

**OVERHEAD LINES GUIDELINE****Date of Issue: October 5, 2022****Information Bulletin No: B-E3 090312 1****REVISION: 03****Topic: Overhead lines**

This information bulletin acts as a guideline for recommended best practices and should be used in conjunction with the BC Electrical Code, Part 1, Technical Safety BC Bulletin IB-EL-2016-02 “High Voltage Installations,” C22.3 NO. 1-15 – Overhead Systems and other standards referenced in the document. This bulletin was developed by the Electrical Technology Advisory Committee through consultation with the industry.

Provincial Safety Manager

## References:

*Safety Standards Act*

Electrical Safety Regulation

Safety Standards General Regulation

Safety Standards Act Repeal and Transitional Provisions Regulations

C22.3 NO. 1-15 - Overhead systems

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**BC Guideline for Overhead Line Construction****SECTION 100 - SCOPE, REFERENCES AND DEFINITIONS****100-00 Scope**

- (1) This document is supplementary to the BC Electrical Code.
- (2) This document provides guidelines for the construction of overhead power and communication lines.
- (3) Where requirements of this document and the BC Electrical Code conflict, the BC Electrical Code will take precedence for private installations.

**100-02 Reference Publications (See Appendix A)****100-04 Definitions**

**BC Electrical Code** means CSA Standard C22.1 as amended and adopted in British Columbia.

**Clearance** means the distance, under specified design conditions, between the nearest points of two objects at points where at least one object is movable. See also **Separation** and **Spacing**.

**Conductor** means a material used for the transmission of electrical, electromagnetic or optical energy.

**Dead-end Construction** means the attachment to structures of wires or cables so as to transmit their tensions directly to the structures in one direction only.

**Free Standing** means self-supported or guyed.

**Grounded** means electrically connected to the earth through a grounding electrode or through an extended conducting body.

**Grounded conductor** means a line conductor that is grounded at one or more points.

**Grounding** means the provision of a permanent and continuous conductive path to the earth that has sufficient ampacity to carry any fault current liable to be imposed upon it, has sufficient low impedance to limit the voltage rise above ground potential, and that facilitates the operation of protective devices in the circuit

**Guy:**

**Span guy** means a guy that spans the distance between structures.

**Working guy** means a guy installed for the purpose of supporting a structure under normal conditions.

**Guy Assembly** means the strand, insulators, clamps, anchor, and devices used to secure the guy to the structure.

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**Line:**

**Line** means conductors and cables, including associated equipment and supporting structures that are located entirely outside buildings.

**Communication line** means a line used for a signal or communication service.

**Primary line** means a line operating at a potential in excess of 1000 V conductor to ground and lower than 60 kV conductor-to-conductor.

**Secondary line** means a line operating at a potential at, or lower than 1000 V conductor-to-ground.

**Temporary line** means a line for construction or other limited time of use, and which shall be left in place for no more than two years.

**Transmission line** means an AC or DC line operating at a potential of 60 kV or greater conductor to conductor.

**Pole structure** means a main support for a line and consists of one or more poles plus any guys, anchors, push braces, and civil works required to provide structural stability and make it free standing.

**Professional engineer** means an engineer registered and in good standing with the Association of Professional Engineers and Geoscientists of BC.

**Qualified person** means a person who is licensed or otherwise authorized to design or construct overhead lines to this Standard as determined by the regulatory authority having jurisdiction

**Regulatory Authority** means the authority that provides an inspection service under the *Safety Standards Act* and has the authority to require inspection of regulated work in an area of British Columbia.

**Sag:**

**Final unloaded sag** means the sag of the conductor after it has been subjected to a load equivalent to that prescribed for the loading district in which it is situated and subjected to the effects of creep, and after the load has been removed.

**Initial loaded sag** means the sag of a conductor prior to the first application of an external load or prior to the effects of creep.

**Maximum sag at any point of a wire or conductor** means the larger of the sags under

- (a) the thermal loading conditions specified in CSA C22.3 No.1-15; or
- (b) a vertical load that is equivalent in magnitude to the total resultant load calculated from ice, wind, and temperature conditions specified in CSA C22.3 No.1-15 for the loading district in which the line is located.

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**Separation** means the distance between the nearest points of two objects, where both objects are fixed. See also **Clearance** and **Spacing**.

