

Motor-operated appliances (household and commercial)



C22.2 No. 68-09

Motor-operated appliances (household and commercial)

1 Scope

1.1

This Standard applies to motor-operated appliances* intended for use with nominal system voltages of 600 V and less, except that where appliances are driven by universal-type motors or electromagnetic mechanisms, the scope is limited to appliances rated for use on nominal system voltages of 240 V or less. This Standard applies to appliances designed to be used in accordance with the Rules of the *Canadian Electrical Code, Part I*.

*For convenience, the term “appliance” or “equipment” is used in this Standard.

1.2

This Standard applies to permanently connected and cord-connected appliances for household and commercial use in non-hazardous locations.

Note: *The products covered by this Standard include shaving and massage appliances, hair clippers, sewing machines, automotive servicing equipment, air compressors, car wash equipment, chairs, beds, exercise appliances, paint sprayers, paint rollers, parts cleaners, household trash compactors, food-waste disposers, barbecue motors, hand-held engravers, and similar equipment.*

1.3

This Standard applies to sprayers intended for extensive open spraying of cleaning fluids, paint, insecticides, and similar liquids having a flashpoint higher than 60 °C, but excluding electrostatic sprayers and sprayers for use in spray booths or in other areas where hazardous concentrations of flammable vapours are likely to be present.

1.4

Automotive equipment covered by this Standard, such as wheel aligners, engine timing lights, and analyzers, might or might not have motors.

1.5

Requirements for cord-connected double-insulated appliances are specified in [Clause 8](#).

1.6

This Standard does not include requirements for equipment covered by a specific Standard under the *Canadian Electrical Code, Part II* (e.g., drafting tables, pencil sharpeners).

1.7

In CSA Standards, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; “may” is used to express an option or that which is permissible within the limits of the standard; and “can” is used to express possibility or capability. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and may be written as requirements. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto:

CSA (Canadian Standards Association)

B51-09

Boiler, pressure vessel, and pressure piping code

CAN/CSA-B64 Series-07

Backflow preventers and vacuum breakers

CAN/CSA-B64.1.1-07

Atmospheric vacuum breakers (AVB)

CAN/CSA-B64.1.2-07

Pressure vacuum breakers (PVB)

CAN/CSA-B64.3-07

Dual check valve backflow preventers with atmospheric port (DCAP)

CAN/CSA-B64.4-07

Reduced pressure principle (RP) backflow preventers

CAN/CSA-B64.8-07

Dual check valve backflow preventers with intermediate vent (DuCV)

B140.0-03 (R2008)

Oil-burning equipment: General requirements

C22.1-09

Canadian Electrical Code, Part I

CAN/CSA-C22.2 No. 0-M91 (R2006)

General Requirements — Canadian Electrical Code, Part II

CAN/CSA-C22.2 No. 0.4-04 (R2009)

Bonding of electrical equipment

CAN/CSA-C22.2 No. 0.17-00 (R2009)

Evaluation of properties of polymeric materials

C22.2 No. 8-M1986 (R2008)

Electromagnetic interference (EMI) filters

CAN/CSA-C22.2 No. 14-05

Industrial control equipment

CAN/CSA-C22.2 No. 18.1-04 (R2009)

Metallic outlet boxes

C22.2 No. 18.2-06

Nonmetallic outlet boxes

C22.2 No. 24-93 (R2008)
Temperature-indicating and -regulating equipment

C22.2 No. 36-08
Hairdressing equipment

C22.2 No. 39-M1987 (R2007)
Fuseholder assemblies

C22.2 No. 42-99 (R2004)
General use receptacles, attachment plugs, and similar wiring devices

C22.2 No. 43-08
Lampholders

C22.2 No. 49-06
Flexible cords and cables

C22.2 No. 55-M1986 (R2008)
Special use switches

C22.2 No. 66.1-06
Low voltage transformers — Part 1: General requirements

C22.2 No. 66.2-06
Low voltage transformers — Part 2: General purpose transformers

C22.2 No. 66.3-06
Low voltage transformers — Part 3: Class 2 and Class 3 transformers

C22.2 No. 77-95 (R2004)
Motors with inherent overheating protection

CAN/CSA-C22.2 No. 94.2-07
Enclosures for electrical equipment, environmental considerations

C22.2 No. 100-04 (R2009)
Motors and generators

C22.2 No. 111-00 (R2005)
General-use snap switches

C22.2 No. 127-09
Equipment and lead wires

CAN/CSA-C22.2 No. 144.1-06
Ground-fault circuit-interrupters

C22.2 No. 156-M1987 (R2004)
Solid-state speed controls

CAN/CSA-C22.2 No. 198.1-06
Extruded insulating tubing

C22.2 No. 210-05
Appliance wiring material products

C22.2 No. 213-M1987 (R2008)
Non-incendive electrical equipment for use in Class I, Division 2 hazardous locations

CAN/CSA-C22.2 No. 4248 Series
Fuseholders

CAN/CSA-C22.2 No. 61058-1-09
Switches for appliances — Part 1: General requirements

CAN3-C235-83 (R2006)
Preferred voltage levels for AC systems, 0 to 50 000 V

CAN/CSA-E60730-1-02 (R2007)
Automatic electrical controls for household and similar use — Part 1: General requirements

Z262.1-09
Ice hockey helmets

ASME (The American Society of Mechanical Engineers)
PTC9-1970 (R1997)
Displacement Compressors, Vacuum Pumps and Blowers

ASTM (American Society for Testing and Materials)
D2240-05
Standard Test Method for Rubber Property — Durometer Hardness

3 Definitions

The following definitions shall apply in this Standard:

Attended intermittent-duty household appliance — an appliance intended for infrequent and short-time use in a household and used only while attended.

Note: *Food-waste disposers are not considered attended intermittent-duty household appliances.*

Basic insulation — insulation applied to bare live parts in order to separate them from inaccessible non-current-carrying metal parts or from supplementary insulation, or both.

Combustible liquid — a liquid having a flash point of 38 °C or higher.

Compressor horsepower — the mechanical power required by the compressor air pump shaft to deliver air at a rated pressure and volume flow rate.

Cord-connected equipment — equipment that is connected to the electrical supply by a cord set or by a power-supply cord terminating in a suitable attachment plug.

Double-insulated appliance — an appliance in which double insulation or reinforced insulation, or both, is used throughout, without provision for grounding.

Note: *An appliance constructed with double or reinforced insulation, or both, throughout but that has a three-conductor cord and attachment plug for grounding certain non-current-carrying metal parts is considered to be grounded equipment and not a double-insulated appliance.*

Double insulation — an insulation system that comprises both basic insulation and supplementary insulation, arranged such that they are not simultaneously subjected to the same deteriorating stresses (e.g., electric field, temperature, contaminants) to the same degree.

Flash point — the minimum temperature at which a liquid gives off sufficient vapour to form an ignitable mixture with the air near the surface of the liquid or within the vessel used.

Hand-held equipment — equipment intended to be held in the hand during normal use and whose motor forms an integral part of the equipment.

High-pressure airless sprayer — a spraying system for paint, insecticides, and similar applications, that employs a high-pressure liquid pump connected by a high-pressure liquid hose to a spray gun and that operates at a pressure of 2500 kPa or greater.

High-pressure washer/cleaner — a cleaning-agent (water with or without the addition of a soluble or miscible chemical) spraying system that employs a high-pressure liquid pump connected by a high-pressure liquid hose to a cleaning-agent spray gun and that operates at a pressure of 2500 kPa or greater.

Permanently connected equipment — an appliance or equipment that is not disconnected from the electrical supply by means of an attachment plug.

Pressure-regulating device — a pressure-responsive mechanism designed to automatically limit the operation of the pressure-imposing element at a predetermined pressure.

Pressure-relief device — a pressure-actuated valve or rupture member designed to automatically relieve pressure in excess of its setting or design rupture-pressure.

Pressure-relief valve — a pressure-actuated valve held closed by a spring or other means and designed to automatically relieve pressure in excess of its setting.

Pressure vessel — an unfired vessel used for containing, storing, distributing, transferring, distilling, processing, or otherwise handling any gas, vapour, or liquid under pressure.

Reinforced insulation — an insulation system applied to bare live parts to separate them from accessible or external surfaces, or both.

Note: *The term “insulation system” does not imply that the insulation is one homogeneous piece; rather, it can comprise several layers that cannot be tested separately as supplementary or basic insulation.*

Supplementary insulation — insulation applied in addition to basic insulation in order to prevent contact with inaccessible non-current-carrying metal parts or with basic insulation, or both.

Note: *An enclosure of insulating material can form a part or all of the supplementary insulation.*

4 General requirements

General requirements applicable to this Standard are given in CAN/CSA-C22.2 No. 0.

5 Construction

5.1 General

5.1.1 Components

Electrical components provided as part of appliances and auxiliary electrical equipment shall conform to the particular Standard of the *Canadian Electrical Code, Part II*, covering such components and shall also be suitable for their respective applications.

5.1.2 Stability

Appliances other than hand-held appliances shall meet the requirements of [Clause 6.10](#). As an alternative, the appliance may be provided with a bracket or other device for being secured to a floor or wall so as to achieve the necessary stability, provided that it is marked in accordance with [Clause 7.14](#).

5.1.3 Backflow prevention

5.1.3.1

Appliances having provision for connection to a potable water supply shall comply with [Clause 5.1.3.2](#) or [5.1.3.3](#), as applicable.

5.1.3.2

Appliances incorporating a liquid storage tank whose source is a potable water supply shall have

- an air gap between the water inlet and the maximum water level in the storage tank. The height of the air gap shall be at least three times the diameter of the water supply pipe to the tank and shall be not less than 25 mm. All appliances except those intended for stationary installation shall comply with [Clause 6.14](#);
- a vacuum breaker in compliance with CAN/CSA-B64.1.1 or CAN/CSA-B64.1.2; or
- a backflow preventer in compliance with CAN/CSA-B64.3, CAN/CSA-B64.4, or CAN/CSA-B64.8.

5.1.3.3

Appliances not incorporating a liquid storage tank shall

- be marked as specified in [Clause 7.21](#); or
- comply with [Clause 5.1.3.2](#).

5.2 Enclosures

5.2.1 General

Enclosures of electrical appliances shall be constructed to provide the strength and rigidity necessary to resist the normal abuse to which they might be subjected, as determined by the applicable physical abuse tests of [Clause 6.11](#).

5.2.2 Protection of electrical parts

Electrical parts of appliances, except power supply cords, shall be located or enclosed to provide protection against accidental contact with bare or single-insulated live parts that could present a shock hazard. Parts of outer enclosures that are intended to be removed, without the use of tools, by the user of the appliance (to permit the attachment of accessories, for operating adjustments, etc.) shall not be considered a suitable means of protection against shock hazard unless the supply cord must be removed from the appliance before disassembly. Insulated brush caps do not require additional enclosures.

5.2.3 Supply cord material

5.2.3.1

If supply cord material is used as internal wiring within the enclosure of an appliance, such wiring material shall be excluded when determining compliance with [Clause 5.2](#), provided that

- all conductor connections are contained within a separate enclosure; and
- the supply cord material used is at least equivalent to the power-supply cord material specified in [Table 1](#) for the type of appliance.

5.2.3.2

If the supply cord material used for internal wiring is of the parallel-conductor integral type (e.g., SPT), it shall not be ripped more than 75 mm unless

- (a) the minimum wall thickness of the conductor insulation after ripping is at least 1.37 mm;
- (b) the minimum thickness of the conductor insulation after ripping is at least 0.66 mm and is wholly contained within a separate enclosure; or
- (c) the minimum thickness of the conductor insulation after ripping is at least 0.66 mm and the conductor is enclosed in supplementary insulating tubing that meets the requirements of CAN/CSA-C22.2 No. 198.1.

5.2.4 Liquid containers

Appliances having a liquid container that can be overfilled in normal use shall comply with the overfill test specified in [Clause 6.9.10.1](#), and portable units having liquid containers that can tip over and spill the liquid shall comply with the tip-over test specified in [Clause 6.9.10.2](#).

5.2.5 Nonmetallic enclosures

Nonmetallic enclosures for live parts shall

- (a) comply with the oven conditioning requirements of [Clause 6.21](#);
- (b) not be in contact with incandescent lamps;
- (c) if part of the insulation system, be moisture-absorption resistant as determined by the moisture-absorption test of [Clause 6.18](#); and
- (d) comply with the flame test requirements of [Clauses 5.2.6 to 5.2.8](#), as applicable.

Enclosures of switches and controls that comply with [Clause 5.11.1](#) shall be exempt from this requirement.

5.2.6 Flammability of enclosures of unattended appliances

5.2.6.1

Appliances that are unattended in normal use (e.g., aquarium pumps), or that have power-consuming components (e.g., transformers, semiconductors, relays, motor windings, but excluding pilot lights, supply conductors, and switches) that remain energized when not operated, shall comply with

- (a) one of the following tests in CAN/CSA-C22.2 No. 0.17:
 - (i) flame test A in Clause D1;
 - (ii) 5VA; or
 - (iii) the flame retardant coatings test; or
- (b) the requirements of [Clause 5.2.6.2](#) of this Standard.

5.2.6.2

Enclosures of appliances specified in [Clause 5.2.6.1](#) shall comply with the high-current arc ignition test and the horizontal burning (HB) test in CAN/CSA-C22.2 No. 0.17.

Components shall comply with the following, as applicable:

- (a) all components: [Clause 6.7.3](#);
- (b) speed controls: [Clause 6.13](#);
- (c) transformers, if provided: CSA C22.2 No. 66.3; and
- (d) motors that can remain energized while the appliance is unattended shall be thermally protected in compliance with CSA C22.2 No. 77.

5.2.7 Flammability of enclosures of attended appliances

Except as otherwise specified in [Clauses 5.2.6.2](#) and [5.2.8](#), appliances that are attended in normal use shall comply with Flame test D in CAN/CSA-C22.2 No. 0.17.

5.2.8 Flammability of enclosures

Enclosures of appliances that have momentary contact switches or are intended to be hand-held during operation shall comply with the horizontal burning (HB) test in CAN/CSA-C22.2 No. 0.17.

For appliances containing open components without enclosures or component enclosures not complying with the applicable Standard of the *Canadian Electrical Code, Part II*, the appliance enclosure shall comply with the high-current arc ignition test in CAN/CSA-C22.2 No. 0.17.

5.2.9 Enclosures of moving parts

Except for parts that are necessarily exposed during normal operation, moving parts that can pose a hazard (e.g., pulleys, belts, and gears) shall be enclosed or guarded to prevent accidental contact. The means used for enclosing or guarding shall comply with the probe test specified in [Clause 5.2.13.3](#) or [5.2.13.4](#).

5.2.10 Enclosures of outdoor equipment

Enclosures for outdoor equipment (e.g., barbecue motors) shall meet the requirements of [Clause 6.8](#).

5.2.11 Enclosures of equipment used in a garage

Equipment intended for use in a garage or similar location and containing sparking or arcing parts (e.g., switches and commutators) shall be

- (a) totally enclosed; or
- (b) constructed to
 - (i) prevent the escape of hot metal, sparks, and flaming particles; and
 - (ii) keep such igniting materials more than 50 mm from any side of the enclosure that can be placed on the floor or another support.

Equipment shall be marked in accordance with [Clause 7.9](#).

5.2.12 Food-waste disposers

5.2.12.1

Food-waste disposers shall be

- (a) constructed so that water from the grinding chamber cannot enter compartments containing electrical components; and
- (b) tested for compliance with [Clause 6.2.12](#).

5.2.12.2

Food-waste disposers shall comply with one or more of the following:

- (a) The opening in the sink flange shall not permit entry of a 64 mm diameter cylinder.
- (b) The sink flange shall be offset so that a 64 mm diameter cylinder, inserted to a depth of 127 mm or less, measured vertically from the plane of the opening in the top of the flange, will not touch cutting or moving parts.
- (c) The opening in the sink flange shall have a diameter of 92 mm or less, and a truncated cone as specified in [Figure 1](#), when inserted small-end-first to a depth of 100 mm or less, measured vertically from the plane of the opening in the top of the flange, shall not touch cutting or moving parts.
- (d) The diameter of the top opening of the sink flange shall be larger than 92.1 mm, and the distance from the plane of the opening to the nearest cutting or moving parts shall be not less than 1.5 times the smallest diameter of the sink flange opening.

Note: *The following are exempt from the requirements of this Clause:*

- (a) a commercial food-waste disposer provided with a hopper; and
- (b) any food-waste disposer equipped with a cover for the sink flange and with an interlock switch arranged so that removal of the cover de-energizes the motor.

5.2.12.3

If the food-waste disposer is adjustable for sink bottoms of different thicknesses, it shall be adjusted for the minimum thickness for the depth measurements specified in [Clause 5.2.12.2\(b\)](#), (c), and (d).

5.2.12.4

A commercial food-waste disposer provided with an inverted truncated cone or pyramid-shaped hopper shall be exempt from [Clause 5.2.12.2](#), provided that the depth of the truncated cone or pyramid is not less than

- (a) the maximum internal dimension of the throat opening, as follows:
 - (i) for a circle — the diameter;
 - (ii) for an ellipse — the major axis; and
 - (iii) for a polygon — the longest diagonal; and
- (b) 127 mm in any case.

5.2.13 Openings in enclosures

5.2.13.1

Openings in appliances, except for hand-held types and those underneath motors that comply with CSA C22.2 No. 77, shall not be located directly below terminals, heater elements, or wiring, including insulated conductors and other live parts, except power-supply cords and wiring suitable for use outside the enclosure, unless they are baffled or screened to prevent molten metal or burning material from falling on the supporting surface. This requirement shall not apply to wiring supplied from a Class 2 transformer that complies with CSA C22.2 No. 66.1 and CSA C22.2 No. 66.3.

