



# UL 921

## STANDARD FOR SAFETY

### Commercial Dishwashers



UL Standard for Safety for Commercial Dishwashers, UL 921

Eighth Edition, Dated January 30, 2020

### **Summary of Topics**

***This reaffirmation of ANSI/UL 921 dated December 17, 2024 is being issued to update the title page to reflect the latest ANSI approval date as a Reaffirmed American National Standard (ANS). No changes in requirements are involved.***

***As noted in the Commitment for Amendments statement located on the back side of the title page, ULSE and CSA are committed to updating this harmonized standard jointly. However, the revision pages dated December 17, 2024 will not be jointly issued by ULSE and CSA as these revision pages only address UL ANSI approval dates.***

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

The requirements are substantially in accordance with Proposal(s) on this subject dated October 18, 2024.

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CSA Group  
CSA/ANSI Z83.21:20 • CSA C22.2 No. 168:20  
Third Edition



ULSE Inc.  
UL 921  
Eighth Edition

## Commercial Dishwashers

January 30, 2020

(Title Page Reprinted: December 17, 2024)

## Commitment for Amendments

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

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The Department of Defense (DoD) has adopted UL 921 on June 18, 1992. 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 UL Standard for Commercial Dishwashers. It is the Third edition of CSA/ANSI Z83.21 • CSA C22.2 No. 168, and the Eighth edition of UL 921. This edition of CSA/ANSI Z83.21 • CSA C22.2 No. 168 supersedes the previous editions published in 2005 and 2016. This edition of UL 921 supersedes the previous edition published in 2016.

This harmonized Standard was prepared by CSA Group and ULSE Inc. (ULSE).

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

This standard was reviewed by the Joint Technical Subcommittee on Gas Food Service Equipment under the jurisdiction of the Z21/83 Technical Committee on Performance and Installation of Gas Burning Appliances and Related Accessories and the CSA Strategic Steering Committee on Fuels and Appliances. It has been formally approved by the Z21/83 Technical Committee and the Interprovincial Gas Advisory Council.

This Standard was also 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. Presentation is word for word except for editorial changes.

### Reasons for Differences From IEC

This Standard provides requirements for commercial dishwashers 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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# Commercial Dishwashers

## 1 Scope

1.1 This Standard covers commercial, freestanding, under-counter, and counter-insert dishwashers, utensil-washers, and glass washers using water as the principal cleaning medium, hereafter referred to as dishwashers. These dishwashers utilize steam, gas, or electric heaters for heating the water. Heated water is provided to a dishwasher by means of steam, gas, or electric heating systems integral to the appliance, or by means not integral to the dishwasher that is provided at the installation site.

1.2 This Standard is not intended to be used to evaluate the gas-fired water heating portions of the system that incorporate water containment vessels operating above atmospheric pressure.

For dishwashers that incorporate a gas-fired water heater with a pressurized water containment vessel operating above atmospheric pressure, the water heater portion of the system is covered by the requirements of ANSI Z21.10.3/CSA 4.3.

1.3 This Standard covers:

a) electric dishwashers rated 600 V or less, installed in accordance with the Canadian Electrical Code (CEC), Part I, CSA C22.1, and the National Electrical Code (NEC), NFPA 70; and

b) the gas-handling, gas-burning, and gas-control features of gas-fired dishwashers having inputs of 420 MJ (400,000 Btu per hour or less, limited to 3.45 kPa (0.5 psig) inlet pressure, installed in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, the International Fuel Gas Code, ICC IFGC, or the Natural Gas and Propane Installation Code, CSA B149.1 for use with:

- 1) natural gas;
- 2) manufactured gas;
- 3) mixed gas;
- 4) propane gas;
- 5) liquefied petroleum gases; or
- 6) LP gas-air mixtures.

1.4 These requirements cover dishwashers intended for use in commercial establishments, such as kitchens of restaurants and hospitals, where they are not intended to be accessible to the public.

## 2 General

### 2.1 Components

2.1.1 Except as indicated in Clauses [2.1.2](#), [2.1.3](#), and [2.1.4](#), a component of a product covered by this standard shall:

- a) comply with the requirements for that component as specified in this Standard;
- b) be used in accordance with its rating(s) established for the intended conditions of use;
- c) be used within its established use limitations or conditions of acceptability;

- d) additionally comply with the applicable requirements of this end product standard; and
- e) not contain mercury, except when contained in lamps.

Note: Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and can be used only under those specific conditions.

2.1.2 A component of a product covered by this standard is not required to comply with a specific component requirement that:

- a) involves a feature or characteristic not required in the application of the component in the product;
- b) is superseded by a requirement in this standard; or
- c) is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.

2.1.3 A component complying with a CSA or UL component standard other than those specified in this Standard is acceptable if:

- a) the component also complies with the applicable component standard specified in this Standard; or
- b) the component standard:
  - 1) is compatible with the ampacity and overcurrent protection requirements in the Canadian Electrical Code (CEC), Part I and National Electrical Code, where appropriate;
  - 2) considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and
  - 3) any use limitations of the other component standard are identified and appropriately accommodated in the end use application.

2.1.4 Components located in an EXTRA-LOW VOLTAGE CIRCUIT that are not relied upon to reduce the risk of electric shock, fire, or injury shall not require additional investigation.

2.1.5 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable CSA and UL standard(s) that cover devices that provide those functions, unless those other functions are:

- a) not required for the application; and
- b) not identified as part of markings, instructions, or packaging for the appliance.

2.1.6 A component not anticipated by the requirements of this end product standard, not specifically covered by the component standards specified in this Standard, and that involves a risk of fire, electric shock, or injury to persons shall be additionally investigated in accordance with the applicable CSA and UL standards, and shall comply with Clause [2.1.1](#) (b) – (e).

2.1.7 With respect to Clause [2.1.6](#), reference to construction and performance requirements in another CSA and UL end product standard is suitable where that standard anticipates normal and abnormal use conditions consistent with the application of commercial dishwashers.

## 2.2 Units of measurement

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

## 2.3 Reference publications

2.3.1 Products covered by this standard shall comply with the reference installation codes and standards noted in this clause. For undated references to standards, such reference shall be considered to refer to the latest edition and all revisions to that edition up to the time when this standard was approved. For dated references to standards, such reference shall be considered to refer to the dated edition and all revisions published to that edition up to the time the standard was approved.

