UL 749

STANDARD FOR SAFETY

Household Dishwashers

UL Standard for Safety for Household Dishwashers, UL 749

Eleventh Edition, Dated November 30, 2018

Summary of Topics

This new edition of ANSI/UL 749 is being issued to incorporate several substantive changes.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated March 9, 2018 and August 17, 2018.

No Text on This Page

Canadian Standards Association
CSA-C22.2 No. 167-18
Eighth Edition

Underwriters Laboratories Inc.
UL 749
Eleventh Edition

Household Dishwashers

November 30, 2018

ANSI/UL 749-2018

Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as "CSA Group"), and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

ISBN 978-1-4883-1467-4 © 2018 Canadian Standards Association

This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquires@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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

The most recent designation of ANSI/UL 749 as an American National Standard (ANSI) occurred on November 30, 2018. 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.

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

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Preface

This is the harmonized CSA Group and UL Standard for Household Dishwashers. It is the eighth edition of CSA C22.2 No. 167 and the eleventh edition of UL 749. This edition of CSA C22.2 No. 167 supersedes the previous edition published in 2017. This edition of UL 749 supersedes the previous edition published in 2017.

The major differences between this edition and the previous edition include the revision of thermocouples requirements, the revision of switch requirements, the revision of control requirements, the revision of flammability requirements for functional parts in Table 10, the revisions to smart-enabled dishwasher requirements, the revision of heating elements requirements, the addition of the dishwasher controls washing test, the addition of the resistance to overvoltage test, the addition of the dishwasher lampholder endurance test, the addition of requirements for glass used as an enclosure, and the clarification of interlock requirements.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL).

The efforts and support of the Harmonization Committee for Household Dishwashers and the Association of Home Appliance Manufactures (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 Dishwashers, under the jurisdiction of the 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.

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number shall 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 UL.

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. Presentation is word for word except for editorial changes.

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.

Household dishwashers

1 Scope

1.1 This standard applies to electric household dishwashers intended to be used in nonhazardous locations in accordance with the Canadian Electrical Code (CEC), Part I, C22.1, General Requirements – Canadian Electrical Code (CEC), Part II, C22.2, 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 Supplement SB.

1.4 This standard applies to household dishwashers generating ozone during normal operation. See Supplement SC.

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 Reference Publications

2.1 Where reference is made to any Standards, such reference shall be considered to refer to the latest editions and revisions thereto available at the time of printing, unless otherwise specified.

CSA Group Standards

B64 Series-11
Backflow preventers and vacuum breakers

B64.1.1-11
Atmospheric Vacuum Breakers (AVB)

C22.1-18
Canadian Electrical Code, Part I

C22.2 No. 0-10 (R2015)
General Requirements – Canadian Electrical Code (CEC), Part II

C22.2 No. 0.1-M1985 (R2013)
General Requirements for Double-Insulated Equipment

C22.2 No. 0.2-93 (R2008)
Insulation Coordination

C22.2 No. 0.3-09 (R2014)
Test Methods For Electrical Wires and Cables

C22.2 No. 0.8-12
Safety Functions Incorporating Electronic Technology

C22.2 No. 0.15-15
Adhesive Labels

CAN/CSA-C22.2 No. 0.17-00 (R2013)
Evaluation of Properties of Polymeric Materials

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

C22.2 No. 14-13
Industrial Control Equipment

CAN/CSA-C22.2 No. 18.1-13
Metallic Outlet Boxes

C22.2 No. 18.2-06 (R2011)
Nonmetallic Outlet Boxes

CAN/CSA-C22.2 No. 18.3-12
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CAN/CSA-C22.2 No. 18.5-13
Positioning Devices

C22.2 No. 21-14
Cord Sets and Power Supply Cords

C22.2 No. 24-15
Temperature-Indicating and -Regulating Equipment

C22.2 No. 38-14
Thermoset-Insulated Wires and Cables

C22.2 No. 39-13
Fuseholder Assemblies

C22.2 No. 42-10 (R2015)
General Use Receptacles, Attachment Plugs, and Similar Wiring Devices

