

STANDARD INFORMATION

Standard: CSA C22.2 No. 96

Standard ID:

Portable Power Cables [CSA C22.2#96:2023 Ed.12]

Previous Standard ID:

Portable Power Cables [CSA C22.2#96:2017 Ed.11+U1]

Portable Power Cables [CSA C22.2#96:2017 Ed.11]

Portable Power Cables [CSA C22.2#96:2013 Ed.10]

Portable power cables [CSA C22.2#96:2009 Ed.9+U1;U2]

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **November 5, 2025**

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement: Per our accreditation, Intertek is required to review reports against the standard revisions to confirm compliance. Once compliance is confirmed, the standard reference in the report is updated to show continued compliance to the technical requirements of the standard. Reports not updated to this version by the effective date above will be withdrawn.

Overview of Changes

All listing must be certified to the 12th edition of CSA C22.2#96 prior to the effective date.

The following changes reflect all of the technical changes between CSA C22.2#96:2009 Ed.9+U1;U2 and CSA C22.2#96:2023 Ed.12:

- Conductor shield semiconducting compound minimum thickness has increased to 0.30 mm
- For cables rated 25-35 kV, the semiconducting insulation shield is now restricted to non-metallic extruded type
- New mandatory requirement to mark number of power conductors on the product for some sections where it was omitted previously
- New mandatory marking to indicate cables with natural rubber jackets are for surface mines only
- Natural rubber is no longer a permitted insulation material for any products
- NBR/PVC and NR have been removed as options for jacket materials
- Deleted option to use surface ink printing as a marking method on the product
- Addition of a new Section to cover special construction cable types SHD-SP, SHD-GC-SP, and SHD-BGC-SP, rated 2 kV up to 35 kV;

Specific details of new/revise requirements are found in table below.

Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.



STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown lined-out below.</i>
1	Info	Scope This Standard specifies the following categories of cables: Clause 5 Thermoset and PUR multiconductor round cables for mining and general applications rated <u>5 kV – 35 kV</u> <u>Types: SHD, SHD-BGC (balanced ground check), SHD-GC</u> Clause 6 Thermoset and PUR multiconductor round cables for mining and general applications rated <u>2 kV</u> <u>Types: W, G, G-BGC (balanced ground check), G-GC, SHC-GC, SHD, SHD-BGC (balanced ground check), SHD-GC, SHD-R</u> Clause 7 1.4 Thermoset single-conductor cables for mining and general applications rated <u>2 kV – 35 kV</u> <u>Types: W, SH</u> Clause 8 Thermoset two- and three-conductor flat cables for mining and general applications rated <u>2 kV — Suitable for underground applications only</u> <u>Types: G, G-GC, W</u> Clause 9 Thermoset three-conductor round cables with a central bonding conductor for underground coal mining applications rated <u>2 kV – 5 kV</u> <u>Types: SHD-PCG</u>



CLAUSE	VERDICT	COMMENT
		Clause 10 Arc-welding cable
		Clause 11 <u>Single-conductor portable power cable rated 600 V</u> <u>Types: PPC, PPC/TPE</u>
		Clause 12 Single and multiconductor portable power cables for general applications <u>rated 600 V – 2 kV</u> <u>Types: PPC, PPC/TPE</u>
		Clause 13 Flexible multiconductor cable for use with cranes and hoists rated 600 V (festoon cable)
		Clause 14 Variable frequency drive cable, multiconductor, round, for mining and general applications rated <u>2 kV – 15 kV</u> <u>Types: VFD, VFD-GC, VFD-BGC (balanced ground check)</u>
		Clause 15 DLO (diesel locomotive) cable, single conductor, used for portable and general <u>permanent applications rated 2 kV</u>
		Clause 16 <u>Thermoset and PUR multiconductor round special construction cables for mining and general applications rated 2 kV – 35 kV</u> <u>Types: SHD-SP, SHD-BGC-SP (balanced ground check), SHD-GC-SP</u>



CLAUSE	VERDICT	COMMENT
5	Info	Multiconductor round cables for mining and general applications rated 5 kV and up to 35 kV
5.3	Info	Construction
5.3.1	Info	Power conductors
5.3.1.2	Info	Conductor shielding
5.3.1.2.1		Conductor shielding shall be used on the power conductors. This shielding may consist of a <u>semiconducting non-metallic tape with a minimum thickness at any point of 0.06 mm or a semiconducting compound with a minimum thickness at any point of 0.3 mm, or any combination thereof with a minimum thickness of 0.3 mm.</u> It shall be applied over the surface of the conductor and be in direct contact with the inner surface of the insulation.
5.3.3	Info	Ground-check conductors
		<i>New clause added;</i>
5.3.3.3		The conductor size for the ground-check conductor for Type SHD-BGC cables shall be No. 16 AWG extensible placed in the centre of the cable assembly.
5.3.3.6		The ground-check conductor shall be insulated with a material in accordance with the physical properties specified in Table 11. <u>Compliance shall be determined in accordance with the physical properties (ultimate elongation and tensile strength) test in CSA C22.2 No. 2556. The rate of separation of the jaws shall be 8.5 mm/s except for polypropylene, where the rate of separation shall be 0.85 mm/s.</u>
5.3.3.7		The average thickness of the insulation shall be not less than 1.14 mm for sizes No. 8 AWG and larger and shall be not less than 0.76 mm for sizes No. 10 AWG and smaller. The minimum thickness at any point shall be not less than 90% of 1.14 mm for sizes No. 8 AWG and larger and not less than 90% of 0.76 mm for sizes No. 10 and smaller. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
5.3.4	Info	Insulation
5.3.4.1		The insulation shall be either cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) having physical properties in accordance with Table 10. <u>Compliance shall be determined in accordance with the physical properties (ultimate elongation and tensile strength) test in CSA C22.2 No. 2556.</u>
5.3.4.2		The average insulation thickness shall be not less than that specified in Tables 4A, 4B, 5A, and 5B. The minimum thickness at any point shall be not less than 90% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>