### CSA Group Standards

CSA Component Acceptance Notice No. 5A

B149.1-15  
*Natural Gas and Propane Installation Code*

C22.1-18  
*Canadian Electrical Code (CEC), Part I*

CAN/CSA-C22.2 No. 0-10 (R2105)  
*General requirements – Canadian Electrical Code (CEC), Part II*

C22.2 No. 0.2-16  
*Insulation coordination*

C22.2 No. 0.8-12 (R2016)  
*Safety functions incorporating electronic technology*

C22.2 No. 0.15-15  
*Adhesive Labels*

CAN/CSA-C22.2 No. 0.17-00 (R2018)  
*Evaluation of properties of polymeric materials*

C22.2 No. 5-16  
*Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures*

C22.2 No. 8-13  
*Electromagnetic interface (EMI) filters*

C22.2 No. 14-18  
*Industrial Control Equipment*

C22.2 No. 21-14  
*Cord sets and power-supply cords*

CSA C22.2 No. 24-15  
*Temperature-indicating and regulating equipment*

C22.2 No. 38-18

*Thermoset-insulated wires and cables*

C22.2 No. 39-13 (R2017)

*Fuseholder assemblies*

C22.2 No. 42-10 (R2015)

*General use receptacles, attachment plugs, and similar wiring devices*

C22.2 No. 43-17

*Lampholders*

C22.2 No. 49-14

*Flexible cords and cables*

C22.2 No. 55-15

*Special use switches*

C22.2 No. 65-18

*Wire connectors*

C22.2 No. 66-1(R2015)

*Low voltage transformers - Part 1: General requirements*

C22.2 No. 66-2 (R2015)

*Low voltage transformers – Part 2: General purpose transformers*

C22.2 No. 66-3 (R2015)

*Low voltage transformers – Part 3: Class 2 and Class 3 transformers*

C22.2 No. 74-16

*Equipment for use with electric discharge lamps*

C22.2 No. 75-17

*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. 127-18

*Equipment and lead wires*

C22.2 No. 144.1-16

*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 (R2014)  
*Terminal blocks*

C22.2 No. 182.3-16  
*Special use attachment plugs, receptacles, and connectors*

C22.2 No. 188-18  
*Splicing wire connectors*

C22.2 No. 209-M1985 (R2013)  
*Thermal cut-offs*

C22.2 No. 210-15  
*Appliance wiring material products*

C22.2 No. 235-04 (R2017)  
*Supplementary protectors*

C22.2 No. 236-15  
*Heating and cooling equipment*

C22.2 No. 248.1-11 (R2016)  
*Standard for low-voltage fuses – Part 1: General requirements*

CAN/CSA C22.2 No. 248.14-00 (R2015)  
*Standard for low-voltage fuses – Part 14: Supplemental fuses*

C22.2 No. 250.4-14  
*Portable luminaires*

C22.2 No. 2459-08 (R2017)  
*Insulated multi-pole splicing wire connectors*

C22.2 No. 4248.1-17  
*Fuseholders*

CAN/CSA-C22.2 No. 60335-2-34:17  
*Household and similar electrical appliances – Safety – Part 2-34: Particular requirements for motor-compressors*

CAN/CSA-C22.2 No. 61058-1:17  
*Switches for appliances – Part 1: General requirements*

CAN/CSA-E60730-1  
*Automatic electrical controls for household and similar use – Part 1: General requirements*

CAN/CSA-E60730-2 Series of Standards  
*Automatic electrical controls for household and similar use – Part 2: Particular requirements*

CAN/CSA-E60730-2-9:15  
*Automatic electrical controls for household and similar use – Part 2-9: Particular requirements for temperature sensing controls*

CAN/CSA-C22.2 No. 60950-1-07 (R2016)  
*Electromagnetic interface (EMI) filters*

ANSI Z21.20-2014/CAN/CSA 60730-2-5-14  
*Automatic electrical controls for household and similar use – Part 2: Particular requirements for automatic electrical burner control systems*

CSA/AM ANSI Z21.15-2009/CSA 9.1-2009 (R2014)  
*Manually-Operated Gas Valves for Appliances Appliance Connector Valves, and Hose End Valves*

CSA/AM ANSI Z21.18-2007/CSA 6.3-2007 (R2017)  
*Gas Appliance Pressure Regulators*

CSA/AM ANSI Z21.20-2014/CAN/CSA-C22.2 No. 60730-2-5-14  
*Automatic Electrical Controls for Household and Similar Use – Part 2: Particular Requirements for Automatic Burner Ignition Systems and Components*

CSA/AM ANSI Z21.21-2015/CSA 6.5-2015  
*Automatic Valves for Gas Appliances*

CSA/AM ANSI Z21.35-2005/CSA 6.8-2005 (R2015)  
*Pilot Gas Filters*

ANSI Z21.78-2010/CSA 6.20-2010 (R2015)  
*Combination gas controls for gas appliances*

### **UL<sup>1</sup> Standards**

UL 44  
*Standard for Thermoset-Insulated Wires and Cables*

UL 62  
*Standard for Flexible Cords and Cables*

UL 66  
*Standard for Fixture Wire*

UL 83  
*Standard for Wires and Cables, Thermoplastic-Insulated*

UL 244A  
*Standard for Solid-State Controls for Appliances*

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

UL 248-14  
*Standard for Low-Voltage Fuses - Part 14: Supplemental Fuses*

UL 310  
*Standard for Electrical Quick-Connect Terminals*

UL 353

*Standard for Limit Controls*

UL 372

*Standard for Automatic Electrical Controls for Household and Similar Use – Part 2: Particular Requirements for Burner Ignition Systems and Components*

UL 429

*Standard for Electrically Operated Valves*

UL 486A-486B

*Standard for Wire Connectors*

UL 486C

*Standard for Splicing Wire Connectors*

UL 486E

*Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 489

*Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures*

UL 489A

*Standard for Circuit Breakers for Use in Communications Equipment*

UL 496

*Standard for Lampholders*

UL 498

*Standard for Attachment Plugs and Receptacles*

UL 508

*Standard for Industrial Control Equipment*

UL 723

*Standard for Test for Surface Burning Characteristics of Building Materials*

UL 746A

*Standard for Polymeric Materials – Short Term Property Evaluations*

UL 746B

*Standard for Polymeric Materials – Long Term Property Evaluations*

UL 746C

*Standard for Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 746E

*Standard for Polymeric Materials – Industrial Laminates, Filament Wound Tubing, Vulcanized Fibre, and Materials Used In Printed Wiring Boards*