5.2.13.2

Ventilating and other openings in external enclosures of table-mounted and hand-held equipment (e.g., shavers) shall be designed, located, or protected to prevent Probe 1 as shown in [Figure 2](#) from contacting live parts, whether bare or insulated (e.g., coil windings), or moving internal parts, contact with which can result in injury to persons during the intended use of the equipment, except as required by [Clause 5.17](#). (For household sewing machines, see [Clauses 5.2.14.3](#) and [5.8.6.2](#).)

5.2.13.3

Except as permitted in [Clause 5.2.13.4](#), openings in enclosures of appliances other than table-mounted and hand-held appliances shall prevent Probe 2 as specified in [Figure 2](#) from contacting bare live parts, insulated live parts (e.g., coil windings), or moving internal parts, contact with which can cause injury to persons during the intended use of the equipment.

5.2.13.4

Openings that permit a 19 mm diameter rod to enter an enclosure shall not permit such a rod to contact live parts, whether bare, insulated, or moving, contact with which can cause injury within the space specified in [Figure 3](#).

5.2.13.5

If a screen or perforated metal panel is used to prevent molten metal or burning material from falling on the supporting surface as required by [Clause 5.2.13.1](#), it shall be

- (a) a galvanized steel screen or the equivalent, having a 14 × 14 mesh and wire with a diameter of 0.46 mm;
- (b) a panel in accordance with [Table 2](#); or
- (c) a perforated metal panel or wire screen that complies with the flaming oil test specified in [Clause 6.15](#).

5.2.14 Enclosure doors and covers

5.2.14.1

Doors or covers shall be hinged or otherwise attached in an equivalent manner where

- (a) they provide access to any protective devices, the normal functioning of which requires replacement;
or
- (b) it is necessary to open such doors or covers in connection with the normal operation of an appliance.

Note: *The replacement of fuses is not considered a normal operation, but the resetting of overload devices and the adjustment of timers or switches or similar equipment are considered normal operations.*

5.2.14.2

Doors or covers shall be close-fitting and provided with means for holding them in a closed position. If such doors and covers provide access to bare live parts, they shall not be capable of being opened without use of a tool or key.

5.2.14.3

A household sewing machine that complies with the probe test of [Clause 5.2.13.2](#) shall

- (a) have means (e.g., friction catch or spring loading [a tool or key is not necessary]) for holding a door or cover closed if it provides access to a moving part(s); and
- (b) comply with the marking requirements of [Clause 7.17](#).

5.2.15 Tests for outdoor and car wash equipment

5.2.15.1 Water test for outdoor equipment

Equipment intended for outdoor use shall comply with the requirements for Type 3 enclosures specified in CAN/CSA-C22.2 No. 94.2.

5.2.15.2 Leakage current test

Immediately following the test specified in [Clause 6.8.1](#), the equipment shall comply with the leakage current test specified in [Clause 6.9](#).

5.2.15.3 Water test for car wash equipment

Electrical equipment intended for use in a car wash area shall comply with the requirements for Type 3 or 4 enclosures specified in CAN/CSA-C22.2 No. 94.2, except as otherwise specified in [Clause 5.2.15.4](#), while the equipment is operating.

5.2.15.4 Exception

Equipment that can be exposed to water, spray, or detergent solution, and that is intended to have its discharge directed manually, shall have the watertight test in CAN/CSA-C22.2 No. 94.2 conducted by means of its own discharge for 5 min from a distance of 1.50 m.

5.2.15.5 Dielectric strength and insulation resistance test

At the conclusion of the tests specified in [Clauses 5.2.15.3](#) and [5.2.15.4](#), the equipment shall withstand a repeat dielectric strength test (see [Clause 6.6](#)), and the insulation resistance at 500 V dc applied between the supply terminals and exposed non-current-carrying conductive parts shall be not less than 50 000 Ω .

Note: *The insulation resistance test should only be conducted on appliances that are not cord- and plug-connected; typically this test is only conducted on permanently connected appliances.*

5.3 Protection against corrosion

5.3.1 Iron and steel parts

Iron and steel parts shall be protected against corrosion in accordance with CAN/CSA-C22.2 No. 0.

5.3.2 Protection of surfaces

The surfaces of metal parts shall be protected, if necessary, against scaling, flaking, and other effects of corrosive action that might, in normal use, cause reduction in the dielectric strength of appliances or reduce the spacings to smaller than those required by [Clause 5.16](#).

5.4 Mechanical assembly

5.4.1 Security from vibration

Appliances shall be so assembled that they will not likely be affected adversely by the vibration of normal operation. Wire connectors shall be taped unless applied by a compression tool or a machine.

5.4.2 Fastening

Switch assemblies, lampholders, receptacles, or controls provided as parts of appliances shall be fastened securely and rigidly and shall be prevented from turning by means other than friction between surfaces. Lockwashers shall not be used to prevent rotation of the body of rotary switches or field wiring terminals.

5.4.3 Connections to live metal parts

Connections to live metal parts (e.g., brushholders) shall be such that

- (a) the electrical connection is maintained; and
- (b) the connection is prevented from turning or shifting in position by means other than friction between surfaces, if such motion would result in a reduction of spacings to smaller than those specified in [Clause 5.16](#).

5.4.4 Splices and connections

Splices and connections shall be mechanically secure and shall provide adequate and reliable electrical contact. Except for printed circuit boards and hollow pin terminals into which the wire is inserted, soldered connections shall be made mechanically secure before being soldered if breaking or loosening of the connections could result in any hazardous condition. Splices shall be provided with insulation equivalent to that of the wires if the required spacing between splices and other metal parts is not met.

5.4.5 Brush caps

Brush caps of motors shall be threaded or otherwise constructed to prevent loosening.

5.5 Supply connections

5.5.1 Permanently connected appliances

5.5.1.1

Appliances intended to be permanently connected shall have a terminal box, or the equivalent, suitable for conduit connection to the supply. Terminal boxes shall comply with CAN/CSA-C22.2 No. 0, CAN/CSA-C22.2 No. 18.1, or CSA C22.2 No. 18.2.

5.5.1.2

Where openings for conduit connection are provided in sheet metal enclosures,

- (a) the metal thickness shall be not less than
 - (i) 0.78 mm (No. 20 MSG) for sheet steel; and
 - (ii) 1.08 mm (No. 16 MSG) for nonferrous metal; or
- (b) the enclosure and conduit connection shall comply with the impact test of [Clause 6.11.1](#).

5.5.1.3

Boxes for wiring terminal parts shall be of metal or of moisture-absorption-resistant insulating material that complies with the flame test of [Clause 5.2.6](#). The thickness of the metal shall be in accordance with [Table 3](#), or the terminal box shall comply with the static load test of [Clause 6.11.4](#).

5.5.1.4

Terminal boxes of wiring compartments in which supply connections are made shall be located so that connections will be readily accessible for inspection after the appliance is installed as intended.

5.5.2 Cord-connected appliances and power-supply cords

5.5.2.1

Appliances shall have a suitable length of permanently attached power-supply cord or shall be provided with male terminals of the pin or blade type that will accommodate a suitable connector for attaching a cord set or interconnecting cord.

If a ground-fault circuit interrupter (GFCI) is provided, it

- (a) shall be a Class A type complying with CAN/CSA-C22.2 No. 144.1; and
- (b) shall be
 - (i) an integral part of the power-supply-cord attachment plug; or
 - (ii) located in the power-supply cord within 200 mm of the attachment plug face. The GFCI shall be marked as specified in [Clause 7.16.4](#).

5.5.2.2

Appliances with a cord set or permanently attached power-supply cord shall have an attachment plug complying with CSA C22.2 No. 42 for connection to the supply circuit. The voltage rating of the attachment plug shall correspond to the voltage rating of the product, and the ampacity of the attachment plug shall be no less than

- (a) the marked current rating of the appliance or the input current under maximum normal load conditions (see [Clause 6.2](#)), whichever is greater, for appliances that operate in the normal intended use for a total of 1 h or less in any 2 h period; and
- (b) 125% of the marked current rating of the appliance or 125% of the input current under maximum normal load conditions (see [Clause 6.2](#)), whichever is greater, for appliances that operate in the normal intended use for a total of more than 1 h in any 2 h period.

5.5.2.3

If an appliance is marked in watts, for the purposes of [Clause 5.5.2.2](#), the marked current shall be measured while the appliance is loaded to draw marked watts.

5.5.2.4

If the appliance is designed for use with two or more different supply voltages, the attachment plug provided shall be rated for the supply voltage selected at the factory, and the appliance shall be marked in accordance with [Clause 7.6](#).

5.5.2.5

Power-supply cords, cord sets, and interconnecting cords provided for use with appliances shall be of the types specified in [Table 1](#) or the equivalent. Interconnecting cords, which are not subjected to the same adverse conditions as supply cords, shall be of types suitable for their specific condition of use. The cords of appliances, considering conditions of use other than those specified in [Table 1](#), shall be of types specified in [Table 4](#).

5.5.2.6

If a household food-waste disposer is supplied with a supply cord, the cord shall be 460 to 900 mm in length.

5.5.2.7

The supply cord for a high-pressure washer/cleaner shall be

- (a) permanently attached to the machine; and
- (b) not less than 7 m in length.

5.5.2.8

The connection at the appliance intended for an accessory such as a connector in a sewing machine for a controller or a power-supply cord shall not be made using general-purpose receptacles or attachment-plug caps of the type used to connect the supply cord to a general-purpose receptacle.

5.5.2.9

Guards or some equivalent type of protection shall be provided to prevent accidental contact with terminals of the pin or blade type when they are live or to protect them from mechanical damage, or both.

The guard shall prevent a straight edge placed in any position across the guard from touching any terminal.

Guards shall afford protection equivalent to that of steel not less than 0.68 mm thick (No. 22 MSG) and shall be fastened independently of the terminals, unless investigation shows that no hazard is present.

5.5.2.10

A hand-held engraver having a rating of 30 W or less shall be provided with a flexible cord having a mechanical serviceability rating of not less than Type SPT-2.

5.6 Strain relief, flexing, and cord set retention**5.6.1 Strain relief**

Strain relief shall be provided where a permanently attached power-supply cord enters an enclosure so that mechanical strain on the supply cord is not transmitted to terminals, splices, or internal wiring. Accessible interconnecting cords and cables that are permanently attached and carry hazardous voltages shall also be provided with a strain-relief device that complies with [Clause 6.12.1](#).

5.6.2 Flat cords

In the case of flat cords (e.g., SPT and HPN) having parallel conductors that can be separated, the strain relief may be applied to the separated conductors, provided that the separated portion of the cord does not extend outside the appliance enclosure or bushing.

5.6.3 Permanently attached cords

A permanently attached power-supply cord, cable, or wiring that is subjected to flexing during normal use of the equipment shall withstand the flexing test specified in [Clause 6.12.2](#).

5.6.4 Hand-held appliances

A hand-held appliance rated over 30 V that employs a cord set shall have the appliance plug retention system tested as specified in [Clause 6.12.3](#).

5.7 Terminal parts

5.7.1 General

Except as otherwise specified in [Clause 5.7.2](#), terminal parts such as binding head screws, bolts, and studs shall not be smaller than Size No. 6.

5.7.2 Terminal parts of hand-held appliances

Terminal parts such as binding head screws, bolts, and studs of shavers or similar hand-held appliances shall not be smaller than Size No. 3.

5.7.3 Leads

Where leads in the terminal box are intended for connection to the power-supply conductors at the time of installation, they shall be

- (a) of suitable ampacity and length;
- (b) No. 18 AWG or larger; and
- (c) Type CL751, CL902, CL1251, or an equivalent as specified in CSA C22.2 No. 127.

5.7.4 Rigid wiring terminals

Rigid wiring terminals shall thread into metal and shall be prevented, by means other than friction, from turning or shifting that could result in reducing the spacings required by [Clause 5.16](#).

5.8 Wiring

5.8.1 Internal wiring

Internal wiring and connections shall be located to prevent contact with moving parts and

- (a) rigid; or
- (b) mechanically held.

5.8.2 Raceways

Raceways shall be smooth and free from projections, sharp edges, burrs, etc., that could cause abrasion of the insulation on conductors.

5.8.3 Holes

Holes in walls through which conductors pass shall have smoothly rounded bushings or shall have smooth, well-rounded surfaces upon which conductors can bear.

5.8.4 Insulation

Internal wiring shall have a type of insulation recognized as suitable for the particular application, when considered with respect to

- (a) the temperature and voltage to which the wiring will be subjected;
- (b) exposure to oil or grease; and
- (c) other conditions of service to which the wiring is likely to be subjected.

5.8.5 Magnet wire

The magnet wire of a coil may be used as a lead if the wire is

- (a) connected directly to fixed terminals of brushholders, switches, terminal boards, and similar parts;
- (b) not smaller than No. 23 AWG copper or the equivalent, except for cord-connected appliances with an input of 300 W or less at 120 V, and 600 W or less at 240 V, in which case the wire may be smaller than No. 23 AWG; or
- (c) provided with a sleeving of suitable insulating material that is securely fastened or supported and that meets the applicable requirements of CAN/CSA-C22.2 No. 198.1, except when
 - (i) not in contact with non-current-carrying conductive parts; or

- (ii) having sufficient rigidity and so located that there is no likelihood of the spacings between bare live parts and non-current-carrying conductive parts becoming smaller than the required minimum, even if the wires break.

5.8.6 Internal wire types

5.8.6.1

Except as otherwise specified by [Clause 5.8.6.2](#), internal wiring shall be of Type TEW, GTF, SEWF-1, SEW-1, TR, or an equivalent as specified in CSA C22.2 No. 127.

5.8.6.2

Lampholders of household sewing machines may be wired with SPT-1 cord as specified in CSA C22.2 No. 49. Portions of the cord that can be exposed to the user shall be suitably sleeved.

5.8.7 Ampacity

The ampacity of conductors shall be such that the limiting temperature for the insulation is not exceeded.

5.8.8 Connections

Connections in wiring shall have their sleeving, if provided, mechanically ensured.

5.8.9 Removal of covers

The removal of covers for coin or ticket collection in coin- or ticket-operated equipment shall not expose terminals, wiring, or other live parts.

5.9 Electrical insulation

5.9.1 General

Current-carrying parts other than magnet wire shall be supported on flame-resistant and moisture-absorption-resistant insulating materials such as porcelain, phenolic composition, or equivalent material and shall be in compliance with the HB test in CAN/CSA-C22.2 No. 0.17. Insulating materials of cord-connected appliances rated 150 volts-to-ground or less shall comply with the moisture-absorption test of [Clause 6.18](#).

5.9.2 Arcing

When subjected to the effects of arcing (e.g., by proximity to open electrical contact of switches or commutators), insulation shall be in compliance with the HB test in CAN/CSA-C22.2 No. 0.17.

5.10 Motors

5.10.1 General

Motors shall comply with the applicable requirements of CSA C22.2 No. 100, except for motor enclosures, which shall meet the applicable requirements of this Standard.

5.10.2 Overheating protection

Motors shall have inherent overheating protection in accordance with CSA C22.2 No. 77. This requirement shall not apply to

- (a) appliances having overload protection, consisting of a device that is responsive to motor current, rated or set at values not greater than specified in the *Canadian Electrical Code, Part I*;
- (b) commercial appliances intended for permanent connection, in which the motor can be readily protected against overload at the time of installation in accordance with the *Canadian Electrical Code, Part I*, and that are marked in accordance with [Clause 7.19](#);

- (c) appliances having a momentary contact switch;
- (d) appliances that are hand-held during the intended use;
- (e) attended intermittent-duty household appliances that comply with [Clause 6.7.3\(e\)](#); or
- (f) attended intermittent-duty household appliances incorporating a one-shot fusible device, which might or might not be installed by the manufacturer.

5.10.3 Motor-operated pumping units for painting equipment

The motor of a motor-operated pumping unit for painting equipment with a roller-type applicator shall have overheating protection in accordance with CSA C22.2 No. 77. The pumping unit shall comply with the abnormal test of [Clause 6.7.9](#).

5.10.4 Automatic-reset protective devices

Automatic-reset types of protective devices shall not be used in motor-operated equipment if the automatic restarting of motors could result in any hazardous conditions.

5.10.5 Food-waste disposers

The motors of food-waste disposers shall comply with the locked-rotor testing requirements of CSA C22.2 No. 77.

5.10.6 Optional thermal protectors

Appliances having motors with optional thermal protectors and marked or claimed to be thermally protected shall comply with the applicable requirements of CSA C22.2 No. 77.

5.10.7 Barbecue motors

Barbecue motors shall not reach temperatures higher than 65 °C above ambient temperature when tested in accordance with [Clause 6.2.17](#).

5.11 Switches and controls

5.11.1 General

Switches and controls shall comply with the applicable requirements of

- (a) CAN/CSA-C22.2 No. 14;
- (b) CSA C22.2 No. 24;
- (c) CSA C22.2 No. 55;
- (d) CSA C22.2 No. 111;
- (e) CSA C22.2 No. 156;
- (f) CAN/CSA-C22.2 No. 61058-1; or
- (g) CAN/CSA-C22.2 No. E60730-1.

5.11.2 Voltage, current, and horsepower ratings

Switches and controls shall have voltage, current, and horsepower (where applicable) ratings not lower than those of the circuits that they control, or they shall be subjected to investigation to determine their acceptability for the application.

5.11.3 Safety interlock switches, mechanisms, and controls

Safety interlock switches, mechanisms, and controls shall meet the requirements of [Clauses 6.8.1](#) and [6.8.2](#).

5.11.4 Manually operated control devices

Manually operated control devices shall have the OFF position clearly indicated, unless their construction or operating conditions render this unnecessary. The symbol "O" may be used to indicate the OFF position.

