CSA GROUP™

CSA C22.1HB:21

Canadian Electrical Code Handbook

An Explanation of the Rules of the Canadian Electrical Code, Part I

2021

Legal Notice

This document is provided by the Canadian Standards Association (operating as "CSA Group") as a convenience only.

Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document's fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party's intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document's compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group's and/or others' intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

Patent rights

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this document are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

Use of this document

This document is being provided by CSA Group for informational and non-commercial use only. If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not use this document. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.

CSA GROUP™

2021 Canadian Electrical Code and related products

In addition to CSA C22.1:21, *Canadian Electrical Code, Part I,* CSA Group offers a variety of related publications and resources designed to assist with the interpretation and application of the Code. Our instructor-led training can be available in both virtual and in-person formats as required.

Overview of Changes Training

Self-guided online | Instructor-led public | Instructor-led onsite

Designed for professionals with a good working knowledge of the Code who only need to know the changes in the 2021 edition.

Essentials Training

Self-guided online | Instructor-led public | Instructor-led onsite

Ideal for new Code users. Gain an understanding of the definitions, scope and objective of the 2021 Code as they apply to construction-related electrical installations.

Modular Training

Self-guided online | Instructor-led onsite

Create your own self-guided online or instructor-led onsite course based on specific sections of the Code. Choose from more than 30 training modules referencing specific Code sections to create a customized learning experience for you or your team.

Learn more

For more information or to purchase CSA C22.1:21, *Canadian Electrical Code*, *Part I* products:

1 800 463 6727

csagroup.org/2021CECode

Standards Update Service

CSA C22.1HB:21
January 2021

Title: *Canadian Electrical Code Handbook*

To register for e-mail notification about any updates to this publication
- go to **store.csagroup.org**
- click on **Product Updates**

The **List ID** that you will need to register for updates to this publication is **2428839**.

If you require assistance, please e-mail **techsupport@csagroup.org** or call 416-747-2233.

Visit CSA Group's policy on privacy at **www.csagroup.org/legal** to find out how we protect your personal information.

CSA C22.1HB:21
Canadian Electrical Code Handbook

An Explanation of the Rules of the Canadian Electrical Code, Part I

- The *Canadian Electrical Code, Part I*, is a voluntary code for adoption and enforcement by regulatory authorities.
- The *Canadian Electrical Code, Part I*, meets the fundamental safety principles of International Standard IEC 60364-1, *Low-voltage electrical installations*.
- Consult with local authorities regarding regulations that adopt and/or amend the Code.

Published in January 2021 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3

To purchase standards and related publications, visit our Online Store at ***store.csagroup.org***
or call toll-free 1-800-463-6727 or 416-747-4044.

ISBN 978-1-4883-3441-2

Contents

Preface

This is the tenth edition of CSA C22.1HB, the *Canadian Electrical Code Handbook.* It supersedes the previous editions published in 2018, 2015, 2012, 2009, 2006, 2002, 1998, 1994, and 1990.

Significant changes since the previous edition include the following:

- Section 0 now contains definitions of the terms "armour" and sheath", as well as revised definitions of the terms “cablebus", "voltage — low voltage", and "wireway";
- Section 2 has a new Rule for seismic restraint requirements;
- Section 4 has new allowances for the ampacity of wires and cables inside electrical equipment for the purposes of termination;
- Section 6 now prohibits service equipment from being installed below the flood elevation (newly defined term);
- Section 8 requirements for the number of branch circuit overcurrent devices in dwelling unit panelboards have been completely rewritten and simplified;
- Section 10 has a new Rule that applies to the installation of bonding conductors. In addition, clarification has been provided on impedance grounded system operation under fault condition;
- Section 12 has new requirements for the installation of cables and raceways in roof decking systems;
- Section 22 contains a new Subsection for farm buildings housing livestock, as well as revised Rules for equipment in Category 1 and 2 locations;
- Section 26 includes several important changes, including a new requirement for ground fault circuit interrupter protection for all 15 A and 20 A receptacles located outdoors within 2.5 m of grade;
- Section 64 features a new Subsection governing installation of energy storage systems and Rules for functionally-grounded renewable energy systems; and
- Section 72 includes updated load calculations and equipment layout for recreational vehicle lots.

