

**CAN/CSA-C22.2 No. 0-M91
(Reaffirmed 2001)
General Requirements -
Canadian Electrical Code,
Part II**

A National Standard of Canada

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Preface

The *Canadian Electrical Code* is a publication issued by CSA in several parts. Among these are *Part I*, which establishes safety standards for the installation and maintenance of electrical equipment, and *Part II*, which consists of safety standards governing the construction, testing, and marking of electrical equipment.

Part II Standards are prepared by Subcommittees, which operate under the jurisdiction of Technical Committees, which in turn are responsible to the Standards Steering Committee on Canadian Electrical Code, Part II. In preparing these Standards, the views of all interested organizations are taken into account; regulatory authorities, industry, and general interests.

This is the eighth edition of CSA Standard C22.2 No. 0, now CAN/CSA-C22.2 No. 0, and supersedes the seventh edition published in 1982.

This Standard is part of the Requirements for Safety of Electrical Products segment of CSA's Electrical Program and is identified as such by the electrical symbol on the front cover.

Amendments to the Standard are to be found in Clauses 3.2.3, 3.4 (the addition of Items (i) and (j)), 5.1(k), 6.2.1, 6.2.5, and the addition of Clauses 5.3, 6.5, and Appendix C.

This Standard was prepared by a Subcommittee of the Technical Committee on General Requirements under the jurisdiction of the Standards Steering Committee on Canadian Electrical Code, Part II, and was formally approved by these Committees. It has been approved as a National Standard of Canada by the Standards Council of Canada.

July 1991

Notes:

- (1) *Use of the singular in this Standard does not exclude the plural (and vice versa) when the sense allows.*
- (2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- (3) *CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.*
- (4) *All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, Standards Division, 178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3.*
Requests for interpretation should
 - (a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
 - (b) *provide an explanation of circumstances surrounding the actual field condition; and*
 - (c) *be phrased where possible to permit a specific "yes" or "no" answer.*

Interpretations are published in CSA Information Update. For subscription details and a free sample copy, write to CSA Sales Promotions or telephone (416) 747-4116.

Foreword

Certification organizations, as accredited by the Standards Council of Canada, have their own criteria and procedures for certification services. The following paragraphs define CSA Certification policies.

The Canadian Standards Association provides certification services for manufacturers who, under license from CSA, wish to use the appropriate registered CSA Marks on certain products of their manufacture to indicate conformity with CSA Standards.

CSA Certification for a number of products is provided in the interest of maintaining a level upon standards of quality, performance, interchangeability and/or safety, as appropriate. Where applicable, certification may form the basis for acceptance by inspection authorities responsible for enforcement of regulations. Where feasible, programs will be developed for additional products for which certification is desired by producers, consumers or other interests.

In performing its functions in accordance with its objectives, CSA does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of the Association represent its professional judgement given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed.

Products in substantial accord with this Standard but which exhibit a minor difference or a new feature may be deemed to meet the Standard provided the feature or difference is found acceptable utilizing appropriate CSA Certification Division Operating Procedures. Products which comply with this Standard shall not be certified if they are found to have additional features which are inconsistent with the intent of this Standard. Products shall not be certifiable if they are discovered to contravene applicable Federal laws or regulations.

Testing techniques, test procedures and instrumentation frequently must be prescribed by the CSA Certification Division in addition to the technical requirements contained in Standards of CSA. In addition to markings specified in the Standard the CSA Certification and Testing Division may require special cautions, markings and instructions that are not specified by the Standard.

Some tests required by CSA Standards may be inherently hazardous. The Association neither assumes nor accepts any responsibility for any injury or damage that may occur during or as the result of tests, wherever performed, whether performed in whole or in part by the manufacturer or the Association, and whether or not any equipment, facility or personnel for or in connection with the test is furnished by the manufacturer or the Association.

Manufacturers should note that, in the event of the failure of the CSA Certification and Testing Division to resolve an issue arising from the interpretation of requirements, there is an appeal procedure: the complainant should submit the matter, in writing, to the Secretary of the Canadian Standards Association.

If this Standard is to be used in obtaining CSA Certification please remember, when making application for certification, to request all current Amendments, Bulletins, Notices and Technical Information Letters that may be applicable and for which there may be a nominal charge. For such information or for further information concerning details about CSA Certification please address your inquiry to the Applications and Records Section, Canadian Standards Association, 178 Rexdale Boulevard, Rexdale (Toronto), Ontario M9W 1R3.

Publication Date - July 31, 1991

(ie, the date on or after which this Standard may, at the discretion of the applicant, be used for certification).

Effective Date - July 31, 1992

(ie, the date on which this Standard shall be applicable to equipment being submitted for certification and to equipment already certified and manufactured on or after that date).

**Unless otherwise noted in the text or General Instruction.*

1. Scope and Object

1.1 Scope of this Standard

This Standard covers definitions, construction requirements, marking, and tests of a general nature that are applicable to all or several of the individual standards of Part II of this Code.

1.2 Scope of Individual Standards

Each individual Standard covers definitions, construction requirements, marking, and tests for a single class or a closely allied group of electrical equipment.

1.3 Object of Canadian Electrical Code, Part II

The object of Standards issued as portions of Part II of this Code is prevention of injury to persons and damage to property through proper design, good construction, and high quality workmanship. To this end, there are safety standards for the design and construction of electrical equipment for use throughout Canada in conformity with the Rules of Part I of this Code.

1.4 Object of this Standard

This Standard shall form a part of, and be read in conjunction with, all individual standards to which the requirements of this Standard may apply, except that, where an individual standard contains requirements that are at variance with those of this Standard, the requirements of the individual Standard shall take precedence.

1.5 Object of Individual Standards

1.5.1

Individual Standards contain only the special requirements applicable to the equipment that they cover.

1.5.2

Where an individual Standard makes reference to another Standard, requirements in the individual Standard at variance with those in the other Standard shall take precedence.

2. Definitions

2.1

For the purpose of correct interpretation, certain terms have been defined and, where such terms appear throughout the *Canadian Electrical Code, Part I*, they shall be understood to have the meaning ascribed to them in the definitions.

2.2

Definitions contained in the *Canadian Electrical Code, Part I* shall also apply to Part II where applicable, unless the terms are defined otherwise in Part II of this Code.

2.3

Individual Standards, in general, contain definitions that are applicable only to themselves or that are intended to have a different meaning for the individual Standard from those contained in this Standard.

2.4

Except as stated above, the following definitions apply throughout the *Canadian Electrical Code, Part II*.

Breakout - a portion of a wall of a cast or moulded enclosure so fashioned, usually by the use of one or more rings of reduced thickness of the wall material, that the material within the outer perimeter of the ring to be removed may be readily broken away at the time of installation in order to provide an opening similar to that provided by a knockout.

Conduit entry (threaded) - a conduit entry that is threaded so as to secure a rigid conduit without the use of a bushing or locknut.

Current-carrying part - a conducting part intended to be connected in an electric circuit to a source of voltage.

