CANADIAN ELECTRICAL CODE, PART I

Consolidated Memorandum of Revisions to the 2021 (25th) edition

Notes:

1. *This document contains the first, second, third, and fourth memorandum of revisions.*

2. *Revisions are identified by a corresponding subject number in the right-hand margin.*
   *First memorandum revisions are identified by a **black** number.*
   *Second memorandum revisions are identified by a **blue** number.*
   *Third memorandum revisions are identified by a **red** number.*
   *Fourth memorandum revisions are identified by a **green** number.*

3. *Unless specified otherwise, revisions are indicated only by strikeout and underline. Revisions in this memorandum are subject to editing, formatting, and renumbering. Revisions are also subject to modification or deletion by subsequent revisions.*

4. *The revisions in this memorandum were approved by the Committee on the Canadian Electrical Code, Part I, and by the Regulatory Authority Committee as of the date below. The revisions are for information only and are not effective until adopted, with or without change, by the authority having jurisdiction, after the twenty-sixth edition is published.*

5. *To obtain the latest edition of this memorandum, visit the CE Code, Part I Portal.*

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July 13 2023

Revision history

Date	Revision	Document
Aug 18 2021	MOR 25-1 Released	MOR 1-2021 CE Code
Nov 3 2021	Deleted change under SN4428-26	MOR 1-2021 CE Code
Aug 5 2022	MOR 25-2 Released	MOR 25-2-2021 CE Code
Feb 6 2023	MOR 25-3 Released	MOR 25-3-2021 CE Code
Feb 7 2023	Minor fixes and edits	MOR 25-3-2021 CE Code R1
Feb 15 2023	Corrections to Section 18	MOR 25-3-2021 CE Code R1.1
July 13 2023	MOR 25-4 Released	MOR 25-4-2021 CE Code
Sept 13 2023	Removed revision to 26-744 (SN4804)	MOR 25-4-2021 CE Code R1.0

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# REFERENCE PUBLICATIONS	
Add new entry to the reference publications: IEC 60228 Conductors of insulated cables	SN4762
Add new entry to the reference publications: NFPA 853 Standard for the Installation of Stationary Fuel Cell Power Systems	SN4610

SECTION 0

Revise Object to read: SN4796

Object (see Appendix B)

The object of this Code is to establish safety standards for the installation and maintenance of electrical equipment. In its preparation, consideration has been given to the prevention of fire and shock hazards, as well as proper maintenance and operation.

The requirements in this Code address the fundamental principles of protection for safety contained in ~~Section 131 of~~ International Electrotechnical Commission Standard 60364-1, Low-voltage electrical installations. IEC 60364-1~~, Section 131,~~ contains fundamental principles of protection for safety that encompass protection against electric shock, thermal effects, overcurrent, fault currents, and overvoltage. Therefore, compliance with the requirements of this Code and proper maintenance will ensure an essentially safe installation. Safe installations may be also achieved by alternatives to this Code, when such alternatives meet the fundamental safety principles of IEC 60364-1 ~~(see Appendix K)~~.
These alternatives are intended to be used only in conjunction with acceptable means to assess compliance of these alternatives with the fundamental safety principles of IEC 60364-1 by the authorities enforcing this Code.

Wiring installations that do not make provision for the increasing use of electricity may be overloaded in the future, resulting in a hazardous condition. It is recommended that the initial installation have sufficient wiring capacity and that there be some provision made for wiring changes that might be required as a result of future load growth.

This Code is not intended as a design specification nor as an instruction manual for untrained persons.

Revise definition of Cable to read: SN4533

Cable —
1) a product identified as a cable in Table 19; or

2) where not listed in Table 19, a complete manufactured assembly consisting of one or more insulated conductors, optical fibers, or both, and which may include fillers, strength members, bonding conductors, and insulating and protective material, and may also include a continuous overall covering providing a degree of electrical, mechanical, and environmental protection to the assembly.

Delete definition of Non-incendive circuit and the associated cross reference: SN4632 SN4565-0

Circuit (see Appendix B) —

~~**Non-incendive circuit** — a circuit in which any spark or thermal effect that may occur under normal operating conditions or due to opening, shorting, or grounding of field wiring is incapable of causing an ignition of the prescribed flammable gas or vapour.~~ ~~**Non-incendive circuit** — see Circuit.~~	
Revise definition for Dwelling unit to read: **Dwelling unit** — ~~one or more rooms for the use of one or more persons as a housekeeping unit with cooking, eating, living, and sleeping facilities.~~ a suite operated as a housekeeping unit, used or intended to be used by one or more persons and containing cooking, eating, living, sleeping and sanitary facilities. (see definition for Suite)	SN4569
Note: *This revision is suspended pending outcome of Subject 4801-86.* *Add definition for Electric vehicle to read:* **Electric vehicle** — an automotive-type vehicle for use on public roads that a) includes automobiles, buses, trucks, vans, low-speed vehicles, motorcycles, and similar vehicles powered by one or more electric motors that draw current from a fuel cell, photovoltaic array, rechargeable energy storage system (such as a battery or capacitor), or other source of electric current; b) includes plug-in hybrid electric vehicles (PHEVs); and c) excludes off-road electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, and mobility scooters for persons with disabilities.	SN4801-0
Revise definition of Identified to read: **Identified —** a) when applied to a conductor, signifies that the conductor has i) a white ~~or grey~~ covering; or ii) a raised longitudinal ridge (s) on the surface of the extruded covering on certain flexible cords, either of which indicates that the conductor is a grounded conductor or a neutral; and b) when applied to other electrical equipment, signifies that the terminals to which grounded or neutral conductors are to be connected have been distinguished for identification by being tinned, nickel-plated, or otherwise suitably marked.	SN4323-0
Revise definition of Industrial establishment to read:	SN4637

Industrial establishment — a building or part of a building (other than office or exhibit space) or a part of the premises outside the building where persons are employed for the purpose of assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials ~~in manufacturing processes or in the handling of material~~, as distinguished from dwellings, offices, and similar occupancies.	
Revise definition of Service, consumer's to read: **Service, consumer's** — all that portion of the consumer's installation from the service box or its equivalent up to ~~and including the point at which connection is made to~~ the supply service.	**SN4690**
Add definition for Suite to read: **Suite** — a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories (see Appendix B)	**SN4569**
Revise definition of Voltage to read: **Voltage** (see Appendix B) — **Extra-low voltage** — a) for ac circuits, any voltage not exceeding 30 V ac; or b) for dc circuits, any voltage not exceeding ~~42.4~~ 60 V dc. **Low voltage** — a) for ac circuits, any voltage exceeding 30 V ac but not exceeding 1000 V ac; or b) for dc circuits, any voltage exceeding ~~42.4~~ 60 V dc but not exceeding ~~1060~~ 1500 V dc. **High voltage** — a) for ac circuits, any voltage exceeding 1000 V ac; or b) for dc circuits, any voltage exceeding ~~1060~~ 1500 V dc.	**SN4555** **SN4645**
Note: The original revision added a definition for "wire mesh cable tray", contingent on approval of Subject 4684. However, Subject 4684 did not result in any change therefore, the definition for "wire mesh cable tray" has been removed.	**SN4683**

SECTION 2

Add new Rule 2-034 to read: SN4459-2

2-034 Application of Code requirements (see Appendix B)
Electrical equipment forming part of an electrical installation which is not covered by the scope of this Code, shall not be used to meet the requirements of this Code.

Revise Subrule 2-100 to read: SN4746 SN4757

2-100 Marking of equipment (see Appendix B)
1) Each piece of electrical equipment shall bear those of the following markings necessary to identify the equipment and ensure that it is suitable for the particular installation:
a) the maker's name, trademark, or other recognized symbol of identification;
b) catalogue number or type;
c) voltage;
d) rated load amperes;
e) watts, volt amperes, or horsepower;
f) whether for ac, dc, or both;
g) number of phases;
h) frequency in hertz;
i) rated load speed in revolutions per minute;
j) designation of terminals;
k) whether for continuous or intermittent duty;
l) short-circuit current rating or withstand rating;
m) evidence of approval; or
n) other markings necessary to ensure safe and proper operation.
2) At the time of installation, each service box shall be marked in a conspicuous, legible, and permanent manner, to indicate clearly the maximum rating of the overcurrent device that may be used for this installation.
3) At each distribution point, circuit breakers, fuses, and switches shall be marked, adjacent thereto, in a conspicuous and legible manner to indicate clearly
a) which installation or portion of installation they protect or control; and
b) the maximum rating of overcurrent device that is permitted.
4) Where feeders or branch circuits are added, removed, or modified at an existing panelboard, the marking required by Subrule 3) shall be updated.
5)~~4)~~ Where the maximum continuous load allowed on a fused switch or circuit breaker as determined in accordance with Rule 8-104 5) and 6) is less than the continuous operating marking of the fused switch or circuit breaker, a permanent, legible caution marking shall be field applied adjacent to the fused switch or circuit breaker nameplate to indicate the maximum continuous loading permitted for connection to the fused switch or circuit breaker.
6) Where the ampacity of the conductors for a service or feeders based on the loads calculated in accordance with Rules 8-200 or 8-202 are less than the rating of the fuse or circuit breaker, a permanent, legible caution marking shall be field applied adjacent to the fused switch or circuit breaker nameplate to indicate the maximum load permitted.

7)~~5)~~ The marking on electrical equipment shall not be added to, or changed, to indicate a use under this Code for which the equipment has not been approved.	
Revise Subrule 2-116 1) to read: **2-116 Corrosion protection for materials used in wiring** 1) Metals used in wiring, such as raceways, cable tray, cable sheaths and armour, boxes, and fittings, shall be suitably protected against corrosion for the environment in which they are to be used or shall be made of suitable corrosion-resistant material.	SN4744
Add new Subrule 2-306 3) to read: **2-306 Shock and arc flash protection** (see Appendix B) 1) Electrical equipment such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centres that are installed in other than dwelling units and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn persons of potential electric shock and arc flash hazards. 2) The marking referred to in Subrule 1) shall be located so that it is clearly visible to persons before examination, adjustment, servicing, or maintenance of the equipment. 3) Where an overcurrent protective device is rated 1200 A or higher: a) means shall be provided to reduce the arcing fault clearing time; and b) documentation regarding such means shall be provided and readily available to personnel that install, operate, inspect and maintain electrical equipment protected by the overcurrent protective device(s).	SN4623
Revise Rule 2-328 to read: **2-328 Electrical equipment near ~~combustible~~ flammable gas equipment** (see Appendix B) For locations that do not have a hazardous area classification in accordance with 18-004 or J18-004, t~~T~~he clearance distance between arc-producing electrical equipment and a flammable ~~combustible~~ gas relief device or vent shall be in accordance with the requirements of CSA B149.1 and CSA B149.2 as applicable.	SN4505 SN4712
Revise Rule 2-400 to read: **2-400 Enclosures, boxes, type designations, and use** (see Appendix B) ~~1) For the purposes of this Code, the following designations of enclosures for electrical equipment other than motors and generators shall be recognized for the intended use as specified in Table 65 and as follows:~~ ~~a) Type 1 for use indoors in ordinary locations;~~ ~~b) Type 2 for use indoors where the enclosure may be subject to drops of falling liquid due to condensation or other causes;~~ ~~c) Type 3R for use outdoors;~~ ~~d) Type 4 for use where the enclosure may be subject to direct streams of water;~~ ~~e) Type 5 for use indoors where the atmosphere may contain settling non-hazardous dust, lint, fibres, or flyings; and~~	SN4531 SN4842

~~f) general-purpose enclosures for use indoors in ordinary locations.~~ ~~2) Other enclosure types tabulated in Table 65 shall be permitted to be substituted for those required in Subrule 1) provided that they~~ ~~a) offer a degree of protection at least equal to that required by Subrule 1) for the intended use, as indicated in Table 65; and~~ ~~b) are marked in accordance with Rule 2-402.~~ 1) Except as provided by Rule 2-404 or permitted by Subrule 2), a degree of protection against inadvertent contact with live parts and a degree of protection against specified environmental conditions shall be provided by a) an enclosure of a type listed in Table 65; or b) a box or boxes complying with the provisions of Section 12. 2) An enclosure not marked with an enclosure type listed in Table 65 shall be considered a general purpose enclosure and shall be permitted to be used indoors in ordinary locations. 3) Enclosures for equipment for use in a hazardous location shall be designated in accordance with Rule 18-052 and J18-052, as applicable.	
Revise Rule 2-402 to read: **2-402 ~~Marking of enclosures~~ Ingress protection** 1) ~~Except for general-purpose enclosures, all enclosures described in Table 65 shall be marked with a type or enclosure designation.~~ ~~2)~~ In addition to the ~~type or~~ enclosure type designation specified in ~~Subrule 1)~~ Rule 2-400, enclosures shall be permitted to be marked with an ingress protection designation (IP Code) ~~designation~~. 2) Ingress protection designations (IP Codes) shall not be permitted to be used as a substitute for enclosure Types listed in Table 65.	SN4531
Revise Rule 2-404 to read: **2-404 Marking of motor~~s~~ enclosures** (see Appendix B) 1) ~~Drip-proof, weatherproof, and totally enclosed motors~~ Motor enclosures for use in ~~non-hazardous~~ locations that require protection from the environment, other than special-purpose motors that are intended to be used only as components of specific equipment, shall be marked ~~as follows:~~ with the type of protection required for the application. ~~a) If a drip-proof motor, with the word "Drip-proof" or the code letters "DP";~~ ~~b) If a weatherproof motor, with the word "Weatherproof" or the code letters "WP"; and~~ ~~c) if a totally enclosed motor, with the words "Totally Enclosed" or the code letters "TE".~~ 2) ~~Notwithstanding Subrule1), special-purpose motors that are intended to be used only as components of specific equipment need not be so marked~~ Motor enclosures referred to in Subrule 1) and motor enclosures without enclosure markings shall be permitted for use indoors in ordinary dry locations.	SN4599

SECTION 4

Revise Rule 4-000 to read:

SN4628-4
SN4701
SN4741

4-000 Scope (see Appendix B)
1) This Section applies to conductors ~~for services, feeders, branch circuits, and photovoltaic circuits~~ in ac and dc systems with regard to
a) the determination of ~~maximum allowable~~ conductor ampacity for specific conditions of use;
b) the determination of maximum conductor termination temperature;
c) the selection of neutral conductors; and
~~d) the selection of a conductor type for a specific condition of use; and~~
~~e~~d) conductor identification.
2) This Section does not apply to other conductors except where specifically referenced in other Sections of this Code.

Revise Rule 4-002 to read:

SN4762

4-002 Size of conductors
1) Except for flexible cord, equipment wire, control circuit insulated conductors, and cable, insulated conductors shall be not smaller than No. 14 AWG when made of copper and not smaller than No. 12 AWG when made of aluminum.

2) Use of conductors in IEC (mm^2) sizes listed in Table D18 shall be permitted, provided that:
a) the ampacity and corresponding AWG or kcmil size is selected in accordance with Rule 4-004; and
b) the cross-sectional area of the listed IEC (mm^2) conductor is not less than the cross-sectional area of the AWG or kcmil conductor selected in Subrule 2) a).

Revise Subrule 4-004 5) to read:

SN4628-4

4-004 Ampacity of wires and cables (see Appendix B)
5) The ~~maximum allowable~~ ampacity of neutral supported cable shall be as specified in Tables 36A and 36B.

Revise Subrule 4-004 21) to read:

SN4628-4

4-004 Ampacity of wires and cables (see Appendix B)
21) The ~~maximum allowable~~ ampacity of bare or covered conductors in free air shall be as specified in Table 66.

Revise Subrule 4-004 22) to read:

SN4509

4-004 Ampacity of wires and cables (see Appendix B)

22) In ventilated and ladder-type cable trays, where the air space between adjacent insulated conductors or cables or both is maintained at greater than 100% of the diameter of the largest conductor or cable, the ampacity of the conductors or cables shall be as follows: a) for single insulated conductors, single-conductor cable, single-conductor metal-sheathed or armoured cable, and single-conductor mineral-insulated cable: i) the value as specified in Tables 1 and 3; and ii) the value as specified in Table 12E when Type DLO cable is marked Type TC and is used in accordance with Rule 4-034 2); and b) for multi-conductor cables, the value as specified in Tables 2 and 4 multiplied by the correction factor from Table 5C for the number of conductors in each cable.	
Revise Subrule 4-004 26) to read: **4-004 Ampacity of wires and cables** (see Appendix B) 26) Where cablebus is installed in a location with an ambient temperature exceeding or anticipated to exceed 30 °C, the ampacity correction factors of Table 5A shall be applied to the cablebus ~~allowable~~ conductor ampacities marked on the cablebus nameplate.	**SN4628-4**
Revise Subrule 4-006 1) to read: **4-006 Temperature limitations** (see Appendix B) 1) Where equipment is marked with a maximum conductor termination temperature, the minimum size of conductor used shall be based on the ~~allowable~~ ampacity in the temperature column in Table 1, 2, 3, or 4, with all relevant correction factors being applied as required by Rule 4-004, corresponding to the maximum termination temperature marked on the equipment.	**SN4628-4**
Add new Rule 4-036 to read: **4-036 Busbar** Where bare busbars are installed in accordance with Rule 12-2600, the ampacity shall be: a) not more than 1200 A; and b) where flat busbars 6.35 mm or less in thickness are used, the ampacity shall not exceed 1000 A per 645 mm^2 of cross-sectional area of copper busbar or 700 A in the case of aluminum busbars.	**SN4766**

SECTION 6

Note: This revision is suspended until Standard ANSI/CAN UL1008M is listed in Appendix A of the CE Code, Part I.

SN4604

Add new terminology to Rule 6-100 to read:

6-100 Special terminology (see Appendix B)

Meter-mounted transfer switch – a transfer switch that is mounted between the jaws of the meter mounting device and the supply authority meter.

Revise Subrule 6-212 3) to read:

SN4661

6-212 Wiring space in enclosures

3) Consumer's service conductors that enter a service box that is not equipped with a barrier between the line and load sides shall

a) enter the service box as close as ~~possible~~ practicable to the line terminals of the main switch or circuit breaker; and

b) not come into contact with or cross conductors connected to the load terminals of the main switch or circuit breaker.

Revise Subrule 6-302 1) to read:

SN4308

6-302 Installation of overhead consumer's service conductors

1) Conductors of a consumer's service that are located above ground, at any point, on a building or other structure shall be installed in one of the following ways:

a) rigid conduit;
b) busway;
c) steel electrical metallic tubing;
d) flexible metal conduit, with lead-sheathed conductors;
e) mineral-insulated cable other than the lightweight type;
f) aluminum-sheathed cable or copper-sheathed cable;
g) Type ACWU75 or Type ACWU90 cable;
h) Type AC90 cable; ~~or~~
i) Type TECK90 cable; or
j) Type NS75 or NS90 cable.

Note: This revision is suspended until Standard ANSI/CAN UL1008M is listed in Appendix A of the CE Code, Part I.

SN4604

Revise Rule 6-200 to read:

6-200 Service equipment (see Appendix B)

1) Except as provided in Subrule 2), each consumer's service shall be provided with a single service box.

2) More than one service box shall be permitted to be connected to a single consumer's service, provided that a) the subdivision is made in a multiple or dual lug meter mounting device rated at not more than 600 A and 150 volts-to-ground; and b) the meter mounting device is located outdoors. 3) For the application of Rule 6-104, each subdivision of the meter mounting device shall be considered a consumer's service. 4) Meter-mounted transfer switches shall be permitted to be connected on the line side of the service box provided that the a) meter-mounted transfer switch is rated for the calculated load in accordance with Rule 8-104; b) meter mounting device is rated not more than 200 A and installed in accordance with Rule 6-402 2); and c) installation includes a caution label on the meter mounting device or the meter-mounted transfer switch indicating that the generator shall not contain a system bonding jumper.	
Revise Rule 6-308 to read: **6-308 Use of ~~bare~~ neutral conductors in consumer's services**) Where a neutral conductor is installed in a consumer's service raceway it shall be insulated. 2) A bare neutral conductor shall be permitted to be installed in accordance with Rule 6-302, when such neutral conductor is used as a part of assembly of a) a busway; or b) neutral supported cables NS75 or NS90. ~~The neutral conductor of a consumer's service shall be permitted to be bare if this conductor is~~ ~~a) made of copper and is run in a raceway;~~ ~~b) made of aluminum and is run above ground in a non-metallic or an aluminum raceway;~~ ~~c) part of a busway or of a service entrance cable; or~~ ~~d) part of a neutral supported cable used in accordance with Rule 6-302 2).~~	SN4308
Revise Rule 6-400 to read: **Rule 6-400 Metering equipment** Metering equipment includes ~~any current and potential~~ instrument transformers (current or voltage) as well as the associated measuring instruments.	SN4707
Revise Subrule 6-402 2) to read: **6-402 Method of installing meter loops** (see Appendix B) 2) Metering equipment shall be connected on the load side of the service box, except that it shall be permitted to be connected on the supply side where	SN4512

a) no live parts or wiring are exposed,~~;b)~~ the supply is ac,~~ and~~ the voltage does not exceed 300 V between conductors,~~;~~ and ~~c)~~ the rating of the consumer's service does not exceed i) 200 A for a meter mounting device; ii) 320 A for a meter mounting device equipped with a bypass means; or iii) 600 A for a transformer rated meter mounting device located outdoors~~.~~; or b) a single or multiple meter mounting device, rated 300 Volts or less between conductors is provided as an integral part of service equipment for use in nonhazardous locations.	
Revise Subrule 6-408 1) to read: **6-408 Location of meters** (See Appendix B) 1) Meters and metering equipment shall be a) located as near as practicable to the service box except as provided for in Subrule 2); b) grouped where practicable; c) readily accessible; d) not located in coal bins, clothes closets, bathrooms, stairways, ~~high ambient~~ rooms or spaces with high ambient temperatures, dangerous or hazardous locations, nor in any similar undesirable places; e) if mounted outdoors, of weatherproof construction or in weatherproof enclosures; and f) in compliance with the requirements of the supply authority.	SN4576

SECTION 8

Revise Subrules 8-104 5) and 6) to read: SN4628-8

8-104 Maximum circuit loading (see Appendix B)

5) Where a fused switch or circuit breaker is marked for continuous operation at 100% of the ampere rating of its overcurrent devices, the continuous load as determined from the calculated load shall not exceed the continuous operation marking on the fused switch or circuit breaker and

a) except as required by Item b), shall not exceed 100% of the ~~allowable~~ ampacities of conductors selected in accordance with Section 4; or

b) shall not exceed 85% of the ~~allowable~~ ampacities of single conductors selected in accordance with Section 4.

6) Where a fused switch or circuit breaker is marked for continuous operation at 80% of the ampere rating of its overcurrent devices, the continuous load as determined from the calculated load shall not exceed the continuous operation marking on the fused switch or circuit breaker and

a) except as required by Item b), shall not exceed 80% of the ~~allowable~~ ampacities of conductors selected in accordance with Section 4; or

b) shall not exceed 70% of the ~~allowable~~ ampacities of single conductors selected in accordance with Section 4.

Revise Subrule 8-106 11) to read: SN4519 SN4620-8

8-106 Use of demand factors (see Appendix B)

11) For the purposes of Rules 8-200 1) a) vi), 8-202 1) a) vii), 8-202 3) d), 8-204 1) d), 8-206 1) d), 8-208 1) d), and 8-210 c), where an electric vehicle energy management system as described in Subrule 10) performs the functions of

a) monitoring ~~monitors~~ the consumer's service, ~~and~~ feeders, and branch circuits and

b) controlling ~~controls~~ the electric vehicle supply equipment loads in accordance with Rule 8-500,

the demand load for the electric vehicle supply equipment shall not be required to be considered in the determination of the calculated load.

