CANADIAN STANDARDS ASSOCIATION

C22.2 No. 52-09
(reaffirmed 2014)

Underground secondary and service-entrance cables

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CANADIAN STANDARDS ASSOCIATION

Update No. 2
C22.2 No. 52-09
April 2010

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Title: *Underground secondary and service-entrance cables* — originally published January 2009

Revisions issued: Update No. 1 — January 2010
If you are missing any updates, please contact CSA Information Products Sales or visit **www.ShopCSA.ca**.

The following revisions have been formally approved and are marked by the symbol delta (Δ) in the margin on the attached replacement pages:

Revised	Table 13
New	None
Deleted	None

CSA C22.2 No. 52-09 originally consisted of **28 pages** (ix preliminary and 19 text), each dated **January 2009**. It now consists of the following pages:

January 2009	iii–ix, 1, 2, 5–16, and 19
January 2010	3 and 4
April 2010	17 and 18

- Update your copy by inserting these revised pages.
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Table 11
Mechanical properties of aluminum conductors
(See Clause 6.2.2.1.)

Size, AWG or kcmil	Tensile strength, MPa	Elongation — Minimum increase in distance between 2.54 cm gauge marks, %	
Stranded ACM	100–140*	10*	
8–2 stranded aluminum alloy 1350	100–150	NA	
> No. 2 aluminum alloy 1350	100–152	NA	
Individual wires, mm		Prior to stranding	Finished cable
1.19–1.52		1.2	0.7
1.53–1.77		1.3	0.8
1.78–2.03		1.4	0.9
2.04–2.79		1.5	1.0
2.80–3.04		1.6	1.1
≥ 3.05		1.7	1.2

**This requirement shall apply to wires taken*
(a) prior to stranding into conductors; or
(b) from a stranded conductor after heat treatment.
Note: *NA = not applicable.*

Table 12
Physical properties of thermoplastic jackets before and after aging
(See Clause 6.4.)

Test	Minimum requirement		
	USEB 90	USEI 75	USEI 90
Original elongation, % Original tensile strength, MPa	100 10.35	100 10.35	100 10.35
After air-oven aging	7 d at 100 °C	7 d at 121 °C	14 d at 121 °C
Retention of elongation, % of unaged value	45	60	65
Retention of tensile strength, % of unaged value	65	85	75
After oil immersion in ASTM No. 2 (or IRM 902) oil for 4 h at 70 ± 2 °C			
Retention of elongation, % of unaged value	75	75	75
Retention of tensile strength, % of unaged valued	75	75	75

Δ

Table 13
Cold bend test conditions
(See Clauses 6.6.1 and 6.15.4.)

Property	Number of adjacent turns	Mandrel size
Diameter of the test specimen or width of minor axis of the test specimen, mm		
USEI 75 and USEI 90		
≤ 19	6	3 × diameter of specimen
> 19.1	one 180° bend	8 × diameter of specimen
USEB 90		
Flat	one 180° bend	8 × minor axis of the finished cable
Round	one 180° bend	12 × diameter of specimen

Table 14
Dielectric strength test voltage
(See Clause 6.8.1.)

	Test voltage (ac), kV	
Phase conductor size, AWG or kcmil	USEI 90 and USEB 90	USEI 75
6–2	5.0	4.5
1–4/0	7.0	5.5
250–500	8.0	6.5
750–1000	10.0	6.5

Table 15
Spark test voltages
(See Clause 6.9.1.)

Phase conductor size, AWG or kcmil	Test voltage (ac), kV
6–2	12.5
1–4/0	15.0
250–500	17.5
750–1000	20.0

Update No. 1
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Revised	Clause 5.1.2
New	None
Deleted	None

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B 800-05
Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes — Annealed and Intermediate Tempers

B 801-07
Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation

B 835-04
Standard Specification for Compact Round Stranded Copper Conductors Using Single Input Wire Construction

B 836-00 (2005)
Standard Specification for Compact Round Stranded Aluminum Conductors Using Single Input Wire Construction

B 901-04
Standard Specification for Compressed Round Stranded Aluminum Conductors Using Single Input Wire Construction

B 902-04a
Standard Specification for Compressed Round Stranded Copper Conductors, Hard, Medium-Hard, or Soft Using Single Input Wire Construction

D 1712-03
Standard Practice for Resistance of Plastics to Sulfide Staining

3 Definitions

The following definitions apply in this Standard:

Aluminum conductor material (ACM) — AA 8000 series aluminum alloy conductor material in accordance with the physical and electrical requirements of ASTM B 800.