CLAUSE	VERDICT	COMMENT
5.3.6	Info	Power conductor identification <i>New clause added;</i>
5.3.6.2		Conductors shall be coded using a coloured insulation, coloured stripe tape, dual-coloured tape, or coloured serving or braid. If coloured insulation is used, it may be a surface coating, stripe, or solid. If a tape is used, the blue phase identifier may contain any other colour except red or black, provided the blue is at least 50% of the surface area. If a coloured serving or braid is used, at least 50% of the non-metallic members shall be coloured according to the phase identification.
5.3.8	Info	Assembly <i>New clause added;</i>
5.3.8.5		Twisted shielded conductors may be incorporated with optional cable fillers. When incorporated, the twisted shielded pairs, triads, and quads (i.e., control conductors) shall meet the applicable requirements of Clause 16.
5.3.9	Info	Jackets
5.3.9.2	Info	Thermoset jackets A thermoset jacket shall be applied over the assembled core in one or two layers to provide a tightly fitting covering. The thermoset jacket shall be
5.3.9.2.1		a) thermoset polychloroprene (CR); b) chloro-sulphonated polyethylene (CSM); c) nitrile-butadiene polyvinyl chloride (NBR/PVC); d) chlorinated polyethylene (CPE); or e) natural rubber (NR). The two layers of a two-layer jacket may be of different base polymers. Extra-heavy-duty grade or natural rubber shall be used in the single-layer jacket and outer layer of a two-layer jacket of shielded cables. <u>The inner layer shall be either heavy duty or extra heavy duty or natural rubber.</u>
5.3.9.2.4.3		<i>New clause added;</i> For two-layer constructions, this reinforcement shall be applied between the two layers of the jacket and may also be applied over the cable core assembly.
5.3.9.2.5		The average thickness of jackets shall be not less than the values specified in Tables 4A and 4B. The minimum thickness at any point shall be not less than 80% of the specified average values. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>



CLAUSE	VERDICT	COMMENT
5.3.9.2.6		<p>Compliance of jackets with the requirements of Clause 5.3.9.2 shall be determined in accordance with the apparatus and methods specified in the following tests:</p> <ul style="list-style-type: none">a) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for tensile strength and elongation;b) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to accelerated aging;c) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to liquids. IRM 902 oil shall be used in accordance with ASTM D471; andd) <u>the tear resistance test in ASTM D470.</u>
5.3.9.3	Info	Thermoplastic jackets
5.3.9.3.5		<p>The average thickness of jackets shall be not less than the values specified in Tables 5A and 5B. The minimum thickness at any point shall be not less than 80% of the specified average values. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u></p>
5.3.9.3.6		<p>Compliance of jackets with the requirements of Clause 5.3.9.3 shall be determined in accordance with the apparatus and methods specified in the following tests:</p> <ul style="list-style-type: none">a) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for tensile strength and elongation;b) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to accelerated aging;c) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to liquids. IRM No. 902 oil shall be used in accordance with ASTM D471; andd) <u>the tear resistance test in ASTM D470.</u>
5.4	Info	Marking
		Product marking
5.4.1		<p>Finished cable shall be surface-marked or, in mining applications, shall have markings impressed in the jacket or raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information:</p> <ul style="list-style-type: none">e) <u>insulation level (for 133% only), "133%" for those cables complying with Table 4B or 5B;</u>f) <u>"FT1" except for natural rubber jackets;</u>g) <u>"FT5" except for natural rubber jackets;</u>i) <u>"NR FOR SURFACE MINES ONLY" or "NATURAL RUBBER FOR SURFACE MINES ONLY" for cables with natural rubber jackets; and</u>



