



UL 2158

**Underwriters Laboratories Inc.**  
**Standard for Safety**

Electric Clothes Dryers



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UL Standard for Safety for Electric Clothes Dryers, UL 2158

Second Edition, Dated June 1, 1997

Revisions: This Standard contains revisions through and including March 20, 2009.

### **Summary of Topics**

***Revisions were issued to incorporate the proposals dated October 13, 2006, June 6, 2008 and November 21, 2008. These proposals add fire containment requirements.***

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Except for the Preface, text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and the date on which requirements with a future effective date become effective is given in the Preface.

The following table lists the future effective dates with the corresponding reference.

Future Effective Date	References
April 30, 2009	Clauses 7.3.2 and 7.3.2A
March 20, 2013	Clauses 2.7A, 4.6.1, 19.6, 19.7, and Figure 8

In the revisions dated May 24, 2004, pages 11 and 12 have been intentionally deleted from the Standard due to the deletion or relocation of text. Please discard any previous versions of these pages from your paper copy of the Standard.

The new and revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated October 13, 2006, June 6, 2008, and November 21, 2008.

The revisions dated March 20, 2009 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net.ul.com/ulforeword.html>.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-4 .....	March 20, 2009
5 .....	May 24, 2004
6-7 .....	March 20, 2009
8-10 .....	October 30, 2007
13 .....	May 24, 2004
14-14B .....	March 20, 2009
15-17 .....	June 1, 1997
18-20B .....	May 24, 2004
21-22B .....	March 20, 2009
23-28B .....	May 24, 2004
29 .....	June 1, 1997
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83 .....	May 24, 2004
84-91 .....	June 1, 1997
92 .....	February 22, 1999
93 .....	May 24, 2004
94-96 .....	March 20, 2009
A1-A4 .....	May 24, 2004
B1-B6 .....	October 30, 2007
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*Second Edition*



## Electric Clothes Dryers

June 1, 1997

(Title Page Reprinted: March 20, 2009)

Approved  
by  
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of Canada



ANSI/UL 2158-2009

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## Preface

This is the harmonized CSA and UL Standard for *Electric Clothes Dryers*. It is the eighth edition of CAN/CSA-C22.2 No. 112 and the second edition of UL 2158. This CSA edition supersedes previous editions published in 1957, 1964, 1970, 1973, 1980, 1990, and 1994. This UL edition supersedes the previous edition published in 1994.

This harmonized standard has been jointly revised on March 20, 2009. For this purpose, CSA and UL are issuing revision pages dated March 20, 2009.

This harmonized Standard was prepared by the Canadian Standards Association and Underwriters Laboratories Inc. (UL), and the appliance manufacturing industry. The efforts and support of the Canadian Appliance Manufacturers Association (CAMA) and the Association of Home Appliance Manufacturers (AHAM) are gratefully acknowledged.

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

This Standard was reviewed by the CSA Subcommittee on Clothes-Drying Machines, 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 as a National Standard of Canada by the Standards Council of Canada.

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

### CSA effective date

The effective date for CSA International will be announced through CSA Informs or a CSA certification notice.

### UL effective date

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As of March 20, 2009, all products Listed or Recognized by UL must comply with the requirements in this standard except for clauses in the following list, which are effective April 30, 2009 and March 20, 2013.

Clauses 2.7A, 4.6.1, 7.3.2, 7.3.2A, 19.6, 19.7, and Figure 8.

Between March 20, 2009 and March 20, 2013, new product submittals to UL may be evaluated under all requirements in this standard or, if requested in writing, evaluated under presently effective requirements only.

A UL effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.

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

The most recent designation of ANSI/UL 2158 as an American National Standard (ANSI) occurred on March 19, 2009. The ANSI approval for this standard does not include the cover page, transmittal pages, title page, preface, appendices A and B, or superseded requirements.

This ANSI/UL Standard for Safety consists of the second edition including revisions through March 20, 2009, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements. 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 <http://csds.ul.com>.

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# Electric Clothes Dryers

## 1 Scope

1.1 This Standard applies to electric clothes dryers intended to be used in nonhazardous locations in accordance with the *Canadian Electrical Code*, Part I (CEC), and the (U.S.) *National Electrical Code* (NEC), on circuits having a nominal voltage not exceeding 600 V.

**Note:** *Wherever practical, for convenience, the term "appliance" has been used in lieu of "clothes dryer" or "machine".*

1.2 This Standard applies to both cord-connected and permanently connected appliances. The appliances covered by this Standard are intended for use by the general public not specifically trained in the use of the appliance, regardless of the mode by which its operation is initiated. They are for use in households and for commercial purposes, including appliances provided with coin-, ticket-, or card-operated mechanisms, and combination washer-dryers.

1.3 This Standard does not apply to industrial and institutional type appliances. Industrial or institutional appliances are covered under the scope of *Electric Commercial Clothes-Drying Equipment*, UL 1240.

**Note:** *Industrial and institutional type appliances are not intended for use by the general public, but only by trained or supervised personnel.*

## 2 Definitions

**Note:** *For the purpose of this standard, the following definitions apply.*

**2.1 Appliance, cord-connected** – an appliance that is connected to the electrical supply by a cord set or by a power-supply cord terminating in an acceptable attachment plug.

**2.2 Appliance, household type** – an appliance commonly used in, but not restricted to, a single-family dwelling.

**2.3 Appliance, permanently connected** – an appliance that is connected to the electrical supply by means other than a supply cord and an attachment plug.

**2.4 Appliance, recessed** – an appliance intended to be:

- a) supported by the floor; and
- b) located immediately adjacent to a wall in the rear or located immediately adjacent to a wall, a cabinet, or another appliance on each side.

If the construction permits, a countertop may cover the appliance and adjacent cabinets and appliances. A recessed appliance is not intended for permanent attachment to the building structure or to adjacent cabinets or appliances.

**2.5 Appliance, stationary** – any appliance that is intended to be fastened in place or located in a dedicated space.

**2.6 Appliance, wall-insert** – an appliance intended to be mounted permanently in a wall or other vertical surface of a building or cabinet.

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**2.7 Automatic** – an appliance is considered to be automatically controlled if one or more of the following condition applies:

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

**2.7A Baffle** – a paddle inside the drum that lifts and tumbles clothes.

**2.8 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.

**2.9 Built-in appliance** – a stationary appliance that is constructed to be permanently installed in a cabinet or wall.

**2.10 Circuit, low-voltage** – a circuit that:

- a) has an ac potential of not more than 30 V (42.4 V peak) and power of 100 VA or less;
- b) has 30 V dc supplied by a primary battery;
- c) is supplied by a Class 2 transformer; or
- d) is supplied by a combination of a transformer and fixed impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer.

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. Class 2 transformers are specified in CSA C22.2 No. 66 and UL 1585.

**2.11 Circuit, line-voltage** – a circuit having characteristics in excess of those of a low-voltage circuit.

**2.12 Enclosure** – a material used to:

- a) render inaccessible, by itself or in conjunction with acceptable enclosure barriers and supplementary enclosures, any or all uninsulated current-carrying parts, internal wiring, or electrical components not having their own enclosures;
- b) reduce the likelihood of propagation of ignition due to electrical disturbances occurring within; or

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c) both (a) and (b).

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2.13 **Enclosure barrier** – a material used to reduce the size of an opening in an enclosure that:

- a) will not permit the entrance of a 19.1 mm diameter rod; and
- b) does not comply with Clause 8.2(a)(1) or (2).

A polymeric enclosure barrier shall be evaluated as a functional polymeric part.

2.14 **Enclosure, supplementary** – a material used to reduce the size of an opening in an enclosure that:

- a) will permit the entrance of a 19.1 mm diameter rod; and
- b) does not comply with Clause 8.2(a)(1) or (2);

when enclosure barriers, if provided, are removed.

A polymeric supplementary enclosure shall be evaluated as an enclosure.

2.15 **Field wiring terminal** – a terminal to which a wire may be connected in the field, unless the wire and a means of making the connection, such as:

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

factory-assembled to the wire, are provided as a part of the appliance.

2.16 **Heater assembly** – an assembly of

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

2.17 **Heating element** – the actual electrical conducting medium that is intended to be heated by an electric current.

2.18 **Noncombustible material** – for purposes of this Standard, a noncombustible material is:

- a) metal;
- b) a 0.17-5VA and 94-5VA material; or
- c) a material that complies with the requirements for enclosure flammability in accordance with the 127 mm flame test in UL 746C.

2.19 **Part, decorative** – a material used for no other function except appearance. A removable polymeric control knob or lever may be considered a decorative part.

**2.20 Part, functional** – a material 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.

**2.21 Part, nonfunctional** – a part, such as thermal insulation or decorative material, that does not serve as electrical insulation or to support or enclose electrical components, maintain electrical spacings, or reduce the risk of injury to persons.

**2.22 Thermostat, combined temperature-regulating and -limiting** – 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.

**2.23 Thermostat, temperature-limiting** – a device that functions:

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

**2.24 Thermostat, temperature-regulating** – a device that:

- a) regulates temperature; and
- b) functions during normal operation of the appliance.

**2.25 Vulcanized fibre** – a material that, if 0.8 mm thick minimum and acceptably mounted and secured, may be used as an enclosure barrier, but not as an enclosure or supplementary enclosure.

### 3 General requirements and reference publications

#### 3.1 General requirements

3.1.1 Except as indicated in Clause 24, a component of a product covered by this Standard shall comply with all the requirements for that component. See Appendix A for a list of Standards covering components generally used in the products covered by this Standard. A component shall comply with both the Canadian Standards Association and Underwriters Laboratories Inc. Standards for the component.

3.1.2 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

3.1.3 Combination washer-dryers shall comply with this Standard and also with the requirements of the Binational Standard CSA C22.2 No. 169 and UL 2157, *Electric Clothes Washing Machines and Extractors*. Where more than one Standard applies, preference shall be given to that Standard considered to require the highest standard of construction or testing.

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### 3.2 Reference publications

3.2.1 Where reference is made to other publications, such reference shall be considered to refer to the latest edition and all amendments published to that edition up to the time when this Standard was approved.

#### CSA Standards

CAN/CSA-B64.1.1-94,  
*Vacuum Breakers, Atmospheric Type (AVB);*

C22.1-94,  
*Canadian Electrical Code, Part I;*

CAN/CSA-C22.2 No. 0-M91,  
*General Requirements – Canadian Electrical Code, Part II;*

C22.2 No. 0.1-M1985 (R1994),  
*General Requirements for Double-Insulated Equipment;*

C22.2 No. 0.2-93,  
*Insulation Coordination;*

C22.2 No. 0.5-1982 (R1992),  
*Threaded Conduit Entries;*

C22.2 No. 0.15-95,  
*Adhesive Labels;*

CAN/CSA-C22.2 No. 0.17-92,  
*Evaluation of Properties of Polymeric Materials;*

C22.2 No. 14-95,  
*Industrial Control Equipment;*

C22.2 No. 24-93,  
*Temperature-Indicating and -Regulating Equipment;*

C22.2 No. 55-M1986 (R1992),  
*Special Use Switches;*

C22.2 No. 66-1988,  
*Specialty Transformers;*

C22.2 No. 77-95,  
*Motors with Inherent Overheating Protection;*

CAN/CSA-C22.2 No. 100-95,  
*Motors and Generators;*

C22.2 No. 156-M1987,  
*Solid-State Speed Controls;*

C22.2 No. 169-97,  
*Electric Clothes Washing Machines and Extractors;*

CAN/CSA-C22.2 No. 223-M91,  
*Power Supplies with Extra-Low-Voltage Class 2 Outputs;*

CAN/CSA-C361-92,  
*Test Method for Measuring Energy Consumption and Drum Volume of Electrically Heated Household Tumble-Type Clothes Dryers.*

## **UL Standards**

UL 94  
*Tests for Flammability of Plastic Materials for Parts in Devices and Appliances;*

UL 157  
*Gaskets and Seals;*

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

UL 506  
*Specialty Transformers;*

UL 508  
*Industrial Control Equipment;*

UL 514A  
*Metallic Outlet Boxes;*

UL 519  
*Impedance-Protected Motors;*

UL 547  
*Thermal Protectors for Motors;*

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

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

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

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

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

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

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UL 969

*Marking and Labeling Systems;*

UL 991

*Tests for Safety-Related Controls Employing Solid-State Devices;*

UL 1004

*Electric Motors;*

UL 1054

*Special-Use Switches;*

UL 1097

*Double Insulation Systems for Use in Electrical Equipment;*

UL 1585

*Class 2 and Class 3 Transformers;*

UL 2157

*Electric Clothes Washing Machines and Extractors.*

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

ANSI MC 96.1-1982,

*Temperature Measurement Thermocouples;*

ANSI/ASSE<sup>2</sup> 1001-1988,

*Pipe Applied Atmospheric Type Vacuum Breakers;*

ANSI/ASSE 1007/AHAM<sup>3</sup> HLW-2PR-1986,

*Plumbing Requirements for Home Laundry Equipment;*

ANSI/NFPA<sup>4</sup> 70-1993,

*National Electrical Code.*

<sup>1</sup>American National Standards Institute.

<sup>2</sup>American Society of Sanitary Engineering.

<sup>3</sup>Association of Home Appliance Manufacturers.

<sup>4</sup>National Fire Protection Association.

## 4 General conditions for the tests

### 4.1 Voltage and frequency

4.1.1 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 mentioned in (a) or (b).

4.1.2 The test voltage ( $V_t$ ) used during the heating tests of Clause 11 and the abnormal operation tests of Clause 19 shall be adjusted so that the calculated (see formula below) heating circuit input ( $W_t$ ) is achieved. This compensates for heating elements with inputs at  $V_s$  (see Clause 4.1.1) that are different than their rated (marked) inputs.

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

where

$W_t$  is the calculated heating circuit input in, W

$W_m$  is the heating element rated (marked) input in, W

$V_s$  is the supply circuit voltage specified in Clause 4.1.1

$V_m$  is the heating element rated (marked) input in, V

4.1.3 If it is necessary to increase the appliance test voltage beyond the voltage as specified in Clause 4.1.1, the motor shall be supplied from a separate circuit not exceeding the nominal system voltage (eg, 120 V, 240 V).

## 4.2 Test load

4.2.1 Unless otherwise specified, the test load shall:

- a) consist of cloths as described in Clause 4.3; and
- b) be soaked in water, which shall be extracted as it would be in normal use just before the cloths are placed in the appliance; or
- c) be wet until they have absorbed a mass of water equal to the dry mass of the cloths.

4.2.2 The dry mass of the test cloths shall be the greater of:

- a) the maximum load recommended by the manufacturer; or
- b) 0.032 kg/L of clothes-drum volume. The clothes-drum volume shall be determined by a measurement or calculation method.

**Note:** *Whenever a referee method is necessary to determine clothes-drum volume, the measurement is to be made in accordance with the method described in CSA C361 or the U.S. Department of Energy (DOE) Energy Conservation Program for Consumer Products – Paragraph 3.1 of Appendix D to Subpart B of 10CFR430 – Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers.*

## 4.3 Test fabric

4.3.1 The fabric used for tests shall be bleached, preshrunk cotton suiting, having a warp of 21-23 threads per cm and a filling of 18-20 threads per cm. Individual cloths shall be 610 × 915 mm, double hemmed to a size of approximately 560 × 865 mm. A small number of smaller cloths, 305 × 305 mm, double hemmed to a size of 255 × 255 mm, may be used if necessary to make the total weight of cloth correct.

## 4.4 Thermocouples

4.4.1 Thermocouples shall consist of wires not larger than No. 24 AWG (0.21 mm<sup>2</sup>). The thermocouple wire shall conform with the requirements for special thermocouples as specified in the table of limits of error of thermocouples in ANSI MC 96.1.

**Note:** *When thermocouples are used in the determination of temperatures in connection with the heating of electrical devices, it is common practice to employ thermocouples consisting of No. 30 AWG (0.05 mm<sup>2</sup>) iron and constantan wires and a potentiometer-type indicating instrument; such equipment shall be used whenever referee temperature measurements by thermocouples are necessary.*

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## 4.5 Laundry detergent

4.5.1 Whenever laundry detergent is required for a test in this Standard it shall be AHAM detergent or any other powdered laundry detergent having similar properties.

## 4.6 Cheesecloth for heating and abnormal tests

4.6.1 Whenever cheesecloth is required for a test in this Standard, the cloth shall be bleached cotton cheesecloth running approximately 34 g/m<sup>2</sup> with a thread count in the range of 10 – 13 × 9 – 12 threads/cm.

## 4.7 Test temperature

4.7.1 The tests shall be conducted in a draught-free location and, in general, at an ambient temperature in the range of 10 – 40°C.

## 5 Void

## 6 Void

## 7 Marking and Instructions

### 7.1 Marking

**Advisory Note:** In Canada, there are two official languages. Therefore, it is necessary to have CAUTION, WARNING, and DANGER markings in both English and French. Appendix B lists acceptable French translations of the markings specified in this Standard. When a product is not intended for use in Canada, cautionary markings may be provided in English only.

#### 7.1.1 General

7.1.1.1 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. Pressure-sensitive labels and adhesive shall comply with CAN/CSA-C22.2 No. 0.15 and UL 969.

7.1.1.2 A marking required to be permanent shall be located on a part that would require the use of a tool for removal.

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

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



### 7.1.2 Appliance markings

7.1.2.1 An appliance shall be rated in volts and in amperes or watts. The number of phases shall be included in the ratings if the appliance is intended for connection to a polyphase circuit, and the ratings shall include the frequency expressed in hertz (Hz).

7.1.2.2 An appliance shall be provided with a schematic circuit diagram, attached or secured to the appliance in a location that is easily accessible for servicing, such as the back panel, the toe panel, the location of the wiring terminals, the console, or the control housing.

7.1.2.3 An appliance, as mentioned in Clause 9.2, 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 15 A time-delay fuse, shall be plainly and permanently marked with the following or the equivalent:

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

7.1.2.4 If fuses are provided, the maximum size in amperes of the fuse required shall be permanently marked on the appliance.

7.1.2.5 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-clad aluminum or copper conductors", if the terminal is acceptable only for connection to either copper or copper-clad aluminum wire.

7.1.2.6 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.

The marking shall withstand the environment involved.

**Note:** An open-wire heating element need not be marked if it is part of an assembly that is marked as required.

7.1.2.7 Clothes dryers employing supply terminals intended for use with supply conductors rated above 60°C shall be marked on the exterior adjacent to the supply entry with the following or equivalent wording:

"USE SUPPLY CONDUCTORS RATED \_\_\_\_ °C ( \_\_\_\_ °F)."

The marking shall include both °C and °F. The temperature rating of the conductors used in the heating test (Clause 11) shall be placed in the marking.

7.1.2.8 An appliance shall be clearly and permanently marked with a warning that the appliance is intended for use only with fabrics that have been washed with water as a cleaning agent.

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7.1.2.9 A warning consisting of the following shall be included in the permanent marking on an appliance:

a) For an appliance that includes a no-heat setting in its controls:

"WARNING – To reduce the risk of fire, do not use heat when drying articles containing foam rubber or similarly textured rubber-like materials";

or the marking given in item (b).

b) For any other appliance:

"WARNING – To reduce the risk of fire, do not dry articles containing foam rubber or similarly textured rubber-like materials."

7.1.2.10 An appliance that provides means for collection of dust and lint accumulation shall be plainly and permanently marked to indicate the necessity of keeping the lint trap cleaned out.

7.1.2.11 The markings mentioned in Clauses 7.1.2.8 to 7.1.2.10 shall be separated from other markings to reduce the likelihood of their being overlooked.

7.1.2.12 Deleted

7.1.2.13 An appliance shall be permanently marked:

a) at or near the exhaust opening of the appliance with the word "CAUTION" and the following statement or the equivalent: "Risk of Fire. A clothes dryer produces combustible lint. The dryer must be connected to an exhaust to the outdoors. See Installation Instructions;" and

b) on a surface readily visible to the user after installation of the appliance with the word "CAUTION" and the following statement or the equivalent: "Risk of Fire. A clothes dryer produces combustible lint. The dryer must be connected to an exhaust to the outdoors. Regularly inspect the outdoor exhaust opening and remove any accumulation of lint around the outdoor exhaust opening and in the surrounding area."

*Exception: This requirement does not apply to an appliance intended to condense lint-bearing moisture vapour and discharge the condensate into a plumbing system.*

7.1.2.14 For a combination washer-dryer, the words "A clothes dryer," where used in Clause 7.1.2.13, shall be changed to "The dryer operation of a combination washer-dryer."

In the markings, where the words "clothes dryer" appear more than once, the word "appliance" may be substituted for the subsequent use of the words "clothes dryer."

7.1.2.15 Deleted

7.1.2.16 If an appliance employs a non-current-carrying metal part that is not grounded as provided in Clause 27.1.3, the appliance shall be permanently marked with the word "WARNING" and the following or the equivalent:

"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)."

The marking shall be located on the outside of the appliance and it shall be readily visible before any servicing operation. The marking also shall be located close to each ungrounded part and it shall be readily visible before or when the part becomes accessible.

If all approaches to ungrounded parts can be adequately covered by one marking:

- a) then only one marking, visible from the outside of the appliance and at the approach to the ungrounded parts, need be employed; or
- b) if the marking is located on the ungrounded part, only one marking need be employed.

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

7.1.2.18 An appliance provided with instructions for any type of user maintenance other than cleaning a lint trap shall be marked with the word "WARNING" and the following or the equivalent:

"To reduce the risk of electric shock, disconnect this appliance from the power supply before attempting any user maintenance other than cleaning the lint trap. Turning the controls to the OFF position does not disconnect this appliance from the power supply."

The marking shall be so located as to be visible before the maintenance is attempted.

**Note:** *An appliance not equipped with a lint trap may omit the reference to a lint trap in the required marking.*

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

- a) manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified – hereinafter referred to as the manufacturer's name;
- b) catalogue number or the equivalent;
- c) electrical rating; and
- d) date of manufacture by week, month or quarter, and year, which may be abbreviated or in an established or otherwise acceptable code.

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7.1.2.20 An appliance that is intended to be installed in a closet shall be provided with a permanent marking that specifies the required clearances to all adjacent surfaces and the required ventilation in the door. This marking may be included with other markings on a common label provided it is:

- a) separate from the wording of all other markings on the label; and
- b) visible during installation.

7.1.2.21 Deleted

7.1.2.22 A stationary appliance employing an attachment plug in accordance with Clause 25.3.3 shall be marked in the installation instructions, markings, or by a hang tag or equivalent: "Connect To Individual Branch Circuit."

7.1.2.23 A cord-connected appliance shall be clearly and permanently marked in a location that will be visible after the appliance has been installed as intended. The marking shall include a statement indicating the size of the branch circuit to which the appliance is intended to be connected and the maximum ampere rating of the overcurrent-protective device to be used in that branch circuit. (See Clause 10.)

**Note:** A marking on the back of the appliance is acceptable.

7.1.2.24 With reference to Clause 10.2, an appliance that is fastened or otherwise secured at a specific location and is intended to be connected to a supply circuit protected by a 15 A or a 20 A overcurrent-protective device and that has a current rating greater than 50% of the supply-circuit-current rating shall be permanently marked to indicate that the appliance shall be connected only to a supply circuit to which no lighting units or general-purpose receptacles are connected. The marking shall be located so that it will be readily visible when the connections to the supply circuit are made.

7.1.2.25 An appliance that does not comply with Clause 22.5.7 shall be marked, in a location that is visible during installation and inspection, with the word: "WARNING", and the following statement or the equivalent:

"To reduce the risk of fire, this appliance must be fastened or otherwise secured to an uncovered concrete floor."

7.1.2.26 The following marking shall appear on all 120/208 V household clothes dryers:

"WARNING: DO NOT USE ON 120/240 V SUPPLY."

The marking shall be located adjacent to the supply entry and shall be in contrasting letters not less than 6 mm high.

7.1.2.27 If a cord-connected appliance employs a dual-voltage motor, instructions shall be provided to indicate the type of attachment plug that should be used if the appliance is reconnected for the alternative voltage.

7.1.2.28 If an appliance can be readily adapted, upon installation, for connection to a supply circuit of either of two different voltages, complete instructions, including identification of terminals, for making the connections for the different voltages shall be included in the permanent marking of the appliance.

7.1.2.29 If an appliance is for use either on a 120 V, 2-wire circuit or on a 120/240 V, 3-wire circuit, depending on the connections to be made when the appliance is installed, there shall be a warning marking on the appliance stating that non-current-carrying metal parts are not to be connected to the grounded terminal when the appliance is used on the lower-voltage circuit.

7.1.2.30 A permanently connected appliance having one motor and other loads or more than one motor with or without other loads shall be permanently marked, in a location that will be visible when connections to the power-supply circuit are made and inspected. The markings shall include:

- a) the minimum supply-circuit conductor ampacity in accordance with Clause 7.1.2.31; and
- b) the maximum rating and type of supply-circuit overcurrent-protective device, such as a non-time-delay fuse or a dual-element time-delay fuse, in accordance with Clause 7.1.2.32.

7.1.2.31 With reference to the requirement in Clause 7.1.2.30(a), the minimum supply-circuit conductor ampacity shall be based on the maximum input in accordance with Clause 10.

7.1.2.32 With reference to the requirement in Clause 7.1.2.30(b), the rating of the supply-circuit overcurrent-protective device shall not exceed the rating of the fuse employed in the short-circuit test of the motor overload-protective device employed in the appliance.

7.1.2.33 An appliance intended for permanent connection shall be marked to indicate the wiring system or systems for which it is acceptable. The marking shall be located so that it will be visible when power-supply connections to the appliance are being made.