5.11.5 Sewing machines

Controls for sewing machines shall be tested as required by [Clause 6.2.7](#), except that a controller not intended for a specific machine shall be tested on the basis of its rating and intended application.

5.11.6 Cord-connected equipment

Cord-connected equipment having a motor rated more than 1/3 hp shall be provided with a switch for controlling the motor. The switch shall not be connected in the circuit of the identified conductor unless this connection results in the opening of all ungrounded supply conductors to the motor.

5.11.7 Painting equipment

For painting equipment utilizing a roller-type applicator and having a pressure-actuated switch that operates under normal use, the endurance test specified in [Clause 6.8.2.2](#) shall be conducted.

5.12 Suppressors

5.12.1 General

Suppressors for radio interference shall comply with CSA C22.2 No. 8.

5.12.2 Connection

Suppressors shall not be connected between live parts and exposed conductive parts, except as is necessary for normal operation of the equipment.

5.13 Lampholders

5.13.1 General

Lampholders shall comply with the applicable requirements of CSA C22.2 No. 43.

5.13.2 Extra-low-voltage lamps

Lampholders for extra-low-voltage lamps (e.g., 30 V or less) shall not be connected across parts of motor windings if the rating of the motor is higher than 150 V.

5.13.3 Mounting

Lampholders and lamps shall be securely mounted and protected from mechanical damage by

- (a) their location;
- (b) the type of lampholder; or
- (c) a suitable guard.

5.13.4 Current and voltage ratings

Lampholders shall have current and voltage ratings suitable for the circuit in which they are connected.

5.13.5 Construction

Lampholders shall be of dead-front construction.

5.13.6 Screw-shells

Screw-shells of lampholders shall be connected in the circuit of the identified conductor if one is provided.

5.13.7 Shades

Shades for lampholders shall be supported independently of the lampholders.

5.14 Protective devices and fuseholders

5.14.1 Construction

Protective devices and fuseholders shall be of dead-front construction unless they are located where access is restricted in accordance with [Clause 5.2.14](#). Fuseholders shall comply with CSA C22.2 No. 39 or the CAN/CSA-C22.2 No. 4248 Series.

5.14.2 Polarization of overcurrent protective device

A single-pole overcurrent protective device shall be connected between the ungrounded branch circuit conductor and the load, except where the overcurrent protection device is located in that part of a circuit that is connected by an unpolarized connector, in which case either or both conductors may be protected. The screwshell of plug-fuse-type fuseholders and the cap end of extractor-post cartridge-type fuseholders shall be connected to the load.

5.14.3 Ungrounded or double-insulated equipment

Ungrounded or double-insulated equipment provided with accessible fuseholders and equipment rated 240 V shall employ dead-front shockproof-type fuseholders, or shall comply with the marking requirements of [Clause 7.8](#).

5.15 Transformers

Transformers shall comply with CSA C22.2 No. 66.1, CSA C22.2 No. 66.2, and CSA C22.2 No. 66.3, as applicable.

5.16 Spacings

5.16.1 General

Except as otherwise specified in [Clauses 5.16.2](#) and [5.16.3](#), spacings shall be not smaller than those specified in [Table 5](#). If bare live parts are not rigidly supported, or if movable non-current-carrying conductive parts are in proximity to bare live parts, the constructions shall be such that the minimum spacings specified in [Table 5](#) will be maintained under all conditions.

5.16.2 Spacings within electrical components

The spacings within motors, switches, lampholders, or other devices supplied as part of equipment shall comply with the applicable Standard of the *Canadian Electrical Code, Part II*. If no such Standard exists, spacings shall be the subject of investigation.

Spacings within motors complying with [Table 5](#) need not comply with the component spacing requirements of CSA C22.2 No. 100.

5.16.3 Use of insulating barriers

An insulating barrier or liner may be used to obtain the spacings required by [Clause 5.16.2](#), provided that it is

- (a) of adequate dielectric strength and resistant to moisture absorption;
- (b) not adversely affected by arcing and is suitable for the temperature encountered;
- (c) of adequate mechanical strength and permanently held in place by means other than adhesives;
- (d) not less than 0.66 mm thick, except that it may be not less than 0.33 mm thick if used in conjunction with a spacing not less than one-half of that required by [Clause 5.16.2](#);
- (e) mica with a thickness of 0.25 mm or another insulating material meeting the requirements of Items (a) and (b) and of suitable thickness, held in position between the parts involved or by other mechanical means (in which case no spacing is required), and adhesives are not used.

5.16.4 Magnet wire

Magnet (e.g., film-coated) wire shall be considered a bare live part for the purposes of determining compliance of equipment with the spacing requirements of this Standard.

5.17 Special safety features

5.17.1 General

Appliances or equipment involving mechanical or other hazards shall be provided with protection that does not interfere with the intended manner of operating the equipment.

5.17.2 Loosening of parts

Movement of parts during the intended operation of equipment shall not result in any loosening of the parts that could pose a hazard of personal injury (e.g., the exposure of moving or bare live parts).

5.17.3 Cutting mechanisms

Cutting mechanisms shall be guarded, except where exposure of the blades or other equivalent parts is necessary for their operation.

5.18 Bonding and grounding

5.18.1 General

Unless double insulated, equipment shall be constructed to comply with CAN/CSA-C22.2 No. 0.4, except as otherwise specified in [Clause 5.18.2](#).

5.18.2 Exceptions

Equipment, other than sprayers, need not comply with [Clause 5.18.1](#) where

- (a) exposed metal parts are not likely to become energized, and the equipment complies with [Clause 8.4](#); or
- (b) it is cord-connected household equipment that is hand-held or table-mounted and is neither connected to the water supply or drainage during use nor intended to be immersed partially or entirely for cleaning.

5.19 Pressure vessels and parts subject to pressure

5.19.1 Exceptions

The requirements of [Clauses 6.16.1](#) and [6.16.2](#) shall not apply to pressure vessels that are required by provincial regulations to bear a Canadian Registration Number (CRN) or to high-pressure liquid spray equipment.

A part of a product, other than a pressure vessel, that is subjected to air or vapour pressure during normal or anticipated abnormal operation shall withstand without rupture a pressure corresponding to

- (a) five times the start-to-discharge setting of the relief device provided in the system, as determined in accordance with [Clause 5.19.15](#); or
- (b) five times the maximum pressure that can be developed in the system, but not greater than the relief valve setting.

A section of a pressure system constructed of continuous copper or steel tubing or of lengths of copper or steel tubing shall be connected by conventional tubing fittings or hard-soldered, brazed.

A motor-operated air compressor intended for use with sprinkler systems shall be tested at a pressure corresponding to five times the maximum relief valve setting.

Note: See *CSA B51* for detailed requirements for pressure vessels.

5.19.2 Hydrostatic strength test

Pressure vessels not required to bear a CRN but that are subjected to pressure exceeding 103 kPa shall comply with the hydrostatic strength test specified in [Clause 6.16](#).

5.19.3 Construction

Pressure vessels shall be constructed of ductile metals.

5.19.4 Drain holes

Where there is no means for gaining access to the inside of a stationary or permanently affixed pressure vessel, a drain hole shall be provided and located in the lowest portion of the pressure vessel. The hole shall be a threaded hole not smaller than 6.3 mm NPT (national pipe thread) and shall be provided with a plug that can be removed or with piping to a drain cock. The system shall have provision for gravity or pressure drainage of the vessel.

As an exception, pressure vessels having a drain hole located a maximum of 45° from the lowest point of the vessel shall be considered to comply with this Clause when

- (a) the product is marked in accordance with [Clause 7.22.3](#);
- (b) the instruction manual explains how to drain the pressure vessel properly; and
- (c) the product can be tilted so that the drain hole is at the lowest point, for complete draining without introducing a risk of personal injury.

5.19.5 Pressure release

A means of relieving pressure (e.g., a pressure-relief device, fusible plug, soldered joint, nonmetal tubing, or other equivalent means) shall be provided for a part in which pressure might be generated by an external source of heat.

5.19.6 Shut-off valves

A shut-off valve shall not be provided between a pressure-relief means and the part that it is intended to protect.

5.19.7 Protection by pressure-relief devices

A pressure vessel having an inside diameter greater than 76 mm and subject to air pressure generated or stored within an assembly shall be protected by a pressure-relief device.

5.19.8 Pressure setting of pressure-relief valves

The start-to-discharge pressure setting of a pressure-relief device shall be not higher than the maximum working pressure of the vessel. The discharge rate of the device shall ensure that the pressure developed in the vessel does not rise more than 10% above the maximum working pressure.

5.19.9 Pressure-relief devices

A pressure-relief device shall

- (a) be connected as close as possible to the pressure vessel or parts of a system that it is intended to protect;
- (b) be located so that it is readily accessible for inspection and repair and cannot be readily rendered inoperative;

Note: *A sealed adjustable pressure-relief valve may be used.*

- (c) have its discharge opening located and directed so that operation of the device does not deposit moisture on uninsulated live parts or on insulation or components negatively affected by moisture;
- (d) have a designated CRN; and
- (e) have means (e.g., a ring or handle) designated for testing whether the device is of a pressure-actuated-valve type.

5.19.10 Setting of pressure-regulating devices

A pressure-regulating device necessary for regulating the pressure in a vessel shall

- (a) have a maximum pressure setting of not more than 90% of the rating of the pressure-relief device;
- (b) prevent the pressure-relief devices specified in [Clause 5.19.9](#) from operating during or after the test specified in [Clause 5.19.11](#); and
- (c) if electric, comply with the requirements of [Clause 5.19.11](#).

5.19.11 Electric pressure-regulating devices

Electric pressure-regulating devices shall comply with the 30 000-cycle test specified in [Clause 6.16.3](#).

5.19.12 Pneumatic pilot valves

A pneumatic pilot valve used as a pressure-regulating device shall comply with the 30 000-cycle test specified in [Clause 6.16.4](#).

5.19.13 Pressure gauges

A pressure vessel shall have a pressure gauge or other equivalent device to indicate when pressure is retained within the vessel. The gauge shall have a full-scale reading of not less than 150% of the pressure-relief device setting. An appliance with a pressure indicator that is not calibrated in pressure units shall be permanently marked to define the significance of the markings on the pressure indicator (e.g., “0, 1, 2, ... 10”, “min – max”, or “10%, 20%, ... 100%”).

5.19.14 Air compressors

Air compressors marked in horsepower at the direction of the manufacturer shall be marked in accordance with [Clause 7.22.1](#). The air volume flow rate shall be measured as specified in ASME PTC9.

Air compressors likely or intended to be used as sprayers for paint, insecticide, or similar applications shall comply with [Clause 5.20.1](#), except that the hose specified in [Clause 5.20.1\(b\)](#) need not be provided.

Air compressors having a head or associated fittings and motor frame that can be contacted by the user and attain temperatures that exceed the 90 °C limit for external surfaces as specified in [Table 7](#) shall be marked as specified in [Clause 7.22.2](#).

5.19.15 Start-to-discharge pressure

To determine the start-to-discharge pressure setting of a pressure-relief device, three samples of the device shall be subjected three times each to a gradually increasing air pressure. The pressure at which the device begins to open shall be recorded. The start-to-discharge pressure setting of each sample shall be considered the average value of the three trials.

5.20 Sprayers, high-pressure airless sprayers, and high-pressure washers/cleaners

5.20.1 Sprayers

Sprayers for paint, insecticides, and similar applications shall comply with the marking requirements of [Clause 7.16.1\(b\)](#) and be constructed as follows:

- (a) Spray shall be prevented from accumulating within the unit in quantities sufficient to allow a hazard to result from
 - (i) a reduction in electrical spacing;
 - (ii) a reduction in heat dissipation; or
 - (iii) the spray residue being ignited by arcing parts.
- (b) Arcing parts shall be so enclosed as to comply with the nonincendive test requirements for nonincendive components as specified in CSA C22.2 No. 213 (Group D test gas), except that a compressor or liquid pump connected to its spray gun by a hose at least 7.60 m in length need not enclose arcing parts if marked in accordance with [Clause 7.16.1\(b\)](#).

- (c) Sprayers shall
 - (i) have a means to limit liquid pressure to a maximum of 2500 kPa; or
 - (ii) comply with [Clause 5.20.2](#).

5.20.2 High-pressure airless sprayers

A high-pressure airless sprayer shall

- (a) comply with [Clause 5.20.1](#)(a) and (b);
- (b) be provided with an instruction manual;
- (c) be marked in accordance with [Clause 7.16.2](#);
- (d) be provided with
 - (i) a guard extending not less than 25.4 mm beyond the airless spraying tip; and
 - (ii) either
 - (1) an automatic trigger-locking device; or
 - (2) a manual trigger-locking device and a diffuser nut;
- (e) employ a hose with a burst pressure rating of four times the maximum rated working pressure of the system for connection between the liquid pump and the spray gun. Such a hose shall have suitable means (e.g., a grounding conductor, conductive hose, or metal reinforcing), to discharge static electricity generated by liquid flow during normal use of the appliance; and
- (f) have a means to limit liquid pressure to the maximum system working pressure.

5.20.3 High-pressure washers/cleaners

A high-pressure washer/cleaner shall

- (a) employ a hose with a burst pressure rating of four times the maximum rated working pressure of the system for connection between the liquid pump and the spray gun;
- (b) have a means to limit liquid pressure to a pressure not exceeding the maximum system working pressure; and
- (c) be provided with a user instructional manual and marked in accordance with [Clause 7.16.3](#).

5.20.4 Flash point of fluid used with sprayers

The flash point of manufacturer-recommended cleaning fluid or any other fluid used with sprayers, high-pressure airless sprayers, and high-pressure washers shall be higher than 60 °C, and machines that use combustible fluids shall be marked in accordance with [Clause 7.15](#).

5.21 Painting equipment with a roller-type applicator

Arcing parts shall be

- (a) so enclosed as to comply with the nonincendive test requirements for nonincendive components in CSA C22.2 No. 213 (Group D test gas); or
- (b) marked in accordance with [Clause 7.18](#).

5.22 Printed circuit boards

5.22.1 General

Printed circuit boards shall be of heat-resistant and moisture-absorption-resistant insulating material and, except as specified in [Clause 5.22.2](#), shall comply with the V-1 or VTM-1 flame test requirements of CAN/CSA-C22.2 No. 0.17.

5.22.2 Class 2 circuits

Printed circuit boards supporting only Class 2 circuits as defined in the *Canadian Electrical Code, Part I*, or in CSA C22.2 No. 66.1 and CSA C22.2 No. 66.3 shall comply with the HB flame test in CAN/CSA-C22.2 No. 0.17.

5.22.3 Spacing between conductors and components

Except where an appliance complies with [Clause 6.7.4](#), spacings between conductors or components, or both, shall be not smaller than specified in [Table 5](#).

5.22.4 Internal spacings

Where spacings cannot be readily ascertained (e.g., spacings internal to a component), the printed circuit board shall withstand the application of the dielectric strength test voltage specified in [Table 6](#) for not less than 1 s without breakdown, unless the equipment complies with [Clause 6.7.4](#).

5.22.5 Component failure

Where the failure of a component can cause a fire or shock hazard, the appliance shall comply with [Clause 6.7.4](#).

5.23 Motorized chairs, beds, and exercise appliances

5.23.1 Entrapment prevention

Motorized chairs, beds, and exercise appliances that have moving parts that, during operation, can cause pinching, crushing, or other injury to limbs or extremities as determined by the entrapment tests of [Clause 6.20.3](#), shall be baffled as specified in [Clause 5.23.2](#) or provided with child-safe controls as specified in [Clause 5.23.3](#).

5.23.2 Protective enclosures and baffles

Except as specified in [Clause 5.23.3](#), moving parts that are determined to be hazardous by the entrapment test of [Clause 6.20.3](#) shall be enclosed or baffled by mechanical barriers that comply with the deflection test requirements of [Clause 6.20.4](#).

5.23.3 Child-safe controls

Where baffling of moving parts is impracticable, other means shall be provided to prevent unsupervised operation of the device mechanism (e.g., a key lock for power switches or controls that are removable). In such cases, a warning marking shall be provided on the control unit as specified in [Clause 7.20](#).

5.23.4 Motion controls

5.23.4.1

Where the operation of exposed movable parts other than vibrators is controlled by a switch, the switch shall be of the type that, when released, all moving parts of the mechanism that constitute a hazard are stopped.

5.23.4.2

A switch that is used to control exposed movable parts that can pose a risk of personal injury shall be guarded or located so as to prevent unintentional movement to any ON position.

5.23.4.3

Controls such as timers or automatic reset overload protective devices shall not be used unless it can be demonstrated that automatic starting of the equipment using such devices will not pose a risk of personal injury.

5.23.4.4

Switches and/or devices controlling the direction of travel of exposed moving parts of a mechanism shall be capable of being stopped and the direction of travel reversed at any point in the operation of the device mechanism when tested as specified in [Clause 6.20.5](#).

5.23.5 Power failure

Motorized chairs, beds, and exercise appliances shall be constructed so that, in the event of a power failure, they do not change position.

5.23.6 Hand-held control box interconnecting cable

The hand-held control box interconnecting cable (pendant cable) of motorized chairs, beds, and exercise appliances, which carries shock-hazardous voltages, shall be

- (a) of a type as specified in [Table 1](#) for power-supply cords; or
- (b) multi-conductor jacketed cable, Type AWM, Class II, Group B, that complies with
 - (i) CSA C22.2 No. 210;
 - (ii) the flexing test of [Clause 6.12.2](#), performed with the pendant control;
 - (iii) the longitudinal abrasion test of [Clause 6.20.8](#); and
 - (iv) the conditioning test of [Clause 6.20.9](#).