UL 758

*Standard for Appliance Wiring Material*

UL 795

*Standard for Commercial-Industrial Gas Heating Equipment*

UL 796

*Standard for Printed-Wiring Boards*

UL 817

*Standard for Cord Sets and Power-Supply Cords*

UL 840

*Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*

UL 873

*Standard for Temperature-Indicating and -Regulating Equipment*

UL 935

*Standard for Fluorescent-Lamp Ballasts*

UL 943

*Standard for Ground-Fault Circuit-Interrupters*

UL 969

*Standard for Marking and Labeling Systems*

UL 1004-1

*Standard for Rotating Electrical Machines – General Requirements*

UL 1004-2

*Standard for Impedance Protected Motors*

UL 1004-3

*Standard for Thermally Protected Motors*

UL 1029

*Standard for High-Intensity-Discharge Lamp Ballast*

UL 1059

*Standard for Terminal Blocks*

UL 1077

*Standard for Supplementary Protectors for Use in Electrical Equipment*

UL 1411

*Standard for Transformer and Motor Transformers for Use in Audio-, Radio-, and Television-Type Appliances*

UL 1434

*Standard for Thermistor-Type Devices*

UL 1446

*Standard for Systems of Insulating Materials – General*

UL 1557

*Standard for Electrically Isolated Semiconductor Devices*

UL 1577

*Standard for Optical Isolators*

UL 1977

*Standard for Component Connectors for Use in Data, Signal, Control and Power Applications*

UL 1995

*Standard for Heating and Cooling Equipment*

UL 2353

*Standard for Single- and Multi-Layer Insulated Winding Wire*

UL 2459

*Standard for Insulated Multi-Pole Splicing Wire Connectors*

UL 4248-1

*Standard for Fuseholders – Part 1: General Requirements*

UL 5085-1

*Standard for Low Voltage Transformers – Part 1: General Requirements*

UL 5085-2

*Standard for Low Voltage Transformers – Part 2: General Purpose Transformers*

UL 5085-3

*Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers*

UL 8750

*Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products*

UL 60065

*Standard for Audio, Video and Similar Electronic Apparatus – Safety Requirements*

UL 60335-1

*Standard for Safety of Household and Similar Electrical Appliances, Part 1: General Requirements*

UL 60335-2-34 (4th, 5th, and 6th Editions)

*Standard for Household and Similar Electrical Appliances, Part 2: Particular Requirements for Motor-Compressors*

UL 60384-14

*Standard for Safety 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

*Standard for Thermal-Links – Requirements and Application Guide*

UL 60730-1

*Standard for Automatic Electrical Controls – Part 1: General Requirements*

**UL 60730-2-5**

*Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Burner Control Systems*

**UL 60730-2-9**

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

**UL 61058-1**

*Standard for Switches for Appliances – Part 1: General Requirements*

**IEC Standards****IEC 60127-1**

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

**IEC 61000-4-2**

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

**IEC 61000-4-3**

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

**IEC 61000-4-4**

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

**IEC 61000-4-5**

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

**IEC 61000-4-6**

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

**IEC 61000-4-11**

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

**IEC 61000-4-13**

*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*

**ULC<sup>2</sup> Standards****CAN/ULC S102-2010**

*Standard for Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies*

**ANSI<sup>3</sup> Standards****ANSI/ASTM E230/E230M**

*Standardized Thermocouples*

ANSI Z21.23-2010 (R2015)  
*Standard for Gas Appliance Thermostats*

#### **ASME<sup>4</sup> Standards**

ANSI/ASME B1.20.1-2013  
*Standard for Pipe Threads, General Purpose (Inch)*

ANSI/ASME B36.10M-2015  
*Welded and Seamless Wrought Steel Pipe*

#### **ASTM<sup>5</sup> Standards**

F1696-14  
*Standard Test Method for Energy Performance of Single-Rack, Door-Type Commercial Dishwashing Machines*

F1704-12 (R2017)  
*Standard Test Method for Capture and Containment Performance of Commercial Kitchen Exhaust Ventilation Systems*

F1920-15  
*Standard Test Method for Performance of Rack Conveyor, Commercial Dishwashing Machines*

F2474-14  
*Standard Test Method for Heat Gain to Space Performance of Commercial Kitchen Ventilation/Appliance Systems*

#### **ICC<sup>6</sup> Standards**

ICC IFGC-2018  
*International Fuel Gas Code*

#### **NFPA<sup>7</sup> Standards**

ANSI Z223.1/NFPA 54-2015  
*National Fuel Gas Code*

NFPA 70-2017  
*National Electrical Code (NEC)*

ANSI/NFPA 96-2017  
*Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*

ANSI/NFPA 211-2016  
*Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances*

<sup>1</sup> Underwriters Laboratories Inc.

<sup>2</sup> Underwriters Laboratories of Canada

<sup>3</sup> American National Standards Institute

<sup>4</sup> American Society of Mechanical Engineers

<sup>5</sup> American Society for Testing and Materials

<sup>6</sup> International Code Council

<sup>7</sup> National Fire Protection Association

## 2.4 General requirements

In Canada, general requirements as indicated in the Canadian Electrical Code, Part II, General Requirements, CSA C22.2 No. 0, are applicable.

## 3 Definitions

3.1 For the purpose of these requirements the following definitions apply.

3.2 **Automatic gas ignition system** – A system intended to ignite and reignite an appliance burner(s). Such systems are intended to:

- a) automatically ignite gas at the main burner, or gas at the pilot burner so that the pilot ignites the main burner;
- b) prove the presence of either the ignition source, the main burner flame, or both; and
- c) automatically act to shut off the gas supply to the main burner or pilot burner and the main burner, when the supervised flame or ignition source is not proved.

3.3 **Automatically controlled dishwasher** – A dishwasher or a unit of a system for which energization of a motor, a solenoid, a magnet, or similar component occurs without manual intervention. Automatic control also occurs during any single predetermined cycle of operation, when automatic changing of the mechanical load reduces the speed of a motor so that starting-winding connections to the branch circuit are reestablished.

3.4 **Auxiliary control** – A control intended primarily for the regulation of time, temperature, pressure, or operations under conditions of normal operation, and that is not intended to address abnormal conditions such as overload or above maximum normal operating temperatures resulting from abnormal operation.

3.5 **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 can serve as a portion of an enclosure and as a functional part.

3.6 **Continuous-duty motor** – A motor that, under any intended condition of use, is intended to operate unattended and under load for 3 hours or more.

