CSA Group

C22.2 No. 96.2-18

Flexible power cables for wind turbine applications rated up to 35 kV

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Preface

This is the second edition of CSA C22.2 No. 96.2, *Flexible power cables for wind turbine applications rated up to 35 kV*, one of a series of Standards issued by the CSA Group under the *Canadian Electrical Code, Part II*. It replaces the previous edition published in 2015.

The main changes in this new edition are the addition of the wind turbine cable < 2 kV. An additional low smoke zero halogen jacket has been defined and specified.

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 Portable, Mine Power Feeder and Wind Turbine 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."

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 Standard 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 Standard.*
4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*
   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) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*

   Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at* ***standardsactivities.csa.ca****.*
5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*
   a) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

C22.2 No. 96.2-18
Flexible power cables for wind turbine applications rated up to 35 kV

1 Scope

1.1
This Standard specifies construction and testing requirements for thermoset insulated
a) single-conductor or multi-conductor cable rated up to 2 kV; or
b) single-conductor or multi-conductor metallic shielded power cables rated 5 kV to 35 kV,

used in wind turbine applications where the cables are subject to frequent flexing.

1.2
The cable constructions specified in this Standard are suitable for use at a maximum conductor temperature of 90 °C under normal operating conditions in wet or dry locations, in wind turbines.

1.3
The values given in SI (metric) units are the standard. The values given in parentheses are for information only.

1.4
In this Standard, “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; and “may” is used to express an option or that which is permissible within the limits of the Standard.

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 Group

C22.1-15
Canadian Electrical Code, Part I

CAN/CSA-C22.2 No. 0-10 (R2015)
General Requirements — Canadian Electrical Code, Part II

C22.2 No. 96-17
Portable power cables

C22.2 No. 230-17
Tray cables

C22.2 No. 272-14
Wind turbine electrical systems

C22.2 No. 2556-15
Wire and cable test methods

C68.10-14
Shielded power cables for commercial and industrial applications, 5 – 46 kV

ASTM (American Society for Testing and Materials)

B3-13
Standard Specification for Soft or Annealed Copper Wire

B33-10 (R2014)
Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes

B172-10
Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors

B173-10
Standard Specification for Rope-Lay-Stranded Copper Conductors Having Concentric- Stranded Members, for Electrical Conductors

B174-10 (2010)
Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors

D746-14
Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

D3182-07
Standard Practice for Rubber — Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D4496-13
Standard Test Method for D-C Resistance or Conductance of Moderately Conductive Materials

3 Definitions and abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

DLO-WT — a round, single, flexible, insulated, power cable for installation in wind turbine tower applications, rated up to 2 kV.

Insulation levels —

100% level — the insulation level of cables used on systems that are provided with relay protection that clears ground faults as rapidly as possible, but in any case within 1 min.

Note: *While cables with 100% level insulation are appropriate for the majority of cable installations on grounded systems, they also may be used on other systems for which the application of cable is acceptable, provided that the clearing criteria for 100% level insulation are met in completely de-energizing the faulted section.*

MV-WT — round single- or multi-conductor metallic or non -metallic shielded power cables rated 5 kV to 35 kV.

Partial discharge extinction level — the voltage at which the apparent charge transfer falls to 5 pC or less.

Partial discharge level (of a cable under test) — the maximum continuous or repetitious apparent charge transfer that occurs at the test voltage, measured in picocoulombs.

SH-WT — a round single-conductor, flexible, insulated, power cable with metallic shield for installation in wind turbine applications, rated 5 to 35 kV.

TC — tray cables complying with the CSA C22.2 No. 230.

Thermoplastic — a material that can be repeatedly softened by heating and hardened by cooling through a temperature range characteristic of the material and that in the softened state can be shaped through the application of force.

Thermoset — a cured compound that will not flow on subsequent heating.

Wind turbine (WT) — a round, single- or multi-conductor, flexible, insulated, power cable for installation in wind turbine tower applications.

3.2 Abbreviations

The following abbreviations shall apply in this Standard:

CPE — chlorinated polyethylene

CR — thermoset polychloroprene

CSM — chloro-sulphonated polyethylene

EPR — ethylene propylene rubber

TPE — thermoplastic elastomer

PVC — polyvinyl chloride

NBR/PVC — nitrile-butadiene polyvinyl chloride

LSZH — low smoke zero halogen

WT — wind turbine

4 General requirements

4.1 General

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

4.2 Torsional test (not required for certification)

A cable shall be capable of passing a torsion test on the cable in accordance with the test method as defined by the purchaser at time of inquiry. The cable construction chosen for this test shall be conducted as per the manufacturer and/or purchaser.

The test method shall specify the following:

a) specimen size, length, number of conductor;
b) test temperature;
c) degrees of rotation;
d) number of flexing cycles;
e) number of samples tested; and
f) compliance criteria.

4.3 Tray cable test

4.3.1 Mechanical damage — Impact

Cables shall comply with the test requirements in CSA C22.2 No. 230, Method 1 (TC types only).

4.3.2 Mechanical damage — Crushing

Cables shall comply with the test requirements in CSA C22.2 No 230, Method 1 (TC types only).

4.3.3 Flame spread rating

Cables shall not have a char length greater than 1.5 m when specimens are tested in accordance with the vertical flame test in CSA C22.2 No. 2556, Method 2 FT4.

4.3.4 Low temperature testing (–40 °C cold bend)

Cables shall comply with the test requirements in CSA C22.2 No. 96.

4.3.5 Low-smoke zero-halogen (LSZH) cable

4.3.5.1 General

Cables with LSZH marking (optional) shall meet the requirements specified in Clause 4.3.5.2.

4.3.5.2 Material combustion (low-smoke zero halogen LSZH cables only)

4.3.5.2.1 Acid gas evolution test of jacket material

Acid gas generation of the jacket shall comply with the limits specified in Table 9 when tested in accordance with the acid gas emission test of CSA C22.2 No. 2556.