Revise Item 8-110 c) to read: SN4353 SN4635

8-110 Determination of areas

The living area designated in Rules 8-200 and 8-202 shall be determined from inside dimensions and include the sum of

a) 100% of the area on the ground floor; b) 100% of any areas above the ground floor used for living purposes; and c) 75% of ~~the~~ only those areas below the ground floor that exceed 1.8 m in height, measured from the lowest part of the ceiling assembly to the ground or other surface below it.	
Revise Subrule 8-200 2) to read: **8-200 Single dwellings** (see Appendix B) 2) The calculated load for the consumer's service or feeder conductors supplying two or more dwelling units of row housing shall be based on a) the calculated load in the dwelling unit, as determined in accordance with Subrule 1), excluding electric vehicle supply equipment loads, described in paragraph 8-202(1)(a)(vii), any electric space-heating loads, and any air-conditioning loads, with application of demand factors to the calculated loads as required by Rule 8-202 3) a) i) to v); plus b) the requirements of Rule 8-202 3) b) to e).	SN4729
Revise Rule 8-202 to read: **8-202 Apartment and similar buildings** (see Appendix B) 1) The calculated load for the service or feeder from a main service supplying loads in dwelling units shall be the greater of Item a) or b): a) i) a basic load of 3500 W for the first 45 m2 of living area (see Rule 8-110); plus ii) an additional 1500 W for the second 45 m2 or portion thereof; plus iii) an additional 1000 W for each additional 90 m2 or portion thereof in excess of the initial 90 m2; plus iv) any electric space-heating loads provided for with demand factors as permitted in Section 62 plus any air-conditioning loads with a demand factor of 100%, subject to Rule 8-106 3); plus v) any electric range load provided for as follows: 6000 W for a single range plus 40% of any amount by which the rating of the range exceeds 12 kW; plus vi) any electric tankless water heaters or electric water heaters for steamers, swimming pools, hot tubs, or spas with a demand factor of 100%; plus vii) any electrical vehicle supply equipment loads, if they are supplied from a panelboard installed in a dwelling unit, with a demand factor of 100%; plus viii)~~vii)~~ any loads provided for, in addition to those outlined in Items i) to vi), at A) 25% of the rating of each load with a rating in excess of 1500 W, if an electric range has been provided for; or B) 25% of the rating of each load with a rating in excess of 1500 W plus 6000 W, if an electric range has not been provided for; or b) 60 A. 2) The total load calculated in accordance with Subrule 1) and Subrule 3) a), b), and c) shall not be considered to be a continuous load for the application of Rule 8-104.	SN4519 SN4681

3) The calculated load for the consumer's service or feeder supplying two or more dwelling units shall be based on the calculated load obtained from Subrule 1) a) and the following:

a) excluding any electric vehicle supply equipment loads, electric space-heating loads and any air-conditioning loads, the load shall be considered to be

i) 100% of the calculated load in the unit having the heaviest load; plus

ii) 65% of the sum of the calculated loads in the next 2 units having the same or next smaller loads to those specified in Item i); plus

iii) 40% of the sum of the calculated loads in the next 2 units having the same or next smaller loads to those specified in Item ii); plus

iv) 25% of the sum of the calculated loads in the next 15 units having the same or next smaller loads to those specified in Item iii); plus

v) 10% of the sum of the calculated loads in the remaining units;

b) if electric space heating is used, the sum of all the space-heating loads as determined in accordance with the requirements of Section 62 shall be added to the load determined in accordance with Item a), subject to Rule 8-106 3);

c) if air conditioning is used, the sum of all the air-conditioning loads shall be added, with a demand factor of 100%, to the load determined in accordance with Items a) and b), subject to Rule 8-106 3);

d) except as permitted by Rule 8-106 10) or Rule 8-106 11), any electric vehicle supply equipment loads ~~not located in dwelling units~~ not supplied from a panelboard installed in a dwelling unit in accordance with Rule 8-202(1)(a)(vii), shall be added with a demand factor of 100% ~~as specified in Table 38~~; and

e) in addition, any lighting, heating, and power loads not located in dwelling units shall be added with a demand factor of 75%.

4) The ampacity of feeder conductors from a service supplying loads not located in dwelling units shall be not less than the rating of the equipment installed with demand factors as permitted by this Code.

SN4681

Revise Item 8-204 1) d) to read:

8-204 Schools

1) The calculated load for the service or feeder shall be based on the following:

a) a basic load of 50 W/m^2 of classroom area; plus

b) 10 W/m^2 of the remaining area of the building based on the outside dimensions; plus

c) electric space-heating, air-conditioning, and total loads of other permanently connected equipment based on the rating of the equipment installed; plus

d) except as permitted by Rule 8-106 10) or Rule 8-106 11), any electric vehicle supply equipment loads with a demand factor of 100% ~~as specified in Table 38~~; plus

e) cord-connected equipment intended for connection to receptacles rated more than 125 V or 20 A based on

i) 80% of the rating of the receptacle; or

ii) the rating of the equipment intended for connection to the receptacle.	
Revise Item 8-206 1) d) to read: **8-206 Hospitals** 1) The calculated load for the service or feeder shall be based on the following: a) a basic load of 20 W/m^2 of the area of the building based on the outside dimensions; plus b) 100 W/m^2 for high-intensity areas such as operating rooms; plus c) electric space-heating, air-conditioning, and total loads of other permanently connected equipment based on the rating of the equipment installed; plus d) except as permitted by Rule 8-106 10) or Rule 8-106 11), any electric vehicle supply equipment loads with a demand factor of 100%~~as specified in Table 38~~; plus e) cord-connected equipment intended for connection to receptacles rated more than 125 V or 20 A based on i) 80% of the rating of the receptacle; or ii) the rating of the equipment intended for connection to the receptacle.	SN4681
Revise Item 8-208 1) d) to read: **8-208 Hotels, motels, dormitories, and buildings of similar occupancy** (see Appendix B) 1) The calculated load for the service or feeder shall be based on the following: a) a basic load of 20 W/m^2 of the area of the building, based on the outside dimensions; plus b) lighting loads for special areas such as ballrooms, based on the rating of the equipment installed; plus c) electric space-heating, air-conditioning, and total loads of other permanently connected equipment based on the rating of the equipment installed; plus d) except as permitted by Rule 8-106 10) or Rule 8-106 11), any electric vehicle supply equipment loads with a demand factor of 100%~~as specified in Table 38~~; plus e) cord-connected equipment intended for connection to receptacles rated more than 125 V or 20 A based on i) 80% of the rating of the receptacle; or ii) the rating of the equipment intended for connection to the receptacle.	SN4681

Revise Item 8-210 c) to read: **8-210 Other types of occupancy** The calculated load for the service or feeder for the types of occupancies listed in Table 14 shall be based on a) a basic load in watts per square metre as required by Table 14 for the area of the occupancy served based on the outside dimensions of the occupancy, with application of demand factors as indicated in Table 14; plus b) special loads such as electric space-heating, air-conditioning, motor loads, show window lighting, stage lighting, etc., based on the rating of the equipment installed with demand factors permitted by this Code; plus c) except as permitted by Rule 8-106 10) or Rule 8-106 11), any electric vehicle supply equipment loads with a demand factor of 100%~~as specified in Table 38~~.	SN4681

SECTION 10

Revise Rule 10-004 definition for Solidly grounded system to read: SN4320

Solidly grounded system — an electrical system in which a point of that system is connected, without inserting an impedance grounding device,

a) to a system bonding jumper; and

b) ~~by a grounding conductor,~~ to a grounding electrode or to a conductive body that extends the ground connection.

Revise Rule 10-004 definition for System bonding jumper to read: SN4320

System bonding jumper — a connection between the ~~system grounded~~ point of an electrical system to be solidly grounded and the non-current carrying conductive parts of ~~an~~ that electrical system ~~to establish a solidly grounded system~~.

Revise Rule 10-206 to read: SN4356

10-206 AC systems required to be solidly grounded

1) Except as permitted by Subrule 2), ac~~AC~~ systems exceeding extra-low voltage shall be solidly grounded. ~~if~~

~~a) by doing so, their maximum voltage-to-ground does not exceed 150 V; or~~

~~b) the system incorporates a neutral conductor.~~

2) AC systems in other than dwelling units ~~exceeding the value prescribed by Subrule 1) a)~~ shall be permitted to be ungrounded or impedance grounded., ~~provided that they meet the requirements for~~

~~a) ungrounded systems; or~~

~~b) impedance grounded systems.~~

3) Extra-low-voltage ac systems shall be solidly grounded where

a) run overhead outside;

b) supplied by transformers energized from systems of more than 150 volts-to-ground; or

c) supplied by transformers energized from ungrounded systems.

Revise Rule 10-212 to read: SN4319

10-212 Grounding connections for solidly grounded separately derived ac systems (see Appendix B)

1) Except as permitted by Subrule ~~2~~3), the grounded conductor of a solidly grounded separately derived ac system shall

a) be connected to the equipment bonding terminal by a system bonding jumper

i) at the point of termination to each source;

ii) at the first switch controlling the system; or

iii) at the tie point, where two or more systems terminate at a tie point;

b) be connected to a grounding conductor at the same point on the separately derived system where the system bonding jumper is connected; and

c) have no other connection to the non-current-carrying conductive parts of electrical equipment on the supply side or the load side of the grounding connection. 2) Where more than one source of supply exists that are intended to be solidly grounded, the connection required by item 1) shall be permitted to be made to a single grounding conductor. 3~~2~~) A separately derived ac system operating at 750 V or less shall be permitted to be grounded by the system bonding jumper that is connected to the bonding conductor included in the primary supply.	
Revise Subrule 10-308 1) to read: **10-308 Conductors used with impedance grounding devices** (see Appendix B) 1) The conductor connecting the impedance grounding device to the system source shall a) be insulated for the nominal system voltage; b) be identified white~~ or grey~~; c) be routed as directly as practicable; d) not be grounded; e) be sized to conduct the rated current of the impedance grounding device, and in no case less than i) No. 12 AWG if of copper; or ii) No. 10 AWG if of aluminum; and f) be protected from damage i) mechanically; or ii) by location.	**SN4323-10**
Revise Subrule 10-400 1) to read: **10-400 Ungrounded** systems (see Appendix B) 1) DC or ac systems shall be permitted to be ungrounded, provided that the system ~~is~~ a) is equipped with suitable ground fault detection; ~~and~~ b) does not include a distributed neutral conductor; and c)~~b)~~ is maintained by qualified persons.	**SN4356**
Revise Rule 10-604 to read: **10-604 Bonding continuity for service equipment (see Appendix B)** 1) The bonding continuity for service equipment ~~raceways, cable armour, cable sheaths, and all service equipment enclosures containing service conductors, including meter fittings, boxes, or the like,~~ shall be assured by bonding means prescribed in Rule 10-610. ~~a) threaded couplings and threaded connections to the conductive enclosures, with joints made up tight where rigid metal conduit is used;~~ ~~b) couplings and connectors made up tight where electrical metallic tubing is used; and~~ ~~c) bonding bushings supplemented with a bonding conductor where the connection to the enclosure is made using standard locknuts.~~	**SN4591**

2) Standard locknuts serving as the bonding means for metal raceway, metal sheath, or cable armour connecting to service equipment shall be supplemented by bonding bushings with a bonding conductor connecting to a bonding bus within the enclosure a) at both ends where the metal raceway, metal sheath, or cable armour serves as the bonding means between service equipment; or b) at one end where i) a bonding conductor is run with circuit conductors; or ii) the termination to service equipment is only at one end. ~~2)~~3) Notwithstanding Subrule 2) ~~1)c)~~, bonding bushings shall not be required for cable assemblies incorporating an internal bonding conductor in continuous contact with the cable armour, provided that the internal bonding conductor extends from the cable and connects to the service equipment.	
Add new Subrule 10-612 3) and renumber existing Subrules 10-612 3) to 7) as 4) to 8): **10-612 Installation of bonding conductors** (see Appendix B) 1) The bonding conductor shall be permitted to be spliced or tapped. 2) Where more than one bonding conductor enters a box, all such conductors shall be in electrical contact with each other by one of the following means: a) securing all bonding conductors under bonding screws; or b) connecting all bonding conductors together with a solderless connector, and then connecting a minimum of one conductor, not smaller than the largest bonding conductor, to the box by a bonding screw or a bonding device. 3) Notwithstanding the requirements of Subrule 2) and Rule 10-614 (3), equipment shall be permitted to be connected to an isolated bonding conductor that extends directly back to its source of supply, or to the main system bonding jumper, provided that the separate bonding conductor is: a) enclosed in the same raceway or cable containing the circuit conductors throughout the length of that cable or raceway, b) sized not less than as required in Rule 10-616, and c) insulated. 4) ~~3)~~ 5) ~~4)~~ 6) ~~5)~~ 7) ~~6)~~ 8) ~~7)~~	SN4655
Revise Rule 10-616 to read: **10-616 Size of system bonding jumper or bonding conductor** (see Appendix B) 1) The size of a field-installed system bonding jumper shall not be less than that determined in accordance with Table 16 based on the ampere rating or setting of the overcurrent device protecting the ungrounded conductors.	SN4628-10

2) The size of a bonding conductor installed in accordance with Rule 10-604 at service equipment shall not be less than that determined in accordance with Table 16 based on the ~~allowable~~ ampacity of the largest ungrounded conductor. 3) The size of a field-installed bonding conductor installed at other than service equipment shall not be less than that determined in accordance with Table 16 based on a) the ampere rating or setting of the overcurrent device protecting the ungrounded conductors; or b) the ~~allowable~~ ampacity of the largest ungrounded conductor for installations where the size of the circuit conductors is increased to compensate for voltage drop. 4) The size of a field-installed bonding conductor installed with each group of parallel conductors run in separate raceways or cables shall be in accordance with Subrule 3) divided by the number of groups of parallel conductors. 5) Notwithstanding Subrules 2), 3), and 4), the bonding conductor shall not be required to be larger than the current-carrying conductors. 6) A metal raceway that is permitted to be used as a bonding conductor shall be considered to meet the requirements of this Rule. 7) A bonding means that is integral to a cable assembly shall be considered to meet the requirements of this Rule.	
Revise Rule 10-702 to read: **10-702 Installation** (See Appendix B) 1) Conductors for equipotential bonding shall be permitted to be installed as open wiring, provided that they are adequately secured. 2) Where installed in structural members, conductors for equipotential bonding shall be installed in the same manner as non-metallic sheathed cable, except that they do not require bushed holes where run through metal studs. 3) Equipotential bonding of the non-electrical equipment referred to in Rule 10-700 shall be permitted to be made by a permanent conductive connection to the non-current carrying conductive parts of electrical equipment, provided the electrical equipment is a) supplied by a permanently connected circuit incorporating a bonding conductor; and b) associated with the non-electrical equipment that is being made equipotential.	SN4514
Revise Rule 10-708 to read: **10-708 Equipotential bonding conductor size** **10-708 Equipotential bonding conductor size** 1) Except as permitted by Subrule 2) or 3), the size of an equipotential bonding conductor installed as exposed wiring where not subject to mechanical damage shall be not smaller than a) No. 6 AWG if of copper; or	SN4514 SN4725

b) No. 4 AWG if of aluminum. 2) The size of an equipotential bonding conductor installed as concealed wiring ~~and~~ or provided with mechanical~~ly protected~~ protection shall be permitted to be a minimum ~~No. 10 AWG copper or No. 8 AWG aluminum~~ a) No. 10 AWG if of copper; or b) No. 8 AWG if of aluminum. 3) The size of an equipotential bonding conductor shall be permitted to be as prescribed by Rule 10-616 when installed in accordance with Rule 10-702 3).	

SECTION 12

Revise Rule 12-000 to read: SN4730-12

12-000 Scope (see Appendix B)

1) The provisions of Section 12 apply to all low voltage and extra-low voltage wiring installations ~~operating at 750 V or less,~~ except for

a) Class 2 circuits unless otherwise specified in Rules 12-2300 to 12-2320 and Section 16;

b) community antenna distribution and radio and television circuits unless otherwise specified in Section 54;

c) optical fiber cables unless otherwise specified in Section 56;

d) communication circuit conductors unless otherwise specified in Section 60; and

e) conductors that form an integral part of factory-built equipment.

2) The provisions of ~~this~~ Section 12 apply ~~also~~ to high voltage installations ~~operating at voltages in excess of 750 V,~~ except as modified by the requirements of Section 36.

Add new Rule 12-002 to read: SN4644

12-002 Special terminology

In this Section, the following definitions shall apply:

Grade level in-ground enclosure – a housing the top of which is installed flush with the ground, and which provides access to equipment located therein through a secured cover.

Revise Subrule 12-010 4) to read: SN4826

4) Notwithstanding Subrule 3), where a plenum or hollow space is created by a suspended ceiling having lay-in panels or tiles, flexible cord not exceeding 3 m in length and terminated with an attachment plug shall be permitted to supply pole-type multi-outlet assemblies, provided that the flexible cord is listed ~~in Table 11~~ for hard usage in accordance with Rule 12-102 4) and the supply voltage does not exceed 300 V.

Revise Subrule 12-012 12), add new Subrules 13) and 14), and renumber Subrule 13) as 15): SN4644 SN4776

12-012 Underground installations (see Appendix B)

1) Direct buried cables or raceways shall be installed to meet the minimum cover requirements of Table 53.

2) Where the depth specified in Rule 4-004 1) d) to g), or Rule 4-004 2) d) to g) for the purposes of determining the ampacity of direct buried cables or raceways is less than the depth required by Table 53, the requirements of Table 53 shall apply.
3) ~~2)~~ The minimum cover requirements shall be permitted to be reduced by 150 mm where mechanical protection is placed in the trench over the underground installation.
4) ~~3)~~ Mechanical protection shall consist of one of the following and, when in flat form, shall be wide enough to extend at least 50 mm beyond the cables or raceways on each side:
a) treated planking at least 38 mm thick;
b) poured concrete at least 50 mm thick;
c) concrete slabs at least 50 mm thick;
d) concrete encasement at least 50 mm thick; or
e) other suitable material.
5) ~~4)~~ Direct buried cables shall be installed so that they run adjacent to each other and do not cross over each other and with a layer of screened sand with a maximum particle size of 4.75 mm or screened earth at least 75 mm deep both above and below the conductors.
6) ~~5)~~ Where cables rise for terminations or splices or where access is otherwise required, they shall be protected from mechanical damage by location or by rigid conduit terminated vertically in the trench and including a bushing or bell end fitting, or other acceptable protection, at the bottom end from 300 mm above the bottom of the trench to at least 2 m above finished grade, and beyond that as may be required by other Rules of the Code, and with sufficient slack provided in the cables at the bottom end of the conduit so that the cables enter the conduit from a vertical position.
7) ~~6)~~ Where a deviation has been allowed in accordance with Rule 2-030, cables buried directly in earth shall be permitted to be spliced or tapped in trenches without the use of splice boxes.
8) ~~7)~~ Raceways or cables, if located in rock, shall be permitted to be installed at a lesser depth entrenched into the rock in a trench not less than 150 mm deep and grouted with concrete to the level of the rock surface.
9) ~~8)~~ Raceways and armoured or metal-sheathed cables suitable for direct burial shall be permitted to be installed directly beneath a concrete slab at grade level, provided that the concrete slab is not less than a nominal 100 mm in thickness, the location and depth of the underground installation is marked in a conspicuous, legible, and permanent manner, and the raceway or cable is not subject to damage during or after installation.
10) ~~9)~~ Any form of mechanical protection that may adversely affect the cable shall not be used.
11) ~~10)~~ Backfill containing large rocks, paving materials, cinders, large or sharply angular substances, or corrosive material shall not be placed in an excavation where such materials may damage cables, raceways, or other substructures, prevent adequate compaction of fill, or contribute to corrosion of cables, raceways, or other substructures.
12) ~~11)~~ The initial installation shall be provided with a suitable marking tape buried approximately halfway between the installation and grade level, or adequate marking in a conspicuous location to indicate the location and depth of the underground installation.
13) ~~12)~~ Where underground raceways, or cables, or grade level in-ground enclosures are subject to movement by settlement or frost, provision shall be made for the prevention of damage to the conductors, conductor insulation, or the electrical equipment.

14) Grade level in-ground enclosures shall be used in accordance with the manufacturers' design class (tier). 15) Except for splicing installed in accordance with Rule 12-112, devices such as receptacles and switches shall not be permitted in grade level in-ground enclosures. 16) ~~13)~~ For installations not covered by the foregoing requirements of this Rule, the requirements of CSA C22.3 No. 7, or the applicable standard, whichever is more stringent, shall apply.	
Revise Subrule 12-020 2) to read: 2) To connect and interconnect data processing and similar systems, portable power cable shall be permitted to be installed under raised floors, pass through an opening in the raised floor located directly below the equipment, and terminate at the equipment supplied, provided that a) the cable contains a bonding conductor; b) the connection between the portable power cable and other wiring methods is made in a junction box or similar enclosure, with a conductor termination that is suitable for the class of strand based on the conductor used; and c) the cable is i) part of the factory-supplied data processing or similar equipment; or ii) ~~of the type listed in Table 11~~ selected in accordance with Rule 12-102 4).	SN4826
Revise Rule 12-102 to read: **12-102 Installation of insulated conductors and cables** (see Appendix B) 1) Insulated conductors and cables shall not be handled or installed when the ambient temperature is sufficiently low as to be liable to cause damage to the insulation. 2) Such insulated conductors and cables shall not be installed so as to permit flexing or movement of the conductors or cables after installation if the ambient temperature is liable to become low enough to damage the insulation during flexing or movement. 3) Except as permitted by other Rules of this Code, insulated conductors and cables shall be of the types specified in Table 19 for the specific condition of use. 4) Except as permitted by other Rules of this Code, flexible cords, portable power cables, and equipment wire shall be of the types specified in Table 11A for the specific condition of use. 5) Flexible cords, heater cords, tinsel cords, equipment wires, appliance wiring materials, Christmas-tree cords, wind turbine cables, electric vehicle supply equipment cables, and dryer and range cable of the types specified in Table 11B shall not be used for general purpose wiring. ~~4~~6) The maximum allowable conductor insulation temperature for T90 Nylon, when exposed to oil, shall be limited to 60 °C. ~~5~~7) Conductor insulation shall be permitted for use where exposed to oil when marked as follows: a) PR I with the maximum allowable conductor insulation temperature limited to 60 °C; and b) PR II with the maximum allowable conductor insulation temperature limited to 75 °C. ~~6~~8) Conductor insulation shall be permitted for use where subjected to alkaline conditions in the presence of petroleum solvents, such as in oil refineries and around gasoline storage or pump areas, when marked as follows: a) GR I with the maximum allowable conductor insulation temperature limited to 60 °C; and b) GR II with the maximum allowable conductor insulation temperature limited to 75 °C.	SN4826
Revise Rule 12-112 to read: **12-112 Conductor joints and splices** (see Appendix B)	SN4644

1) Conductors shall be spliced or joined with splicing devices or by brazing, welding, or soldering with a fusible metal or alloy. 2) Soldered splices shall first be spliced or joined so as to be mechanically and electrically secure without solder and then be soldered. 3) Joints or splices shall be covered with an insulation equivalent to that on the conductors being joined. 4) Joints or splices in conductors and cables shall be accessible. 5) Joints or splices in conductors and cables in grade level in-ground enclosures shall be in accordance with Subrule 6) b) and suitable for wet locations. ~~5)~~ 6) Splices in underground runs of cable, if required due to damage to the original installation, shall be permitted to be made a) in junction boxes suitably protected from mechanical damage that are located at least 1 m above grade and secured to buildings or to stub poles; or b) notwithstanding the requirements of Subrule 4), by means of splicing devices or materials (kits) for direct earth burial; or c) in grade level in-ground enclosures intended for the purpose and not subject to vehicular traffic, by means of splice connectors suitable for wet locations.	
Revise Rule 12-116 to read: **12-116 Termination of conductors** (see Appendix B) 1) Connection of conductors to terminal parts shall be made by means of pressure connectors, solder lugs, or splices to flexible leads. 2) The portion of stranded conductors to be held by binding-screw terminals or solderless wire connectors shall have the strands confined so that there will be no stray strands to cause either short-circuits or grounds. 3) Stranded and solid conductors No. 10 AWG and smaller shall be permitted to be connected by means of binding-screw terminals or studs and nuts that have upturned lugs or the equivalent. 4) Stranded and solid conductors larger than No. 10 AWG shall be terminated in solderless conductor connectors or shall be permitted to be soldered into conductor connectors suitable for the purpose, except where prohibited by Section 10. 5) Fine-strand conductors shall terminate in a) connectors identified for use with fine-strand conductors; or b) standard connectors with the use of ferrules. 6) Ferrules shall not be used on solid conductors.	SN4665
Revise Subrule 12-122 1) to read: 1) Equipment wire shall be ~~of the types specified in Table 11~~ selected in accordance with Rule 12-102 4) for the specific condition of use and shall be suitable for the particular location involved with respect to, but not limited to, a) moisture; b) corrosive action; c) temperature; d) degree of enclosure; and e) exposure to mechanical damage.	SN4826
Note: This revision is on hold pending approval of related changes to Section 76.	SN4148-12