3.7 **Control, operating** – Control, the operation of which starts or regulates the appliance during normal operation.

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3.8 **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 protective control, the protective functions are verified under normal and single-fault conditions of the control.

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**3.9 Cord-connected dishwasher** – A dishwasher that is connected to the electrical supply by a power-supply cord or cord set.

**3.10 Extra-low voltage circuit** – A circuit having an open-circuit potential of not more than 30 V, ac or dc, or 42.4 V peak ac supplied by a primary battery, by a standard Class 2 transformer, or by a combination of a transformer and a fixed impedance that, as a unit, complies with all performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting a resistance in series with the supply circuit as a means of limiting the voltage and current is not an extra-low voltage circuit.

**3.11 Factory-wired** – The installation of wiring or wiring harnesses on or in the equipment in the factory.

**3.12 Field-wired** – The wiring or wiring harnesses which are connected to the equipment in the field.

**3.13 Field wiring terminal** – A terminal to which a power supply or control connection is made in the field when the dishwasher is installed.

**3.14 Gas ignition device** – A device, either a pilot or an igniter, for igniting gas at a burner.

**3.15 Igniter** – A device that utilizes electrical energy to ignite gas at a pilot or main burner.

**3.16 Internal wiring** – Wiring that is interconnecting beyond the point where the power-supply cord of a cord-connected dishwasher enters the enclosure, or beyond the wiring terminals or leads for power-supply connection of a fixed dishwasher.

**3.17 Line-voltage circuit** – A circuit having a potential of not more than 600 V and having circuit characteristics in excess of those of a low-voltage circuit.

**3.18 Multi-flame pilot burner** – A pilot burner that produces a single flame with variation in contour under minimum pilot conditions.

**3.19 Operational maintenance** – Any operation, accessible without the use of tools, that can be performed by other than authorized maintenance personnel for the equipment. The following service functions which require the use of tools to perform are not considered operational maintenance:

- a) resetting of overload devices and primary safety controls;
- b) repeated adjustment of timers; and
- c) replacement of fuses.

**3.20 Permanently connected dishwasher** – A dishwasher that is connected to the electrical supply by means of conduit, armored cable, or non-metallic sheathed cable.

**3.21 Pilot** – A gas flame utilized to ignite the gas at a main burner.

**3.22 Pressure-relief device** – A pressure-actuated valve or rupture member constructed to automatically relieve pressures above normal operating pressures.

3.23 **Pressure-relief valve** – A pressure-actuated valve held closed by a spring or other means and constructed to automatically relieve pressure in excess of its setting.

3.24 **Recessed dishwasher** – A dishwasher that is intended:

- a) to be supported by the floor;
- b) to rest against a wall in the rear;
- c) to rest against a wall, a cabinet, or another dishwasher on one side; and
- d) to rest against a cabinet or another dishwasher on the other side.

Installation configurations include a countertop covering the dishwasher and the adjacent cabinets and appliances. A recessed dishwasher is not intended for permanent attachment to the building structure or to adjacent cabinets or dishwashers.

3.25 **Remotely controlled** – A dishwasher or a unit of a system that is out of sight of an operator who is at the device by which the dishwasher is started.

3.26 **Safety circuit** – A circuit connected to an interlock, limit control, safety pilot, or similar control (other than an operating or regulating control), the failure of which results in a risk of fire, electric shock, or injury to persons during operation of the equipment or burner in the event any part of the circuit (wiring or components) becomes grounded, open-circuited, or short-circuited. In the application of the Supplement [SB](#), Electronic Circuit requirements, a safety circuit is considered to be a protective electronic circuit (PEC) – see [SB3.6](#).

3.27 **Safety critical function (SCF)** – Control, protection, and monitoring functions which are being relied upon to reduce the risk of fire, electric shock, or injury to person hazards.

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3.28 **Single-flame pilot burner** – A pilot burner that produces a single flame with substantially uniform contour under minimum pilot conditions.

3.29 **Temperature controls** – Devices that respond with a change in temperature (thermostatic devices) may be one of the following types:

- a) **Regulating** – Functions only to regulate the temperature of the dishwasher under intended conditions of use, and whose malfunction would not result in a risk of fire.
- b) **Limiting** – Functions only under conditions that produce abnormal temperatures. The malfunction of such a device will result in a risk of fire.

3.30 **Wall-insert dishwasher** – A dishwasher that is intended to be permanently attached to the building structure and mounted in a wall or other vertical surface of a building or in a cabinet.

## 4 Construction Requirements Applicable To All Dishwashers

### 4.1 General

4.1.1 A dishwasher shall be constructed and assembled so that it has the strength and rigidity to resist the abuses to which it is subjected during intended use, without increasing the risk of fire, electric shock, or

injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

4.1.2 A dishwasher shall be constructed and assembled so that parts fit together tightly and bolts or other fasteners are drawn tightly to produce rigidity. Exposed edges and surfaces shall be smooth when the potential exists for contact with hands or other body parts during the operation and maintenance of the dishwasher.

4.1.3 A free-standing dishwasher shall be provided with a means to attach it to a floor or with other mounting means unless the dishwasher has stability such that it does not overturn under conditions of intended use. See Clause [7.22.1](#).

4.1.4 A dishwasher shall be provided with enclosures of material rated for the application that enclose all parts that involve, under any conditions of use, a risk of fire, electric shock, or injury to persons.

4.1.5 Side or back panels are not required for a dishwasher intended to be mounted in or under a counter and marked in accordance with Clause [14.17](#). See [4.4.5](#) and [4.9.3](#).

Note: Omitting a portion of the overall enclosure of a dishwasher intended to be installed in conjunction with other equipment complies with the requirement when:

- a) the adjoining equipment completes the enclosure (see Clause [14.17](#)); and
- b) the installation instructions and marking provide the information required for proper installation.

4.1.6 Asbestos shall not be used in the construction of a dishwasher.

4.1.7 The effects of the following factors shall be determined for compliance with Clause [4.1.1](#):

- a) mechanical strength;
- b) resistance to impact;
- c) moisture-absorptive properties;
- d) combustibility;
- e) resistance to corrosion; and
- f) resistance to distortion at temperatures to which the enclosure is subjected under conditions of intended or unintended use.

All of these factors shall be evaluated with respect to thermal aging when a nonmetallic enclosure is being investigated to determine compliance.