CAN/CSA-C22.2 No. 42.1-13
Cover Plates for Flush-Mounted Wiring Device

C22.2 No. 43-08 (R2013)
Lampholders

C22.2 No. 49-14
Flexible Cords and Cables

C22.2 No. 55-15
Special Use Switches

CAN/CSA-C22.2 No. 65-13
Wire Connectors

C22.2 No. 66.2-06 (R2011)
Low Voltage Transformers – Part 2: General Purpose Transformers

C22.2 No. 66.3-06 (R2011)
Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers

C22.2 No. 72-10 (R2014)
Heater Elements

CAN/CSA-C22.2 No. 74-96 (R2015)
Equipment for Use with Electric Discharge Lamps

C22.2 No. 75-14
Thermoplastic-Insulated Wires and Cables

C22.2 No. 77-14
Motors with Inherent Overheating Protection

C22.2 No. 100-14
Motors and Generators

C22.2 No. 107.1-01 (R2011)
General Use Power Supplies

CAN/CSA-C22.2 No. 108-14
Liquid Pumps

C22.2 No. 111-10 (R2015)
General-Use Snap Switches

C22.2 No. 127-09 (R2014)
Equipment and Lead Wires

C22.2 No. 139-13
Electrically Operated Valves

C22.2 No. 144-M91 (R2011)
Ground Fault Circuit Interrupters

C22.2 No. 153-14
Electrical Quick-Connect Terminals

C22.2 No. 156-M1987 (R2013)
Solid-State Speed Controls

C22.2 No. 158-10
Terminal Blocks

C22.2 No. 168-16
Commercial Dishwashers

C22.2 No. 177-13
Clock-Operated Switches

C22.2 No. 182.3-M1987 (R2014)
Special Use Attachment Plugs, Receptacles, and Connectors

C22.2 No. 188-13
Splicing Wire Connectors

C22.2 No. 190-14
Capacitors for Power Factor Correction

C22.2 No. 197-M1983 (R2013)
PVC Insulating Tape

CAN/CSA-C22.2 No. 198.1-06 (R2015)
Extruded Insulating Tubing

CAN/CSA C22.2 No. 198.3-05 (R2014)
Coated Electrical Sleeving

C22.2 No. 210-15
Appliance Wiring Material Products

CAN/CSA-C22.2 No. 223-M91 (R2013)
Power Supplies with Extra-Low-Voltage Class 2 Outputs

C22.2 No. 235-04 (R2013)
Supplementary Protectors

C22.2 No. 248.1-11
Low-Voltage Fuses - Part 1: General Requirements

C22.2 No. 250.4-14
Portable Luminaires

C22.2 No. 2459-08 (R2013)
Insulated Multi-pole Splicing Wire Connectors

CAN/CSA-C22.2 No. 4248.1-07 (R2012)
Fuseholders – Part 1: General Requirements

CAN/CSA-C22.2 No. 61058-1-09 (R2014)
Switches for Appliances - Part 1: General Requirements

CAN/CSA-C22.2 No. 60950-1-07 (R2012)
Information Technology Equipment - Safety - Part 1: General Requirements

CAN/CSA-E730-2-6-94 (R2013)
Automatic Electrical Controls for Household and Similar Use – Part 2: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements

CAN/CSA-E730-2-7-94 (R2013)
Automatic Electrical Controls for Household and Similar Use – Part 2: Particular Requirements for Timers and Time Switches

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

CAN/CSA-E60730-1-13
Automatic Electrical Controls for Household and Similar Use – Part 1: General Requirements

CAN/CSA-E60730-2-8-01 (R2011)
Automatic Electrical Controls for Household and Similar Use – Part 2-8: Particular Requirements for Electrically Operated Water Valves, Including Mechanical Requirements

CAN/CSA-E60730-2-9-15
Automatic Electrical Controls for Household and Similar Use – Part 2-9: Particular Requirements for Temperature Sensing Controls