Add new Rule 12-124 to read: **12-124 Temporary Installation of Single Conductor Cables** Except as provided for by other Rules of this Code, single conductor cables terminated into single-pole connectors for single-conductor cables shall only be installed in accordance with Rule 76-100.	
Revise Rule 12-300 to read: **12-300 Exterior exposed wiring Rules** Rules 12-302 to 12-320 apply only to exposed wiring run on the exterior surfaces of buildings, or between poles, and buildings on the same premises.	SN4697
Revise Rule 12-304 to read: **12-304 Location of insulated conductors and cables** 1) ~~Subject to the provisions of Rule 6-112, where the insulated conductors and cables are supported on or in close proximity to the exterior surfaces of buildings, they shall be installed and protected so that they shall not be a hazard to persons or be exposed to mechanical damage, and they shall not be less than 4.5 m from the ground unless a deviation has been allowed in accordance with Rule 2-030~~ ~~2) Where the insulated conductors and cables are exposed to mechanical damage from awnings, swinging signs, shutters, or other movable objects, they shall be run in rigid conduit made watertight.~~ Insulated conductors and cables supported on or in close proximity to the exterior surfaces of buildings shall a) be installed not less than, i) 4 m above finished grade across driveways to residential garages; ii) 5m above finished grade across driveways to commercial and industrial premises; and iii) 3.5m above finished grade normally accessible to pedestrians only b) have a clearance of not less than 1 m from the windows, doors, balconies or porches; c) not pose a hazard to persons, and d) be suitably protected where exposed to mechanical damage.	SN4763
Revise Rule 12-308 to read: **12-308 Maximum span of overhead conductors** 1) Spans of single conductors, or cables run aerially between buildings or supports on the same premises, shall not exceed 4.5 m. 2) Notwithstanding Subrule 1), conductors and cables run aerially between buildings or supports shall be permitted to have spans exceeding 4.5 m where installed in accordance with Rule 12-318.	SN4697

3) Poles used for supporting neutral supported cables shall be placed not more than 40 m apart.	
Revise Rule 12-318 to read: **12-318 Overhead installations** 1) When neutral supported cables are used, the following requirements shall apply: a) they shall not be mounted directly on any surface; b) they shall be secured so that they will be not less than i) 1 m from a building in the case of Types NS75 and NS90; or ii) 50 mm from a building in the case of Types NS75 and NS90, marked FT1; cd) the insulated conductors shall be secured to the messenger at all terminations; and de) the bare neutral (messenger) when used as a neutral conductor forming part of an electrical circuit shall i) be supplied from a grounded ac system; ii) be attached to an insulator at points of support and at terminations; and iii) not be connected to or in contact with any grounded surface except as permitted by other Rules of this Code; ec) they shall be supported in spans of not more than i) 3840 m in length; when attached to other than a mobile home, relocatable structure, or similar structure; or ii) 10 m in length when the final point of attachment is to a mobile home, relocatable structure, or similar structure; f) the sag shall not be less than the minimum sag detailed in Table 72; and g) notwithstanding Item f), the minimum sag shall be permitted to be calculated in accordance with the manufacturer's recommendations and as acceptable to the regulatory authority having jurisdiction. 2) Insulated conductors and cables shall be permitted to exceed an overhead span of 4.5 m when lashed to a messenger cable in accordance with Rule 12-320.	SN4697
Revise Subrule 12-320 4) to read: **12-320 Messenger Cables** 1) Messenger cables shall be securely attached at each end of the run and shall be bonded in accordance with Section 10. 2) Insulated conductors and cables shall be permanently lashed to the messenger cable.	SN4775

3) Cable ties shall not be permitted as the sole means to lash insulated conductors and cables to a messenger cable. 4) Messenger cables shall be stranded construction with not less than seven strands, and be of a) ~~of~~ galvanized steel having a coating of not less than 45g/m^2; b) ~~of~~ copper-coated steel; c) ~~of~~ All Aluminum Alloy 6201 Conductor (AAAC); d) ~~of~~ Aluminum Conductor Steel Reinforced (ACSR); or e) ~~of~~ stainless steel~~; and~~ ~~b) of stranded construction with not less than seven strands~~.	
Revise Subrule 12-402 1) to read: 1) Flexible cord shall be ~~of the types specified in Table 11~~ selected in accordance with Rule 12-102 4) for the specific condition of use and shall be suitable for the particular location involved with respect to, but not limited to, a) moisture; b) corrosive action; c) temperature; d) degree of enclosure; and e) exposure to mechanical damage.	SN4826
Revise Rule 12-406 to read: **12-406 Uses of portable power cable (see Appendix B)** 1) Portable power cables shall be ~~of the types specified in Table 11~~ selected in accordance with Rule 12-102 4) for the specific condition of use and shall be suitable for the particular location involved with respect to, but not limited to, a) moisture; b) corrosive action; c) temperature; d) degree of enclosure; and e) exposure to mechanical damage. 2) Portable power cables shall be permitted to be used for a) electrical equipment that is intended to be i) moved from place to place; or ii) detachably connected according to the applicable Canadian safety Standard for electrical equipment; b) wiring of cranes and hoists; c) the connection of stationary equipment to facilitate its interchange; d) the connection of electrical components between which relative motion is necessary; and e) the connection of equipment used in conjunction with travelling amusement rides. 3) Portable power cable shall not be used a) as a substitute for the fixed wiring of structures and shall not be i) permanently secured to any structural member; ii) run through holes in walls, ceilings, or floors of permanent structures; or	SN4665 SN4678 SN4826

iii) run through doorways, windows, or similar openings of permanent structures; or

b) at a temperature above the temperature rating of the cable or at a temperature sufficiently low as to be liable to result in damage to the insulation or overall covering.

4) Notwithstanding Subrule 3) a), Type DLO cable in sizes 1/0 or larger shall be permitted to be used
in permanent installations in cable tray, provided that the cable

a) is marked as Type TC cable;

b) conforms with the conditions of use for Type TC cable in accordance with Rule 12-2202 and as listed in Table 19;

c) terminates in

i) connectors marked for use with fine-strand conductors~~cables~~; or

ii) standard connectors with the use of ferrules; and

d) has an ampacity rating as described in Table 12E and Rule 4-004.

5) Where portable power cable enters or passes through the wall of an enclosure or fitting, it shall be protected in accordance with Rule 12-3022.

6) Where a single-conductor Type DLO cable is installed in accordance with Subrule 4), installation shall comply with Rule 4-008 3) to 6).

7) Portable power cables with natural rubber jackets marked “NR FOR SURFACE MINES ONLY” or “NATURAL RUBBER FOR SURFACE MINES ONLY” shall not be used where exposed to oil.

Add new Rules 12-500 to 12-524 to read:

SN4831

Non-metallic-jacketed cable

12-500 Non-metallic-jacketed cables (see Appendix B**)**

1) Rules 12-500 to 12-524 apply to non-metallic-jacketed

a) cables other than Types NMD90 and NMWU; and

b) Type FAS cables installed as part of a fire alarm system in accordance with Section 32.

2) Rules 12-500 to 12-524 do not apply to

a) non-metallic-jacketed cables including Types NMD90 and NMWU that are used in Class 2 applications and are installed in accordance with Section 16

b) the cables and flexible cords used in accordance with Rule 12-102 4); and

c) mineral-insulated cable, aluminum-sheathed cable, copper-sheathed cable and armoured cables with or without a jacket covered by Rules 12-600 and 12-700

12-502 Maximum voltage

Non-metallic-jacketed cable shall not be used in circuits exceeding the voltage rating as marked on the cable.

12-504 Use of jacketed cable (see Appendix B**)**

1) Non-metallic-jacketed cable shall be permitted to be installed in or on buildings of combustible or non-combustible construction in accordance with Rule 2-130, and the National Building Code or local building legislation.

2) Non-metallic-jacketed cables used shall be suitable for the conditions of use in accordance with Rule 12-102 3).

3) Non-metallic-jacketed cables installed in cable tray shall be marked either TC or TC-ER, unless otherwise permitted by Rule 12-2202.

4) Type CIC control and instrumentation cables shall be limited to raceway or direct burial installations in accordance with Rule 12-102 3).

12-506 Method of installation (see Appendices B and G**)**

1) The cable shall be run in continuous lengths between outlet boxes, junction boxes, and panel boxes as a loop system and the joints, splices, and taps shall be made in the boxes.

2) Where concealed wiring is connected to non-metallic-jacketed cable, the junction shall be made in a box.

3) Where open wiring is connected to non-metallic-jacketed cable, the junction shall be made in a box or at, or in, a fitting having a separately bushed hole for each conductor.

4) Where non-metallic-jacketed cable is run in proximity to heating sources, transfer of heat to the cable shall be minimized by means of an air space of at least

a) 25 mm between the cable and heating ducts and piping;

b) 50 mm between the cable and masonry or concrete chimneys; or

c) 150 mm between the cable and chimney and flue cleanouts.

5) Notwithstanding Subrule 4), a thermal barrier conforming to the requirements of the National Building Code of Canada or local building legislation shall be permitted to be installed between the cable and heating sources to maintain the ambient temperature of the cable at not more than 30 °C.

6) Flat cables with parallel conductors shall not be stapled on edge.

7) Non-metallic-jacketed cables shall be permitted to be installed in a raceway when fill is in accordance with Table 8.

12-508 Bending and stapling of cable (see Appendix G**)**

The cable shall not be bent, handled, or supported in such a way that the insulated conductors or outer covering is damaged.

12-510 Running of cable between boxes and fittings (see Appendices B and G**)**

1) Where the cable is run between boxes and fittings, it shall be supported by straps, Types 2S or 21S cable ties, or other devices located

a) within 300 mm of every box or fitting; and

b) at intervals of not more than 1.5 m throughout the run.

2) Cables run through holes in joists or studs shall be considered to be supported.

3) Cables of different systems or types shall not pass through the same hole in joists or studs.

4) Notwithstanding Subrules 1) and 2), where the cable is run as concealed wiring such that it is impracticable to support it, and where metal sheeting or cladding, metal joists, metal top or bottom plates, or metal studs are not used, the cable shall be permitted to be fished and need not be supported between boxes and fittings.

5) Straps and support devices shall be suitable for the type of non-metallic-jacketed cable being used, except that straps and support devices suitable for use with Types NMD90 and NMWU cables shall be permitted for the support of Type FAS and similar non-metallic-jacketed cables, provided they do not damage the cable during or after installation.

12-512 Not to be embedded (see Appendix G**)**

The cable shall not be buried in plaster, cement, or similar finish.

12-514 Protection of cables in non-concealed locations (see Appendix B**)**

1) Cables shall be protected from mechanical damage in the form of running boards or guard strips when they are installed in the following locations:

a) the upper faces of ceiling joists or the lower faces of rafters in attic or roof spaces, where the vertical distance between the joists and the rafters exceeds 1 m;

b) the lower faces of exposed ceiling joists;

c) the open face of wall studs; or

d) where the cable is exposed and is installed less than 1.5 m above the floor.

2) Running boards and guard strips shall be at least 19 mm × 38 mm, and the edges of the running board shall project at least 12 mm beyond the cables.

3) Guard strips shall be at least as high as the cable and placed as close to the cable as practicable.

4) Running boards or guard strips installed on the upper face of ceiling joists in attic or roof spaces shall be at least 38 mm × 38 mm.

12-516 Protection for cable in concealed installations (see Appendices B and G**)**

1) Where the cable is run through studs, joists, or similar members, the outer surfaces of the cable shall be kept a distance of at least 32 mm from the edges of the members, or the cable shall be protected from mechanical damage by

a) a protector plate covering the width of the member; or

b) a cylindrical bushing sized for the hole through the member, and extending a minimum of 13 mm beyond both sides of the member.

2) Where the cable is run along studs, joists, or similar members, the cable shall be

a) kept a minimum of 32 mm from the edges of the members that can be covered by drywall or a similar material; or

b) protected from mechanical damage by corrosion-resistant ferrous metal not less than 1.3 mm thick, securely fastened in place, extending beyond the face of the member in such a manner that it will cover the width of the cable or group of cables.

3) Where the cable is run through metal studs, or along metal joists, sheathing, or cladding, it shall be

a) located so as to be effectively protected from mechanical damage both during and after installation; and

b) protected where it passes through a member by an insert adequately secured in place.

4) Where the cable is installed immediately behind a baseboard, it shall be effectively protected from mechanical damage from driven nails.

12-518 Protection for cable in exposed installations (see Appendix G**)**

1) Cable used in exposed wiring shall be adequately protected against mechanical damage where it

a) passes through a floor;

b) is less than 1.5 m above a floor; or

c) is exposed to mechanical damage.

2) Notwithstanding Rule 12-918, non-metallic conduit or tubing shall be permitted to be used as a sleeve for the mechanical protection of non-metallic-jacketed cables when

a) the cables are protected from abrasion where they issue from the raceway by a bushing or equivalent protection; and

b) the raceway fill is in accordance with Table 8.

12-520 Fished cable installation

Where the cable is used in concealed wiring and it is impracticable to provide the supports required by Rule 12-510, and where metal sheeting or cladding, metal joists, metal top or bottom plates, or metal studs are not used, the cable shall be permitted to be fished.

12-522 Types of boxes and fittings

1) Boxes, connectors, and fittings shall be suitable for the particular type of non-metallic-jacketed cable used, except that boxes, connectors, and fittings suitable for Types NMD90 and NMWU cables shall be considered acceptable for use with Type FAS and similar non-metallic-jacketed cables, provided the cable is not damaged during or after installation.

2) Where grounded metal boxes are not required by these Rules, outlet and switch boxes shall be permitted to be of fire-resisting moulded composition insulating material, furnished with a cover of the same material.

12-524 Provision for bonding

Where non-metallic-jacketed cable is used, provision for bonding to ground shall be made in accordance with Section 10.

SN4831

Revise Rules 12-500 to 12-526 to read:

Non-metallic-sheathed cable Types NMD90 and NMWU

12-550~~500 Non-metallic-sheathed cable~~ Rules for cable Types NMD90 and NMWU (see Appendix B)

Rules 12-552 ~~502~~ to 12-576 ~~526~~ apply only to ~~non-metallic-sheathed~~ cable Types NMD90 and NMWU.

12-552 ~~502~~ Maximum voltage

~~Non-metallic-sheathed cable~~ Type NMD90 and NMWU cables shall not be used where the voltage exceeds 300 V between any two conductors.

12-554 ~~504~~ Use of ~~non-metallic-sheathed cable~~ Type NMD90 and NMWU cables (see Appendix B)

~~Non-metallic-sheathed~~ Type NMD90 and NMWU cables shall be permitted in or on buildings of combustible construction and in or on other types of construction where acceptable.

12-556 ~~506~~ Method of installation (see Appendices B and G)

1) The cable shall be run in continuous lengths between outlet boxes, junction boxes, and panel
boxes as a loop system and the joints, splices, and taps shall be made in the boxes.
2) Where concealed wiring is connected to ~~non-metallic-sheathed~~ Type NMD90 or NMWU cable, the junction shall be made in a box.
3) Where open wiring is connected to ~~non-metallic-sheathed~~ Type NMD90 or NMWU cable, the junction shall be made in a box or at, or in, a fitting having a separately bushed hole for each conductor.
4) Where ~~non-metallic-sheathed~~ Type NMD90 or NMWU cable is run in proximity to heating sources, transfer of heat to the cable shall be minimized by means of an air space of at least
a) 25 mm between the cable and heating ducts and piping;
b) 50 mm between the cable and masonry or concrete chimneys; or
c) 150 mm between the cable and chimney and flue cleanouts.
5) Notwithstanding Subrule 4), a thermal barrier conforming to the requirements of the *National Building Code of Canada* or local building legislation shall be permitted to be installed between the cable and heating sources to maintain the ambient temperature of the cable at not more than 30 °C.
6) Two-conductor cable shall not be stapled on edge.

12-558 ~~508~~ Bending and stapling of cable (see Appendix G)
The cable shall not be bent, handled, or stapled in such a way that the insulated conductors or outer covering is damaged.

12-560 ~~510~~ Running of cable between boxes and fittings (see Appendices B and G)
1) Where the cable is run between boxes and fittings, it shall be supported by straps, Type 2S or 21S cable ties, or other devices located
a) within 300 mm of every box or fitting; and
b) at intervals of not more than 1.5 m throughout the run.
2) Cables run through holes in joists or studs shall be considered to be supported.
3) Notwithstanding Subrules 1) and 2), where the cable is run as concealed wiring such that it is impracticable to support it, and where metal sheeting or cladding, metal joists, metal top or bottom plates, or metal studs are not used, the cable shall be permitted to be fished and need not be supported between boxes and fittings.
4) Notwithstanding Subrule 1) a), where cable is run to a switch or a receptacle with an integral enclosure incorporating an integral cable clamp, the cable shall be supported by straps, Type 2S or 21S cable ties, or other devices located within 300 mm of the switch or receptacle wall opening, and there shall be at least a 300 mm loop of unbroken cable or 150 mm of a cable end available on the interior side of the finished wall to permit replacement.

12-562 ~~512~~ Not to be embedded (see Appendix G)
The cable shall not be buried in plaster, cement, or similar finish.

12-564 ~~514~~ Protection of cables in non-concealed locations (see Appendix B)
1) Cables shall be protected from mechanical damage in the form of running boards or guard strips when they are installed in the following locations:
a) the upper faces of ceiling joists or the lower faces of rafters in attic or roof spaces, where the vertical distance between the joists and the rafters exceeds 1 m;
b) the lower faces of exposed ceiling joists;
c) the open face of wall studs; or

d) where the cable is exposed and is installed less than 1.5 m above the floor.

2) Running boards and guard strips shall be at least 19 mm × 38 mm, and the edges of the running board shall project at least 12 mm beyond the cables.

3) Guard strips shall be at least as high as the cable and placed as close to the cable as practicable

4) Running boards or guard strips installed on the upper face of ceiling joists in attic or roof spaces shall be at least 38 mm × 38 mm.

12-566 ~~516~~ Protection for cable in concealed installations (see Appendices B and G)

1) Where the cable is run through studs, joists, or similar members, the outer surfaces of the cable shall be kept a distance of at least 32 mm from the edges of the members, or the cable shall be protected from mechanical damage by

a) a protector plate covering the width of the member; or

b) a cylindrical bushing sized for the hole through the member, and extending a minimum of 13 mm beyond both sides of the member.

2) Where the cable is run along studs, joists, or similar members, the cable shall be

a) kept a minimum of 32 mm from the edges of the members that can be covered by drywall or a similar material; or

b) protected from mechanical damage by corrosion-resistant ferrous metal not less than 1.3 mm thick, securely fastened in place, extending beyond the face of the member in such a manner that it will cover the width of the cable or group of cables.

3) Where the cable is run through metal studs, or along metal joists, sheathing, or cladding, it shall be

a) located so as to be effectively protected from mechanical damage both during and after installation; and

b) protected where it passes through a member by an insert adequately secured in place.

4) Where the cable is installed immediately behind a baseboard, it shall be effectively protected from mechanical damage from driven nails.

12-568 ~~518~~ Protection for cable in exposed installations (see Appendix G)

1) Cable used in exposed wiring shall be adequately protected against mechanical damage where it

a) passes through a floor;

b) is less than 1.5 m above a floor; or

c) is exposed to mechanical damage.

2) Notwithstanding Rule 12-918, non-metallic conduit or tubing shall be permitted to be used as a sleeve for the mechanical protection of ~~non-metallic-sheathed~~ Type NMD90 or NMWU cables when

a) the cables are protected from abrasion where they issue from the raceway by a bushing or equivalent protection; and

b) the raceway fill is in accordance with Table 8.

12-570 ~~520~~ Fished cable installation

Where the cable is used in concealed wiring and it is impracticable to provide the supports required by Rule 12-560 ~~510~~, and where metal sheeting or cladding, metal joists, metal top or bottom plates, or metal studs are not used, the cable shall be permitted to be fished.

12-572 ~~522~~ Where outlet boxes are not required

1) Where the cable is exposed, switch, outlet, and tap devices of insulating material shall be
permitted to be used without boxes.
2) The openings in the devices shall fit closely around the outer covering of the cable.
3) The device shall fully enclose any part of the cable from which any part of the covering has been removed.
4) Where the conductors are connected to the devices by binding-screw terminals, there shall be as many screws as there are conductors, unless the cables are clamped within the device.

12-574 ~~524~~ Types of boxes and fittings
1) Boxes and fittings shall be of a type for use ~~non-metallic-sheathed~~ with Types NMD90 or NMWU cable.
2) Where grounded metal boxes are not required by these Rules, outlet and switch boxes shall be permitted to be of fire-resisting moulded composition insulating material, furnished with a cover of the same material.

12-576 ~~526~~ Provision for bonding
Where ~~non-metallic-sheathed~~ Type NMD90 or NMWU cable is used, provision for bonding to ground shall be made in accordance with Section 10.

Revise Rule 12-602 to read:

SN4706

12-602 Use (see Appendix B)
1) Armoured cable shall be permitted to be installed in or on buildings or portions of buildings of either combustible or non-combustible construction.
2) Armoured cable shall be of the type listed in Table 19 as suitable for direct burial if used
a) for underground runs;
b) for circuits in masonry or concrete~~, provided that the cable is encased or embedded in at least 50 mm of the masonry or concrete~~; or
c) in locations where it will be exposed to weather, continuous moisture, excessive humidity, or to oil or other substances having a deteriorating effect on the insulation.
~~3) Notwithstanding Subrule 2), armoured cable in which the armouring is made wholly or in part of aluminum shall not be embedded in concrete containing reinforcing steel, unless~~
~~a) the concrete is known to contain no chloride additives; or~~
~~b) the armour has been treated with a bituminous base of paint or other means to prevent galvanic corrosion of the aluminum.~~
~~4) Where armoured cables are laid in or under cinders or cinder concrete, they shall be protected from corrosive action by a grouting of non-cinder concrete at least 25 mm thick entirely surrounding them unless they are 450 mm or more under the cinders or cinder concrete.~~
~~5)~~ 3) In buildings of non-combustible construction, armoured cables having conductors not larger than No. 10 AWG copper or aluminum shall be permitted to be laid on the face of the masonry or other material of which the walls and ceiling are constructed and shall be permitted to be buried in the plaster finish for extensions from existing outlets only.
~~6)~~ 4) Armoured cable with overall jacket shall be permitted for use in a raceway when it is installed in accordance with Rule 12-902 2).