Note: *Non-current-carrying parts are those not intended to be so connected.*

Date —

Effective date - the date on which a Standard or revision to an existing Standard shall be applicable to equipment being submitted for certification and to equipment already certified that is manufactured on or after that date. The effective date shall be 12 months after the publication date, unless otherwise recommended by the Canadian Electrical Code, Part II Subcommittee.

Publication date - the date on which a standard or revision to an existing standard is first available for general release in its final form. When used as a basis for certification, it also means the date on or after which the standard may, at the discretion of the applicant, be used for certification.

Enamelled wire - see definition for Film-coated wire.

Film-coated wire - magnet wire with a continuous film (not wrapped) of synthetic or natural insulating materials.

Full thread - the full major diameter of a screw thread for a distance equal to the pitch of the thread (one complete revolution).

Grounding/bonding screw (terminal) - a screw (terminal) used for connecting a grounding/bonding conductor to a non-current-carrying conductive part intended to be grounded, or bonded to ground.

Heater element - that part of a heating device which comprises the heating element and its porcelain, mica, or other insulating support.

Heating element - the actual electrical conducting medium, in a heating device, that is intended to be heated by an electric current.

Instantaneous - that no delay in operation is purposely introduced.

Knife switch - a switch in which the moving element is in the form of a blade, usually hinged, that enters or embraces contact clips.

Knockout - a portion of a wall of a sheet metal enclosure so fashioned that it may be readily removed at the time of installation in order to provide a hole, usually circular in shape, for the entrance of wires or the attachment of conduit, cable, etc.

Pryout - a knockout provided with a slot in order that a tool such as a screwdriver may be inserted to pry out the knockout.

Rated frequency - the frequency or range of frequencies at which any particular ac apparatus or device is intended to operate.

Rated load - any ampere, watt, or horsepower rating given to electrical equipment by the manufacturer.

Note: *Ampere ratings will be considered to be rms values, unless otherwise specified.*

Rated voltage - the voltage or range of voltages given to electrical equipment by the manufacturer.

Note: *Voltage ratings will be considered to be rms values, unless otherwise specified.*

Terminal parts - the parts used in making wiring connections.

Twistout* - a ring member surrounding a knockout and similarly fashioned so that it may be removed after the knockout in order to provide a larger hole than that provided for by the removal of the knockout only.

**The term "multiple knockout" has generally been applied by the trade to denote a knockout surrounded by one or more twistouts.*

Wiring terminal screws or wiring terminal parts - those terminal screws or parts to which connections are to be made in the field.

3. General Requirements

3.1 Compliance with Standards

3.1.1

Electrical equipment or parts thereof complying with a particular Standard shall not incorporate in it or them other features or materials that will impair the result intended with respect to safety.

3.1.2

Electrical equipment or parts thereof using materials or having forms of construction differing from those detailed in the Standard may be considered to comply with the Standard if the intent has been properly observed.

3.1.3

When electrical equipment covered by a particular Standard contains components that are covered by other CE Code, Part II Standards, such components shall be suitable for the intended application, and shall

(a) be approved; or

(b) comply with those requirements of the component Standard which are pertinent to the intended application.

3.2 Safety and Protection

3.2.1

Electrical equipment shall be so designed and constructed that adequate provision is made for the safety of persons and

property, that it is itself adequately protected from mechanical and other injury, and that, with proper handling, it may be expected to give safe service for a reasonable length of time.

3.2.2

Exposed moving parts that might constitute an accident hazard, other than those which are required to be exposed for proper operation of the equipment, shall

(a) in the case of portable equipment, be provided with adequate guards, which shall form an integral part of the equipment; or

(b) in the case of stationary equipment, be similarly guarded where practicable unless it is evident that such guarding, or equivalent protection, will be separately provided during installation.

3.2.3

Nothing in this Standard or in an individual Standard of the *Canadian Electrical Code, Part II* shall obviate compliance with federal safety regulations.

3.3 Materials and Workmanship

3.3.1

Only materials and parts that are suitable for the particular use to which they are put shall be used.

3.3.2

Equipment shall be made and finished with a degree of uniformity and grade of workmanship complying with the appropriate requirements of the Standard and the generally accepted principles of sound and safe practice.

3.3.3

Special attention shall be paid to the mechanical execution of the work, careful and neat running, connection, soldering, and taping of conductors, and secure attachment of component parts.

3.4 Basis for Compliance

Individual Standards shall provide requirements for electrical equipment, particularly with reference to the following considerations:

(a) suitability for installation and use in conformity with the requirements of the *Canadian Electrical Code, Part I*;

(b) mechanical strength and durability including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided;

(c) electrical insulation including over surface and through air spacings;

(d) heating effects under normal conditions of use and also under abnormal conditions that are likely to arise in service;

(e) arcing effects;

(f) protection of bare* or insulated live parts to prevent contact by persons or objects;

**Film-coated wire is considered to be a bare live part.*

(g) markings or arrangements to ensure safe and proper application and use;

(h) protection provided against moisture, corrosion, and other adverse conditions likely to arise in service;

(i) leakage current for cord-connected equipment (see Clause 6.5); and

(j) limits of temperature on parts of equipment that have to be handled in normal use.

3.5 Reference Publications

3.5.1

Where reference is made to CSA Standards of the *Canadian Electrical Code, Parts I and II*, such reference shall be considered to refer to the latest edition and revision thereto, unless otherwise specified.

This Standard makes reference to the following such Standards and the year dates shown indicate the latest editions available at the time of printing:

CSA Standards

C22.1-1990,

Canadian Electrical Code, Part I;

C22.2 No. 0.1-M1985,

General Requirements for Double Insulated Equipment;

C22.2 No. 0.4-M1982,

Bonding and Grounding of Electrical Equipment (Protective Grounding);

C22.2 No. 0.5-1982,

Threaded Conduit Entries;

C22.2 No. 0.7-M1985,
Equipment Electrically Connected to a Telecommunication Network;
C22.2 No. 0.12-M1985,
*Wiring Space and Wire Bending Space in Enclosures for Equipment
Rated 750 V or Less.*

3.5.2

Where reference is made to the following Publications not under the jurisdiction of the Standards Steering Committee on Canadian Electrical Code, Part II, such reference shall be considered to refer to that edition listed below:

ANSI* Standard

B18.6.3-1972 (R1983),
Slotted and Recessed Head Machine Screws and Machine Screw Nuts.

Note: *This Standard does not cover square recess head machine screws, but ANSI plans on issuing a new Standard for such screws.*

ANSI/ASTM† Standard

A568M-77,
General Requirements for Steel, Carbon and High-Strength Low-Alloy, Hot-Rolled Sheet and Cold-Rolled Sheet (Metric).

ANSI/IEEE‡ Standard

1-1986,
Standard General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation.

*American National Standards Institute.

†American National Standards Institute/American Society for Testing and Materials.

‡American National Standards Institute/Institute of Electrical and Electronic Engineers.

3.6

Equipment that is intended to be electrically connected to a telecommunication network shall comply with the requirements of CSA Standard C22.2 No. 0.7.

3.7

Cord-connected double-insulated equipment shall comply with the requirements of CSA Standard C22.2 No. 0.1.