5.23.7 Testing

Motorized chairs, beds, and exercise appliances shall be tested as specified in [Clauses 6.2.16](#) and [6.20](#).

6 Tests

6.1 General

6.1.1 Sequence of tests

Except as otherwise indicated, representative samples shall be subjected to the tests specified in [Clause 6](#). The order of the tests shall correspond to the order of the Clauses.

6.1.2 Test voltage

Tests shall be conducted with the equipment connected to a supply having a voltage equal to the nominal system voltage for the supply system with which the equipment is intended to operate (e.g., 120 V). Nominal system voltage shall be as specified in CSA CAN3-C235.

6.1.3 Rated frequency

Where rated frequency is referred to the tests specified in [Clause 6](#), it shall include dc if applicable.

6.1.4 Duty cycle

Where an appliance is marked for duty cycle, it shall be tested accordingly.

6.2 Maximum normal load

6.2.1 General

6.2.1.1

Except as otherwise specified in [Clause 6.2.1.5](#), the maximum normal load shall be considered to be that which approximates as closely as possible the most severe conditions of normal use, but which is not a deliberate overload unless, in the opinion of the testing agency, conditions warrant such a load. Test loads that have been found to be representative of the most severe conditions of normal use are specified in [Clauses 6.2.2](#) to [6.2.18](#). Protective devices (e.g., motor overheat protectors, fuses) shall not operate during testing.

6.2.1.2

Equipment having characteristics not covered by the test procedures specified in [Clause 6](#) shall be tested as necessary to meet the intent of the requirements specified in this Standard.

6.2.1.3

Equipment using more than one attachment shall be tested with the attachment that provides the greatest maximum normal load.

6.2.1.4

The value of current or watts input derived from a variable load, excluding OFF periods, shall be the arithmetic average of the results from a recording meter.

6.2.1.5

Equipment that is marked in amperes, watts, horsepower, or any other rating greater than the representative load specified in [Clauses 6.2.2 to 6.2.18](#) shall be tested with a load applied to the motor output shaft by a dynamometer, or by any other suitable means, to produce the greater load. This greater load shall be considered the maximum normal load and shall be used as specified in [Clauses 6.4 and 6.5](#).

6.2.2 Household hair clippers

Household hair clippers shall be operated continuously at no-load for 20 min.

6.2.3 Commercial hair clippers

Commercial hair clippers shall be operated at no-load for 5 min ON and 5 min OFF until constant temperatures are reached.

6.2.4 Vibrators and massage machines

Equipment that is intended to be hand-held shall be subjected to the same tests as specified for hair clippers. Equipment that is not intended to be hand-held while in use shall be operated continuously until constant temperatures are reached. Massagers with rope heaters shall meet the 300 h endurance test as specified in [Clause 6.19](#) of [CSA C22.2 No. 36](#).

6.2.5 Shavers

Shavers shall be subjected to the test specified for household hair clippers (see [Clause 6.2.2](#)). The conditions of operation need not approximate those of actual service because they do not appreciably affect the operating temperature of the appliance.

6.2.6 Shoe polishers (buffers)

Household shoe polishers (buffers) shall be operated at no-load for 20 min, and commercial shoe polishers shall be operated continuously at no-load until constant temperatures are reached.

6.2.7 Sewing machines

Household sewing machines shall be operated intermittently by actuating the controller in accordance with the following cycle:

- (a) 2.5 s from start to full speed;
- (b) 5.0 s at full speed; and
- (c) 7.5 s switched OFF.

The machine shall be operated without thread and fabric and with the regulating device for operating the needle adjusted to provide the most unfavourable load.

Where a sewing machine is provided with a speed selection switch in addition to the controller, the test shall be repeated in each position of the selection switch.

Commercial sewing machines shall be operated continuously until constant temperatures are reached.

6.2.8 Air compressors

6.2.8.1

Air compressors shall be operated continuously at the test voltage and maximum electrical load until a constant temperature is reached.

6.2.8.2

Air compressors with timers that are used as air dispensers/tire inflators at automotive service stations shall be operated for 10 cycles with a 20 s interval between cycles, except that there shall be no interval between the last two cycles. The duration of each cycle shall be equal to the maximum operating time of the timer.

6.2.9 Household trash compactors

Household trash compactors shall be operated for 6 consecutive cycles with a 5 s interval between cycles, under both of the following load conditions, with the motor being allowed to cool to room temperature between test conditions:

- (a) no-load; and
- (b) with a simulated load of plastic foam blocks*, or a load that would cause the ram to reverse direction within 25.4 mm of its maximum travel.

**Ethafoam® has been found to be suitable as a load for this test.*

The input current or wattage to be marked on the units shall be the maximum value obtained while operating under the conditions specified in Items (a) and (b), excluding the interval from 2 s before to 2 s after the reversal of the ram at the compacting end of the operational cycles.

6.2.10 Paint sprayers

Paint sprayers shall be operated continuously while spraying water until a constant temperature is reached. For sprayers with compressors integral to the spray guns, 2 min intervals shall be allowed for the refilling of the reservoir, and the test shall be terminated after 1 h. If water is incompatible with the paint sprayer mechanism or does not yield comparable results, another liquid may be substituted for the test.

6.2.11 Painting equipment with roller-type applicators

Painting equipment with a roller-type applicator shall have the reservoir filled with water, and painting action shall be simulated by cycling the unit 5 min ON followed by 1 min OFF. After five complete ON and OFF cycles, the roller applicator shall be laid down for 10 min while leaving the unit active, and the cycling shall be resumed until a constant temperature is reached. If water is incompatible with the mechanism or does not yield comparable results, another liquid may be substituted for the test.

6.2.12 Food-waste disposers

6.2.12.1 Household food-waste disposers

A household food-waste disposer shall be tested by filling the grinding chamber to 2/3 of its capacity with leafy waste, and to the remaining 1/3 of its capacity with soft pine cubes (20 to 25 mm in size). The pine cubes shall be conditioned by being soaked in vegetable oil for 24 h. The grinding chamber shall then be flushed with cold tap water at a rate of 4 to 5 L/min. The duty cycle shall consist of a 3 min ON period (grinding) followed by a 1 min OFF period. During the OFF period no water shall flow, and the motor shall be switched OFF while the unit is reloaded. The temperature test shall be conducted for 11 min. If the unit stalls at the beginning of any cycle, the obstruction shall be removed and the test shall be continued. If the unit stalls while running, the obstruction shall be removed and the entire test shall be restarted after the unit has cooled to room temperature. If the unit stalls more than twice while running, it shall be considered unacceptable, except as otherwise specified in [Clause 6.5.2](#).

6.2.12.2 Other acceptable materials

At the discretion of the manufacturer, pine cubes and leafy waste may be substituted by raw potatoes cut into 50 mm or smaller pieces, leafy waste, and uncooked steer rib bones of 25 to 50 mm in length. These materials shall be combined 50% bones by weight, 25% leafy waste by weight, and 25% potatoes by weight, and loosely packed in the disposer. The potatoes and leafy waste shall form the bulk of the initial layer placed in the chamber.

6.2.12.3 Commercial food-waste disposers

Commercial food-waste disposers shall be tested using the same materials in the same proportions and loaded in the same way as specified for household food-waste disposers (see [Clause 6.2.12.1](#)).

For the temperature test, water at a temperature of 18 to 24 °C shall be turned on and adjusted to the minimum flow rate required to flush ground waste material out of the appliance, but not less than 4 L/min. The motor shall be brake-loaded so that the unit draws a current equal to the average value of current recorded during the input test. The unit shall run until thermal equilibrium is reached. If tested on the brake without using water, a temperature reading that is 10 °C higher shall be considered acceptable.

Except as specified in [Clause 6.5.2](#), any integral thermal or overcurrent protective device shall not operate during the tests specified in this Clause.

6.2.12.4 Current rating

The current rating of food-waste disposers shall be the average current measured during the grinding period from initial startup until the current drops to 110% of the current measured when the food-waste disposer is operating with no load but with a water flow rate of 4 L/min.

6.2.13 Motor-operated hoists

The input of motor-operated hoists shall be measured by performing 10 operations of raising the hoist to the maximum recommended load with 2 min off at the top and 2 min off at the bottom. The hoist shall be loaded with the maximum recommended load.

6.2.14 Motor-operated treadmills

The input in amperes and watts shall be determined by having a person weighing 91 kg run on the belt. The temperature test shall be conducted by loading the motor on the dynamometer at the measured input until a constant temperature is reached. The ventilation provided to the motor shall be simulated to approximate that of the treadmill.

6.2.15 Golf putting cups

The input in amperes and watts shall be determined by energizing the solenoid every 10 s. RMS values of 10 pulses shall be measured and an average value shall be calculated. The temperature test shall be conducted by energizing the solenoid every 10 s until a constant temperature is reached.

6.2.16 Household electrically operated chairs, beds, and exercise appliances

An electrically operated chair, bed, or exercise appliance shall be operated for nine complete cycles of adjustment through its complete range of motion, without pause between cycles, except that a 5 min period shall be interposed between the third and fourth cycle and between the sixth and seventh cycle. During the 5 min intervals the motor shall be running without the operation of the appliance, if possible; otherwise the motor shall be de-energized. If the speed of the operation of the appliance can be controlled, the test shall be performed at such speed that maximum heating will result. An appliance that is capable of more than one mode of motion shall be tested for each mode. The appliance shall be loaded with weights representing the weight of a person, as follows:

- (a) An electric chair or exercise appliance shall be loaded with 90 kg by placing a 45 kg weight on the seat, a 15 kg weight on the leg supports, and a 30 kg weight on the back supports, as shown in [Figure 4](#). A chair without a leg support shall be loaded with a 60 kg weight on the seat and a 30 kg weight on the back support, as shown in [Figure 5](#). The centre of gravity of the load secured to the

seat or leg/back support section shall be at a maximum distance from the pivot, but not more than 450 mm. The chair shall be operated in the mode that represents the maximum load (e.g., lifting of 90 kg total weight, while simultaneously raising the back and leg support sections, which shall be loaded as specified above).

- (b) A single-size electric bed or exercise appliance shall be loaded with two 45 kg weights in a similar fashion as specified in Item (a). A maximum of two adjacent reclining sections may be loaded, but all sections shall be operated at the same time. The centre-to-centre distance between the two loads shall not exceed 1.2 m.
- (c) A double bed or exercise appliance shall be loaded in a similar fashion as specified in Items (a) and (b), with an additional 90 kg load (two 45 kg weights), and all sections of the bed shall be operated simultaneously (see [Figure 6](#)).

6.2.17 Barbecue motors

Barbecue motors shall undergo temperature testing by operating until equilibrium is reached.

6.2.18 Brake lathes

The spindle motor of a brake lathe shall be operated continuously while cutting a rotor or drum until thermal equilibrium is reached. The slide motor, if provided, shall be subjected to a duty cycle of 15 min ON and 5 min OFF, until thermal equilibrium is reached. The input in amperes and watts of the slide motor shall be determined by operating the motor through one complete cycle.

6.2.19 Dental irrigators (with or without a toothbrush)

The input in amperes and watts shall be determined by operating the unit with the reservoir filled with water. The temperature test shall be conducted as specified in the previous sentence by operating the unit for five cycles of 5 min ON and 5 min OFF.

6.3 Starting

6.3.1 General

Equipment shall be capable of starting and operating normally on branch circuits protected by ordinary fuses (not time-delay fuses) having current ratings corresponding to that of the branch circuits to which the equipment would be connected, except where

- (a) the equipment starts and operates normally on circuits protected by time-delay fuses; and
- (b) the equipment is marked in accordance with [Clause 7.11](#).

6.3.2 Compliance testing

To determine compliance with [Clause 6.3.1](#), the equipment shall be connected to an electrical supply of the nominal system voltage and rated frequency and shall be started from stand-still to normal operating speed three consecutive times without blowing the fuse. The equipment shall be at room temperature at the beginning of the test. If the marked rating covers a range of frequencies, the equipment shall be tested at the frequency found to yield the highest starting current.

6.4 Rating

The measured input to the equipment in amperes or watts shall be 85 to 110% of the marked rating when the equipment is operated at nominal system voltage and at any of the frequency ratings marked on the nameplate under the condition of maximum normal load, as specified in [Clause 6.2](#), except that single-phase equipment rated less than 3 A or 300 W input shall be 80 to 120% of the marked rating and the indicated horsepower shall be 70 to 130% of the marked rating.

The shaft output horsepower of motors is not a required marking, but when it is indicated, advertised, or marked, the actual shaft output horsepower at the maximum normal load shall be 80 to 120% of the marked horsepower rating.

Equipment having a motor that is to be interchanged with another certified motor during production or at the time of installation shall not impose a brake load exceeding the motor horsepower rating. This requirement shall not affect the marking on an electric motor or generator meeting the requirements of CSA C22.2 No. 100.

6.5 Temperature (normal)

6.5.1 Maximum temperature

When connected to an electrical supply complying with [Clauses 6.1.2](#) and [6.5.3](#) and operated under conditions of maximum normal load as specified in [Clause 6.2](#), equipment shall attain neither

- (a) a temperature at any point sufficiently high to constitute a fire hazard or to affect adversely any materials used in the equipment; nor
- (b) temperatures at specific points greater than those indicated in [Table 7](#), based on an ambient temperature of 25 °C.

6.5.2 Testing at overvoltage and undervoltage

Equipment other than food-waste disposers shall meet the requirements of [Clause 6.5.1](#) when tested at the extreme operating voltages of the supply system (e.g., 120 V at 104 and 127 V; see CSA CAN3-C235) while operating in the intended manner and at any speed setting for equipment designed to operate at more than one speed with an additional allowance of 20 °C above the insulation temperature specified in [Clause 6.5.1](#).

When being tested at maximum overvoltage, thermal or overcurrent protective devices of food-waste disposers may be operated before completion of the grind load. When tested at minimum undervoltage, there shall be no limit to the number of starting or running jams allowed.

6.5.3 Frequency

Equipment shall be tested at 60 Hz unless rated for dc only or for another frequency only.

6.5.4 Limiting temperature of insulating materials

The limiting temperature for insulating materials other than those specified in [Table 7](#) shall be the subject of investigation.

6.5.5 Temperature tests

Temperature tests shall be conducted at any room temperature between 10 and 40 °C, and the variation below or above 25 °C shall be respectively subtracted from or added to the limiting temperatures specified in [Table 7](#), except where the temperatures in question are controlled by a thermostat.

6.5.6 Temperature measurement

Temperature readings shall be obtained by means of thermocouples, except that coil temperatures may be determined by the rise-of-resistance method. For continuously operated equipment, a temperature may be considered 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. For equipment that is not operated continuously, the recorded maximum temperatures shall be those obtained when the equipment is operated at the maximum normal load specified in [Clause 6.2](#).

6.5.7 Equipment not continuously operated

Equipment not intended for continuous operation (see [Clause 7.3](#)) shall be operated under its probable intermittent or short-term duty for the maximum normal load conditions as specified in [Clause 6.2](#).

6.6 Dielectric strength

6.6.1 Criteria

Immediately after the temperature test, the equipment shall withstand without breakdown, for 1 min, the application of an ac voltage of suitable frequency between live parts and non-current-carrying conductive parts that can become grounded, as follows:

- (a) for equipment rated 31 to 250 V: 1000 V;
- (b) for equipment rated 251 to 600 V: 1000 V plus twice the rated voltage;
- (c) for equipment rated 31 to 250 V that is not grounded and is applied directly to persons: 2500 V; and
- (d) for extra-low-voltage circuits (other than self-generating millivolt circuits) at 30 V or less: 500 V.

Solid-state control circuits that normally have a connection to ground may have the ground connection disconnected during the dielectric strength test.

6.6.2 Testing transformer

Compliance with [Clause 6.6.1](#) shall be determined by means of a suitable testing transformer, the output of which can be regulated. Starting at zero, the applied voltage shall be increased gradually and at a uniform rate until the required test value is reached or breakdown occurs.

6.6.3 Switches and controls

For the dielectric strength test, all switches and controls shall be in the ON position.

6.7 Temperature (abnormal)

6.7.1 General

If the conditions of normal operation are not representative of abnormal conditions likely to be encountered in actual service, equipment shall not become a fire or shock hazard when operated under such abnormal conditions.

6.7.2 Determining hazards

Equipment shall be considered a hazard if operation under abnormal conditions results in

- (a) any emission of flame or molten metal, excluding solder; or
- (b) the glowing or flaming of combustible material on which the equipment might be placed, or of adjacent wall surfaces, as specified in [Clause 6.7.3](#).

6.7.3 Test conditions for hazards

To determine whether a fire hazard exists, a separate burnout or abnormal heating test shall be conducted with the equipment connected to an electrical supply circuit complying with [Clause 6.1.2](#) and operating continuously until the ultimate result has been determined. The ultimate result may be constant temperatures, the opening of the circuit by a fuse or thermal protector, or the opening of a winding without resulting in a hazard. The following test conditions shall apply:

- (a) The equipment shall be located or supported in the same manner as specified for the normal temperature test.
- (b) Controls such as temperature-regulating thermostats shall be set to the maximum heat position.
- (c) The test surfaces shall consist of four single-ply layers of cheesecloth, located in the position most likely to be subject to fire hazard (e.g., on supporting surfaces) and draped loosely over the appliance. The cloth used shall be bleached cheesecloth running approximately 34 g/m², with a thread count in the range of 10 to 13 by 9 to 12 thread/cm.
- (d) Cord-connected equipment that is designed to operate at more than one voltage (e.g., 120 and 240 V) shall be tested at the highest voltage while connected for operation at the lowest voltage, and at any other connection and voltage if a more severe condition would result.
- (e) Equipment of the type specified in [Clause 5.10.2\(e\)](#) shall be tested additionally by subjecting five samples to a stalled rotor test.