Revise Rule 12-608 to read: **12-608 Continuity of armoured cable** 1) Armoured cable shall be run in a manner such that the mechanical and electrical continuity of the armour is maintained throughout the run, and the armour of cables shall be mechanically and electrically secured to all equipment to which it is attached. 2) Notwithstanding Subrule 1), electrical continuity between the armour and the equipment shall not be required at the final point of termination of a feeder or branch circuit provided that a) the enclosure at the final point of termination is non-metallic; b) an electrical connection between the armour and the bonding system has been established at the supply end of the cable run; and c) the equipment at the final point of termination is bonded using the internal bonding conductor of the cable.	SN4782
Revise Rule 12-616 to read: **12-616 Concealed armoured cable installation** 1) Where armoured cable is run through studs, joists, or other members, it shall be a) located so that the outer surfaces of the cable are kept at least 32 mm from the nearest edge of the members; or b) protected from mechanical damage where it passes through the holes in the members by i) a protector plate covering the width of the member; or ii) a cylindrical bushing sized for the hole through the member, and extending a minimum of 13 mm beyond both sides of the member. 2) Where armoured cable is installed immediately behind baseboards, it shall be protected from mechanical damage from driven nails. 3) Armoured cable without an overall jacket in which the armouring is made wholly or in part of aluminum shall not be embedded in concrete containing reinforcing steel, unless a) the concrete is known to contain no chloride additives; or b) the armour has been treated with a bituminous base of paint or other means to prevent galvanic corrosion of the aluminum. 4) Where armoured cable is used in concrete or masonry, the cable shall be encased or embedded in at least 50 mm of the masonry or concrete. 5) Where armoured cables are laid in or under cinders or cinder concrete, they shall be protected from corrosive action by a grouting of non-cinder concrete at least 25 mm thick entirely surrounding them unless they are 450 mm or more under the cinders or cinder concrete.	SN4706
Revise Rule 12-910 to read:	SN4703

12-910 Conductors and cables in conduit and tubing (see Appendix B) 1) Conduit and tubing shall be of sufficient size to permit the conductors to be drawn in and withdrawn without damage to the conductors or conductor insulation. 2) Subrules 3), 4), and 5) shall apply only to complete systems and not to short sections of conduit and tubing used for the protection of portions of open wiring that would otherwise be exposed to mechanical damage. 3) The maximum number of conductors in one conduit or tubing shall not exceed 200. 4) The maximum number of insulated conductors or multi-conductor cables in one conduit or tubing shall be such that the insulated conductors or cables and their coverings will not result in a greater fill than that specified in Table 8, and in this determination, a) the usable interior cross-sectional area for allowable fill for various sizes of conduit and tubing shall be as specified in Tables 9A to 9H; b) notwithstanding Item a), the interior cross-section of raceways shall be permitted to be derived from their measured internal dimensions or from the manufacturer's listed specifications; c) the diameters and cross-sectional areas of insulated single conductors and cables shall be as indicated in Tables 6A to 6K, or as obtained by field measurement for the constructions identified in table 6A to 6K; ~~and~~ d) ~~notwithstanding Item c),~~ the dimensions of uninsulated single conductors ~~and cables~~ shall be permitted to be obtained from ~~Tables 10A to 10D and~~ Table D5, or from field measurement ~~for the constructions identified in Tables 6A to 6K.~~ ; and e) the diameters and cross-sectional areas of Type DLO cables shall be as indicated in Table 10D or as obtained by field measurement. 5) Notwithstanding Subrule 4), the maximum permitted number of conductors shall be determined by the summation of the cross-sectional areas of all conductors, the value of which shall not exceed the limits set out in Tables 9A to 9H for the specified conduit and tubing.	
Revise Subrule 12-930 1) to read: **12-930 Raceways installed underground or where moisture may accumulate** (see Appendix B) 1) The requirements for Category 1 locations as specified in Section 22 shall be complied with where raceways are installed a) underground; b) in concrete slabs ~~or other masonry~~ in direct contact with the earth; ~~or~~ c) in the portion of masonry in direct contact with the earth; or ~~c)~~ d) in other locations where the conductors are subject to moisture.	**SN4274**
Revise Rule 12-2252 to read: **12-2252 Use of cablebus** (see Appendix B)	**SN4682**

1) Class A cablebus shall be permitted for installations a) accessible to the public; or b) where Class B cablebus is permitted. 2) Class B cablebus shall be permitted ~~only for installations~~ provided that a) the installation is serviced ~~accessible~~ only ~~to authorized~~ by qualified persons; and b) the installation is inaccessible to the public ~~isolated by elevation or by barriers; and~~ ~~c) serviced by qualified electrical maintenance personnel~~.	
Revise Subrule 12-2258 2) to read: **12-2258 Provisions for bonding** (see Appendix B) 1) Where metal supports for metal cablebus are bolted to the cablebus enclosure and are in good electrical contact with the grounded structural metal frame of a building, the cablebus enclosure shall be deemed to be bonded to ground. 2) Where the conditions of Subrule 1) do not apply, the metal cablebus shall be adequately bonded a) at intervals not exceeding 15 m, and the size of bonding conductors shall be based on the ~~allowable~~ ampacity as specified in Rule 10-616; or b) at both ends, where the cablebus enclosure is marked for use as a bonding conductor.	**SN4628-12**
Revise Rule 12-2600 to read: **12-2600 Where bare busbars are permitted to be used** Bare conductors shall not be used as main risers or feeders in buildings unless a deviation has been obtained in accordance with Rule 2-030, and a) the building is of non-combustible construction; b) the conductors are placed in a chase, channel, or shaft located or guarded so that the conductors are inaccessible; c) suitable cut-offs to protect against the vertical spread of fire are provided where floors are pierced; and ~~d) the mechanical and electrical features of the installation and the conductor supports are suitable and the following specific requirements are met in the case of busbars rated 1200 A or less:~~ ~~i) where flat busbars 6.35 mm or less in thickness are used, the continuous current rating shall not exceed 1000 A per 645 mm2 of cross-sectional area of copper busbar or 700 A in the case of aluminum busbars; and~~ ~~ii) busbar supports shall be spaced not more than 750 mm apart, with minimum clearance across insulating surfaces between bars of opposite polarity of not less than 50 mm, and 25 mm between busbars and any grounded surface; and~~ d) busbars rated 1200 A or less have i) conductor supports that are suitable for the purpose and spaced not more than 750 mm apart; and ii) a minimum clearance across insulating surfaces between busbars of opposite polarity of not less than 50 mm, and 25 mm between busbars and any grounded surface.~~; and~~ ~~e) the resulting installation is acceptable~~	**SN4765**

Revise Rule 12-3022 to read: **12-3022 Entrance of cables into boxes, cabinets, and fittings** 1) Where cables pass through the walls of boxes, cabinets, or fittings, provision shall be made to a) protect the insulation on the conductors from damage; b) protect terminal connections from external strain; c) provide electrical continuity between a metal box, cabinet, or fitting and conduit, armour, or metal sheathing of cables, whether or not the armour or metal sheathing is to be used as a bonding conductor; d) prevent damage to a jacket ~~non-metallic sheath~~ applied over armour or metal sheathing for protection against moisture or corrosion; and e) close the openings through which the cables pass in such a manner that any remaining opening will not permit entrance of a test rod 6.75 mm in diameter. 2) Where insulated conductors run as open wiring enter a box, cabinet, or fitting, they shall pass through insulating bushings or be installed in raceways or insulating tubing. 3) Where ~~non-metallic-sheathed cable or tray~~ cable enters a box, cabinet, or fitting, a box connector, either as a separate device designed for use with such cable or as part of the box, cabinet, or fitting, shall be used to secure the cable in place adequately and without damage to the cable ~~jacket or conductor insulation~~. 4) Where rigid or flexible metal conduit, electrical metallic tubing, or armoured cable enters boxes, cabinets, or fittings, it shall be secured in place in accordance with the requirements of Section 10. 5) Where metal-sheathed cables enter boxes, cabinets, or fittings, the box connector shall be installed in a manner that will meet the requirements of Section 10 without damage to the cable jacket or conductor insulation and shall be of a type for use with the cable. 6) Where liquid-tight flexible metal conduit, flexible metal conduit, armoured cable, or metal-sheathed cable of a type having a jacket ~~non-metallic sheath~~ over the armour or metal sheath enters a box, cabinet, or fitting, the box connector shall ensure electrical continuity without damage to the jacket ~~non-metallic sheath~~ unless the point of connection is in a dry location free from corrosive atmosphere, where the jacket ~~non-metallic sheath~~ shall be permitted to be stripped back a sufficient distance. 7) Where single-conductor cables or insulated single conductors enter metal boxes through separate openings, precautions shall be taken in accordance with the requirements of Rule 4-008.	SN4831
Revise Rule 12-3030 to read: **12-3030 Insulated conductors in boxes, cabinets, or fittings** (see Appendix B) 1) Insulated conductors that are connected to different power or distribution transformers or other different sources of voltage shall not be installed in the same box, cabinet, or fitting unless a) ~~unless~~ a barrier of sheet steel not less than 1.3 mm thick or a flame-retardant, non-metallic insulating material not less than 1.6 mm in thickness is used to divide	SN4761

the space into separate compartments for the insulated conductors of each system; b) ~~unless~~ the insulated conductors i) ~~the insulated conductors~~ are used for the supply and/or control of devices and equipment that are interconnected or dependent upon each other for proper operation and functionality; ii) ~~the insulated conductors~~ are insulated for at least the same voltage as that of the circuit having the highest voltage; and iii) ~~none of the insulated conductors~~ of the circuits of lower voltages ~~is~~ are not directly connected to a lighting branch circuit; ~~or~~ c) ~~unless~~ the insulated conductors are used for the supply of a double-throw switch in an emergency lighting system; or d) the insulated conductors are being added to an enclosure forming part of an existing installation to facilitate the installation of an alternate power supply and the voltage of the alternate supply is equivalent to the voltage of the existing installation. 2) Where a barrier is used, it shall be fastened rigidly to the box, cabinet, or fitting, or a device assuring positive separation of the insulated conductors shall be used. 3) Where insulated conductors within an enclosure are connected to different sources of voltage as permitted in Item 1) d) a warning label shall be placed on the enclosure to warn persons that more than one source of supply may be present.	

SECTION 14

Revise Subrule 14-104 1) to read:

SN4628-14

14-104 Rating of overcurrent devices (see Appendix B)

1) The rating or setting of overcurrent devices shall not exceed the ~~allowable~~ ampacity of the conductors that they protect, except

a) where a fuse or circuit breaker having a rating or setting of the same value as the ampacity of the conductor is not available, and the maximum calculated or known load is in accordance with the Rules of Section 8, the ratings or settings given in Table 13 shall be permitted to be used within the maximum value of 800 A;

b) in the case of equipment wire, flexible cord in sizes Nos. 16, 18, and 20 AWG copper, and tinsel cord, which are considered protected by 15 A overcurrent devices; or

c) as provided for by other Rules of this Code.

Revise Subrule 14-104 1) to read:

SN4774

1) The rating or setting of overcurrent devices shall not exceed the ampacity of the conductors that they protect, except

a) where a fuse or circuit breaker having a rating or setting of the same value as the ampacity of the conductor is not available, and the maximum calculated or known load is in accordance with the Rules of Section 8, the ratings or settings given in Table 13 shall be permitted to be used within the maximum value of 800 A;

b) in the case of equipment wire, flexible cord in sizes Nos. 16, 18, and 20 AWG copper, and tinsel cord, which are considered protected by ~~15~~ 15 A or 20 A overcurrent devices; or

c) as provided for by other Rules of this Code.

SECTION 16

Revise Subrule 16-222 2) to read: SN4630 SN4750

16-222 Equipment located on the load side of overcurrent protection, transformers, or devices having class 2 outputs

2) Notwithstanding Subrule 1) a), lighting products, ~~electro~~medical electrical equipment, equipment for hazardous locations, ~~and~~ thermostats incorporating heat anticipators and the field installed insulated conductors and cables, connected to these products, shall comply with Rule 2-024(1).

Revise Subrule 16-226 3) to read: SN4730-16

3) Direct buried Class 2 circuits shall be permitted to be placed at random separation in a common trench with power circuits that are for the sole purpose of supplying power to the Class 2 circuits, provided that

a) the Class 2 circuit is in a metal-sheathed cable, with the sheath bonded to ground;

b) the power circuit operates at ~~750 V~~ 1000V or less; and

c) all cables are insulated for the maximum voltage of any cable in the trench.

Revise special terminology for Cable bundle to read: SN4592

16-310 Special terminology (see Appendix B)
In this Subsection, the following definitions shall apply:

Cable bundle — two or more cables that are tied together or in contact with one another in a closely packed configuration. ~~for a length of at least 1 m~~.

Revise Rule 16-330 to read: SN4592

16-330 Cables and conductor ampacity (see Appendix B)

1) Conductors for Class 2 power and data communication circuits shall be suitable for the application in accordance with Rule 12-102 3).

2) Where communication cable marked with the suffix “-LP” is used

a) the maximum current that each insulated conductor is permitted to carry shall be limited to the current rating marked on the cable; and

b) ampacities for conductors smaller than No. 26 AWG, or for conductors in cable bundles of a length of 1 m or more, and of more than 192 cables, shall be permitted to be determined by a qualified person, as recognized by the regulatory authority having jurisdiction, provided that a deviation has been allowed in accordance with Rule 2-030.

3) Where communication cable not marked with the suffix “-LP” is used a) the maximum current that each insulated conductor shall be permitted to carry shall be as specified in Table 60, based on i) the size of the conductor; ii) the cable temperature rating; iii) the number of cables in a cable bundle in contact with each other of a length of 1 m or more; and iv) the smallest conductor size and lowest temperature rating of any cable in the cable bundle of a length of 1 m or more; b) not more than 192 cables shall be permitted to be bundled together for a length of 1 m or more; and c) where not more than four conductors in each cable are used to transmit power, the maximum current that each conductor shall be permitted to carry shall be permitted to be calculated by multiplying the values listed in Table 60 multiplied by 1.4. 4) The maximum current permitted in a Class 2 power and data communication circuit shall not exceed the rating of the connectors or components used in the circuit. 5) The correction factors of Table 5A shall apply where Class 2 power and data communication circuit cables are installed in an ambient temperature exceeding 30 °C. 6) Notwithstanding Rule 8-102 1), for Class 2 power and data communication circuits, the circuit length shall ensure that the voltage at the point of utilization is within the rating or voltage tolerance of the connected powered device(s). 7) Where more than one cable bundle is installed in a ventilated and ladder-type cable tray, cable bundles of a length of 1 m or more shall be spaced at not less than 25 mm.	

SECTION 18

Revise Subrule 18-000 4) to read: SN4736

18-000 Scope (see Appendices B and J)
4) Where the Division system of classification is used as permitted by Subrule 3), ~~the Rules for Class I, II, and III locations found in~~ Annexes J18 and J20 of Appendix J shall apply.

Add new entries to Rule 18-002 to read: SN4565-18 SN4745 SN4806

18-002 Special terminology (see Appendix B)
In this Section, the following definitions shall apply:

Dust-protected enclosure – an enclosure where the ingress of dust is not totally excluded, but where dust is unlikely to enter in sufficient quantity to interfere with the safe operation of the equipment and does not accumulate within the enclosure where it is liable to cause an ignition hazard.

Non-incendive circuit — a circuit in which any spark or thermal effect that may occur under normal operating conditions or due to opening, shorting, or grounding of field wiring is incapable of causing an ignition of the prescribed flammable gas or vapour.

Uninterrupted –

As applied to conduit - that portion of a rigid metal conduit system that includes only couplings with NPT threads.

As applied to cable – that portion of a cable system having a continuous sheath, either metal or non-metal.

Revise Rule 18-004 to read: SN4785

18-004 Classification of hazardous locations (see Appendices B, J, and L)
1) Hazardous locations shall be classified according to the nature of the hazard, as follows:
a) explosive gas atmospheres; or
b) explosive dust atmospheres.
2) The classification of hazardous locations required by Subrule 1 shall include the nature of the flammable or combustible materials, as follows:
a) the Equipment Group designation; and
b) the minimum ignition temperature
3~~2~~) Hazardous location classification shall be carried out and documented by qualified persons.
4~~3~~) The hazardous location classification required by Subrules 1) to 3) ~~2)~~ shall be authenticated by the person assuming responsibility for the classification.

5~~4~~) Notwithstanding Subrules ~~2)~~ ~~3) and~~ ~~3)~~ 1) to 4), installations within the Scope of Section 20 shall be permitted to be classified in accordance with Section 20.	
Revise Rule 18-010 to read: **18-010 Maintenance** (see Appendix B) Special precautions shall be observed as follows: a) unauthorized repairs or alterations shall not be made to ~~live~~ equipment; ~~and~~ b) electrical equipment shall be maintained in its original safe and operable condition~~.~~; and c) unused enclosure openings shall be suitably closed.	SN4735 SN4823
Revise Rule 18-052 to read: **18-052 Marking** (see Appendices B and J) Electrical equipment installed in hazardous locations shall have markings that are suitable for the Zone or Zones in which the equipment is installed.	SN4687
Revise Rule 18-074 to read: **18-074 Bonding in hazardous locations** 1) Exposed non-current-carrying metal parts of electrical equipment, including the frames or metal exteriors of motors and generators, fixed or portable lamps or other utilization equipment, luminaires, cabinets, cases, and conduit, shall be bonded to ground using a) bonding conductors sized in accordance with Rule 10-616; or b) rigid metal conduit with threaded couplings and threaded bosses on enclosures with joints made up tight. 2) Notwithstanding Subrule 1), where raceways or cables incorporate an internal bonding conductor, box connectors with standard locknuts shall be permitted to bond the metallic armour or raceway.	SN4791
Add new Rule 18-078 to read: **18-078 Threaded joints** (see Appendix B) 1) Threaded joints that are required to be explosion-proof, flameproof "d", or flameproof "db" shall be permitted to be either tapered or straight and shall comply with the following: a) tapered threads shall have at least 4-1/2 fully engaged threads, and running threads shall not be used; and b) metric straight threads shall have a class-of-fit 6g/6H or better and at least 5 fully engaged threads. 2) Where thread forms differ between the equipment and the wiring system, suitable adapters shall be used.	SN4760

Revise Subrule 18-092 3) to read: **18-092 Wiring methods, Zone 0** (see Appendix B) 3) Threaded r~~R~~igid metal conduit containing one or more circuits that are not intrinsically safe shall be permitted to pass through a Zone 0 location, provided that it passes completely through the Zone 0 location with no fittings, couplings, or connections within the Zone 0 location.	SN4760
Revise Subrule 18-094 1) to read: **18-094 Sealing, Zone 0** 1) Where a conduit run that contains circuits in accordance with Rule 18-092 1) terminates in a Zone 0 location, a flammable fluid migration seal shall be installed with an uninterrupted ~~no box, coupling, or fitting in the~~ conduit run between the seal and the point at which the conduit crosses the Zone 0 boundary.	SN4749
Revise Rule 18-102 to read: **18-102 Wiring methods, Zone 1** (see Appendix B) 1) The wiring method shall be a) threaded rigid metal conduit with explosion-proof, flameproof "d", or flameproof "db" fittings; or b) hazardous location cables with associated cable glands suitable for the application. 2) Explosion-proof, flameproof "d", or flameproof "db" boxes, fittings, and joints shall be threaded for connection to conduit and cable glands. ~~3) Threaded joints that are required to be explosion-proof, flameproof "d", or flameproof "db" shall be permitted to be either tapered or straight and shall comply with the following:~~ ~~a) tapered threads shall have at least 4-1/2 fully engaged threads, and running threads shall not be used; and~~ ~~b) metric straight threads shall have a tolerance class 6g/6H and shall have at least 5 fully engaged threads.~~ ~~4) Where thread forms differ between the equipment and the wiring system, suitable adapters shall be used.~~ 3)~~5)~~ Conduit and cable entries into increased safety "e" enclosures shall be made so as to maintain the Ex e protection of the enclosure as well as its degree of protection ~~provided by the enclosure~~, and such entries shall be by means of a) increased safety "e" conduit hubs; b) increased safety "e" cable glands; or c) cable glands suitable as an explosion seal. 4) Where a cable gland entry to an increased safety "e" enclosure is through a clearance hole, an O-ring, sealing washer, or sealing locknut shall be used to maintain the degree of protection. 5)~~6)~~ Cables shall be installed and supported so as to avoid tensile stress at the cable glands. 6)~~7)~~ Wiring methods for intrinsically safe equipment and associated circuits designed and installed as "ia", "ib", or intrinsically safe for Class I locations shall be permitted to be exempt from the requirements of Subrules 1) and 2) ~~to 4)~~.	SN4760 SN4784

Revise Rule 18-104 to read:

SN4749
SN4806

18-104 Sealing, Zone 1 (see Appendix B)

~~1) Explosion seals shall be provided in conduit systems where the conduit~~
~~a) enters an explosion-proof, flameproof "d", or flameproof "db" enclosure that contains devices which produce ignition-capable arcs or temperatures; or~~
~~b) is 53 trade size or larger.~~
~~2) Where conduit explosion seals are required for an enclosure, they shall be located as close as practicable to the enclosure, or as marked on the enclosure, but not farther than~~
~~a) 450 mm from the enclosure; and~~
~~b) 50 mm from the enclosure for field-drilled entries.~~
~~3) Where a conduit run crosses a Zone 1 boundary and terminates in the Zone 1 area,~~
~~a) an explosion seal shall be installed in the conduit run~~
~~i) within the Zone 1 location; or~~
~~ii) no more than 1 m external to the Zone 1 boundary; and~~
~~b) the conduit run shall be uninterrupted between the explosion seal and the point~~
~~i) of termination within the Zone 1 location; and~~
~~ii) at which the conduit crosses the Zone 1 boundary.~~
~~4) Where a conduit run passes through a Zone 1 area without termination, it shall not require an explosion seal, provided that~~
~~a) the conduit run is uninterrupted within the Zone 1 area; and~~
~~b) the termination points of the conduit are in a non-hazardous location.~~
~~5) In Subrules 3) and 4), an uninterrupted conduit run is that portion of a conduit run which~~
~~a) except as provided for in Item b), shall not have any equipment, box, fitting, union, tee, or similar device installed; and~~
~~b) shall be permitted to have conduit couplings installed.~~
~~6) Only explosion-proof, flameproof "d", or flameproof "db" unions, reducers, and elbows that are not larger than the trade size of the conduit shall be permitted between the explosion seal and an explosion-proof, flameproof "d", or flameproof "db" enclosure.~~
~~7) A flammable fluid migration seal shall be provided where a cable first terminates after entering the Zone 1 area.~~
~~8) Explosion seals shall be provided in a cable system where the cable enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db".~~
~~9) Runs of cables, each having a continuous sheath, either metal or non-metal, shall be permitted to pass through a Zone 1 location without seals.~~

1) Except as permitted in Subrule 2), an explosion seal shall be provided where a wiring system (conduit or cable) enters an explosion-proof, flameproof "d", or flameproof "db" enclosure.

2) An explosion seal shall not be required
   a) for a wiring system (conduit or cable) passing through a Zone 1 area uninterrupted, and the termination points are in a Zone 2 or non-hazardous location; or
   b) in conduit systems where the conduit enters an explosion-proof enclosure if

i) the enclosure does not contain devices which produce ignition-capable arcs or temperatures, or the enclosure is marked “Factory Sealed” or “Seal Not Required”; and

ii) the conduit is smaller than 53 trade size.

3) Explosion seals shall be located as close as practicable to the enclosure or as marked on the enclosure, and for conduit systems no farther than

a) 450 mm from an explosion-proof enclosure;

b) 50 mm from an explosion-proof enclosure for field-drilled entries; and

c) 50 mm from a flameproof “d” or flameproof “db” enclosure.

4) Only explosion-proof, flameproof “d”, or flameproof “db” unions, reducers, adapters, and elbows that are not larger than the trade size of the conduit shall be permitted between an explosion seal and an explosion-proof enclosure.

5) Except as permitted by Rule 18-066 5), where a conduit system crosses a Zone 1 boundary and terminates in the Zone 1 area,

a) an explosion seal shall be installed in the conduit

i) within the Zone 1 location; or

ii) no more than 1 m external to the Zone 1 boundary; and

b) the conduit system shall be uninterrupted between the explosion seal and

i) the point of termination within the Zone 1 location; and

ii) the point at which the conduit crosses the Zone 1 boundary.

6) An explosion seal shall be provided in a conduit system run between an explosion-proof enclosure described in Subrule 2) b) and an increased safety “e” enclosure within a Zone 1 area, and the conduit system shall be uninterrupted between the explosion seal and

a) the point of termination at the explosion-proof enclosure described in Subrule 2) b); and

b) the point of termination at the increased safety “e” enclosure.

7) A flammable fluid migration seal shall be provided where a cable first terminates after entering the Zone 1 area.

Revise Rule 18-106 to read:

SN4791

18-106 Motors ~~and generators~~, Zone 1 (see Appendix B)

Increased safety “eb” motor installations shall meet the requirement for thermal protection of motors given in IEC 60079-14.

Revise Rule 18-150 to read:

SN4638
SN4791

18-150 Equipment, Zone 2 locations (see Appendices B and F)

1) Electrical equipment installed in a Zone 2 location shall be in accordance with Table 18.