3.8

Enclosed equipment that is to be permanently field-connected to line or load circuits rated 750 V, or less, shall comply with the requirements of CSA Standard C22.2 No. 0.12.

4. Construction Details

4.1 Bases for the Mounting of Live Parts

Bases on which live parts are to be mounted shall conform to the following:

- (a) they shall be composed of insulating material suitable for the purpose;
- (b) untreated fibre shall not be used as the sole support for current-carrying parts; and
- (c) the construction shall be such that, considering the material used, the base will withstand the most severe conditions likely to arise in service.

4.2 Terminal Parts

Terminal parts by means of which connections are made to or between conductors shall conform to the following requirements:

- (a) they shall ensure thoroughly good connection even under hard usage;
- (b) they shall consist of solderless connectors or be suitable for use with solderless connectors or soldered lugs in the case of
 - (i) wiring terminal parts (for external connection) of equipment that will require the use of conductors larger than No. 10 AWG for field connections;
 - (ii) terminal parts (for internal connection only) of equipment that requires the use of conductors larger than No. 8 AWG; and
- (c) they may consist of means for clamping the conductors where the conductors are not larger than indicated in Item (b) and such means are constructed so that
 - (i) they will firmly grip the conductors and securely hold them in place; and
 - (ii) solid conductors cannot come out from under the clamping means even though the latter is loosened sufficiently to allow lateral movement of the conductors with respect to the means.

4.3 Size of Screws

If binding head screws or machine screws and washers are used as clamping means for conductors, the size of screw shall be not less than

- (a) No. 10 if for use with conductors larger than No. 14 AWG;
- (b) No. 8 if for use with conductors of No. 14 AWG; or
- (c) No. 6 if for use with conductors smaller than No. 14 AWG.

4.4 Material for Screws, Etc

4.4.1

Binding head and machine screws shall conform to ANSI Standard B18.6.3.

4.4.2

Binding head screws, bolts, studs, nuts, and washers used in electrical connections shall be of nonferrous metal except that, in sizes No. 10 or larger, iron or steel may be used if

- (a) such parts are suitably protected with a plating of cadmium, zinc, or equivalent material having a thickness not less than 0.005 mm; and
- (b) the conductor or terminal to be secured is clamped against a surface of nonferrous metal that will carry the greater part of the current.

4.5 Terminal Plates and Threading

4.5.1

Wiring terminal screws shall thread into metal.

4.5.2

The threading of binding head screws and machine screws, other than wiring terminal screws, into material other than metal shall be subject to investigation.

4.5.3

Terminal plates through which binding head screws or machine screws are threaded shall have a thickness at least equal to twice the pitch of the thread of the screw but not less than 0.76 mm, and shall have at least two complete clean-cut full threads.

4.5.4

Terminal plates for solderless connectors or solderless lugs shall

- (a) have a thickness of not less than 1.27 mm;
- (b) have at least two complete full threads, if threaded; and
- (c) provide contact areas, such that the full contact area of the tongue of the largest lug that would normally be used will be properly utilized.

4.5.5

Screws engaging threaded holes in plates shall have not fewer than two full threads engaging under any condition of service.

4.5.6

If terminal screws do not pass entirely through threaded holes, they shall engage clean-cut full threads for a distance not less than the major diameter of the screw.

4.6 Identification

4.6.1

Terminals that are intended for direct connection to either a grounded conductor or a neutral conductor of a supply circuit shall be identified unless their intended use is clearly evident. They shall be substantially white in colour if colour coded, or be marked "N", "Neutral", "W", or "White" either on or adjacent to the terminal.

4.6.2

Leads that are intended for direct connection to either a grounded conductor or a neutral conductor of a supply circuit shall be identified at the point of supply connection. Identification shall be a white or natural grey covering or other means as permitted by the *Canadian Electrical Code, Part I*.

4.7 Bonding and Grounding Provisions

Cord-connected equipment that is required to be grounded and permanently connected equipment shall be grounded in accordance with the requirements of CSA Standard C22.2 No. 0.4.

4.8 Switches and Overcurrent Protection in Identified and Grounding Conductors

4.8.1

No single-pole, manually operated switch or single-pole overcurrent device or single-pole safety control, that is intended to disconnect the power from equipment shall be connected in the circuit of an identified conductor when used in equipment having polarized supply connections, except where

- (a) the overcurrent device is located in that part of a circuit which is connected by a two-pole polarized or unpolarized attachment plug;
- (b) the circuit is rated 15 A or less, 125 V or less;
- (c) the equipment is marked

WARNING: DISCONNECT SUPPLY BEFORE SERVICING*; and

*See Appendix C for French translation.

- (d) if fuses are used, fuseholders are of the type that permits replacement without hand access to live parts.

Notes:

(1) "Safety control" means a control that is intended to prevent unsafe operation of the controlled equipment.

(2) "Polarized supply connections" means that one of the terminals or leads intended to be connected to a grounded or neutral supply circuit conductor is identified.

4.8.2

No switch, control, or overcurrent device shall be connected in the circuit of a grounding conductor or in the circuit of a conductor that is bonded to ground.

4.9 Polarization

4.9.1

If a polarized receptacle (or other polarized device such as a lampholder having a socket screw shell, or a load fitting as used on a flexible cord, ie, a cord connector) is used on equipment that

- (a) plugs into the supply; and
- (b) is conductively connected to the blades of the plug or equivalent*; then
 - (i) the plug or equivalent shall be of a polarized type;
 - (ii) polarization shall be maintained throughout by connecting corresponding terminals of the plug and receptacle to the same conductor; and
 - (iii) overcurrent and switching devices, if provided, shall be connected in the circuit of ungrounded conductors only, unless of the multi-pole type that opens the circuit of the ungrounded and grounded (eg, neutral) conductors simultaneously.

*The "equivalent" of a plug in the above has reference to the blade configuration as used on direct plug-in devices.

4.9.2

The converse of Clause 4.9.1 shall apply if a polarized type of plug or equivalent is used with equipment having a receptacle to which it is conductively connected.

4.10 Over Surface and Through Air Spacings

4.10.1

Over surface and through air spacings between live parts of opposite polarity or of different voltages and between live parts and non-current-carrying conductive parts shall be adequate for the conditions.

4.10.2

Over-surface and through-air spacings shall be measured around barriers, provided that, in the case of over-surface spacings, the barriers either are integral with the supporting bases or are fastened to them so that they effectively prevent leakage along the path that, without the barrier, would be the over-surface path.

4.10.3

Barriers and tubes or beads used to provide effective through-air spacings and to increase over-surface spacings shall be made of insulating material suitable for the purpose.

4.10.4

Tubes and beads shall be suitably secured in place.

4.11 Protection and Enclosures

4.11.1

Bare live parts shall be inaccessible to unauthorized and unqualified persons unless the voltage between live parts and between live parts and ground cannot, normally, exceed 30 V.

4.11.2

Enclosures of electrical equipment shall be noncombustible, subject to the requirements of the individual Standards.

4.11.3

Protection against injury from any cause, whether aqueous, mechanical, thermal, chemical, or electrical, shall be adequate and suitable for the most severe conditions of normal use and exposure, and shall be provided whenever it is necessary.