4.1.8 A part fabricated from polymeric materials and that is subject to ignition by its operating environment shall have a flame spread rating of not more than 25 and a smoke developed rating of not more than 50, when tested as specified in the requirements of the Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723, or the Standard for Method of Tests for Surface Burning Characteristics of Building Materials and Assemblies, CAN/ULC-S102.

4.1.9 A flame spread rating is not required for finishes and parts immersed in water, gaskets forming an air or water seal between metal parts, and miscellaneous small parts, such as drain fittings, insulating bushings, vibration mounts, wire ties, labels, and clamps having an exposed surface area not exceeding 161.29 cm<sup>2</sup> (25 in<sup>2</sup>).

4.1.10 A flame spread rating is not required for molded or formed polymeric-material components in such quantity that the total face surface area does not exceed 0.93 m<sup>2</sup> (10 ft<sup>2</sup>). For this construction, the polymeric material shall have a flame spread rating of not more than 25 or shall comply with the requirements for a material classified 5V in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and CAN/CSA-C22.2 No. 0.17, Evaluation of Properties of Polymeric Materials.

4.1.11 A cast- or sheet-metal section of an enclosure shall have a thickness not less than that specified in [Table 3](#), Minimum thickness of enclosure materials.

4.1.12 Reinforcement as specified in [Table 3](#), Minimum thickness of enclosure materials, is not required to consist of a complete frame for all edges. A large enough number of reinforcing members shall be employed to provide additional support for all surfaces.

4.1.13 Ventilation and other openings in the external enclosure of a dishwasher shall be constructed, located, or baffled so that:

- a) the risk of water entering the enclosure as a result of spillage or splashing is reduced; and
- b) electrical disturbances are contained within the enclosure.

4.1.14 An enclosure shall be constructed so that molten metal, burning insulation, flaming particles, or similar material does not fall onto combustible materials, including the surface on which the dishwasher is supported.

4.1.15 Compliance with [Clause 4.1.14](#) requires that a switch, a relay, a solenoid, or similar component be completely enclosed, unless it is shown that malfunction or breakdown of the component does not result in a risk of fire, or there are no openings in the bottom of the enclosure. See [Clause 7.15](#), Abnormal operation test, and [Clause 7.16](#), Blocked plunger test.

4.1.16 Component terminals are not required to be enclosed.

4.1.17 Compliance with [Clause 4.1.14](#) requires the use of a barrier:

- a) under a motor unless:
  - 1) structural parts of the motor or of the dishwasher provide the equivalent of such a barrier;
  - 2) the protection provided with the motor is such that no burning insulation or molten material falls onto the surface that supports the dishwasher when the motor is subjected to fault conditions of open main winding, open starting winding, and starting switch short-circuited;
  - 3) the motor is provided with overload protection such that, regardless of the motor insulation system class rating:
    - i) the temperature of the motor windings does not exceed 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle; and
    - ii) the temperature of the motor windings does not exceed 150°C (302°F) with the rotor of the motor locked; and

Note: A shaded-pole motor having a difference of 1 A or less between no-load and locked-rotor currents and having a 2:1 or smaller ratio between locked-rotor and no-load current, and that is provided with protection for locked-rotor conditions, complies with the requirement.

4) the motor is impedance protected and the locked-rotor temperature of the winding of an open motor or the enclosure of a totally enclosed motor does not exceed 150°C (302°F) with the dishwasher otherwise operating normally;

- b) under wire unless it is flame-retardant wire; and
- c) under a combustion chamber or burner compartment.

4.1.18 The barrier specified in Clause [4.1.17](#) shall:

- a) be horizontal or at such an angle that falling molten, burning, or flaming materials hitting the barrier do not rebound and fall on the supporting surface;
- b) be located as illustrated in [Figure 1](#), Location and extent of barrier;
- c) have an area not less than that determined in accordance with [Figure 1](#); and
- d) be metal or constructed of a polymeric material that complies with Clause [4.1.7](#).

4.1.19 With reference to Clause [4.1.17](#), an opening that is intended for drainage or ventilation shall be such that molten metal, burning insulation, or similar material does not fall onto combustible material.

## 4.2 Field-attached accessories

4.2.1 An accessory intended for installation on, or connection to, a dishwasher to modify or supplement the functions of the dishwasher shall comply with Clauses [4.2.2](#) – [4.2.7](#).

4.2.2 A dishwasher having provisions for accessories to be attached in the field shall be constructed so that the use of the accessories does not introduce a risk of fire, electric shock, or injury to persons.

4.2.3 The installation of an accessory by the operator shall be an operation that is accomplished by receptacles and plug-in connectors.

4.2.4 The installation of an accessory by qualified personnel shall be an operation performed by use of wire connectors to a terminal block provided for the purpose.

4.2.5 The installation of an accessory shall be such that the field rearrangement of components or wiring, the cutting or splicing of wiring, or the soldering of connections is not required.

4.2.6 Each accessory shall be tested and trial-installed to determine whether:

- a) the accessory can be installed;
- b) the instructions are detailed and correct; and
- c) use of the accessory does not result in a risk of fire, electric shock, or injury to persons.

4.2.7 A dishwasher that includes provisions for field connection of a detergent or chemical dispenser, or other accessory, shall be supplied with:

- a) a circuit that provides a programmed signal to the dispenser or other accessory; and
- b) a wiring diagram or other marking that gives the electrical rating and illustrates how connections to the circuit shall be made.

### 4.3 Doors and covers

4.3.1 An overcurrent or overload-protective device shall not be accessible from outside the dishwasher without opening a door or a cover.

Note: The operating handle of a circuit breaker, the operating button of a manually-reset motor protector, or a similar part that projects outside the enclosure complies with the requirement.

4.3.2 A door or a cover of an enclosure that gives access to a fuse or overload-protective device that requires replacement shall be secured by being hinged or pivoted, or by sliding.

Note: A cover that is provided over a compartment that encloses current-carrying parts, is intended for access to replace or reset a burned out overload-heater element, fuse, or similar component, and that requires the use of tools for removal complies with the requirement.

4.3.3 A door or cover over a fuseholder shall fit tightly. Means shall be provided for holding the door or cover closed. The holding means shall be a captive screw or a latch operated by hand or by a hand tool such as a screwdriver.

Note: A snap latch complies where no live parts, other than fuse clips or screwshells, are accessible with the cover open.

### 4.4 Accessibility of current-carrying parts

4.4.1 The electrical parts of a dishwasher shall be so located or enclosed as to reduce the risk of persons unintentionally contacting uninsulated current-carrying parts.