**Note:** *An appliance intended for permanent connection to a rigid metal conduit or armoured cable wiring system need not be marked.*

7.1.2.34 An appliance constructed in accordance with Clause 25.2.7 shall be marked, in a location visible during connection to the supply circuit, with the word "WARNING" and the following statement:

"To reduce the risk of electric shock or fire, do not use a flexible power-supply cord with this appliance."

7.1.2.35 An appliance provided with double insulation shall be permanently marked with the words:

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

The words "DOUBLE-INSULATED" may be used instead of "DOUBLE INSULATION".

7.1.2.36 An appliance shall not be marked with a double insulation symbol (a square within a square, the words "DOUBLE INSULATION", or the equivalent) unless it complies with the requirements for double-insulated appliances in accordance with CSA C22.2 No. 0.1 and UL 1097.

7.1.2.36A A pressure wire connector intended for connection of an equipment-grounding conductor shall be identified by being marked "G", "GR", "GND", "Ground", or "Grounding"; by the grounding symbol illustrated in Figure 7, or a similar marking; or by a marking on the wiring diagram provided on the appliance.



### 7.1.2.37 Dryers with neutral-link grounding

**Note:** *The CEC does not permit the use of neutral-link grounding on products intended to be installed in Canada.*

7.1.2.37.1 If a neutral-grounding link as described in Clause 27.2 is provided, instructions for the proper use of the link, which may be in the form of a circuit diagram, shall be provided on the appliance. If a dryer or combination washer-dryer is for use either on a 120 V, 2-wire circuit or on a 120/240 V, 3-wire circuit, depending on the connections to be made when the dryer or combination washer-dryer is installed, there shall be a warning marking on the appliance stating that non-current-carrying metal parts are not to be connected to the grounded terminal when the appliance is used on the lower voltage circuit.

7.1.2.37.2 A clothes dryer or combination washer-dryer intended for permanent connection to the power supply, and for which the connection between the grounding link and the grounded terminal is made at the factory in accordance with the requirements in Clause 27.2, shall be legibly marked at a location visible during installation of the appliance with the word "WARNING" and the following statement or the equivalent:

"Risk of Electric Shock: Appliance grounded to neutral conductor through a link. Grounding through the neutral conductor is prohibited for (1) new branch-circuit installations, (2) mobile homes, (3) recreational vehicles, and (4) areas where local codes prohibit grounding through the neutral conductor. For installations where grounding through the neutral conductor is prohibited: (1) disconnect the link from the neutral, (2) use grounding terminal or lead to ground appliance, and (3) connect neutral terminal or lead to branch-circuit neutral in usual manner (where the appliance is to be connected by means of a cord kit use 4-conductor cord for this purpose)."

7.1.2.37.3 A clothes dryer or combination washer-dryer intended to be connected to the power supply by a flexible cord and attachment plug, and for which the connection between the grounding link and the grounding terminal is made at the factory in accordance with the requirements of Clause 27.2, shall be legibly marked at a location visible during installation of the appliance with the word "WARNING" and the following or equivalent:

"Risk of Electric Shock: Appliance grounded to neutral conductor through a link. Grounding through the neutral conductor is prohibited for (1) new branch-circuit installations, (2) mobile homes, (3) recreational vehicles, and (4) areas where local codes prohibit grounding through the neutral conductor. For installations where grounding through the neutral conductor is prohibited, the 3-conductor cord or cable assembly must be replaced by a 4-conductor cord or cable assembly. See manufacturer's instructions."

(See also Clause 7.3.4.)

### 7.1.3 Wall-mounting kits and stands

7.1.3.1 A wall-mounting kit or an appliance stand packaged and marketed separately for the basic appliance or recommended by the appliance manufacturer for use with the basic appliance shall be permanently and legibly marked with a catalogue number or the equivalent. Information packaged with the appliance shall identify, by catalogue number:

- a) the wall-mounting kits; or
- b) the appliance stands that have been investigated and found acceptable for use with the appliance; or
- c) the appliance with which the wall-mounting kit or appliance stand is intended to be used.

7.1.3.2 The catalogue number mentioned in Clause 7.1.3.1 shall appear in at least one of the following locations:

- a) on the wall-mounting kit or appliance stand;
- b) on the package containing the wall-mounting kit or appliance stand; or
- c) in the information furnished with the wall-mounting kit or appliance stand.

## 7.2 Instruction manual

### 7.2.1 General

7.2.1.1 A household appliance shall be provided with:

- a) instructions pertaining to a risk of fire, electric shock, or injury to persons associated with the use of the appliance;
- b) installation instructions;
- c) operating instructions; and, if applicable
- d) user-maintenance instructions.

7.2.1.2 The instructions required by Clause 7.2.1.1 shall be:

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

7.2.1.3 Instructions for user repair that are provided with an appliance, or that are specifically referenced by other literature or markings provided with the appliance, shall be considered with respect to the risks that may be present during the repair and after the repair has been completed.

7.2.1.4 Any heading or statement requiring the cautionary prefix "WARNING" shall be entirely in upper case letters or otherwise emphasized to distinguish it from the rest of the text.

7.2.1.5 Unless otherwise indicated, the text of all instructions shall be in the words specified or words that are equivalent, clear, and understandable. However, there shall be no substitute for the word "WARNING".

**Note:** *If the appliance is such that the specific wording is unnecessary or conflicting, the wording may be omitted or modified as appropriate.*

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

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

7.2.2.2 The heading "IMPORTANT SAFETY INSTRUCTIONS" or the equivalent shall precede the list of instructions required in Clause 7.2.2.4, and the statement "SAVE THESE INSTRUCTIONS" or the equivalent shall either precede or follow the list (see Clause 7.2.1.4).

7.2.2.3 The instructions shall include the appropriate instructions from Clauses 7.2.2.4 and 7.2.2.5.

7.2.2.4 The instructions required by Clause 7.2.2.1 shall include the items in the following list, as applicable, as well as any other instructions a manufacturer considers to be necessary for the appliance. The items in the list may be numbered (see Clause 7.2.1.4).

### **IMPORTANT SAFETY INSTRUCTIONS**

**WARNING** – To reduce the risk of fire, electric shock, or injury to persons when using your appliance, follow basic precautions, including the following:

- 1) Read all instructions before using the appliance.
- 2) Do not dry articles that have been previously cleaned in, washed in, soaked in, or spotted with gasoline, dry-cleaning solvents, or other flammable or explosive substances, as they give off vapours that could ignite or explode.

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- 3) Do not allow children to play on or in the appliance. Close supervision of children is necessary when the appliance is used near children.
- 4) Before the appliance is removed from service or discarded, remove the door to the drying compartment.
- 5) Do not reach into the appliance if the drum is moving.
- 6) Do not install or store this appliance where it will be exposed to the weather.
- 7) Do not tamper with controls.
- 8) Do not repair or replace any part of the appliance or attempt any servicing unless specifically recommended in the user-maintenance instructions or in published user-repair instructions that you understand and have the skills to carry out.
- 9) Do not use fabric softeners or products to eliminate static unless recommended by the manufacturer of the fabric softener or product.
- 10) Do not use heat to dry articles containing foam rubber or similarly textured rubber-like materials.
- 11) Clean lint screen before or after each load.
- 12) Keep area around the exhaust opening and adjacent surrounding areas free from the accumulation of lint, dust, and dirt.
- 13) The interior of the appliance and exhaust duct should be cleaned periodically by qualified service personnel.
- 14) Do not place items exposed to cooking oils in your dryer. Items contaminated with cooking oils may contribute to a chemical reaction that could cause a load to catch fire.

### SAVE THESE INSTRUCTIONS

7.2.2.5 The instructions pertaining to a risk of fire, electric shock, or injury to persons shall include (a), (b), or (c) below, as applicable. As an alternative, (a) or (b) may be included in the installation instructions, and (c) may be included in the user-maintenance instructions. If the instructions in (a) and (b) are included in the installation instructions, and if (c) is included in the user-maintenance instructions, a reference to these instructions shall be included as a separate item in the list required by Clause 7.2.2.4. (See Clause 7.2.1.4.)

- a) For a grounded, cord-connected appliance:

### GROUNDING INSTRUCTIONS

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

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**WARNING** – Improper connection of the equipment-grounding conductor can result in a risk of electric shock. Check with a qualified electrician or service representative or personnel if you are in doubt as to whether the appliance is properly grounded.

Do not modify the plug provided with the appliance: if it will not fit the outlet, have a proper outlet installed by a qualified electrician.

b) For a permanently connected appliance:

#### GROUNDING INSTRUCTIONS

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

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

#### SERVICING A DOUBLE-INSULATED APPLIANCE

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

### 7.3 Installation instructions

7.3.1 The installation instructions shall include all the information needed to install the appliance for use as intended, and shall be preceded by the heading "INSTALLATION INSTRUCTIONS" or the equivalent (see Clause 7.2.1.4).

7.3.2 The cover or first page of the installation instructions shall include:

- a) the safety alert symbol (triangle with exclamation mark);
- b) the word "WARNING" in black letters not less than 6.4 mm high on an orange or white background; and
- c) the following wording or equivalent:

"WARNING – Risk of Fire"

"Clothes dryer installation must be performed by a qualified installer."

"Install the clothes dryer according to the manufacturer's instructions and local codes."

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"Do not install a clothes dryer with flexible plastic venting materials. If flexible metal (foil type) duct is installed, it must be of a specific type identified by the appliance manufacturer as suitable for use with clothes dryers. Flexible venting materials are known to collapse, be easily crushed, and trap lint. These conditions will obstruct clothes dryer airflow and increase the risk of fire."

"To reduce the risk of severe injury or death, follow all installation instructions."

"Save these instructions."

7.3.2A The installation instructions shall include statements concerning how the appliance is to be exhausted. The instructions shall state:

- a) that the appliance shall not be exhausted into a chimney, a wall, a ceiling, an attic, a crawl space, or a concealed space of a building;
- b) that only rigid or flexible metal duct shall be used for exhausting;
- c) in Canada, that only those foil-type flexible ducts, if any, specifically identified for use with the appliance by the manufacturer shall be used. In the United States, that only those foil-type flexible ducts, if any, specifically identified for use with the appliance by the manufacturer and that comply with the Outline for Clothes Dryer Transition Duct, Subject 2158A, shall be used;
- d) in Canada, that the exhaust duct shall be 102 mm in diameter. In the United States, the required exhaust duct diameter;
- e) the maximum duct length and number of bends;
- f) that the total length of flexible metal duct shall not exceed 2.4 m; and
- g) that the duct shall not be assembled with screws or other fastening means that extend into the duct and catch lint.

**Note:** *Exhausting refers to removal of moist air from the drying compartment.*

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7.3.3 Where the clothes dryer or combination washer-dryer installation instructions indicate that the appliance is not restricted from being connected by means of a power-supply cord kit, the instructions shall indicate that only a power-supply cord kit rated \_\_\_\_\_ V min, \_\_\_\_\_ A, and marked for use with clothes dryers shall be used. The specified ampere rating for the cord shall be 30, 40, or 50 A as applicable. The instructions shall also specify:

- a) the number of conductors (3 or 4);
- b) the type of terminations (tinned leads, closed-loop terminals, open-end spade lugs with upturned ends, or the like) that the cord kit is to employ; and
- c) that only a 4-conductor cord shall be used when the appliance is installed in a location where grounding through the neutral conductor is prohibited. Grounding through the neutral conductor is prohibited for (1) new branch-circuit installations, (2) mobile homes, (3) recreational vehicles, and (4) areas where local codes prohibit grounding through the neutral conductors.

7.3.4 The installation instructions for a clothes dryer or combination washer-dryer that is marked with the warning specified in Clause 7.1.2.37.3 shall include explicit instructions for changing from a 3-conductor cord or cable assembly to a 4-conductor cord or cable assembly when the appliance is to be used in a location where grounding through the neutral conductor is prohibited. Grounding through the neutral conductor is prohibited for (1) new branch-circuit installations, (2) mobile homes, and (3) recreational vehicles, and (4) areas where local codes prohibit grounding through the neutral conductor. The instructions shall specify the:

- a) size of the conductors and the type of cord or cable to be used;
- b) size and the configuration of attachment plug to be used; and
- c) means of strain relief to be used.

With regard to cord replacement, and except as specified in Clause 7.3.5, the instructions shall:

- 1) indicate that only a 4-conductor power-supply cord kit rated \_\_\_\_\_ V min, \_\_\_\_\_ A, and marked for use with clothes dryers shall be used; and
- 2) specify the type of terminations (tinned leads, closed-loop terminals, open-end spade lugs with upturned ends, or similar terminations) that the cord kit is to employ.

The specified ampere rating for the cord shall be 30, 40, or 50 A as applicable.

7.3.5 For a clothes dryer or combination washer-dryer equipped with a factory-connected flexible cord that leaves the appliance enclosure through an opening sized in accordance with Clause 25.3.5, the cord replacement instructions specified in Clause 7.3.3 shall identify the specific cord kit that is to be used. The identification shall include a part number or the name of the cord-kit manufacturer and a distinctive catalogue number.

7.3.6 The installation instruction for an appliance that is intended to be installed in a closet shall specify the required clearances to all adjacent surfaces and the required ventilation in the door.

7.3.7 Deleted

## 7.4 Operating instructions

7.4.1 The operating instructions shall include all the information needed to operate an appliance as intended, and shall be preceded by the heading "OPERATING INSTRUCTIONS" or the equivalent (see Clause 7.2.1.4).

7.4.2 The operating instructions shall:

- a) explain and describe the location, function, and operation of each user-operated control of the appliance; and
- b) include the statement:

"WARNING – To reduce the risk of fire, electric shock, or injury to persons, read the IMPORTANT SAFETY INSTRUCTIONS before operating this appliance."

**Note:** The statement in item (b) may be omitted if the IMPORTANT SAFETY INSTRUCTIONS required by Clauses 7.2.2.1 through 7.2.2.5 are included in the operating instruction manual immediately prior to the operating instructions.

## 7.5 User-maintenance instructions

7.5.1 The user-maintenance instructions shall include explicit instructions for all cleaning and servicing that is intended to be performed by the user, such as lubrication, adjustments, or removal of lint, dust, or dirt.

7.5.2 The user-maintenance instructions shall be preceded by the heading "USER-MAINTENANCE INSTRUCTIONS" or the equivalent (see Clause 7.2.1.4).

## 7.6 Appliance stand and wall-mounting kit instructions

7.6.1 Installation instructions for an appliance stand or wall-mounting kit shall include a complete list and description of all parts that are included with the kit or stand, and a complete and detailed description of any additional readily available part, such as a nail, a screw, or a piece of lumber, that is needed but not included with the kit or stand. The instructions shall be included with the wall-mounting kit or appliance stand, and shall contain information so that the kit or stand can be installed as intended.

7.6.2 The appliance stand and wall-mounting kit instructions shall be preceded by the heading "APPLIANCE STAND AND WALL-MOUNTING KIT INSTRUCTIONS" or the equivalent (see Clause 7.2.1.4).

## 8 Protection against accessibility to current-carrying parts

8.1 Where an opening in an enclosure has a minor dimension (see Clause 8.5):

- a) less than 25.4 mm, an uninsulated current-carrying part or film-coated wire shall not be contacted by the probe illustrated in Figure 1; or
- b) of 25.4 mm or more, an uninsulated current-carrying part or film-coated wire shall be positioned from the opening as specified in Table 2, to reduce the likelihood of electric shock resulting from unintentional contact with such a part or wire.

8.2 A motor with an integral enclosure that has an opening with a minor dimension (see Clause 8.5):

- a) less than 19.1 mm shall be acceptable, if:
  - 1) film-coated wire cannot be contacted by the probe illustrated in Figure 2;
  - 2) in a directly accessible motor (see Clause 8.6), an uninsulated current-carrying part cannot be contacted by the probe illustrated in Figure 3; and

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3) in an indirectly accessible motor (see Clause 8.6), an uninsulated current-carrying part cannot be contacted by the probe illustrated in Figure 4; and

b) of 19.1 mm or more is acceptable, if a part or wire is spaced from the opening as specified in Table 2.

8.3 The probes referenced in Clauses 8.1 and 8.2 and illustrated in Figures 1, 2, 3, and 4 shall be applied to any depth that the opening will permit and shall be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure. The probes illustrated in Figures 1 and 3 shall be applied in any possible configuration and, if necessary, the configuration shall be changed after insertion through the opening.

8.4 The probes referenced in Clauses 8.1 and 8.2 shall be used as measuring instruments to determine the accessibility provided by an opening, and not as instruments to measure the strength of a material. They shall be applied with the minimum force necessary to determine accessibility.

8.5 With reference to the requirements in Clauses 8.1 and 8.2, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.

8.6 With reference to the requirements in Clause 8.2:

a) an indirectly accessible motor is a motor that is:

- 1) accessible only by opening or removing a part of the outer enclosure, such as a guard or panel, that can be opened or removed without using a tool; or
- 2) located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted; and

b) a directly accessible motor is a motor that:

- 1) can be contacted without opening or removing any part; or
- 2) is located so as to be accessible to contact.

8.7 Terminals, wires, or other current-carrying parts shall not be exposed by the removal of covers:

- a) that open for cleaning and do not require the use of a tool (eg, screwdriver) for opening or removal; or
- b) for coin or ticket collection on coin-, ticket-, or card-operated appliances.

8.8 With reference to the requirements in Clauses 8.1 and 8.2, insulated brush caps are not required to be additionally enclosed.

8.9 The requirements in Clauses 8.1 and 8.2 apply to the back of a freestanding appliance and to the back and sides of a recessed appliance. They do not apply to the bottom of a freestanding or recessed appliance if the front, sides, and back of the appliance extend substantially to the surface upon which the appliance rests.

8.10 Wire screens, expanded metal mesh, or the like, together with methods of fastening them, shall be the subject of investigation.

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8.11 The accessibility of protective devices shall be determined by the following requirements.

8.11.1 A protective device, such as a fuse, the functioning of which requires renewal or replacement, shall be in a readily accessible location.

8.11.2 A protective device shall be wholly inaccessible from outside the appliance without opening a door or cover.

**Note:** The operating handle of a circuit breaker, the operating button of a manually operable motor protector, and similar parts may project outside the appliance enclosure.

8.11.3 A door or cover of an enclosure shall be hinged or otherwise attached in an equivalent manner if it gives access to any overload-protective device, the functioning of which requires renewal, or if it is necessary to open the cover in connection with the operation of the protective device.

8.11.4 Means shall be provided for holding the door or cover over a fuseholder in a closed position, and the door or cover shall be tight fitting.

8.11.5 The construction and installation of a fuseholder shall be such that an uninsulated current-carrying part other than the screw shell or clips will not be exposed to contact by persons removing or replacing fuses.

## 9 Starting of motor-operated appliances

9.1 An appliance shall start and operate normally on a circuit protected by an ordinary (not a time-delay) fuse.

9.2 For the test in Clause 9.1, a time-delay fuse shall be employed if the appliance:

- a) will start and operate normally on a circuit protected by a time-delay fuse; and
- b) is marked in accordance with Clause 7.1.2.3.

9.3 To determine whether an appliance complies with the requirements in Clause 9.1, the appliance shall be connected to a supply circuit of the rated test voltage and rated frequency through a fuse of other than the time-delay type, which has a rating equal to the minimum rating of a branch circuit to which the appliance can be properly connected in accordance with the CEC and the NEC. If the manufacturer recommends that the appliance be used on a larger branch circuit, the current rating of the fuse or fuses shall be the same as that of the recommended branch circuit.

The appliance shall be started three times with the control(s) set to that part of the cycle resulting in the highest starting current. The appliance shall be allowed to come to full speed after each start, and to come to rest between successive starts. The performance is unacceptable if the fuse opens or an overload protector provided as part of the appliance trips.

## 10 Power input and current

10.1 The current input shall not be more than 105% or less than 90% of the marked rating with the appliance connected to a supply circuit of rated voltage and frequency. The appliance shall be loaded with its rated load and the power input measured with the appliance at normal operating temperatures.

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10.2 Unless marked in accordance with Clause 7.1.2.24, the rating of an appliance that is fastened or otherwise secured at a specific location and intended to be connected to a supply circuit protected by a 15 A or a 20 A overcurrent-protective device shall not exceed 50% of the supply-circuit-current rating.

## 11 Heating

11.1 An appliance shall be tested as described in Clauses 11.8 to 11.11, and shall not:

- a) reach a temperature, at any point, high enough to result in a risk of fire or to damage any material used in the appliance; or
- b) exceed the temperature rises specified in Table 3.

11.2 A motor-protective, thermal, or overcurrent-protective device shall neither operate nor open the circuit during the heating test.

11.3 All temperature rises in Table 3 are based on an assumed ambient temperature of 25°C. An observed temperature shall be corrected by addition (if the ambient temperature is lower than 25°C) or by subtraction (if the ambient temperature is higher than 25°C) of the difference between 25°C and the ambient temperature.

11.4 A temperature is considered to be constant when three successive readings taken at intervals of 10% of the previously elapsed duration of the test, but not less than 5 min intervals, indicate no change.

11.5 Ordinarily, coil or winding temperatures shall be measured by thermocouples, unless the:

- a) coil is inaccessible because of mounting, such as a coil immersed in sealing compound; or
- b) coil-wrap includes thermal insulation of more than two layers, up to a 0.8 mm maximum, of cotton, paper, rayon, or the like.

For a thermocouple-measured temperature of a coil of an ac motor other than a universal motor (refer to Table 3 Items 11 and 14) having a frame diameter of 178 mm or less (see Note c in Table 3), the thermocouple shall be mounted on the integrally applied insulation of the conductor.

11.6 Supply-cord reels shall be tested with the supply cord unreeled to 1/3 of its full extension, and the cord insulation temperatures shall be determined at the centre of the cord reel, the terminal end, and between the outer two layers on the reel.

11.7 An appliance that is:

- a) intended to be installed in a closet; and
- b) marked in accordance with Clause 7.1.2.20;

shall be tested in an enclosure that is constructed of nominal 9.5 mm thick flat-black-painted plywood and consists of a bottom, a back, two sides, a top, and a door. The spacings to each enclosure surface, and the door ventilation, shall be as specified by the manufacturer.

11.8 A wall-insert or recessed appliance shall be mounted in an enclosure constructed of nominal 9.5 mm thick plywood painted black. The enclosure shall consist of a bottom, a back, two sides, and a top. The top shall be omitted for the test on a recessed appliance if its construction is such that a countertop could not be used. Each of these areas shall be brought into as intimate contact with the corresponding surface of the appliance as the configuration of the appliance will permit. Temperatures shall be measured at points on each of these enclosing surfaces.

11.9 An appliance that is not intended to be installed in a:

- a) closet (Clause 11.7); or
- b) wall or recess (Clause 11.8);

shall be placed on a horizontal surface and located within an enclosure formed by three flat-black-painted, vertical surfaces of nominal 9.5 mm thick plywood. The enclosure surfaces shall be located as close to the back and both sides of the appliance as possible and shall extend not less than 610 mm beyond the physical limits of the front and the top of the appliance.

11.10 A household appliance shall be operated through the complete programme cycle(s) that give the highest temperature rises. The test shall be conducted for 3 cycles. For the heating test, the drum shall be normally loaded with damp cloths, as described in Clause 4.2, at the beginning of each drying cycle, and operation shall be continued until temperatures have become constant. The interval between cycles shall not be longer than that necessary for removing the dried cloths from the drum and reloading it with damp cloths. If the appliance is provided with a heat-control switch or thermostat-adjustment means, the control shall be adjusted to give maximum temperatures. The lint screen shall have 25% of its surface area blocked, in the area representing lint build-up, and the accumulated lint during testing shall be removed between cycles.

A commercial appliance shall be operated continuously through the cycles until maximum temperatures have been obtained.

If the appliance employs a drum light that is ON only at the end of a cycle after the door is opened, the test shall be continued after the last cycle with the door open until temperatures affected by the drum light have become constant but for no more than 1 h. The door shall be opened to the position when the drum light first turns ON.



11.11 During the heating test, the appliance shall be connected to an exhaust duct system.

The exhaust duct shall be metal and of the same size as the exhaust-duct connection on the appliance. The exhaust duct system shall consist of a centre section approximately 3.35 m long, a 90° elbow connected to each end of the centre section, and an additional straight section approximately 460 mm long connected to each elbow. These dimensions are not specified, but the total length of the exhaust duct system, not including elbows, shall be the maximum length recommended by the manufacturer or 4.27 m, whichever is longer. One end of the exhaust duct system shall be long enough to pass through the test enclosure and to be connected to the appliance.

A 7.6 mm water column (w.c.) static pressure shall be applied at the outlet of the exhaust duct system during the test. The 7.6 mm w.c. static pressure shall be adjusted at the start of the test to  $\pm 0.51$  mm w.c.. The w.c. static pressure shall be determined by averaging the measurements taken from four static pressure taps spaced at 90° intervals around the circumference of the exhaust duct and located 305 mm from the outlet end of the exhaust duct system.

If the application of a 7.6 mm w.c. static pressure results in abnormal operation of the appliance, such as the functioning of a temperature-limiting control, the test shall be conducted at the maximum w.c. static pressure against which the appliance will continue to operate normally.

## 12 Void

## 13 Leakage current

13.1 When tested as described in Clauses 13.2 to 13.6, the leakage current of an appliance rated 240 V or less, single phase, that is:

- a) moved, or can be moved easily from one place to another in normal use, shall not be more than 0.5 mA; or
- b) not moved easily from one place to another in normal use, or fastened or otherwise secured at a specific location, shall not be more than 0.75 mA.