- (f) The equipment may be stationary during the test, and conditions of operation need not approximate those of actual service.
- (g) During the test the leakage current shall be measured and shall not exceed the limit specified in [Clause 6.9.1](#).
- (h) After allowing the equipment to cool to room temperature, the equipment shall also withstand the dielectric strength test of [Clause 6.6](#) (repeated) after the abnormal temperature tests.

6.7.4 Additional abnormal test

Where required by [Clauses 5.22.3](#), [5.22.4](#), or [5.22.5](#), equipment shall comply with the additional abnormal test specified in [Clause 6.7.5](#).

6.7.5 Short-circuiting of components and conductors

Conductors or components, or both, with spacings smaller than those required by [Table 5](#) shall be short-circuited. The failure mode of components (open or short circuit) shall be simulated. Only one condition at a time shall be tested.

6.7.6 Hand-held appliances

Appliances that are hand-held and/or operated by a momentary contact switch shall be tested as follows:

- (a) The rotor shall be locked and the unit shall be tested for 10 cycles of 15 s ON and 15 s OFF.
- (b) The unit shall be operated continuously under no-load conditions until the ultimate result has been determined but for not longer than 7 h.
- (c) Where the unit has a one-shot protector that is necessary to prevent a hazard under the conditions of Item (a), then five samples shall be tested.
- (d) Where the unit is not supplied with a one-shot protector, only one sample shall be required for the test of Item (a).
- (e) Where the unit has an “optional” one-shot protector (i.e., the unit will pass all required tests without the protector), then for the test of Item (a), one sample shall be tested with the protector shorted and one sample shall be tested with the protector in place.
- (f) The appliance shall comply with CSA C22.2 No. 77, unless
 - (i) the unit is not marked THERMALLY PROTECTED; and
 - (ii) the appliance is investigated to ensure that the one-shot protector does not contribute to or cause any fire or shock hazard.

6.7.7 Testing of foot control

In addition to being tested in accordance with [Clause 6.7.6](#), foot controls shall be continuously operated in the position that will generate the most heat, until the ultimate result has been determined (see [Clause 6.7.3](#)) or for a maximum of 7 h. During the test, the foot control may be readjusted in order to achieve and maintain the maximum temperature of the enclosure.

6.7.8 Thermal protection

An appliance that is not required by this Standard to be thermally protected but is equipped with thermal protection shall be tested as follows:

- (a) The rotor shall be locked and the unit shall be operated continuously until the ultimate result has been determined (see [Clause 6.7.3](#)).
- (b) The unit shall be continuously operated under no-load conditions until the ultimate result has been determined or for a maximum of 7 h.

6.7.9 Motor-operated pumping units

As required by [Clause 5.10.3](#), the switch of a motor-operated pumping unit shall be locked in the ON position to cause pressure buildup. The pumping unit shall be tested until an ultimate result is achieved, but for not more than 7 h. At the completion of the test, the pressure vessel shall not burst, leak, or have any visible cracks.

6.7.10 Criteria

Following the additional abnormal tests, the equipment shall

- (a) not yield results as specified in [Clause 6.7.2](#);
- (b) comply with [Clause 6.6](#);
- (c) for cord-connected appliances rated 150 volts-to-ground or less, comply with [Clause 6.10](#); and
- (d) comply with [Clause 5.2.13](#).

6.8 Overload and endurance (switches and controls)

6.8.1 Overload

6.8.1.1

As required by [Clause 5.11.3](#), safety interlock switches, mechanisms, and controls shall be tested at the specified test voltage (see [Clause 6.1.2](#)) and rated frequency of the equipment, by making and breaking the stalled motor current 50 consecutive times without undue arcing, burning, pitting, or welding of the switch contacts, and without electrical or mechanical failure. If, in addition to the motor, another circuit is controlled by the switch, it shall be included in the test load.

6.8.1.2

The following test conditions shall apply:

- (a) The duration of the ON and OFF periods shall be such that the temperature rise of the motor windings does not exceed that which is normally encountered in service. The switches shall not be operated at a rate higher than 10 times/min.
- (b) The switch poles that are least likely to arc to non-current-carrying conductive parts shall be connected to such parts through a suitable fuse. Under this condition the fuse shall not blow.

6.8.1.3

If the equipment has both ac and dc ratings, the test required by [Clause 6.8.1.1](#) shall be conducted with the equipment connected to a dc supply of maximum rated voltage, and the dc overload test shall be considered representative of the test for ac. In the event that switches fail the dc tests but subsequent samples pass the ac tests, the equipment shall be rated for ac use only.

6.8.2 Endurance

6.8.2.1

As required by [Clause 5.11.3](#), safety interlock switches, mechanisms, and controls shall comply with the endurance test required by CSA C22.2 No. 55 and CSA C22.2 No. 111, as applicable, except that the rated load may be considered to be the load controlled by the switch in the equipment.

6.8.2.2

As required by [Clause 5.11.7](#), the pressure-actuated switch of painting equipment using a roller-type applicator shall comply with the endurance test as required by CAN/CSA-C22.2 No. 14, conducted at normal load for 100 000 cycles of operation.

6.9 Leakage current

6.9.1 Single-phase cord-connected appliances

The leakage current of single-phase cord-connected appliances rated not more than 150 volts-to-ground shall not exceed 0.5 mA when tested in accordance with [Clauses 6.9.2 to 6.9.10](#).

6.9.2 Meter

The meter shall be

- (a) electronic or of a direct-indicating type;
- (b) average responding;
- (c) calibrated at 60 Hz; and
- (d) indicating the rms value of a pure sine wave, with an accuracy of 5% at an indication of 0.5 mA. The meter shall have a terminal impedance of 1500 shunted by a 0.15 μ F capacitor.

6.9.3 Frequency

The frequency of the supply for the test shall be 60 Hz.

6.9.4 Applied voltage

The applied voltage shall be the nominal system voltage.

6.9.5 Test circuit

The test circuit shall be as shown in [Figure 7](#).

6.9.6 Test conditions

The equipment shall be at room temperature with all switches in the ON position and switch S1 open. It shall also be tested within 5 s of applying the test voltage (with switch S1 closed) and again after reaching normal operating temperatures. Equipment with speed or temperature controls shall be tested at low, medium, and high settings of the controls.

6.9.7 Position of switches

The tests shall be conducted with the switch S2 in position A, and repeated with switch S2 in position B, and with switch S1 both closed and open.

6.9.8 Bonding conductors

The bonding conductor of cord-connected appliances having a grounding circuit shall be connected to ground only through the leakage current meter.

6.9.9 Appliances with enclosures of insulating material

Appliances having an enclosure of insulating material shall have a probe applied to metal foil with an area of 200 cm² in contact with accessible surfaces of such insulating material.

6.9.10 Overfill and tip over

6.9.10.1

Appliances having a liquid container (see [Clause 5.2.4](#)) that can be overfilled in normal use shall have the container filled, after which half of this quantity of liquid (but not more than 0.5 L) shall be added evenly over a 30 s period while the equipment is in the position of normal use. Where the test liquid is water, it shall be a hard water solution of 0.5 g calcium sulphate (CaSO₄) per litre.

6.9.10.2

Portable appliances having a liquid container that can be tipped over (see [Clause 5.2.4](#)) shall be filled to capacity and then overturned. The direction of the spill shall be that which is most likely to result in a shock hazard. Where the test liquid is water, the same water solution as specified in Item (a) shall be used.

6.10 Stability

The stability of a non-hand-held appliance shall be such that it will not overturn when placed in any position on a surface inclined 10° from the horizontal. During this test, an appliance having casters shall have the casters turned to the most unfavourable position, and any doors, drawers, or containers supplied with the appliance shall be in the most unfavourable position, and filled or empty, whichever is the more severe condition.

6.11 Physical abuse

6.11.1 Impact

Except as otherwise specified in [Clause 6.11.2](#), exposed surfaces of equipment enclosures, supports, handles, and controls shall withstand, while at normal room temperature, an impact of 2.03 J from a 50 mm diameter steel ball with a mass of approximately 0.5 kg. During the test,

- (a) the equipment shall be held in a fixed position on a supporting surface;
- (b) all attachments shall be removed; and
- (c) any covers or lids that can be opened or removed during use or adjustment shall be opened or removed.

6.11.2 Drop

A sample of hand-held appliances such as razors, hair clippers, and massage appliances shall withstand being dropped from a height of 0.91 m, three times, on the hardwood test floor specified in Item (c) of this Clause. The three drops shall result in an impact on three different locations of the sample.

For this test,

- (a) if the equipment is provided with a cord set, it shall not be removed;
- (b) attachments, except for shaving and clipping heads, shall be removed; and
- (c) the hardwood test floor shall be constructed of oak, birch, or maple flooring, securely attached to a fir plywood base not less than 12 mm thick, with a total overall thickness between 25 and 38 mm.

During the test, the hardwood floor, which may be small in area (minimum 43 × 43 cm), shall be supported by a concrete floor or the equivalent.

6.11.3 Shock hazard

As a result of the tests specified in [Clause 6.11.1](#) or [6.11.2](#), the appliance shall not become a shock hazard, as determined by the leakage current test of [Clause 6.9](#) and the requirements of [Clause 5.2.13](#) regarding openings in enclosures.

6.11.4 Static load

The terminal box shall be capable of withstanding for 1 min a vertical force of 1000 N on horizontal surfaces when the appliance is mounted in any intended position. The load shall be applied through a flat metal surface of 50 mm in diameter without impairing the effectiveness of the enclosures or reducing the spacings to smaller than those specified in [Table 5](#).

6.12 Strain relief, flexing, and cord set retention

6.12.1 Strain relief

As required by [Clause 5.6.1](#), strain relief for permanently attached cords and cables shall prevent transmission of strain to interior wiring, splices, and terminals when

- (a) a steady pull of 150 N is applied in any direction for 1 min, except that for household equipment other than power-supply cords of residential garage door operating units and food-waste disposers, the test shall be conducted with a steady pull of 90 N;
- (b) the cord or cable is pushed in, in which case the cord shall be prevented from contacting sharp edges, points, or moving parts, or shall be exposed to temperatures above the temperature rating of the cord insulation; and

- (c) a torque of 0.226 N•m per 2.54 mm minimum cross-section of the cord or cable is applied between the cord and the enclosure for 1 min in either direction.

6.12.2 Flexing

6.12.2.1

As required by [Clause 5.6.3](#), cords, cables, or wires that are flexed while in use shall withstand a flex test of 5000 cycles where they enter the enclosure without causing exposure or breakage of the conductors and without displacement or breakage of the anti-kink device, if supplied. The rate of flexing shall be 10 cycles/min unless the manufacturer agrees to a faster rate. The flexing test may be performed on a sample other than that used for the strain relief test.

6.12.2.2

One cycle of the flexing test shall consist of the movement of the cord, cable, or wiring from a position of the most extreme flex to the opposite position of the most extreme flex and back again, but no more than a total of 180° (twice), and in the direction resulting in the most severe test.

6.12.2.3

The flexing test shall be conducted with the cord under a tension force of 1.1 N, with the tension applied to the cord 200 mm from the point of cord entry.

6.12.2.4

At the completion of the test the appliance shall withstand the dielectric strength test specified in [Clause 6.6](#) and shall continue to function.

6.12.2.5

Impairment of the strain relief shall be determined by the test specified in [Clause 6.12.1](#).

6.12.3 Cord set retention

As required by [Clause 5.6.4](#), the appliance plug retention system shall be subjected to 1000 cycles of plug insertion and removal, with each cycle consisting of an insertion into and removal from the appliance.

The insertion and removal of the plug shall be done at a rate not exceeding 10 cycles/min unless the manufacturer agrees to a faster rate. The appliance shall not be energized.

At the end of the test the plug retention system shall withstand for 1 min a 4.4 N withdrawal force axially applied to the cord, without the plug becoming disengaged from the retention system.

6.13 Speed control — Limited short-circuit

6.13.1 Testing for fire hazard

Solid-state speed controls shall be tested for fire hazards in their enclosure (which could be the enclosure of the equipment controlled). Each of the six controls shall be connected in turn in a circuit limited to the values shown in [Table 8](#) at a power factor of 0.9 to 1.0. The circuit capacity shall be measured without the control or protective fuse in the circuit.

6.13.2 Controls to be tested

Each control to be tested shall be connected in the circuit in series with the supply cord, where applicable, that is supplied with

- (a) the equipment; and
- (b) a non-renewable fuse (i.e., not of the time-delay type) of four times the rating of the motor but not less than 15 A.

6.13.3 Enclosure

The enclosure and exposed non-current-carrying conductive parts surrounding the control shall be grounded, and surgical cotton shall be placed around and in all openings of the enclosure.

6.13.4 Testing of samples

Six samples shall be tested by closing the short-circuit on each speed control. Three samples shall be tested with the control set at the maximum speed, and three samples shall be tested with the control set at the minimum speed.

6.13.5 Ignition

In each case there shall be no ignition of the cotton.

6.14 Backflow

The air gap required by [Clause 5.1.3.2\(a\)](#) shall be maintained when the tank is filled to the maximum water level condition that could occur and the machine is

- (a) tilted up to 15° in any direction; and
- (b) tipped over, and the air gap is measured 60 s later.

6.15 Flaming oil — Perforated metal panels or wire screens

6.15.1 Application of test

This test shall be performed on perforated metal panels or wire screens as required by [Clause 5.2.13.5\(c\)](#).

6.15.2 Apparatus

The apparatus for the test shall consist of

- (a) an iron ladle 63 mm in diameter with a pouring lip;
- (b) a heat-resistant glass dish;
- (c) a standard for supporting the test specimen;
- (d) a quantity of single-ply bleached cheesecloth running approximately 34 g/m², with a thread count in the range of 10 to 13 thread/cm (warp) by 9 to 12 thread/cm (weft);
- (e) a supply of No. 2 furnace oil*; and
- (f) a stop-clock.

*For further information see *CSA B140.0*.

6.15.3 Location

The test shall be conducted in a room with no air drafts. A specimen of the material shall be supported horizontally, 50 mm above a layer of cheesecloth placed in a dish.

6.15.4 Ignition of oil

Ten cm³ of No. 2 furnace oil poured into the ladle shall be ignited and allowed to burn for at least 1 min, at which point it shall be poured at a rate of not less than 1 cm³/3 s onto the specimen from a position 100 mm above it. The burning oil shall be applied three times, with a 5 min interval between applications.

6.15.5 Contact of oil with cheesecloth

Means shall be provided to ensure that only oil that passes through the test specimen makes contact with the cheesecloth.

6.15.6 Criteria

The cheesecloth shall not be ignited at any point during the three applications specified in [Clause 6.15.4](#).

6.16 Hydrostatic strength — Pressure vessel and system parts

6.16.1 Requirements

Pressure vessels or system parts not bearing a Canadian Registration Number (CRN), when tested as specified in [Clause 6.16.2](#), shall not

- (a) leak at a pressure of 1-1/2 times the maximum allowable working pressure; or
- (b) rupture at a pressure of 2-1/2 times the maximum allowable working pressure.

Rupture of a nonmetallic fluid transfer line and its connections, or at a gasket, may be considered to comply with the requirements of this Clause provided that repeated tests conducted with the media the line or gasket is intended to contain show no evidence of posing a risk of electric shock or injury to persons.

6.16.2 Test procedure

The test shall be conducted by filling the pressure vessels and system parts as necessary with water so as to exclude all air to comply with [Clause 5.19.2](#). Hydrostatic pressure shall be gradually applied by means of a connected hydraulic pump until reaching the levels specified in [Clause 6.16.1](#); each level shall be maintained for 1 min.

6.16.3 Performance under rated load

As required by [Clause 5.19.11](#), an electric pressure-regulating device shall perform under rated load for 30 000 cycles of operation with no shift in pressure calibration greater than 5% of the initial calibration setting. An adjustable pressure-regulating device shall be tested at its highest pressure setting unless the adjustment means is reliably sealed at a lower setting.

6.16.4 Pneumatic pilot valve

As required by [Clause 5.19.12](#), a pneumatic pilot valve used as a pressure-regulating device shall be capable of performing under rated load for 30 000 cycles of operation without exceeding a valve set pressure drift of 5% of the working pressure of the system. The valve construction shall be such that it cannot be locked to prevent performance of its intended function.

6.17 High-current arc ignition

Where required by [Clauses 5.2.7](#) and [5.2.9](#), three samples of the enclosure material, each measuring 127 ± 5 mm \times 12.7 ± 0.2 mm and having a thickness equal to that of the enclosure at the point where arcing occurs, shall be tested as specified in the high-current arc ignition (HAI) test in CAN/CSA-C22.2 No. 0.17, except that the material shall be considered acceptable if each sample resists ignition during the first 60 arcs.

6.18 Moisture-absorption resistance of insulation

A cord-connected appliance rated 150 volts-to-ground or less shall be conditioned for 48 h in air that has a temperature of 32 ± 2 °C and a relative humidity of $88 \pm 2\%$. Immediately after conditioning, the leakage current shall be measured and shall comply with [Clause 6.9](#).

6.19 Standard flame

6.19.1 Appliances unattended in normal use

Appliances that are unattended in normal use shall comply with [Clause 5.2.6.1](#) or [5.2.6.2](#).

After the fifth application of the test flame, there shall be no openings in the test specimens that will permit a 6.3 mm diameter probe to enter after the material has returned to approximate room temperature. The probe shall be applied with minimal force. Test specimens shall not drip flaming particles that ignite the surgical cotton.

6.19.2 Appliances attended in normal use

Enclosures of appliances that are attended in normal use shall comply with [Clause 5.2.7](#).