**Spacing** means the distance between the centers of two objects where both objects are fixed. See also **Clearance** and **Separation**.

**Structure** means a line or equipment supporting unit, usually a pole or tower.

**Wire** means a messenger, catenary, overhead support, span guy, shield wire, or other similar non-electrical aerial device, excluding conductors.

## **SECTION 102 – GENERAL REQUIREMENTS**

### **102-00 Construction**

- (1) Line construction shall satisfy the requirements of CSA C22.3 No.1-15 and the BC Electrical Code as specified in this document.
- (2) Lines shall be designed for operation at the highest voltage expected.
- (3) A primary line on private property, not owned and operated by the supply authority but connected to the supply authority's system, shall have service disconnect equipment mounted on the privately-owned pole closest to the supply authority's system
- (4) Service disconnect equipment referred to in Subrule (3) shall:
  - (a) Conform to the requirements of Section 36 of the BC Electrical Code; and
  - (b) Simultaneously disconnect all live lines; and
  - (c) Include overcurrent protection on the same structure.
- (5) Except for the initial span entering private property, a private line on private property shall be free-standing without dependence upon its attachments to the supply authority plant for support.
- (6) A private transmission line connected to a supply authority system shall be designed, operated and maintained at acceptable levels determined by the supply authority.
- (7) A private line connected to a supply authority system shall comply with the requirements of both the supply authority and the regulatory authority having jurisdiction.
- (8) Lines built for supply authority and communication utility takeover shall be:
  - (a) Built in accordance with the design and construction standards of the supply authority and communication utility and.
  - (b) Be constructed of electrical equipment that has been accepted by the supply authority and communication utility.

### **102-02 Connection to a Supply Authority System**

The electrical and mechanical contact between a private overhead line and a supply authority system shall be made only by the supply authority or its agent after acceptance by:

- (a) the Regulatory Authority, and
- (b) the supply authority

### **102-04 Approval of Electrical Equipment for Construction (See Appendix B)**

Lines shall be constructed of electrical equipment approved in accordance with the

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Electrical Safety Regulation. Where approval is not available from an accredited, certification agency, refer to Section 36 Directive, D-EL-090313-1 High Voltage Installations.

## **SECTION 104 – CLEARANCES AND SEPARATIONS**

### **104-00 General**

- (1) For private installations, other than transmission lines, clearances shall be those specified in the BC Electrical Code.

### **104-02 Line Clearances and Separations (See Appendix B)**

- (1) A line shall be designed and constructed so that under the specified mechanical and electrical operating conditions, the maximum sag of the wire or conductor shall not result in a clearance or separation less than that specified in CSA C22.3 No.1-15.
- (2) When a structure supports a primary line, a secondary line, a communication line, or any combination of these, the higher voltage line shall be placed at the highest level and the communication line at the lowest level with a separation between lines not less than what is given in CSA C22.3 No.1-15.
- (3) The separation referred to in Subrule (2) shall be maintained with:
  - (a) The upper conductors at maximum sag; and
  - (b) The lower conductors assumed to be a straight line between the points of support.
- (4) Lines which are supported on separate structures shall have a separation from one another not less than that given in CSA C22.3 No.1-15.
- (5) Open wire secondary conductors supported on vertical brackets or secondary racks shall have a clearance or separation not less than that given in CSA C22.3 No. 1-15.

### **104-04 Maximum Sag Allowance (See Appendix B)**

- (1) For spans up to 120 m (394') in length, conductors and wires shall be sagged in accordance with sag tables developed by a professional engineer in accordance with CSA C22.3 No.1-15, unless specific sag calculations are performed by a professional engineer.
- (2) Sag calculations shall be performed by a professional engineer using approved methods:
  - (a) for all spans in excess of 120 m (394') and,
  - (b) for all regulated crossings of railways, waterways, and pipelines, and
  - (c) for all transmission lines

**104-06 Separation of Equipment from Ground (See Appendix B)** Equipment mounted on poles and structures shall have a minimum separation from ground, being the greater of the requirements given in CSA C22.3 No.1-15 and placing separations given in the BC Electrical Code, Section 36.

### **104-08 Clearances to Buildings and Signs (See Appendix B)**

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clearance shall be the greater of requirements given in CSA C22.3 No.1-15 or placing clearances given in the BC Electrical Code.