Appliances having sheathed heating elements may exceed the leakage current specified in items (a) or (b) above for a period not exceeding 5 min, but shall not exceed 2.5 mA. The 5 min period is measured during the warmup period and again during the cooldown period from the first excursion above the value specified in (a) or (b) until the value is less than and remains less than the value in (a) or (b).

**Note:** Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of an appliance and ground or other exposed surfaces of the appliance.

13.2 All exposed conductive surfaces shall be tested for leakage currents. The leakage currents shall be measured from the accessible surface or parts individually as well as collectively where simultaneously accessible to the grounded supply conductor and from one surface or part to another where both are simultaneously accessible.

Parts shall be considered to be exposed surfaces unless guarded by an enclosure that has been investigated and found to be acceptable to reduce the risk of electric shock (see Clauses 8 and 21).

Surfaces are considered to be simultaneously accessible if they can be readily contacted by one or both hands of a person at the same time.

These measurements do not apply to terminals operating at voltages that are not considered to involve a risk of electric shock. If all accessible surfaces are bonded together and connected to the bonding conductor of the power-supply cord, the leakage current can be measured between the bonding conductor and the grounded supply conductor.

13.3 If a conductive surface other than metal is used for the enclosure or part of the enclosure, the leakage current shall be measured using a metal foil with an area of  $100 \times 200$  mm in contact with the surface. If the surface is less than  $100 \times 200$  mm, the metal foil shall be the same size as the surface. The metal foil shall not remain in place long enough to affect the temperature of the appliance.

13.4 The measurement circuit for leakage current shall be as illustrated in Figure 5. The meter that is actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument. The measurement instrument is defined as:

- a) a meter that has an input impedance of  $1\,500\ \Omega$  shunted by a capacitance of  $0.15\ \mu\text{f}$ ;
- b) a meter that indicates 1.11 times the average of the full-wave rectified composite waveform of the voltage across the resistor or current through the resistor; and
- c) an instrument in which the measurement circuitry has a frequency response ratio (over a range of 0-100 kHz) of indicated to actual value of current that is equal to the ratio of the impedance of a  $1\,500\ \Omega$  resistor shunted by a  $0.15\ \mu\text{f}$  capacitor to  $1\,500\ \Omega$ . At an indication of 0.5 or 0.75 mA, the measurement shall not have an error of more than 5% at 60 Hz.

13.5 Unless the meter is used to measure leakage from one part of an appliance to another, it shall be connected between accessible parts and the grounded supply conductor.

13.6 A sample of the appliance shall be tested for leakage current starting with the as-received condition. "As-received" is defined as not having previously been energized except as may occur as part of the production-line testing. The bonding conductor of the appliance, if any, shall also be open at the grounding terminal or attachment plug. The supply voltage shall be adjusted to the voltage specified in Clause 4.1. The test sequence, with reference to the measuring circuit (Figure 5), shall be as follows:

- a) with switch S1 open, the appliance shall be connected to the measuring circuit. The leakage current shall be measured using both positions of switch S2, and with the appliance switching devices in all their normal operating positions;
- b) switch S1 shall then be closed, energizing the appliance, and within 5 s, the leakage current shall be measured using both positions of switch S2 and with the appliance switching devices in all their normal operating positions; and

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c) the leakage current shall be monitored until temperatures become constant. Both positions of switch S2 shall be used in determining this measurement. The appliance shall be operated as described in Clause 11.

#### 14 Void

#### 15 Moisture resistance

15.1 A cord-connected appliance rated 240 V or less, single phase, shall comply with the requirements for leakage current in Clause 13.1 following exposure in air for 48 h at a temperature of  $32 \pm 2^\circ\text{C}$  and  $88 \pm 2\%$  relative humidity.

15.2 To determine whether an appliance complies with the requirement in Clause 15.1, a sample of the appliance shall be heated to a temperature just above  $34^\circ\text{C}$ , to reduce the likelihood of condensation of moisture during conditioning. The heated sample shall be placed in the humidity chamber and conditioned for 48 h under the conditions specified in Clause 15.1. Following the conditioning, the sample shall be tested unenergized, as described in Clause 13.6(a). The sample shall then be energized and tested as described in Clauses 13.6(b) and (c). The test shall be discontinued when the leakage current stabilizes or decreases.

#### 15.3 Insulation resistance

15.3.1 An appliance employing insulating material that may be adversely affected by moisture under conditions of normal use and intended to be permanently connected to the power source shall be conditioned in moist air for 24 h at a temperature of  $32 \pm 2^\circ\text{C}$  and  $85 \pm 5\%$  relative humidity. After the conditioning the appliance shall have an insulation resistance of not less than  $50\,000\ \Omega$  between current-carrying parts and interconnected non-current-carrying metal parts.

#### 16 Electric strength

16.1 An appliance shall withstand for 1 min without breakdown the application of a 60 Hz essentially sinusoidal potential between current-carrying parts and non-current-carrying metal parts. This potential shall be:

- a) 1 000 V for an appliance of any rated voltage up to 250 V; or
- b) 1 000 V plus twice rated voltage for an appliance of any rated voltage from 251 to 600 V.

**Note:** Solid-state control circuits, which normally have a connection to ground, may have the ground connection disconnected during the electric strength test.

16.2 If a transformer or an autotransformer is employed in the appliance, the test potential for the secondary circuit shall be:

- a) 500 V if the secondary operates at 50 V or less, except that this does not apply if the secondary circuit is supplied from a Class 2 transformer;
- b) 1 000 V if the secondary operates from 51 to 250 V; and
- c) 1 000 V plus twice the rated voltage of the appliance if the secondary operates from 251 to 600 V.

16.3 To determine whether an appliance complies with the requirements in Clause 16.1, the appliance shall be tested by means of a 500 V-A or larger-capacity transformer, the output voltage of which is essentially sinusoidal and can be varied. The applied potential shall be increased from zero until the required test level is reached and shall be held at that level for 1 min. The increase in the applied potential shall be at a uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter. The appliance shall be at the maximum operating temperature reached in normal use and all controls shall be in the ON position.

## **17 Overload protection of transformers and associated circuits**

17.1 Transformers shall comply with the applicable requirements of CSA C22.2 No. 66 and UL 506 or CSA C22.2 No. 223 and UL 1585.

17.2 Transformers intended for supplying power to low-voltage, Class 2 circuits shall not be of the conductively coupled (eg, autotransformer) type.

## **18 Void**

## **19 Abnormal operation**

### **19.1 Grounded heating element**

19.1.1 When an appliance is operated under the conditions specified in Clause 19.1.2, there shall be no:

- a) emission of flame or molten metal;
- b) glowing or flaming of combustible material upon which the appliance may be placed or that may be in proximity to the appliance as installed; or
- c) indication of flame or glowing embers in the load of clothes either before or after the access door is opened.

19.1.2 An appliance shall be operated under all of the following conditions:

- a) the test load shall be 100% of the rated load;
- b) the test cloths shall be dry and tumbled for 5 min;
- c) the temperature-regulating thermostats shall be shunted out of the circuit;
- d) temperature controls shall be set to the position resulting in maximum temperatures in the dryer;
- e) the timer shall be set to the longest drying time duration and the drum shall be held in a stationary position; and

f) the heating element shall have one of its terminals open circuited and the element grounded at a point which will result in a current of 110% of the rating of the intended branch-circuit over-current protection flowing through the heater. If the current at 110% results in opening the heating element then the test shall be conducted at the maximum current that will result without the heating element opening.

The test shall be continued until the ultimate result is obtained or for 7 h, whichever is less.

## 19.2 Cord reels

19.2.1 An appliance having a cord reel shall withstand an abnormal test at the rated voltage, applied through the highest-rated fuse that can be installed in the branch-circuit fuseholder, with the motor or highest-rated (if more than one) motor stalled and while the cord is as fully reeled on the takeup reel as the construction will permit. A 3 A fuse shall be connected between the accessible non-current-carrying conductive parts of the appliance and ground, and the power shall be left connected until the branch circuit fuse opens the circuit, or until temperatures stabilize. The 3 A fuse shall not rupture. There shall be no resultant risk of electric shock, fire, or serious deterioration of the insulation on the supply cord and cord reel as demonstrated by visual inspection and a repeated electric strength test.

## 19.3 Wetting of electrical components

19.3.1 The malfunction of a boot, diaphragm, or the like of rubber or similar material, when tested as described in Clause 19.3.2, shall not result in:

- a) a leakage current greater than 5.0 mA for cord-connected appliances;
- b) an insulation resistance of not less than 50 000  $\Omega$  for permanently connected appliances;
- c) insulation breakdown as determined by repeating the electric strength test; or
- d) the wetting of current-carrying materials.

**Note:** Wetting of current-carrying materials is determined by a stream, a spray, or the dripping of water on a component that will likely happen during each flooding or overfill test, as a result of oversudsing, or as a result of a malfunction of the boot or diaphragm and not as a random occurrence.

19.3.2 To determine whether or not an appliance complies with the requirements in Clause 19.3.1 with respect to the malfunction of a boot or diaphragm, the appliance shall be levelled prior to the test, and operated through one complete cycle of normal operation, after which the boot, diaphragm, or the like shall be removed. A solution of 5 g of a low-sudsing detergent per litre of water shall be placed in the vessel described in Clause 19.3.3, and maintained at the maximum at-rest level of the water and clothes load in the appliance during operation. The free end of the flexible tube, pointed in any direction, shall be held at points within the body enclosed by the outer surface of the boot, diaphragm, or the like when in position.

**Note:** A boot or diaphragm that is acceptable when tested in accordance with the requirements of Clause 24.10 is considered to comply with this requirement.

19.3.3 The vessel mentioned in Clause 19.3.2 shall be flat-bottomed, be of any convenient dimensions, and have a 1.6 mm diameter hole in the bottom. A tube of rubber or similar flexible material shall be attached to the bottom of the vessel beneath the hole. The tube shall have an inside diameter of 9.5 mm, and shall be of whatever length is necessary for conditioning as described.

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## 19.4 Breakdown of belts or parts and the interruption of water supply

19.4.1 An appliance shall be tested as described in Clauses 19.4.2 and 19.4.3, and there shall be no:

- a) emission of flame or molten metal;

**Note:** Drops of melted solder are not considered to be molten metal.

- b) glowing or flaming of combustible material upon which the appliance may be placed or that may be in proximity to the appliance as installed; or

- c) indication of flame or glowing embers in the load of cloths, either before or after the access door is opened.

19.4.2 With consideration given to the design of the appliance, the appliance shall be operated under abnormal conditions representing those likely to be encountered in actual service, such as the breakdown of drive belts or other parts, or interruption of the water supply to an appliance of the condensing type. Ordinarily, only one such condition shall be assumed at one time. In each abnormal-operation test, the drum shall be loaded with dry cloths having the weight specified in Clause 4.2. The cloths shall be stacked by hand, without propping by means of other objects, in the position that will result in maximum temperatures on the cloths in the stationary drum. Before the start of the test, the appliance shall be thoroughly heated by being operated through one complete cycle of normal operation.

19.4.3 The test shall be continued until ultimate results are observed or for an appliance controlled by a timer switch, the duration of the test shall be the maximum interval permitted by the timer. The appliance shall be installed as described in Clauses 11.7, 11.8, or 11.9 whichever is applicable.

## 19.5 Blockage of lint screen and exhaust

19.5.1 A household appliance shall be tested as described in Clauses 19.5.2 to 19.5.5, and there shall be no:

- a) emission of flame or molten metal;

**Note:** Drops of melted solder are not considered to be molten metal.

- b) glowing or flaming of combustible material upon which the appliance may be placed or that may be in proximity to the appliance as installed; or

- c) indication of flame or glowing embers in the load of cloths, either before or after the access door is opened.

19.5.2 An appliance shall be operated as described in Clause 19.5.4 under each of the following conditions, in turn:

- a) lint screen blocked 75%;
- b) lint screen blocked 100%;
- c) exhaust blocked 75%; and
- d) exhaust blocked 100%.

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19.5.3 Each blockage is stated as a percentage of the total effective area of the opening as follows:

- a) lint screen blockage shall be in the area representing lint build-up; and
- b) exhaust blockage shall be at the point where the air exits the dryer prior to connection of external exhaust ducts that are to be put in place when the dryer is installed.

19.5.4 The appliance shall be installed as described in Clauses 11.7 to 11.9, inclusive, as applicable, and exhausted as described in Clause 11.11. The drum shall be loaded with test cloths that have:

- a) a dry weight as specified in Clause 4.2; and
- b) been soaked in water, which shall be extracted as it would be in normal use, immediately prior to the test.

The appliance shall be operated through one conditioning cycle of maximum length as dictated by the timer. All temperature-regulating and -limiting devices shall then be defeated and the appliance operated under this condition, with the timer modified so as to result in continuous operation, until ultimate results are obtained or for 7 h, whichever is less.

19.5.5 For the tests in Clauses 19.5.2 to 19.5.4, a temperature-limiting device that complies with the requirements in Clause 24.12.8 may remain in the circuit. A device that is provided by a motor manufacturer as an integral part of a motor, and that operates during the tests, shall be defeated.

## 19.6 Load fire containment

19.6.1 Appliances having a rotating drum or basket shall be tested as described in Clauses 19.6.2 to 19.6.19, and there shall be no ignition of the cheesecloth located on the outside of the appliance.

19.6.2 Tests shall be conducted in a closed, draft-free room. When mechanical ventilation is employed during the test, an air stream shall not be directed across the appliance, unless agreed upon by those concerned. The test room shall have:

- a) vents for the discharge of the combustion products and
- b) provisions for fresh air intake so that no oxygen-deficient air is introduced into the test configuration during the test.

19.6.3 The supporting surface for the appliance shall be calcium silicate board, fiber cement board, or other material that is noncombustible. Metal shall not be used. With the concurrence of those concerned, metal drains or a similar device may be located in the supporting surface. The supporting surface shall be cleaned between tests.

19.6.4 All labels that are applied by the manufacturer shall be applied to the intended surfaces of the test appliance. Printing on the labels is not required for this test. The manufacturer shall provide the wiring diagram on the test appliance as intended.



19.6.5 The appliance shall be connected to a source of power for all test conditions. The supply circuit for the appliance shall be provided with time-delay fuses of the maximum rating for the branch circuit to which the appliance can properly be connected.

19.6.6 The appliance shall be operated in timed dry cycle. For any appliance that does not employ a timed dry cycle, any moisture-sensing devices shall be defeated. When the software associated with a moisture-sensing device does not allow operation of the appliance by defeating the moisture sensor, the software will, in some cases, need to be modified to allow heated operation of the appliance.

19.6.7 The appliance shall be leveled, starting with any adjustable feet at the maximum distance from the bottom of the appliance to the supporting surface.

19.6.8 The top, two sides, front, and back external surfaces of the appliance shall be completely covered by single-layer cheesecloth panels. The cheesecloth panels shall be held in close contact with the external surfaces of the appliance. A mechanical means, such as small pieces of metal foil adhesive tape, shall be employed to secure the cheesecloth panels to each other, so that there are no gaps between the cheesecloth panels. The tape shall not cover openings or enclosure seams in the construction of the appliance. A single layer of cheesecloth that is slightly larger than the appliance bottom surface shall cover the supporting surface. The side, front, and back panels of cheesecloth shall be of sufficient length to touch the bottom panel of cheesecloth.

19.6.9 The appliance shall be installed freestanding and exhausted with metal duct of the same size as the exhaust-duct connection on the appliance. For vented appliances, the duct shall consist of a total length of 4.27 m with two 90° bends. A sample configuration is shown in Figure 8. The exhaust duct shall consist of a 1 m straight section connected to the dryer exhaust outlet and terminating perpendicularly in a tee. The tee shall have blast gates/dampers at its outlets. The blast gates/dampers shall be connected to 0.5 m straight sections. One branch shall connect to a 90° bend with 2.27 m of straight duct downstream from the bend. The other branch shall connect to the suction of an exhaust blower complying with Clause 19.6.10. The discharge of the blower shall connect to a 2.27 m length of straight duct. With the concurrence of those concerned, less than 4.27 m total length and less than two 90° bends may be used for testing. Condensate appliances are not exhausted.

19.6.10 An external blower shall be connected to the exhaust duct of a vented appliance as described in Clause 19.6.9. The airflow direction shall be out of the appliance and shall be adjusted to produce  $3.3 \pm 0.5$  L/s ( $7 \pm 1$  CFM) through the exhaust duct when the appliance is not operating. The external blower shall be operating at the set airflow for the duration of the test. For the conditions described in Clause 19.6.12(b), the blast gate/damper to the external blower shall be closed at the start of the test and the blast gate/damper to the unrestricted duct shall be open. If the appliance internal blower ceases to function, the positions of the blast gates/damper shall be switched to open for the external blower and closed for the unrestricted exhaust duct.

19.6.11 A washer/dryer combination shall be connected to a water supply and to a drain, but shall not be operated in a wash cycle for this test.

19.6.12 The fire containment tests shall be conducted under each of the following test conditions:

- a) The appliance is not started (no drum or basket motion).
- b) The appliance timer shall be set for the maximum time at the highest heat setting, and the appliance shall be started resulting in the drum or basket rotating.

A separate test appliance shall be used for each test condition.

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19.6.13 The appliance shall be loaded with dry cloths, as described in Clause 4.2, that have a dry weight of 0.016 kg/L (1.0 lb per ft<sup>3</sup>) of clothes-drum volume. The test cloths shall be preconditioned by exposing the cloths to 5 wash and dry cycles. The appliance shall be operated through one conditioning cycle of 15 min at the highest heat setting with the dry test load. The lint screen shall be cleaned after the conditioning cycle.

19.6.14 The test load shall be placed in the most severe position in the rotating tumbler in relation to plastic or other flammable materials. When possible, such positioning shall include locating the maximum amount of combustible materials, such as the maximum number of polymeric tumbler baffles, above the drum centerline. When possible, starting and stopping the appliance shall be used to position the combustible materials.

19.6.15 If the test load completely covers the clothes-loading opening after the 15 min conditioning cycle, the load shall be patted down to provide enough clearance for the propane torch flame to reach the back surface of the test load.

19.6.16 A propane torch shall be used to ignite the test load.

19.6.17 The front panel of cheesecloth shall be positioned on top of the appliance while igniting the test cloths. To protect the panels of cheesecloth surrounding the clothes-loading door from ignition while igniting the test load, a metal foil dam may be taped to the appliance to shield the cheesecloth. Metal foil may also be used to protect any plastic component edges that may ignite during the load-lighting process.

19.6.18 The flame of the torch shall be applied to the surface of the load, starting from the back and moving the torch forward while sweeping the flame across the surface from left to right. The aim is to ignite most of the top surface of the load. A total lighting time of 45 to 50 s to the top surface of test cloths is likely to be needed. If substantial ignition is achieved in less time, then the lighting time shall be reduced. After igniting as much of the top surface of the test cloths as possible in not more than 45 to 50 s of the sweeping motion, the flames shall be observed for no more than 20 s to verify that the test cloths are continuing to burn. Metal foil protecting plastic edges shall be removed, and the clothes-loading door shall be closed. The aluminum foil dam shall be removed after the clothes-loading door is closed, and the front panel of cheesecloth shall be placed over the front surface of the appliance.

19.6.19 The test shall be continued until the external cheesecloth ignites or for 7 h, whichever is less. One appliance construction shall be tested.

## 19.7 Base fire containment

19.7.1 Appliances having a rotating drum or basket shall be tested as described in Clauses 19.7.2 to 19.7.17, and there shall be no ignition of the cheesecloth located on the outside of the appliance.

19.7.2 Tests shall be conducted in a closed, draft-free room. When mechanical ventilation is employed during the test, an air stream shall not be directed across the appliance, unless agreed upon by those concerned. The test room shall have:

- a) vents for the discharge of the combustion products and
- b) provisions for fresh air intake so that no oxygen-deficient air is introduced into the test configuration during the test.

19.7.3 The supporting surface for the appliance shall be calcium silicate board, fiber cement board, or other material that is noncombustible. Metal shall not be used. With the concurrence of those concerned, metal drains or a similar device may be located in the supporting surface. The supporting surface shall be cleaned between tests.

19.7.4 All labels that are applied by the manufacturer shall be applied to the intended surfaces of the test appliance. Printing on the labels is not required for this test. The manufacturer shall provide the wiring diagram on the test appliance as intended.

19.7.5 The appliance shall be connected to a source of power for all test conditions. The supply circuit for the appliance shall be provided with time-delay fuses of the maximum rating for the branch circuit to which the appliance can properly be connected.

19.7.6 The appliance shall be operated in timed dry cycle. For any appliance that does not employ a timed dry cycle, any moisture-sensing devices shall be defeated.

19.7.7 The appliance shall be leveled, starting with any adjustable feet at the maximum distance from the bottom of the appliance to the supporting surface.

19.7.8 The top, two sides, front, and back external surfaces of the appliance shall be completely covered by single-layer cheesecloth panels. The cheesecloth panels shall be held in close contact with the external surfaces of the appliance. A mechanical means, such as small pieces of metal foil adhesive tape, shall be employed to secure the cheesecloth panels to each other, so that there are no gaps between the cheesecloth panels. The tape shall not cover openings or enclosure seams in the construction of the appliance. A single layer of cheesecloth that is slightly larger than the appliance bottom surface shall cover the supporting surface. The side, front, and back panels of cheesecloth shall be of sufficient length to touch the bottom panel of cheesecloth.

19.7.9 The appliance shall be installed freestanding and exhausted with metal duct of the same size as the exhaust-duct connection on the appliance. For vented appliances, the duct shall consist of a total length of 4.27 m with two 90° bends. A sample configuration is shown in Figure 8. The exhaust duct shall consist of a 1 m straight section connected to the dryer exhaust outlet and terminating perpendicularly in a tee. The tee shall have blast gates/dampers at its outlets. The blast gates/dampers shall be connected to 0.5 m straight sections. One branch shall connect to a 90° bend with 2.27 m of straight duct downstream from the bend. The other branch shall connect to the suction of an exhaust blower complying with Clause 19.7.10. The discharge of the blower shall connect to a 2.27 m length of straight duct. With the concurrence of those concerned, less than 4.27 m total length and less than two 90° bends may be used for testing. Condensate appliances are not exhausted.

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19.7.10 An external blower shall be connected to the exhaust duct of a vented appliance as described in Clause 19.7.9. The airflow direction shall be out of the appliance and shall be adjusted to produce  $3.3 \pm 0.5$  L/s ( $7 \pm 1$  CFM) through the exhaust duct when the appliance is not operating. The external blower shall be operating at the set airflow for the duration of the test. For the conditions described in Clause 19.7.12(b), the blast gate/damper to the external blower shall be closed at the start of the test and the blast gate/damper to the unrestricted duct shall be open. If the appliance internal blower ceases to function, the positions of the blast gates/damper shall be switched to open for the external blower and closed for the unrestricted exhaust duct.

19.7.11 A washer/dryer combination shall be connected to a water supply and to a drain, but shall not be operated in a wash cycle for this test.

19.7.12 The fire containment tests shall be conducted under each of the following test conditions:

- a) The appliance is not started (no drum or basket motion).
- b) The appliance timer shall be set for the maximum time at the highest heat setting, and the appliance shall be started resulting in the drum or basket rotating.

A separate test appliance shall be used for each test condition.

19.7.13 All base surfaces, electrical components, internal wiring, and connections that are located in:

- a) the air inlet path to the drum heat source; and
- b) an area where lint is likely to accumulate

shall be covered by 8 layers of cheesecloth. Electric heater surfaces shall not be covered by cheesecloth. The cheesecloth shall be draped to completely cover the base, electrical components, electrical connections, internal wiring, and bearings that are attached to the bottom or located within 150 mm of the bottom of the appliance so that they are continuously covered. Eight-layered strips approximately 25 mm wide that are of sufficient length to contact surfaces of cheesecloth in the areas being tested shall be used to provide a path for the fire to be transferred from one section of cheesecloth to another and from the base to the cheesecloth on components located above the base of the appliance. The cheesecloth shall be closely placed around components to conform to their shape. The cheesecloth shall be spaced so that it does not contact moving parts such as fan blades. Cheesecloth shall not cover openings to moving parts of components or ventilation openings of motors. If small pieces of metal foil tape are used to secure the cheesecloth, they should be located so that the propagation of flame is not impeded.

19.7.14 An opening shall be made in a front or side enclosure to allow access for the purpose of igniting the internal cheesecloth. The access panel shall be of the same type of material as the enclosure material or heat-resistant glass. The access panel shall overlap the opening a minimum of 25 mm and be mechanically secured. Gaps created by the access panel shall be sealed by metal foil adhesive tape.

19.7.15 The appliance shall be loaded with dry cloths, as described in Clause 4.2, that have a dry weight of 0.016 kg/L (1.0 lb per ft<sup>3</sup>) of clothes-drum volume. The test cloths shall be preconditioned by exposing the cloths to 5 wash and dry cycles. The appliance shall be operated through one conditioning cycle of 15 min at the highest heat setting with the dry test load. The lint screen shall be cleaned after the conditioning cycle.

19.7.16 The cheesecloth shall be ignited using an electrically operated match, butane lighter, or other suitable means. The internal cheesecloth shall be ignited at the lowest point near bearings or components and away from the appliance air ventilation openings. The cheesecloth shall be relit, as necessary, to burn the internal cheesecloth. If necessary, a total of 5 attempts, each in different areas, shall be made to achieve burning of the internal cheesecloth. An observation window or camera may be installed in the appliance enclosure to determine that the cheesecloth burns.

19.7.17 The test shall be continued until the external cheesecloth ignites or for 7 h, whichever is less. If it is determined through the use of observation windows or cameras that the cheesecloth inside the appliance cabinet has ceased burning, the test may be terminated.

