Film-coated wire shall not be contacted by the probe illustrated in [Figure 9.1](#); or

b) Of 25.4 mm (1 in) or more, an uninsulated current-carrying part or film-coated wire shall be positioned from the opening as specified in [Table 9.1](#), to reduce the likelihood of electric shock resulting from unintentional contact with such a part or wire.

Figure 9.3
Articulate Probe with Web Stop



9.2.9 An accessible motor with an integral enclosure that has an opening with a minor dimension (see [9.2.10](#)):

- a) Of less than 19.1 mm (0.75 in) is acceptable, if uninsulated current-carrying parts or film-coated wire cannot be contacted by the probe illustrated in [Figure 9.1](#); or
- b) Of 19.1 mm (0.75 in) or more is acceptable, if an uninsulated current-carrying part or film-coated wire is spaced from the opening as specified in [Table 9.1](#).

9.2.10 With reference to the requirements in [9.2.8](#) and [9.2.9](#), the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.

9.2.11 With reference to [9.2.9](#), an accessible motor is a motor that:

- a) Can be contacted without opening or removing any part, except as indicated in [9.4.3](#); or
- b) Is located so as to be accessible to contact when evaluating the dishwasher enclosure as specified in [9.2.8](#).

9.3 Enclosures for built-in appliances

9.3.1 Except as specified in [9.1.2](#), enclosures of built-in dishwashers shall prevent access to internal current-carrying parts as specified in [9.3.2](#) to [9.3.4](#).

9.3.2 Openings in the front and inside the washing compartment shall be examined in accordance with [9.2.1](#). The front shall include the whole front plus those portions of the sides accessible from the front when the appliance is installed in a simulated cabinet enclosure. A 9.5 mm (0.37 in) clearance shall be between each side and the simulated enclosure.

9.3.3 When applied to the sides, the tip of the probe as shown in:

- a) [Figure 9.3](#) shall not touch uninsulated current-carrying parts that could present a risk of electric shock. When testing for uninsulated current-carrying parts, the probe shall be inserted as far as the enclosure will permit; and
- b) [Figure 9.1](#) shall not touch insulated internal wiring, other than as specified in [9.4.5](#), or film-coated wire. The tip of the probe shall be inserted up to 150 mm (5.9 in) inside the planes of the sides as defined in [9.3.4](#).

9.3.4 For the purpose of the probe test, the sides, back, and top of a built-in appliance shall be the planes defined by the inside surfaces of the sides, back, and top of the smallest rectangular compartment that will completely enclose the appliance.

9.4 All dishwashers

9.4.1 For any probe test, the probe shall be inserted, rotated, or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure.

9.4.2 The probes in [Figure 9.3](#) and [Figure 9.1](#) shall be used to determine the accessibility provided by the opening and not to determine the strength of a material. They shall be applied with the minimum force necessary to determine accessibility. The probe in [Figure 9.2](#) shall be applied with a force not exceeding 22 N (4.9 lb-f).

9.4.3 During examination with the probes, any part that can be removed without the use of a tool shall be removed or moved to the position that gives greatest accessibility to the probes.

9.4.4 When used as enclosures, wire screens, expanded metal mesh, etc., together with the methods of fastening, shall be subjected to investigation.

9.4.5 During an examination in accordance with [9.2.1](#) to [9.2.9](#), the probe may touch insulated internal wiring, provided that the wiring is secured within the enclosure so that it is unlikely to be subjected to stress or mechanical damage.

10 Starting of Motor-Operated Appliances

10.1 An appliance shall start and operate as intended on a circuit protected by an ordinary (not a time-delay) fuse having a current rating corresponding to that of the branch circuit to which the appliance should be connected.

10.2 For the test in [10.3](#), a time-delay fuse may be employed if the appliance:

- a) Will start and operate as intended on a circuit protected by a time-delay fuse; and
- b) Is marked in accordance with [7.2.8](#).

10.3 To determine if an appliance complies with the requirements in [10.1](#), the appliance shall be connected to a supply circuit of the rated test voltage and rated frequency. The appliance shall be started three times with the timer mechanism set to that part of the cycle resulting in the highest starting current. The appliance shall be allowed to come to full speed after each start, and to come to rest between successive starts. The operation of the appliance is unacceptable if the fuse opens or an overload protector provided as part of the appliance trips.

11 Power Input and Current

11.1 When operated as described in [11.3](#), the input current to an appliance rated in accordance with [7.2.2\(a\)](#) or [7.2.4](#) shall not be more than 110 percent of the marked rating.

11.2 When operated as described in [11.3](#), an appliance rated in accordance with [7.2.2\(b\)](#) shall not have an input current to:

- a) The motor more than 110 percent of the marked rating of the motor load; and
- b) A load other than the motor load more than 105 percent of the marked rating of such a load.

11.3 The appliance shall be operated as described in [12.9](#). Only the steady-state input current to an appliance during any condition of intended operation (e.g., washing, rinsing, or drying) shall be measured. The input during a period of acceleration shall not be measured.

11.4 The input to a portable cord-connected dishwasher for use on nominal 120 V branch circuits protected by overcurrent devices rated or set at not more than 15 A shall not exceed 1500 W at 115 V.