2) Notwithstanding Subrule 1) and Rule 18-052, the following shall be permitted:

a) ~~transformers, solenoids, coils, and similar electromagnetic devices that comply~~ equipment that complies with the requirements of Rule 18-054 and is any of the following;

i) inductive devices, including transformers, solenoids, coils and similar equipment;
ii) capacitors that do not have integral fuses; or
iii) devices used for instrumentation and measurement purposes, including thermocouples, resistance temperature detectors (RTDs), piezoelectric pressure transducers and accelerometers, resistive strain gauges, passive RFID (radio frequency identification) tags, and similar equipment;

b) conduit and cables as specified in Rule 18-152 1);
c) equipment that is installed in a Type 4 or 4X enclosure, or an IP65 or higher enclosure, and is
i) non-sparking in normal operation;
ii) not used for heating purposes; and
iii) not otherwise provided for in Subrule 2);
d) fuses, where they are used for
i) the protection of equipment subject to overload during normal operation and are
A) of the current-limiting, non-indicating, filled type; or
B) of the current-limiting, indicating, filled type constructed in a manner such that the blown fuse indication does not cause the fuse body to be penetrated; or
ii) short-circuit protection only; or
e) motors and~~,~~ generators~~, and other rotating electrical machines~~ of the open or non-explosion-proof type that
i) except as permitted by Subrule 3) or 4), do not incorporate arcing, sparking, or heat producing components; or
ii) incorporate arcing, sparking, or heat-producing components that comply with the requirements of Rule 18-100.

3) The motors and generators ~~machines~~ referred to in Subrule 2) e) i) shall be permitted to contain anti-condensation heaters suitable for non-hazardous locations, provided that they
a) do not use arcing or sparking components;
b) do not use temperature-limiting controls;
c) comply with the requirements of Rule 18-054 under normal operating conditions; and
d) are marked on a separate nameplate on the machine with
i) the maximum surface temperature of the heater in degrees Celsius; or
ii) a temperature code that indicates the maximum surface temperature.

4) ~~Machines~~ Motors and Generators referred to in Subrule 2) e) that contain a sliding contact shaft bonding device suitable for non-hazardous locations shall be permitted for use, provided that
a) the device is used for the purpose of maintaining the rotor at ground potential;
b) the potential discharge energy is determined to be non-incendive for the application; and
c) the potential discharge energy calculation is documented and authenticated by the person assuming responsibility for the calculation.

Revise Rule 18-152 to read:

SN4745
SN4760

18-152 Wiring methods, Zone 2 (see Appendix B)
1) The wiring method shall be

a) threaded rigid metal conduit;
b) hazardous location cables;
c) Tray cables in accordance with Rule 12-102 3);~~Type TC cable, installed in cable tray in accordance with Rule 12-2202~~
d) armoured and metallic sheathed cables with an overall ~~non-metallic~~ jacket~~,~~ in accordance with Rule 12-102 3); ~~such as TECK90, ACWU90, copper-sheathed RC90, or aluminum-sheathed RA90;~~
~~e) Armoured fire alarm and signal cable, such as FAS, FAS90, FAS105, FAS150, and FAS200;~~
~~f) control and instrumentation cables with an interlocking metallic armour and a continuous jacket in control circuits (Type ACIC);~~
~~g) Type CIC cable (non-armoured control and instrumentation cable) installed in cable tray in accordance with the installation requirements of Rule 12-2202 3), where~~
~~i) the voltage rating of the cable is not less than 300 V;~~
~~ii) the circuit voltage is 150 V or less; and~~
~~iii) the circuit current is 5 A or less;~~
e) Non-armoured control and instrumentation cable (CIC), and non-armoured fire alarm and signal cables (FAS), provided that
i) the installation is in cable tray in accordance with Rule 12-2202 3);
ii) the voltage rating of the cable is not less than 300 V;
iii) the circuit voltage is 150 V or less; and
iv) the circuit current is 5 A or less;
f)~~h)~~ rigid RTRC conduit Type XW, provided that
i) boxes, fittings, and joints are marked with the suffix “-XW”; and
ii) installation is performed in industrial establishments that are not accessible to the public and where only qualified persons service the installation; or
g)~~i)~~ liquid-tight flexible metal conduit and connectors, marked for heavy duty.

2) Explosion-proof, flameproof “d”, or flameproof “db” boxes, fittings, and joints shall be threaded for connection to conduit and cable glands.

~~3) Threaded joints that are required to be explosion-proof shall be permitted to be either tapered or straight and shall comply with the following:~~
~~a) tapered threads shall have at least 4-1/2 fully engaged threads, and running threads shall not be used; and~~
~~b) metric straight threads shall have a tolerance class 6g/6H and shall have at least 5 fully engaged threads.~~

~~4) Where thread forms differ between the equipment and the wiring system, suitable adapters shall be used.~~

3~~5~~) Cables shall be installed and supported so as to avoid tensile stress at the cable glands.

4~~6~~) Boxes, fittings, and joints need not be explosion-proof or flameproof “d”, except as required by the Rules in this Section.

5~~7~~) Cable glands shall be compatible with the degree of protection and explosion protection provided by the enclosure that the cable enters, where the area classification and environmental conditions require these degrees of protection.

6~~8~~) Wiring methods for intrinsically safe equipment and associated circuits designed and installed as “ia”, “ib”, "ic", intrinsically safe for Class I locations, or non-incendive shall be permitted to be exempt from the requirements of Subrules 1) and 2).~~to 4).~~

Revise Rule 18-154 to read:

SN4749
SN4806

18-154 Sealing, Zone 2 (see Appendix B)

~~1) Explosion seals shall be provided in conduit systems where the conduit enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db", and the seals shall be located as close as practicable to the enclosure, or as marked on the enclosure, but not farther than~~
~~a) 450 mm from the enclosure; and~~
~~b) 50 mm from the enclosure for field-drilled entries.~~
~~2) Flammable fluid migration seals for conduit shall be installed where~~
~~a) the conduit leaves the Zone 2 location with no box, coupling, or fitting in the conduit run between the seal and the point at which the conduit leaves the location, except that a rigid unbroken conduit that passes completely through a Zone 2 area, with no fittings less than 300 mm beyond each boundary, need not be sealed, provided that the termination points of the unbroken conduit are in non-hazardous areas; or~~
~~b) the conduit leaves a Zone 2 location outdoors, in which case the seal shall be permitted to be located more than 300 mm beyond the Zone 2 boundary, provided that it is located on the conduit before the conduit enters an enclosure or building.~~
~~3) Only explosion-proof, flameproof "d", or flameproof "db" unions, couplings, reducers, and elbows that are not larger than the trade size of the conduit shall be permitted between the sealing fitting and an explosion-proof, flameproof "d", or flameproof "db" enclosure.~~
~~4) An explosion seal shall be provided in a cable system where the cable enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db".~~
~~5) Where a run of conduit enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db", every part of the conduit from the explosion seal to that enclosure shall comply with Rule 18-102.~~
~~6) Runs of cables, each having a continuous sheath, either metal or non-metal, shall be permitted to pass through a Zone 2 location without seals.~~

1) An explosion seal shall be provided in a wiring system (cable or conduit) that enters an enclosure which
   a) is explosion-proof, flameproof "d", or flameproof "db";
   b) contains devices which produce ignition-capable arcs or temperatures in normal operation; and
   c) is not marked "Factory Sealed" or "Seal Not Required".

2) Explosion seals shall be located as close as practicable to the enclosure or as marked on the enclosure, and for conduit systems no farther than
   a) 450 mm from an explosion-proof enclosure;
   b) 50 mm from an explosion-proof enclosure for field-drilled entries; and
   c) 50 mm from a flameproof "d" or flameproof "db" enclosure.

3) Only explosion-proof, flameproof "d", or flameproof "db" unions, reducers, adapters, and elbows that are not larger than the trade size of the conduit shall be permitted between an explosion seal and an explosion-proof enclosure.

4) Where an explosion seal is installed in a conduit system to provide explosion protection, the wiring method between the seal and the enclosure shall be compatible with the degree of protection provided by the enclosure in accordance with Rule 18-102.

5) Except as permitted in Subrule 6), flammable fluid migration seals for conduit shall be installed where a) the conduit leaves the Zone 2 location uninterrupted between the seal and the point at which the conduit leaves the location, up to 1 m beyond each boundary, provided that all termination points of the conduit are in non-hazardous areas; or b) the conduit leaves a Zone 2 location outdoors, in which case the seal shall be permitted to be located more than 1 m beyond the Zone 2 boundary, provided that i) the seal and conduit are located outdoors; and ii) the conduit is uninterrupted. 6) Seals shall not be required for a wiring system (conduit or cable) passing through a Zone 2 area uninterrupted, and the termination points are in a non-hazardous location.	
Add new Rule 18-206 to read: **18-206 Luminaires, Zone 21** 1) Luminaires shall be supported by boxes, box assemblies, and fittings that are intended for the purpose. 2) Pendant luminaires shall be a) Suspended by a threaded rigid conduit stem or chains with suitable fittings or by other means that does not include a flexible cord as the support medium, and threaded joints shall be provided with a means to prevent loosening; and b) Where suspended by threaded rigid conduit stems longer than 300mm, provided with i) permanent and effective bracing against lateral displacement at a level not more than 300mm from the point of attachment to the supporting box or fitting; or ii) flexibility in the form of a fitting or flexible connector suitable for the purpose and for the location not more than 300 mm from the point of attachment to the supporting box or fitting.	SN4786
Revise Rule 18-250 to read: **18-250 Equipment, Zone 22 locations** 1) Electrical equipment installed in a Zone 22 location shall be in accordance with Table 18.	SN4728 SN4787

2) Where installed in Zone 22, Group IIIA locations, travelling cranes and hoists for material handling, travelling cleaners for textile machinery, and similar equipment shall conform to the following: a) the power supply to contact conductors shall be isolated from all other systems, ungrounded, and equipped with i) recording ground detection that will give an alarm and will automatically de-energize the contact conductors in case of a fault to ground; or ii) ground fault detection that will give a visual and audible alarm and maintain the alarm as long as power is supplied to the system and the ground fault remains; b) contact conductors shall be located or guarded so as to be inaccessible to other than authorized persons and shall be protected against accidental contact with foreign objects; and c) current collectors shall conform to the following: i) they shall be arranged or guarded to confine normal sparking and to prevent escape of sparks or hot particles; ii) to reduce sparking, two or more separate surfaces of contact shall be provided for each contact conductor; and iii) reliable means shall be provided to keep contact conductors and current collectors free of accumulations of lint or flyings.~~; and~~ ~~iv) control equipment shall be suitable for Zone 22.~~ 3) Notwithstanding Subrule 1), totally enclosed pipe-ventilated (TEPV), totally enclosed nonventilated (TENV), and totally enclosed fan-cooled (TEFC) motors and generators shall be permitted to be installed in Zone 22 Group IIIA and IIIB locations provided a) they are equipped with integral overheating protection in accordance with Rule 28-314; and b) drain holes and other openings are suitably closed. 4) Notwithstanding Subrule 1, where installed in dust-protected enclosures, the following equipment shall be permitted: a) Switches, motor controllers, circuit breakers, fuses, meters, instruments, relays, transformers, impedance coils, resistors; and b) Signal, alarm, remote control, and communications systems.	
Revise Rule 18-252 to read: **18-252 Wiring methods, Zone 22** (see Appendix B) ~~1)~~ The wiring method shall conform to Rule 18-152 1). ~~be~~ ~~a) threaded metal conduit;~~ ~~b) hazardous location cables;~~ ~~c) Type TC cable installed in cable tray in accordance with Rule 12-2202 and enclosed in rigid conduit or another acceptable wiring method wherever it leaves the cable tray;~~ ~~d) armoured cable with overall non-metallic jacket, such as TECK90, ACWU90, copper-sheathed RC90, or aluminum-sheathed RA90;~~ ~~e) armoured fire alarm and signal cable, such as FAS, FAS90, FAS105, FAS150, and FAS200;~~ ~~f) control and instrumentation cables with an interlocking metallic armour and a continuous jacket in control circuits (Type ACIC);~~	SN4745 SN4760 SN4787

~~g) Type CIC cable (non-armoured control and instrumentation cable) installed in cable tray in accordance with the installation requirements of Rule 12-2202 2), where~~ ~~i) the voltage rating of the cable is not less than 300 V;~~ ~~ii) the circuit voltage is 150 V or less; and~~ ~~iii) the circuit current is 5 A or less;~~ ~~h) rigid RTRC conduit Type XW, provided that~~ ~~i) boxes, fittings, and joints are marked with the suffix "-XW"; and~~ ~~ii) installation is performed in industrial establishments that are not accessible to the public and where only qualified persons service the installation; or~~ ~~i) liquid-tight flexible metal conduit and connectors, marked for heavy duty.~~ 2) Boxes and fittings in which taps, joints, or terminal connections are made shall be dust-protected. ~~either an Enclosure Type 4 or 5, or~~ ~~a) be provided with telescoping or close-fitting covers or other effective means to prevent the escape of sparks or burning material; and~~ ~~b) have no openings, such as holes for attachment screws, through which, after installation, sparks or burning material might escape, or through which exterior accumulations of dust or adjacent combustible material might be ignited.~~ 3) Cables shall be installed and supported so as to avoid tensile stress at the cable glands. 4) Where it is necessary to use flexible connections, the provisions of Rule 18-202 4) b) and 5) shall apply. 5) Wiring methods for intrinsically safe equipment and associated circuits designed and installed as "ia", "ib", "ic", intrinsically safe for Class II or Class III locations, or non-incendive shall be permitted to be exempt from the requirements of Subrules 1) and 2).	
Add new Rule 18-256 to read: **18-256 Luminaires, Zone 22** Luminaires shall be installed in accordance with Rule 18-206.	SN4786

SECTION 20

Revise Subrule 20-000 1) to read: SN4790

20-000 Scope (see Appendices G and J)
1) This Section supplements or amends the general requirements of this Code and Section 18 and applies to installations as follows:
a) gasoline dispensing and service stations — Rules 20-002 to 20-014;
b) propane vehicle fuel dispensers, container filling, and storage — Rules 20-030 to 20-042;
c) compressed natural gas refuelling stations, compressors, and storage facilities — Rules 20-060 to 20-070;
d) commercial repair garages — Rules 20-100 to 20-112;
e) bulk storage plants — Rules 20-200 to 20-212;
f) finishing processes — Rules 20-300 to 20-314; and
g) aircraft hangars — Rules 20-400 to 20-422.

Revise Subrule 20-004 8) and add new Subrule 11) to read: SN4693

20-004 Hazardous areas (see Appendix B)
8) Except as permitted by Subrule 11), ~~E~~electrical wiring and equipment, any portion of which is below the surface of areas defined as Zone 1 or Zone 2 in Subrule 1), 4), 6), or 7), shall ~~be considered~~ conform to the requirements for ~~to be within~~ a Zone 1 location that extends at least to the point of emergence above grade.
“
“
11) Non-metallic conduit shall be permitted where at least 600mm below the surface areas defined as Zone 1 or Zone 2 in Subrule 1), 4), 6), or 7) provided:
a) The last 600mm to the point of emergence above grade or finished floor is threaded rigid metal conduit; and
b) A Flammable fluid migration seal is located above grade or finished floor with no box, coupling, or fitting in the conduit run between the seal and non-metallic conduit

Revise Rule 20-402 to read: SN4692

20-402 Hazardous areas
1) Any pit or depression below the level of the hangar floor shall be a Zone 1 location that shall extend up to the floor level.
2) The entire area of the hangar, including any adjacent and communicating areas not suitably cut off from the hangar, shall be a Zone 2 location up to a level 450 mm above the floor.
3) The area within 1.5 m horizontally from aircraft power plants, aircraft fuel tanks, or aircraft structures containing fuel shall be a Zone 2 location that extends upward from the floor to a level 1.5 m above the upper surface of wings and of engine enclosures.
4) Adjacent areas in which hazardous vapours are not likely to be released, such as stock rooms, electrical control rooms, and other similar locations, shall be permitted

to be classed as non-hazardous when adequately ventilated and when effectively cut off from the hangar itself in accordance with Rule 18-058. 5) Except as permitted by Subrule 6), Electrical wiring and equipment, any portion of which is in or below the hangar floor shall conform to the requirements for Zone 1. 6) Raceways located at least 600 mm below the hanger floor shall not be required to conform to the requirements for Zone 1 when: a) encased in a concrete envelope a minimum of 50 mm thick where both ends of the conduit emerge in a non-hazardous locations; or b) they are Non-Metallic Conduit and where the last 600 mm to the point of emergence above grade or finished floor is threaded rigid metal conduit, and a flammable fluid migration seal is located above grade or finished floor with no box, coupling, or fitting in the conduit run between the seal and non-metallic conduit.	
Revise Rule 20-404 to read: **20-404 Wiring and equipment in hazardous areas** 1) All fixed and portable wiring and equipment that is or may be installed or operated within any of the hazardous locations defined in Rule 20-402 shall conform to the requirements of Section 18. ~~2) All wiring installed in or under the hangar floor shall conform to the requirements for Zone 1 locations.~~ 2) ~~3)~~ Wiring systems installed in pits, or other spaces in or under the hangar floor, shall be provided with adequate drainage and shall not be placed in the same compartment with any other service except piped compressed air. 3) ~~4)~~ Attachment plugs and receptacles in hazardous locations shall be explosion-proof, or shall be designed so that they cannot be energized while the connections are being made or broken.	SN4692

SECTION 24

Revise Rule 24-002, entry for Delayed vital branch, to read: SN4711

Delayed vital branch — the portion of an essential electrical system in which the circuits require power restoration within 1 ~~2~~ min.

Add new Rule 24-101 to read: SN4571

24-101 Panelboards supplying circuits in patient care areas (see Appendix B)

1) Panelboards supplying circuits in patient care areas, shall be
   a) secured;
   b) accessible only to authorized personnel; and
   c) except as provided by Subrule 2), outside patient care areas.

2) Panelboards supplying circuits described in Subrule 24-302 1), shall be permitted to be located in patient care areas.

3) Panelboards installed in basic or intermediate care areas in accordance with Subrule 2), shall supply only circuits located within those patient care areas.

4) Panelboards installed in critical care areas in accordance with Subrule 2), shall supply only circuits intended for, and dedicated to, the critical care area where they are located.

Revise Subrule 24-102 8) to read: SN4755

8) A circuit consisting of conductors connected to communication or nurse call equipment that is installed within a patient care area shall be deemed a Class 1 circuit but shall have its voltage and power limited in accordance with Rule 16-222 3) ~~the applicable Rules of Section 16~~.

Add new Subrule 24-102 9) to read: SN4633

9) all branch circuits supplying loads within patient care environments, other than those supplying multi-phase equipment, shall be 2-wire circuits.

Revise Rule 24-104 to read: SN4494

24-104 Bonding to ground in basic care areas (see Appendix B)
1) Bonding conductors shall be insulated unless they are
   a) installed in non-metallic conduit; or
   b) incorporated into a cable that is constructed in such a manner that contact between any metal shield or armour, if it is present, and a bare bonding conductor is not possible.

2) All receptacles and other permanently connected equipment shall be bonded to ground by copper equipment bonding conductors, sized in accordance with Table 16 but in no case smaller than No. 12 AWG, installed in accordance with Rule 10-614 and run with the circuit conductors in accordance with the following:

a) each multi-wire branch circuit shall be provided with its own equipment bonding conductor;

b) except as permitted by Items c) and d), each 2-wire branch circuit supplying a receptacle in a patient care environment shall be provided with its own equipment bonding conductor;

c) when the receptacles in a patient care environment are supplied from two 2-wire branch circuits in the same raceway, a single equipment bonding conductor shall be permitted to be shared by the two circuits; or

d) when receptacles intended for a pair of adjacent patient care environments are supplied by three 2-wire branch circuits and one of the circuits is intended to be shared by both environments, the three circuits shall be permitted to share two equipment bonding conductors.

3) Utilization equipment bonding conductors required by Subrules 2), 6), and 7) shall terminate either at the panelboard supplying the branch circuits to the patient care environment from which they arise or on a separately installed busbar that is bonded to that panelboard.

4) Where branch circuits for a patient care environment are supplied from more than one panelboard, the panelboards shall be bonded together with a single copper equipment bonding conductor sized in accordance with Rule 10-616 ~~Table 16~~, but in no case smaller than a No. 6 AWG.

5) Each panelboard supplying branch circuits as described in Rule 24-102 3) and located in a basic care area shall be bonded to ground by a copper ~~utilization equipment~~ bonding conductor that is

a) installed in the same raceway as the circuit conductors supplying that panelboard or installed in accordance with Rule 10-614, and sized in accordance with Rule 10-616 ~~Table 16~~; or

b) incorporated into the assembly of the cable supplying that panelboard.

6) Each panelboard supplying branch circuits as described in Rule 24-102 3) and located outside a basic care area shall be bonded to ground in accordance with Rule 10-610.

7)~~6)~~ Each item of three-phase equipment shall be bonded to ground with a copper equipment bonding conductor that is

a) sized in accordance with Rule 10-616 ~~Table 16~~, but is in no case smaller than No. 12 AWG; and

b) connected to its own terminal at the equipment and the panelboard.

8)~~7)~~ If they could become energized, exposed non-current-carrying metal parts of communication, radio, or television equipment, other than telephone sets, in a patient care environment shall be bonded to ground using a copper equipment bonding conductor sized in accordance with Subrule 7)~~6)~~, by

a) connection to the bonding screw in the communication section of a barriered and ganged metal outlet box that serves a patient care environment; or

b) connection to an equipment bonding conductor or bonding busbar for that patient care environment as identified in Subrule 3).

9)~~8)~~ If they could become energized, exposed non-current-carrying metal parts of non-electrical equipment, in a patient care environment, shall be bonded to ground using a copper equipment bonding conductor sized in accordance with Subrule 7)~~6)~~ by connection to an equipment bonding conductor or bonding busbar for that patient care environment as identified in Subrule 3).

10)~~9)~~ Notwithstanding Subrules 1) and 2), recessed and surface-mounted luminaires located more than 2.3 m above floor level, and their associated switches located outside a patient care environment, shall be permitted to be bonded in accordance with Section 10.	
Revise Subrule 24-106 5) to read: 5) Except for receptacles as described in Subrule 3), all ~~15 A and 20 A non-locking~~ receptacles of CSA configuration 5-15R, 5-20R, 5-20RA, 6-15R, 6-20R, and 6-20RA shall be hospital grade.	**SN4795**
Add new Subrule 24-106 8) to read: **24-106 Receptacles in basic care areas** (see Appendix B) 8) All receptacles of CSA configuration 5-15R and 5-20R installed in areas designated by the health care facility administration as being intended primarily for the provision of diagnosis, therapy, or care to children, other than receptacles dedicated for stationary appliances such that the receptacle is rendered inaccessible, and receptacles located above 2 m from the floor, shall be tamper-resistant receptacles and shall be so marked.	**SN4572**

SECTION 26

Revise Rule 26-100 to read: SN4710

26-100 Location and marking of isolating switches (See Appendix B)

~~1) Isolating switches shall be permitted to be located so that a hook stick is required to operate them.~~

~~2)~~ Isolating switches shall be plainly marked to minimize the chance that they will be opened under load, unless

a) they are located or guarded so that they are inaccessible to unauthorized persons; or

b) they are interlocked so that they cannot normally be opened under load.

Revise Subrule 26-246 3) to read: SN4732

26-246 Dry-core, open-ventilated-type transformers

3) Notwithstanding Subrule 1), where the adjacent surface is the wall on which the transformer is mounted, the minimum permissible separation between the enclosure and the mounting wall shall be 6.5 mm if the adjacent surface is made of

a) non-combustible material;

b) combustible material adequately protected by non-combustible heat insulating material other than sheet metal; or

c) combustible material shielded by grounded sheet metal with an air space of not less than 50 mm between the sheet metal and the combustible material.

Revise Rule 26-256 to read: SN4628-26

26-256 Conductor size for transformers (see Appendix B)

1) The conductors supplying transformers shall have an ampacity ~~rating~~

a) not less than 125% of the rated primary current of the transformer for a single transformer; or

b) not less than the sum of the rated primary currents of all transformers plus 25% of the rated primary current of the largest transformer for a group of transformers operated in parallel or on a common feeder.

2) The secondary conductors connected to transformers shall have an ampacity ~~rating~~

a) not less than 125% of the rated secondary current of the transformer for a single transformer; or

b) not less than 125% of the sum of the rated secondary currents of all the transformers operated in parallel.