**104-10 Cleared Rights-Of-Way**

Lines shall be provided with a cleared corridor suitable for the voltage class and type of environment and in compliance with the tree pruning requirements in CSA C22.3 No. 1-15.

**SECTION 106 – STRUCTURES****106-00 Unacceptable Structures**

- (1) Trees and rock outcroppings are unacceptable line structures.
- (2) Buildings are an acceptable structure where they supply or receive energy at 1000 V or less.
- (3) Above 1000 V lines may only be attached directly to buildings at generator stations or sub-stations.

**106-02 Height**

Structures shall be of sufficient height to accommodate all circuits for which they are intended, and to maintain clearances under maximum sag and loading conditions between circuits and between the lowest conductor and ground. Clearances shall be in accordance with CSA C22.3 No.1-15 and the BC Electrical Code.

**106-04 Treatment**

- (1) Structures shall have coatings or preservation treatment which:
  - (a) Are suitable for service conditions and planned service life of the structure; and
  - (b) Do not cause corrosion of pole line hardware.
- (2) The treatment of wood poles shall conform to the requirements of CAN/CSA-O80 SERIES-08 (R2012).
- (3) For utility take-over lines, the treatment shall meet the requirements of the utility having jurisdiction.
- (4) Wood poles for temporary lines need not be treated.

**106-06 Setting Gain**

Wood poles shall have a setting gain on the face of the pole located 3.66m (144 inches) from the butt of the pole for the purpose of verifying the setting depth. Non-wood poles shall have a weather proof tag in lieu of a setting gain affixed at the same distance from the butt.

**106-08 Pole Selection (See Appendix A)**

- (1) Wood poles shall be Western Red Cedar, Yellow Cedar, Lodgepole Pine, or Douglas Fir with dimensions not less than those given in CSA 015-05.
- (2) Wood poles used for primary lines shall be a minimum of Class 5 and at least 10.5 m (35') in length.
- (3) Wood poles used for secondary lines shall be a minimum of Class 6 and at least 9 m (30') in length, unless it can be shown that clearances as required

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- by Section 104 can be maintained with shorter poles.
- (4) Wood poles used for transmission lines, shall be of a class and length suitable for the service conditions and the design loads as defined in CSA C22.3 No.1-15 or as dictated by specific local conditions.
  - (5) Steel, concrete and fibre-reinforced composite poles are permitted, provided they meet the requirements of CSA C22.3 No.1-15 and are selected for the application by a professional engineer.
  - (6) Class 6 wood poles shall not be longer than 12 m (40').
  - (7) For joint builds accommodating both secondary power lines and communications (Telecommunication, CATV, or both) with maximum span of 38 m (125'), wood poles shall;
    - (a) be a minimum of Class 6;
    - (b) be at least 10 m (30') in length
    - (c) meet the minimum required ground clearance as noted in CSA C22.3 No.1-15 and the BC Electrical Code.

**106-10 Transformer and Equipment Structures**

Poles which support transformers or other equipment shall be of a class as determined by a qualified person based on the stability, strength, and climb ability of the pole. Minimum strength shall be in accordance with CSA C22.3 No.1-15

**106-12 Pole Setting**

- (1) The setting depth of a pole shall provide suitable overturning resistance taking into consideration the soil type and stability and be at least 10% of the pole length plus 0.6m (2 ft), except that for a pole set in rock, the setting depth shall be at least 10% of the pole length but not less than 1.2m (4 ft).
- (2) Notwithstanding Subrule (1), poles erected in a manner to provide equivalent strength shall be approved by a professional engineer.

**106-14 Non-Pole Structures**

Non-pole structures shall be set on foundations that are suitable for service conditions and design loads as required by CSA C22.3 No.1-15.

**SECTION 108 – CONDUCTORS AND WIRES****108-00 Primary and Transmission Conductors**

Primary and transmission line conductors shall be of a material, strength and size suitable for line designs that conform with CSA C22.3 No.1-15 as specified by a qualified person.