4.11.4

Equipment that is intended or likely to be exposed to the weather shall be protected against accumulation of moisture due to snow, rain, or sleet.

4.11.5

Ferrous metals susceptible to rusting, whether cast or wrought, shall, except where it is otherwise impracticable, be protected against rusting by the use of one or more of

- (a) coatings or platings, such as
 - (i) coating of nonferrous metals applied by the hot process method; or
 - (ii) plating of nonferrous metals, applied either by electro-deposition or by chemical means;
- (b) coatings of nonmetallic substances applied by the vitreous process;
- (c) paints or similar coatings of the baked-finish type; or
- (d) paints or similar coatings of the air-drying type.

The protection shall be effective under adverse conditions that are likely to be encountered by any particular device or part in service.

Notes:

- (1) *For ordinary locations, cast iron will, in general, be considered to be protected by any finish used for ornamental purposes, but it is recommended that the interior portions of castings be, at least, coated with a drying oil.*
- (2) *Resistance and heating elements and other parts that will be subjected to high temperatures during service will not, in general, require protection.*
- (3) *Laminations used for magnetic cores will be considered to be protected by the process used to reduce currents between laminations.*
- (4) *Shafts, bearings, and other parts, the proper operation of which would be adversely affected by platings and coatings, and all parts that, in normal operation, will be under oil will not require protection.*

4.11.6

Notwithstanding that equipment is provided with the protective enclosure as required by Clauses 4.11.1 to 4.11.5, suitable additional protection may be required for live parts considered to be concealed hazards as follows:

- (a) by location;
- (b) by supplementary guarding; or
- (c) by conspicuous, specifically worded caution markings.

4.12 Threaded Conduit Entries

Threaded conduit entries shall comply with the requirements of CSA Standard C22.2 No. 0.5.

4.13 Boxes for Wiring Terminal Parts

4.13.1 Size

Boxes, either integral with or attached to equipment, shall be of sufficient size to accommodate wiring joints or terminal blocks without crowding.

4.13.2 Construction

4.13.2.1

Boxes shall have removable plates to facilitate connection and inspection, and no conductor shall be brought out through such plates.

4.13.2.2

Boxes for use in nonhazardous locations shall have no openings other than those which are required for support and connections and which will be filled or covered when the box is in use.

4.13.2.3

Where conductors pass through an opening from the enclosure of a device to a terminal box

- (a) the edges of such openings shall be well rounded to prevent abrasion of the conductor insulation;
- (b) a bushing shall be used to protect the conductor insulation; or
- (c) the opening, with the conductors in place, shall be filled with an insulating compound that will prevent the conductors

coming in contact with the metal surrounding the opening.

4.14 Wiring Connections

4.14.1

Electrical connections shall be made in such a manner as to obtain good and permanent contact.

4.14.2

That portion of stranded conductors to be held by wire-binding screws or solderless connectors shall have the strands confined in such a manner that no stray strands can cause either short-circuits or grounds.

4.14.3

Soldered joints and taps in conductors shall be both mechanically and electrically secure before solder is applied. Noncorrosive soldering fluxes only shall be used.

4.14.4

Joints or splices made in or between insulated conductors, other than suitable rigid terminal points need not be enclosed to a greater degree than is required for the conductors being joined, but shall be

- (a) covered in a suitable manner with insulation equivalent to or better than the insulation on the conductors themselves with regard to voltage, thermal, and other characteristics; and
- (b) located so that they will be accessible for maintenance or service without disturbing the wiring of the equipment.

4.14.5

Conductors shall be supported and connected so that there will be no undue mechanical strain on either the conductors or their terminals.

4.14.6

Where the outer covering of an insulated conductor may be subject to ravelling or fraying, such action shall be prevented at any point where the outer covering is cut by treating, taping, or other equivalent means.

4.14.7

Where the outer covering of an insulated conductor consists of a material that will carry leakage current, the covering shall be cut back at all points where the bare conductor is exposed and, if necessary, other types of insulation substituted.

4.15 Rough Edges

Rough edges and burrs shall be removed from materials at all places where they would be likely to injure the insulation on conductors.

4.16 Supply Connections

4.16.1

Equipment shall have provision for connection to the supply by means of

- (a) a terminal block;
- (b) leads; or
- (c) an attachment plug.

4.16.2

The current-carrying parts shall have adequate mechanical strength and ampacity.

4.16.3

Where flexible cord or power supply cable is connected to an attachment plug, its ampacity shall be in accordance with the *Canadian Electrical Code, Part I*.

4.16.4

Terminal blocks and internal leads shall be located at a readily accessible point either within the enclosure of the equipment or in an attached terminal box.

4.16.5

Flexible cords and power supply cables shall be provided with strain relief to prevent mechanical strain from being transmitted to the connections.

4.16.6

Joints shall not be made in flexible cords and power supply cables external to the equipment.

4.17 Provision for Clearance Holes for Conduit Connection

4.17.1

Clearance holes in enclosures for the introduction of conduit, or threaded connectors conforming to conduit dimensions, shall be of such sizes and so located that they conform to the following:

- (a) openings shall be of such diameter that the conduit can be readily inserted without binding but shall not provide excessive clearances. Recommended diameters are shown in Table 1;
- (b) openings shall be surrounded by a substantially flat surface of sufficient diameter to permit the proper seating of a conduit bushing or locknut. Recommended minimum diameters are shown in Table 1;
- (c) the centre-to-centre distance between adjacent openings shall be sufficient to permit proper tightening of the conduit bushing or nut without interference; and
- (d) where provision, by such means as multiple breakouts or twistouts, is made at a given point for more than one size of conduit, the diameter and distance required by Items (b) and (c) shall be based on the largest size of conduit provided for.

4.17.2

Where single or multiple breakouts are provided in cast or moulded enclosures by means of an area or rings of reduced thickness of material, the reduction in thickness used shall be such that

- (a) the material can be readily removed, using ordinary care, to provide an opening of the required size without damaging the remainder of the enclosure or any outer rings; and
- (b) the strength of any remaining rings will withstand the loading test specified in Clause 6.4.3(b).

4.17.3

Knockouts, pryouts, and twistouts shall be so formed that they are capable of being readily removed and they will have sufficient strength to meet the test requirements of Clause 6.4 of this Standard.

4.18 Equipment for Mounting On or Over Combustible Surfaces

4.18.1

Electrical equipment shall be so constructed that molten or flaming particles cannot fall on the surface on or over which the equipment is mounted.

4.18.2

Notwithstanding Clause 4.18.1, certain commercial and industrial equipment specified in individual standards shall be permitted to be marked with the following or equivalent wording;

CAUTION: WHEN MOUNTING ON OR OVER A COMBUSTIBLE SURFACE, A FLOOR PLATE OF AT LEAST 1.43 mm GALVANIZED OR 1.6 mm UNCOATED STEEL EXTENDED AT LEAST 150 mm BEYOND THE EQUIPMENT ON ALL SIDES MUST BE INSTALLED.*

* See Appendix C for French translation.