4.4.2 When determining compliance with Clause 4.4.1, a part of the outer enclosure that can be removed by the user of the dishwasher, without the use of tools, shall be removed.

4.4.3 With reference to the requirement in Clause 4.4.1:

an opening complies with the requirement when a 19.1-mm (3/4-in) diameter rod cannot be inserted into the opening and when:

- 1) a probe as illustrated in [Figure 2](#), Probe for uninsulated live part, does not touch any uninsulated live part when inserted, at any angle, through the opening; and
- 2) a probe as illustrated in [Figure 3](#), Probe for film-coated wire, does not touch film-coated wire when inserted, at any angle, through the opening; and

b) for an opening that enables a 19.1-mm (3/4-in) diameter rod to be inserted, at any angle, the opening complies with the requirement only under the conditions described in Clause 4.4.4 and [Figure 4](#), Opening in enclosure.

4.4.4 With reference to [Figure 4](#), Opening in enclosure, for an opening to comply with the requirement, uninsulated current-carrying parts and film-coated wire, inside the enclosure shall be:

- a) X mm (X in) or more from the perimeter of the opening; and
- b) outside the volume generated by projecting the perimeter X mm (X in) normal to the plane.

The dimension X equals five times the diameter of the largest-diameter rod that can be inserted through the opening. In any case, X shall not be less than 102 mm (4 in). In evaluating an opening, any barrier located within the volume shall be ignored unless it intersects the boundaries of the volume in a continuous, closed line.

4.4.5 Each electrical component of an under-counter dishwasher not provided with an overall enclosure – back, top, and sides – when shipped from the factory shall be enclosed, other than at its terminals.

4.4.6 With reference to Clause [4.4.5](#), an enclosure is not required for:

- a) insulated wiring;
- b) a solenoid, a solenoid valve, a relay, or a motor-starting relay whose malfunction or breakdown does not result in a risk of fire;
- c) a motor protected in accordance with Clauses [4.1.17\(a\)\(3\)](#) and [4.1.17\(a\)\(4\)](#); or
- d) a component more than 76.2 mm (3 in) from the back, top, and side surfaces of the smallest compartment that encloses the dishwasher.

4.4.7 The guarding and arrangement of a part shall be such that:

- a) a strainer, a basket, or a similar part is easily installed and removed without a risk of injury to persons;
- b) containers that must be removed, cleaned, and replaced are easily refilled by the operator; and
- c) removal, replacement, and refilling of these containers and ingredients shall not result in damage to or contamination of wiring, electrical components, or other parts.

4.4.8 The part arrangement described in Clause [4.4.7](#) shall be such that the risk of spillage on current-carrying parts, including film-coated wire, is remote.

## 4.5 Corrosion protection

4.5.1 To reduce the risk of corrosion, an iron or steel part shall be enameled, galvanized, plated, or similarly treated.

4.5.2 The corrosion protection treatment is not required for:

- a) a bearing, a balance weight, a lamination, or a minor part of iron or steel such as a washer or screw; or
- b) an iron or steel part where corrosion of the part does not result in a risk of fire, electric shock, or injury to persons.

4.5.3 A reservoir for a cleaning agent or other additive – liquid or powder – shall be resistant to the corrosive and other deteriorating effects of the intended contents.

## 4.6 Mechanical assembly

4.6.1 A switch, a lampholder, an attachment-plug receptacle, a connector base (motor-attachment plug), or similar component shall be securely mounted and shall not rotate.

The means intended to inhibit rotation of the switch is not required when the switch complies with the following:

- a) the switch has a plunger or push-type actuator that does not tend to rotate the switch when operated. A toggle switch does not comply with this requirement;
- b) the risk of the switch loosening from its mounting means due to operation is remote;

c) in the event switch rotation occurs, spacings are not reduced below the minimum required values; and

d) intended operation of the switch is by mechanical means rather than by direct operation by persons.

4.6.2 The means intended to inhibit rotation of a lampholder for a lamp that is not replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, is not required when the means does not reduce spacings below the minimum required values.

4.6.3 Friction between surfaces shall not be used as the only means to reduce the risk of the rotation specified in Clause [4.6.1](#). For example, using a lock washer that is applied as intended to prohibit the rotation of a stem-mounted switch or other device having a single-hole mounting means complies with the requirement.

4.6.4 An uninsulated live part shall be secured so that the part does not rotate or shift in position where such motion results in a reduction of spacings less than the required spacings.

4.6.5 Friction between surfaces shall not be used as the only means to reduce the risk of rotation specified in Clause [4.6.4](#). For example, using a lock washer to prohibit rotation of the components complies with this requirement.

## 4.7 Power-supply connections

### 4.7.1 Cord-connected dishwashers

4.7.1.1 A power-supply cord shall comply with CSA C22.2 No. 21 and UL 817.

4.7.1.2 Flexible cords and cables shall comply with CSA C22.2 No. 49 and UL 62. Flexible cords or cables are considered to fulfill this requirement when preassembled into a power-supply cord complying with Clause [4.7.1.1](#).

4.7.1.3 Attachment plugs and appliance couplers shall comply with CSA C22.2 No. 42 and UL 498. Attachment plugs and appliance couplers are considered to fulfill this requirement when preassembled into a power-supply cord complying with Clause [4.7.1.1](#).

4.7.1.4 A portable dishwasher shall be provided with a power-supply cord.

4.7.1.5 The power-supply cord shall be provided either permanently attached to the dishwasher or as a separate detachable cord set.

4.7.1.6 A dishwasher intended for use with a detachable cord set shall not be provided with terminal pins that accommodate a standard flatiron appliance receptacle.

4.7.1.7 A flexible cord used in a power-supply cord shall be Type S, SE, SO, SOO, ST, STO, or STOO. The length of the cord – measured from the face of the attachment plug to the point of entry into the dishwasher – shall not be less than 1.83 m (6 ft).

Note: For conditions of use, such as those of a counter-top glass washer, that indicate that a lighter cord is applicable, using a Type SJ, SJE, SJO, SJOJ, SJT, SJTO, or SJTOO cord complies with the intent of the requirement.

4.7.1.8 The current rating of the flexible cord used in a power-supply cord for a dishwasher rated 15 A or less, and the current rating of cord fittings, shall not be less than the current rating of the dishwasher.