**108-02 Secondary Conductors**

- (1) Secondary conductors may be either single conductor or neutral supported cable and, except for the neutral, shall not be bare.
- (2) Single conductors shall:
  - (a) Be a minimum of No. 10 AWG copper or No. 6 AWG aluminum for spans up to 30 m (100'); and

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- (b) Be a minimum of No. 6 AWG copper or No. 3 AWG aluminum for spans up to 40 m (131'); and
  - (c) Be of adequate strength, preferably Aluminum Conductor, Steel Reinforced (ACSR), for spans greater than 40 m (131'); and
  - (d) Have a maximum allowable ampacity as given in Section 4 of the BC Electrical Code.
- (3) Neutral supported cables shall have spans of not more than 38 m (125') in length.
- (4) Neutral supported cables shall have an ampacity not less than that required in Section 4 of the BC Electrical Code.

**108-04 Sag**

- (1) Conductors, wires and cable shall be sagged in such a manner so as to meet the loading and clearance requirements of Section 104 and of CSA C22.3 No. 1-15.
- (2) Transmission line conductors and wires shall be sagged to data produced from detailed calculations prepared by a professional engineer.
- (3) Conductor and wire tension limits, and minimum clearances under service conditions shall be in accordance with CSA C22.3 No.1-15.
- (4) The use of vibration dampers to increase allowable tension must be approved by a professional engineer.

**108-06 Splices and Terminations**

- (1) Splices for primary and secondary lines shall have a mechanical tensile holding strength equal to at least 90% of the conductor ultimate strength and shall meet the requirements of CSA C57-98 (R2015) for Electrical Duty Class A.
- (2) Splices for service conductors shall meet the requirements of CSA C57-98 (R-2002) for Mechanical Duty Class 2 and Electrical Duty Class A.
- (3) Jumper taps and service connections are not considered to be splices but they shall meet the requirements of CSA C57-98 (R2015) for Electrical Duty Class A.
- (4) Splices for transmission lines shall meet the requirements of CSA C57-98 (R2015) for Mechanical Duty Class 1 and Electrical Duty Class A.
- (5) Transmission line jumper terminals shall meet the requirements of CSA C57-98 (R2015) for Mechanical Duty Class 2 and Electrical Duty Class A.

**SECTION 110 – INSULATORS AND HARDWARE****110-00 General**

Insulators and hardware shall be approved for the application by a qualified person.

**110-02 Insulators**

- (1) Line insulators shall comply with CSA C22.3 No.1-15, Rule 8.18.
- (2) Primary and secondary line insulators shall have a minimum wet flashover rating of:
  - (a) Three times conductor-to-ground voltage for pin type insulators.

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- (b) Four times conductor-to-ground voltage for suspension type insulators, regardless of whether they are in the suspension position or the vertical position.
  - (c) 2.0 times conductor-to-ground voltage for guy strain insulators; or
  - (d) 10,000 volts for secondary and neutral insulators.
- (3) Two or more insulators may be used in series to comply with Sub-rules (2) (b) and (2) (c).
- (4) Sub-rules (2) and (3) shall not apply to transmission lines which have a coordinated insulation system designed to meet the service conditions and required reliability level.

**110-04 Hardware**

- (1) Hardware shall be of strength and type suitable for the application and shall meet the requirements of CAN/CSA C83-M96 (R2011).
- (2) Notwithstanding (1), alternate materials having similar mechanical, safety and durability attributes may be used if approved by a professional engineer.

**SECTION 112 – GUYS AND ANCHORS****112-00 General**

- (1) Poles used for dead end construction must be guyed.
- (2) Notwithstanding Subrule (1), communication drops and low voltage service drops to a dead-end service pole which is un-guyed may be acceptable if:
- (a) The drop has a maximum length of 20 m (66');
  - (b) The pole is set in firm soil;
  - (c) The service size is 400 A maximum and ;
  - (d) The installation is approved by a qualified person.
- (3) Poles with a line angle greater than 5 degrees must be guyed in the opposite direction of the maximum strain.
- (4) Notwithstanding Subrules (3),
- (a) poles used for supporting only secondary lines or self supporting communications lines do not require guys when set in firm ground, the line angle is 25 degrees or less and the installation is approved by a qualified person.
  - (b) other supporting arrangements may be acceptable if the design, as determined by a qualified person provides for adequate support if the lines.
- (5) Subrules (1) and (3) are not applicable to transmission lines.

**112-02 Guy Strand**

- (1) Guy strand shall have adequate tensile strength and shall be galvanized steel wire not less than 8 mm (5/16") in diameter, or other similar material.

