Update No. 1
C22.2 No. 100-04
September 2004

Note: General Instructions for CSA Standards are now called Updates. Please contact CSA Information Products Sales or visit www.ShopCSA.ca for information about the CSA Standards Update Service.

Title: Motors and generators — originally published June 2004

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September 2004
(Replaces p. ix, June 2004)
Preface

This is the sixth edition of CSA C22.2 No. 100, Motors and generators, one of a series of Standards issued by the Canadian Standards Association under Part II of the Canadian Electrical Code. It supersedes the previous editions published in 1995, 1992, 1985, 1982, and 1974.

Significant changes from the previous edition are as follows:
(a) the addition of the construction requirements for two- and three-wire generator circuits in Clause 4.14; and
(b) an expansion of testing requirements in Clause 11.4.

For general information on the standards of the Canadian Electrical Code, Part II, see the Preface of CAN/CSA-C22.2 No. 0.

This Standard was prepared by the Subcommittee on C22.2 No. 100, under the jurisdiction of the Technical Committee on Industrial Products and the Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the Technical Committee.

Interpretations: The Strategic Steering Committee on Requirements for Electrical Safety has provided the following direction for the interpretation of standards under its jurisdiction: “The literal text shall be used in judging compliance of products with the safety requirements of this Standard. When the literal text cannot be applied to the product, such as for new materials or construction, and when a relevant committee interpretation has not already been published, CSA's procedures for interpretation shall be followed to determine the intended safety principle”.

June 2004

Notes:
(1) Use of the singular 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) This publication was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as “substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity”. It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.
(4) CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.
(5) All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.

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.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are published in CSA’s periodical Info Update, which is available on the CSA Web site at www.csa.ca.
10.4.2.3
For air-cooled machines, including those with air-to-air heat exchangers, the temperature tests may be made at any convenient temperature between 10 and 40 ºC, as it is assumed that the temperature rise above ambient is the same for all temperatures of the ambient air between those limits. The difference between the test ambient air temperature and the marked ambient temperature shall be added to or subtracted from the test readings to reach the temperature valve for comparison with Table 4.

10.4.2.4
For totally enclosed water-air-cooled machines, the temperature of the cooling air is the temperature of the air leaving the coolers. Tests may be made at any water-supplied temperature between 3 ºC and the specified maximum cooling water temperature (see Note (1) of Table 10, 11, or 12). The difference between the temperature of the cooling air during test and 40 ºC shall be added to or subtracted from the test readings to reach the temperature valve for comparison with Table 4.

10.4.3 Motor-rated load current
The requirements of Clause 6.3 shall not be applied to motors rated over 1500 W. When tested at rated horsepower, base speed, and rated voltage, the measured current shall not differ from the marked current by more than 10% of the amount corresponding to the implied loss. If the machine is too large for a full-load test, the segregated loss method may be used to determine the equivalent of the measured current.

10.4.4 Dielectric strength
The requirements of Clause 6.4.2 shall be applied, or a dc voltage equal to 1.4 times the ac voltage specified in Clause 6.4.2 may be used.

10.4.5 Overspeed
Machines shall withstand, without mechanical damage, the following speeds:
(a) for shunt wound motors, 25% above the highest rated speed or 15% above the corresponding no-load speed, whichever is greater;
(b) for compound wound motors with speed regulation of 35% or less at the highest rated speed, 25% above the highest rated speed or 15% above the corresponding no-load speed, whichever is greater, but not more than 50% above the highest rated speed;
(c) for series wound motors and compound wound motors with speed regulation greater than 35%:
   (i) 10% above the mechanically safe speed marked as required by Clause 5.1, Item (x); or
   (ii) 10% above the no-load speed, at the manufacturer’s option;
(d) for permanent magnet motors, the same as that specified in Item (a), (b), or (c), as applicable; and
(e) for machines that are speed regulated or have a mounted overspeed switch, 15% above the highest rated speed (see Clause 5.1(x)).