5. Marking

5.1 Marking Required

Electrical equipment shall be plainly marked in a permanent manner, in a place where the details will be readily visible after installation, with any of the following items that individual standards may require:

- (a) registered trademark, trade name, manufacturer's name, or other recognized symbol of identification of the manufacturer;
 - (b) catalogue or type number, or other mark used for distinguishing purposes;
 - (c) rated voltage;
 - (d) rated-load amperes, watts, volt amperes, or horsepower;
 - (e) whether for ac* or dc, or both;
- * The symbol "~" may be used.
- (f) number of phases (if for ac);
 - (g) rated frequency in hertz (if for ac);
 - (h) rated load speed in revolutions per minute;
 - (i) designation of terminals (polarity, etc);
 - (j) duty rating, ie, continuous, short-time, intermittent, periodic, or varying duty;
 - (k) caution or warning markings† (see Clause 5.3); and

† It is recommended that the word "WARNING" be used in markings to emphasize that hazardous voltages, currents, and temperatures, which could cause personal injury, exist in the use of equipment to which it is applied if the warning is ignored.

It is recommended that the word "CAUTION" be used in markings if damage to the equipment may result if the caution is ignored.

Where both personal injury and damage to the equipment may occur if the marking is ignored, it is recommended that the marking include the word "WARNING".

(l) the words "ON" and "OFF" or symbols** to indicate the "ON" and "OFF" positions of switches or controls that have such positions, unless the construction or application of the switch or control is such that marking is unnecessary.

‡ Symbols for "ON" and "OFF" are respectively "I" and "O".

5.2 Double Insulated Equipment

5.2.1

Where individual standards specify requirements for double insulated equipment, such equipment shall be marked in a permanent manner where the details will be readily visible

(a) with the words "DOUBLE INSULATED"; or



(b) with the symbol

5.2.2

When the double insulated symbol is used, it shall be so placed that it will be obvious that it is a part of the technical information and, it is unlikely to be confused with the trademark of any manufacturer or with any other marking.

The dimensions of the symbol shall be such that the length of the sides of the outer square is about twice the length of the sides of the inner square. The length of the sides of the outer square shall not be less than 5 mm, unless the largest dimension of the appliance does not exceed 15 cm, in which case the dimensions of the symbol may be reduced, but the length of the sides of the outer square shall be not less than 3 mm.

5.3 Language of Markings

5.3.1

Caution and warning markings shall be in English and French except as permitted by Clause 5.3.3.

5.3.2

Individual Standards shall include the French translation of the markings (in an appendix).

Note: The preferred French translations of the words **WARNING** and **CAUTION** are **AVERTISSEMENT** and **ATTENTION**, respectively.

5.3.3

Where the product is intended for use outside Canada, caution and warning markings may be in other languages.

6. Tests

6.1 Voltage

6.1.1

Rated voltage and, for ac, rated frequency shall be used for rated-load tests.

6.1.2

Alternating current voltages and currents referred to in Standards of this Code are root-mean-square symmetrical values unless specified otherwise.

6.2 Temperature Determination

6.2.1

Temperatures shall be considered to have reached their maxima when three consecutive readings are practically the same. The interval between consecutive readings will depend upon the thermal characteristics of the equipment. Shifts in ambient temperature should be taken into account when determining if maximum temperature has been attained.

6.2.2

Temperatures may be determined by the use of thermometers, thermocouples, rise of resistance method, or the equivalent, whichever is most suitable for the particular case.

6.2.3

Care shall be taken to ensure that the thermometer bulb, thermocouple, or other temperature-detecting element maintains low thermal impedance contact with the surface whose temperature is to be measured. The method used to

secure the detecting element to the surface shall not result in any appreciable change in temperature.

6.2.4

The formula for obtaining the temperature of copper by the rise of resistance method is as follows:

$$T = \frac{R}{r} (234.5 + t) - 234.5$$

where

T = calculated temperature in °C

t = reference (room) temperature in °C

R = resistance in ohms at temperature "T" (ie, while hot)

r = resistance in ohms at temperature "t"

Note: For aluminum conductors of 62% volume conductivity, substitute "225" for "234.5" in the above formula; for 61% volume conductivity substitute "228".

6.2.5

Thermocouples shall have No. 30 AWG conductors, except that larger conductors may be used where it can be demonstrated that the accuracy of the temperature measurements will not be affected. If referee temperature measurements are necessary, thermocouples having No. 30 AWG conductors shall be used. Thermocouples with gauge sizes smaller than No. 30 AWG may be used for measurement of miniature circuitry and components.

6.3 Dielectric Strength

6.3.1

Dielectric tests, where required, shall be performed immediately following the temperature tests.

6.3.2

If a number of approved components are assembled to form a single electrical unit, the assembly shall be permitted to be tested with a voltage 15% lower than the lowest voltage required for any of the individual components, but in no case less than 1000 V.

6.4 Test Requirements for a Knockout Surrounded by Multiple Twistouts

6.4.1

Clause 6.4 provides test requirements to determine that a combination, consisting of an inner knockout surrounded by twistouts, has been manufactured such that, when one or more of its elements are removed, there will be no change to the remaining twistouts, if any, or to the enclosure in which the combination is located, either during the removal or when conduit has been properly secured in place.

6.4.2

Samples for testing shall be either in the form of complete boxes or as sample plates that will fulfill the requirements of Figure 1.

6.4.3

With a sample box securely held or a test plate supported as in Figure 1, the following tests shall be applied:

- (a) the knockout shall remain in place when subjected to a load of 44 N steadily applied for not less than 1 min normal to the face of the plate by means of a mandrel with a 6.35 mm diameter flat end. The mandrel shall be applied at the point most liable to cause movement of the knockout in the direction in which it was originally punched;
- (b) a load of 220 N shall be steadily applied for not less than 1 min, first in compression and second in tension, through a conduit properly installed in the knockout opening. When this test is being conducted, the conduit shall be not more than 5° from the normal to the surface. There shall be no appreciable distortion of the twistouts or fracture of the ties.

6.4.4

The knockout and each twistout, starting at the smallest, shall be capable of being easily and cleanly removed without disturbing the other twistouts or distorting the box. The sample, if a test plate, shall be supported as shown in Figure 1.

6.5 Leakage Current

6.5.1

Leakage current tests shall be performed with the equipment at normal operating temperature.

6.5.2

The measurement of leakage current shall be made using one of the test circuits of Figure 2.

6.5.3

Leakage current measurements shall be made for each supply system on which a product is intended to be used (see Table 2). The test voltage and frequency shall be the most onerous for which the product is rated.

6.5.4

The measurement instrument shall be electronic or a direct indicating type, average responding, calibrated at 60 Hz and 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-to-terminal impedance equivalent to a 1500 Ω resistance shunted by a 0.15 μ F capacitance.

6.6 Cheesecloth

Where cheesecloth is specified in a standard, it shall be the required number of single plies* of bleached cheesecloth running approximately 34 g/m² with a thread count in the range of 10-12 by 9-12 threads/cm.