**112-04 Anchors**

- (1) An anchor shall have sufficient strength to sustain the load at the point of attachment, independent of the strength of the pole.
- (2) An anchor shall be:
- (a) A plate or an expanded anchor; or

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- (b) A power installed screw anchor; or
- (c) A pressure-treated log of new material not less than 300 mm in diameter and 2 m (6.5') long buried horizontally at a depth of 2 m (6.5') minimum and at right angles to the pull; or
- (d) A rock anchor or other anchor designed by a qualified person to provide adequate support.

**112-06 Installation (See Appendix B)**

- (1) Plate and expanding anchors shall be installed against an undercut to bear on firm, undisturbed soil.
  - (2) A guy assembly shall be installed before any conductors are attached to the pole and located so that the guy will not be abraded by rubbing against any wire, pole, or structure.
  - (3) A guy located where there is possibility of contact with supply conductors, due to the failure of the guy or conductors, shall be effectively insulated.
  - (4) All down guys shall be fitted with a highly visible guard and have at least one strain insulator installed.
  - (5) Notwithstanding Subrule (3) and (4), where engineering data is provided to justify an alternative design, guys for poles which carry only transmission lines need not be insulated, but shall be effectively bonded to ground.
- (6) Guy strain insulators shall be installed so that:
  - (a) if the guy is hanging vertically, the lowest insulator will be at least 2.5 m (8') above ground; and
  - (b) if the guy should break loose from its anchor, there will be an insulator between any transmission, primary and secondary, or neutral conductors so as to prevent a guy wire short circuit path between conductors.

**SECTION 114 – GROUNDING****114-00 Grounding Conductor for Supply Systems Less Than or Equal to 22 kV**

- (1) The grounding conductor composition and system grounding conductors for supply systems less than or equal to 22 kV shall meet the requirements of CSA C22.3 No 1-15 – Overhead Systems – Clause 9.1.1.1 and 9.1.1.2. In no case shall the ampacity of the grounding conductor be less than that of No. 4 AWG copper.
- (2) Notwithstanding Subrule (1), privately-owned electrical power lines and electrical equipment shall meet the grounding and bonding requirements of the BC Electrical Code.
- (3) The neutral conductor of a grounded system shall be grounded at the first and last pole of the line and at intervals not greater than 400 m (1312').
- (4) Communications line messengers shall be grounded at the first and last pole of the line and at intervals not greater than:
  - (a) 300 m (984') if the pole line also supports a joint use primary line; and
  - (b) 800 m (2624') if the pole is for the exclusive use of the communications line.

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**114-02 Ground Resistance Requirements (See Appendix B)**

- (1) The neutral shall be:
  - (a) of sufficient size and ampacity for the duty involved,
  - (b) connected to a ground electrode at each piece of electrical equipment and to a sufficient number of additional ground electrodes (not including grounds at a consumer's service) to prevent electric shock hazards caused by the buildup of excessive neutral to earth steady-state voltage.
- (2) Where a single electrode resistance exceeds 25  $\Omega$ , the following applies unless it is clear that additional electrodes will not significantly reduce the resistance:
  - (a) up to two additional electrodes connected in parallel; or
  - (b) up to two deep-driven electrodes shall be used;
- (3) Where practicable, the resistance of the interconnected neutral system shall not exceed 6  $\Omega$ .
- (4) Notwithstanding Subrules (1), (2) and (3), privately-owned electrical power lines and electrical equipment shall meet the grounding and bonding requirements of the BC Electrical Code.

**114-04 Ground Electrodes and Connections**

- (1) Ground electrodes, ground electrode couplers, and connections to ground electrodes shall:
  - (a) have sufficient ampacity to safely conduct the electrical utility system's maximum available fault current and any steady-state ground current that might flow on the electrical utility grounding system where applicable; and
  - (b) be manufactured in accordance with CSA C22.2 No. 41-13.
- (2) Where practicable, ground electrodes shall be installed such that they extend below the frost level.
- (3) Where used, rod-type ground electrodes shall be installed such that:
  - (a) the top ends of the ground electrodes are a minimum distance of 300 mm (1') below final grade level; and
  - (b) the horizontal distance between ground electrodes are greater than, or equal to their depth.