UL Standards

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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

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Gaskets and Seals

UL 224
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UL 244A
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UL 248-1
Low-Voltage Fuses – Part 1: General Requirements

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UL 355
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UL 429
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UL 486A-486B
Wire Connectors

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Equipment Wiring Terminals For Use With Aluminum And/Or Copper Conductors

UL 496
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UL 508
Industrial Control Equipment

UL 510
Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

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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
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Appliance Wiring Material

UL 778
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Cord Sets and Power-Supply Cords

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Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment

UL 873
Temperature-Indicating and -Regulating Equipment

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Outline for Solenoids

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UL 921
Commercial Dishwashers

UL 935
Fluorescent-Lamp Ballasts

UL 943
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UL 969
Marking and Labeling Systems

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Tests for Safety-Related Controls Employing Solid-State Devices

UL 1004-1
Rotating Electrical Machines – General Requirements

UL 1004-2
Impedance Protected Motors

UL 1004-3
Thermally Protected Motors

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Electronically Protected Motors

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Power Units Other Than Class 2

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High-Intensity-Discharge Lamp Ballast

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Sheathed Heating Elements

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Ground Fault Sensing and Relaying Equipment

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Special-Use Switches

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Terminal Blocks

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Supplementary Protectors for Use in Electrical Equipment

UL 1097
Double Insulation Systems for Use in Electrical Equipment

UL 1283
Electromagnetic Interference Filters

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 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 2459
Insulated Multi-Pole Splicing Wire Connectors

UL 2557
Outline for Membrane Switches

UL 4248-1
Fuseholders – 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 – Part 2-6: 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 60730-2-16A
Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Water Level Controls of the Float Type for Household and Similar Applications

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

AHAM (Association of Home Appliance Manufacturers) Standards

AHAM DW-1
Dishwashers

ASSE (American Society of Sanitary Engineering) Standards

ASSE 1001
Performance Requirements for Atmospheric Type Vacuum Breakers

ASTM (American Society for Testing and Materials) Standards

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

IEC (International Electrotechnical Commission) Standards

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

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 60695-2-12
Fire Hazard Testing – Part 2-12: Glowing/Hot-Wire Based Test Methods – Glow-Wire Flammability Test Method for Materials

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 (National Fire Protection Association) Standards

NFPA 70
National Electrical Code

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 Clauses 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, Clause 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 and a height of 50 mm, 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 13.

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, 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.

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

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:

a) 15 V rms;

b) 21.2 Vac peak; or

c) 30 V continuous dc.

Note: Either a low-voltage circuit or the secondary circuit of a Class 2 circuit do 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 within 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 DEVICE – A device that:

a) Regulates temperature; and

b) Functions during normal operation of the appliance.

3.31 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.

3.32 WITHIN 3MM – Falling within the dotted boundary formed by the cylinder with hemispherical ends, as shown in Figure 12.

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 CAN/CSA-C22.2 No. 0.

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 Clause 12 and the abnormal operation tests of Clause 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 Clause 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 Clause 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 Clause 5.1.2 through a separate circuit, the rest of the appliance shall be supplied at the voltage specified in Clause 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/m^2 (lbs-/ft^2) 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 mm^2). 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-1.

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 Clause 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 Clause 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 Clause 15.5).

7 Marking

Advisory Note: *In Canada, there are two official languages, English and French. Annex A provides 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 Clauses 7.1.2 and 7.1.3.

7.1.2 After being conditioned as described in Clause 7.1.3, an adhesive label, immediately following removal from each test medium, and after being exposed to room temperature for 24 hours 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 Clause 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 Clause 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 Clause 7.2.6 shall include both °C and °F. The temperature rating of the conductors required by the heating test (see Clause 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 Clause 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 Clause 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 Clause 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 Clauses 25.1.5 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 Clause 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 Clause 7.2.11, at the approach to the ungrounded parts, shall be required.

7.2.14 If the marking specified in Clause 7.2.11 is located on the ungrounded part, only one marking shall be required.