**Cheesecloth is typically packaged in folded form in bolts or rolls such that one layer from the bolt or roll may comprise one or more single plies of the cheesecloth material. Accordingly, it will be necessary for the individual product Standard to specify the number of single plies to be used for a particular test.*

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Table 1
Recommended Diameters of Conduit Openings
and Flat Surfaces Surrounding Conduit Openings
(See Clause 4.17.1(a) and (b).)

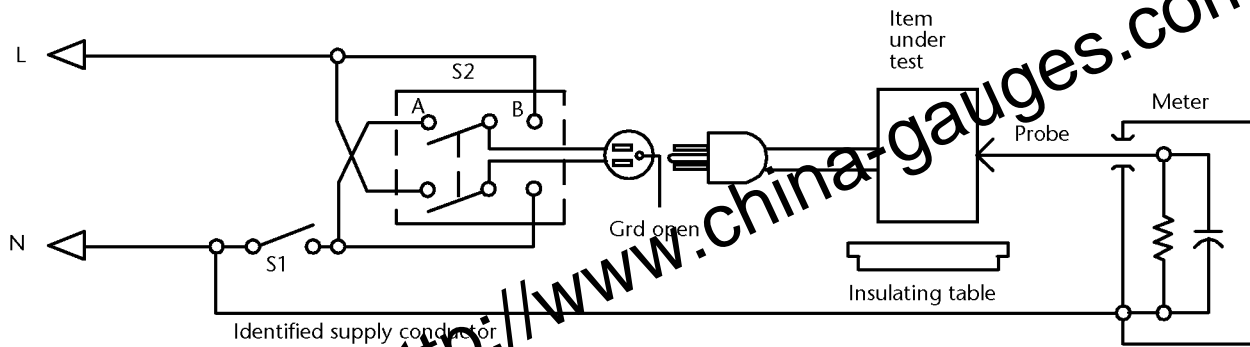
| Trade size of conduit, inch | Recommended diameter of opening, mm | Recommended minimum diameter of flat surface, mm |
|-----------------------------------|---|--|
| 3/8 | 18 | 25 |
| 1/2 | 22 | 30 |
| 3/4 | 28 | 38 |
| 1 | 35 | 48 |
| 1-1/4 | 41 | 60 |
| 1-1/2 | 50 | 67 |
| 2 | 63 | 83 |
| 2-1/2 | 76 | 95 |
| 3 | 93 | 113 |
| 3-1/2 | 106 | 125 |
| 4 | 119 | 138 |
| 5 | 147 | 162 |
| 6 | 175 | 203 |

Table 2
Leakage Current Test Circuits
 (See Clause 6.5.3.)

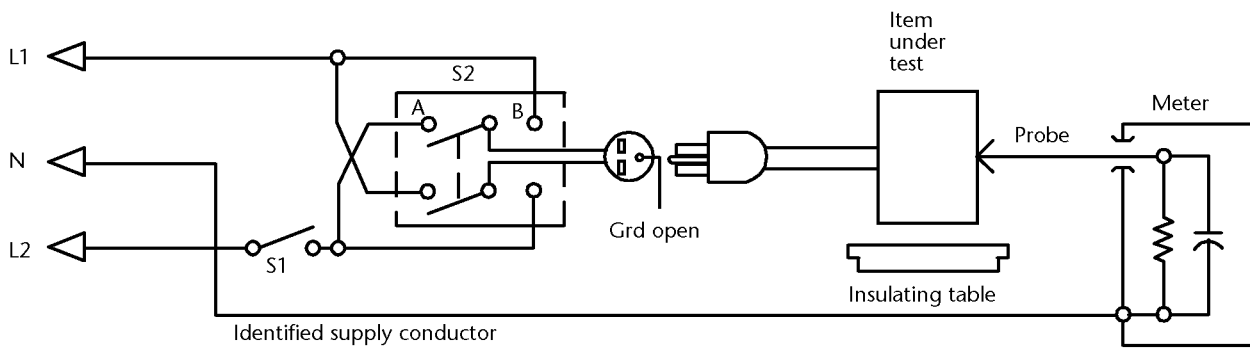
| Intended supply system, V | Figure 2.1 | Figure 2.2 | Figure 2.3 |
|---|------------|------------|------------|
| 120 | X | | |
| 208 (Derived from 120/208 single phase system) | | X | |
| 240 (Derived from 120/240 single phase system) | | X | |
| 240 (Derived from 240/417 three phase system) | X | | |
| 120/208 (Derived from 120/208 three phase system) | | | X |
| 120/208 (Single phase) | | | X |

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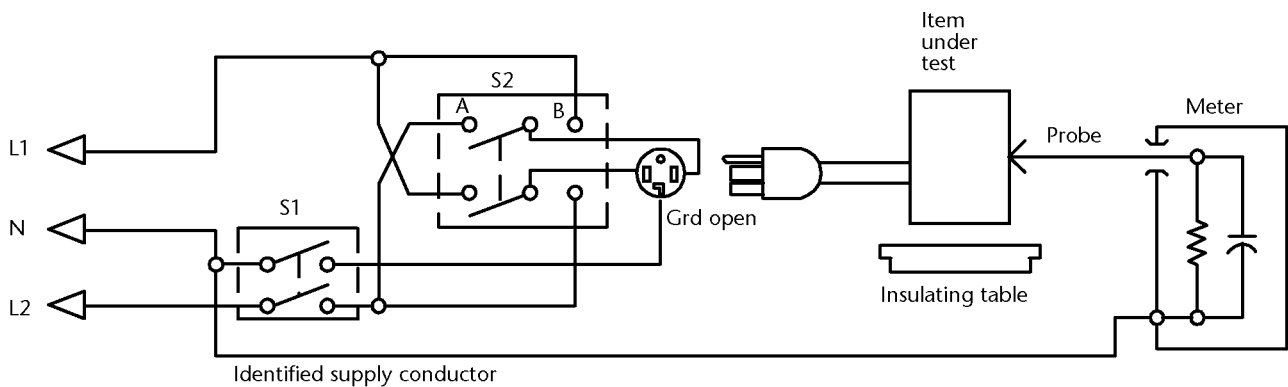
Figure 2
Leakage Current Measurement Circuits
 (See Clause 6.5.2.)



*Receptacle appropriate for the supply system/configuration used.
 (a) Unbalanced supply systems.



(b) Balanced supply systems without identified supply conductor connection at load.



(c) Balanced supply systems with identified supply connection at load.

Appendix A

Gauge Numbers and Thickness of Sheet Metal

Note: This Appendix is not a mandatory part of this Standard.

A1. Scope

A1.1

This Appendix provides information with respect to sheet steel, uncoated and galvanized, and nonferrous sheet metal, aluminum, copper, and brass for the fabrication of enclosures, etc. to be used in the construction of electrical equipment in accordance with the requirements of the *Canadian Electrical Code, Part II*.

A2. Information Included

A2.1

Table A1 of this Appendix provides the following information:

- (a) the gauge number, ie, the Manufacturers' Standard Gauge (MSG) for uncoated steel, the Galvanized Sheet Gauge (GSG) for galvanized steel, and the American Wire Gauge (AWG) (B & SG) for aluminum, copper, and brass;
- (b) the nominal thickness for a given gauge number; and
- (c) the minimum thickness permitted for a given gauge number for the purpose of the standards included in this Code.