**114-06 Grounding Lightning Arresters**

- (1) The grounding connection between the arrester and the frames of equipment being protected shall be as short, straight, and free from sharp bends as practical.
- (2) The grounding conductor shall have adequate short time ampacity to carry the excess current caused by, or following a surge.
- (3) Individual arrester grounding conductors shall be no smaller than No. 6 AWG copper or equivalent
- (4) For private lines, refer to BC Electrical Code rule 36-308(2)(c) for conductor size.

**114-08 Grounding Pole-Mounted Equipment**

- (1) For equipment connected in a grounded-wye configuration, the neutral point of a pole-mounted transformer, capacitor, or regulator shall be grounded with a ground conductor connected to a ground electrode.
- (2) Notwithstanding Subrule (1), privately-owned electrical equipment shall meet

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the grounding and bonding requirements of the BC Electrical Code.

**114-10 Grounding of Riser Pipes and Guards**

Exposed metal riser pipes and guards in contact with supply cables shall be grounded, unless such cables are covered with a grounded metal sheath.

**114-12 Grounding and Bonding of Gang-operated Switches**

- (1) Gang operated switch handles shall be grounded as per the requirements of the BC Electrical Code, Rule 36-310.
- (2) Gradient control mats shall be provided at switch handles and frames as required by Section 36 of the BC Electrical Code.
- (3) Notwithstanding Subrule (2), a gradient control mat need not be provided where:
  - (a) The switch is owned and operated by the supply authority;
  - (b) The switch handle is at least 3m above grade;
  - (c) An insulator is installed in the operating rod; and
  - (d) The operating handle is grounded to one or more ground rods.

**114-14 Ground Interconnection of Different Systems**

- (1) Where different systems serve the same customer, the grounds of the different systems shall be bonded together.
- (2) A single grounding conductor may be used for both supply and communication grounding, provided that the ground connection is of sufficiently low impedance and of sufficient current-carrying capacity to prevent the buildup of voltages that can result in a hazard to persons or equipment.

**114-16 Grounding Conductors on Joint Use Structures**

Grounding of supply attachments on joint use structures shall meet the requirements of CSA C22.3 No.1-15, Clause 9.1.14.1.

**114-18 Grounding of Consumer Service and Equipment on Joint Use Structures**

Grounding of consumer service and equipment on joint use structures shall meet the requirements of CSA C22.3 No.1-15, Clause 9.1.14.2.

**114-20 Grounding and Bonding of Telecommunications Facilities**

- (1) The grounding conductor shall be made of copper or other metal that will not corrode excessively during the expected service life of the conductor under existing conditions.
- (2) Where joints are unavoidable, they shall be made and maintained such that they do not materially increase the resistance of the grounding conductor and they shall have appropriate mechanical and corrosion-resistant characteristics.
- (3) For telecommunications-only lines, the grounding conductor shall be a minimum of No. 6 AWG insulated wire.
- (4) For joint use and non-joint use poles, the bonding conductor shall be minimum of No. 6 AWG insulated wire.

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- (5) Ground electrodes and connectors shall;
  - (a) be manufactured in accordance with CSA C22.2 No. 41-13, and
  - (b) where practicable, be installed such that they extend below the frost level.
- (6) Ground connections used on grounding systems for telecommunications systems shall comply with CSA C22.2 No. 41-13.

**114-22 Grounding and Bonding Intervals — Aerial, Joint Use, Fiber Cables**

The grounding and bonding intervals for fiber cables in aerial joint use shall follow the requirements of CSA C22.3 No.1-15, Clause 9.2.4.1, 9.2.4.2 and Clause 9.2.4.3.

**114-24 Alternative to Copper Ground Wire**

Ground wires made from alternate metals are permitted to be substituted for specified copper wire provided that:

- (a) the current carrying capability requirements of the selected alternate ground wire is equivalent or better for the purpose;
- (b) the durability of the alternate ground wire is similar to copper for the local environmental conditions where it is installed; and
- (c) a variance from the BC Electrical Code is provided by the authority having jurisdiction.

**APPENDIX A – NOTES ON RULES****100-02 REFERENCE PUBLICATIONS**

Publications referenced in this Standard are as listed below: CSA

C22.3 No.1-15 Overhead Systems

CSA C22.1 Grounding and Bonding Equipment CSA

Z462-12 Workplace Electrical Safety

CSA 015-05 Wood Utility Poles and Reinforcing Stubs

CAN/CSA G12-14 Zinc-Coated Steel Wire Strand CSA 080-97

(R2012) Wood Preservation

CSA C83-96 (R2011) Communication and Power Line Hardware

CAN/CSA C411.1-M89 (2009) AC Suspension Insulators

CSA C57-98 (R2015) Electric Power Connectors for Use in Overhead Line Conductors.