3) Notwithstanding Subrules 1) and 2), primary and secondary conductors shall be permitted to have an ampacity ~~rating~~ not less than that required by the demand load, provided that they are protected in accordance with Rules 14-100 and 14-104.

4) Where the transformer overcurrent protection is more than 125% of the rated primary or secondary current in accordance with Rule 26-250 1) or 2) or 26-254 3),

the primary and secondary conductors connected to the transformer shall be protected in accordance with Rules 14-100 and 14-104. 5) Where multi-rating transformers are used, the primary and secondary conductors shall have an ampacity ~~rating~~ not less than 125% of the rated primary and secondary current of the transformer at the utilization voltage.	
Revised Subrule 26-600 1) to read: **26-600 Location of panelboards** (see ~~Appendix~~ Appendices B and G) 1) Panelboards shall not be located in coal bins, clothes closets, bathrooms, stairways, ~~high ambient~~ rooms or spaces with high ambient temperatures, dangerous ~~or hazardous~~ locations, nor in any similar undesirable places.	SN4575 SN4705
Revise Subrule 26-700 8) to read: 8) Receptacles having CSA configuration 5-15R or 5-20R installed within 1.5 m of sinks shall not be located a) on the area of the counter directly in front of the sink; and b) on the area of the wall directly behind the sink, except where the distance between the wall and the inside edge of the sink ~~exceeds~~ is not less than 450 mm.	SN4781
Revise Rule 26-724 to read: **26-724 Outdoor and garage ~~R~~receptacles for single dwellings** (see Appendices B and G) ~~Receptacles for single dwellings only shall meet the following requirements:~~ ~~a~~1) Except as permitted by Subrule 2), ~~for each single dwelling,~~ at least ~~one~~ two duplex receptacles, readily accessible from ground or grade level shall be installed outdoors ~~so as to be readily accessible from ground or grade level for the use of appliances that need to be used outdoors~~; a) on two opposite sides of the single dwelling; or b) where the single dwelling configuration does not have opposite sides, installed on adjacent sides of the single dwelling and separated from each other by no less that one half of the width of the longest side. 2) At least one duplex receptacle shall be installed on single dwellings having a continuous perimeter at grade level of 20 m or less. ~~b~~3) ~~a~~At least one duplex receptacle readily accessible from floor or grade level shall be provided for each car space in a garage or carport of a single dwelling.~~; and~~ ~~c~~4) ~~o~~One receptacle shall be provided in a garage for each cord-connected overhead garage door opener and shall be located within 1 m of the overhead door opener.	SN4602

SECTION 28

Revise Rule 28-012 to read: SN4631

Exposed live parts of generators, motors and controllers operating at greater than 30 V ac or 60 V dc ~~50 V or more~~ between terminals shall be guarded against ~~accidental~~ inadvertent contact by means of enclosures or by location, except that stationary motors having commutators, collectors, and brush rigging located inside motor end brackets and not conductively connected to supply circuits operating at more than 150 volts-to-ground shall be permitted to have live parts exposed.

Revise Rule 28-014 to read: SN4730-28

28-014 Methods of guarding

Methods of guarding of motors having exposed live parts shall be by

a) installation in a room or enclosure that is accessible only to authorized persons;

b) installation on a suitable balcony, gallery, or platform elevated and arranged to exclude other than qualified persons;

c) elevation by 2.5 m or more above the floor; or

d) guard rails if the motor operates at ~~750 V~~ 1000V or less.

Revise Item 28-206 c) ii) to read: SN4730-28

ii) the rating or setting of the branch circuit overcurrent protection is not greater than that permitted by Table 29 for the full load current rating of the largest motor in the group, plus the sum of the full load current ratings of all other motors in the group that may be in operation at one time, but in no case more than 200 A at 250 V or less or 100 A at voltages from 251 to ~~750 V~~ 1000V;

Revise Rule 28-706 to read: SN4628-28

28-706 Insulated conductor ampacity

The ~~allowable~~ ampacity of insulated conductors of a branch circuit supplying a motor-compressor, or equipment consisting of one or more motor-compressors and other loads, shall be based on the marked rated load current of the motor-compressor or equipment and shall comply with the general requirements of this Section.

Revise Subsection heading for 28-900 series of Rules to read: SN4631

~~**Protection and control of generators**~~ **Generators**

Add new Rule 28-900 to read: **28-900 Rules for Generators** Rules 28-902 to 98-914 apply to the installation of generators.	SN4631
Add new Rule 28-902 to read: **28-902 Working space** 1) If the generator is provided with a generator enclosure, and the working space required by Rules 2-310 and 2-308 Subrule 1) cannot be provided within the enclosure, the enclosure is permitted to be used, when such enclosure is equipped with access doors where the working space is required, so that working space provisions are met. 2) Generators shall not be installed where the working space required by Subrule 1) can be obstructed by storage or vehicle parking when located in a public area.	SN4631
Add new Rule 28-904 to read: **28-904 Conductor size** 1) Where the generator is designed to prevent being overloaded, the conductors from the generator output terminals to the first overcurrent protection device shall have an ampacity of not less than 100% of the nameplate current rating of the generator. 2) Where the generator is not factory-supplied with overcurrent protection, the conductors from the generator output terminals to the first overcurrent protection device shall have an ampacity of not less than 115% of the generator of the nameplate current rating.	SN4631
Renumber existing Rules 28-900 to 28-908 to read: **28-906~~900~~ Disconnecting means required for generators** (see Appendix B) **28-908~~902~~ Protection of constant-voltage generators** **28-910~~904~~ Generator not driven by electricity.** **28-912~~906~~ Balancer sets** **28-914~~908~~ Three-wire dc generators**	SN4631

SECTION 30

Add new Rule 30-114 to read: SN4643

30-114 Branch circuit loading and protection (See Appendix B)
The total load on a branch circuit shall not exceed the continuous operation marking on the overcurrent device protecting the circuit.

Revise Rule 30-310 to read: SN4659

30-310 Luminaire as a raceway
1) Insulated branch circuit conductors run through a luminaire shall be contained in a raceway that is an integral part of the luminaire and that meets the requirements for a surface raceway, except that the insulated conductors of a 2-wire, 3-wire, or 4-wire branch circuit supplying the luminaires shall be permitted to be carried through luminaires marked as suitable for continuous row mounting.
2) Ballasts located within the luminaires referred to in Subrule 1) shall be deemed to be sources of heat and the conductors supplying the luminaires shall
a) have a voltage rating not less than 600 V;
b) have an insulation temperature rating not less than 90 °C; and
c) be either ~~of a type~~
i) a type selected in accordance with Rule 12-102 3) as being suitable for use in raceways; or
ii) ~~selected in accordance with Rule 12-402 1) as being suitable for use in accordance with this Rule,~~ Type GTF, REW, TEW, TBS, SIS, SEW-2, or SEWF-2 equipment wire installed in a raceway, provided that the insulated conductors are not smaller than No. 14 AWG and do not extend beyond the luminaires through raceways more than 2 m long.
3) Notwithstanding Subrule 2), non-metallic-sheathed cable shall be permitted to be used for supplying the luminaires, provided that it has a temperature rating of 90 °C.

Revise Rule 30-712 to read: SN4643

30-712 Branch circuit capacity
~~1)~~ Where lighting branch circuits supply luminaires employing ballasts, transformers, or autotransformers, the load on the branch circuits shall be computed on the basis of the total amperes of the units and not on the watts of the lamps.
~~2) The aggregate capacity of luminaires connected to a lighting branch circuit shall not exceed 80% of the branch circuit overcurrent protection.~~

Revise Subrule 30-1006 1) to read: SN4563

30-1006 Wiring methods on poles
1) A disconnecting means shall be provided for ~~A~~all electrical equipment on the pole ~~shall be controlled by a switch that can be locked in the OFF position~~, and each pole shall be provided with a prominent sign warning against climbing the pole if the disconnecting means ~~switch~~ is not in the open ~~OFF~~ position, unless all

conductors and live parts other than those used for pole-top wiring are guarded against accidental contact in one of the following ways: a) the insulated conductors are run in rigid or flexible metal conduit, as mineral-insulated cable, or up the centre of steel, aluminum, or hollow concrete poles; b) the insulated conductors, cables, and live parts are kept at least 1 m from the climbing ladder or climbing steps; or c) barriers are provided between insulated conductors or live parts, or both, and the climbing ladder to reduce the likelihood of contact by the climber.	
Revise Rule 30-1116 to read: **30-1116 Use of messenger cables** 1) Messenger cables shall be used to support the insulated conductors a) if lampholders having permanently attached leads are used, and the span exceeds 12 m; and b) in all cases where lampholders having terminals that puncture the insulation are used. 2) Messenger cable shall be installed in accordance with Rule 12-320. ~~2) Messenger cables shall be securely attached at each end of the run and shall be grounded in accordance with Section 10.~~ ~~3) Insulated conductors shall be permanently attached to the messenger.~~	SN4660
Delete Rule 30-1118: ~~**30-1118 Construction of messenger cables**~~ ~~1) Messenger cables shall be of galvanized steel, copper-coated steel, or stainless steel, and shall be of stranded construction with not less than seven strands.~~ ~~2) Galvanized steel shall have a coating of not less than 45 g/m2.~~ ~~3) The effective ultimate strength of a messenger cable shall be not less than three times the calculated maximum working load, including loading due to ice loads and wind loads, and the individual strands shall in no case be less than~~ ~~a) 1.17 mm in diameter in the case of galvanized or copper-coated wire; or~~ ~~b) 1.11 mm in diameter in the case of stainless steel wire.~~	SN4660
Revise Rule 30-1120 to read: **30-1120 Branch circuit loading and protection** ~~1)~~ Branch circuits shall be protected by overcurrent devices rated at not more than 30 A. ~~2) The total load on a branch circuit shall not exceed 80% of the rating or setting of the overcurrent devices.~~	SN4643

SECTION 36

Add new entry to Rule 36-002 to read: SN4154

Coupler — a wiring device that provides the means for joining and separating two portable power cables and is intended to be used repeatedly without any further alterations to the cables.

Add new Rules 36-400 to 36-410 to read: SN4154

High Voltage Couplers

36-400 General
High voltage couplers shall be permitted only where the electrical installation is maintained by qualified persons.

36-402 Cables
1) Male and female high voltage couplers intended to mate shall be attached to cables that have the same insulation temperature rating.

2) The ampacity of cables connecting high voltage couplers intended for use on general purpose branch circuits or feeders, shall be not less than the ampere rating of the coupler.

36-404 Wiring Methods (see Appendix B)
Wiring methods in high voltage couplers shall be in accordance with Section 12.

36-406 Terminations (See Appendix B)
Conductor terminations shall be in accordance with the manufacturer's installation instructions.

36-408 Bonding (see Appendix B)
A high voltage coupler with a bonding contact shall have the bonding conductor sized in accordance with Table 16.

36-410 Protective devices (See Appendix B)
1) High voltage couplers shall be connected only to circuits having a nominal system voltage and ampere rating equal to or less than the coupler rating.

2) Circuits which utilize couplers shall be provided with devices that automatically open the circuit and will not automatically reset if overcurrent, overload, under-voltage or ground fault occurs on any of the power conductors.

3) The bonding conductor monitoring system shall de-energize the supply by a fail-safe circuit in less than 0.5 s, and a de-energized supply shall not become re-energized if
(a) the bond-check conductor opens;
(b) the bond-return conductor opens; or
(c) the bond-check conductor shorts to ground.

4) A bonding conductor monitoring system shall have an open circuit voltage of less than 100V and shall continuously indicate the status of the bond-circuit continuity.	

SECTION 38

Revise Subrule 38-021 2) to read:

SN4532

38-021 Wiring methods (see Appendix B)

Escalators

2) Insulated conductors and optical fiber cables in escalator and moving walk wellways shall be installed in rigid metal conduit, flexible metal conduit, liquid-tight flexible conduit, electrical metallic tubing, rigid PVC conduit, or wireways or shall be mineral-insulated cable, aluminum-sheathed cable, copper-sheathed cable, or armoured cable, if not subject to physical damage, unless otherwise permitted in Items a) ~~and~~ b), and c):

a) cables used in Class 1 extra-low-voltage and Class 2 low-energy circuits, including extra-low-voltage cable, extra-low-voltage control cable, communication cable, fire alarm and signal cable, multi-conductor jacketed thermoplastic-insulated cable, and hard-usage and extra-hard-usage cables shall be permitted to be installed between risers and signal equipment and operating devices, provided that the cables are supported and protected from physical damage and are of a jacketed and flame-tested type; ~~and~~

b) flexible cords and cables that are components of equipment and used in extra-low-voltage circuits (30 V or less) shall be permitted in lengths not exceeding 2 m, provided that the cords and cables are supported and protected from physical damage and are of a jacketed and flame-tested type; and

c) extra-hard usage flexible cords as listed in Table 11 shall be permitted as flexible connections on escalator or moving walk controllers and disconnecting means installed in conformance with Rules 38-005 2)a).

SECTION 42

Revise Subrules 42-008 2) and 3) to read:

SN4628-42
SN4723

42-008 Overcurrent protection for transformer arc welders and inverter welders

2) Each ungrounded conductor supplying a transformer arc welder and inverter welder shall have overcurrent protection rated or set at not more than 200% of the ~~allowable~~ ampacity of the insulated conductor as specified in Table 1, 2, 3, or 4, except that the next higher rating or setting shall be permitted to be used where

a) the nearest standard rating of the overcurrent device is less than the rating or setting otherwise required by this Rule; or

b) the rating or setting otherwise required by this Rule results in too frequent opening of the overcurrent device.

3)The maximum rating or setting of an overcurrent device protecting a feeder supplying a group of transformer arc welders shall not exceed a value calculated by determining the maximum rating or setting of overcurrent device permitted by Subrules 1) and 2) for the welder allowed the highest overcurrent protection and adding to this value the sum of ampacities as calculated by Rule 42-006 1) for all other welders in the group.

Revise Rule 42-014 to read:

SN4617

42-014 Supply conductors for resistance welders

The ampacity of insulated supply conductors shall be as follows:

a) where an individual seam resistance welder or an individual automatically fed resistance welder is operated at different times at different values of primary current or duty cycle, the insulated supply conductors shall have an ampacity of not less than 70% of the rated primary current of the welder;

b) where an individual manually operated non-automatic resistance welder is operated at different times at different values of primary current or duty cycle, the ampacity of the insulated supply conductors shall be not less than 50% of the rated primary current of the welder;

c) where an individual resistance welder operates at known and constant values of actual primary current and duty cycle, the insulated supply conductors shall have an ampacity of not less than the value obtained by multiplying the actual primary current by the applicable factor from Table 42C; and

d) where insulated conductors supply ~~there~~ two or more ~~is a group of~~ resistance welders, the insulated ~~supply~~ conductors shall have an ampacity of not less than the sum of

i) ~~the sum of~~ the value~~s obtained from Item a), b), or c)~~ for the welder having the largest conductor ampacity as calculated from Items a), b), and c) ~~welder in the group~~; and

ii) 60% of the conductor ampacities~~values~~ obtained for all of the other welders ~~in the group~~.	
Revise Subrule 42-016 2) to read: **42-016 Overcurrent protection** 2) Every ungrounded conductor of a resistance welder shall have overcurrent protection rated or set at not more than 300% of the ~~allowable~~ ampacity of the insulated conductor as specified in Table 1, 2, 3, or 4, except that the next higher rating or setting shall be permitted to be used where a) the nearest standard rating of the overcurrent device is less than the rating or setting required by this Rule; or b) the rating or setting required by this Rule results in too frequent opening of the overcurrent device.	SN4628-42

SECTION 52

Revise Rule 52-004 to read: SN3961-52

52-004 High-voltage guarding

(1) High-voltage parts shall be mounted within metal enclosures that are bonded to ground, except when installed in separate rooms or enclosures, where a suitable switch shall be

(a) provided to control the circuit supplying diagnostic imaging equipment; and

(b) arranged so that it will be in an open position except when the door of the room or enclosure is locked.

(2) High-voltage parts of diagnostic imaging equipment shall be insulated from the enclosure.

(3) ~~Conductors~~ Cables in the high-voltage circuits shall be of the shockproof type.

(4) A milliammeter, if provided, shall be

(a) connected, if practicable, in the lead that is bonded to ground; or

(b) guarded if connected in the high-voltage lead.

Revise Rule 52-016 to read: SN3961-52

52-016 Ampacity of insulated supply conductors and rating of overcurrent protection

1) The ampacity of supply conductors and the rating of overcurrent protection devices shall not be less than

a) the long-time current rating of X-ray or computerized tomography equipment; or

b) 50% of the maximum momentary current rating required by X-ray or computerized tomography equipment on a radiographic setting.

2) The ampacity of insulated conductors and the rating of overcurrent protection devices for two or more branch circuits supplying X-ray or computerized tomography units shall be not less than

a) the sum of the long-time current rating of all X-ray or computerized tomography units that are intended to be operated at any one time; or

b) the sum of 50% of the maximum momentary current rating for X-ray or computerized tomography equipment on a radiographic setting for the two largest units, plus 20% of the maximum current rating of the other units.

SECTION 56

Add new Subrule 56-202 5) to read:

SN4271

56-202 Conductive optical fiber cables (see Appendix B)

1) Conductive optical fiber cables shall be permitted to occupy the same raceway with any of the following systems:
   a) Class 2 circuits in accordance with Section 16;
   b) communication circuits in accordance with Section 60; or
   c) community antenna distribution and radio and television circuits in accordance with Section 54.
2) Conductive optical fiber cables shall not occupy the same raceway, panel, cabinet, or similar enclosure housing electric lighting, power, or Class 1 circuits.
3) Conductive optical fiber cables shall not occupy the same cabinet, panel, outlet box, or similar enclosure housing the electrical terminals of a Class 2, communications, community antenna distribution, or radio and television circuit, unless
   a) the conductive optical fiber cables are functionally associated with the Class 2, communication, community antenna distribution, or radio and television circuit; or
   b) the conductive optical fiber cables are factory assembled in the enclosure.
4) The conductive non-current-carrying members of conductive optical fiber cables shall be grounded in accordance with Section 10.

5) Notwithstanding Subrules 2) and 3), for industrial establishments only, where conditions of maintenance and supervision ensure that only authorized persons service the installation, conductive optical fiber cables shall be permitted to occupy the same raceway, cabinet, panel, outlet box, or similar enclosure as electric power, control, or instrumentation cables, provided that the total length of each conductive optical fiber cable does not extend beyond the boundaries of the industrial establishment.

SECTION 58

Revise Rule 58-012 to read:

SN4646

58-012 Grounding of circuits ~~of less than 50 V~~

Circuits ~~of less than 50 volts-to-ground~~ shall be grounded ~~in accordance with Rule 10-206 3),~~ except that

a) ungrounded isolated haul ropes shall be permitted to be used for safety, communication, control, remote control, monitoring, supervision, and signal circuits; and

b) extra-low-voltage safety, communication, control, remote control, monitoring, supervision, and signal circuits shall be permitted to be ~~isolated,~~ ungrounded ~~provided that they are grounded~~ in accordance with Rule ~~10-212~~ 10-400 4).

Revise Rule 58-014 to read:

SN4574
SN4666

58-014 Voltage limitations

1) Voltages for safety, communication, control, remote control, monitoring, supervision, and signal circuits shall not exceed 48 V ~~volts-to-ground (nominal)~~, ~~with the exception of~~ except circuits for hand-crank-type telephone signal bells.

2) Only safety, communication, control, remote control, monitoring, supervision and signal circuits shall be carried between towers that support the passenger ropeway.

3)~~2)~~ Voltages for motors, motor controllers, machine brakes, motor-generator sets, floodlighting, ~~and~~ heaters, and air conditioners shall not exceed 750 V ac or 1060 V dc ~~volts-to-ground~~.

4)~~3)~~ Voltages for ~~motor~~ control circuits of motor controllers shall not exceed 120 V nominal ~~volts-to-ground (nominal)~~.

~~4) Voltages for aerial conductors or cables carried between towers that support the passenger ropeway shall not exceed 30 volts-to-ground or 42 volts-to-ground peak, with the exception of circuits for hand-crank-type telephone signal bells.~~

5) Voltages for all other circuits shall not exceed 300 V ~~volts-to-ground~~.

SECTION 60

Revise Rule 60-102 to read: SN3948-60

60-102 ~~Use of approved~~ Electrical equipment

The following equipment shall be permitted to be exempt from the requirements of Rule 2-024~~Electrical equipment used in the installation of a communication system shall be approved~~

a) ~~if~~ equipment not connected to exposed plant; ~~if~~ and

b) ~~if the~~ equipment not ~~is~~ connected to a telecommunication network.~~, unless the equipment is specifically allowed by other Rules in this Section; or~~

~~c) if required by other Rules in this Section.~~

Revise Rule 60-104 to read: SN3961-60

60-104 Circuits in communication cables (see Appendix B)

Radio and television circuits, remote control circuits, and fire alarm circuits or parts of this equipment shall be

a) permitted to use insulated conductors in a communication building entrance cable ~~assembly~~ having other insulated conductors used as communication circuits;

b) deemed to be communication circuits for those portions of circuits that use insulated conductors within the communication building entrance cable ~~assembly~~; and

c) suitably protected at the point of interface connection with the communication cable ~~conductors~~.

Delete Rule 60-110: SN3948-60

~~**60-110 Approved transformers**~~

~~Where transformers or other devices supply current to a communication circuit from an electric supply circuit, the transformers or other devices shall be of a type approved for the service.~~

Revise Rule 60-200 to read: SN3961-60

60-200 Provision of primary protectors (see Appendix B)

1) A primary protector shall be provided on each electrical communication circuit, except as permitted in Subrule 4).

2) The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point at which the ~~conductors~~ cables enter or attach to the structure or building.

3) The primary protector shall not be located in any hazardous location as defined in Sections 18, 20, and 24, nor in the immediate vicinity of flammable or explosive materials.

4) A primary protector need not be provided if no portion of the circuit is considered exposed plant.