A2.2

Tables A2 and A3 of this Appendix provide information for Subcommittees of the *Canadian Electrical Code, Part II* when converting sheet metal thicknesses to metric values.

A2.3

For uncoated sheet steel the minimum thicknesses specified in Table A2 are recommended.

These have been harmonized with nominal preferred thicknesses and take into account tolerances given in ANSI/ASTM Standard A568M. In no case do they result in larger minimum thicknesses than those specified in Table A1.

A2.4

Pending the publication of metric standards providing tolerances for galvanized steel sheet and for nonferrous sheet metal, the minimum metric thicknesses specified in Table A3 are recommended. These values have been soft converted from Table A1.

A2.5

In applying the values of Tables A2 and A3 to Part II Standards, it is recommended that only the minimum thickness in millimetres be specified. For example, a clause that now reads as follows: "... shall be formed of metal not less than 0.0528 in. thick for sheet steel (No. 16 MSG) and 0.0571 in for sheet aluminum (No. 14 AWG)...." would read:

"... shall be formed of metal not less than 1.34 mm thick for sheet steel and 1.45 mm for sheet aluminum"

A3. Application

A3.1

In cases where individual standards of *Canadian Electrical Code, Part II* specify steel, aluminum, copper or brass by gauge number, it will be understood that material having a minimum thickness not less than that specified in Table A1 for the particular material and gauge number will be acceptable.

A3.2

In cases where individual standards specify the minimum thickness permitted, it will be understood that material supplied by gauge number will be permitted, provided the thickness is in no case less than the minimum thickness permitted.

A4. Measurement of Thickness

A4.1

To determine whether a particular sheet or a part cut from a sheet meets the requirements of minimum thickness, measurements shall be made by a suitable micrometer at any point not less than 25 mm from the edge of the sheet or from any edge of a fabricated part and the sheet or part shall be subject to rejection if any such measurement is less than the minimum thickness permitted.

A5. Drawn, Embossed, and Formed Material

A5.1

Where the material is subject to drawing, embossing, or other forming operation that will decrease the thickness of the sheet, the measurement shall be made before such operation is performed, unless otherwise stated, and if deemed necessary the ultimate thickness of the finished piece will be the subject of investigation, to determine that it has the strength necessary for the particular application.

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Table A1
Gauge Numbers and Thicknesses of Sheet Metal

| Thickness of sheet metal, inch* | | | | | | | | |
|---------------------------------|----------------------|----------------|------------------------|----------------|-------------------------|----------------|-----------------------|--------------|
| MSG equivalent | | GSG equivalent | | AWG equivalent | | | | |
| Gauge number | Uncoated sheet steel | | Galvanized sheet steel | | Aluminum, copper, brass | Aluminum sheet | Copper or brass sheet | Gauge number |
| | Nominal | Minimum | Nominal | Minimum | Nominal | Minimum | Minimum | |
| 6 | --- | --- | --- | --- | 0.1520 | 0.1500 | 0.1500 | 6 |
| 7 | --- | --- | --- | --- | 0.1443 | 0.1323 | 0.1323 | 7 |
| 8 | 0.1544 | 0.1524 | --- | --- | 0.1285 | 0.1195 | 0.1185 | 8 |
| 9 | 0.1495 | 0.1375 | --- | --- | 0.1244 | 0.1044 | 0.1044 | 9 |
| 10 | 0.1345 | 0.1225 | 0.1252 | 0.1272 | 0.1019 | 0.0919 | 0.0919 | 10 |
| 11 | 0.1196 | 0.1076 | 0.1233 | 0.1123 | 0.0907 | 0.0827 | 0.0807 | 11 |
| 12 | 0.1046 | 0.0926 | 0.1084 | 0.0974 | 0.0800 | 0.0720 | 0.0700 | 12 |
| 13 | 0.0897 | 0.0797 | 0.0934 | 0.0844 | 0.0720 | 0.0640 | 0.0640 | 13 |
| 14 | 0.0747 | 0.0667 | 0.0785 | 0.0705 | 0.0641 | 0.0571 | 0.0561 | 14 |
| 15 | 0.0673 | 0.0603 | 0.0710 | 0.0640 | 0.0571 | 0.0501 | 0.0491 | 15 |
| 16 | 0.0598 | 0.0528 | 0.0635 | 0.0565 | 0.0508 | 0.0438 | 0.0428 | 16 |
| 17 | 0.0530 | 0.0460 | 0.0575 | 0.0505 | 0.0453 | 0.0413 | 0.0383 | 17 |
| 18 | 0.0478 | 0.0418 | 0.0516 | 0.0456 | 0.0403 | 0.0363 | 0.0333 | 18 |
| 19 | 0.0418 | 0.0358 | 0.0456 | 0.0396 | 0.0359 | 0.0324 | 0.0299 | 19 |
| 20 | 0.0359 | 0.0309 | 0.0396 | 0.0346 | 0.0320 | 0.0285 | 0.0260 | 20 |
| 21 | 0.0329 | 0.0279 | 0.0366 | 0.0316 | 0.0285 | 0.0250 | 0.0225 | 21 |
| 22 | 0.0299 | 0.0269 | 0.0336 | 0.0296 | 0.0253 | 0.0220 | 0.0203 | 22 |
| 23 | 0.0269 | 0.0239 | 0.0306 | 0.0266 | 0.0226 | 0.0201 | 0.0176 | 23 |
| 24 | 0.0239 | 0.0209 | 0.0275 | 0.0235 | 0.0201 | 0.0176 | 0.0151 | 24 |
| 25 | 0.0209 | 0.0179 | 0.0247 | 0.0207 | 0.0179 | 0.0154 | 0.0129 | 25 |
| 26 | 0.0179 | 0.0159 | 0.0217 | 0.0187 | 0.0159 | 0.0139 | 0.0114 | 26 |
| 27 | 0.0164 | 0.0144 | 0.0202 | 0.0172 | 0.0143 | 0.0122 | 0.0097 | 27 |
| 28 | 0.0149 | 0.0129 | 0.0187 | 0.0157 | 0.0126 | 0.0106 | 0.0086 | 28 |
| 29 | 0.0135 | 0.0115 | 0.0172 | 0.0142 | 0.0113 | 0.0093 | 0.0073 | 29 |
| 30 | 0.0120 | 0.0100 | 0.0157 | 0.0127 | 0.0100 | 0.0085 | 0.0060 | 30 |

*See Tables A2 and A3 for recommended metric conversions.