## **20 Stability and mechanical hazards**

### **20.1 Automatic restarting of motor**

20.1.1 If an automatically reset protective device is employed in an appliance, automatic restarting of the motor shall not result in a risk of injury to persons.

20.1.2 The requirement in Clause 20.1.1 necessitates the use of an interlock in the appliance if moving parts or the like may result in a risk of injury to persons upon automatic restarting of the motor.

### **20.2 Stability (freestanding appliances)**

20.2.1 An appliance shall not accidentally overturn in normal use, which includes the moving of appliances having casters or wheels. Appliances shall have any casters, wheels, or other supporting means placed in the most unfavourable position. If adjustable feet are provided, all of them shall be adjusted to the same height. The appliance shall not overturn when tested in accordance with Clause 20.2.2.

Appliances that are intended to tilt in normal operation shall be investigated.

20.2.2 The empty appliance shall be placed on a flat surface inclined at an angle of 10° from the horizontal. The loading door of the appliance shall be placed in the most unfavourable position. The appliance shall be blocked to reduce the likelihood of sliding during the test, and it shall be rotated so that all positions are evaluated.

20.2.3 Front-loading appliances having a mass of more than 11.5 kg when empty, and having any hinged door, shelf, or other projection that is hung with a horizontal hinge and that opens beyond the enclosure, shall not overturn when a weight of 16 kg is supported from any position along the outside edge of such projection while the appliance is empty, on a level surface, and with any casters turned to the most unfavourable position.

The test weight shall be 9 kg for a front-loading appliance that has a projection hung with a vertical hinge.

## 20.3 Wall-mounted appliances

20.3.1 A wall-mounting kit shall contain all of the hardware needed to assemble and mount the kit and to install the appliance.

**Note:** A readily available part, such as a nail, a screw, or a piece of lumber, need not be provided if the instructions accompanying the kit include a description of the part and specify how the part is to be used.

20.3.2 The mounting means shall be constructed so that the appliance, when hung from the wall in the intended manner, cannot be removed without the use of a tool.

20.3.3 A wall-mounted appliance shall be subjected to the test described in Clauses 20.3.4 to 20.3.7. There shall be no damage to the wall, the appliance, or the mounting means, and the appliance shall not become dislodged.

**Note:** Damage to the loading door is acceptable.

20.3.4 The appliance shall be mounted on a wall in accordance with the installation instructions, using the hardware provided in the mounting kit and the hardware and construction materials described in the instructions. The hardware shall be used as specified in the instructions and, if not otherwise indicated, securing screws shall be positioned between the studs and secured in the plasterboard.

20.3.5 If no wall constructions are specified in the instructions, a wall construction of nominal 9.5 mm thick plasterboard on nominal 38 by 88 mm wood studs spaced on 406 mm centres shall be used as the support.

20.3.6 An adjustable mounting means shall be adjusted to the position that results in the maximum projection from the wall.

20.3.7 A 45.4 kg weight shall be suspended from the front of the appliance or the loading door. The weight and the door shall be positioned so as to produce the most severe test condition. The weight shall remain in place until the ultimate results have been observed, but not longer than 5 min.

## 20.4 Appliance stands

20.4.1 An appliance stand shall contain all of the hardware needed to assemble the stand and to install the appliance on it.

**Note:** A readily available part, such as a nail, a screw, or a piece of lumber, need not be provided if the instructions accompanying the kit include a description of the part and specify how the part is to be used.

20.4.2 When installed as intended on the appliance stand, the appliance shall be reliably attached to the stand assembly, and shall not overturn on an inclined surface when tested in accordance with Clauses 20.4.3 to 20.4.5 or on a flat level surface when tested in accordance with Clauses 20.4.6 to 20.4.10.

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20.4.3 An appliance and stand assembly that has been assembled as specified in the instructions shall be placed on a flat surface inclined at an angle of 10° from the horizontal. The loading door of the appliance shall be placed in the most unfavourable position.

20.4.4 If the stand permits stacking of appliances, the test shall be conducted both with and without the bottom appliance installed and with the loading door of the bottom appliance placed in the most unfavourable position. The appliance stand assembly shall be blocked to preclude sliding during the test, and it shall be rotated on the inclined surface so that all positions are evaluated.

20.4.5 The appliances in the stand either shall be loaded as described in Clause 4.2 or unloaded, whichever results in the most unfavourable test condition.

20.4.6 An appliance and stand assembly shall be assembled in accordance with the instructions. A fastener provided for anchoring the stand to a wall shall not be used if a tool is required to attach the:

- a) appliance or stand to the fastener; or
- b) fastener to the wall.

20.4.7 The assembly shall be tested in accordance with Clauses 20.4.8 to 20.4.10. If the stand permits stacking of appliances, the tests shall be conducted both with and without the bottom appliance installed.

20.4.8 The appliances in the stand shall be either loaded, as described in Clause 4.2, or unloaded, whichever results in the most unfavourable test condition.

20.4.9 A 22.6 kg weight shall be suspended from the front of the upper appliance or the front edge of the loading door. The weight and the door shall be placed in the most unfavourable position and the weight shall remain suspended for 1 min.

20.4.10 A hollow rubber ball, 240 to 250 mm in diameter, shall be filled with sand to a total weight of 9.1 kg. The weight shall fall from the rest position as a pendulum through the distance necessary to strike with an impact of 40.7 J. The ball shall strike the appliance and stand assembly 1.5 m above floor level or at the top of the upper appliance, whichever is less. All four sides of the appliance-stand assembly shall be subjected to the impact.

## **20.5 Sharp edges, projections, and moving parts**

20.5.1 An enclosure, opening, frame, guard, knob, handle, or the like shall not result in a risk of injury to persons in normal maintenance or use.

20.5.2 A moving part, such as the rotor of a motor, a pulley, belt, or gear, shall be acceptably enclosed or guarded to reduce the likelihood of unintentional contact by persons.

## **20.6 Entrapment**

20.6.1 If a household front-loading appliance has an opening into the clothes drum that will permit the entrance of a 203 mm diameter sphere and a clothes drum with a volume of 60 L or more, then the appliance shall:

- a) have a clothes loading-and-unloading door that, when tested as described in Clause 20.6.4, opens with a force of 67 N or less;

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- b) be investigated with respect to the ventilation it provides; or
- c) be constructed so that the clothes loading-and-unloading door can be latched only by holding the door closed and simultaneously performing a second operation near the rear of the top of the appliance.

20.6.2 The secondary-function control may be located on the front of the appliance if:

- a) the appliance is intended to be installed in a recess, stacked on top of another appliance, or mounted on a wall;
- b) there are no user-operable controls on the top surface of the appliance; and
- c) the secondary-function control:
  - 1) is located as far from the clothes loading-and-unloading door as practical; and
  - 2) requires a minimum of two distinct operations to function.

20.6.3 A rotary switch having a push-and-turn or a pull-and-turn operating sequence is generally considered to comply with the intent of the requirement in Clause 20.6.2.

20.6.4 The force mentioned in Clause 20.6.1(a) shall be applied through a point corresponding to, and representative of, any point:

- a) accessible from the inside of the clothes drum with the door closed; and
- b) accessible to contact by a person's hand.

The force shall be applied to the door:

- 1) in a manner representative of a push from inside the clothes drum;
- 2) in a direction perpendicular to the plane of the opening into the clothes drum; and
- 3) at a rate of 13 to 18 N/s.

20.6.5 An appliance that complies with the requirements of Clause 20.6.2(c) shall withstand the operation described in Clause 20.6.6 without malfunction.

20.6.6 With reference to the requirement in Clause 20.6.5, an appliance shall be subjected to 6 000 cycles of operation, with each cycle consisting of opening, closing, and latching the clothes loading-and-unloading door. The test shall be conducted at a rate of 12 cycles per hour. However, with the concurrence of those concerned, the test may be conducted at a rate other than 12 cycles per hour, provided the test will not be less severe than if conducted at the specified rate. The door shall be operated in the intended manner under the conditions that will result in maximum wear on all parts.

## 20.7 Contact with rotating tumbler

20.7.1 An appliance shall be provided with:

- a) a means to reduce the likelihood of the opening of the clothes loading-and-unloading door during the operating cycle; or

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b) an interlock that, when the clothes loading-and-unloading door is opened 76 mm or more during the operating cycle, will:

- 1) remove the driving force from the clothes basket; and
- 2) de-energize the heat source within 10 s.

20.7.2 The interlock mentioned in Clause 20.7.1(b) shall be such that the basket will not rotate and the heat source will not be energized until:

- a) the door is closed to less than 76 mm of opening; and
- b) a secondary-function control, manually operated from outside the appliance, is actuated. The requirement for a secondary-function control does not apply to an appliance having an opening into the clothes drum with a dimension of less than 203 mm or a clothes drum with a volume less than 60 litres.

20.7.3 To determine whether a clothes dryer or combination washer-dryer complies with the requirements in Clauses 20.7.1 and 20.7.2, tests shall be conducted with the appliance operating with its rated clothes load.

20.7.4 With reference to Clause 20.7.1(a), a solenoid or similar component that is employed to hold the door latched in the closed position shall be subjected to a 6000-cycle endurance test consisting of energizing and de-energizing the component. There shall be no malfunction of the locking means or component as a result of this test.

20.7.5 If opening and closing the door affects mechanical operation of the component, the test shall be conducted in the normal manner. The test shall be conducted at the rate of six times per min unless a slower rate is dictated by the construction of the appliance.

## **21 Mechanical strength**

### **21.1 Frame and enclosure**

21.1.1 The frame and enclosure of an appliance shall have the necessary strength and rigidity to resist the abuses likely to be encountered during normal service. The degree of resistance inherent in the unit shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other defects that alone or in combination would result in a risk of fire, electric shock, or injury to persons.

**Note:** For nonmetallic materials, see Clause 32.

21.1.2 For an unreinforced, flat surface, cast metal shall not be less than 3.2 mm thick, malleable iron shall not be less than 2.4 mm thick, and die-cast metal shall not be less than 2.0 mm thick.

**Note:** Metal of lesser thickness, but not less than 2.4, 1.6, and 1.2 mm, respectively, may be acceptable, provided the surface under consideration is curved, ribbed, or otherwise reinforced or sized to provide mechanical strength equivalent to that required.

21.1.3 An enclosure of sheet metal shall be investigated with respect to size, shape, thickness of metal, and acceptability for the application considering the intended use of the appliance.

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21.1.4 For an enclosure of sheet metal, steel shall be not less than 0.66 mm thick, aluminum shall not be less than 0.91 mm thick, and copper or brass shall not be less than 0.84 mm thick.

**Note:** This requirement does not apply to an area that is relatively small or to a surface that is curved or otherwise reinforced in a manner that provides equivalent strength.

## 21.2 Back covers

21.2.1 The back cover may be of thinner material if the enclosure complies with the requirements of Clause 21.2.2.

21.2.2 The back cover shall be able to withstand a continuous force of 110 N applied through a 51 mm steel ball for a period of 1 min at any location, without resulting in a risk of electric shock or reducing spacings below those required by Clause 29.

## 22 Construction

### 22.1 Current-carrying parts

22.1.1 A current-carrying material shall be silver, copper, a copper alloy, or other material that has been investigated and found to be acceptable for the purpose. Current-carrying materials shall have acceptable mechanical strength and current-carrying capacity.

22.1.2 Plated iron or steel may be used for a current-carrying material, if the material:

- a) has a temperature during normal operation of more than 100°C;
- b) is within a motor or associated governor; or
- c) is acceptable in accordance with Clause 24.1.1.

Unplated iron or steel may not be used. Stainless steel and other corrosion-resistant alloys may be used for a current-carrying part regardless of temperature.

### 22.2 Electrical insulation

22.2.1 An insulating washer, bushing, and the like and the base or support for the mounting of a current-carrying part shall be of a heat- and moisture-resistant material that will not be damaged by the temperatures to which it will be subjected under conditions of actual use, such as porcelain, phenolic, cold-moulded composition, or other materials that have been investigated and found to be acceptable for the application.

22.2.2 Insulating material employed in an appliance shall be investigated with respect to the application. Materials such as mica, some moulded compounds, and certain refractory materials may be used as the sole support of a current-carrying part. Materials that are not acceptable for general use, such as magnesium oxide, may be acceptable if used in conjunction with other acceptable insulating materials or if located and protected so as to reduce the likelihood of mechanical damage and the absorption of moisture.

22.2.3 If an investigation is necessary to determine whether a material is acceptable, consideration shall be given to its mechanical strength, electric strength characteristics, insulation resistance, heat- and moisture-resistance properties, the degree to which it is enclosed or protected, and any other features that may have a bearing on the risk of fire, electric shock, and injury to persons, in conjunction with the conditions of actual use.

22.2.4 Ordinary vulcanized fibre may be used for an insulating bushing, a washer, a separator, and a barrier, but not as the sole support for an uninsulated current-carrying part if shrinkage, current leakage, or warpage may introduce a risk of fire or electric shock.

22.2.5 Coils and windings shall incorporate moisture absorption-resistant insulating materials or shall be acceptably treated to render them absorption resistant.

### **22.3 Thermal insulation**

22.3.1 Combustible or electrically conductive heat-insulating material shall not be located so that it contacts an uninsulated current-carrying part.

22.3.2 With reference to Clause 22.3.1, some types of mineral-wool thermal insulation contain conductive impurities in the form of slag that may present a risk of fire or electric shock if in contact with an uninsulated current-carrying part.

### **22.4 Overflow pipes**

22.4.1 An overflow pipe or the like shall be secured if the flow of liquid from the pipe can be misdirected so as to wet an uninsulated current-carrying part, a film-coated current-carrying part, or electrical insulation.

22.4.2 Compliance with Clause 22.4.1 of the means of securing an overflow pipe or the like shall be determined with respect to its reliability, acceptability, and likelihood of being defeated.

### **22.5 Bottom openings**

22.5.1 Means shall be provided to reduce the likelihood of molten metal, burning insulation, or the like falling upon combustible materials, including the surface on which the appliance is supported.

22.5.2 The bottom of the enclosure of a wall-insert appliance shall be complete and without openings.

22.5.3 Except as mentioned in Clause 22.5.4, a complete bottom enclosure shall be provided for a freestanding or recessed appliance beneath all wiring and other electrical components not having an individual housing or enclosure.

22.5.4 A complete bottom enclosure is not required for an appliance that complies with Clause 22.5.7 and is intended:

- a) to condense the lint-bearing moisture vapour and discharge the condensate into a plumbing system; or
- b) to have all blowers discharge into an exhaust duct and all joints in the duct within the appliance are permanently airtight (ie, all connections are welded or, in the case of plastics, permanently sealed by adhesives or solvent bonding the parts).

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22.5.5 With reference to the requirements in Clause 22.5.4, a bottom enclosure is considered to be complete if:

- a) no unused opening has an area of more than 160 mm<sup>2</sup>; and
- b) the total area of all such openings is no more than 1290 mm<sup>2</sup>.

22.5.6 In an appliance other than as mentioned in Clause 22.5.4, arcing parts of a component, such as a switch or thermostat, shall be totally enclosed. However, arcing parts of a component need not be totally enclosed if:

- a) the component is located in a separate enclosure, such as a console or other enclosure located outside the enclosure surrounding the drum; and
- b) the unused portion of any opening into the enclosure housing the component is not more than 480 mm<sup>2</sup>, and the total of all unused openings into that enclosure is not more than 1940 mm<sup>2</sup>.

22.5.7 With reference to Clause 22.5.1, a barrier of noncombustible material shall be used to reduce the likelihood that molten metal, burning material, and the like will fall to the supporting surface:

- a) under a motor unless:
  - 1) the structural parts of the motor or the appliance provide the equivalent of such a barrier;
  - 2) the protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the appliance when the motor is energized under each of the following fault conditions:
    - i) open main winding;
    - ii) open starting winding;
    - iii) starting switch short-circuited; or
    - iv) capacitor of permanent-split capacitor motor short circuited. The short circuit shall be applied before the motor is energized, and the rotor shall be locked; or
  - 3) the motor is provided with a thermal motor protector (a protective device that is sensitive to temperature and current) that will reduce the likelihood that the temperature of the motor windings will exceed 125°C under the maximum load under which the motor will run without resulting in the protector cycling and that the temperature will exceed 150°C with the rotor of the motor locked;
- b) under wiring, unless there is no evidence of a risk of fire as a result of the tests conducted in this Standard; and
- c) under the grounded sheath of a heater assembly.

22.5.8 The requirement in Clause 22.5.7 will also necessitate that a component such as a switch, relay, or solenoid be individually and completely enclosed.

A component need not be enclosed if:

- a) malfunction of the component would not result in a risk of fire; or
- b) there are no openings in the bottom of the appliance enclosure.

The terminals of a component need not be enclosed.

22.5.9 The barrier mentioned in Clause 22.5.7 shall:

- a) be horizontal;
- b) be located as illustrated in Figure 6; and
- c) have an area in accordance with Figure 6.

22.5.10 With reference to the barrier mentioned in Clause 22.5.7, openings for drainage, ventilation, and the like may be employed in the barrier if such openings will not permit molten metal, burning insulation, or the like to fall on combustible material.

## 22.6 Plumbing requirements

22.6.1 An appliance shall comply with ANSI/ASSE 1007/AHAM HLW-2PR.

22.6.2 If a vacuum breaker is installed, it shall comply with the requirements of CAN/CSA-B64.1.1 or ANSI/ASSE 1001. It shall be installed downstream from the last valve (including any solenoid) in the water supply system.

## 22.7 Deflectors

22.7.1 Deleted

22.7.2 Deleted

## 22.8 Condensate dryers

22.8.1 In a clothes dryer provided with a means for condensing the moisture vapour, electrical components shall be located so that there will be no collection of moisture on or flooding of such parts by condensed vapour dripping from pipes, tanks, or the like, or by malfunction of parts of the water system.

## 22.9 Ventilation openings

22.9.1 A ventilation opening in the enclosure, other than in the bottom, that may allow the expulsion of burning insulation, molten metal, or the like shall be provided with a barrier or louver. Such an opening shall not permit the entrance of a 9.5 mm diameter rod.

## 23 Internal wiring

23.1 The internal wiring of an appliance shall be considered to be all the interconnecting wiring beyond the point where the power-supply cord of a cord-connected appliance enters the enclosure, or beyond the wiring terminals or leads for power-supply connection of a permanently connected appliance, even though some of such wiring may not be completely enclosed and even though some of it may be in the form of flexible cord.

23.2 The internal wiring and connections between parts of an appliance shall be protected or enclosed. A length of flexible cord may be employed for an external (unenclosed) connection between such parts if flexibility is necessary.

23.3 The protection of insulated wiring required by Clause 23.2 shall be considered to exist if, when evaluated as though it were film-coated wire, the wiring is acceptable in accordance with Clause 8.2. Internal wiring not so protected may be accepted if it is secured within the enclosure so that it is unlikely to be subjected to stress or mechanical damage.

23.4 A conductor shall not be smaller than No. 20 AWG (0.52 mm<sup>2</sup>). Integral leads not more than 150 mm long of a small electrical component, such as a relay coil or a timer motor, may be smaller than No. 20 AWG (0.52 mm<sup>2</sup>), but shall not be smaller than No. 24 AWG (0.21 mm<sup>2</sup>).

**Note:** This requirement does not apply to solid-state controls and associated circuits.

23.5 Unless it is to be investigated as an uninsulated current-carrying part, insulated internal wiring of an appliance, including a bonding conductor, shall consist of wire that is acceptable for the application, when considered with respect to:

- a) the temperature and voltage to which the wiring may be subjected;
- b) exposure to oil, grease, or other substances that may have a deleterious effect on the insulation;
- c) exposure to moisture; and
- d) other conditions of service to which it may be subjected.

23.6 Wiring shall be protected from sharp edges, including screw threads, burrs, fins, moving parts, and the like, that may result in abrasion of the insulation on conductors.

23.7 Wiring shall not be supported by bare-metal-wire type wire-routing clips. Such clips may be used to position wiring that:

- a) runs vertically; or
- b) is supported by a flat, horizontal surface.

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23.8 A hole through which insulated wires pass in a sheet-metal wall within the overall enclosure of an appliance shall be provided with a smooth, rounded bushing of one of the materials mentioned in Clause 25.4.2 or shall have smooth surfaces, upon which the wires may bear, free of burrs, fins, sharp edges, and the like, which may result in abrasion of the insulation.

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

### **23.10 Splices and connections**

23.10.1 Splices and connections shall be mechanically secure and shall provide adequate and reliable electrical contact. Soldered connections shall be made mechanically secure before being soldered, if breaking or loosening of the connection may result in a risk of fire, electric shock, or injury to persons. Splices shall be provided with insulation equivalent to that of the wires involved if permanency of spacing between splices and other metal parts may be maintained.

23.10.2 A wire-binding screw or nut shall be provided with a lock washer under the head of the screw or under the nut to reduce the likelihood of it's becoming loosened due to vibration, if such loosening may result in a risk of fire, electric shock, or injury to persons.

23.10.3 An open-end spade lug shall not be used unless additional means are provided to hold the lug in place should the wire-binding screw or nut become loosened.

23.10.4 Splices shall be provided with insulation equivalent to that of the wires involved if the spacing between the splice and other metal parts are found not likely to be permanently maintained.

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

23.10.6 The means of connecting stranded internal wiring to a wire-binding screw shall be such that loose strands of wire will not contact other current-carrying parts not always of the same polarity as the wire and will not contact non-current-carrying metal parts. This may be accomplished by use of a pressure terminal connector, a soldering lug, a crimped eyelet, soldering all strands of the wire together, or other equivalent means.

23.10.7 An aluminum conductor, insulated or uninsulated, used as internal wiring, such as for interconnection between current-carrying parts or as motor windings, shall be terminated at each end by a method that has been investigated and found to be acceptable for the combination of metals involved at the connection point.

23.10.8 With reference to Clause 23.10.7, a wire-binding screw construction or a pressure terminal connector used as a terminating device shall be acceptable for use with aluminum under the conditions involved, such as temperature, heat cycling, or vibration.

### **23.11 Separation of circuits**

23.11.1 Conductors of circuits operating at different potentials shall be reliably separated from each other unless they are provided with insulation acceptable for the highest potential involved.

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23.11.2 An insulated conductor shall be reliably retained so that it cannot contact an uninsulated current-carrying part of a circuit operating at a different potential.

23.11.3 In a compartment that is intended for the field installation of conductors, and that contains provision for the connection of Class 1, power, or lighting circuit conductors, and low-voltage, Class 2, circuit conductors, a barrier shall be provided to separate the conductors of the different circuits, or the arrangement of the compartment shall be such that a minimum spacing of 6.4 mm can be maintained between the conductors of the different circuits including the conductors to be field installed.

## **23.12 Overcurrent protection**

23.12.1 If an appliance is intended to be connected to a branch circuit rated more than 30 A, overcurrent protection shall be provided for the control circuits.

## **24 Components**

### **24.1 General requirements for components**

24.1.1 Except as indicated in Clause 24.1.2, a component of an appliance covered by this Standard shall comply with the requirements for that component. See Appendix A for a list of Standards covering components generally used in the appliances covered by this Standard.

24.1.2 A component is not required to comply with a specific requirement that:

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

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

24.1.4 Specific components are considered as being 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 shall be used only under those specific conditions for which they have been investigated.

### **24.2 Specific requirements for components**

24.2.1 An appliance shall be assembled so that it will not be adversely affected by the vibration of normal operation. Brush caps shall be tightly threaded or otherwise constructed to reduce the likelihood of loosening. The operating mechanism of switches or controls shall not subject electrical parts to undue strain.

24.2.2 A switch, a lampholder, an attachment-plug receptacle, a motor-attachment plug, or a similar component shall be mounted securely and rigidly to maintain the required clearances.

**Note:** A lampholder of the type in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in by a nonremovable lens, need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values.

24.2.3 Means to reduce the likelihood of the turning of a switch need not be provided if:

- a) the switch is of a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to rotate the switch during normal operation of the switch;
- b) means for mounting the switch make it unlikely that operation of the switch will loosen it;
- c) spacings are not reduced below the minimum acceptable values if the switch rotates; and
- d) normal operation of the switch is by mechanical means rather than by direct contact by persons.

24.2.4 Means for reducing the likelihood of the rotation shall consist of more than friction between surfaces. For example, a lock washer, properly applied, may be used to reduce the likelihood of turning of a small stem-mounted switch or other device having a single-hole mounting means.

24.2.5 Moisture and lint from the drying operation, unless intentionally collected within the dryer, shall be conveyed to the outside of the enclosure without coming into contact with bare live parts. If found to comply with the intent of this requirement, exhaust air that is acceptably filtered may be recirculated through the heater assembly.

### 24.3 Capacitors

24.3.1 A capacitor provided as a part of a capacitor motor and a capacitor connected across the line, such as a capacitor for the elimination of radio-frequency interference, shall be housed within an enclosure or container that is intended to protect the plates against mechanical damage and that will reduce the likelihood of the emission of flame or molten material resulting from malfunction of the capacitor. The construction shall comply with one of the following:

- a) the capacitor container or enclosure shall be of sheet steel not less than 0.51 mm thick, or shall be constructed to afford equivalent protection; or
- b) a capacitor having a sheet-steel container or enclosure thinner than 0.51 mm or of other material shall be mounted in an enclosure that houses other parts of the appliance and that is acceptable for the enclosure of current-carrying parts.

24.3.2 If a capacitor that is not part of a permanent-split-capacitor motor or a part of a capacitor-start motor is connected in an automatic appliance so that capacitor malfunction would result in a risk of fire, electric shock, or injury to persons, thermal or overcurrent protection shall be provided in the appliance.