Cable —

USEB 90 cable — underground secondary or service-entrance cable consisting of three or four conductors, one of which is an uninsulated neutral conductor. Each phase conductor is insulated with cross-linked polyethylene (XLPE), an ethylene propylene co-vulcanizate (EPCV), or ethylene propylene rubber (EPR). The wires of the neutral conductor are applied helically over the assembly of insulated phase conductors, and a polyvinyl chloride (PVC) jacket is applied over the cable assembly.

USEI 75 cable — underground secondary or service-entrance cable consisting of two, three, or four circuit conductors twisted together, one of which is an identified neutral. Each conductor is insulated with thermoplastic polyethylene.

USEI 90 cable — underground secondary or service-entrance cable consisting of two, three, or four circuit conductors twisted together, one of which is an identified neutral. Each conductor is insulated with XLPE, EPCV, or EPR, and is jacketed with PVC.

Capability test — a test used to verify the capability of a parameter to meet specific requirements, performed at least every 3 years or when a cable component material is changed.

Finished length — a continuous length of cable or cable assembly produced as a result of the final manufacturing process, before being cut into shipping lengths.

Service-entrance cable — an underground cable used between a utility's point of supply and a user's service equipment.

4 General requirements

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

5 Construction

5.1 Conductors

5.1.1 Material

5.1.1.1 General

All insulated conductors shall be

(a) aluminum; or

(b) coated or uncoated copper.

The neutral conductor of USEB 90 cable and the optional control/supply conductor in USEI 75 and USEI 90 cable shall be copper.

5.1.1.2 Aluminum conductors

Aluminum conductors shall be stranded and shall be of ACM in accordance with CAN/CSA-C22.2 No. 38 or aluminum alloy 1350 in accordance with CSA C49.3 and CAN/CSA-C60889. Each wire in an aluminum conductor shall meet the requirements of this Standard.

5.1.1.3 Copper conductors

The following requirements shall apply:

(a) Coated copper conductors — each wire in a tin-coated conductor shall comply with the requirements of ASTM B 33.

(b) Uncoated copper conductors — each wire in an uncoated copper conductor shall comply with the requirements of ASTM B 3.

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5.1.2 Sizes

The following requirements shall apply:

(a) Phase conductors shall be between No. 6 AWG and 1000 kcmil.

(b) Neutral conductors shall be in accordance with

(i) Table 1 for USEI 75 and USEI 90 cable; and

(ii) Table 2 for USEB 90 cable. The individual wires for USEB 90 cable shall be not smaller than No. 18 AWG and shall comply with ASTM B 3 for uncoated wire or ASTM B 33 for tin-coated wire.

(c) Control/supply conductors shall be sized in accordance with CAN/CSA-C22.2 No. 38, except that the nominal dc resistance of the control/supply conductors shall be not less than that of the phase conductors.

5.1.3 Stranding

5.1.3.1

All phase conductors shall

(a) be stranded Class B or single input wire (SIW);

be compressed or compact; and

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Preface

This is the sixth edition of CSA C22.2 No. 52, *Underground secondary and service-entrance cables*, one of a series of Standards issued by the Canadian Standards Association under the *Canadian Electrical Code, Part II*. It supersedes the previous editions, published in 1996, 1989, 1970, 1955, and 1941 under the title *Underground Service-Entrance Cables*.

This Standard specifies requirements for 600-volt-class copper and aluminum conductor underground secondary and service-entrance cables.

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

This Standard was prepared by the Subcommittee on Fixed Installation Wires and Cables, under the jurisdiction of the Technical Committee on Wiring 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".

January 2009

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.*

C22.2 No. 52-09
Underground secondary and service-entrance cables

1 Scope

1.1
This Standard specifies requirements for 600-volt-class copper and aluminum conductor secondary and service-entrance cables intended for underground installation
(a) by direct burial; or
(b) in duct systems.

This Standard also applies to multiple-conductor cable assemblies.

Note: *Portions of the cable covered by this Standard will be exposed to sunlight on terminal poles and during storage.*

1.2
This Standard applies to cable with
(a) a maximum allowable conductor temperature of
  (i) 75 °C; or
  (ii) 90 °C; and
(b) cold impact and cold bend ratings of –40 °C.

1.3
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)
CAN/CSA-C22.2 No. 0-M91 (R2006)
General Requirements — Canadian Electrical Code, Part II

C22.2 No. 0.3-01 (R2005)
Test methods for electrical wires and cables

CAN/CSA-C22.2 No. 38-05
Thermoset-insulated wires and cables