CLAUSE	VERDICT	COMMENT
		<p>Package marking</p> <p>Each package shall be marked with the following information:</p> <p>a) name of the manufacturer; b) type designation; c) number and size of power conductors; d) voltage rating; e) <u>“NATURAL RUBBER FOR SURFACE MINES ONLY” when natural rubber jackets are supplied;</u> f) the date of manufacture; g) <u>“Larger Diameter Cable: XXX mm” if the tolerance exceeds +8% nominal overall diameter;</u> h) <u>length of cable; and</u> i) <u>gross weight.</u></p>
5.5	Info	<p>Tests</p> <p>Insulation deformation test</p> <p>For XLPE insulation, the thickness of the insulation on conductors of No. 4/0 AWG and smaller shall not <u>decrease by more than 25% of the unaged value, and on smoothed samples of insulation from conductors No. 4/0 AWG and larger shall not decrease by more than 15% of the unaged value, when tested at 131 ± 2 °C as specified in the deformation test in CSA C22.2 No. 2556 using the test load given in Table 14.</u></p>
5.5.12	Info	<p>Weather resistance test</p> <p><i>New clause added;</i></p> <p>The specimen to be exposed in the weatherometer shall be straight and a minimum of 400 mm in length. The specimen shall be hung vertically in the drum of the apparatus. The test shall be conducted as follows:</p> <p>a) A straight specimen of the finished cable, a minimum of 400 mm in length, shall be exposed for 720 h in a xenon-arc weather (sunlight) resistance apparatus, as specified in CSA C22.2 No. 2556. The specimen shall be hung vertically in the drum of the apparatus. b) After exposure, the specimen shall be subjected to the cold bend test specified in Clause 5.5.10 for 4 h at -30 °C \pm 2 °C. A mandrel having a diameter six times the overall diameter of the cable shall be used. c) The specimen shall be wrapped 180° around the mandrel. d) The jacket shall be examined for cracks both outside and inside.</p>



CLAUSE	VERDICT	COMMENT
6	Info	Multiconductor round cables for mining and general applications rated up to 2 kV
6.1	Info	Construction
6.1.4	Info	Ground-check conductors
		<i>New clause added;</i>
6.1.4.2		The size of the ground-check conductor for Types G-GC, SHD-GC, and SHC-GC cable shall be in accordance with Tables 21, 22, and 24, respectively. The copper wire shall be in accordance with ASTM B3 or ASTM B33. For sizes smaller than No. 8 AWG, the conductor shall be composed of wires no larger than No. 20 AWG. When an extensible ground-check conductor is used, it shall comply with Clause 5.3.3.4. For Type SHD-R, the ground check conductor shall be equal in size and stranding to the power conductor.
6.1.4.5		The ground-check conductor shall be insulated with a material in accordance with the physical properties specified in Table 11. <u>Compliance shall be determined in accordance with the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556. The rate of separation of the jaws shall be 8.5 mm/s except for polypropylene, where the rate of separation shall be 0.85 mm/s.</u>
6.1.5	Info	Insulation
6.1.5.2		The average insulation thicknesses shall be not less than those specified in Tables 19 to 23, 32, and 33. <u>The minimum thickness at any point shall be not less than 90% of the specified average. Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
		Ground-check conductor identification
6.1.8		The ground-check conductor shall be yellow. <u>For Type SHD-R, the textile member of the braided covering shall be yellow.</u>
		Shielding, Type SHC-GC
6.1.10		The shield over the assembly of Type SHC-GC cable shall comply with Clauses 5.3.5.1 to 5.3.5.3. <u>A semi-conductive tape may be applied to the assembly prior to overall braided shielding.</u>
6.1.11	Info	Jackets
6.1.11.2	Info	Thermoset jackets
		<i>New clause added;</i>
6.1.11.2.2		The average thickness of jackets for Types SHD, SHD-GC, SHD-BGC, and SHC-GC cable shall be not less than that specified in Tables 21 and 23. The minimum thickness at any point shall be not less than 80% of the specified average values. For Types W, G, G-GC, G-BGC, and SHD-R cable, the minimum thickness at any point shall be not less than 70% of the maximum thickness measured radially over a power conductor. Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.



CLAUSE	VERDICT	COMMENT
6.1.11.3	Info	Thermoplastic jackets
6.1.11.3.5		<p>The average thickness of jackets for Types SHD, SHD-GC, SHD-BGC, and SHC-GC cable shall be not less than that specified in Tables 21 and 23. The minimum thickness at any point shall be not less than 80% of the specified average values. For Types W, G, G-GC, G-BGC, and <u>SHD-R</u> cable, the minimum thickness at any point shall be not less than 70% of the maximum thickness measured radially over a power conductor. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u></p> <p>Compliance of jackets with the requirements of Clause 6.1.11.3.2 shall be determined in accordance with the apparatus and the methods specified in the following tests:</p> <p>a) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for tensile strength and elongation; b) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to accelerated aging; c) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to liquids. IRM 902 oil shall be used in accordance with ASTM D471; and <u>d) the tear resistance test in ASTM D470.</u></p>
6.1.11.3.6		
6.2	Info	Marking
		Product marking
6.2.1		<p>Finished cable shall be surface-marked by ink-printing or, in mining applications, shall have markings impressed in the jacket or raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information:</p> <p>e) <u>"FT1";</u> f) <u>"FT5";</u> g) <u>"Larger Diameter Cable: XXX mm" if the tolerance exceeds +8% nominal overall diameter;</u> h) <u>length of cable; and</u> i) <u>gross weight.</u></p>
6.3	Info	Tests
		Spark test
6.3.3		<p>For factory testing, the wire shall be spark-tested in accordance with the spark test in CSA C22.2 No. 2556. The spark voltage shall be applied to 100% of the wire production and be no less than</p> <p>a) 12.5 kV (rms) for No. 8 AWG to No. 2 AWG; b) 15 kV (rms) for No. 1 AWG to No. 4/0 AWG;</p>