12 Heating

12.1 An appliance tested as described in [12.2](#) to [12.9](#) shall not:

- a) At any point reach a temperature high enough to result in a risk of fire or damage to any material used; or

b) Exceed the temperature rises specified in [Table 12.1](#).

Table 12.1
Maximum Acceptable Temperature Rises

Materials and components	°C	(°F)
A. Motors		
1) Class A insulation systems on coil windings of a motor and on vibrator coils		
a) in an open motor and on vibrator coils – thermocouple or resistance method	75 ^a	(135 ^a)
b) in a totally enclosed motor – thermocouple or resistance method	80	(144)
2) Class B insulation systems on coil windings of a motor		
a) in an open motor – thermocouple or resistance method	95 ^a	(171) ^a
b) in a totally enclosed motor – thermocouple or resistance method	100	(180)
3) Class F insulation systems on coil windings of an ac motor having a frame diameter of 178 mm (7 in) or less, not including a universal motor, in an open motor by the thermocouple or resistance method	120	(216)
B. Components		
1) Capacitors:		
a) electrolytic	40 ^b	(72 ^b)
b) other types	65 ^c	(117 ^c)
2) Fuses	65 ^d	(117 ^d)
3) Relay, solenoid, and coils (except motor coil windings) with:		
a) Class 105 insulation systems:		
Thermocouple method	65 ^a	(117 ^a)
Resistance method	85	(153)
b) Class 130 insulation systems:		
Thermocouple method	85 ^a	(153 ^a)
Resistance method	105	(189)
4) Sealing compound – this is a maximum temperature, not a temperature rise	40 (72) less than melting point	
C. Conductors		
Insulated wires and cords	35 ^d	(63 ^d)
D. Electrical insulation – general		
1) Fiber employed as electrical insulation	65	(117)
2) Moulded phenolic composition employed as electrical insulation or as a part the deterioration of which could result in a risk of fire or electric shock	125 ^d	(225 ^d)
3) Varnished-cloth insulation	60	(108)
E. Surfaces		
1) A surface upon which a unit might be placed or mounted for operation, and surfaces that might be adjacent to the unit when it is so placed or mounted.	65	(117)
2) Any point within a terminal box or wiring compartment of a permanently connected appliance in which power-supply conductors are to be connected, including such conductors themselves, unless the appliance is marked in accordance with 7.2.6 .	35	(63)
3) Wood or other combustible material, including the inside surface of the test enclosure and the surface supporting the appliance.	65	(117)
^a At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature measured by means of a thermocouple may be more than the maximum acceptable temperature specified in this Table, if the temperature as		

Table 12.1 Continued on Next Page

Table 12.1 Continued

Materials and components		°C	(°F)
measured by the resistance method is not more than that specified. The temperature measured by means of a thermocouple may be more than the specified value by			
Reference Item	Temperature rise, °C (°F), thermocouple method		
A (1)	5 (9)		
A (2)	10 (18)		
B (3)(a)	15 (27)		
B (3)(bi)	20 (36)		
^b For an electrolytic capacitor that is physically integral to or attached to a motor, the maximum acceptable temperature rise on insulating material integral to the capacitor enclosure shall not be more than 65 °C (117 °F).			
^c A capacitor that operates at a temperature rise of more than 65 °C (117 °F) may be evaluated on the basis of its marked temperature limit.			
^d These limitations shall not apply to classes of fuses, compounds, and components that have been investigated and found to be acceptable for use at higher temperatures.			

12.2 A motor-protective device or equipment protective device ([20.2.3](#)) shall not operate during the heating test.

12.3 All temperatures in [Table 12.1](#) are based on an assumed ambient temperature of 25 °C (77 °F). An observed temperature shall be corrected by addition [if the ambient temperature is lower than 25 °C (77 °F)] or subtraction [if the ambient temperature is higher than 25 °C (77 °F)] of the difference between 25 °C (77 °F) and the ambient temperature.

12.4 A thermocouple shall be used for determining the temperature of a coil or winding if it can be mounted, without removal of encapsulating compound or the like, on the following:

- a) Integrally applied insulation of a coil without a wrap; or
- b) Outer surface of a wrap that is not more than 0.81 mm (0.03 in) thick and consists of cotton, paper, rayon, or the like, but not of thermal insulation.

12.5 The rise-of-resistance method shall be used if the thermocouple measurement cannot be conducted in accordance with [12.4](#). For a thermocouple-measured temperature of a motor coil as specified in [Table 12.1](#), items A(1) and A(2), the thermocouple shall be mounted on the integrally applied insulation on the conductor.

12.6 A permanently connected appliance or a cord-connected undercounter appliance shall be mounted in an enclosure constructed of nominal 9.5 mm (0.37 in) thick plywood painted black. The enclosure shall consist of a bottom, a back, two sides, and a top. The top shall be omitted for the test if a countertop is provided as part of the appliance. Each part of the enclosure shall be brought into the closest contact with the corresponding surface of the appliance as the configuration of the appliance permits. Temperatures shall be measured at points on each of the enclosure surfaces.

12.7 A free-standing dishwasher shall be enclosed at the sides and rear by nominal 9.5 mm (0.37 in) unpainted plywood panels extending from the floor to the top of the dishwasher and located as close to the appliance as the construction permits.

12.8 If the appliance incorporates a reel for the power-supply cord, one-third of the length of the cord shall be unreel for the heating test.