4.7.1.9 For a dishwasher rated 15 A or less, the attachment plug shall:

- a) have a voltage rating equal to the rated voltage of the dishwasher and a current rating not less than 125 percent of the current rating of the dishwasher; and
- b) be a grounding type.

Note: The use of a 20-A attachment plug complies with the requirement when the dishwasher is rated not more than 4000 W at 240 V.

4.7.1.10 The attachment plug for a dishwasher that is adaptable for use on two or more different values of voltage by field alteration of internal connections shall have a voltage rating equal to the voltage for which the dishwasher is connected when shipped from the factory. See Clause [14.7](#).

4.7.1.11 Strain relief shall be provided for a permanently attached power-supply cord so that mechanical stress on the flexible cord is not transmitted to terminals, splices, or interior wiring. The strain relief shall comply with the requirements in Clause [7.23](#), Strain relief test.

4.7.1.12 For a knot in a flexible cord serving as strain relief, the surfaces that the knot contacts shall be smooth and free from projections, sharp edges, burrs, or fins.

4.7.1.13 The edges of an entry hole for a flexible cord, including a hole in a bushing, shall be smooth and free from projections, sharp edges, burrs, or fins.

4.7.1.14 The hole in the metal for an insulating bushing constructed of material other than ceramic, phenolic, or cold-molded composition, fiber, or other material rated for the application shall be smooth and free from projections, sharp edges, burrs, or fins.

4.7.1.15 Means shall be provided so that a flexible cord can not be pushed into an appliance through the cord-entry hole when such displacement results in a risk of:

- a) subjecting the cord to mechanical damage;
- b) exposing the cord to a temperature higher than that for which the cord is rated;
- c) reducing spacings, such as to a metal strain-relief clamp, below the minimum required values; or
- d) damaging internal connections or components.

To determine compliance, the cord shall be tested in accordance with Push-back relief test, Clause [7.24](#).

## 4.7.2 Permanently connected dishwashers

4.7.2.1 A dishwasher intended to be fastened or secured in position or permanently connected to the water supply or drain line shall be provided with wiring terminals or leads for field connection to the power-supply conductors and means for connection of a permanent wiring system.

4.7.2.2 A compartment or outlet box provided for connections to the power-supply conductors shall be located so that:

- a) during the making of electrical connections in the compartment or outlet box, internal wiring and electrical components are not exposed to mechanical abuse or stress; and
- b) after the dishwasher has been installed as intended, the terminal compartment or outlet box is accessible without moving the dishwasher.

4.7.2.3 A dishwasher provided with an extension for the point of supply connection to an accessible location remote from the dishwasher shall be a maximum length of 1.83 m (6 ft).

4.7.2.4 A compartment or outlet box to which the permanent wiring system is attached shall be secured to the dishwasher so that the compartment or box does not rotate with respect to the dishwasher.

4.7.2.5 A terminal or splice compartment shall be complete and shall enclose all field-wiring terminals and all splices to be made in the field unless the dishwasher enclosure is otherwise complete, that is, unless all sides and a complete bottom are provided when the dishwasher is shipped from the factory.

4.7.2.6 A dishwasher constructed so that it is adaptable upon installation to different supply voltages – for example, 120 V, 2-wire or 120/240 V, 3-wire – shall be provided with a means for making the connections during field installation without changing or disrupting internal wiring or connections other than at the point of field connection.

4.7.2.7 A dishwasher intended for connection to a grounded power-supply conductor shall have one terminal or lead identified for connection of the grounded conductor of the supply circuit when it employs:

- a) an Edison-base screwshell lampholder;
- b) a single-pole switch;
- c) a single-pole automatic control; or
- d) a ballast that is marked to specify the connection of a grounded circuit conductor.

4.7.2.8 The identified terminal or lead shall be connected to the screwshell of a lampholder and to the identified circuit conductor of a ballast when specified. The identified terminal or lead shall not be connected to a single-pole switch or a single-pole automatic control other than an auxiliary control complying with Clause [4.22.10](#).

4.7.2.9 A field-wiring terminal for connection of a grounded power-supply conductor shall be of, or plated with, a metal substantially white in color and shall be readily distinguishable from other terminals; or proper identification of that terminal shall be clearly shown in some other manner, such as on a wiring diagram adjacent to the terminal.

4.7.2.10 The surface of a lead intended for field connection of a grounded power-supply conductor shall be white or gray, and that lead shall be readily distinguishable from other leads.

4.7.2.11 The requirements in Clause [4.7.2.10](#) related to color coding do not apply to internal wiring.

4.7.2.12 For a lead intended to be spliced in the field to an external conductor:

- a) the lead shall not be smaller than 18 AWG (0.82 mm<sup>2</sup>);
- b) the insulation shall not be less than 0.8 mm (1/32 in) thick; and
- c) the free length of the lead inside an outlet box or wiring compartment shall not be less than 152 mm (6 in) unless the use of a lead 152 mm (6 in) or longer results in a risk of fire or electric shock.

4.7.2.13 A field-wiring terminal or lead shall be rated for the connection of conductors having an ampacity not less than:

- a) the rating of the branch circuit marked on the dishwasher in accordance with Clause [14.4](#) or [14.13](#); or

b) the current rating of the dishwasher when the dishwasher is not marked as indicated in (a).

4.7.2.14 The ratings of field-wiring terminals and leads of a dishwasher rated 100 A or less shall be based on the use of power-supply wires rated 60°C (140°F). For a dishwasher rated more than 100 A, the ratings shall be based on the use of power-supply conductors rated 75°C (167°F).

4.7.2.15 A field-wiring terminal shall be provided with a soldering lug, a pressure wire connector, or a wire-binding screw at a terminal intended to accommodate an 8 AWG (8.4 mm<sup>2</sup>) or smaller conductor. The lug or connector shall be firmly bolted or held by a screw. For a wire-binding screw, upturned lugs or the equivalent shall be provided to hold the wire in position.

4.7.2.16 A field-wiring terminal shall not rotate.

4.7.2.17 A wire-binding screw shall thread into metal.

4.7.2.18 A wire-binding screw at a field-wiring terminal:

- a) shall not be smaller than No. 10;
- b) shall be a No. 8 screw at a terminal intended for the connection of a 14 AWG (2.1 mm<sup>2</sup>) conductor; or
- c) shall be a No. 6 screw for the connection of a 16 or 18 AWG (1.3 or 0.82 mm<sup>2</sup>) control-circuit conductor.