CSA C22.2 No. 41-13 Grounding and Bonding Equipment BC

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Electrical Code Regulation 100\2004

TSBC Bulletin IB-EL 2016-02 - High Voltage Installations Safety

Standards Act Bill 19 – 2003

Electrical Safety Regulation, BC Reg. 100/2004

WorkSafe BC Regulation Part 19

Canada Occupational Health & Safety Regulation Part VIII

## **APPENDIX B – NOTES ON RULES**

### **RULE 102-04**

The Electrical Safety Regulation (BC Reg. 100/2004) recognizes utility electrical equipment that does not require a label or mark. Such equipment may be used by a utility in its capacity as a utility if a professional engineer has certified that the use of the equipment is safe. In this context “supply authority” and “utility” have the same meaning. The BC Electrical Code provides the criteria for the “utility” exemption.

### **RULE 104-02**

Wires and conductors suspended between two points will have varying sag, clearance, and separations due to the following phenomena:

- (1) wind and ice loadings; and
- (2) thermal expansion and contractions caused by variation in ambient temperature, solar radiation, and air movement; and
- (3) thermal expansion and contractions caused by changes in electrical loading of electrical conductors; and
- (4) mechanical creep, which is a permanent elongation of wires and conductors caused by mechanical and thermal loadings.

The overall effect on sag, clearance, and separation varies considerably with the material and design of the conductor or wire, with the pre-loaded and initial tensions, and with span length.

The phenomena can act simultaneously to cause a cumulative effect and will usually result in a large variation in the sag, clearance and separation of wire or conductor. This variation may, theoretically, be almost continuous if the separate parameters are varying from hour to hour. The overall effect is particularly complex when multiple circuits of different characteristics are involved such as when circuits cross, or when multiple circuits share the same pole.

The sags, clearances, and separations referred to in this Standard and in CSA C22.3 No.1- 15 are the maximum or minimum permissible under the prescribed loading conditions, unless otherwise stated.

Clearances specified in the BC Electrical Code apply at the time of installation rather than under specified maximum conditions and are therefore larger than those specified in CSA C22.3 No.1 - 15.

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**RULE 104-04**

As stated in the notes on Rule 104-02, sags, clearances, and separations can vary considerably. As a result, measurements taken in the field at an instant in time will only indicate the sag, clearance, or separation for the prevailing mechanical and thermal conditions at the time the measurements are taken. Simple field measurements do not guarantee that the conductor or wire will meet the clearance requirements specified in this Standard for all service conditions. Complex calculations, or the use of charts and tables, are usually required to transform the measurement data into sag, clearances, and separations at the specified maximum conductor or wire, mechanical and/or electrical loadings.

Constructing a line with exceptionally large clearances and separations is one method of ensuring that the sagging of conductor or wire under service conditions will not contravene the clearance and separation requirements in this Standard.

**RULE 104-06**

Lightning discharge currents contain high-frequency components that produce large voltage gradients on grounding conductors. By keeping the grounding conductor as short, straight, and free from sharp bends as practical, we avoid hazards due to flashover to nearby objects, permit effective operation of the lightning arrester, and minimize the impedance of the connection.

**RULE 104-08**

See WorkSafe BC Section 19 and Human Resources Development Canada (HRDC) regulations for minimum clearances required when working in close proximity to lines.

**RULE 106-08**

In wet service areas, the preferred wood pole is CCA pressure treated Western Red Cedar due to its superior resistance to decay.

**RULE 112-06**

To avoid anchor rod corrosion and penciling due to circulating currents, all power and communication guys must be fitted with guy insulators.

**RULE 114-02**

Multigrounded neutral systems that extend over a substantial distance are more dependent on the multiplicity of grounding electrodes than on the resistance to ground of one individual electrode. Thus, up to two additional electrodes are specified in this clause in order to achieve isolated ground resistances, in the recognition that the primary concern is meeting the interconnected resistance requirements.

BC Safety Authority is now Technical Safety BC.

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