CLAUSE	VERDICT	COMMENT
		c) 17.5 kV (rms) for 250 kcmil to 500 kcmil; and d) 22.5 kV (rms) for 501 kcmil to 1000 kcmil.
		<u>For the ground-check conductors, the spark voltage shall be 3 kV.</u>
7	Info	Single-conductor cables for mining and general applications rated up to 35 kV
7.1	Info	Single-conductor Type W cables rated up to 2 kV
7.1.2	Info	Construction
7.1.2.2		The average insulation thickness shall be not less than that specified in Table 24. The minimum thickness at any point shall be not less than 90% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
7.2	Info	Type SH cables rated 5, 8, 15, 25, and 35 kV
7.2.2	Info	Construction
7.2.2.2	Info	Conductor shielding
7.2.2.2.1		Conductor shielding shall be used on the power conductors. This shielding may consist of a <u>semiconducting non-metallic tape with a minimum thickness at any point of 0.06 mm, a semiconducting compound with a minimum thickness at any point of 0.3 mm, or any combination thereof with a minimum thickness of 0.3 mm.</u> <u>The shielding shall be applied over the surface of the conductor and be in direct contact with the inner surface of the insulation.</u>
7.2.2.3	Info	Insulation
7.2.2.3.2		The average insulation thickness shall be not less than that specified in Table 26. The minimum thickness at any point shall be not less than 90% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
7.2.2.6	Info	Jackets
7.2.2.6.2		The average jacket thickness shall be not less than that specified in Table 26. The minimum jacket thickness at any point shall be not less than 80% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
7.3	Info	Marking
		Product marking
7.3.1		Finished cable shall be surface-marked by ink-printing or, in mining applications, shall have markings impressed in the jacket or raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information: e) "FT1"; f) "FT5";



CLAUSE	VERDICT	COMMENT
		Package marking
		Each package shall be marked with the following information:
7.3.2		a) name of the manufacturer; b) type designation; c) size of conductor; d) voltage rating; e) date of manufacture; <u>f) length of cable; and</u> <u>g) gross weight.</u>
7.4	Info	Tests
7.4.3	Info	Dielectric voltage withstand test
		Test for single-conductor Type W cables rated up to 2 kV
7.4.3.1		Finished cables shall withstand the voltage specified in Table 24 for 5 min after <u>not less than 6 h immersion in water. As an alternative to the voltage withstand test, the spark test in Clause 6.3.3 may be performed. The spark voltage shall be applied to 100% of the wire production and be no less than</u>
		a) 12.5 kV (rms) for No. 8 AWG to No. 2 AWG; b) 15 kV (rms) for No. 1 AWG to No. 4/0 AWG; c) 17.5 kV (rms) for 250 kcmil to 500 kcmil; and d) 22.5 kV (rms) for 501 kcmil to 1000 kcmil.
		<i>New clause added;</i>
7.4.5		Test for permittivity and power factor of insulated power conductors — Type SH only
		The permittivity and power factor of insulated power conductors shall comply with Table 15. Compliance shall be determined by the method specified in Clause 5.5.5.
8	Info	Two- and three-conductor flat cables for mining and general applications rated up to 2 kV
8.2	Info	Construction
8.2.5	Info	Insulation
8.2.5.2		The average insulation thickness shall be not less than the values given in Tables 27 to 29. The minimum thickness at any point shall not be less than 90% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
8.2.8	Info	Jackets
8.2.8.2		The overall dimensions of the cable shall be as specified in Tables 27 to 29. The minimum jacket thickness at any point shall not be less than 70% of the maximum thickness measured over the outer power conductors. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>