Revise Rule 60-202 to read: **60-202 Primary protector requirements** 1) The primary protector shall connect between each line conductor and ground and, when required by Subrule 3), have a fuse connected in series in each line conductor. 2) Fuseless primary protectors shall be permitted a) on circuits that enter a building in a cable with a grounded metal sheath or shield, provided that the insulated conductors in the cable safely fuse at currents less than the ampacity of the primary protector and the primary protector grounding conductor; b) on circuits served by ~~insulated conductors~~ cable extending to a building from a grounded metal-sheathed or shielded cable, provided that the insulated conductors in the cable safely fuse at currents less than the ampacity of the primary protector, the associated insulated conductors, and the primary protector grounding conductor; c) on circuits served by ~~insulated conductors~~ cable, extending to a building from other than grounded metal-sheathed or shielded cable, provided that i) the primary protector grounding conductor is grounded in conformance with Rule 60-704; and ii) the connections of the ~~insulated conductors~~ cable extending from the building to the exposed plant, or the conductors of the exposed plant, safely fuse at currents less than the ampacity of the primary protector, the associated insulated conductors, and the primary protector grounding conductor; or d) on circuits in a cable with a grounded metal sheath or shield that are subject to lightning strikes but are otherwise not exposed plant. 3) Where the requirements of Subrule 2) are not met, fused primary protectors shall be used. 4) Primary protectors having exposed live parts shall be located in a suitable room or similar area as required by Rule 2-202, separate from electrical light or power installations, except where it is necessary to place them in a joint-use room, in which case a minimum separation of 900 mm from electrical equipment requiring adjustment and maintenance shall be provided and maintained.	SN3961-60
Revise Subsection title and Rule 60-300 to read: **Inside conductors and cables** **60-300 Installation of conductor and cables ~~installations~~** Rules 60-302 to 60-334 apply to the installation of inside communication conductors and cables.	SN3961-60
Revise Rule 60-302 to read: **60-302 Raceways** Raceways for insulated communication cable ~~conductors~~ shall be installed in accordance with the requirements of Section 12 and, if metal, shall be grounded in accordance with Section 10.	SN3961-60
Revise Rule 60-304 to read:	SN3948-60

60-304 Insulation Wire and cable used for communication systems shall be of ~~approved~~ types selected in accordance with Rule 12-102 3).	
Revise Rule 60-306 to read: **60-306 ~~Grounding~~ Bonding of ~~conductors~~ cables with an outer metal covering** Where a ~~conductor or~~ cable is equipped with an outer metal covering, the covering shall be bonded to ground in accordance with Section 10 ~~grounded~~.	SN3961-60
Revise Rule 60-308 to read: **60-308 Separation from other insulated conductors** 1) The ~~conductors~~ cables of an electrical communication system in a building shall be separated at least 50 mm from any insulated conductor of a Class 1 circuit or an electric lighting or power system operating at 300 V or less, and shall be separated at least 600 mm from any insulated conductor or ~~a~~ an electric lighting or power system operating at more than 300 V, unless a) one system is in ~~grounded~~ metal raceways, metal-sheathed cable, or ~~grounded~~ armoured cable bonded to ground in accordance with Section 10; b) the Class 1 circuit or circuits of electric lighting or power in electrical system operating at 300 V or less uses a hard-usage or extra-hard-usage flexible cord selected in accordance with Rule 12-402 1); or c) both systems are permanently separated by a continuous, firmly fixed non-metallic ~~non-metal~~ raceway in addition to the insulation of the conductors or cables. 2) Where the light or power conductors are bare, all communication ~~conductors~~ cables in the same room or space shall be enclosed in a grounded metal raceway, and no opening, such as an outlet box, shall be permitted to be located within 2 m of bare conductors if up to and including 15 kV or within 3 m of bare conductors above 15 kV. 3) The ~~conductors~~ cables of an electrical communication system shall not be placed in any outlet box, junction box, raceway, or similar fitting or compartment that contains insulated conductors of electric lighting or power systems or of Class 1 circuits (as defined in Rule 16-002), unless a) the communication ~~conductors~~ cables are separated from the other conductors by a suitable partition; or b) the power or Class 1 insulated conductors are placed solely for the purpose of supplying power to the communication system or for connection to remote control equipment, except that no communication ~~conductors~~ cables installed in an outlet box, junction box, raceway, or similar fitting or compartment that contains such insulated conductors of power or Class 1 circuits shall show a green-coloured insulation, unless ~~such a~~ the insulated communication conductor is completely contained within a ~~sheathed or~~ jacketed cable ~~assembly~~ throughout the length that is present in such raceways or enclosures. 4) The ~~conductors~~ cables of an electrical communication system in a building shall not be placed in a shaft with the insulated conductors of an electric lighting or power system, unless a) the conductors of all systems are insulated and are separated by at least 50 mm; or b) the conductors of either system are encased in non-combustible tubing.	SN3961-60

Revise Rule 60-310 to read: **60-310 Penetration of a fire separation** ~~Conductors~~ Cables of communication circuits extending through a fire separation shall be installed to limit fire spread in accordance with Rule 2-128.	SN3961-60
Revise Rule 60-312 to read: **60-312 Communication cables in hoistways** 1) Special permission shall be required to install communication ~~conductors~~ cables in hoistways. 2) All ~~conductors~~ cables, except travelling cables, shall be totally enclosed in continuous metal raceway. 3) Pullboxes required for communication interconnection shall be located outside the hoistway.	SN3961-60
Revise Rule 60-314 to read: **60-314 Communication ~~conductors~~ cables in ducts and plenum chambers** Communication ~~conductors~~ cables shall not be placed in ducts or plenum chambers except as permitted by Rules 2-130 and 12-010.	SN3961-60
Revise Rule 60-316 to read: **60-316 Data processing systems** ~~The i~~Interconnecting cables ~~used~~ in data processing systems ~~shall be permitted to~~ containing power and ~~communication~~ insulated communication conductors shall be suitable ~~where such cables are specifically approved~~ for the purpose.	SN3961-60 SN3948-60
Revise Rule 60-318 to read: **60-318 ~~Conductors~~ Cables under raised floors** ~~Conductors~~ Cables of communication circuits shall be permitted to be installed without additional mechanical protection under a raised floor, provided that a) the raised floor is of suitable non-combustible construction; b) a minimum separation of 50 mm is provided and maintained where the ~~conductors~~ cables are used to serve data processing systems and are placed parallel to any other insulated power supply conductors ~~wiring~~; and c) the ~~conductors~~ cables serve the equipment located only on the floor above the raised floor, where the space under the raised floor is used as an air plenum.	SN3961-60
Revise Rule 60-320 to read: **60-320 ~~Conductors~~ Cables in concealed installations** Where the ends of cables ~~or conductors~~ are not terminated on a device, they shall be capped or taped.	SN3961-60

Revise Rule 60-324 to read: **60-324 Use permitted** Type CFC system wiring shall be permitted to be used a) only under carpet squares not exceeding 750 mm, and any adhesive used shall be of the release type; b) as an extension of conventional wiring to serve areas or zones, and each run of wiring from the transition point shall not exceed 15 m; c) on hard, smooth continuous floor surfaces made of concrete if sealed, ceramic, or composition flooring, wood, or similar material; d) in dry or interior damp locations; and e) on floors heated in excess of 30 °C ~~only if approved and~~ when the Type CFC system is marked ~~identified~~ for that purpose.	SN3948-60
Revise Subsection title and Rule 60-500 to read: **Outside ~~conductors~~ cables** **60-500 Overhead ~~conductors~~ cables on poles** The installation of overhead communication ~~conductors~~ cables on poles in proximity with power conductors shall be established in accordance with the Canadian Electrical Code, Part III.	SN3961-60
Revise Rule 60-502 to read: **60-502 Overhead ~~conductors~~ cables on roofs** 1) Communication ~~conductors~~ cables passing over buildings shall be kept at least 2.5 m above any roof that can be readily walked upon. 2) Communication ~~conductors~~ cables shall not be attached to the upper surfaces of roofs or be run within 2 m, measured vertically, of a roof unless a deviation has been allowed in accordance with Rule 2-030. 3) A deviation in accordance with Rule 2-030 shall not be necessary where the building is a garage or other auxiliary building of one storey.	SN3961-60
Revise Rule 60-506 to read: **60-506 ~~Wire~~ Conductor insulation** In a communication circuit requiring a primary protector, each ~~wire~~ conductor shall have rubber or thermoplastic insulation and shall a) have a protective jacket placed over individual or groups of ~~wires~~ insulated conductors, which shall be permitted to be integral with the insulation; and b) be suitable for the application and in accordance with the manufacturer's recommendations.	SN3961-60
Revise Rule 60-508 to read: **60-508 Cable insulation**	SN3961-60

1) ~~Wires~~ Conductors within a cable used for communication circuits requiring primary protectors shall be permitted to have paper, thermoplastic, or other suitable insulation. 2) The cable shall be of a type suitable for the application and in accordance with the manufacturer's recommendations, with a) a metal sheath; b) a composite sheath having a metal shield and overall outer protective rubber or thermoplastic jacket; or c) a protective rubber or thermoplastic jacket without a metal shield.	
Revise Rule 60-510 to read: **60-510 Communication ~~conductors~~ cables on buildings** 1) Communication ~~conductors~~ cables on buildings shall be separated from insulated light or power conductors not in conduit by at least 300 mm unless permanently separated by a continuously and firmly fixed non-metal raceway, in addition to the insulation on the conductors. 2) Where the light or power conductors are bare, the communication ~~conductors~~ cables shall be in the lower position and, in order to provide adequate working space, the clearance given in Subrule 1) shall be increased to a minimum of 600 mm from a conductor operating at 750 V or less. 3) Communication ~~conductors~~ cables subject to accidental contact with light or power conductors operating at voltages exceeding 300 V, and attached exposed to buildings, shall be separated from combustible material by being supported on glass, porcelain, or other suitable insulating material, except that such separation is not required where fuses are omitted as provided for in Rule 60-202 2), or where ~~conductors~~ cables are used to extend circuits to a building from a cable having a grounded metal sheath or shield.	SN3961-60
Revise Rule 60-512 to read: **60-512 Communication ~~conductors~~ cables entering buildings** Where a primary protector is installed inside the building, the communication ~~conductors~~ cables shall enter the building either through a non-combustible, non-absorptive insulating bushing, or through a metal raceway, except that the insulating bushing shall be permitted to be omitted where the entering ~~conductors~~ cables a) are in metal-sheathed or shielded cable; b) pass through masonry; c) are without fuses in the primary protectors as provided for in Rule 60-202 2); or d) are used to extend circuits to a building from a cable having a grounded metal sheath or shield.	SN3961-60
Revise Rule 60-514 to read: **60-514 Communication ~~conductors~~ cables entering mobile homes** Communication ~~conductors~~ cables shall enter the mobile home using the facility provided by Rule 70-106.	SN3961-60
Revise Rule 60-516 to read:	SN3961-60

60-516 Lightning conductors A separation of at least 2 m shall, where practicable, be maintained between ~~conductors~~ cables of communication circuits on buildings and lightning down conductors.	
Revise Rule 60-518 to read: **60-518 Swimming pools** Where ~~wires or~~ cables are installed over or adjacent to swimming pools, they shall be placed in accordance with Rules 68-054 and 68-056.	SN3961-60
Revise Rule 60-600 to read: **60-600 Direct buried systems** Where communication ~~conductors or~~ cables ~~assemblies~~ are direct buried, they shall be suitable for direct burial and ~~the conductor or cable assembly~~ shall a) not be installed in the same vertical plane with other underground systems, except when installed in accordance with Item g); b) maintain a minimum horizontal separation of 300 mm from other underground systems, except when installed in accordance with Item g); c) be not less than 600 mm deep, unless rock bottom is encountered at a lesser depth, in which case a minimum depth of 450 mm shall be permitted, except that for service ~~wires~~ cables under parkways and lawns the depth shall be permitted to be reduced to 450 mm; d) be placed with a layer of sand 75 mm deep, both above and below the cable, if in rocky or stony ground; e) be not less than 900 mm deep under an area that is subject to vehicular traffic, except that the depth shall be permitted to be reduced to 600 mm if mechanical protection is provided that consists of i) treated plank at least 38 mm thick or other suitable material, which shall be placed over the ~~conductor or~~ cable after first backfilling with 75 mm of sand or earth containing no rocks or stones; or ii) a conduit suitable for earth burial placed to facilitate cable replacement and to minimize traffic vibration damage; f) not be placed in a common trench involving random separation with power supply ~~cables or~~ conductors operating at over 750 V, except when the applicable requirements of CAN/CSA-C22.3 No. 7 are adhered to and the power supply cables ~~or conductors~~ operating voltage does not exceed 22 kV line to ground; and g) have a metal sheath when placed in a common trench involving random separation with power supply cables ~~or conductors~~, in which case the communication ~~conductor or~~ cables ~~assembly~~ shall not cross under the supply cables.	SN3961-60
Revise Rule 60-602 to read: **60-602 Underground raceway** Where communication ~~conductors or~~ cables ~~assemblies~~ are placed in underground raceway systems	SN3961-60

a) the raceway, including laterals, shall be separated from those used for the electric power system by not less than 50 mm of concrete or 300 mm of well-tamped earth; b) the raceway shall be located to maintain a minimum depth of 600 mm in areas subject to vehicular traffic and 450 mm in all other areas, except that where rock bottom is encountered at a lesser depth the raceway shall be encased in concrete; c) the raceway shall not terminate in the same maintenance hole, and the ~~conductors or~~ cables ~~assembly~~ shall not be placed in the same maintenance hole, used for the electric power system, unless all requirements of Clause 6 of CAN/CSA-C22.3 No. 7 are adhered to; d) the cables shall not be placed in the same raceway containing electric lighting or power supply cables; e) the cables shall be suitable for wet locations; and f) raceways entering a building and forming part of an underground installation shall be sealed with a suitable compound in such a way that moisture and gas will not enter the building and shall i) enter the building above ground where practicable; or ii) be suitably drained.	
Revise Rule 60-604 to read: **60-604 Underground block distribution** Where the entire street circuit is run underground and the part of the circuit within the block is placed so that it is not liable to contact with electric lighting or power circuits of more than 300 V a) no primary protector is required as specified in Rule 60-200; b) the insulation requirements of Rules 60-506 and 60-508 shall not apply; c) ~~conductors~~ cables need not be placed on insulating supports as specified in Rule 60-510 3); and d) where the ~~conductors~~ cables enter the building, no bushings are required as specified in Rule 60-512.	SN3961-60
Revise Rule 60-706 to read: **60-706 Grounding electrode** (see Appendix B) 1) The grounding conductor shall preferably be connected to a water pipe grounding electrode, as close to the point of entrance as possible. 2) Where the water pipe is not readily available and the grounding conductor of the power consumer's service is connected to the water pipe at the building, the primary protector grounding conductor shall be permitted to be connected to the metal conduit, service equipment enclosures, or to the grounding conductor of the power consumer's service. 3) In the absence of a water pipe, the communication primary protector grounding conductor shall be permitted to be connected to an effectively grounded metal structure, or to a ground rod or pipe driven into permanently damp earth, but a) steam, gas, and hot water pipes and lightning ~~rod~~ down conductors shall not be used as grounding electrodes; and b) a driven rod or pipe used for grounding power circuits shall not be used as a communication primary protector grounding electrode unless it is connected to the grounded conductor of a multi-grounded power neutral.	SN3961-60

4) Where a driven ground rod or pipe is used as a grounding electrode for an electrical communication system, it shall be separated by at least 2 m from any other electrode, including those used for power circuits, radio, lightning rods, or any other purpose, and shall be connected only to that of the power circuits in accordance with Rule 10-104. 5) The normal length of a driven ground rod used as the grounding electrode for a communication station primary protector is 1.5 m, but where the normal rod would not reach moist soil when installed, a rod of suitable additional length shall be used.	
Revise Rule 60-708 to read: **60-708 Grounding electrode connection** The grounding conductor shall be attached to the grounding electrode as required in Rule 10-118 a) directly; or b) to a conductor ~~wire~~ lead permanently connected to the ground rod electrode in a manner specified in CSA C83.	SN3961-60

SECTION 62

Revise Rule 62-102 definition of Heating device to read: SN4691-R

Heating device – any form of electrical heater, including trace heaters, fixtures, water heaters, and panels

Revise Subrules 62-114 2), 3), and 8) to read: SN4621 SN4628-62

62-114 Overcurrent protection and grouping (see Appendix B)

2) For dwelling units ~~In buildings for residential occupancy~~, two or more heating fixtures, trace heater sets, or heating panel sets shall be permitted to be connected to a branch circuit used for space heating, provided that the branch circuit overcurrent devices are rated or set at not more than 30 A.

3) For ~~In~~ other than dwelling units ~~buildings for residential occupancy~~,
a) two or more heating fixtures, trace heater sets, or heating panel sets shall be permitted to be grouped on a branch circuit, and the branch circuit overcurrent devices shall not be set or rated in excess of 60 A unless a deviation has been allowed in accordance with Rule 2-030 to use overcurrent devices having a higher setting or rating; and
b) where three heating fixtures, trace heater sets, or heating panel sets are grouped on a branch circuit in a balanced three-phase arrangement, the branch circuit overcurrent devices shall be permitted to be set or rated in excess of 60 A.

8) Notwithstanding Subrule 7) b), where 125% of the ~~allowable~~ ampacity of an insulated conductor does not correspond to a standard rating of the overcurrent device, the next higher standard rating shall be permitted.

Revise Subrule 62-118 3) to read: SN4814

3) Notwithstanding Subrule 1), where a heating installation in a building for residential occupancy is provided with automatic thermostatic control devices in each room or heated area, the ampacity of service or feeder insulated conductors supplying heating devices ~~only~~ shall be permitted to be based on the following for that portion of the demand:

a) the first 10 kW of connected heating load at 100% demand factor; plus

b) the balance of the connected heating load at 75% demand factor.

Revise Rule 62-124 to read: SN4607

62-124 Installation of series trace heater sets
1) The heating portion of a series trace heater set shall not be shortened, and any trace heater set that does not bear its original markings shall be considered to have

been shortened unless the installer can demonstrate, by instrument measurements, that the characteristics of the series trace heater set have not been altered. 2) Except as provided for in Subrule 3), ~~T~~the entire length of the heating portion, including connections to non-heating leads, shall be installed within the heating area. 3) Where a series trace heater set is designed for installation without non-heating leads, the transition of the trace heater from the heating area shall be through a suitable fitting and junction box assembly.	
Revise Rule 62-130 to read: **62-130 Heater controls installed in proximity to sinks, tubs, or shower stalls** (see Appendix B) 1) A manually operated control for a heating device shall be located not less than 1 m from a sink (a wash basin complete with a drainpipe), tub, or shower stall entrance, this distance being measured horizontally between the control and the sink, tub, or shower stall entrance without piercing a wall, partition, or similar obstacle. 2) Notwithstanding Subrule 1), a manually operated control shall be permitted to be located less than 1 m from a sink (a wash basin complete with a drainpipe) and not less than 500 mm from a tub or shower stall entrance, provided that it is a) protected by a ground fault circuit interrupter of the Class A type; or b) supplied by an extra-low-voltage Class 2 circuit.	**SN4567** **SN4773**
Revise Rule 62-132 to read: **62-132 Heating devices installed in proximity to sinks, tubs, or shower stalls** (see Appendix B) 1) A heating device installed less than 1.8 m above the floor shall not be installed less than 1 m horizontally from a sink (a wash basin complete with a drainpipe), tub, or shower stall entrance, this distance being measured horizontally between the heating device and the sink, tub, or shower stall entrance without piercing a wall, partition, or similar obstacle. 2) Notwithstanding Subrule 1), a heating device shall be permitted to be installed less than 1.8 m above the floor and less than 1 m from a sink (a wash basin complete with a drainpipe), tub, or shower stall entrance, provided that it is protected by a ground fault circuit interrupter of the Class A type.	**SN4567**
Revise Rule 62-216 to read: **62-216 Trace heater sets and heating panel sets ~~in gypsum board and other cementitious~~ for ceiling and wall installations** (see Appendix B) 1) Trace heater sets and heating panel sets shall be installed parallel to the joists, studs, or nailing strips, with clearance not less than 13 mm on each side of the joist, stud, or nailing strip.	**SN4568** **SN4803** **SN4753**

2) After the trace heater sets and heating panel sets are installed, the heater surface facing the space to be heated ~~entire ceiling below the installed trace heater set or heating panel set~~ shall be covered with gypsum board or acceptable cementitious materials not exceeding 13 mm in thickness. 3) Trace heater sets shall be permitted to cross at the ends of the joists and studs, no further than 150 mm from the ends of the joists or studs. 4) Trace heater sets and heating panel sets shall be permitted for installation less than 50 mm from the wall or ceiling finished surface a) for walls, provided they are i) marked “mechanically protected”; ii) installed up to a maximum height of 1.2 m above the finished floor; and iii) protected by a ground fault circuit interrupter of the Class A type; and b) for ceilings, provided they are i) marked “mechanically protected”; or ii) protected by a ground fault circuit interrupter of the Class A type. 5) Notwithstanding Subrule 2), trace heater sets and heating panel sets shall be permitted to be installed without gypsum board or cementitious materials when provided with mechanical protection.	

SECTION 64

Revise Section title to read:

Section 64 — Renewable energy systems, energy production systems, ~~and~~ energy storage systems, and batteries

SN4758

Revise Rule 64-000 to read:

64-000 Scope (see Appendix B)
1) This Section applies to the installation of renewable energy systems, energy production systems, ~~and~~ energy storage systems and batteries ~~except where the voltage and current are limited in accordance with Rule 16-200 1) a) and b)~~.
2) This Section supplements or amends the general requirements of this Code.

SN4758
SN4834

Revise Rule 64-002 entry for "Energy storage system" to read:

Energy storage system — a system capable of storing energy~~,~~ and supplying electrical energy to local power loads, or operating in parallel with a supply authority system or any other power sources.

Field-assembled energy storage system — ~~a system with storage capacity not exceeding 1 kWh (3.6 MJ) that has not been evaluated in accordance with UL 9540~~. Equipment assembled in the field to form an energy storage system.

~~**Non-residential use energy storage system** — an energy storage system that is not marked as being suitable for residential use.~~

Residential use energy storage system — an energy storage system for use in a dwelling unit or residential occupancy that
~~a) is marked as being suitable for residential use; and~~
~~b) conforms to the requirements of UL 9540.~~ has a capacity not exceeding 20 kWh for any single energy storage unit.

Self-contained energy storage system — ~~a system that conforms to the requirements of UL 9540~~ equipment manufactured as a single unit to form an energy storage system.

SN4758
SN4834

Revise Rule 64-060 to read:

64-060 Disconnecting means (see Appendix B)
~~1) A disconnecting means shall be provided to disconnect simultaneously all ungrounded conductors supplied from~~

SN4689

a) a renewable energy system from all other insulated conductors in a building or other structure; and
b) batteries.

2) The disconnecting means referred to in Subrule 1) shall
a) be capable of being energized from both sides;
b) indicate whether it is in the open or closed position;
c) have provision for being locked in the open position;
d) conform to Section 14;
e) be capable of being opened at rated load;
f) be capable of being closed with a fault on the system; and
g) be located within sight of and within 9 m of the equipment or be integral to the equipment.

3) Where the disconnecting means referred to in Subrule 1) is used as the service disconnecting means, it shall be suitable for service entrance equipment.

4) A disconnecting means shall be provided to disconnect equipment such as inverters, batteries, and charge controllers from all conductors of all sources that are not solidly grounded.

5) The disconnecting means required by this Rule shall not be connected in any solidly grounded conductor if operation of that disconnecting means would cause the grounded conductor to be in an ungrounded and energized state.

6) Where the equipment is energized from more than one supply source, the disconnecting means shall comply with Rules 14-414 and 14-700.

7) Output circuits rated 48 V and greater shall have means to disable and isolate them.

8) Disconnecting means shall be provided to disconnect a fuse from all sources of supply if the fuse is energized from both directions, as required by Rule 14-402.

9) Disconnecting means provided on dc circuits shall be marked for the purpose.

10) The disconnecting means shall bear a warning to the effect that the terminals on both the line and load sides could be energized when the disconnecting means is open.

11) The disconnecting means for a hydrokinetic power system shall be permitted to be located beyond the limits defined in Subrule 2), provided that it is capable of being locked in the open position.

12) For installations with combiners, a single disconnecting means capable of being opened at the ampere rating of its photovoltaic output circuit in accordance with Rule 64-206 shall be installed for the photovoltaic output circuit as follows:

a) for photovoltaic combiners equipped with fuses protecting photovoltaic source circuits, the disconnecting means shall be
i) integral with the photovoltaic combiner and interlocked with the door; or
ii) installed within 2 m of the photovoltaic combiner and interlocked with the combiner door; and
b) for photovoltaic combiners equipped with circuit breakers protecting photovoltaic source circuits, the disconnecting means shall be integral with the photovoltaic combiner or located not more than 2 m from each photovoltaic combiner.

13) Notwithstanding Subrules 6) and 12), for installations with recombiners, where the recombiner is installed in excess of 7.5 m from the inverter, a single disconnecting means capable of being opened at the ampere rating of the inverter input circuit in accordance with Rule 64-206 shall be installed for the inverter input circuit as follows:

~~a) for photovoltaic recombiners equipped with fuses protecting photovoltaic output circuits, the disconnecting means shall be~~
~~i) integral with the photovoltaic recombiner and interlocked with the door; or~~
~~ii) installed within 2 m of the photovoltaic recombiner and interlocked with the recombiner door; and~~
~~b) for photovoltaic recombiners equipped with circuit breakers protecting photovoltaic output circuits, the disconnecting means shall be~~
~~i) integral with the photovoltaic recombiner; or~~
~~ii) located not more than 2 m from each photovoltaic recombiner.~~

1) Except as permitted by other Rules of this Section, disconnecting means required by this rule shall:
a) simultaneously disconnect all ungrounded conductors of the circuit;
b) be capable of being opened at rated load;
c) be rated for the voltage and current for which it is to be employed;
d) have an adequate short-circuit current rating for the available fault current;
e) be suitable of being energized from both sides where applicable;
f) indicate whether it is in the open or closed position;
g) have provision for being locked in the open position;
h) bear a warning when there is more than one source of supply that the terminals on both the line and load sides could be energized when the disconnecting means is open; and
i) not be connected in any solidly grounded conductor if operation of that disconnecting means would cause the grounded conductor to be in an ungrounded and energized state.