24.3.3 The voltage rating of a capacitor, other than a motor-starting capacitor, shall not be less than the maximum steady-state potential to which the capacitor is subjected during operation of the appliance.

### 24.4 Field-installed devices and accessories

#### 24.4.1 Field-installed devices

24.4.1.1 Field installed devices that are necessary for the operation of the appliance, such as complete coin-, ticket-, or card-operated assemblies and the like, and that are to be attached mechanically and electrically to the appliance in the field, shall comply with the following:

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- a) electrical conductors and connections shall comply with Clauses 23 and 28;
- b) the wiring within the appliance shall not be disturbed;
- c) the wires and terminals shall be acceptably tagged or otherwise coded, and a wiring diagram shall be affixed to the appliance where it shall be readily visible during assembly, or shall be included in the assembly instructions; and
- d) if the wiring between the coin-, ticket-, or card-operated timer assembly and the appliance is external to the appliance, it shall be enclosed in flexible conduit, armored cable, or the equivalent.

#### 24.4.2 Field-attached or optional accessories

24.4.2.1 Clauses 24.4.2.2 to 24.4.2.6 apply to accessories intended for installation on or connection to an appliance for the purpose of modifying or supplementing the functions of the appliance.

24.4.2.2 An appliance having provision for the use of an accessory to be attached in the field shall be constructed so that the use of the accessory will not introduce a risk of fire, electric shock, or injury to persons.

24.4.2.3 The installation of an electrical component of an accessory by the operator shall be restricted to an arrangement that can be accomplished by means of receptacles and plug-in connectors.

24.4.2.4 The installation of an electrical component of an accessory by qualified personnel is acceptable if connections are made to existing terminals by use of wire connectors.

24.4.2.5 An installation that requires field rearrangement of components or wiring, cutting or splicing of wiring, or soldering of connections is not acceptable.

24.4.2.6 As part of the investigation, an accessory shall be tested and trial-installed to determine that installation is feasible, that the instructions are detailed and correct, and that the use of the accessory will not introduce a risk of fire, electric shock, or injury to persons.

#### 24.5 Heating elements

24.5.1 The voltage rating of a heating element employed in an appliance shall be not less than:

- a) 110 V if connected in a circuit in which the potential across the heating element is a nominal 120 V;
- b) 191 V if connected in a circuit in which the potential across the heating element is a nominal 208 V;
- c) 220 V if connected in a circuit in which the potential across the heating element is a nominal 240 V;
- d) 254 V if connected in a circuit in which the potential across the heating element is a nominal 277 V;
- e) 440 V if connected in a circuit in which the potential across the heating element is a nominal 480 V; or
- f) the voltage rating of the circuit if connected in a circuit in which the potential across the heating element is more than 480 V.

24.5.2 A heating element shall be supported in a substantial and reliable manner, and provided with a means to reduce the likelihood of mechanical damage and contact with outside objects.

24.5.3 An appliance shall be constructed so that the clothes load will be reliably confined to the drum or basket, and will be provided with a means to reduce the likelihood of contact between clothes and heating elements and other parts operating at temperatures that could result in the ignition of fabric.

24.5.4 An appliance in which the heating element is intended for operation only in an air stream shall be wired or controlled so that the element can be operated only when under the cooling effect of the stream. An appliance in which the cooling effect of the motion of a part is necessary to reduce the likelihood of excessive temperatures shall be wired or controlled so that the heating element cannot be operated in the absence of such motion.

#### Notes:

1) Controls that could be used to comply with this requirement include centrifugal switches, belt switches, thermally operated switches, and fusible links.

2) More than one control may be necessary if absence of the air can occur at more than one location in the circulation system (eg, centrifugal switch and a belt switch for motor and belt-drive failure, respectively).

24.5.5 Open-wire, radiation-type heater elements shall be the subject of investigation to determine the extent of guarding required and the precautions necessary to reduce the likelihood of collection of lint on the heater element. Openings in the dryer drum or guard in front of the element shall have no dimensions greater than 8 mm.

## 24.6 Lampholders

24.6.1 An Edison-base lampholder of:

- a) a permanently connected appliance; or
- b) an appliance equipped with a polarized attachment plug;

shall be wired so that the screw shell will be connected to the terminal or lead that is intended for the connection of the grounded conductor of a supply circuit.

24.6.2 A lampholder shall be constructed or installed so that uninsulated current-carrying parts other than a screw shell will not be exposed to contact by persons removing or replacing lamps in normal service.

**Note:** If it is necessary to dismantle the appliance or remove a cover plate or other part by means of a tool in order to remove or replace a lamp, uninsulated current-carrying parts may be accessible to contact during the relamping process only.

24.6.3 Lamps shall be provided with a means to reduce the likelihood of damage, either by their location or by the provision of an acceptable guard.

## 24.7 Motors

24.7.1 Motors shall have inherent overheating protection in accordance with the requirements of CSA C22.2 No. 77 and UL 547, except for:

- a) appliances having a device, which may be integral with the control of the appliance, responsive to motor current, as required by the CEC and the NEC, for overload and overheating, and which reduces the likelihood of the motor's overheating, as required by CSA C22.2 No. 77 and UL 547;

b) motors employing impedance protection complying with the locked-rotor requirements specified in CSA C22.2 No. 77 and UL 519; or

c) appliances with a rated load capacity of 11.3 kg or more that may have a separate motor-protective device that complies with Clauses 24.7.4 and 24.7.5.

24.7.2 Devices employed for motor-overload protection, other than those that are inherent in a motor, shall be located in an ungrounded conductor of each phase.

24.7.3 The duration of the locked-rotor test required by Clause 24.7.1 for automatically reset motor-protective devices may be less than 15 days if the protective device permanently opens the circuit in a shorter time, or if the appliance includes other controls, such as a timer, that will positively and reliably limit the operation to a shorter interval.

24.7.4 A separate protective device incorporated in an appliance in accordance with Clause 24.7.1(c), shall be responsive to the motor current, and shall be rated or set in accordance with Table 4.

24.7.5 With reference to the requirements in Clause 24.7.4, each winding connection of a multispeed motor shall be considered separately.

## **24.8 Motor overload-protective devices**

24.8.1 Overload-protective devices for motors shall comply with the tests specified in Clauses 24.8.2 to 24.8.4. Three samples of the device shall be subjected to the tests, and in one of the three tests the protector shall close the short circuit.

24.8.2 Protective devices for motors rated 1/2 hp (373 W) or less and 250 V or less shall be connected in turn to a circuit limited to 200 A at a power factor between 0.9 and 1.0, in series with a nonrenewable cartridge fuse rated four times the full-load current of the motor for which the device is intended, but in no case less than 15 A for devices rated 125 V or less, or less than 10 A for devices rated more than 125 V and less than 250 V.

24.8.3 Protective devices for motors rated more than 1/2 hp (373 W) or more than 250 V shall be tested as in Clause 24.8.2, except that the short-circuit current shall be limited to 1 000 A.

24.8.4 The outer enclosure of the device under test, or the enclosure of the motor to be protected in the case of inherent protective devices, shall be surrounded by cotton. There shall be no ignition of such cotton during the test.

## **24.9 Receptacles**

24.9.1 An appliance shall not be provided with a general-use receptacle.

**Note:** Stacked clothes dryers may be provided with a dedicated receptacle for the connection of a clothes washer.

## **24.10 Seals and diaphragms**

24.10.1 If the deterioration or breakage of a liquid seal or the like could increase the risk of electric shock, the seal or the like shall be investigated.



24.10.2 The test procedure for determining whether a component complies with the requirement in Clause 24.10.1 depends upon the material of which it is composed, its size and shape, the mode of application in the appliance, and other factors. The test procedure may include visual inspection for determination of cracks, deformation, and the like, after artificial ageing, as well as comparison of hardness, tensile strength, and elongation before and after artificial ageing.

24.10.3 With reference to Clauses 24.10.1 and 24.10.2, a noncomposite material, when tested to compare its tensile strength and elongation before and after artificial ageing, is acceptable if these properties are found to be not less than the minimum corresponding values specified in UL 157. The maximum service temperature specified in UL 157 corresponds to the temperature of the component during the heating test.

## **24.11 Switches and controls**

24.11.1 Switches and controls shall be acceptable for the application, and shall have a current and voltage rating not less than that of the load they control when the appliance is operated normally.

**Note:** Refer to Clause 24.12 for requirements relating to temperature controls and thermostats.

24.11.2 For a centrifugal-type switch that controls a motor-start winding, the basis for the current and voltage rating of auxiliary contacts provided for the direct or indirect control of a heating element shall include the endurance test in Clause 24.11.8.

24.11.3 Switches and controls shall be so located or protected that they are not subjected to mechanical damage, excessive moisture, or excessive collection of lint.

24.11.4 Switches shall disconnect all ungrounded conductors of the circuit controlled when in the OFF position, except that one ungrounded conductor only may be disconnected if the other ungrounded conductor is thereby automatically disconnected by a second switch (eg, motor centrifugal switch).

24.11.5 A switch or other device that controls a motor shall have a horsepower rating not less than that of the motor that it controls. This requirement does not apply to a centrifugal-type switch or other device that is necessary for a motor to change from the start winding to the main winding so that the motor will attain running speed.

24.11.6 A switch or other device that controls a solenoid, relay coil, or the like, and that has not been investigated for the purpose for which it is used, shall be tested as described in Clause 24.11.7. As a result of the test, there shall be no electrical or mechanical malfunction or breakdown of the switch or other device nor welding or undue pitting or burning of the contacts. A 3 A fuse placed in the grounding connection shall not open.

24.11.7 In a test to determine whether a switch or other control device complies with the requirement in Clause 24.11.6, the appliance shall be connected to a supply circuit of rated frequency and 110% of maximum rated voltage. The load on the device under test shall be the same as that which it is intended to control in normal service. The device shall be operated for 50 cycles at a rate of not more than 10 cycles/min. However, with the concurrence of those concerned, a faster rate of operation may be employed.

24.11.8 For a centrifugal-type switch that controls a motor-start winding, auxiliary contacts provided for the direct or indirect control of a heating element shall be subjected to an endurance test consisting of at least 30 000 cycles of operation conducted in accordance with the requirements of CSA C22.2 No. 55 and UL 1054.

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24.11.9 If a cord-connected appliance employs a motor rated more than 1/3 hp (249 W), a controller for the motor shall be provided in the appliance. The control shall not be located in the grounded conductor unless its operation also results in the opening of all ungrounded supply conductors to the motor.

24.11.10 The operating mechanism of switches or controls shall not subject electrical parts to undue strain.

24.11.11 An appliance control containing solid-state components shall comply with the applicable requirements in CSA C22.2 No. 156 and UL 244A.

*Exception No. 1: A control or transformer that is part of a control that complies with CSA C22.2 No. 14 and UL 508 or CSA C22.2 No. 24 and UL 873 need not comply with CSA C22.2 No. 156 or UL 244A.*

*Exception No. 2: A power transformer used to supply a control that complies with CSA C22.2 No. 156 and UL 244A need not be tested to the overload heating requirements specified in CSA C22.2 No. 223 or UL 1585, if the transformer and any fixed-impedance regulating network, or other device that is used to limit current, complies with Clause 24.11.12.*

24.11.12 With reference to Clause 24.11.11, Exception No. 2, the transformer and the current-limiting device, if employed, shall be installed in the appliance. The appliance shall be placed on a layer of cheesecloth. A 3 A fuse shall be connected from the core of the transformer to ground. With each secondary short-circuited one at a time on each separate sample, the transformer shall be tested in accordance with the requirements contained in Clause 24.11.11 for 7 h or until ultimate results occur. A separate sample of the transformer shall be used for each test. The transformer shall be protected by the branch-circuit fuse required by the appliance. The results are acceptable if:

- a) the ground fuse does not open;
- b) each transformer withstands the electric strength test described in Clause 16 for 1 min between the primary and the secondary and any secondary winding;
- c) there is no ignition of the cheesecloth; and
- d) the branch-circuit fuse opens, provided there is no indication of fire, electric shock, or injury to persons.

*Exception: The test may be performed with the transformer outside the appliance if this is agreeable to the manufacturer.*

24.11.13 An electronic circuit that performs a temperature-limiting, interlock, or other function intended to reduce the risk of electric shock, fire, or injury to persons shall comply with the requirements in UL 991.

24.11.14 The test parameters used in the investigation of the circuit covered by Clause 24.11.13 shall be as stated in UL 991, except that exposure Class H5 shall be used for the Humidity Test. If the Computational Investigation is conducted, the predicted failure rate calculated shall not exceed six failures per million hours for the entire system. If the Demonstrated Method Test is conducted, the multiplier shall be 576.30, and a minimum of 24 units for a minimum of 24 hours per unit shall be tested. If Electrical Supervision is investigated, the failure of a critical component shall be indicated by a distinctive audible trouble indication not occurring during normal operation.

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## 24.12 Temperature controls

24.12.1 A temperature control such as a temperature-regulating, temperature-limiting, or combination temperature-regulating and -limiting thermostat shall comply with the requirements for automatic temperature controls in Clauses 24.12.2 to 24.12.6 and with the requirements in CSA C22.2 No. 24 and UL 873.

24.12.2 Temperature controls shall be connected in the ungrounded conductor of the circuit. Devices of the single-pole type, which control the power supply to the dryer or to components, shall not be connected in the grounded conductor of the circuit if the short-circuiting of the switching device may increase the risk of fire.

24.12.3 Temperature controls shall open all ungrounded conductors to the heater assembly or to a single-pole limit control that shall open one ungrounded conductor to the heating element, and a single-pole regulating control that shall open the remaining ungrounded conductor to the heating element. Controls for polyphase heater assemblies shall open all ungrounded supply conductors.

24.12.4 A single-pole limit control or a single-pole cycling control shall open one ungrounded conductor to the heating element if the remaining ungrounded conductor to the heating element is automatically disconnected by a switch (eg, motor centrifugal switch).

Controls for polyphase heating elements shall open all ungrounded supply conductors.

24.12.5 A temperature-limiting control shall comply with CSA C22.2 No. 24 and UL 873, pertaining to the calibration of temperature-limiting controls.

24.12.6 Temperature-regulating and temperature-limiting thermostats shall comply with the requirements of CSA C22.2 No. 24 and UL 873 for the following minimum number of cycles:

- a) manually reset type – 6 000 cycles; and
- b) all other temperature-regulating and temperature-limiting thermostats – 100 000 cycles.

24.12.7 If a thermostat is used in conjunction with a magnetic contactor or other auxiliary equipment, the tests shall be conducted on the combination of thermostat and contactor functioning as a unit.

24.12.8 A temperature-limiting device that is relied upon for compliance with the requirements in Clauses 19.5.2 to 19.5.5 shall:

- a) be of the manual-reset or nonresettable type and inaccessible to the user without the use of tools; or
- b) de-energize both the heating element and the drum-driving force (motor) and necessitate that the appliance be manually restarted.

## 25 Supply connection and external flexible cords

### 25.1 General

An appliance shall be provided with wiring terminals or leads for the connection of conductors that will be connected in the field and means for connection of a wiring system.

**Note:** An appliance other than a wall-insert type may be provided with a flexible cord and an attachment plug for connection to the supply circuit.

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## 25.2 Permanently connected appliances

**Note:** The CEC requires that electric clothes dryers having an input of 30 A or less be cord-connected.

25.2.1 An outlet or terminal box in which connections to the supply circuit will be made shall be located so that, after the appliance has been connected as intended, such connections will be readily accessible for inspection.

**Note:** The appliance may be moved to examine these connections.

25.2.2 The requirement in Clause 25.2.1 necessitates that the terminal box of a wall-insert appliance be located so that it will be accessible without the necessity of moving the appliance after installation, unless the appliance is provided with not less than 1.5 m of either:

- a) flexible metallic conduit with conductors; or
- b) armored cable;

to extend the point of supply to an accessible location.

**Note:** The top or front of the appliance may serve as the inspection cover, provided that the fastening means for the cover is apparent, or indicated, and that the cover may be moved and replaced without damage to the cover or fastening means.

25.2.3 An outlet box, terminal box, wiring compartment, or the like in which connections to the supply circuit will be made in the field shall be free from any sharp edges, including screw threads, a burr, a fin, a moving part, or the like, that could damage the insulation on a conductor.

25.2.4 If it is intended that supply connections be made to the motor of an appliance, the terminal compartment on the motor shall comply with the requirements for terminal compartments in CAN/CSA C22.2 No. 100 and UL 1004.

25.2.5 Conduit connection shall not be made to covers giving access to supply terminals. Component parts shall not be mounted on removable covers giving access to supply connections.

25.2.6 An opening in a wiring compartment for the connection to the power supply in the field, whether in the form of a knockout or an open hole, shall:

- a) have the minimum width of flat surface surrounding the opening as specified in Table 5; or
- b) be acceptable when the test gauge for flat surfaces surrounding knockout is applied as specified in CAN/CSA-C22.2 No. 0.5 and UL 514A.

25.2.7 A household appliance shall be marked in accordance with Clause 7.1.2.34 if it:

- a) has a knockout with a diameter of 21.9 mm minimum to 23.0 mm maximum; or
- b) is only intended to be connected to the power supply by means of permanent wiring brought into the appliance.

25.2.8 A household appliance that is intended to be connected to the power supply by means of either permanent wiring brought into the appliance or a power-supply cord kit shall be provided with:

- a) two knockouts (concentric or eccentric);
- b) an opening inside a knockout;
- c) a reducing fitting in an opening; or
- d) a single knockout or opening sized in accordance with Table 6.

The smaller knockout or opening, or the opening in the reducing fitting, shall have a diameter of 21.9 mm minimum to 23.0 mm maximum. The larger knockout, or the opening in which the reducing fitting is mounted, shall be sized in accordance with Table 6.

25.2.9 A knockout shall remain in place when a force of 44.5 N is applied at right angles to the knockout by means of a mandrel with a 6.4 mm diameter flat end. The mandrel shall be applied at the point most likely to result in movement of the knockout.

25.2.10 The removal of a knockout shall not result in deformation that would affect the attachment of a strain relief or fitting, or result in reduction of electrical spacings below the minimum acceptable values.

25.2.11 At a point where the power-supply conductors enter the enclosure, sheet metal shall not be less than 0.81 mm thick if uncoated steel, not less than 0.86 mm if galvanized steel, not less than 1.12 mm if aluminum, and not less than 1.09 mm if copper or brass.

### 25.3 Cord-connected appliances

25.3.1 The flexible cord shall have an ampacity not less than the current rating of the appliance.

25.3.2 An attachment plug shall have an ampere rating not less than 125% of the rated current of the appliance, and shall have a voltage rating not less than the rated voltage of the appliance, except as stated in Clause 25.3.3.

**Note:** The CEC requires that electric clothes dryers have a plug ampere rating not less than 125% of the rated current of the appliance in all cases.

25.3.3 A stationary product marked in accordance with Clause 7.1.2.22 shall employ an attachment plug rated no less than the current rating of the appliance or the input current under normal load conditions in Clause 10, whichever is greater.

25.3.4 Flexible cord shall be Type SJ, SJO, SJT, SJTO, S, SO, ST, STO, SRD, SRDE, SRDT, HSJ, HSJO, HS, HSO, DRT, HSJOO, SJOO, SJTOO, SOO, and STOO, or equivalent. Type SP-3 or SPT-3 cord may be used on an appliance not mounted on wheels, casters, or the equivalent.

25.3.5 A power-supply connection opening in the enclosure of an appliance shall be sized in accordance with Table 6.

**Note:** The opening need not be sized in accordance with Table 6 if the clothes dryer is provided with the instructions described in Clause 7.3.3.

25.3.6 The cord length shall not be less than:

- a) 1.8 m for an appliance provided with casters; or
- b) 1.5 m for an appliance not provided with casters.

The cord length shall be measured from the face of the attachment plug to the point of entry into the appliance.

25.3.7 A flexible cord shall be provided with strain relief so that stress on the cord will not be transmitted to terminals, splices, or internal wiring.

25.3.8 Except as specified in Clause 25.3.10, a strain relief shall be constructed so that the flexible cord, when installed as intended, does not contact the edges of the opening in which the strain relief is mounted.

25.3.9 The flexible cord shall be provided with a means to reduce the likelihood of the cord's being pushed into the appliance through the cord-entry hole if such displacement:

- a) may subject the cord to mechanical damage or to exposure to a temperature higher than that for which the cord is rated; or
- b) may reduce spacings, such as to a metal strain-relief clamp, below the minimum acceptable values.

25.3.10 If a knot in a flexible cord serves as strain relief, a surface against which the knot may bear or with which it may come in contact shall be free from projections, sharp edges, burrs, fins, or the like that may result in abrasion of the insulation of the cord.

25.3.11 When tested as described in Clause 25.3.12, a strain-relief device shall withstand for 1 min, without displacement, a direct pull of 155 N applied to the cord, with the connections within the appliance disconnected.

25.3.12 A 16 kg weight shall be suspended on the cord and supported by the appliance so that the strain-relief device will be stressed from any angle that the construction of the appliance permits. The strain relief is not acceptable if there is movement of the cord, at the point of disconnection of the conductors, to indicate that stress would have resulted on the connections.

## 25.4 Bushings

25.4.1 The edges of an opening through which flexible cord passes, including the opening in a strain relief or bushing, shall be smooth and free from burrs, fins, projections, sharp edges and the like that may result in abrasion of the insulation of the cord.

25.4.2 If an insulating bushing is provided in an opening through which a power-supply cord passes, and if the bushing is of material other than ceramic, phenolic, or cold-moulded composition, fibre, or other material that has been investigated and found to be acceptable for the application, the opening shall be smooth and free from burrs, fins, projections, sharp edges, and the like that may result in abrasion of the cord.

## 26 Terminals for external conductors

26.1 Wiring terminals or leads intended for connection of the conductors of the supply circuit shall be acceptable for the connection of conductors having an ampacity not less than the rating of the branch circuit marked on the appliance. Leads for supply connection are acceptable only for appliances requiring No. 12 AWG (3.3 mm<sup>2</sup>) or smaller supply conductors.

26.2 A wiring terminal shall be provided with a soldering lug or with a pressure terminal connector securely fastened in place (ie, firmly bolted or held by a screw). A connection device that depends on solder shall not be used for the connection of an equipment-bonding conductor. A wire-binding screw may be employed at a wiring terminal intended to accommodate a No. 10 AWG (5.3 mm<sup>2</sup>) or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in position.

26.3 A wiring terminal shall be provided with means to reduce the likelihood of turning.

26.4 A wire-binding screw shall thread into metal.

26.5 A wire-binding screw at a wiring terminal shall not be smaller than No. 10 (M5). A No. 8 (M4) screw may be used at a terminal intended only for the connection of a No. 14 AWG (2.1 mm<sup>2</sup>) conductor.

26.6 A terminal plate tapped for a wire-binding screw shall be of metal not less than 1.27 mm thick and shall provide not less than two full threads in the metal.

**Note:** An alloy plate not less than 0.76 mm thick may be used if the tapped threads have adequate mechanical strength.

26.7 A terminal plate may have the metal extruded at the tapped hole to give the thickness necessary for not less than two full threads, provided the thickness of the unextruded metal is not less than the pitch of the thread.

26.8 Upturned lugs or a cupped washer shall be capable of retaining a conductor of the size mentioned in Clause 26.1, but not smaller than No. 14 AWG (2.1 mm<sup>2</sup>), under the head of the screw or the washer.

26.9 The free length of a lead inside an outlet box or wiring compartment shall be 152 mm or more if the lead is intended for field connection to an external circuit.

26.10 An appliance constructed so that it may be adapted upon installation for either of two different supply voltages, such as 120 V, 2-wire or 120/240 V, 3-wire, shall be provided with a terminal block or board on which the appropriate connections may be made during field installation without the necessity of changing or disrupting internal wiring or connections other than at the terminal block.

26.11 An appliance provided with wiring terminals or leads and rated 125 V or 125/250 V or less and employing:

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

shall have one terminal or lead identified for connection of the grounded conductor of a supply circuit.

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The terminal or lead intended to be connected to a grounded conductor of a supply circuit shall be the one that is connected to the screw shells of lamp- or element-holders, and to which are connected the single-pole switches or single-pole automatic controls.

26.12 A terminal for connection of the grounded conductor of a supply circuit shall be of, or plated with, a silver-coloured metal. Such a terminal shall be readily distinguishable from the other terminals, or identification of the terminal shall be clearly shown in some other way, such as on an attached wiring diagram.

26.13 A lead for connection of the grounded conductor of a supply circuit shall have a white or natural grey colour and shall be readily distinguishable from the other leads.

## 27 Provision for grounding

### 27.1 General

27.1.1 In an appliance intended to be permanently connected to the power supply, all exposed non-current-carrying metal parts that may become energized and all non-current-carrying metal parts within the enclosure that are exposed to contact during any servicing operation and that may become energized shall be conductively connected to the equipment-grounding terminal or lead (see Clause 27.5).

27.1.2 For an appliance provided with a power-supply cord and an attachment plug for connection to the power supply, the supply cord shall contain a bonding conductor for use in connecting the equipment to ground.

**Note:** A portable appliance provided with a system of double insulation need not comply with this requirement.

27.1.3 Except as specified in Clause 27.1.4, the bonding conductor of a flexible power-supply cord shall be:

- a) bare or provided with insulation having an outer surface that is green with or without one or more yellow stripes;
- b) connected to the grounding blade of an attachment plug of the grounding type; and
- c) conductively connected to all exposed non-current-carrying metal parts that may become energized and all non-current-carrying metal parts within the enclosure that are exposed to contact during any servicing operation and that may become energized.