CLAUSE	VERDICT	COMMENT
		Overall dimensions
8.2.9		The nominal overall dimensions of completed cable shall be in accordance with Tables 27 to 29, <u>with a tolerance as follows:</u> <u>a) two conductors flat: major ± 1.016 mm; minor ± 0.762 mm; and</u> <u>b) three and four conductors flat: major ± 2.032 mm; minor ± 1.27 mm.</u>
8.3	Info	Marking
		<i>New clause added;</i>
		Product marking
		Finished cable shall be surface-marked by markings impressed in the jacket or raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information: a) name of the manufacturer or a symbol by which the cable can be identified as the product of a particular facility; b) type designation; c) number and size of conductors (AWG or kcmil); d) voltage rating; e) "FT1" with the exception of natural rubber jackets; f) "FT5" with the exception of natural rubber jackets; g) "-40 °C" or "MINUS 40 °C", or alternatively, another applicable low-temperature marking lower than -40 °C if the requirements for the cold bend test and low temperature impact test at the marking temperature are met; Note: The low temperature marking indicates the cables have passed a cold bend and low temperature impact test under carefully controlled laboratory conditions. These conditions might not reflect actual field conditions. h) "SR", "Sun Res", or "Sunlight Resistant" is optional for cables complying with the weather resistance test in Clause 8.4.10; and i) "NR FOR SURFACE MINES ONLY" or "NATURAL RUBBER FOR SURFACE MINES ONLY" for cables with natural rubber jackets.
		<i>New clause added;</i>
		Package marking
		Each package shall be marked with the following information:
8.3.2		a) name of the manufacturer; b) type designation; c) number and size of power conductors; d) voltage rating; e) date of manufacture; f) length of cable; and g) gross weight.



CLAUSE	VERDICT	COMMENT										
		Alternative marking										
8.3.3		As an alternative to the marking in Clause 8.3.2e), the month and year of manufacture may be included in the product markings described in Clause 8.3.1. A code may be used for this alternative marking.										
9	Info	Three-conductor SHD-PCG round cables with a central bonding (grounding) conductor for underground coal mining applications rated up to 5 kV										
9.2	Info	Construction										
9.2.4	Info	Ground-check conductor										
9.2.4.1		The ground-check conductor(s) shall consist of individual wires in accordance with ASTM B3 or ASTM B33. <u>If more than one ground-check conductor is used, the minimum size for the ground-check conductor shall be No. 10 AWG. For a single ground-check conductor, the minimum size shall be equal to the power conductors.</u>										
		The colour of the ground-check conductor shall be as follows:										
9.2.4.6		<table border="1"> <thead> <tr> <th>Number of conductors</th> <th>Colour</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Yellow</td> </tr> <tr> <td>2</td> <td>Yellow, black</td> </tr> <tr> <td>3</td> <td>Yellow, black, blue</td> </tr> <tr> <td>4</td> <td>Yellow, black, blue, red</td> </tr> </tbody> </table>	Number of conductors	Colour	1	Yellow	2	Yellow, black	3	Yellow, black, blue	4	Yellow, black, blue, red
Number of conductors	Colour											
1	Yellow											
2	Yellow, black											
3	Yellow, black, blue											
4	Yellow, black, blue, red											
		If more than one ground-check conductor is used, then the assembly of conductors shall have an overall thermosetting covering that meets the requirements of materials listed in Table 13.										
9.2.5	Info	Insulation										
9.2.5.2		The average insulation thicknesses shall be not less than those specified in Table 31. The minimum thickness at any point shall be not less than 90% of the specified average. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>										
9.2.9	Info	Jackets										
9.2.9.2		The average jacket thickness shall be not less than that specified in Table 31. The minimum thickness at any point shall be not less than 80% of the specified average values. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>										
9.3	Info	Marking										
		Product marking										
9.3.1		Finished cable shall be surface-marked by markings impressed in the jacket or, in mining applications, shall have raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information:										



CLAUSE	VERDICT	COMMENT
		<p>c) <u>conductor size (AWG or kcmil) and number of conductors;</u> d) <u>number and size of ground-check conductor(s);</u> e) <u>"FT5";</u> g) <u>"FT1".</u></p>
		<p>Package marking</p> <p>Each package shall be marked with the following information:</p> <p>a) name of the manufacturer; b) "Type SHD-PCG"; c) number and size of power conductors; d) voltage rating; e) date of manufacture; <u>f) length of cable; and</u> <u>g) gross weight.</u></p>
9.4	Info	<p>Tests</p> <p><i>New clause added;</i></p>
9.4.4		<p>Test for permittivity and power factor of 5000 V insulated power conductors</p> <p>The permittivity and power factor of insulated power conductors shall comply with Table 15. Compliance shall be determined by the method specified in Clause 5.5.5.</p> <p><i>New section added;</i></p> <p>Arc-welding cable</p> <p>Clause 10 applies to electrode holder cable intended for use with arc welders.</p> <p>This type of cable has no voltage rating; therefore, the requirements of the Canadian Electrical Code, Part I, shall not apply. It is supplied as a single conductor only.</p> <p>See standard for details.</p>
10		
11	Info	<p>Single-conductor Type PPC rated 600 V</p> <p><i>New clause added;</i></p> <p>General</p>
11.1		<p>This Clause applies to flexible single-conductor cable rated 600 V and intended for use in temporary installations such as portable stage lighting and temporary outdoor functions.</p> <p>This type of cable is not intended for mining applications.</p>