10.4.6 Water tests
If by inspection of a machine or drawings, compliance with the tests for drip-proof enclosures is evident, the test described in Clause 6.8 may be waived.

11 Portable and standby generators

11.1 Scope
Clause 11 applies to portable generators up to 12 kW, rated 240 V and less, and to standby generators.
11.2 Construction

11.2.1 General
The requirements of Clause 4 shall apply except as modified in Clauses 11.2.2 through 11.2.8.

11.2.2 Enclosure or panels

11.2.2.1 Generator panels or covers giving access to bare live parts of over 30 V ac rms or 50 V dc shall be secured by means requiring a tool or key to remove them.

11.2.2.2 Openings in generators shall be of such size and shape as to prevent the passage of a straight 12.7 mm diameter probe, with a straight cut-off end, from touching a bare live part or rotating parts. If the distance between live parts or rotating parts and the closest enclosure opening is greater than 100 mm, the probe shall be 19 mm in diameter. The probe shall be applied as directed in Clause 11.4.5.

11.2.2.3 Enclosures and fan covers, if of non-metallic material, shall be resistant to the adverse effects of exposure to moisture, oil, and temperature under normal and abnormal conditions of use, and shall meet the impact test requirements of Clause 11.4.7. The material shall also meet the applicable flame test described in Clause 11.4.6.

11.2.3 Terminal boxes (750 V and less)

11.2.3.1 A terminal box panel or enclosure shall be of non-combustible, moisture- and oil-absorption-resistant material. If made of metal, the thickness shall be as specified in Table 1. Terminal box panels or enclosures shall comply with the physical abuse requirements of Clause 11.4.8.

11.2.3.2 A terminal box panel or enclosure of non-metallic material shall comply with the flame test described in Clause 11.4.6 and the impact test described in Clause 11.4.7.

11.2.3.3 For standby generators only, a terminal box panel or enclosure, when furnished, shall
(a) have usable volume as specified in Table 2 for the generator full-load amperes listed or as specified in Clauses 11.2.3.6 and 11.2.3.7 when copper supply conductors are intended to be used; and
(b) be provided with removable inspection plates or covers that have no provision for supply connections to be made to such plates or covers.

11.2.3.4 For standby generators only, conduit entry, when furnished, shall be not less than the size(s) specified in Table 2 for the machine full-load current.
Conduit entry shall be located in a surface having a flat area large enough for the required bushing(s) or locknut(s) unless the conduit entrance is suitably threaded and does not require the use of a bushing to protect the insulation on the supply conductors where they enter the terminal box.
Generators requiring larger than trade size 1-1/2 conduit may have the conduit opening omitted to permit machining the required supply conductor entrance opening(s) at the time of installation.

Note: Insulated bonding and grounding conductors have not been considered in this Clause; they can require a larger terminal box or conduit entry.
11.2.6.5
Wiring terminals shall be prevented from turning by means other than friction.

△ 11.2.7 Battery chargers
Where generators are provided with a circuit for charging external batteries, the battery-charging circuit shall comply with the applicable construction, test, and marking requirements of CAN/CSA-C22.2 No. 107.2.

△ 11.2.8 Protection and control of generators

11.2.8.1
Protection and control of generators and generator output circuits shall be provided in accordance with the Canadian Electrical Code, Part I, or the generator shall be marked in accordance with Clause 11.3.3.

11.2.8.2

11.2.8.2.1
The means of protection and control shall be as specified in Clauses 11.2.8.2.2 to 11.2.8.2.5. This is considered to be in compliance with the Canadian Electrical Code, Part I.

11.2.8.2.2
Permanently connected and standby generators shall be provided with overcurrent protection for the load circuits in accordance with Section 14 of the Canadian Electrical Code, Part I, and with a disconnecting means in accordance with Rule 28-900 of the Canadian Electrical Code, Part I.

11.2.8.2.3
Disconnecting means, when provided, shall be provided by a moulded case switch, moulded case circuit breaker, or an enclosed disconnect switch complying with CSA C22.2 No. 4.