27.1.4 With reference to the requirements of Clause 27.1.3, the bonding conductor of the power-supply cord of a nonautomatic appliance may be connected to the motor frame only and not to the enclosure of the appliance, provided that the:

- a) only electrical components of the appliance are the motor and power-supply cord;
- b) power-supply cord enters the motor without being attached to or passing through any other part of the appliance; and
- c) motor is mounted in resilient mounting rings that provide between the frame of the motor and all other non-current-carrying metal parts of the appliance:

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- 1) a spacing of not less than 3.2 mm; and
- 2) insulation resistance of not less than 50 000  $\Omega$ .

A non-current-carrying metal part within the enclosure need not be bonded to ground, provided the appliance is marked in accordance with Clause 7.1.2.16.

27.1.5 With reference to the requirements of Clause 27.1.3(c), the connection shall be made by a means not likely to be removed during ordinary servicing not involving the power-supply cord. Solder alone shall not be used for making this connection.

27.1.6 With reference to the requirements in Clauses 27.1.1 and 27.1.3, the following non-current-carrying metal parts are not considered as being likely to become energized:

- a) a small metal part such as an adhesive-attached foil marking, a screw, or a handle that is:
  - 1) on the exterior of the enclosure and separated from all electrical components by grounded metal; or
  - 2) electrically isolated from all electrical components;
- b) a panel, cover, or other metal part that is isolated from all electrical components, including wiring, by a barrier or vulcanized fibre, varnished cloth, phenolic composition, or other moisture-resistant insulating material not less than 0.8 mm thick and secured in place;
- c) a panel, cover, or other metal part that does not enclose uninsulated current-carrying parts and that is electrically isolated from other electrical components; and
- d) a door or the like that may only become energized through a grounded part;

27.1.7 Servicing, as mentioned in Clauses 27.1.1 and 27.1.3, is considered to include the repair of the appliance by a qualified serviceman as well as by the user.

27.1.8 If an appliance is intended to be grounded and is provided with means for separate connection to more than one power supply, each such connection shall be provided with a means for grounding.

## 27.2 Neutral-grounding link

**Note:** The CEC does not permit the use of neutral-link grounding on products intended to be installed in Canada.

27.2.1 An appliance having a nominal rating of 120/208 or 120/240 V shall be equipped with a detachable link or the equivalent by which the non-current-carrying metal parts may be connected to the grounded wiring terminal.

27.2.2 The link mentioned in Clause 27.2.1 shall be located so that it will be readily visible at the field wiring terminals after the appliance has been installed as intended.

27.2.3 The connection between the grounding link mentioned in Clause 27.2.1 and the grounded terminal shall be made at the factory (see Clause 7.1.2.37).

27.2.4 An appliance provided with a 4-conductor power-supply cord having a bonding conductor shall not be provided with the link mentioned in Clause 27.2.1, and the bonding conductor of the flexible cord shall be connected to the equipment-grounding terminal.

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### 27.3 Bonding for grounding

27.3.1 A bonding conductor shall be copper, copper alloy, or other material that has been investigated and found to be acceptable for use as an electrical conductor. The likelihood of corrosion of a ferrous metal part in the grounding path shall be reduced by enamelling, galvanizing, plating, or other equivalent means.

27.3.2 A bonding conductor shall:

- a) be protected from mechanical damage or be located within the enclosure; and
- b) not be secured by a removable fastener used for any purpose other than bonding for grounding unless the bonding conductor is not likely to be omitted after removal and replacement of the fastener.

27.3.3 Bonding shall be by a positive means, such as by clamping, riveting, bolted or screwed connection, or by welding or soldering and brazing for materials having a softening or melting point more than 454°C.

27.3.4 The bonding connection shall penetrate nonconductive coatings such as paint or vitreous enamel.

27.3.5 Among the factors to be taken into consideration when judging the acceptability of a clamping device are the:

- a) effect of assembling and disassembling the appliance for servicing; and
- b) likelihood that the device will not be reassembled in its intended manner.

27.3.6 If the adequacy of a bonding connection cannot be determined by examination, it shall comply with the requirement in Clause 27.3.11.

27.3.7 A bonding conductor shall have a cross-sectional area not less than that of the bonding conductor of the power-supply cord.

27.3.8 A bonding conductor:

- a) may be smaller if it complies with the requirements in Clause 27.3.12; or
- b) for a component or electrical enclosure may be smaller than the conductors supplying power to the component or components within the enclosure.

27.3.9 A bonding conductor intended to be permanently connected to the power supply shall not be smaller than the size specified in Table 7, except as provided in Clause 27.3.8.

27.3.10 If more than one rating of the branch-circuit overcurrent-protective device is involved, the size of the bonding conductor shall be based on the rating of the overcurrent device intended to provide ground-fault protection for the component bonded by the conductor. For example, if a motor is individually protected by a branch-circuit overcurrent device of lesser rating than other overcurrent devices used with the appliance, a bonding conductor for that motor shall be sized on the basis of the overcurrent device intended for ground-fault protection of the motor.



27.3.11 If a test is needed to determine the adequacy of a bonding connection, the connection shall not open when carrying a current equal to twice the rating of the branch-circuit overcurrent device for the time specified in Table 8.

27.3.12 A bonding conductor having a cross-sectional area less than that of the bonding conductor of the power-supply cord and the bonding connections may be used if the connection does not open when carrying a current of 200% of the rating of the appropriate branch-circuit protective device for the time specified in Table 8.

#### 27.4 Continuity of grounding circuit

27.4.1 The resistance between the point of connection of the equipment-grounding means, at or within the appliance, and any point in the grounding circuit shall not be more than 0.1  $\Omega$ .

27.4.2 With reference to Clause 27.4.1, the resistance may be determined by any convenient method. However, if unacceptable results are obtained, an alternating current of at least 20 A from a source of supply of not more than 12 V shall be passed from the point of connection of the equipment-grounding means to a metal part in the grounding circuit, and the resulting drop in potential shall be measured between these two points. The resistance shall be determined by dividing the drop in potential in volts by the current in amperes passing between the two points. The bonding conductor of a power-supply cord is not to be included in this measurement.

#### 27.5 Grounding terminals and leads

27.5.1 A wiring terminal or lead for attaching an equipment-bonding conductor shall be provided and shall comply with the requirements in Clause 26.

27.5.2 A terminal for attaching an equipment-bonding conductor shall be such that the equipment-bonding conductor can be connected either inside or outside the appliance.

**Note:** A terminal that is placed in close proximity to the terminal box or wiring compartment so as not to expose the equipment-bonding conductor to damage may be such that the conductor can be connected only inside the appliance, or only outside the appliance.

27.5.3 A wire-binding screw intended for the connection of an equipment-bonding conductor shall have a green-coloured head that is hexagonal, slotted, or both. A pressure terminal connector intended solely for the connection of such a conductor shall be marked in accordance with 7.1.2.36A. The wire-binding screw or pressure terminal connector shall be located so that it does not require removal during normal servicing of the appliance. A sheet-metal screw shall not be used for connection of an equipment-grounding conductor.

**Note:** The ground screw may be provided with a secondary means of rotation.

27.5.4 A lead intended for attaching an equipment-bonding conductor shall not be smaller than the wire to which it is intended to be connected.

27.5.5 The surface of an insulated lead intended solely for the connection of an equipment-bonding conductor shall be green with or without one or more yellow stripes, and no other lead shall be so identified.

## 28 Screws and connections

28.1 Screws or other fastenings of fragile insulating parts shall not be so tight as to result in cracking or breaking of such parts due to expansion and contraction, unless the insulating material is completely retained. Generally, such parts shall be slightly loose or shall be provided with cushioning material.

## 29 Creepage distances, clearances, and distances through insulation

29.1 Spacings between uninsulated current-carrying parts of opposite polarity, and between an uninsulated current-carrying part and a non-current-carrying metal part, shall not be less than the value specified in Table 9. If an uninsulated current-carrying part is not rigidly fixed in position, by means other than friction between surfaces, or if a movable non-current-carrying metal part is in proximity to an uninsulated live part, the construction shall be such that the acceptable minimum spacing is maintained.

Spacings on printed wiring boards shall comply with the requirements in UL 244A.

29.2 The spacing between parts of different circuits shall not be less than the largest spacings required for the circuits involved.

29.3 The spacing requirements specified in Clause 29.1 do not necessarily apply to the inherent spacings of a component of the appliance, such as a snap switch, lampholder, motor, or other device. Such spacings shall comply with the requirements for the component in question if they are smaller than the values specified in Table 9.

29.4 Film-coated wire shall be regarded as an uninsulated current-carrying part when spacings are being considered.

29.5 At terminal screws and studs to which connection may be made in the field by means of wire connectors, eyelets, or the like, the spacings shall not be less than those specified in Table 9 when the connectors, eyelets, or the like are in such position that minimum spacings exist between:

- a) current-carrying parts;
- b) current-carrying parts of opposite polarity; or
- c) current-carrying parts and non-current-carrying metal parts.

29.6 An insulating liner or barrier of vulcanized fibre or similar material employed in lieu of spacings shall:

- a) not be less than 0.8 mm thick; and
- b) be located so, or of such material that, it will not be adversely affected by arcing.

Fibre not less than 0.4 mm thick may be used in conjunction with an air spacing of not less than 50% of the spacing required for air alone.

## 29.7 Alternate spacings – clearances and creepage distances

29.7.1 As an alternative to the specified spacing requirements of Clause 29.1, the spacing requirements in UL 840 may be used. The spacing requirements in CSA C22.2 No. 0.2 and UL 840 shall not be used for spacings:

- a) between field wiring terminals; or
- b) between uninsulated current-carrying parts and a metal enclosure.

29.7.2 Appliances shall be considered overvoltage category 2 as specified in CSA C22.2 No. 0.2 and UL 840.

29.7.3 Printed wiring boards constructed of Types XXXP, XXXPC, G-10, FR-2, FR-3, FR-4, FR-5, CEM-1, CEM-3, GPO-2, or GPO-3 industrial laminates in accordance with UL 746E shall be considered to have a minimum comparative tracking index of 100 as specified in accordance with CSA C22.2 No. 0.17 and UL 746A.

29.7.4 The internal microenvironment of the enclosure shall be considered pollution degree 2 (that is, an environment that normally has only nonconductive pollution, or a temporary conductivity resulting from condensation) as specified in CSA C22.2 No. 0.2 and UL 840. Steps can be taken to achieve pollution degree 1 at a creepage distance by encapsulation or hermetic sealing; for printed wiring boards, coatings may be used that satisfy the performance criteria specified in CSA C22.2 No. 0.2 and UL 840.

29.7.5 In order to evaluate clearances where the levels of overvoltage are controlled, control of overvoltage shall be achieved by providing an overvoltage device or system as an integral part of the appliance. The appliance shall be evaluated for the rated impulse withstand voltage specified in CSA C22.2 No. 0.2 and UL 840.

29.7.6 A device having exposed Class 2 outputs that:

- a) may be contacted during normal operation or user servicing; and
- b) has clearances between the Class 2 circuit and an overvoltage-protected line-voltage circuit that have been evaluated in accordance with Clearance B requirements in CSA C22.2 No. 0.2 and UL 840;

shall be provided with a mechanism to indicate the malfunction of the overvoltage-protective device or system.

### 30 Resistance to heat, fire, and tracking

30.1 See Clause 32 for details.

### 31 Resistance to rusting

31.1 Iron and steel parts shall be provided with a means to reduce the likelihood of corrosion, such as enamelling, galvanizing, plating, or other equivalent means, if the corrosion of such unprotected parts would be likely to result in a risk of fire, electric shock, or injury to persons.

#### Notes:

1) *In certain instances in which the oxidation of iron or steel resulting from the exposure of the metal to air and moisture is not likely to be appreciable and the thickness of metal and temperature are also factors, surfaces of sheet-steel and cast-iron parts within an enclosure may not be required to be protected against corrosion.*

2) *Bearings, laminations, or minor parts of iron or steel, such as washers, screws, or the like, need not be protected against corrosion.*

31.2 If deterioration or breakage of a liquid container provided as a part of an appliance would result in a risk of fire, electric shock, or injury to persons, the container shall be of a material that is resistant to corrosion by the liquid intended to be contained.

### 32 Polymeric materials

#### 32.1 General

32.1.1 The requirements of Clause 32 apply to polymeric materials, including thermoset materials, used as enclosures, functional polymeric parts, decorative parts, or liquid containers.

32.1.2 Some tests may be eliminated or modified if specimen testing as part of a previous test programme indicates that the polymeric material is acceptable for the properties being investigated.

32.1.3 The tests that may be conducted are identified in Table 10. Table 11 specifies the tests applicable to the polymeric part being evaluated.

## 32.2 Mould stress relief

32.2.1 A polymeric part shall be tested as specified in the mould stress relief test in UL 746C. As a result of this test:

- a) spacings shall not be reduced to less than those specified in Table 9;
- b) current-carrying parts or internal wiring shall not be exposed, as determined in accordance with Clause 8;
- c) there shall be no damage that would increase the risk of fire, electric shock, or injury to persons; and
- d) a part exposed to liquid shall not crack or leak.

**Note:** *This test may be waived if the part is required to be subjected to the thermal ageing test, Clause 32.11.*

## 32.3 Horizontal burning rate

32.3.1 The burning rate of a polymeric part shall have a flammability rating complying with 0.17 HB and 94 HB. The test specimens may be flat stock of the thickness of the end-use part or cut from the part.

## 32.4 Flammability

32.4.1 Specimens of a polymeric part shall be subjected to the tests specified in CSA C22.2 No. 0.17 and UL 94, and shall have a flammability rating of 0.17-5VA and 94-5VA or 0.17-5VB and 94-5VB.

**Note:** *Materials not classified 0.17-5VA and 94-5VA or 0.17-5VB and 94-5VB may be tested in accordance with the 127 mm flammability test described in UL 746C using parts moulded from the polymeric material.*

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### 32.5 6.8 J impact (ambient and low temperature)

32.5.1 A polymeric part shall be subjected to the impact test specified in Clause 32.5.2. As a result of the impacts:

- a) spacings shall not be reduced to less than those specified in Table 9;
- b) current-carrying parts or internal wiring shall not be exposed, as determined in accordance with Clause 8; and
- c) there shall be no damage that would increase the risk of fire, electric shock, or injury to persons.

32.5.2 Samples of the polymeric part shall be subjected to the impact test described in UL 746C. Counter-supported, floor-supported, fixed, and stationary appliances shall be subjected to 6.8 J impacts. Samples shall be tested from each group as follows:

- a) Group A shall be tested in as-received condition.
- b) For Group B, the tests shall be performed on samples that have been conditioned to the low-temperature conditioning specified in UL 746C for indoor equipment. The samples are to be subjected to the impact while still cold.

**Note:** If the size of the surface is such that the results of a second or third impact would be affected by previous impacts, only one impact shall be performed.

### 32.6 Static load

32.6.1 A polymeric part on which a person could stand shall be subjected to the loading described in Clauses 32.6.2 and 32.6.3. As a result of the loading:

- a) spacings shall not be reduced to less than those specified in Table 9;
- b) current-carrying parts or internal wiring shall not be exposed, as determined in accordance with Clause 8; and
- c) a condition shall not be produced that would increase the risk of fire, electric shock, or injury to persons.

32.6.2 The test shall be conducted on as-received samples and then repeated on samples that have been subjected to the mould stress-relief test, Clause 32.2.

32.6.3 Two hardwood or equivalent material boards having rounded edges and corners, each 25.4 mm thick by 86.5 mm wide by 127 mm long, and separated by a distance of 25.4 mm along the 127 mm edge, shall be placed on the surface under investigation. A 400 N force shall be applied simultaneously to each board for 3 min. The test may need to be repeated on several different areas to completely evaluate the polymeric part. A different sample shall be used for each subsequent test if the preceding test damages or reduces the integrity of the part.

### 32.7 56.7 J impact

32.7.1 A polymeric part on which a person could jump shall be subjected to the impact described in Clauses 32.7.2 and 32.7.3. As a result of the impact:

- a) spacings shall not be reduced to less than those specified in Table 9;
- b) current-carrying parts or internal wiring shall not be exposed, as determined in accordance with Clause 8; and
- c) there shall be no damage that would increase the risk of fire, electric shock, or injury to persons.

32.7.2 The test shall be conducted on as-received samples.

32.7.3 A hardwood or equivalent material board having rounded edges and corners, 25.4 mm thick by 86.5 mm wide by 127 mm long, shall be placed in the area under investigation. A 45.4 kg weight shall be dropped from a height of 127 mm to impact evenly over the surface of the board. The test may need to be repeated on different areas of the sample. A different sample shall be used for each subsequent test if the preceding test damages or reduces the integrity of the part.

**Note:** This test may be conducted at different height and weight combinations resulting in 56.7 J, provided they are not less severe than if conducted as specified.

### 32.8 Thermal cycling

32.8.1 A polymeric part shall be tested as described in Clause 32.8.2. The part shall show no cracking, leakage, or deterioration that would increase the risk of fire, electric shock, or injury to persons.

32.8.2 Three samples of the polymeric part shall be subjected to 50 cycles of thermal cycling, with each cycle consisting of 1 h in a circulating-air oven at a temperature 10°C above that temperature to which the part is subjected, but not less than 70°C, followed by 1 h in a room ambient of 25°C.

### 32.9 Crush resistance

32.9.1 Three complete as-received samples of the polymeric enclosure shall each withstand the crushing force specified in the crush-resistance test described in UL 746C.

### 32.10 Hot-wire ignition

32.10.1 A polymeric material shall be tested as described in Clause 32.10.2. The part shall not ignite for at least 15 s.

**Note:** A polymeric material that does not ignite when tested as specified in the abnormal current tests described in UL 746C is acceptable.

32.10.2 Bar specimens shall be subjected to the hot-wire-ignition test specified in CAN/CSA-C22.2 No. 0.17 and UL 746A.

### 32.11 Thermal ageing



32.11.1 A polymeric part shall be tested as described in Clause 32.11.2. As a result of the test:

- a) spacings shall not be reduced to less than those specified in Table 9;
- b) current-carrying parts or internal wiring shall not be exposed, as determined in accordance with Clause 8;
- c) a condition shall not be produced that would increase the risk of fire, electric shock, or injury to persons; and
- d) a part exposed to liquids shall not crack or leak.

32.11.2 Three complete samples of the polymeric part shall be placed in an oven for 1 000 h at the temperature specified in Table 12. The parts shall be removed from the oven, cooled to room temperature, and examined for compliance with the requirements of Clause 32.11.1.

### **32.12 Volume resistivity**

32.12.1 The resistance per unit volume (volume resistivity) of the polymeric material shall not be less than the values specified in CAN/CSA-C22.2 No. 0.17 and UL 746C. The volume resistivity shall be determined in accordance with CAN/CSA-C22.2 No. 0.17 and UL 746A.

### **32.13 Enclosure flammability – large mass consideration**

32.13.1 A polymeric part shall be composed of the material that is to be tested as described in UL 723 or UL 94. The flame-spread rating of the part shall not exceed 200.

### **32.14 Abnormal operation test on enclosures**

32.14.1 A polymeric enclosure shall be tested as described in Clause 32.14.2. There shall be no:

- a) ignition of the enclosure material;
- b) exposure of current-carrying parts, as determined in accordance with Clause 8; or
- c) deformation or damage that would increase the risk of fire, electric shock, or injury to persons.

32.14.2 A polymeric enclosure that contains a motor, solenoid, relay, transformer, or solid-state component shall be evaluated by operating the appliance with the motor armature locked, relay or solenoid plunger blocked open, transformer secondary shorted, and solid-state component opened or shorted. If other electrical components are employed, consideration shall be given to operating them within the enclosure under an abnormal operating condition. The abnormal test shall be continued until ultimate results occur, but no longer than 7 h. If the appliance is provided with a timer or the equivalent that will terminate operation in less than 7 h, the test need not be continued longer than the maximum interval permitted by the timer.

### **32.15 Abnormal operation test on functional polymeric parts**

32.15.1 A functional polymeric part shall be tested as described in Clause 32.15.2. There shall be no:

- a) ignition of the polymeric part; or
- b) damage or deformation of the part that would increase the risk of fire, electric shock, or injury to persons.

32.15.2 A functional polymeric part located below a motor, solenoid, relay component, transformer, solid-state component, or within 100 mm of any of these components, shall be evaluated by operating the appliance with the motor armature locked, relay or solenoid plunger blocked open, transformer secondary shorted, and solid-state component opened or shorted. If other electrical components are located within 100 mm of the functional polymeric part or above the part, consideration shall be given to operating them under an abnormal condition. The abnormal operation test shall be continued until ultimate results occur, but no longer than 7 h. If the appliance is provided with a timer or the equivalent that will terminate operation in less than 7 h, the test need not be continued longer than the maximum interval permitted by the timer.

**Note:** This test need not be conducted if the component is provided with acceptable protection against overload.

### 32.16 High-current arc ignition

32.16.1 Bar specimens of a polymeric material shall be subjected to a minimum of 30 high-current arcs in accordance with the high-current arc-ignition test specified in CAN/CSA-C22.2 No. 0.17 and UL 746A. The specimens shall not ignite.

**Note:** Polymeric materials that comply with the end-use product tests under normal current conditions as specified in UL 746C are acceptable.

## 33 Manufacturing and production tests

### 33.1 Plumbing system leakage test

33.1.1 The manufacturer shall determine that the plumbing system of each appliance produced does not leak. The test shall consist of filling the appliance with a sufficient amount of water and operating the appliance in a manner that will permit any leakage from the plumbing system to be observed.

### 33.2 Grounding continuity test

33.2.1 Each appliance that has a power-supply cord having a bonding conductor for connecting the appliance to ground shall be tested to determine that grounding continuity exists between the grounding blade of the attachment plug and the accessible non-current-carrying metal parts of the appliance that may become energized.

33.2.2 Any acceptable indicating device, such as an ohmmeter, a battery and buzzer combination, or the like, may be used to determine compliance with the requirement in Clause 33.2.1.

33.2.3 Only a single test need be conducted if the accessible metal selected is conductively connected to all other accessible metal.

### 33.3 Electric strength test

33.3.1 Each appliance shall withstand without electrical breakdown the application of a potential at a frequency within the range of 40 to 70 Hz:

- a) between the primary wiring, including connected components, and accessible non-current-carrying metal parts that are likely to become energized; and
- b) between primary wiring and accessible low-voltage (42.4 V peak or less) metal parts, including terminals.

33.3.2 The test shall be conducted in accordance with either condition A or condition B of Table 13.

33.3.3 The appliance may be in a heated or an unheated condition for the test.

33.3.4 The test shall be conducted when the appliance is complete and fully assembled. It is not intended that the appliance be unwired, modified, or disassembled for the test.

#### Notes:

- 1) *A part, such as a snap cover or a friction-fit knob, that would interfere with conducting the test need not be in place.*
- 2) *The test may be conducted before final assembly if the test represents that for the completed appliance.*

33.3.5 An appliance employing a solid-state component that is not relied upon to reduce the risk of electric shock and that may be damaged by the electric strength potential may be tested before the component is electrically connected, provided a random sampling of each day's production is tested at the potential specified in Table 13. The circuitry may be rearranged for the purpose of the test to reduce the likelihood of solid-state-component damage while retaining the representative electric-strength stress of the circuit.

33.3.6 The test equipment shall include a transformer having an essentially sinusoidal output, a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually reset device to restore the equipment after electrical breakdown or an automatic reject feature of any unacceptable unit.

33.3.7 If the output of the test equipment transformer is less than 500 V·A, the equipment shall include a voltmeter in the output circuit to directly indicate the test potential.

33.3.8 If the output of the test equipment transformer is 500 V·A or larger, the test potential may be indicated:

- a) by a voltmeter in the primary circuit or in a tertiary-winding circuit;
- b) by a selector switch marked to indicate the test potential; or
- c) for equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. If marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manually reset switch has been reset following an electric strength breakdown.

33.3.9 Test equipment other than that described in Clauses 33.3.6 to 33.3.8 may be used if found acceptable to accomplish the intended factory control.

33.3.10 During the test, the primary switch shall be in the ON position, both sides of the primary circuit of the appliance shall be connected together and to one terminal of the test equipment, and the second test-equipment terminal shall be connected to accessible non-current-carrying metal.

**Notes:**

*1) An appliance – resistive, high-impedance winding, and the like – having circuitry not subject to excessive secondary-voltage buildup in case of electrical breakdown during the test may be tested:*

- a) with a single-pole primary switch in the OFF position; or
- b) with only one side of the primary circuit connected to the test equipment when the primary switch is in the ON position, or when a primary switch is not used.

*2) The primary switch is not required to be in the ON position if the testing means applies full test potential between primary wiring and non-current-carrying metal parts with the switch not in the ON position.*

**Table 1 – Markings  
(Deleted)**

**Table 2 – Minimum acceptable distance from an opening to a part that may involve a risk of electric shock  
(See Clauses 8.1 and 8.2.)**

Minor dimensions of opening, <sup>a</sup> mm	Minimum distance from opening to part, mm
≤ 19.1	114.0
25.4	165.0
31.8	190.0
38.1	318.0
47.6	394.0
54.0	444.0
> 54.0 ≤ 152.0	762.0
<sup>a</sup> See Clause 8.5 <b>Notes:</b> 1) Between 19.1 mm and 54.0 mm, interpolation is used to determine a value between values specified in the table. 2) Any dimension less than 25.4 mm applies to a motor only.	