Table A2
Recommended Metric Conversion of
Uncoated Sheet Steel Thicknesses

| Gauge No. MSG | Nominal thickness (preferred size), mm | Minimum thickness, mm |
|------------------|--|-----------------------------|
| 8 | 4.00 | 3.80 |
| 10 | 3.50 | 3.11 |
| 11 | 3.17 | 2.73 |
| 12 | 2.50 | 2.30 |
| 13 | 2.20 | 2.00 |
| 14 | 2.00 | 1.69 |
| 16 | 1.60 | 1.34 |
| 18 | 1.20 | 1.02 |
| 20 | 1.00 | 0.78 |
| 22 | 0.80 | 0.68 |
| 24 | 0.60 | 0.52 |
| 26 | 0.50 | 0.40 |
| 28 | 0.40 | 0.32 |

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Table A3
Recommended Metric Conversion of
Galvanized Steel
Sheet Metal Thicknesses and
Nonferrous Sheet Metal Thicknesses

| Gauge No. | GSG equivalent | AWG equivalent | Copper and brass sheet minimum, mm |
|-----------|------------------------------------|----------------------------|------------------------------------|
| | Galvanized sheet steel minimum, mm | Aluminum sheet minimum, mm | |
| 6 | -- | 3.81 | 3.81 |
| 7 | -- | 3.36 | 3.36 |
| 8 | -- | 3.03 | 3.01 |
| 9 | -- | 2.65 | 2.65 |
| 10 | 3.23 | 2.33 | 2.33 |
| 11 | 2.85 | 2.10 | 2.05 |
| 12 | 2.47 | 1.85 | 1.80 |
| 13 | 2.14 | 1.62 | 1.62 |
| 14 | 1.79 | 1.45 | 1.42 |
| 15 | 1.62 | 1.27 | 1.24 |
| 16 | 1.43 | 1.11 | 1.08 |
| 17 | 1.28 | 1.05 | 0.97 |
| 18 | 1.16 | 0.92 | 0.84 |
| 19 | 1.00 | 0.82 | 0.76 |
| 20 | 0.88 | 0.72 | 0.66 |
| 21 | 0.80 | 0.63 | 0.57 |
| 22 | 0.75 | 0.58 | 0.51 |
| 23 | 0.67 | 0.51 | 0.44 |
| 24 | 0.59 | 0.44 | 0.38 |
| 25 | 0.52 | 0.39 | 0.33 |
| 26 | 0.47 | 0.35 | 0.29 |
| 27 | 0.43 | 0.31 | 0.24 |
| 28 | 0.40 | 0.27 | 0.22 |
| 29 | 0.36 | 0.23 | 0.18 |
| 30 | 0.32 | 0.21 | 0.15 |

Appendix B

Classes of Insulation

Note: This Appendix is not a mandatory part of this Standard.

B1. Scope

B1.1

This Appendix provides information on the various classes of electrical insulation referred to in the Standards of the Canadian Electrical Code, Part I.

B2. Classes of Electrical Insulation

B2.1

The following definitions are unchanged from the previous edition of this Standard (C22.2 No. 0) and are reproduced below for convenience. In these definitions the term "experience or accepted tests" is, for Part II purposes, intended to refer to data that are in keeping with the concepts expressed in ANSI/IEEE Standard 1.

| Class | Definitions |
|------------------------|---|
| 90°C (Class 0) | Materials or combinations of materials such as cotton, silk, and paper without impregnation. Other materials or combinations of materials may be included in this class if by experience or accepted tests they can be shown to be capable of operation at 90°C. |
| 105°C (Class A) | Materials or combinations of materials such as cotton, silk, and paper when suitably impregnated or coated or when immersed in a dielectric liquid such as oil. Other materials or combinations of materials may be included in this class if by experience or accepted tests they can be shown to be capable of operation at 105°C. |
| 130°C (Class B) | Materials or combinations of materials such as mica, glass fibre, asbestos, etc, with suitable bonding substances. Other materials or combinations of materials, not necessarily inorganic, may be included in this class if by experience or accepted tests they can be shown to be capable of operation at 130°C. |
| 155°C (Class F) | Materials or combinations of materials such as mica, glass fibre, asbestos, etc, with suitable bonding substances. Other materials or combinations of materials, not necessarily inorganic, may be included in this class if by experience or accepted tests they can be shown to be capable of operation at 155°C. |
| 180°C (Class H) | Materials or combinations of materials such as silicone elastomer, mica, glass fibre, asbestos, etc, with suitable bonding substances such as appropriate silicone resins. Other materials or combinations of materials may be included in this class if by experience or accepted tests they can be shown to be capable of operation at 180°C. |
| 220°C | Materials or combinations of materials that by experience or accepted tests can be shown to be capable of operation at 220°C. |
| Over 220° (Class C) | Insulation that consists entirely of mica, porcelain, glass quartz, and similar inorganic materials. Other materials or combinations of materials may be included in this class if by experience or accepted tests they can be shown to be capable of operation at temperatures over 220°C. |

Notes:

(1) Insulation is considered to be "impregnated" when a suitable substance provides a bond between components of the structure and also a degree of filling and surface coverage sufficient to give adequate performance under the extremes of temperature, surface contamination (moisture, dirt, etc), and mechanical stress expected in service. The impregnant must not flow or deteriorate enough at operating temperatures to seriously affect performance in service.

(2) The electrical and mechanical properties of the insulation must not be impaired by the prolonged application of the limiting insulation temperature permitted for the specific insulation class. The word "impaired" is used here in the sense of causing any change that would disqualify the insulating material from continuously performing its intended function whether creepage spacings, mechanical support, or dielectric barrier action.

(3) In the above definitions, the words "accepted tests" are intended to refer to recognized Test Procedures established for the thermal evaluation of materials by themselves or in simple combinations. Experience or test data, used in classifying insulating materials, are distinct from the experience or test data derived for the use of materials in complete insulation systems. The thermal endurance of complete systems may be determined by Test Procedures specified by the responsible Technical Committees. A material that is classified as suitable for a given temperature may be found suitable for a different temperature, either higher or lower, by an insulation system Test Procedure. For example, it has been found that some materials suitable for operation at one temperature in air may be suitable for a higher temperature when used in a system operated in an inert gas atmosphere.

(4) It is important to recognize that other characteristics, in addition to thermal endurance, such as mechanical strength, moisture resistance, and corona endurences, are required in varying degrees in different applications for the successful use of insulating materials.

Appendix C

Marking Translations

Note: *This Appendix is provided for information only.*

C1. Clause 4.8.1

WARNING: DISCONNECT SUPPLY BEFORE SERVICING and

AVERTISSEMENT : COUPER L'ALIMENTATION AVANT L'ENTRETIEN ET LE DÉPANNAGE

C2. Clause 4.18.2

CAUTION: WHEN MOUNTING ON OR OVER A COMBUSTIBLE SURFACE, A FLOOR PLATE OF AT LEAST 1.43 mm GALVANIZED OR 1.6 mm UNCOATED STEEL EXTENDED AT LEAST 150 mm BEYOND THE EQUIPMENT ON ALL SIDES MUST BE INSTALLED and

AVERTISSEMENT : LORSQUE L'APPAREIL EST INSTALLÉ SUR OU AU-DESSUS D'UNE SURFACE COMBUSTIBLE, ON DOIT PRÉVOIR UNE PLAQUE D'ACIER GALVANISÉ D'AU MOINS 1.43 mm OU UNE PLAQUE D'ACIER SANS REVÊTEMENT DE 1.6 mm SE PROLONGEANT SUR AU MOINS 150 mm TOUT AUTOUR DE L'APPAREIL.

<http://www.china-gauges.com/>