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
		Construction
11.2		Conductors shall be rope stranded, having bunch-stranded members composed of soft annealed copper wires meeting the requirements of ASTM B3 for uncoated conductors or ASTM B33 for tin-coated conductors.
		See standard for details.
11.4	Info	Markings
		Package marking
		Each reel or carton shall be identified with the following information:
11.4.2		a) manufacturer's identification (name or trademark); b) date of manufacture; c) conductor size; d) specified average insulation thickness in mm, if different from Table 36; e) cable type "PPC" or "PPC/TPE", as applicable; f) length of cable and/or gross weight; and g) "600 V".
12	Info	Single and multiconductor Type PPC cables for general applications rated 2 kV
12.2	Info	Construction
12.2.4	Info	Ground-check conductors
12.2.4.4		The ground-check conductor shall be insulated with a material in accordance with the physical properties specified in Table 11. <u>Compliance shall be determined in accordance with the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556. The rate of separation of the jaws shall be 8.5 mm/s except for polypropylene, where the rate of separation shall be 0.85 mm/s.</u>
		The average thickness of the insulation shall be not less than
12.2.4.5		a) 1.14 mm for sizes No. 8 AWG and larger; and b) <u>0.76 mm for sizes No. 10 AWG and smaller.</u>
		The minimum thickness at any point shall be not less than 90% of 1.14 mm for sizes No. 8 AWG and larger and not less than 90% of 0.76 mm for sizes No. 10 and smaller. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>



CLAUSE	VERDICT	COMMENT
		<p>Insulation</p> <p>The insulation shall be</p> <p>a) CSM; b) CR; c) SBR; d) CPE; e) EPR; f) any combination of Items a) to e); or g) TPE (to be used only with a TPE jacket as specified in Clause 12.2.9.1).</p> <p>The insulation shall have physical properties in accordance with Table 38. The average thickness of the insulation shall be not less than that specified in Table 19 or 20. The minimum thickness at any point shall be not less than 90% of the thickness specified in Table 19 or 20. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u></p>
12.2.5		
12.2.9	Info	<p>Jackets</p> <p>The jacket of a multiconductor cable shall meet the requirements of Table 35. For single-conductor constructions, jackets may be used and if used, <u>the jacket shall meet the requirements of Table 35.</u></p> <p><u>The jacket shall be</u></p> <p>a) CSM; b) CR; c) SBR; d) CPE; e) EPR; or f) TPE.</p>
12.2.9.1		
12.2.9.4		<p>The minimum thickness at any one point shall be not less than 70% of the maximum thickness measured radially over a power conductor. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u></p>
12.4	Info	<p>Tests</p> <p><i>New clause added;</i></p>
12.4.2		<p>TPE insulation deformation test</p> <p>TPE insulation shall meet the deformation requirements of Table 38 using the test loads specified in Table 14.</p>



CLAUSE	VERDICT	COMMENT
		New clause added;
		Spark test
12.4.3		For factory testing, the wire shall be spark-tested in accordance with the spark test in CSA C22.2 No. 2556. The spark voltage shall be applied to 100% of the wire production and be no less than a) 12.5 kV (rms) for No. 8 AWG to No. 2 AWG; b) 15 kV (rms) for No. 1 AWG to No. 4/0 AWG; c) 17.5 kV (rms) for 250 kcmil to 500 kcmil; and d) 22.5 kV (rms) for 501 kcmil to 1000 kcmil. For the ground-check conductors, the spark voltage shall be 3 kV.
13	Info	Flexible multiconductor cable for use with cranes and hoists rated 600 V (festoon cable)
13.2	Info	Construction
13.2.1		Conductors shall be of annealed copper, bare or tin-coated, meeting the requirements of ASTM B3 or ASTM B33, and <u>shall be from No. 18 AWG to No. 4/0 AWG in stranded conductor assemblies. Conductors shall consist of either Class K or Class M stranding that complies with either ASTM B172 or ASTM B174.</u>
13.2.3	Info	DC resistance
13.2.3.1		The dc resistance of uncoated copper or tin-coated copper conductors shall be as specified in Table 18. <u>When measured on a length of a finished product, conductors in a twisted assembly having a single layer construction are allowed a tolerance of +2%. When measured on a length of a finished product, conductors in a twisted assembly having more than one layer are allowed a tolerance of +3%.</u>
13.2.4	Info	Insulation
13.2.4.1		Conductors shall be insulated with a material in accordance with Table 46. <u>The average thickness and minimum thickness at any point shall be not less than those specified in Table 42. Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
13.2.4.2		An optional separator of suitable material may be provided between the ground-check conductor and the insulation. <u>The separator shall be of a colour that contrasts with the conductor colour; however, clear or green shall not be used. The separator and any other component shall not have any deleterious effects on each other.</u>
		Overall jacket
13.2.7		Overall jackets shall be made of one of a material specified in Table 43. The average thickness and minimum thickness at any point shall be not less than those specified in Table 42. Where more than one conductor size is present, the minimum average jacket thickness shall be based on the largest conductor size.