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**Table 3 – Maximum acceptable temperature rises  
(See Clauses 11.1, 11.3 and 11.5.)**

Location		°C
1	Varnished-cloth insulation	60
2	Fuses a) Class J, L, T and CC 1) tube 2) ferrule or blade b) Others	100 85 65 <sup>a</sup>
3	Fibre employed as electrical insulation	65
4	Wood or other combustible material, including the inside surfaces of the test enclosure and the surface supporting the appliance	65
5	Class A insulation systems on coil windings of an ac motor having a frame diameter of more than 178 mm, a dc motor, and a universal motor in a) an open motor 1) thermocouple method 2) resistance method b) a totally enclosed motor 1) thermocouple method 2) resistance method	b, c, d  65 75  70 80
6	Phenolic composition employed as electrical insulation, or as a part the malfunction of which could result in a risk of injury to persons.	125 <sup>e</sup>
7	Insulated wires and cords	35 <sup>e,f</sup>
8	At any point within a terminal box or wiring compartment of a permanently connected appliance	35
9	Sealing compound	40 less than melting point
10	Capacitors a) electrolytic b) other types	40 <sup>g</sup> 65 <sup>h</sup>
11	Class A insulation systems on coil windings of an ac motor having a frame diameter of 178 mm or less, not including a universal motor in a) an open motor; thermocouple or resistance method b) a totally enclosed motor; thermocouple or resistance method	b, c, d  75 80
12	Class 130 insulation systems, other than as specified in 13 and 14(a); thermocouple method	80
13	Class B insulation systems on coil windings of an ac motor having a frame diameter of more than 178 mm, of a dc motor, and of a universal motor in a) an open motor 1) thermocouple method 2) resistance method b) a totally enclosed motor 1) thermocouple method 2) resistance method	b, c, d  85 95  90 100
14	Class B insulation systems on coil windings of an ac motor having a frame diameter of 178 mm or less, not including a universal motor in a) an open motor and on vibrator coils; thermocouple or resistance method b) a totally enclosed motor; thermocouple or resistance method	b, c, d  95 100

**Table 3 – Maximum acceptable temperature rises Continued**

Location		°C
15	Class F insulation systems on coil windings of an ac motor having a frame diameter of 178 mm or less, not including a universal motor, in an open motor by the thermocouple or resistance method	<sup>d</sup>  120
16	Transformer windings a) Class 105 insulation systems 1) thermocouple method 2) resistance method b) Class 130 insulation systems 1) thermocouple method 2) resistance method	  65 75  85 95
17	Windings of relays, coils, buzzers, and the like a) Class 105 insulation systems 1) thermocouple method 2) resistance method b) Class 130 insulation systems 1) thermocouple method 2) resistance method	  65 85  85 105

<sup>a</sup> These limitations do not apply to classes of fuses that have been investigated and found to be acceptable for use at higher temperatures.

<sup>b</sup> At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature measured by means of a thermocouple may be more than the maximum acceptable temperature specified in this table, provided the temperature as measured by the resistance method is not more than that specified. The temperature measured by means of a thermocouple may be more than the specified value by

Reference item	Temperature rise, °C – thermocouple method
5(a)	15
11(a)	5
13(a)	20
14(a)	10

<sup>c</sup> For an automatic clothes washer or an automatic combination washer-dryer, the maximum acceptable temperature rises may be more than the values specified in this table for short intervals during the cycle, provided analysis indicates that the insulation systems will not be adversely affected by the higher temperature (see Clause 11.5).

<sup>d</sup> This is the diameter measured in the plane of the lamination of the circle circumscribing the stator frame, excluding lugs, fins, boxes, and the like, used solely for motor mounting, cooling, assembly, or connection.

<sup>e</sup> Phenolic composition rubber and thermoplastic insulation that have been investigated and found acceptable for use at higher temperatures may be used at those temperatures.

<sup>f</sup> A rubber-insulated conductor within a motor, a rubber-insulated motor lead, and a rubber-insulated conductor of a flexible cord entering a motor may be subjected to a higher temperature if the conductor is provided with sleeving or a braid that has been investigated and found acceptable for use at the higher temperature. This does not apply to thermoplastic-insulated wires or cords.

<sup>g</sup> For an electrolytic capacitor that is physically integral with or attached to a motor, the maximum acceptable temperature rise on insulating material integral with the capacitor enclosure may be not more than 65°C.

<sup>h</sup> A capacitor that operates at a temperature rise of more than 65°C may be evaluated on the basis of its marked temperature limit.



**Table 4 – Maximum rating or setting of overcurrent-protective device  
(See Clause 24.7.4.)**

Type of motor	Maximum ampere rating of device as a percentage of motor full-load current rating
Motor with marked service factor of 1.15 or more, or with marked temperature rise of 40°C or less <sup>a</sup>	125
Any other motor	115
<sup>a</sup> Motor manufacturer's applied marking.	

**Table 5 – Sizes of flat surfaces surrounding connection openings  
(See Clause 25.2.6.)**

Nominal diameter of opening, mm	Corresponding conduit trade size, in	Minimum width of surrounding flat surface, mm
22.23	1/2	3.38
28.17	3/4	3.96
34.93	1	5.03

**Table 6 – Clothes dryer connection opening sizes  
(See Clauses 25.2.8 and 25.3.5.)**

Rating, W		Nominal diameter of connection opening, <sup>a</sup> mm
120/240 V, 3-wire	120/208 V, 3-wire	
> 0 ≤ 7,200	> 0 ≤ 6,240	28.17
> 7,200 ≤ 9,600	> 6,240 ≤ 8,320	34.93
> 9,600 ≤ 12,000	> 8,320 ≤ 10,400	44.04
<sup>a</sup> Tolerance of opening diameter +0.79 mm, -0.38 mm.		

**Table 7 – Minimum acceptable size of bonding conductor on an appliance intended to be permanently connected to the power supply  
(See Clause 27.3.9.)**

Rating of branch-circuit overcurrent device to which appliance will be connected, A	Size of bonding conductor, AWG (mm <sup>2</sup> ) <sup>a</sup>	
	Copper wire	Aluminum wire
15	14 (2.1)	12 (3.3)
20	12 (3.3)	10 (5.3)
30	10 (5.3)	8 (8.4)
40	10 (5.3)	8 (8.4)
60	10 (5.3)	8 (8.4)

<sup>a</sup> Or equivalent cross-sectional area.

**Table 8 – Duration of overcurrent test  
(See Clauses 27.3.11 and 27.3.12.)**

Rating or setting of branch-circuit overcurrent- protective device, A	Test time, min
≤ 30	4
> 30 ≤ 60	6
> 60 ≤ 100	8
> 100 ≤ 200	10

**Table 9 – Minimum spacings**  
**(See Clauses 29.1, 29.3, 29.5, 32.2, 32.5.1, 32.6.1, 32.7.1 and 32.11.)**

Spacing involved	Spacings, mm			
	≤ 300 V		> 300 ≤ 600 V	
	Through air	Over surface	Through air	Over surface
a) At field wiring terminals <sup>a</sup>				
1) between current-carrying parts of opposite polarity, and between current-carrying parts and non-current-carrying metal parts other than the enclosure	6.3	9.5	9.5	12.5
2) between current-carrying parts and the enclosure	12.5	12.5	12.5	12.5
b) At points other than field wiring terminals and closed-in points				
1) between current-carrying parts of opposite polarity, and between current-carrying parts and non-current-carrying metal parts other than enclosures	1.6 <sup>b</sup>	1.6 <sup>b</sup>	6.3	6.3
2) between current-carrying parts and the enclosure	6.3	6.3	12.5	12.5
3) between open-coil heating elements and the heater enclosure under any test condition	6.3		12.5	
c) At closed-in points, such as screw-and-washer construction of an insulated terminal mounted in metal between current-carrying parts and non-current-carrying metal parts	1.6	1.6	2.4	2.4
<sup>a</sup> These spacings do not apply to connecting straps or buses extending away from wiring terminals. Such spacings are investigated under the requirements of (b) of this Table. <sup>b</sup> At open-coil heating element insulators, the spacings through air and over the surface from the heating element to non-current-carrying metal parts shall be not less than 3.2 mm.				

**Table 10 – Polymeric materials test summary  
(See Clause 32.1.3.)**

Test No.	Test
1	Mould stress-relief test (7 h), Clause 32.2.
2	Horizontal burning-rate test, Clause 32.3.
3	Flammability test, Clause 32.4.
4	6.8 J impact test, Clause 32.5.
5	Static load test, Clause 32.6.
6	56.7 J impact test, Clause 32.7.
7	Thermal cycling test, Clause 32.8.
8	Crush resistance test, Clause 32.9.
9	Hot-wire-ignition test, Clause 32.10.
10	Thermal ageing test, Clause 32.11.
11	Volume resistivity test, Clause 32.12.
12	Enclosure flammability – large mass consideration, Clause 32.13.
13	Abnormal operation test on enclosures, Clause 32.14.
14	Abnormal operation test on functional polymeric parts, Clause 32.15.
15	High-current arc-ignition test, Clause 32.16.

**Table 11 – Tests on a polymeric part  
(See Clause 32.1.3.)**

Group <sup>a</sup>	Description	Applicable test number <sup>b</sup>
1	A decorative part	2, 12 <sup>c,d</sup>
2	A functional polymeric part subjected to a temperature of not more than 65°C and not subjected to impact	1, 2, 12 <sup>c,d</sup> , 14
3	A functional polymeric part subjected to a temperature of not more than 65°C and subjected to impact	1, 2, 4, 5 <sup>e</sup> , 6 <sup>e</sup> , 12 <sup>c,d</sup> , 14
4	A functional polymeric part subjected to a temperature of more than 65°C and not subjected to impact	1, 2, 10 <sup>h</sup> , 12 <sup>c,d</sup> , 14
5	A functional polymeric part subjected to a temperature of more than 65°C and subjected to impact	1, 2, 4, 5 <sup>e</sup> , 6 <sup>e</sup> , 10 <sup>h</sup> , 12 <sup>c,d</sup> , 14
6	A part serving as an enclosure or supplementary enclosure and subjected to a temperature of not more than 65°C	1, 3 <sup>f</sup> , 4, 5 <sup>e</sup> , 6 <sup>e</sup> , 8 <sup>c</sup> , 9, 12 <sup>c,d</sup> , 13
7	A part serving as an enclosure or supplementary enclosure and subjected to a temperature of more than 65°C	1, 3 <sup>f</sup> , 4, 5 <sup>e</sup> , 6 <sup>e</sup> , 8 <sup>c</sup> , 9, 10 <sup>h</sup> , 12 <sup>c,d</sup> , 13
8	A part spaced less than 12.7 mm through air or over surface from an uninsulated current-carrying part	11, 15 <sup>g</sup>
9	A part located in the air stream	2 <sup>i</sup>
<sup>a</sup> If a polymeric part falls into more than one test group, separate samples shall be subjected to the tests required for each group. <sup>b</sup> These requirements do not fully cover a plated plastic part if loss of bond strength between the plastic substrate and the metal coating may result in a reduction of electrical spacings, reduction in mechanical strength, or reduction in resistance to flammability. A plated plastic part shall be the subject of a separate investigation. <sup>c</sup> These tests do not apply to an appliance readily movable from one place to another. <sup>d</sup> This test shall be conducted only on an external part having a dimension greater than 1.83 m or a projected surface area greater than 0.93 m <sup>2</sup> . <sup>e</sup> This test may be waived for a console. <sup>f</sup> An enclosure provided with a liner of vulcanized fibre, metal foil, or other material intended to reduce the flammability of the enclosure shall be tested with the liner in place, and the flame shall be applied to the liner. <sup>g</sup> Additional consideration shall be given to an appliance protected by an overcurrent device rated more than 30 A. <sup>h</sup> Material used within its temperature index based on historical data or a long-term thermal ageing programme need not be subjected to Test No. 10. <sup>i</sup> This test does not apply to a dryer drum seal or door gasket.		

**Table 12 – Temperatures for oven conditioning  
(See Clause 32.11.2.)**

Maximum operating temperature of polymeric enclosure part, °C	Oven temperature, °C
> 65 ° 75	85
> 75 ° 85	95
> 85 ° 95	105
> 95	<sup>a</sup>

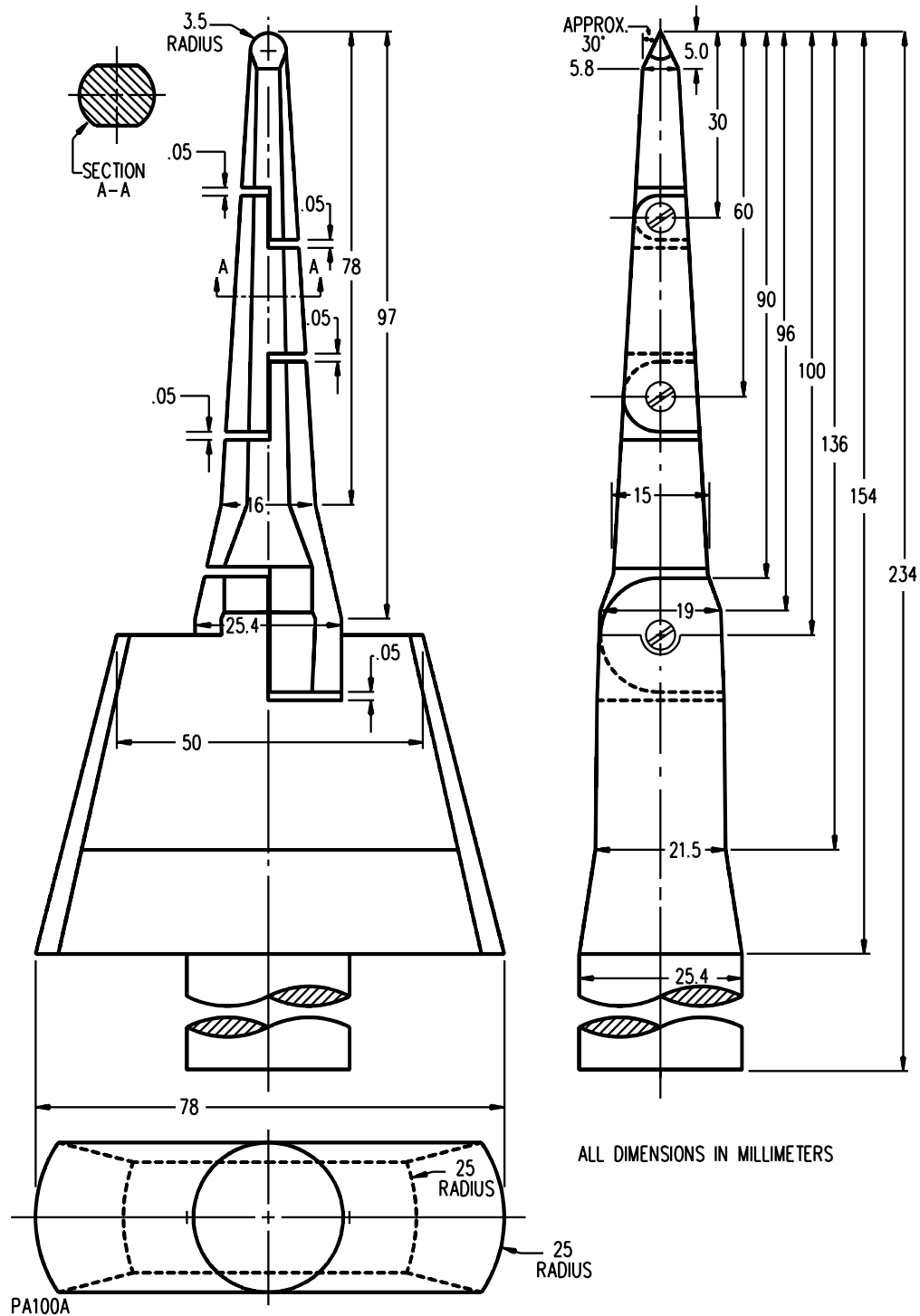
<sup>a</sup> A polymeric part subjected to a temperature higher than 95°C shall have a temperature index, based on historical data or a long-term thermal-ageing programme, that indicates its acceptability for use at the temperature involved. This part shall be the subject of a separate investigation.

**Table 13 – Production line test conditions  
(See Clauses 33.3.2 and 33.3.5.)**

Appliance rating, V	Condition A		Condition B	
	Potential, V	Time, s	Potential, V	Time, s
≤ 250	1000	60	1200	1
> 250 ≤ 600	1000 + 2V	60	1200 + 2.4V	1

V = maximum marked voltage.

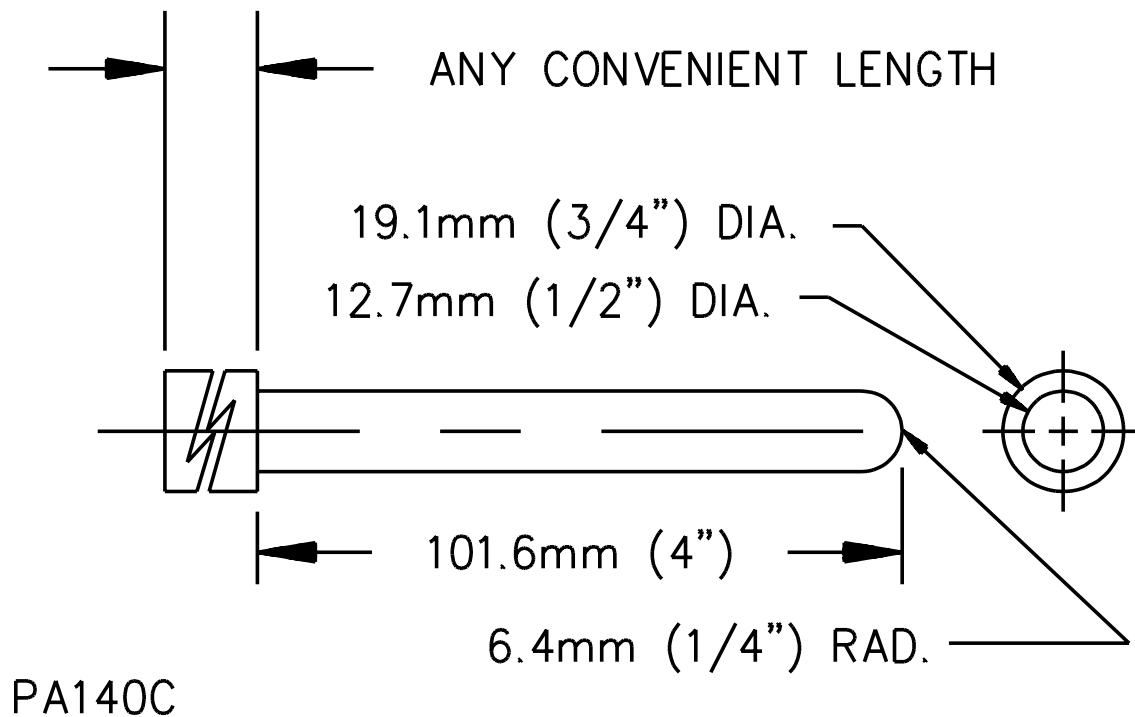
Figure 1 – Articulated probe with web stop  
(See Clauses 8.1 and 8.3.)



Dimensions in mm

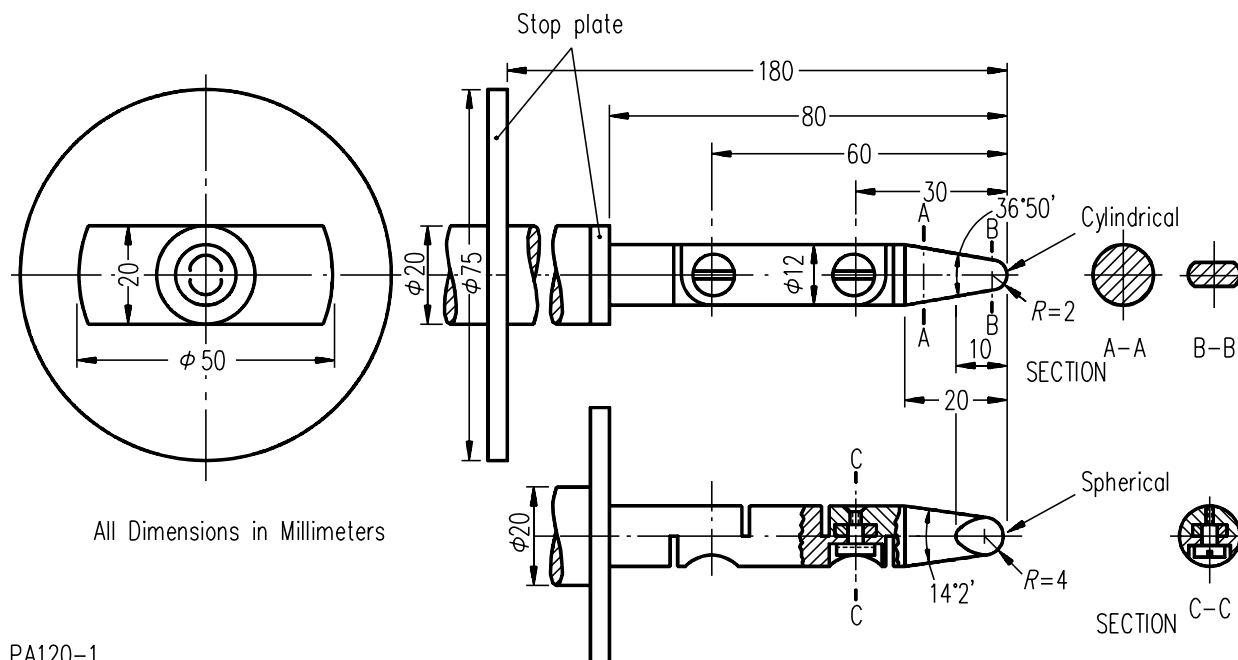
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Figure 2 – Probe for film-coated wire  
(See Clauses 8.2 and 8.3.)





**Figure 3 – IEC accessibility probe with stop plate**  
(See Clauses 8.2 and 8.3.)



Dimensions in mm

Material: metal, except where otherwise specified

Linear: dimensions in mm

Tolerances on dimensions without specific tolerance:

on angles: 0/-10'

on linear dimensions:

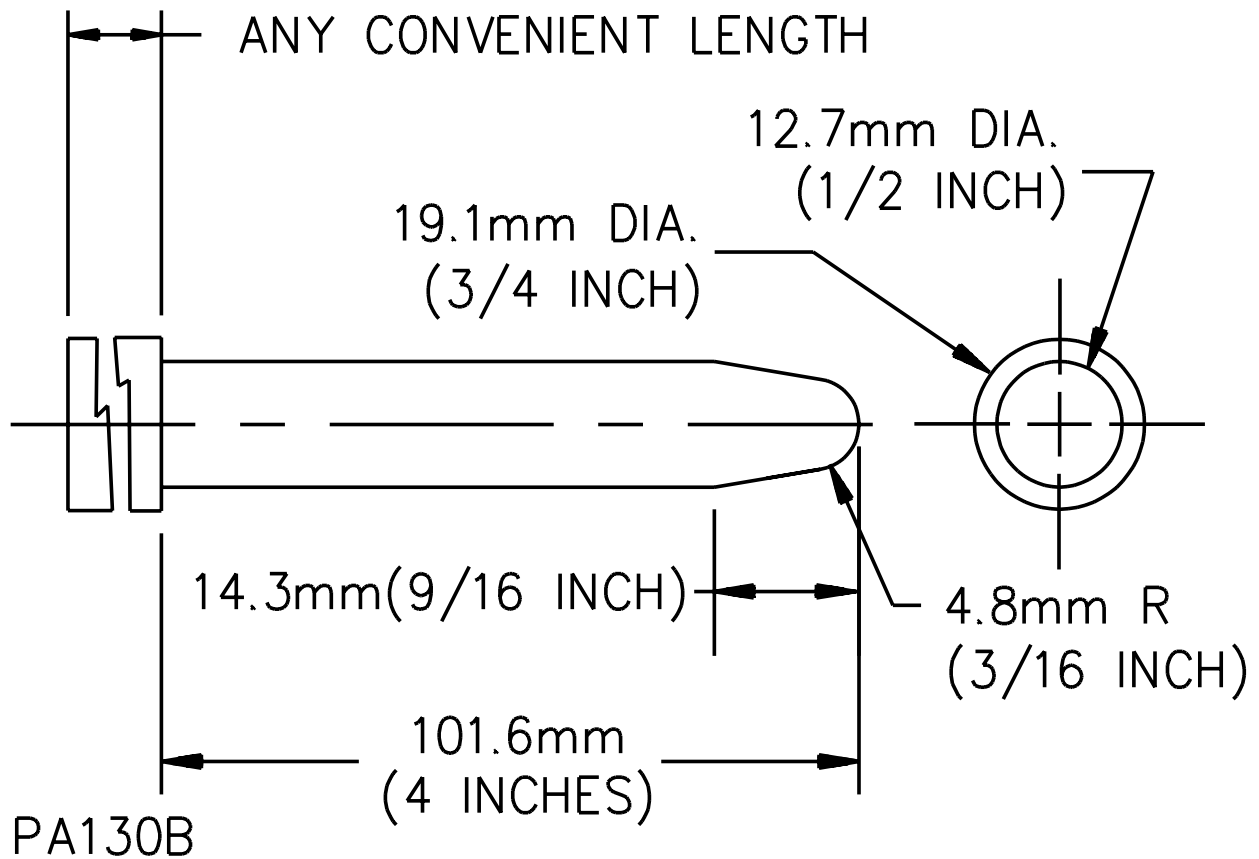
up to 25 mm: 0/0,05

over 25 mm:  $\pm 0,2$

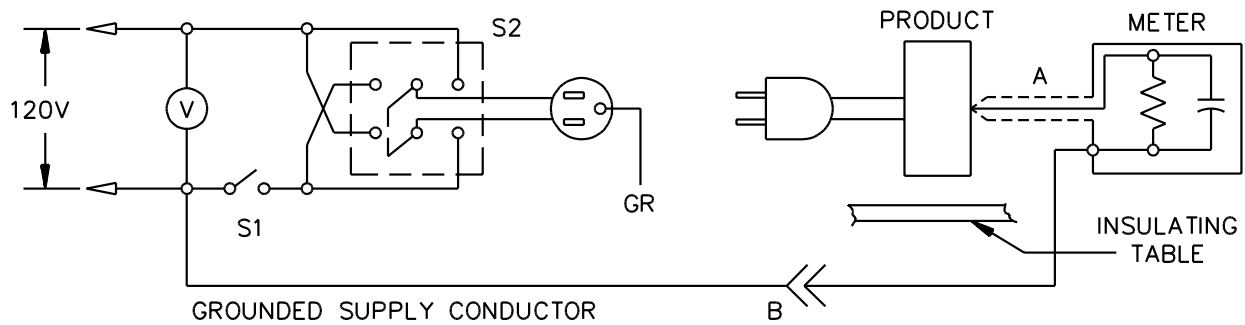
Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0 to +10° tolerance.