11.2.8.2.4
A breaker may be installed in a generator field supply that is shunt-tripped when the output of the generator has reached a predetermined overcurrent. Such protection shall be considered protection of the generator and shall not be considered protection of the output circuits, nor as protection of personnel as required by the Canadian Electrical Code, Part I.

11.2.8.2.5
A supplemental protector may be used in the output circuits of portable generators in order to comply with Clause 11.2.8.1, provided that the supplemental protector complies with the following:
(a) It is suitable for use in industrial equipment.
(b) It has an “overload must trip” classification TC0, TC1, or TC3.
(c) It has a “suitable for further use” classification of U3 or U1a or has a classification of C3 or C1a if provided with the required line side fuse or moulded case circuit breaker.
(d) Its short-circuit rating is equal to or greater than the available current from the generator output at rated voltage.
(e) It has an overload rating classification of OL1.
(f) The 250 V single-phase and three-phase output circuits are protected by multi-pole protectors meeting the intention of Rule 14-302 of the Canadian Electrical Code, Part I.
11.3 Marking

11.3.1 In addition to the marking requirements of CAN/CSA-C22.2 No. 0, each generator shall be marked with the following information, as applicable, appearing on a nameplate, die stamped in a readily visible location on the frame or enclosure, or marked in some equivalent, permanent manner:
(a) the manufacturer’s name, trademark, trade name, or other symbol of identification;
(b) the model, catalogue, style, or other type of designation;
(c) the rated output in volt amperes, watts, or kilowatts;
(d) the time rating if not continuous (see Item (j) for standby generators or Item (k) for overload rating of continuous rated AC generators);
(e) the rated load speed or synchronous speed in revolutions per minute;
(f) dc (for DC generators);
(g) the frequency in hertz (for AC generators);
(h) the number of phases (for AC generators), unless for single-phase operation;
(i) the insulation system, using the appropriate letter code, and the maximum ambient temperature (in degrees Celsius) for which the generator is designed;

Note: This information may be omitted from the marking of machines having Class “A” insulation.

(j) in the case of standby generators, the words STANDBY SERVICE;

(k) for continuously rated AC generators that comply with Clause 11.4.1.5, the words “10% OVERLOAD FOR 2 H IN A 24 H PERIOD”;

(l) for standby and portable generators only, the words CAUTION: USE SUPPLY WIRES SUITABLE FOR ___°C or the equivalent wording if it is shown by test (see Clause 11.4.2.1) that such marking is necessary (see Table 5). The temperature to be marked shall be 90 °C or 110 °C for temperature ranges of 76 to 90 °C or 91 to 110 °C, respectively. The marking shall appear on the nameplate, in the terminal box, or near the point where the supply connections are made. Generators intended for use only as components or specific equipment need not be so marked if this information is provided separately;

(m) the service factor if greater than unity; and

(n) the month and year of manufacture. Date coding, serial numbers, or equivalent means may be used.

11.3.2 The following additional information and instructions shall be provided:
(a) a suitable diagram;
(b) the status of the neutral conductor, marked on each machine, as follows:
   (i) NEUTRAL FLOATING; or
   (ii) NEUTRAL BONDED TO FRAME.

   Where provision has been made to connect or disconnect the neutral conductor from the machine frame, such provision shall be clearly indicated in the marking;

(c) for generators equipped with a GFCI receptacle, an indication that the neutral is bonded to the frame; and

(d) for generators intended to be tractor driven or generators to be supplied with a prime mover, where it is intended that the output be connected as a standby source of supply, the words CAUTION: FOR STANDBY SERVICE, CONNECT OUTPUT OF GENERATOR TO SUITABLY RATED TRANSFER SWITCH IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I.

   In addition, installation instructions shall include a reference to the need for a transfer switch to prevent inadvertent interconnection of normal and standby sources of supply, and to the need for installation to be performed by people who are accepted by the regulatory authorities of each province.

△ 11.3.3

Where required by Clause 11.2.8.1, a generator shall be marked SEPARATE PROTECTION AND CONTROL MUST BE PROVIDED IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I or the equivalent.