CLAUSE	VERDICT	COMMENT										
		<u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>										
13.4	Info	Tests										
13.4.2	Info	Cold bend test										
		<i>New clause added;</i>										
		Specimens of finished cable shall not exhibit cracks or ruptures in the insulation or jacket that are visible to normal or corrected-to-normal vision when bent 180° around a mandrel having a diameter										
13.4.2.1		<p>a) three times the minor dimension or overall diameter of the cable for up to 8.0 mm;</p> <p>b) four times the minor dimension or overall diameter of the cable for greater than 8.0 mm up to 12.0 mm; and</p> <p>c) five times the minor dimension or overall diameter of the cable for greater than 12.0 mm.</p> <p>The sample shall be conditioned for 4 h at -30 ± 2 °C or at the low temperature rating marked on the cable.</p>										
		<i>New clause added;</i>										
13.4.2.2		Compliance with Clause 13.4.2.1 shall be determined in accordance with the cold bend test in CSA C22.2 No. 2556.										
13.4.4	Info	Heat shock										
		<i>New clause added;</i>										
13.4.4.2		The jacket and insulation shall show no cracks when unwound from the mandrel after cooling to room temperature.										
		Dielectric voltage withstand test										
		Each insulated conductor of the finished cable shall withstand, for a period of 1 min, the ac voltage specified below when tested in accordance with the dielectric voltage withstand test (Method 1) in CSA C22.2 No. 2556. <u>The test shall be performed after not less than 6 h immersion in water.</u>										
13.4.11		<table border="1"> <thead> <tr> <th>Conductor size, AWG</th> <th>Applied ac test voltage, kV</th> </tr> </thead> <tbody> <tr> <td>18-10</td> <td>3.0</td> </tr> <tr> <td>8</td> <td>4.0</td> </tr> <tr> <td>6-2</td> <td>6.0</td> </tr> <tr> <td>1-4/0</td> <td>8.0</td> </tr> </tbody> </table>	Conductor size, AWG	Applied ac test voltage, kV	18-10	3.0	8	4.0	6-2	6.0	1-4/0	8.0
Conductor size, AWG	Applied ac test voltage, kV											
18-10	3.0											
8	4.0											
6-2	6.0											
1-4/0	8.0											



CLAUSE	VERDICT	COMMENT
14	Info	Multiconductor round cables for variable frequency drive (VFD) applications rated up to 15 kV
		General
14.1		This Clause applies to Types VFD, <u>VFD-GC</u> , and <u>VFD-BGC</u> cables rated 2–15 kV and intended for use in mining and general applications. All VFD cable types have an overall shield and are used in conjunction with conveyor belt drives and other motors.
14.3	Info	Construction
14.3.1	Info	Power conductors
14.3.1.2	Info	Conductor shielding
14.3.1.2.1 .1		Conductor shielding shall be used on the power conductors over 2 kV. This shielding may consist of a semiconducting non-metallic tape <u>with a minimum thickness at any point of 0.06 mm, a semiconducting compound with a minimum thickness at any point of 0.3 mm, or any combination thereof with a minimum thickness of 0.3 mm.</u> The shielding shall be applied over the surface of the conductor and be in direct contact with the inner surface of the insulation.
14.3.3	Info	Ground-check conductors
		<i>New clause added;</i>
14.3.3.3		For Type VFD-GC cable, the ground-check conductor(s) the minimum size shall be No. 14 AWG.
14.3.3.5		The ground-check conductor shall be insulated with a compound in accordance with the physical properties specified in Table 11. The average thickness of the insulation shall be not less than 1.14 mm for sizes No. 8 AWG and larger and shall be not less than 0.76 mm for sizes No. 10 AWG and smaller. The minimum thickness at any point shall be not less than 90% of 1.14 mm for sizes No. 8 AWG and larger and 0.76 mm for sizes No. 10 AWG and smaller. <u>Compliance shall be determined in accordance with the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556.</u> The rate of separation of the jaws shall be 8.5 mm/s except for polypropylene, where the rate of separation shall be <u>0.85 mm/s.</u>
14.3.4	Info	Insulation
14.3.4.1		The insulation shall be either XLPE or ethylene propylene rubber (EPR) having physical properties in accordance with Table 10. <u>Compliance shall be determined in accordance with the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556.</u>
14.3.4.2		The average insulation thickness shall be not less than that specified in Table 6. The minimum thickness at any point shall be not less than 90% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>