4.7.2.19 A terminal plate tapped for a wire-binding screw, including an equipment-grounding screw, shall be of metal not less than 1.27 mm (0.050 in) thick and provide a minimum two threads' engagement in the metal, or not less than 0.76 mm (0.030 in) thick for tapped threads investigated and found to have the required mechanical strength.

4.7.2.20 Extrusion of the metal at a tapped hole to provide two full threads for the binding screw meets the intent of the requirement for two full threads specified in Clause [4.7.2.19](#).

4.7.2.21 An upturned lug or a cupped washer shall retain a conductor of the size specified in Clause [4.7.2.12](#) under the head of the screw or the washer.

## 4.8 Current-carrying parts

4.8.1 A current-carrying part shall be silver, silver alloy, copper, copper alloy, stainless steel, or other corrosion-resistant material. Unplated iron or unplated steel shall not be used as a current-carrying part.

4.8.2 Plated iron and plated steel may be used for a current-carrying part, if the part:

- a) has a temperature during intended operation of more than 100°C (212°F);
- b) is within a motor or associated governor; or
- c) complies with Clause [2.1.1](#).

## 4.9 Internal wiring

4.9.1 The internal wiring and interconnecting wiring between parts of a dishwasher shall be enclosed or protected.

4.9.2 Flexible cord may be used, and not required to be enclosed or protected, provided:

- a) the cord is one of the types specified in Clause [4.7.1.7](#);
- b) the cord complies with Strain relief test, Clause [7.23](#); and
- c) the cord is routed and protected to reduce the risk of damage.

4.9.3 In an under-counter dishwasher shipped from the factory without back or side panels, internal wiring shall be located, cabled, routed, or secured so that wiring is not damaged prior to, and during, installation.

4.9.4 With reference to Clause [4.9.1](#), the required protection of insulated wiring exists when the wiring is investigated as though it were film-coated wire and the wiring complies with Clause [4.4.3\(a\)\(2\)](#) and [Figure 3](#), Probe for film coated wire. Internal wiring not so protected complies where it is secured within the enclosure so that the risk of damage to the wiring due to stress or mechanical abuse is remote.

4.9.5 Wiring employed for internal wiring shall be standard building wire or appliance wiring material rated for the application, and shall comply with [Table 4](#), Characteristics of internal wiring.

4.9.6 Appliance wiring material having insulation not less than 0.4 mm (1/64 in) thick and without a braid or jacket in a circuit operating at not more than the rated voltage of the wiring shall be located within an individual, completely enclosed chassis that is not required to be opened for placement or normal field adjustment.

4.9.7 Unless it is investigated as an uninsulated current-carrying part, insulated internal wiring of a dishwasher, including a grounding conductor, shall consist of wire having insulation rated for the application. The following factors shall be used to determine the applicable wire to be used:

- a) the temperature and voltage to which the wire is subjected;
- b) exposure to oil, grease, cleaning fluid, or other substances having a degrading effect on the insulation;
- c) exposure to moisture; and
- d) other conditions of service to which the wire is subjected during intended use.

4.9.8 Internal wiring that is subjected to potential mechanical damage shall be in armored cable, conduit, or electrical metallic tubing or shall be otherwise protected.

4.9.9 Internal wiring shall be protected from sharp edges, including projections, screwheads, burrs, and fins.

4.9.10 A hole through which insulated wires pass in a sheet-metal wall within the overall enclosure shall be provided with a smooth, rounded bushing or shall have smooth surfaces, free of burrs, fins, projections, and sharp edges, upon which the wires bear so that the insulation is not abraded.

4.9.11 A splice or connection shall be mechanically secure and provide electrical continuity. A soldered connection shall be made mechanically secure before being soldered. Splices shall be located only in accessible junction boxes or control enclosures. For a soldered connection on a printed wiring board, the wire shall be passed through a hole in the printed wiring board before soldering.

4.9.12 A splice shall be provided with insulation equivalent to that of the wires being spliced. For splices involving 250 V or less, the use of insulation consisting of two layers of friction tape, of two layers of

thermoplastic tape, or of one layer of friction tape on top of one layer of rubber tape complies with this requirement. The effects of factors such as dielectric properties and heat- and moisture-resistant characteristics shall be evaluated during the investigation to determine compliance of splice insulation consisting of coated-fabric, thermoplastic, or other tubing.

4.9.13 An insulated splicing device shall be used within the limits of its voltage and temperature ratings.

4.9.14 Thermoplastic tape used as an insulating means shall not be wrapped over a sharp edge.

4.9.15 Stranded internal wiring connected to a wire-binding screw shall be connected so that loose strands of the wire do not:

- a) reduce spacings;
- b) contact other current-carrying parts not always of the same polarity as the wire; and
- c) contact dead-metal parts.

4.9.16 When the loosening of a screw or nut results in a risk of fire or electric shock, the screw or nut shall be provided with a means to reduce the risk of loosening. For example, where a wire-binding screw or nut can be loosened by vibration, providing a lock washer under the head of the screw or under the nut complies with the requirement.

4.9.17 An open-end spade lug shall be provided with additional means, such as upturned ends or similar construction, to hold the lug in place in the event that the wire-binding screw or nut becomes loosened. An open-end lug with a lock washer alone shall not be used.

4.9.18 Unless it is to be investigated as an uninsulated current-carrying part or located in a low-voltage circuit not involving a risk of personal injury, insulated internal wiring of an appliance, including a bonding conductor, shall consist of wire complying with:

- a) CSA C22.2 No. 127 or CSA C22.2 No. 210, and UL 758;
- b) CSA C22.2 No. 38 and UL 44;
- c) CSA C22.2 No. 75 and UL 83;
- d) CSA C22.2 No. 49 and UL 66; or
- e) the applicable CSA and UL standards for other insulated conductor types specified in the Canadian Electrical Code (CEC), Part I, for Wiring Methods, and the National Electrical Code (NEC) for Wiring Methods and Materials.

4.9.19 Terminals and connectors shall comply with:

- a) CSA C22.2 No. 153 and UL 310 for quick connect terminals;
- b) CSA C22.2 No. 182.3 and UL 1977 for single and multiple connectors for use in data, signal, control and power applications;
- c) CSA C22.2 No. 65 and UL 486A-486B for wire connectors;
- d) CSA C22.2 No. 188 and UL 486C for splicing wire connectors;
- e) C22.2 No. 158 and UL 486E for equipment wiring terminals for use with aluminum and/or copper conductors;