The enclosures shall not continue to burn for more than 1 min after either application of the test flame, and there shall be no openings in the test specimens that will permit a 6.3 mm diameter probe to enter, after the material has returned to approximate room temperature. The probe shall be applied with minimal force. Test specimens shall not drip flaming particles that ignite the surgical cotton.

6.19.3 Other appliances

Appliances having momentary contact switches or that are hand-held shall comply with [Clause 5.2.8](#).

6.20 Motorized chairs, beds, and exercise appliances

6.20.1 Rating

Ratings shall comply with [Clause 6.4](#) during normal operation.

6.20.2 Normal load and operating cycle

The normal load and operating cycle to be used for the rating test shall be the same as specified in [Clause 6.2.16](#).

6.20.3 Entrapment

6.20.3.1

As required by [Clause 5.23.1](#), chairs, beds, and exercise appliances that are not provided with controls complying with [Clauses 5.23.3](#) and [7.20](#) shall be tested as specified in [Clause 6.20.3.4](#) to [6.20.3.6](#) and in accordance with the deflection test specified in [Clause 6.20.4](#).

6.20.3.2

The test probe shall be a 100 mm long neoprene rod 9.5 mm in diameter and having a hardness of 50 to 70 Durometer A, as specified in ASTM D2240.

6.20.3.3

The headform used for this test shall be a juvenile head-size type that conforms to CSA Z262.1.

6.20.3.4

The probe or headform shall be placed in the closing area of any exposed mechanical assembly in order to determine whether the mechanical assembly is capable of trapping the probe or headform while the mechanical assembly is moving to close the gap or angle of a scissors action. The probe or headform shall be placed in the gap using minimal force. The mechanism shall be operated in the direction that closes the gap. If the mechanism does not trap the probe or headform, it shall be considered acceptable. If the mechanism does trap the probe or headform, the test of [Clause 6.20.3.6](#) shall apply.

6.20.3.5

The headform shall be inserted so that the mechanism will close on the front-to-rear and side-to-side headform orientation dimensions. Other orientations of the headform in the closing gap may be tested if applicable.

6.20.3.6

Entrapment shall be confirmed when a force of 9 N or greater is required to dislodge the probe or headform. The weight of the probe and headform shall be excluded from the 9 N force. During the entrapment test, the appliance shall be loaded as specified in [Clause 6.2.16](#) or with no load, whichever results in a more unfavourable condition.

6.20.4 Bed or chair deflection test

6.20.4.1

As required by [Clause 5.23.2](#), the test shall be applied only to those parts of the enclosure that cover moving parts. A force of 110 N shall be applied for 1 min by means of a metal rod 13 mm in diameter with a hemispherical end.

6.20.4.2

To comply with enclosure deflection requirements,

- (a) any resultant opening shall comply with [Clause 5.2.13](#); and
- (b) there shall be no hazardous contact with moving mechanical parts.

6.20.5 Motion control

As required by [Clause 5.23.4.4](#), each switch or control mechanism shall be operated at least once for each third of the mechanism travel distance, and stop, start, and reversing capabilities shall be checked in order to determine compliance with [Clause 5.23.4.4](#).

6.20.6 Power failure

As required by [Clause 5.23.5](#), the appliance shall be loaded as specified in [Clause 6.2.16](#) and extended to the extreme position in which it is most likely to have the maximum movement in the event of a power failure. The power shall be removed and the amount of movement of the person-supporting surface shall be measured. The movement shall be not more than 6.3 mm.

6.20.7 Bed or chair temperature (abnormal) test

6.20.7.1

For an appliance having a heating pad controlled by a timer, the test shall be performed as specified in [Clauses 6.2.16](#) and [6.5](#), except that the regulating thermostat shall be bypassed and 2 single plies of cheesecloth shall be placed over the unit (but under the load). The unit, including cheesecloth, shall be covered by a 12 mm thick felt pad. The timer shall be set to its maximum setting. There shall be no charring of the cheesecloth.

6.20.7.2

For an appliance not having a timer, the test of [Clause 6.20.7.1](#) shall be performed until an ultimate result has been determined (see [Clause 6.7.3](#)) or for a maximum of 7 h. There shall be no charring of the cheesecloth.

6.20.8 Longitudinal abrasion

As required by [Clause 5.23.6\(b\)\(iii\)](#), three samples of the cable shall be tested as received and after being conditioned as specified in [Clause 6.20.9](#).

A 50 to 75 mm wide strip of medium grade, 120 grit, 3M brand (or equivalent) emery cloth shall be supported over a 190 mm radius of a quarter cylinder.

The cable (approximately 1.2 m) shall be passed over the emery surface with one end fastened to a reciprocating machine and the other end secured to an 11 N weight. The cable shall be operated at 36 ± 1 cycles/min with a 305 ± 6 mm stroke.

The cable shall be positioned so that its mid-length is at the midpoint of the abrasive surface at the end of the down stroke.

Each sample shall withstand 350 cycles (700 strokes) of abrasion of the outer surface of the cable without exposure of a current-carrying conductor.

A conductor shall be considered exposed if it is visually conspicuous and the exposure has been verified by the dielectric strength test of [Clause 6.6](#), applied between the conductor and a sheet of metal foil placed between the emery cloth and the area where maximum abrasion has occurred.

6.20.9 Conditioning

As required by [Clause 5.23.6\(b\)\(iv\)](#), samples of the cables shall be placed in a circulating-air oven maintained at 90 °C for 7 d or, at the request of the manufacturer, at 65 °C for 90 d. After removal from the oven the cables shall remain at room temperature (25 ± 5 °C) for at least 24 h before any tests are conducted. If the cables are conditioned at 65 °C for 90 d, samples of the separately insulated current-carrying conductors shall be conditioned at 90 °C for 7 d.

6.21 Oven conditioning (nonmetallic enclosures)

6.21.1

To determine compliance with [Clause 5.2.5\(a\)](#), the appliance shall be placed in a circulating-air oven for 7 h at a temperature 10 °C above the maximum attained on the enclosure during the rated-load temperature test or

- (a) 70 °C, whichever is higher, for appliances that are typically used indoors, such as aquarium pumps, hair clippers, beds, chairs, exercise appliances, food-waste disposers, scissors, shavers, sewing machines, and toothbrushes; or
- (b) 90 °C, whichever is higher, for appliances that are typically used outdoors.

6.21.2

Following the conditioning specified in [Clause 6.21.1](#), there shall be no

- (a) reduction of spacings to smaller than those required by this Standard;
- (b) exposure of live parts or internal wiring, as determined by the requirements of [Clauses 5.2.13](#) and [8.3.2](#); or
- (c) conditions that would increase the risk of shock or fire hazard.

7 Marking

7.1 General

Equipment shall be plainly marked, in a permanent manner, in a place where the details are readily visible, with the following:

- (a) the manufacturer's name, trademark, trade name, or other recognized symbol of identification;
- (b) the catalogue, style, model, or other type designation;
- (c) the voltage;
- (d) the letters "ac", if the appliances are not suitable for use on dc, after the voltage, the symbol "~", or the frequency in Hz, if necessary;
- (e) the number of phases, unless obviously intended for single-phase use only;
- (f) the rated input in amperes or watts; and
- (g) the month and year of manufacture, at minimum, shall be marked on each product in a location accessible with the use of tools. Date coding, serial numbers, or equivalent means may be used.

7.2 Compliance

Markings shall comply with CAN/CSA-C22.2 No. 0.

7.3 Equipment for intermittent use

Equipment intended for intermittent or short-term operation shall be marked accordingly, unless the nature of its use is obvious.

7.4 Separately supplied components

Where required components such as a capacitor or a capacitor-transformer unit are not supplied as part of the equipment, suitable instructions regarding the proper ratings and connections of these separately

supplied components shall be provided. This marking may take the form of a suitable wiring diagram or equivalent attached to the inside of a connection box or equivalent.

7.5 Single-motor equipment

In equipment having a single motor as the only electric-energy-consuming component, the electrical rating that appears on the motor nameplate need not be shown elsewhere on the appliance if the nameplate is visible after the motor has been installed in the appliance. This does not preclude the necessity of opening doors or removing simple covers when motors are enclosed within permanently connected equipment.

7.6 Voltage

The appliance shall be marked in a permanent manner to indicate the particular voltage for which it is connected when shipped from the factory and when

- (a) it is a cord-connected appliance equipped with a multi-voltage motor and the motor nameplate is used to show the electrical rating of the equipment as specified in [Clause 7.5](#); or
- (b) it is a multi-voltage appliance as specified in [Clause 5.5.2.4](#).

7.7 Hair clippers and electric beds

Hair clippers and electric beds intended for household use shall be plainly marked “FOR HOUSEHOLD USE ONLY” or with equivalent wording.

7.8 Cleaning instructions

If the construction of equipment is such that a cleaning or similar servicing by the user (e.g., the replacement of pilot lamps, fuses, ink ribbons, or paper rolls) could result in accidental contact due to the exposure of normally enclosed or protected live parts, the equipment shall be clearly and permanently marked with the following warning: DISCONNECT FROM SUPPLY CIRCUIT BEFORE OPENING.

7.9 Equipment for garage use

Equipment intended for use in a garage or similar location shall be plainly and permanently marked with the warning “DO NOT USE BELOW GARAGE FLOOR OR GRADE LEVEL” in letters of a contrasting colour to the background and not less than 2.8 mm high. Embossed letters shall be raised at least 0.4 mm.

7.10 Receptacles

If receptacles, as specified in CSA C22.2 No. 42, are provided for any purpose, they shall be clearly and permanently marked on or adjacent to the receptacle with the maximum load or intended purpose. This requirement does not apply to special-type receptacles or connectors.

7.11 Non-time-delay equipment

Equipment that does not start and attain normal running speed when connected to a circuit protected by an ordinary fuse (i.e., not a time-delay type) as specified in [Clause 6.3](#) shall be plainly marked with the following: IF CONNECTED TO A CIRCUIT PROTECTED BY FUSES, USE TIME-DELAY FUSE MARKED “D”.

7.12 Fuse ratings

Fuse ratings shall be clearly and permanently marked adjacent to each fuseholder.

7.13 Supply conductor temperatures

The permanent marking “USE SUPPLY WIRES SUITABLE FOR ___ °C” shall be located near the supply entrance or on the nameplate if the temperature in the terminal box or the compartment intended for the supply connections exceeds 60 °C during the normal temperature test. The temperature to be marked shall be 75, 90, or 110 °C for temperature ranges of 61 to 75 °C, 76 to 90 °C, or 91 to 110 °C, respectively.

7.14 Brackets

Equipment needing a bracket to provide the stability required by [Clause 6.10](#) shall be marked to indicate the purpose and location of the bracket. This marking may appear on a paper label.

7.15 Combustible fluids

As required by [Clause 5.20.4](#), appliances using cleaning fluids or other combustible fluids shall be marked with an identification of the recommended fluid or with the following: WARNING: USE A _____ FLUID HAVING A FLASH POINT HIGHER THAN 60 °C.

7.16 Sprayers

7.16.1 General

As required by [Clause 5.20.1](#), sprayers shall be

- (a) provided with an instruction manual that includes instructions concerning the fire, electrical, and physical hazards involved in the use of combustible solvents and toxic chemicals; and
- (b) marked with the following or equivalent wording in a location that is readily visible and legible during normal use and unlikely to be obscured by accumulation of paint spray residue: WARNING: WHEN A COMBUSTIBLE LIQUID IS SPRAYED THERE CAN BE DANGER OF FIRE OR EXPLOSION, ESPECIALLY IN A CLOSED AREA. READ INSTRUCTION MANUAL BEFORE OPERATING.

A sprayer having arcing parts that do not comply with [Clause 5.20.1\(b\)](#), but that is connected to its spray gun by a hose at least 7.60 m in length, shall be marked with the following or equivalent wording: WARNING: ARCING PARTS. USE SPRAY GUN HOSE AT LEAST 7.6 m LONG AND KEEP THE COMPRESSOR/MOTOR/ _____ AT LEAST 6 m AWAY FROM EXPLOSIVE VAPOURS.

7.16.2 High-pressure airless sprayers

As required by [Clause 5.20.2](#), a high-pressure airless sprayer shall

- (a) have an instruction manual as specified in [Clause 7.16.1\(a\)](#) that includes comprehensive instructions concerning the prevention of static sparking, the method of cleaning, the relieving of pressure, the maintenance of the hose and its integral grounding conductors, and the following or equivalent wording:
 - (i) INJECTION HAZARD: EQUIPMENT CAN CAUSE SERIOUS INJURY IF THE SPRAY PERMEATES THE SKIN. DO NOT POINT THE GUN AT ANYONE OR ANY PART OF THE BODY. IN CASE OF PERMEATION, SEEK MEDICAL AID IMMEDIATELY;
 - (ii) THIS SYSTEM IS CAPABLE OF PRODUCING ___ kPa. TO AVOID RUPTURE AND INJURY, DO NOT OPERATE THIS PUMP WITH COMPONENTS RATED LESS THAN ___ kPa WORKING PRESSURE (INCLUDING BUT NOT LIMITED TO SPRAY GUNS, HOSE, AND HOSE CONNECTIONS); and
 - (iii) BEFORE SERVICING, CLEANING, OR REMOVAL OF ANY PART, SHUT OFF POWER AND RELIEVE PRESSURE;
- (b) be marked, in addition to the requirements of [Clause 7.16.1\(b\)](#) and (c), with the following: WARNING: HIGH PRESSURE. KEEP CLEAR OF NOZZLE; and
- (c) be marked with the following or equivalent wording: HIGH-PRESSURE DEVICE. READ INSTRUCTION MANUAL BEFORE OPERATING AND OBSERVE ALL WARNINGS.

7.16.3 High-pressure washers/cleaners

As required by [Clause 5.20.3](#), a high-pressure washer/cleaner shall be marked with the following or equivalent wording: WARNING: DO NOT SPRAY ELECTRICAL APPARATUS AND WIRING.

7.16.4 GFCI marking

As required by [Clause 5.5.2.1](#), the GFCI shall be marked "RAINPROOF" or "SUITABLE FOR WET LOCATIONS".

7.17 Household sewing machines

A door or cover of a household sewing machine complying with [Clause 5.2.14.3](#) shall be permanently marked with the following on its inside surface: CLOSE DOOR (OR COVER) BEFORE OPERATING MACHINE.

7.18 Painting equipment

As required by [Clause 5.21](#), painting equipment that utilizes a roller-type applicator shall be marked with the following:

- (a) DO NOT IMMERSE IN WATER OR SOLVENT; and
- (b) FOR USE WITH WATER-BASED LIQUIDS ONLY.

7.19 Commercial appliances for permanent connection

Where required by [Clause 5.10.2\(b\)](#), commercial appliances for permanent connection shall be marked with the words

“CAUTION:

- (1) MOTOR NOT PROTECTED — EXTERNAL OVERHEAT PROTECTION IN ACCORDANCE WITH *CE CODE, PART I*, SHALL BE PROVIDED.
- (2) MINIMUM CIRCUIT AMPACITY OF CONDUCTOR IS _____ A.
- (3) MAXIMUM BRANCH CIRCUIT FUSE IS _____ A”.

7.20 Motorized chairs, beds, and exercise appliances

As required by [Clause 5.23.3](#), the control unit of an appliance shall be marked in a readily visible manner with the following or equivalent wording: WARNING: REMOVE CONTROL BOX (OR KEY, OR SAFETY PIN, AS APPLICABLE) WHEN NOT IN USE, AND STORE OUT OF REACH OF CHILDREN.

7.21 Connections to potable water

Appliances having provision for connection to a potable water supply as required by [Clause 5.1.3.3](#) shall be marked with the following or equivalent wording: WARNING: IF CONNECTION IS MADE TO A POTABLE WATER SYSTEM, THE SYSTEM SHALL BE PROTECTED AGAINST BACKFLOW.

7.22 Air compressors

7.22.1

As required by [Clause 5.19.14](#), an air compressor rated in W (hp) shall be marked “COMPRESSOR ___ W (OR HP), AT AIR PRESSURE ___ Pa (OR PSI) AND AIR VOLUME FLOW RATE ___ dm³/s (OR CFM)”. If the air compressor motor is marked in horsepower, the marked motor horsepower shall be equal to or higher than the compressor (air pump shaft) horsepower, and the compressor horsepower shall be marked as specified in this Clause.

7.22.2

As required by [Clause 5.19.14](#), air compressors whose temperature exceeds the 90 °C limit for external surfaces shall be marked with the following or equivalent wording on or adjacent to the hot surfaces: WARNING: HOT SURFACE — DO NOT TOUCH.

7.22.3

A product constructed in accordance with [Clause 7.22.1](#) shall be marked, adjacent to the drain hole so as to be visible while the product is in use, with the word “CAUTION” and the following or equivalent wording: “RISK OF BURSTING — TILT TANK TO DRAIN”.

8 Cord-connected double-insulated appliances

8.1 Application

The requirements of [Clause 8](#) apply to cord-connected appliances for use in nonhazardous locations on circuits not exceeding 150 volts-to-ground and designed to be used in accordance with the Rules of the *Canadian Electrical Code, Part I*.

This Clause supplements those requirements specified elsewhere in this Standard and forms the basis for the design and construction of cord-connected appliances that have double insulation in lieu of the grounding of exposed non-current-carrying conductive parts, if any, and that are marked to indicate this in accordance with [Clause 8.4](#).

8.2 General requirements

8.2.1 Grounding

Double-insulated equipment shall not have provision for grounding.

8.2.2 Construction

The construction shall be such that failure of two independent sections of insulation occurs before any exposed metal becomes live, unless the construction is such that reinforced insulation is used (see the definition of double-insulated appliance in [Clause 3](#)).