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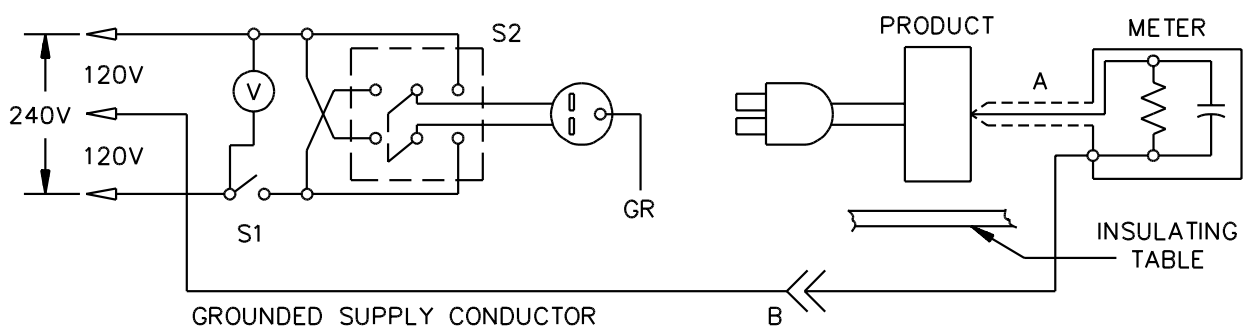
Figure 4 – Probe for uninsulated current-carrying parts  
(See Clauses 8.2 and 8.3.)



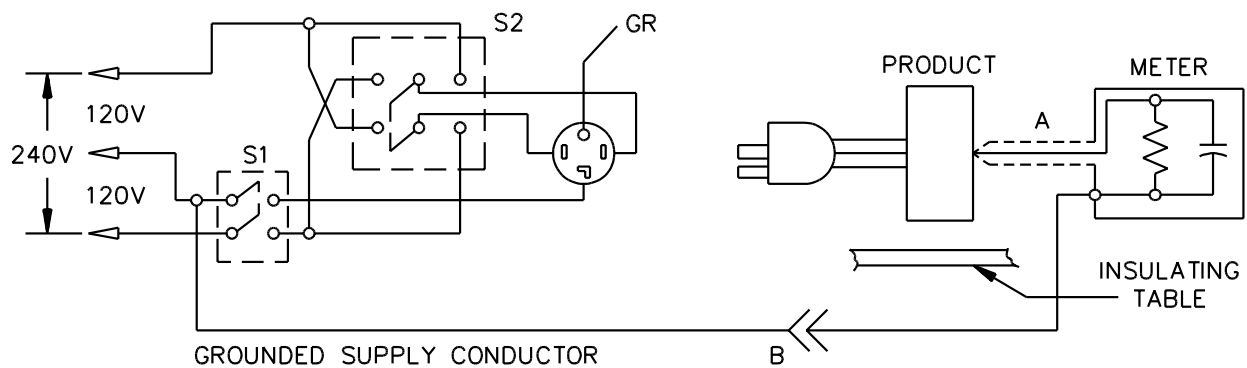
**Figure 5 – Leakage current measurement circuits**  
(See Clauses 13.4 and 13.6.)



Product intended for connection to a 120-volt power supply, as illustrated above.



Product intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.



Product intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.

LC300J

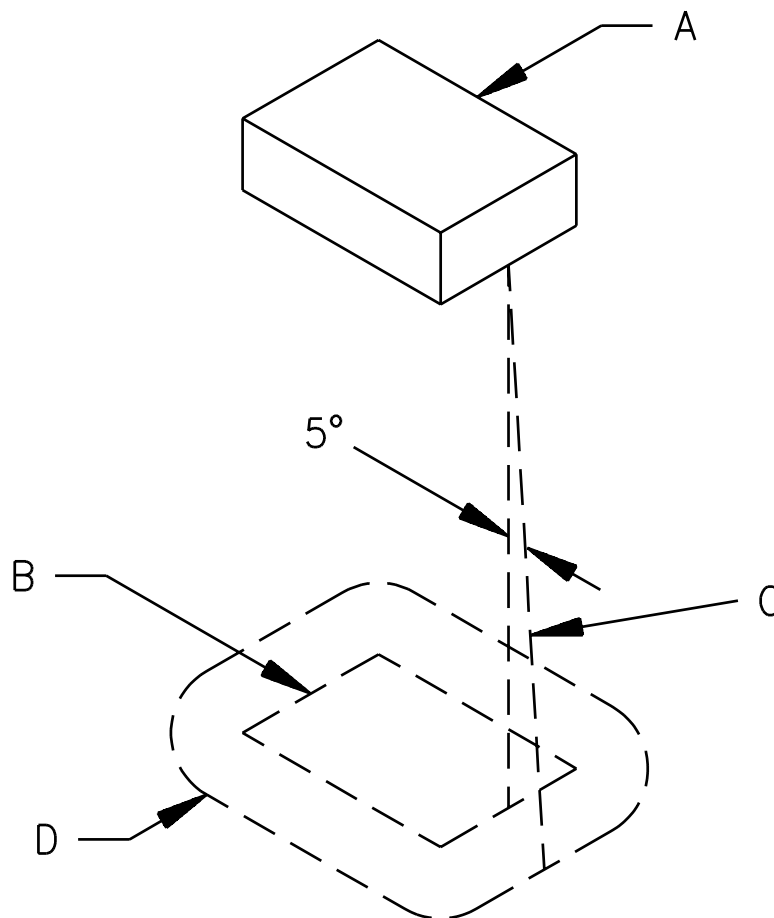
**NOTES –**

A Probe with shielded lead.

B Separated and used as clip when measuring currents from one part of appliance to another.

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**Figure 6 – Location and extent of barrier  
(See Clause 22.5.9)**



EB120A

**NOTES –**

A Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded, and will consist of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent.

B Projection of outline of component on horizontal plane.

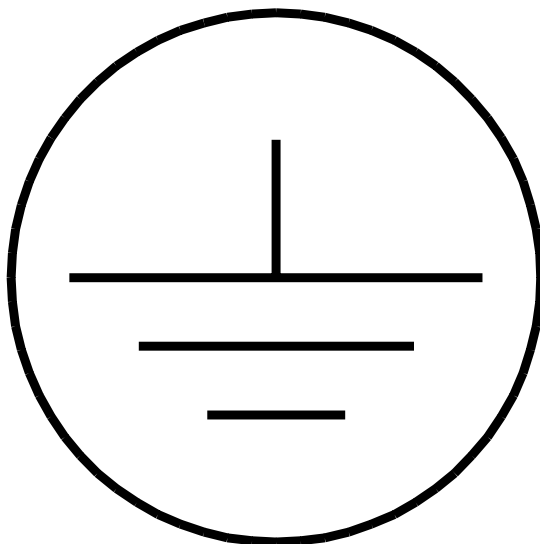
C Inclined line that traces out minimum area of barrier. When moving, the line is always:

- 1) tangent to the component;
- 2) 5° from the vertical; and
- 3) so oriented that the area traced out on a horizontal plane is maximum.

D Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

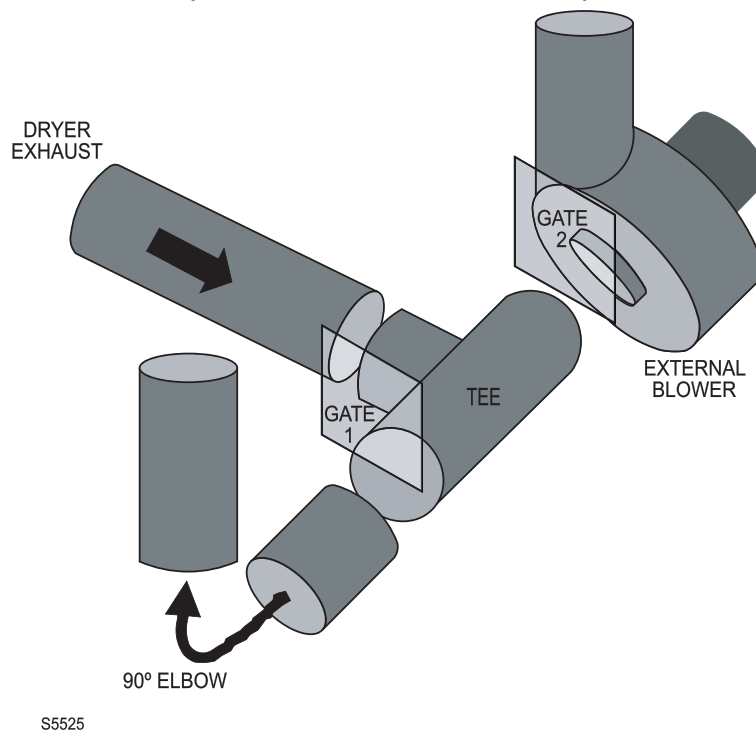
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Figure 7 – Grounding Symbol  
(See Clause 7.1.2.36A)



IEC417, Symbol 5019

**Figure 8 – Sample configuration for fire containment tests  
(See Clauses 19.6.9 and 19.7.9.)**



## Appendix A

### Standards for Components

#### A1 Component Standards

A1.1 The CSA and UL Standards listed below are used for the evaluation of components and features of products covered by this standard. Components shall comply with all the applicable CSA and UL component standards. These standards shall be considered to refer to the latest edition and all revisions published to that edition.

#### CSA Standards

C22.1-94,  
*Canadian Electrical Code, Part I;*

CAN/CSA-C22.2 No. 0-M91,  
*General Requirements – Canadian Electrical Code, Part II;*

C22.2 No. 0.4-M1982 (R1993),  
*Bonding and Grounding of Electrical Equipment (Protective Grounding);*

C22.2 No. 0.5-1982 (R1992),  
*Threaded Conduit Entries;*

C22.2 No. 8-M1986 (R1992),  
*Electromagnetic Interference (EMI) Filters;*

C22.2 No. 13-1962 (R1992),  
*Transformers for Luminous-Tube Signs, Oil- or Gas-Burner Ignition Equipment, Cold-Cathode Interior Lighting;*

C22.2 No. 14-95,  
*Industrial Control Equipment;*

C22.2 No. 24-93,  
*Temperature-Indicating and -Regulating Equipment;*

C22.2 No. 42-M1984,  
*General Use Receptacles, Attachment Plugs, and Similar Wiring Devices;*

C22.2 No. 43-M1984 (R1992),  
*Lampholders;*

C22.2 No. 55-M1986 (R1992),  
*Special Use Switches;*

C22.2 No. 66-1988,  
*Specialty Transformers;*

C22.2 No. 74-96,  
*Equipment for Use With Electric Discharge Lamps;*

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C22.2 No. 100-95,  
*Motors and Generators;*

C22.2 No. 111-M1986 (R1992),  
*General Use Switches;*

CAN3-C235-83 (R1996),  
*Preferred Voltage Levels for AC Systems, 0 to 50 000 V.*

## **UL Standards**

*Armored Cable –*  
UL 4

*Attachment Plugs and Receptacles –*  
UL 498

*Ballasts, Fluorescent-Lamp –*  
UL 935

*Building Materials, Test for Surface Burning Characteristics of –*  
UL 723

*Cables, Nonmetallic-Sheathed –*  
UL 719

*Capacitors –*  
UL 810

*Capacitors, Across-the-Line, Antenna-Coupling and Line-by-Pass, for Radio- and Television-Type Appliances –*  
UL 1414

*Circuit Breakers, Molded-Case, Molded-Case Switches and Circuit-Breaker Enclosures –*  
UL 489

*Conduit, Flexible Metal –*  
UL 1

*Conduit, Liquid-Tight Flexible Steel –*  
UL 360

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

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

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

*Fuseholders –*  
UL 512

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*Fuses for Supplementary Overcurrent Protection –*  
UL 198G

*Fuses, Plug –*  
UL 198F

*Heating Elements, Sheathed –*  
UL 1030

*Industrial Control Equipment –*  
UL 508

*Lampholders, Edison-Base –*  
UL 496

*Lampholders, Starters, and Starter Holders for Fluorescent Lamps –*  
UL 542

*Marking and Labeling Systems –*  
UL 969

*Motors, Electric –*  
UL 1004

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

*Outlet Boxes, Metallic –*  
UL 514A

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

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

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

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

*Polymeric Materials – Fabricated Parts –*  
UL 746D

*Printed-Wiring Boards –*  
UL 796

*Protectors, Thermal, for Electric Motors –*  
UL 547

*Safety-Related Controls Employing Solid-State Devices, Tests for –*  
UL 991

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*Signal Appliances, Audible –*  
UL 464

*Switches, Clock-Operated –*  
UL 917

*Switches, Snap, General-Use –*  
UL 20

*Switches, Special-Use –*  
UL 1054

*Tape, Insulating –*  
UL 510

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

*Terminal Blocks –*  
UL 1059

*Terminals, Electrical, Quick-Connect –*  
UL 310

*Thermal Cutoffs for Use in Electrical Appliances and Components –*  
UL 1020

*Time-Indicating and -Recording Appliances –*  
UL 863

*Transformers, Class 2 and Class 3 –*  
UL 1585

*Transformers, Specialty –*  
UL 506

*Tubing, Electrical Metallic –*  
UL 797

*Tubing, Extruded Insulating –*  
UL 224

*Valves, Electrically-Operated –*  
UL 429

*Wire Connectors and Soldering Lugs for Use With Copper Conductors –*  
UL 486A

*Wire Connectors for Use With Aluminum Conductors –*  
UL 486B

*Wires and Cables, Thermoplastic-Insulated –*  
UL 83

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## Appendix B

### French Translations

7.1.1.4 «ATTENTION», «AVERTISSEMENT» ou «DANGER»

7.1.2.3 «Si cet appareil est raccordé à un circuit protégé par des fusibles, utiliser des fusibles à action différée.»

7.1.2.5

- a) «Utiliser seulement des conducteurs en cuivre»
- b) «Utiliser seulement des conducteurs en aluminium»
- c) «Utiliser des conducteurs en cuivre ou en aluminium» ou «Utiliser des conducteurs en cuivre, en aluminium cuivré, ou en aluminium»
- d) «Utiliser des conducteurs en aluminium cuivré ou en cuivre»

7.1.2.7 «UTILISER DES CONDUCTEURS D'ALIMENTATION D'UNE TEMPÉRATURE NOMINALE DE \_\_\_\_\_ °C (\_\_\_\_\_ °F).»

7.1.2.9

- a) «AVERTISSEMENT. Pour prévenir les risques d'incendie, ne pas utiliser de chaleur pour le séchage des articles contenant du caoutchouc mousse ou d'autres matériaux similaires texturés caoutchouteux»; ou
- b) «AVERTISSEMENT. Pour prévenir les risques d'incendie, ne pas faire sécher des articles contenant du caoutchouc mousse ou d'autres matériaux similaires texturés caoutchouteux.»

7.1.2.13

- a) «ATTENTION. Risque d'incendie. Une sècheuse produit la charpie combustible. La sècheuse doit évacuer à l'extérieur. Voir la notice d'installation.»
- b) «ATTENTION. Risque d'incendie. Une sècheuse produit de la charpie combustible. La sècheuse doit évacuer à l'extérieur. Examiner régulièrement l'ouverture de l'orifice d'évacuation d'air et enlever toute charpie accumulée à l'orifice et autour.»

7.1.2.14 «Section qui assure le séchage d'une laveuse-sècheuse», «sècheuse», «appareil».

7.1.2.16 «AVERTISSEMENT. Certaines pièces internes ne sont pas mises à la terre intentionnellement et peuvent présenter un risque de choc électrique pendant l'entretien seulement. Personnel d'entretien: Ne pas toucher les pièces suivantes lorsque l'appareil est sous tension: (liste des pièces non mises à la terre).»

7.1.2.18 «AVERTISSEMENT. Pour réduire les risques de choc électrique, déconnecter cet appareil avant de procéder à tout entretien autre que le nettoyage du filtre à charpie. Placer les commandes à la position ARRÊT ne coupe pas l'alimentation.»

7.1.2.22 «Connecter à une dérivation individuelle»

7.1.2.25 «AVERTISSEMENT. Pour réduire les risques d'incendie, fixer cet appareil sur un plancher en béton sans revêtement.»

7.1.2.26 «AVERTISSEMENT. NE PAS BRANCHER SUR RÉSEAU DE 120/240 V»

7.1.2.34 «AVERTISSEMENT. Pour réduire les risques de choc électrique ou d'incendie, ne pas utiliser un cordon d'alimentation souple avec cet appareil.»

7.1.2.35 «DOUBLE ISOLATION – pour l'entretien, n'utiliser que des pièces de rechange identiques.», «ISOLATION DOUBLE».

7.1.2.36 «DOUBLE ISOLATION»

7.1.2.36A «TERRE» ou «TE»

7.1.2.37.2 «AVERTISSEMENT. Risque de choc électrique, appareil mis à la terre au conducteur neutre par un lien. La mise à la terre par le conducteur neutre est interdite dans le cas 1) de nouvelles dérivations; 2) de maisons mobiles; et 3) de véhicules de camping; et 4) là où les codes locaux interdisent la mise à la terre par le conducteur neutre. Si la mise à la terre par le conducteur neutre est interdite 1) débrancher le lien avec le neutre, 2) utiliser la borne de mise à la terre ou le conducteur de raccordement pour mettre l'appareil à la terre et 3) raccorder la borne neutre ou le conducteur de raccordement au neutre de la dérivation de la façon habituelle (si l'appareil doit être branché au moyen d'un cordon amovible, utiliser un conducteur quadrifilaire).»

7.1.2.37.3 «AVERTISSEMENT. Risque de choc électrique, appareil mis à la terre au conducteur neutre par un lien. La mise à la terre par le conducteur neutre est interdite dans le cas 1) de nouvelles dérivations, 2) de maisons mobiles et 3) de véhicules de camping; et 4) là où les codes locaux interdisent la mise à la terre par le conducteur neutre. Si la mise à la terre par le conducteur neutre est interdite, remplacer le conducteur ou le câble trifilaire par un conducteur ou câble quadrifilaire. Voir les instructions du fabricant.»

7.2.1.4 «AVERTISSEMENT»

7.2.1.5 «AVERTISSEMENT»

7.2.2.2 «IMPORTANTES MESURES DE SÉCURITÉ» et «CONSERVER CES INSTRUCTIONS»

7.2.2.4

### IMPORTANTES MESURES DE SÉCURITÉ

AVERTISSEMENT. Pour réduire les risques d'incendie, de choc électrique ou de blessure quand on utilise l'appareil, prendre les précautions élémentaires et:

- 1) Lire toutes les instructions avant d'utiliser l'appareil.

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- 2) Ne pas faire sécher des articles qui ont été nettoyés ou lavés avec de l'essence, des solvants pour nettoyage à sec ou d'autres substances inflammables ou explosives, ou que l'on a fait tremper dans ces produits. Ces substances dégagent des vapeurs qui peuvent s'enflammer ou exploser.
- 3) Ne pas permettre aux enfants de jouer sur ou dans l'appareil. Surveiller étroitement les enfants lorsqu'ils se trouvent près de l'appareil qui fonctionne.
- 4) Avant de mettre l'appareil hors service ou de le jeter, retirer la porte.
- 5) Ne pas mettre la main dans l'appareil lorsque le tambour bouge.
- 6) Ne pas installer ou placer cet appareil dans un endroit où il sera exposé aux intempéries.
- 7) Ne pas trafiquer les commandes.
- 8) Ne pas réparer ou remplacer les pièces de l'appareil ou procéder à l'entretien de celui-ci sauf si les instructions visant l'entretien et les réparations qui doivent être effectués par l'utilisateur le spécifient, si vous comprenez bien ces instructions et si vous possédez les connaissances nécessaires.
- 9) Ne pas utiliser d'assouplissant ou de produits antistatiques sauf si les fabricants de ces produits le recommandent.
- 10) Ne pas utiliser de chaleur pour le séchage des articles contenant du caoutchouc mousse ou d'autres matériaux similaires texturés caoutchouteux.
- 11) Nettoyer le filtre à charpie avant ou après chaque utilisation.
- 12) La zone autour de l'évent doit être exempte d'accumulations de charpie, de poussière et de saleté.
- 13) L'intérieur de l'appareil et du conduit d'évacuation devrait être nettoyé régulièrement par un technicien qualifié.
- 14) Ne pas mettre de vêtements exposés aux huiles de cuisson dans la sècheuse. L'huile de cuisson pourrait provoquer une réaction chimique entraînant l'inflammation des vêtements dans la sècheuse.

### CONSERVER CES INSTRUCTIONS

#### 7.2.2.5

- a) Appareils à cordon mis à la terre

#### MISE À LA TERRE

Cet appareil doit être mis à la terre. En cas de mauvais fonctionnement ou de bris de l'appareil, la mise à la terre réduira les risques de choc électrique en offrant un parcours de moindre résistance au courant électrique. Cet appareil est pourvu d'un cordon à conducteur de terre et d'une fiche de mise à la terre. Brancher la fiche dans une prise installée adéquatement et mise à terre conformément à tous les codes et règlements locaux.

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AVERTISSEMENT. Une mauvaise connexion du conducteur de terre peut présenter des risques de choc électrique. Consulter un électricien ou un technicien qualifiés si vous n'êtes pas certain que l'appareil soit mis à terre adéquatement.

Ne pas modifier la fiche de l'appareil. Si elle ne pénètre pas bien dans la prise, faire installer une prise adéquate par un électricien qualifié.

b) Appareils raccordés à demeure

#### MISE À LA TERRE

Cet appareil doit être relié à une canalisation électrique métallique fixe ou la dérivation doit comporter un conducteur de terre connecté à la borne au fil de terre de l'appareil.

c) Appareils à cordon, à double isolation

#### ENTRETIEN DES APPAREILS À DOUBLE ISOLATION

Dans les appareils à double isolation, deux systèmes d'isolation remplacent la mise à la terre. Ces appareils ne sont pourvus d'aucune borne de mise à la terre et aucune borne de terre ne doit y être ajoutée. L'entretien de ces appareils demande extrêmement de soins et une très bonne connaissance du système, et ne devrait être effectué que par des techniciens qualifiés. Les pièces de rechange des appareils à double isolation doivent être identiques aux pièces à remplacer. Ces appareils portent le marquage «DOUBLE ISOLATION». Le symbole représentant la double isolation, soit un carré dans un carré, peut aussi figurer sur ces appareils.

#### 7.3.1 «INSTALLATION»

#### 7.3.2

b) «AVERTISSEMENT»

c) «AVERTISSEMENT. Risque d'incendie.»

«Les sècheuses doivent être installées par un installateur qualifié.»

«Les sècheuses doivent être installées selon les instructions du fabricant et les codes locaux.»

«Ne pas raccorder de matériaux d'évacuation en plastique à une sècheuse. Si une gaine métallique flexible (de type pellicule métallique) est installée, elle doit être d'un type recommandé par le fabricant pour utilisation avec la sècheuse. Les matériaux d'évacuation en plastique ont tendance à s'affaisser, et ils sont faciles à écraser et retiennent la charpie. Ces conditions obstrueront la circulation de l'air et augmenteront le risque d'incendie.»

«Afin de réduire le risque de blessure grave ou de mort, suivre toutes les instructions d'installation.»

«Conserver ces instructions.»

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7.4.1 «UTILISATION»

7.4.2 «AVERTISSEMENT. Pour réduire les risques d'incendie, de choc électrique et de blessure, lire les IMPORTANTES MESURES DE SÉCURITÉ avant d'utiliser cet appareil.»

7.5.2 «ENTRETIEN EFFECTUÉ PAR L'UTILISATEUR»

7.6.2 «INSTRUCTIONS D'INSTALLATION DE L'APPAREIL EN POSITION DEBOUT OU AU MUR»

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**Superseded requirements for  
the Standard for  
Electric Clothes Dryers**

**UL 2158, Second Edition**

The requirements shown are the current requirements that have been superseded by requirements in revisions issued for this Standard. To retain the current requirements, do not discard the following requirements until the future effective dates are reached.

7.3.2 The installation instructions shall include explicit instructions specifying:

- a) how the appliance should be exhausted;
- b) that the appliance should not be exhausted into a chimney, a wall, a ceiling, or a concealed space of a building; and
- c) that only rigid or flexible metal duct should be used for exhausting, unless the appliance has been investigated for use with nonmetallic duct or the duct has been investigated and found acceptable for use with clothes dryers.

*Exception: This requirement does not apply to an appliance intended to condense lint-bearing moisture vapour and discharge the condensate into a plumbing system.*

**Note:** *Exhausting refers to removal of moist air from the drying compartment.*

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