CLAUSE	VERDICT	COMMENT
		When an extruded semiconducting layer is used, the sum of the average insulation thickness plus the average extruded semiconducting layer thickness shall be not less than the values specified in Table 6.
14.3.6	Info	Power conductor identification
		<i>New clause added;</i>
14.3.6.1		Conductors shall be coded using a coloured insulation, coloured stripe tape, dual-coloured tape, or coloured serving or braid. If coloured insulation is used, it may be a surface coating, stripe, or solid. If a tape is used, the blue phase identifier may contain any other colour except red or black provided the blue is at least 50% of the surface area. If a coloured serving or braid is used, at least 50% of the non-metallic members shall be coloured according to the phase identification.
14.3.8	Info	Assembly
		Overall shield
14.3.8.6		Bare or coated copper wires shall be applied in the form of a braid over the assembly. <u>The wires shall meet the requirements of Clause 5.3.1.1. A metallized/polyester tape shall be at least 0.06 mm thick and may be applied over the braid, with the metal side in contact with the braid, with a minimum of 10% overlap.</u>
14.3.9	Info	Jackets
		<i>New clause added;</i>
14.3.9.1		The jacket shall be either thermoset in accordance with Clause 14.3.9.2 or thermoplastic in accordance with Clause 14.3.9.3.
14.3.9.3	Info	Thermoplastic jackets
14.3.9.3.5		The average thickness of jackets for Types VFD, VFD-GC, and VFD-BGC cable shall be not less than the values specified in Table 6. The minimum thickness at any point shall be not less than 80% of the specified average values. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
		Compliance of jackets with the requirements of Table 13 shall be determined in accordance with the apparatus and methods specified in the following tests:
14.3.9.3.6		<ul style="list-style-type: none"> a) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for tensile strength and elongation; b) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to accelerated aging; c) the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556 for exposure to liquids. IRM 902 oil shall be used in accordance with ASTM D471; and d) <u>the tear resistance test in ASTM D470.</u>



CLAUSE	VERDICT	COMMENT
14.4	Info	Marking
		Product marking
14.4.1		Finished cable shall have markings impressed in the jacket or raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information: <u>i) "SR", "Sun Res", or "Sunlight Resistant" is optional for cables complying with the weather resistance test in Clause 14.5.14.</u>
		Package marking
14.4.2		Each package shall be marked with the following information: a) name of the manufacturer; b) type designation; c) number and size of power conductors; d) voltage rating; e) date of manufacture; and <u>f) length of cable and/or gross weight.</u>
14.5	Info	Tests
		Cold bend test
14.5.12		Cold bend properties shall be in accordance with Clause 5.5.10 <u>except the specimen and the mandrel shall be conditioned for 4 h at -35 ± 2 °C or at the lower temperature rating marked on the cable. For temperature ratings below -35 °C, 5 °C decrements shall be used (-40 °C, -45 °C, -50 °C, -55 °C, etc.).</u>
		Low temperature impact test
14.1.13		Low temperature impact properties shall be in accordance with Clause 5.5.11 <u>except the sample shall be conditioned for 4 h at -35 ± 2 °C or at the lower temperature rating marked on the cable. For temperature ratings below -35 °C, 5 °C decrements shall be used (-40 °C, -45 °C, -50 °C, -55 °C, etc.).</u>
15	Info	Single-conductor flexible cables (DLO) for portable power and general applications rated 2 kV
15.1	Info	Single-conductor Type DLO cables rated 2 kV
15.1.2	Info	Construction
		Separator
15.1.2.3		An optional separator of suitable material may be provided between the conductor and the insulation. <u>The separator shall be of a colour that contrasts with the conductor colour; however, clear or green shall not be used. The separator and any other component shall not have any deleterious effects on each other.</u>



CLAUSE	VERDICT	COMMENT
15.1.2.4	Info	Insulation
15.1.2.4.1		Insulation shall be 90 °C EPR having physical properties in accordance with values in Table 10. <u>Compliance shall be determined in accordance with the physical properties test (ultimate elongation and tensile strength) in CSA C22.2 No. 2556.</u>
15.1.2.4.2		The average insulation thickness shall be not less than that specified in Table 25. The minimum thickness shall be not less than 90% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
15.1.2.5	Info	Jackets
15.1.2.5.1		The jacket shall be heavy-duty or extra-heavy-duty with properties type as specified in Table 13. <u>Compliance of jackets with the requirements of Table 13s shall be determined in accordance with the apparatus and methods specified in Clause 5.3.9.2.6.</u>
15.1.2.5.2		The average jacket thickness shall be not less than that specified in Table 25. The minimum thickness shall be not less than 80% of the specified average value. <u>Compliance shall be determined in accordance with the thickness test in CSA C22.2 No. 2556.</u>
15.2	Info	Marking
		Product marking
15.2.1		Finished cable shall be surface-marked by ink-printing or shall have markings impressed in the jacket or raised letters and figures on an impressed background, at intervals not exceeding 1 m, with the following information: <u>e) the maximum operating temperature rating in (°C);</u>
		Package marking
15.2.2		Each package shall be marked with the following information: a) name of the manufacturer; b) type designation; c) conductor size; d) voltage rating; e) date of manufacture; and <u>f) length of cable and/or gross weight.</u>
15.4	Info	Insulation resistance test
		<i>New clause added;</i>
15.4.2		Compliance shall be determined in accordance with the short-term insulation resistance test (Method 1) in CSA C22.2 No. 2556.



CLAUSE	VERDICT	COMMENT
		<i>New section added;</i>
		General
16		Special constructions shall meet all applicable requirements for cable Types SHD, SHD-GC, and SHD- BGC, from 2 kV to 35 kV, except for the deviations permitted in this Clause.
		Special constructions may have fibre optics as specified by end user and manufacturer, and twisted shielded pairs, triads, and quads (i.e., control conductors).
		See standard for details.