8.2.3 Enclosure material

Insulating material may form a part or the whole of the enclosure of double- or reinforced-insulated equipment.

8.2.4 Supplementary insulation

Supplementary insulation shall provide insulating and mechanical properties at least equivalent to the basic insulation normally acceptable for the appliance.

8.2.5 Enclosure as supplementary or reinforced insulation

Where part or all of the enclosure is of insulating material (i.e., there is no exposed metal), it shall be treated as supplementary insulation or reinforced insulation.

8.2.6 Basic insulation

Basic insulation and metal insulated from bare live parts by basic insulation shall not be accessible to the user, as required by [Clause 8.3.2.2](#).

8.2.7 Capacitors

Capacitors shall not be connected to exposed conductive parts.

8.2.8 Loss of insulation

The construction shall be such that normal use of the appliance, including servicing, does not result in loss of insulation as originally provided.

8.3 Construction

8.3.1 General

8.3.1.1

Except where reinforced insulation is used, supplementary insulation shall be interposed between all exposed non-current-carrying conductive parts and

(a) basic-insulated current-carrying parts, including insulated wire; and

- (b) non-current-carrying conductive parts that are separated from bare current-carrying parts by basic insulation.

A permanently maintained air space may be used as either supplementary or reinforced insulation.

8.3.1.2

External parts of insulating material, the deterioration of which might cause the appliance to become unsafe, shall be sufficiently resistant to heat (see [Clauses 5.2.6 to 5.2.8](#)).

8.3.1.3

The construction shall be such that the added protection provided by any supplementary insulation will not be reduced by the normal use and servicing to which the equipment is likely to be subjected.

8.3.1.4

Unless protected from physical abuse by the outer enclosure of the equipment or by other means, supplementary insulation shall be adequately resistant to such abuse. Supplementary insulation that comprises the outer enclosure of the appliance shall be considered to be adequately resistant to physical abuse if the appliance complies with the mechanical strength requirements of [Clause 6.11](#).

8.3.1.5

Bare live parts of a switch, other than its terminals, shall be completely enclosed in a separate enclosure of insulating material, and

- (a) no non-current-carrying conductive part that extends outside the switch enclosure shall enter the arc chamber;
- (b) the plunger, toggle, or similar part that contacts bare live parts shall be wholly of insulating material; and
- (c) no bare live parts shall be accessible to the probe specified in [Clause 8.3.2.2](#) when the exposed parts of the plunger, toggle, or other actuating member are removed by being cut off flush with the external surface.

8.3.2 Openings and recesses

8.3.2.1

There shall be no openings other than those required for the proper functioning of the appliance, including for the dissipation of the heat generated during normal operation.

8.3.2.2

Openings or recesses providing access to bare live parts, basic-insulated parts, or basic insulation shall be of such size and shape that the entry of Probe 1 of [Figure 2](#) is prevented.

Magnet (e.g., film-coated) wire shall be considered a bare live part for the purposes of this Clause.

8.3.2.3

Openings, including construction joints, shall be designed to minimize the accumulation of dirt or fragments of metal and commutator dust that could cause bridging or serious contamination of insulating surfaces.

8.3.3 Mechanical assembly

8.3.3.1

Bare live parts shall be constructed and secured so that in normal use they cannot come into contact with supplementary insulation or any non-current-carrying conductive parts that are separated from external conductive parts by only supplementary insulation.

8.3.3.2

Construction shall be such that an air gap between the parts specified in [Clause 8.3.3.1](#) cannot be reduced to less than permitted in [Table 8](#) or be easily bridged by foreign matter.

Magnet (e.g., film-coated) wire shall be considered a bare live part for the purposes of this Clause.

8.3.3.3

Construction shall be such that it prevents wires, screws, nuts, washers, springs, and similar parts that might become loose or free, from bridging supplementary or reinforced insulation.

8.3.3.4

Sleeves, if provided as additional basic insulation on insulated conductors, shall be secured in position to prevent accidental removal (e.g., during servicing).

8.3.3.5

An accessible brush cap shall be

- (a) of suitable insulating material;
- (b) recessed so that its top is behind the plane of the brush-holder opening in the surrounding portion of the equipment; and
- (c) capable of withstanding three impact tests as specified in [Clause 6.11](#), each impact being made on a different part or area of the enclosure, without cracking or exposing of bare live parts.

8.3.4 Supply connections

8.3.4.1

A jacket on a power-supply cord shall not be considered supplementary insulation.

8.3.4.2

The power-supply cord shall have a mechanical serviceability of at least that required for grounded appliances and shall not have a grounding conductor.

8.3.4.3

The power-supply cord shall be insulated additionally from exposed conductive parts at the point where it enters the appliance.

8.3.4.4

A metal strain-relief clamp shall not be accessible and shall not make contact with an accessible non-current-carrying conductive part unless the clamp is suitably insulated from the cord.

8.3.5 Spacings

8.3.5.1

The spacings shall be not smaller than those specified in [Table 9](#). Larger spacings can be required at points at which carbon dust, lubricants, or other conductive contaminants exist or can accumulate.

8.3.5.2

Magnet (e.g., film-coated) wire shall be considered a bare live part when determining compliance with the spacings specified in [Table 9](#).

8.3.5.3

When spacings are measured, screws that are not prevented from loosening shall be positioned, by unscrewing if necessary, to yield minimum spacings.

8.3.5.4

All over-surface spacings shall be measured along or across the joints unless such joints are effectively cemented together.

8.3.5.5

Spacings measured through openings in housings of insulating material shall be measured using metal foil drawn tightly across the opening.

8.3.5.6

All air gaps shall be included when determining over-surface spacings, except those less than 1.0 mm wide.

8.3.5.7

The depth of any groove less than 1.0 mm wide shall not be considered when determining the over-surface spacing.

8.4 Marking

Markings shall comply with the requirements for double-insulated equipment in CAN/CSA-C22.2 No. 0.

8.5 Tests**8.5.1 Dielectric strength**

While at normal operating temperature, the appliance shall be capable of withstanding without breakdown, for 1 min, the application of the ac test voltages specified in [Table 10](#).

8.5.2 Leakage current**8.5.2.1**

When tested under the conditions specified in [Clause 6.9](#), the leakage current shall not exceed

- (a) 3.5 mA with the nominal system voltage specified in CSA CAN3-C235 (e.g., 120 V) applied between each side of the supply circuit in turn and inaccessible basic-insulated non-current-carrying conductive parts; and
- (b) 0.5 mA with the nominal system voltage applied between each side of the supply circuit in turn and exposed non-current-carrying conductive parts or metal foil 10 × 20 cm in area, or smaller if the total area of the plastic enclosure is less than 200 cm², in contact with external non-conductive surfaces.

8.5.2.2

Prior to the measurement of the leakage current, the sample shall be operated under no-load conditions for 100 h or until the brushes wear out, whichever interval is shorter, but in no case less than 25 h.

Note: *The brushes may be replaced during this test.*

8.5.2.3

Following the no-load conditioning test specified in [Clause 8.5.2.2](#), and prior to the measurement of the leakage current, the sample shall be subjected for 48 h to a moist atmosphere having a relative humidity of 80 to 90% at a temperature of 32 ± 2 °C.

8.5.2.4

The frequency of the supply for the test shall be the rated frequency or dc rating, as applicable.

8.5.3 Insulation test

8.5.3.1

This test shall apply to appliances that employ motors other than induction motors. Appliances that employ induction motors shall be the subject of investigation.

8.5.3.2

Any protective device that is provided with the appliance and that can be reset, replaced, repaired, or otherwise modified by the user shall be short-circuited, except as otherwise specified in [Clause 8.5.3.3](#).

Note: *The objective of the insulation test is to determine the integrity of the appliance insulation and not the effectiveness of a protective device, with the exception of a thermal cutoff of the type specified in [Clause 8.5.3.3](#).*

8.5.3.3

A one-shot non-resettable or non-replaceable thermal cutoff that is permanently incorporated in the motor shall not be short-circuited if, upon opening of the thermal cutoff, each motor part intended for protection by the cutoff is rendered permanently inoperative and must be replaced in order to return the appliance to a functional condition.

8.5.3.4

Severe overstress of the basic insulation shall not cause exposure of basic-insulated live parts as specified in [Clause 8.3.2](#) and shall not cause failure of the supplementary insulation as determined by

- (a) the leakage current test as specified in [Clause 8.5.2.1\(b\)](#), conducted while the appliance is hot; and
- (b) the dielectric strength test as specified in [Clause 8.5.3.6](#).

8.5.3.5

To determine compliance with [Clause 8.5.3.4](#), a motor-operated appliance shall be subjected to a running overload test, when connected to a fused 30 A branch circuit of nominal system voltage, by operating the appliance at full load for 30 min and increasing the load by 10% every 30 min until any one of the following conditions occurs:

- (a) the 30 A fuse operates;
- (b) the input current suddenly increases by 100%, or more, of rated current;
- (c) flame appears (if flame occurs it shall be extinguished immediately); or
- (d) there is an open circuit in the motor winding(s).

8.5.3.6

Following the running overload test specified in [Clause 8.5.3.5](#) and after allowing the appliance to cool to room temperature, the appliance shall be capable of withstanding without dielectric breakdown, for 1 min, the application of an ac voltage of 1000 V between live parts and accessible non-current-carrying conductive parts (or metal foil in contact with external nonconductive surfaces).

Table 1
Cord type
 (See [Clauses 5.2.3](#) and [5.5.2.5](#).)

Appliance	Cord type (minimum requirements)	
	Household	Commercial
Air compressors/paint sprayers	SJO, SJT	SJO, SJT
Air compressors/paint sprayers (with wheels) rated more than 2 hp (1492 W)	SO, ST	SO, ST
Air compressors/paint sprayers (with wheels) rated less than 2 hp (1492 W)	SJO, SJT	SJO, SJT
Air inflators (without compressors)	SPT-2	SJT
Aquarium pumps	SPT-1	SJ
Auto service equipment	—	SJT, SJO
Auto wash equipment	—	SOW, STW
Barbecue motors	SJOW, SJTW	SOW, STW
Beds, chairs, exercise appliances	SV, SVT	SJ, SJT
Cloth cutters	—	SJ
Food-waste disposers and trash compactors	SPT-3	SJT
Golf putting machines	SPT-1	SJT
Hair clippers		
for use on animals*	—	SJ
for use on people†	SPT-2	SV
Hand-held engravers	SPT-2	—
Hat-cleaning machines	—	SJ
Painting equipment/roller applicators	SJT	SJT
Scissors, shavers, toothbrushes, and vibrators		
rated greater than 0.5 A	SPT-1	SV
rated 0.5 A or less	TST	—
Sewing machines	SPT-2	SJ
Spray washers (without wheels, employing a motor of any rating)	SJOW, SJTW	SJOW, SJTW
Spray washers (with wheels, employing a motor rated more than 2 hp (1492 W))	SOW, STW	SOW, STW
Spray washers (with wheels, employing a motor rated 2 hp (1492 W) or less and provided with a Class A GFCI)	SJOW, SJTW	SJOW, SJTW

*Hair clippers for household pets rated 50 W or less may have Type SV cord.

†Hair clippers rated at 0.5 A or less may have Type SPT-1 cord.

Table 2
Perforated metal panels
 (See [Clause 5.2.13.5.](#))

Thickness, mm	Diameter of holes, mm	Spacing of holes centre-to-centre, mm
0.76	1.14	1.70 (36 holes per cm ²)
0.76	1.19	2.36
0.89	1.90	3.20 (11 holes per cm ²)
0.99	1.60	2.70

Table 3
Thickness of metal for boxes for wiring of terminal parts
 (See [Clause 5.5.1.3.](#))

Type of metal	Minimum thickness, mm
Sheet steel	1.06*
Cast iron	3.20
Malleable iron	2.40
Die-cast metal	
for an area greater than 154 cm ² or having any dimension greater than 150 mm	2.40
for an area greater than 154 cm ² or having no dimension greater than 150 mm	1.60

**Thinner metal may be used if investigation shows that adequate rigidity is provided, except as required by [Clause 5.5.1.2.](#)*

Table 4
Conditions of use, voltage, and temperature ratings of flexible cords
 (See [Clause 5.5.2.5](#) and [Table 10.](#))

	Use	Kind	CSA type designation	Voltage rating, V	Temperature rating, °C	Notes	
Damp (or dry) locations	Not for hard usage	Flexible cord	SV	300	60	—	
			SVO	300	60	1, 4	
			SVT	300	60	1, 4	
			SPT-1	300	60	4	
			SPT-2	300	60	4	
			SPT-3	300	60	4	
	For hard usage	Flexible cord	SJ	300	60	2	
			SJO	300	60	1, 2, 4	
			SJT	300	60	1, 2, 4	
			SPT-3	300	60	1, 2, 4	
	For extra-hard usage	Flexible cord	S	300	60	2	
			SO	300	60	1, 2, 3	
			ST	300	60	1, 2, 4	
	Wet (or damp or dry) locations	For hard usage	Outdoor flexible cord	SJOW			1, 5
				SJTW			—
For extra-hard usage		Outdoor flexible cord	SOOW			1, 5	
			SOW			1, 5	
			STW			—	

Notes:

- (1) When exposed to oil, the temperature rating of the jacket of types SVO, SVT, SJO, SJT, SO, ST, SOW, and SJOW is limited to 60 °C regardless of the temperature rating of the insulation.
- (2) Types SJ, SJO, SJT, S, SO, and ST flexible cords are now recognized only as components of equipment.
- (3) Types SVO, SJO, and SO are also available rated 90 °C.
- (4) Types SVT, SPT-1, SPT-2, SPT-3, SJT, and ST are also available rated 105 °C.
- (5) Types SOW, SOOW, and SJOW are also available rated 90 and 105 °C.

Table 5
Minimum spacings for bare live parts
 (See Clauses 5.16.1, 5.22.3, 6.7.5, and 6.11.4.)

Parts involved	Maximum voltage,		Minimum spacing, mm	
	V rms	Through air	Through air	Over surface
Installer wiring terminals*	375	6.3	6.3	6.3
	750	9.5	9.5	12.5
Appliances without motors and with motors having a motor-frame diameter of 178 mm or less				
(a) between bare live parts of different voltage; and between bare live parts and non-current-carrying conductive parts other than an electrically conductive enclosure	30 Class 2†	—	—	—
	50	0.5	0.5	—
	150	1.6	1.6	1.6
	375	3.2	3.2	3.2
	750	6.3	6.3	9.5
(b) between bare live parts and an electrically conductive enclosure	150	3.2	3.2	3.2
	375	6.3	6.3	6.3
	750	9.5	9.5	12.5
Appliances with motors having a motor-frame diameter‡ larger than 178 mm between bare live parts of different voltage; and between bare live parts and non-current-carrying conductive parts including an electrically conductive enclosure	150	3.2	3.2	3.2
	375	6.3	6.3	6.3
	750	9.5	9.5	12.5
Printed circuit conductors	30 Class 2†	—	—	—
	50	0.5	0.5	0.5
	150	1.0	1.0	1.0

*Installer wiring terminals are those to which supply connections are made at the time of installation.

†Includes the following types of circuit:

(a) Class 2 not exceeding 30 V rms as defined in the Canadian Electrical Code, Part I;

(b) those supplied by a Class 2 transformer, as defined in CSA C22.2 No. 66.3;

(c) those protected by a dropping resistor, where investigation demonstrates equivalent protection to an impedance-protected Class 2 transformer; and

(d) those protected by other means of isolation, where investigation demonstrates equivalent protection to a Class 2 circuit.

‡The required spacings in this Table are based on the size of the largest motor in the equipment. See CSA C22.2 No. 100 for a description of the motor-frame diameter.

Table 6
Dielectric strength test voltages
 (See Clause 5.22.4.)

Parts	Voltage, V
Potentiometers and rheostats	900
Parts operating at less than	
175 V peak	1500
375 V peak	2000
750 V peak	2250

Table 7
Limiting temperatures for appliances
 (See Clauses 6.5.1, 6.5.4, and 6.5.5.)

Item	Location	Maximum temperature, °C
1	At any point on or within a supply terminal box to which connections are made in the field	60*
2	On fibre used as electrical insulation or as a part whose failure would result in a hazardous condition	90
3	On wood or other combustible material whose failure would result in a hazardous condition	90
4	On fuses	100
5	On surfaces adjacent to or upon which appliances can rest in service and on any external surface	90
6	On varnished-cloth insulation	85
7	On phenolic composition used as electrical insulation or as a part whose failure would result in a hazardous condition	150†
8	On capacitors, unless marked otherwise	
	Electrolytic	65‡
	Other types	90
9	On sealing compound	20 less than the melting point
10	On conductor insulation	Limiting temperature of the insulation§
11	On flexible cords	Limiting temperature of the insulation

(Continued)

Table 7 (Concluded)
Table 8
Capacity of test circuit
 (See [Clause 6.13.1.](#))

Item	Location	Maximum temperature, °C		
		Metal	Porcelain, enamel	Plastic, wood
12	Handles, knobs, grips			
	(a) held continuously in normal use	55	65	75
	(b) held intermittently in normal use	60	70	85
13	On motor windings, cords, and other moving parts	See CSA C22.2 No. 100		
14	On transformers	See CSA C22.2 No. 66.1, CSA C22.2 No. 66.2, or CSA C22.2 No. 66.3, as applicable		
15	On switch parts	See CSA C22.2 No. 55 and CSA C22.2 No. 111		
16	On thermostat parts	See CSA C22.2 No. 24		
17	On controls (other than switch parts), resistors, solenoids, relays, etc.	See CAN/CSA-C22.2 No. 14		

*Higher temperatures may apply provided that appliances are marked in accordance with [Clause 7.13](#) or [Clause 7.22.2](#), as applicable.