Other revisions in this edition include the following:

- new requirements in support of climate change adaptation appear in several Sections of the Code;
- redundant or out-of-date requirements, such as the Rules for open wiring, have been removed; and
- the Index has been deleted in conformance with CSA Group’s drafting and editorial requirements.

CSA gratefully acknowledges the outstanding contribution of Ron Hiscock to the development and publication of the 2021 *Canadian Electrical Code Handbook*.

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 Handbook is stated in its Introduction, it is important to note that it remains the responsibility of the users of this Handbook to judge its suitability for their particular purpose.*

3) *All enquiries regarding this Handbook should be addressed to CSA Group, 178 Rexdale Blvd., Toronto, Ontario, Canada M9W 1R3.*

Introduction to the *Canadian Electrical Code Handbook*

This Handbook provides background information on the reasons behind the requirements in the *Canadian Electrical Code, Part I*, and gives an explanation of the Rules in plain, easy-to-understand language. The Handbook is intended to provide a clearer understanding of the safety requirements of the Code.

The content of this Handbook is not meant to form a code of mandatory requirements. The mandatory language ("shall") that is used in the *CE Code, Part I*, has not been used here. Care has been taken to ensure that the intent of the Code Rules is clear to the users of the Handbook. However, users of the Handbook must not under any circumstances rely on it to determine the current requirements of the Code. As always, reference must be made to the Code itself and any local amendments. Consult with the authority having jurisdiction (AHJ) for specific Code interpretations. CSA Group does not assume responsibility for any errors or omissions resulting from the information contained in this Handbook.

The Rules in the *CE Code, Part I*, are divided into two groups. Sections 0 to 16 and 26 are considered general Sections, and the other Sections supplement or amend those general Sections. Therefore, a requirement in the supplementary Sections takes precedence over a general requirement. For example:

- Rule 12-1008 requires 3 threads to be engaged when making a threaded connection, whereas Rule 18-102 requires 5 threads to be engaged when making a threaded connection in a Zone 1 area.
- Section 4 permits the use of aluminum conductors, but Rule 32-100 does not allow aluminum conductors to be used in fire alarm systems.

Section 0 — Object, scope, and definitions

Object

The object of the Code is to specify requirements for the installation and maintenance of electrical equipment to help ensure electrical safety. Electrical safety is also ensured through compliance with the objective-based fundamental safety principles of IEC 60364-1 and through the implementation of a quality management or equivalent program acceptable to the authorities having jurisdiction (AHJ) over the adoption and enforcement of the Code.

In the preparation of the Code, consideration has been given to the following four major areas:

1) the prevention of fire hazards by
    a) using overcurrent protection for
        i) short-circuits; and
        ii) excessive current (overload);
    b) providing clearances from combustible materials; and
    c) preventing ignition of hazardous and combustible materials;
2) the prevention of shock hazards by
    a) grounding and bonding to
        i) establish an equipotential plane so that the possibility of a potential difference between metal parts is minimized;
        ii) connect to earth the equipotential plane, thereby minimizing any potential difference to earth; and
        iii) provide a low impedance path for fault current to flow back to the source; or
    b) using insulation to separate conducting surfaces. Insulation can consist of a dielectric material or an air space that has high enough resistance to prevent the flow of current and/or the discharge of disruptive voltage spikes (e.g., from lightning or transients) from causing damage to the installation and/or endangering personnel (electric shock);
3) the installation and maintenance requirements for electrical equipment to ensure essentially safe installation and operation; and
4) the proper operation of electrical installations and electrical equipment by ensuring that they are
    a) installed to meet the conditions of use/applications; and
    b) certified/approved to
        i) a CSA Group Standard;
        ii) other recognized documents, where such CSA Group Standards do not exist or are not applicable; or
        iii) the requirements of the authority having jurisdiction.

Safe installations may also be achieved by alternatives to the Code provided that such alternatives meet the fundamental safety principles of IEC 60364-1 (see Appendix K).

The Code recommends that, when considering new installations, designers and field personnel make provision for wiring changes that might be required as a result of future load growth. If future growth is not taken into consideration, electrical installations may can become overloaded, resulting in hazardous conditions.

Scope

The Code applies to all electrical installations for buildings, structures, and premises and is intended to apply to all voltages. Although low voltages may not present a shock hazard, there are conditions that can lead to the injury to persons and damage to equipment.