†This limitation shall not apply to a composition whose heat-resisting properties have been found suitable for higher temperatures.

‡This limitation shall not apply to a capacitor that is an integral part of a motor.

§Short lengths of conductors may be exposed to higher temperatures, provided that supplementary heat-resistant insulation of adequate dielectric strength is used over the insulation to safeguard it against deterioration where breakdown of the insulation can result in electrical failure.

Table 8
Capacity of test circuit
 (See [Clause 6.13.1.](#))

Motor rating, hp	Nominal system voltage, V		Test circuit current limit, A
	Single-phase	Three-phase	
≤ 1	0–600	0–300	1000
		301–600	2000
> 1 and ≤ 3	0–600	0–600	2000
> 3 and ≤ 7.5	0–250	0–300	3500
	251–600	301–600	5000
> 7.5	0–600	0–600	2000

Table 9
Minimum spacings
 (See Clauses 8.3.5.1 and 8.3.5.2.)

Item	Parts involved	Minimum spacing, mm
1	Between bare live parts and inaccessible non-current-carrying conductive parts separated by basic insulation only	Not less than the through-air and over-surface spacings specified in Clause 5.16 for bare live parts and exposed non-current-carrying conductive parts
2	Between inaccessible non-current-carrying conductive parts and exposed non-current-carrying conductive parts separated by supplementary insulation	
3	Between bare live parts and exposed non-current-carrying conductive parts separated by double or reinforced insulation (where applicable), except as indicated in Item 4	Not less than twice the through-air and over-surface spacings specified in Clause 5.16 for bare live parts and exposed non-current-carrying conductive parts
4	Between bare live parts and accessible non-current-carrying conductive parts at a commutator or other location in which foreign materials can build up	7.9 over surface
5	Between bare live parts, including film-coated wire wound in the form of a coil (wrapped or unwrapped) and reliably held in place, and the interior surface of insulating material that serves as supplementary insulation	0.8 through air

10

Dielectric strength test voltages

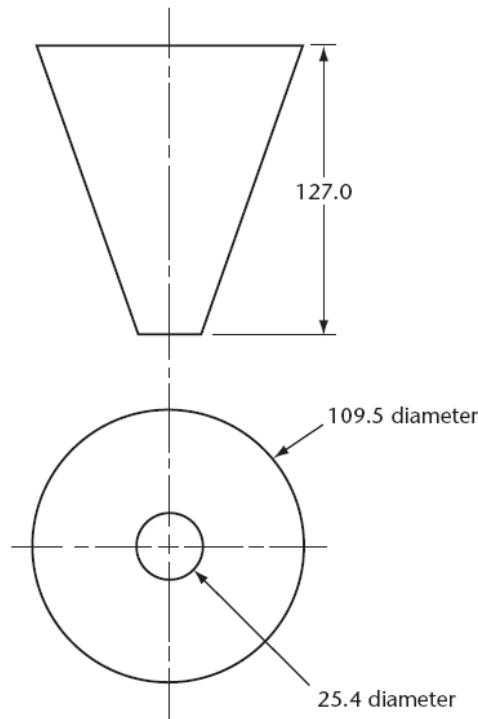
(See [Clause 8.5.1.](#))

Item	Point of application of test voltage	AC dielectric strength test voltage, V
1	Between live parts and inaccessible basic-insulated non-current-carrying conductive parts	Value specified in Clause 6.6
2	Between inaccessible basic-insulated non-current-carrying conductive parts and accessible conductive parts	2500
3	Between inaccessible basic-insulated non-current-carrying conductive parts and metal foil in contact with external non-conductive surfaces*	2500
4	Between live parts with reinforced insulation and accessible non-current-carrying conductive parts	4000
5	Between live parts with reinforced insulation and metal foil in contact with external nonconductive surfaces*	4000
6	Between accessible non-current-carrying conductive parts (or metal foil in contact with external non-conductive surfaces) and metal foil wrapped around the supply cord at the point of entry into the housing (or metal rod of the same diameter as the cord inserted in its place)†	2500

*A coating of conductive material may be used in place of metal foil.

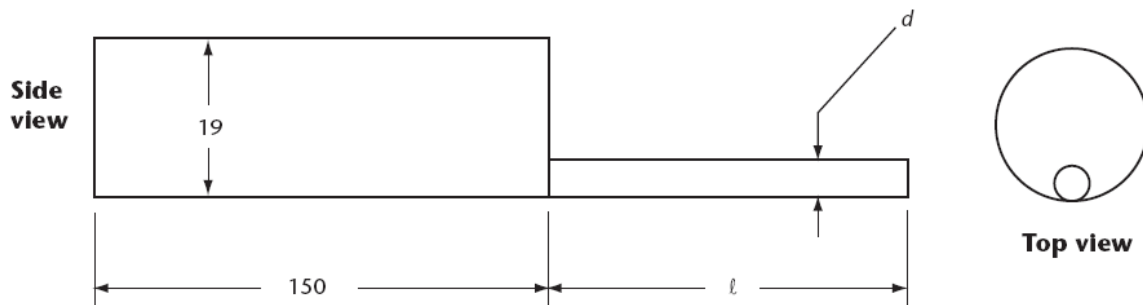
†If the power-supply cord enters through an opening in an insulating case, the metal foil shall be adjusted so that the distance between it and the metal rod is approximately 50 mm over surface.

Note: For appliances having both reinforced insulation and double insulation, care shall be taken to ensure that the voltage applied to the reinforced insulation does not further stress the basic or supplementary insulation beyond the stress provided by the voltages specified in [Table 4](#).



Note: All dimensions given are in millimetres.

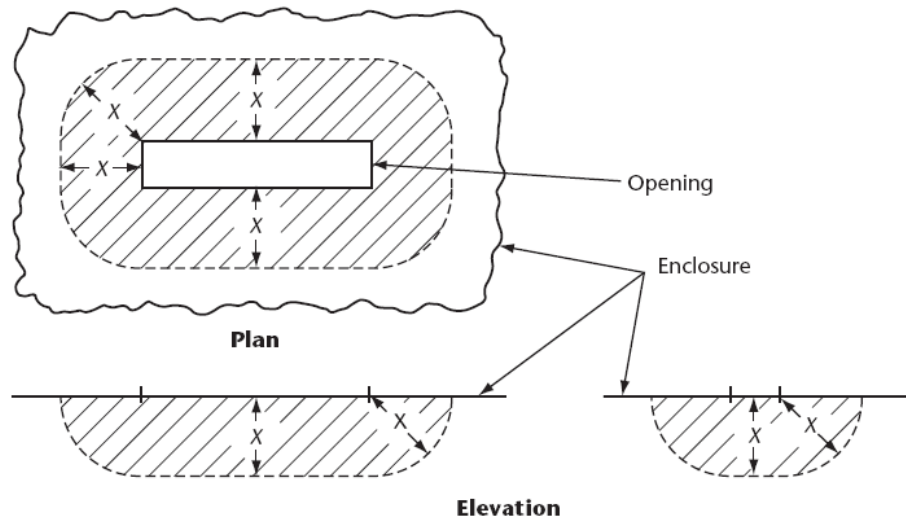
Figure 1
Probe for sink flange openings
 (See [Clause 5.2.12.2\(c\)](#).)



	Diameter, d	Length, ℓ
Probe 1	6.3	75
Probe 2	12.5	100

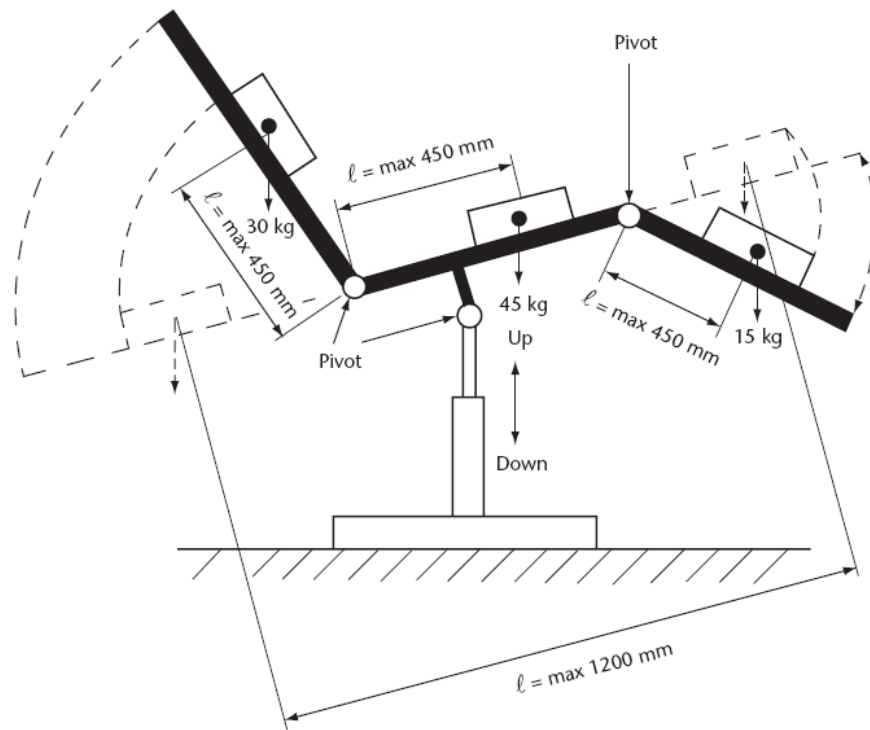
Note: All dimensions given are in millimetres.

Figure 2
Probe for table-mounted and hand-held appliances
 (See [Clauses 5.2.13.2](#), [5.2.13.3](#), and [8.3.2.2](#).)



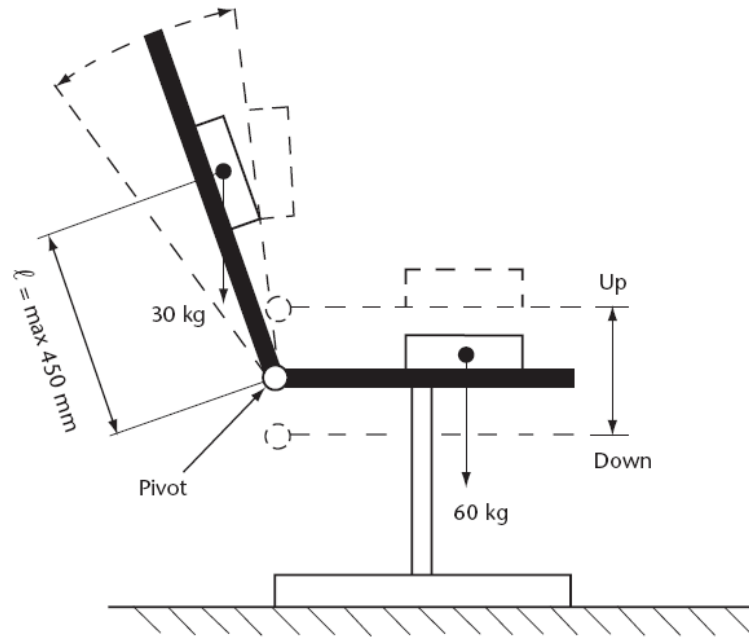
Note: "X" equals five times the diameter of the largest rod that can be inserted through the opening, but not less than 100 mm.

Figure 3
Probe areas for bare live parts
(See [Clause 5.2.13.4.](#))



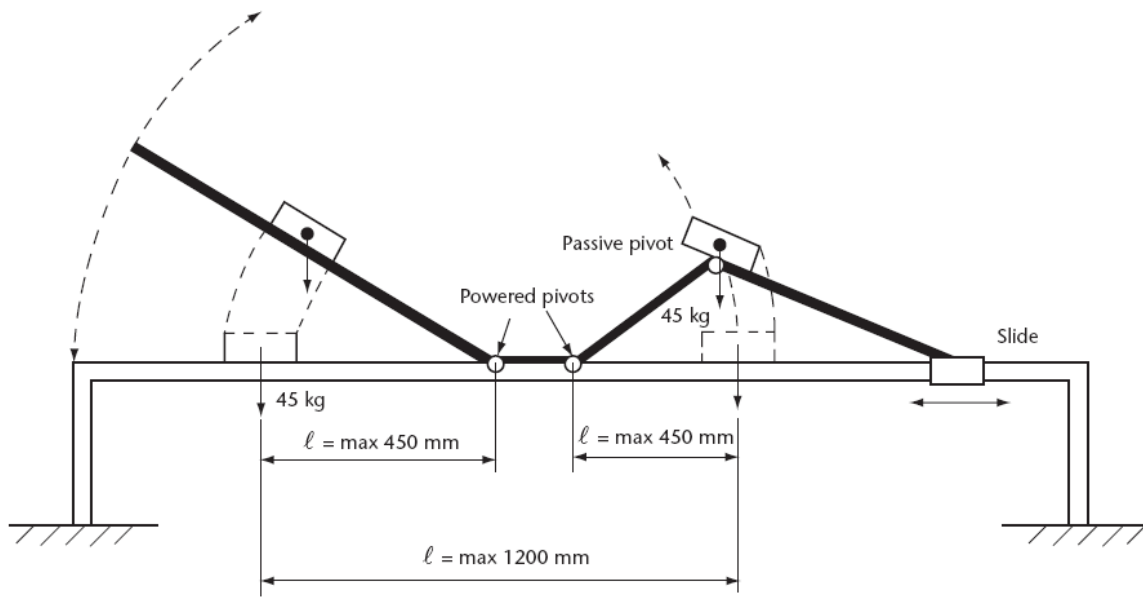
Legend:
 l = length

Figure 4
Loading for electric chair or exercise appliance
(See [Clause 6.2.16.](#))



Legend:
 l = length

Figure 5
Loading for chair without a leg support
(See [Clause 6.2.16.](#))



Legend:
 l = length

Figure 6
Loading for bed
(See [Clause 6.2.16.](#))

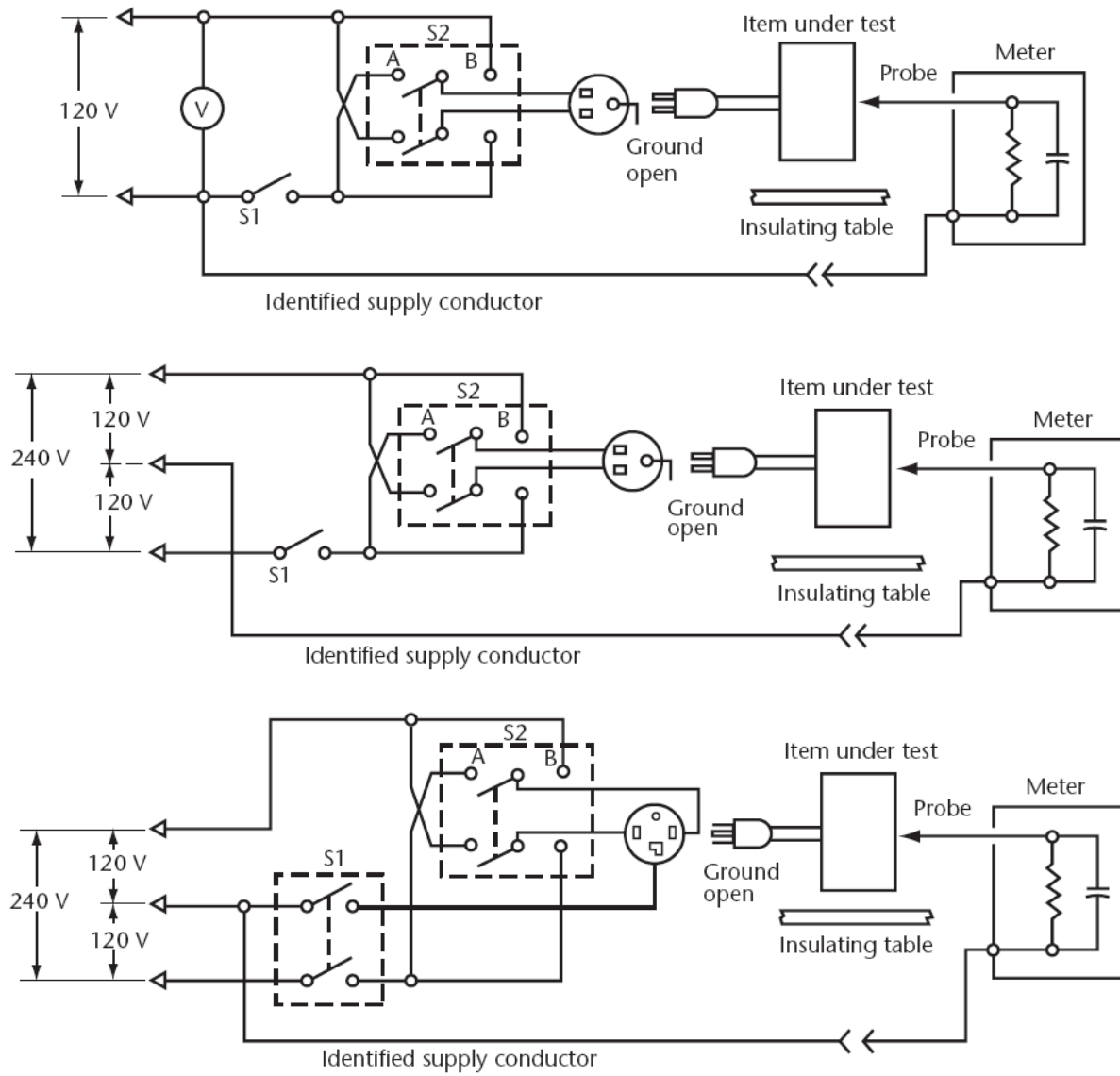


Figure 7
Leakage current measurement circuit
(See Clause 6.9.5.)

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