2) A disconnecting means shall be provided to simultaneously disconnect all ungrounded conductors of a renewable energy system, energy storage system or energy production system, and shall:
a) for an interconnected system, be installed in accordance with Section 84;
b) for a standalone system, be located on the exterior of the building being supplied by the renewable energy system, energy storage system or energy production system, or in a location acceptable to the inspection department; and
c) be readily accessible.

3) A disconnecting means for equipment covered by this Section and that is connected to more than one source of supply shall:
a) be located
i) integral with the equipment;
ii) within sight of and within 3 m of the equipment; or
iii) be lockable in the open position;
b) be permitted to be in accordance with Rule 14-414; and
c) be provided to disconnect a fuse from all sources of supply, as required by Rule 14-402, if the fuse is energized from both directions;

4) The system disconnecting means installed in accordance with Subrule 2) and meeting the requirements of Subrule 3) shall be permitted to serve as an equipment disconnecting means.

5) A disconnecting means shall be installed as close as practicable where ungrounded conductors, covered by this Section, enter a building or structure not

used exclusively for renewable energy systems, energy storage systems, and energy production systems. 6) Disconnecting means for high voltage circuits shall be provided with means for adequate visual isolation in accordance with Section 36.	
Add new Rule 64-061 to read: **64-061 Isolating means** Notwithstanding Rule 64-060 3) an isolating means shall be permitted to be used as the equipment disconnecting means provided a) the circuit for the equipment is rated not more than 30A; and b) a separate disconnecting means is provided elsewhere in the circuit to allow safe operation of the isolation means.	SN4689
Revise Rule 64-104 to read: **64-104 Location of interactive inverters** (See Appendix B) ~~**mounted in locations that are not readily accessible**~~ ~~Interative inverters shall be permitted to be mounted on roofs or other exterior areas that are not readily accessible, provided that~~ ~~a) a dc and ac disconnecting means is provided in accordance with Rule 64-060 2);~~ ~~b) an additional ac disconnecting means for the inverter is provided in accordance with Rule 84-020; and~~ ~~c) a diagram is installed in accordance with Rule 84-030 2).~~ 1) Interactive inverters shall not be located in clothes closets, bathrooms, stairways or in any similar undesirable places. 2) Except as permitted by Subrule 3), interactive inverters shall be readily accessible and installed in accordance with Rules 2-308 and 2-310. 3) Interactive inverters shall be permitted to be mounted on roofs or in other exterior locations that are not readily accessible provided the inverter: a) is an integral part of an ac module or equivalent; or b) has a minimum of 1m working space maintained on the sides of the inverter that provide access to conductor connections or other parts requiring service. 4) Permanent secure footing prescribed by Rule 2-308 shall not be required for interactive inverters installed in accordance with Subrule 3). 5) Where an interactive inverter is installed as permitted by Subrule 3), the location of the inverter shall be indicated on the diagram required by Rule 84-030 2).	SN4411
Revise Rule 64-112 to read: **64-112 Interactive point of connection** (see Appendix B)	SN4759

1) The output of an interactive inverter or power conditioning unit shall be connected to the supply authority system in accordance with Section 84.
2) Except as provided for in Subrule 3), the output of an interactive inverter described in this Section shall be connected to the supply side of the service disconnecting means.
3) The output of an interactive inverter shall be permitted to be connected to the load side of the service disconnecting means of the other source(s) at any ~~distribution~~ equipment on the premises under the provisions of Subrule 4).

4) Where ~~distribution~~ equipment or conductors ~~such as switchboards or panelboards~~ located on the premises ~~is~~ are supplied simultaneously by a primary power source and one or more interactive inverters and where ~~the distribution~~ equipment connected as permitted by Subrule 3) is capable of supplying multiple branch circuits or feeders, or both, provisions for interconnection between the primary power supply source and the interactive inverter(s) shall comply with the following conditions:

a) have each source interconnection ~~shall be~~ made at a dedicated circuit breaker or fusible disconnecting means;

b) ~~each panelboard, busbar, or conductor supplied by the multiple sources in the interactive system shall be provided with~~
~~i) suitable warning signs adjacent to each source disconnecting means to indicate that all of the disconnecting means must be opened to ensure complete de-energization of the equipment in accordance with Rule 14-414;~~
~~ii)~~ have the point of connection positioned at the opposite (load) end from the input feeder ~~location~~ or main circuit location, except as provided in Item g), where the ~~panelboard~~ equipment is rated less than the sum of the ampere ratings of all overcurrent devices in source circuits supplying the ~~panelboard~~ equipment; ~~and~~

c) ~~iii)~~ have a permanent warning label installed at the ~~distribution~~ equipment referred to in item b) to indicate that the overcurrent device shall not be relocated;

d) have suitable warning signs installed on the equipment, and adjacent to each source disconnecting means to indicate that all of the disconnecting means must be opened to ensure complete de-energization of the equipment in accordance with Rule 14-414;

~~c~~e) notwithstanding Section 14, the sum of the ampere ratings of the overcurrent devices ~~in source circuits~~ supplying power to equipment ~~a busbar~~ or conductor shall be permitted to exceed the equipment ~~the busbar~~ or conductor ratings to a maximum of 120% ~~of the rating of the busbar or conductor~~;

~~d~~f) notwithstanding Section 14, for a dwelling unit, the sum of the ampere ratings of the overcurrent devices ~~in source circuits~~ supplying power to ~~a busbar or~~ equipment or conductors shall be permitted to exceed the

equipment ~~the busbar~~ or conductor ratings to a maximum of 125% ~~of the rating of the busbar or conductor~~;

~~e~~g) notwithstanding Items ~~c~~e) and ~~d~~f), the sum of the ampere rating of the overcurrent devices shall be permitted to exceed the rating of the ~~busbar~~ equipment or conductor where;

i) ~~means~~ equipment ~~are~~ is provided to limit the input and output current of the interconnected systems to ensure the ~~busbar~~ equipment or conductor cannot be overloaded; or

ii) the equipment is used to combine ac supply circuits only, and a

A) single output circuit overcurrent device is installed that does not exceed the equipment rating; and

B) label is installed to indicate no other loads are permitted; and

~~f~~h) except as provided for in Subrule 5), the interconnection point shall be made on the line side of all ground fault protection equipment.

5) The interconnection point described in Subrule 4) e) shall be permitted to be made on the load side of ground fault protection equipment, provided that

a) there is ground fault protection for equipment from all ground fault current sources; and

b) ground fault protection devices used with supplies connected to the load side terminals are suitable for back-feeding.

Revise Subrule 64-202 5) to read:

SN4668

64-202 Voltage of solar photovoltaic systems (see Appendix B)

5) Photovoltaic source and output circuits, and equipment connected to or within ~~those~~ these circuits, with maximum voltages ~~higher than 750 V dc but~~ not exceeding 1500 V dc shall not be required to comply with Rules 36-204, 36-208, and 36-214, provided that

a) the installation is serviced only by qualified persons;

b) the part of the installation where high voltage is present ~~exceeding 750 V dc~~ is inaccessible to the public; and

c) enclosures in which photovoltaic source and output circuits exceeding 750 V dc are present are marked with the word “DANGER” followed by the maximum rated photovoltaic circuit voltage of the equipment.

Revise Rule 64-210 5) to read:

SN4587

64-210 Wiring method (see Appendix B)

5) Where the dc arc-fault protection ~~referred to in Rule 64-216~~ is not ~~located at~~ an integral part of the module, photovoltaic source and output circuit insulated conductors and cables installed on or above a building ~~and installed in accordance with Subrules 1), 2), and 3)~~ shall be provided with mechanical protection in the form of an enclosed raceway or other acceptable material to protect against damage from rodents.

Revise Subrules 64-214 1) and 2) to read: **64-214 Overcurrent protection for apparatus and conductors** (see Appendix B) 1) Notwithstanding Rules 64-058 1) and 64-066 1) a), individual overcurrent protection devices shall not be required where the sum of the available short-circuit currents from all photovoltaic source circuits connected to the same power conditioning unit is not greater than the ~~rated~~ ampacity of the apparatus or conductors. 2) Where overcurrent protection is required by Rule 64-058 1) for a photovoltaic source circuit, each photovoltaic source circuit shall be protected by an individual overcurrent device rated or set at not more than the ~~allowable~~ ampacity of the conductors of the photovoltaic source circuit or the maximum overcurrent protection indicated on the photovoltaic module nameplate, whichever is less.	SN4628-64
Revise Rule 64-218 to read: **64-218 Photovoltaic rapid shutdown** (see Appendix B) 1) Photovoltaic rapid shutdown shall be provided for a photovoltaic system installed on or in buildings where the photovoltaic source or output circuit insulated conductors or cables installed on or in buildings are more than 1 m from a photovoltaic array. 2) Notwithstanding Subrule 1), photovoltaic rapid shutdown shall not be required for ground mounted photovoltaic system circuits that enter a building whose sole purpose is to house photovoltaic system equipment. 3) Photovoltaic rapid shutdown shall limit photovoltaic source or output circuits located more than 1 m from the photovoltaic array to not more than 30 V within 30 s of rapid shutdown initiation. 4) A device used to initiate photovoltaic rapid shutdown shall be readily accessible and located a) for single dwelling units, at the supply authority meter location; b) for other than single dwelling units, at the consumer's service equipment or supply authority meter location, and, where practicable i) at a permanent access to a building roof where an array(s) is installed; or ii) within sight and within 9 m of the array(s); and c) for a stand-alone system, in accordance with Items b) i) and ii). 5) Rapid shutdown of a photovoltaic system shall be permitted to be automatically initiated by a building fire alarm system provided a) the fire alarm system is installed in a building in accordance with the National Building Code of Canada; and b) a label is installed at the fire alarm annunciator panel and at the fire alarm control panel indicating that rapid shutdown of the photovoltaic system is initiated by the fire alarm system. 6 ~~5~~) The location of the device used to initiate photovoltaic rapid shutdown shall be shown on the diagram required in Rule 84-030 2).	SN4561

7 ~~6~~) A label indicating that the photovoltaic system is equipped with photovoltaic rapid shutdown shall be installed at the supply authority meter location and at the consumer's service equipment location.	
Add new Rule 64-221 to read: **64-221 Disconnecting means for combiners and recombiners** 1) Notwithstanding Rule 64-060 3), for installations with combiners, a single disconnecting means capable of being opened at the ampere rating of its photovoltaic output circuit in accordance with Rule 64-206 shall be installed for the photovoltaic output circuit as follows: a) for photovoltaic combiners equipped with fuses protecting photovoltaic source circuits, the disconnecting means shall be i) integral with the photovoltaic combiner and interlocked with the door; or ii) installed within 2 m of the photovoltaic combiner and interlocked with the combiner door; and b) for photovoltaic combiners equipped with circuit breakers protecting photovoltaic source circuits, the disconnecting means shall be integral with the photovoltaic combiner or located within 2 m of each photovoltaic combiner. 2) Notwithstanding Rule 64-060 3), for installations with recombiners, where the recombiner is installed in excess of 7.5 m from the inverter, a single disconnecting means capable of being opened at the ampere rating of the inverter input circuit in accordance with Rule 64-206 shall be installed for the inverter input circuit as follows: a) for photovoltaic recombiners equipped with fuses protecting photovoltaic output circuits, the disconnecting means shall be i) integral with the photovoltaic recombiner and interlocked with the door; or ii) installed within 2 m of the photovoltaic recombiner and interlocked with the recombiner door; and b) for photovoltaic recombiners equipped with circuit breakers protecting photovoltaic output circuits, the disconnecting means shall be i) integral with the photovoltaic recombiner; or ii) located within 2 m of each photovoltaic recombiner.	SN4689
Revise Subrules 64-308 1) and 3) to read: **64-308 Overcurrent protection for apparatus and insulated conductors** (see Appendix B) 1) Notwithstanding Rules 64-058 1) and 64-066 1) a), individual overcurrent protection devices shall not be required where the available steady-state short-circuit current is not greater than the ~~rated~~ ampacity of the apparatus or insulated conductor. 3) Notwithstanding Subrule 2), an overcurrent device shall not be required for insulated circuit conductors sized in accordance with this Rule and when the maximum currents from all sources do not exceed the ~~allowable~~ ampacity of the insulated conductors.	SN4628-64
Revise Subrule 64-506 1) to read:	SN4628-64

64-506 Overcurrent protection for apparatus and insulated conductors 1) Notwithstanding Rules 64-058 1) and 64-066 1) a), individual overcurrent protection devices shall not be required where the available short-circuit current is not greater than the ~~rated~~ ampacity of the equipment or insulated conductor.	
Revise Subrule 64-606 1) to read: **64-606 Overcurrent protection for apparatus and insulated conductors** 1) Notwithstanding Rules 64-058 1) and 64-066 1) a), individual overcurrent protection devices shall not be required where the available steady-state short-circuit current is not greater than the ~~rated~~ ampacity of the apparatus or insulated conductor.	**SN4628-64**
Add new Subrule 64-610 1) to read: **64-610 Disconnecting means** (see Appendix B) 1) The disconnecting means for a hydrokinetic power system shall be permitted to be located beyond the limits defined in Rule 64-060 3), provided that it is capable of being locked in the open position. 2) The disconnecting means installed in accordance with Rules 64-060 and 84-020 shall be labelled in a conspicuous, legible, and permanent manner, identifying it as the hydrokinetic power system generator disconnecting means.	**SN4689**
Revise Item 64-710 c) to read: **64-710 Location of fuel cells** (see Appendix B) A fuel cell system(s) and associated equipment, components, and controls shall meet the following requirements: c) stationary fuel cell systems shall not be located in: ~~clothes closets, bathrooms, stairways,~~ i) spaces with high ambient ~~rooms~~ temperatures; ii) storage areas for flammable, combustible, or hazardous materials; iii) hazardous, corrosive or wet locations, unless suitably rated; or iv) any similar undesirable places; and	**SN4610**
Revise Rule 64-800 to read: **64-800 Scope** ~~(see Appendix B)~~ 1) Batteries shall be installed in accordance with the provisions of Rules 64-80~~0~~2 to 64-814, except as otherwise required by the manufacturer. 2) Electrical equipment associated with batteries shall be installed in accordance with the provisions of Rules 64-816 to 64-820 ~~apply to the installation of electrical equipment, other than batteries, in a battery room.~~	**SN4758**
Revise Rule 64-802 to read:	**SN4834**

64-802 Ventilation of battery rooms or areas (see Appendix B) 1) Rooms or areas that contain batteries that vent ~~hydrogen~~ gasses to the atmosphere under normal operation shall be adequately ventilated. 2) Lead-acid batteries shall not be subjected to ambient temperatures greater than 45 °C or less than the freezing point of the electrolyte.	
Revise Rule 64-810 to read: **64-810 Bonding of battery installations** Bonding of the non-current-carrying conductive parts of battery installations shall be in accordance with Section 10.	SN4834
Revise Rule 64-812 to read **64-812 Battery interconnections** (see Appendix B) 1) Insulated conductors and cables used to terminate to battery terminals shall be of ~~a fine strand~~ the flexible fine strand type. 2) The connection method between batteries shall be permitted to be insulated or bare busbars. 3) Flexible metal raceways shall not be permitted for battery interconnections. 4) Conductors shall have sufficient ampacity for the maximum load. 5) Insulated flexible conductor and cable terminations to a battery terminal or associated equipment, as well as interconnections between battery strings, shall be secured to minimize the movement of cables due to short-circuit forces and at intervals of not more than 1.5 m throughout the run.	SN4626
Revise Rule 64-814 to read: **64-814 Wiring from batteries to other equipment** 1) Conductors for connection from battery terminals to other equipment shall a) be installed in accordance with Rule 64-812; b) be sized in accordance with the load but not less than 2/0 AWG; and c) extend not less than 300 mm from battery terminals. 2) Conductors that extend more than 3 m from battery terminals shall be a) installed ~~in a wiring method~~ in accordance with Section 12; and b) protected in accordance with Rule 14-100 ~~b).~~ 3) For batteries containing corrosive electrolyte, insulated conductors between batteries and other equipment shall be permitted to be installed in a raceway, provided the raceway a) is of corrosion-resistant material or other materials suitably protected from corrosion; b) is tightly sealed with sealing compound, rubber tape, or other material to resist the entrance of electrolyte by spray or creeping; c) has an insulating bushing where the conductor emerges for connection to the battery, or be a non-metallic raceway with a suitable fitting; and	SN4834

d) is located ~~at least~~ a minimum 300 mm above the highest battery terminal ~~to reduce electrolyte creepage or spillage entering the raceway.~~ 4) Flexible metal raceways shall not be permitted to connect batteries to other equipment. 5) For batteries containing corrosive electrolyte, cable shall be permitted to be installed for connection to other equipment provided a) the cable is of corrosion-resistant material or other materials suitably protected from corrosion; b) the end of the cable is tightly sealed with sealing compound, rubber tape, or other material to resist the entrance of electrolyte by spray or creeping; c) the conductor issues from a cable through an insulating bushing or inner jacket where a metal armoured cable is used; d) at least 300 mm of free conductor extends from the cable where connected to a battery terminal; and e) the conductor issues from a cable ~~exit is located at least~~ a minimum 300 mm above the highest battery terminal ~~to reduce electrolyte creepage or spillage entering the raceway.~~	
Revise Rule 64-816 to read: **64-816 Wiring methods and installation of equipment in battery rooms** The installation of wiring and equipment in a battery room, which is not part of the wiring of the batteries, shall be in accordance with the requirements for a~~n ordinary~~ dry location.	SN4834
Revise Rule 64-818 to read: **64-818 Charge control** (see Appendix B) 1) Equipment shall be provided to control the charging process of the batteries. 2) Notwithstanding Subrule 1), charge controller equipment shall not be required where the ~~design of the renewable energy source circuit is the only supply and is matched to the voltage rating and charge current requirements of the interconnected battery cells, and the maximum charging current multiplied by 1 h is less than 3% of the rated battery capacity.~~ a) only battery charging circuit is a renewable energy source; b) renewable energy system source and output circuits are not capable of exceeding the voltage rating and charge current requirements of the interconnected battery cells; and c) maximum charging current multiplied by 1 h is less than 3% of the rated battery capacity. 3) All adjusting means for control of the charging process shall be accessible only to qualified persons.	SN4834
Revise Subsection heading for Energy storage systems to read: **Energy storage systems (general)**	SN4758

Revise Rule 64-902 to read: **64-902 Marking** (see Appendix B) 1) In addition to the requirements in Rule 64-074, a plaque or directory shall be provided, in a location acceptable to the inspection department, to indicate the building or structure contains an energy storage system, including ~~and~~ the location of all energy storage system disconnecting means. 2) Energy storage systems with a storage capacity of 1 kWh or less, ~~Field-assembled energy storage systems~~ shall include permanent markings, as applicable to the system, in accordance with Rule 2-100 at a readily accessible location at the disconnecting means for the energy storage system. 3) Energy storage systems meeting the requirements of Rule 2-024 shall be deemed to meet the requirements of Subrule 2).	SN4758 SN4834
Revise Rule 64-904 to read: **64-904 Voltage of energy storage systems** ~~1) Batteries forming part of a field-assembled energy storage system installed in or on a dwelling unit shall be connected so as not to exceed 50 V dc.~~ ~~2)~~ 1) ~~Self-contained E~~energy storage systems installed in accordance with Rule 64-1100 ~~output circuits for installations in or on a dwelling unit~~ shall ~~be permitted to have a voltage not exceeding 600 V, provided that all energized parts in the energy storage system circuits over 150 volts-to-ground are accessible only to qualified persons.~~ a) not exceed 600 V; and b) have all energized parts over 150 volts-to-ground accessible only to qualified persons. ~~3)~~ 2) The dc portion of energy storage systems with maximum voltages higher than 750 V dc but not exceeding 1500 V dc shall not be required to comply with Rules 36-204, 36-208, and 36-214 provided that a) the installation is serviced only by qualified persons; b) the part of the installation exceeding 750 V dc is inaccessible to the public; and c) enclosures in which circuits exceeding 750 V dc are present are marked with the word “DANGER” followed by the maximum rated circuit voltage of the equipment.	SN4758
Revise Rule 64-910 to read: **64-910 Installation~~s~~ and maintenance** 1) ~~Self-contained e~~Energy storage system~~s~~ equipment shall be installed and maintained in accordance with the manufacturer’s ~~installation~~ instructions. 2) Mechanical protection shall be provided where an energy storage system is subject to the risk of vehicular impact or other physical damage.	SN4758
Revise Rule 64-914 to read:	SN4758 SN4834

64-914 Disconnecting means for energy storage systems ~~(see Appendix B)~~
1) Disconnecting means for energy storage systems shall be in accordance with Subrules 2) to 8) ~~9)~~.

2) ~~A disconnecting means shall be provided to disconnect simultaneously all ungrounded conductors supplied from an energy storage system.~~ Where an energy storage system does not include an integral output disconnecting means, a disconnecting means shall be installed in accordance with Subrule 3).

3) The disconnecting means ~~for a field-assembled energy storage system~~ referenced in Subrule 2) shall
a) be capable of being energized from both sides;
b) indicate whether it is in the open or closed position;
c) have provision for being locked in the open position;
d) be in accordance with Section 14;
e) be capable of being opened at rated load;
f) be capable of being closed with a fault on the system; and
g) be located within sight of and within 9 m of the energy storage system equipment ~~or be integral to the equipment~~.

~~4) Where a self-contained energy storage system does not include an integral output disconnecting means, a disconnecting means shall be installed in accordance with Subrule 3).~~

~~5)~~ 4) The disconnecting means required by this Rule shall not be connected in any grounded conductor if operation of that disconnecting means would cause the grounded conductor to be in an ungrounded and energized state.

~~6)~~ 5) The disconnecting means shall comply with Rules 14-414 and 14-700.

~~7)~~ 6) As required by Rule 14-402, disconnecting means shall be provided to disconnect a fuse from all sources of supply if the fuse is energized from both directions, unless the fuse can be readily and safely de-energized.

~~8)~~ 7) Disconnecting means provided on dc circuits shall be rated for dc applications.

~~9)~~ 8) ~~The disconnecting means shall bear a~~ A permanent warning label shall be installed on the disconnecting means to indicate ~~the effect~~ that the terminals on both the line and load sides could be energized when the disconnecting means is in the open position.

Revise Rule 64-916 to read:

SN4834

64-916 Bonding (see Appendix B)
1) Non-current-carrying conductive parts of electrical equipment shall be bonded in accordance with Section 10.
~~2) In addition to the bonding requirements of Section 10, metal objects such as battery racking, cable management systems, structures, and enclosures housing~~

~~field-assembled energy storage equipment, etc., shall be made electrically continuous and bonded to non-current-carrying conductive parts of electrical equipment.~~ ~~3~~2) Bonding conductors installed in circuits described in Subrule 64-912 2) shall be sized in accordance with Section 10 based on the largest overcurrent device protecting ~~the~~ circuit conductors from each source of supply.	
Delete Rule 64-918: **~~64-918 Location and separation requirements for energy storage systems~~** ~~(see Appendix B)~~ ~~1) Self-contained energy storage systems shall be installed in accordance with the manufacturer's installation instructions.~~ ~~2) Energy storage systems utilizing batteries shall not be installed where the floor is~~ ~~a) higher than 23 m above grade; or~~ ~~b) below grade.~~ ~~3) Notwithstanding Subrule 2), energy storage systems utilizing batteries shall be permitted to be installed in an electrical equipment vault.~~ ~~4) Energy storage systems with a storage capacity greater than 1kWh or utilizing lithium-ion batteries shall not be installed in~~ ~~a) dwelling units; and~~ ~~b) any living space of a residential occupancy including clothes closets, storage rooms, bathrooms, stairways, or any other similar undesirable places.~~ ~~5) Energy storage systems installed outside of a dwelling unit shall not be installed within 1 m of any window, door, or ventilation opening.~~ ~~6) Notwithstanding Subrule 4), residential use energy storage systems shall be permitted to be installed in garages of dwelling units, provided that the~~ ~~a) storage capacity of any single energy storage system does not exceed 20 kWh; or~~ ~~b) aggregate storage capacity of multiple energy storage systems does not exceed 40 kWh and the energy storage systems are spaced not less than 1 m apart.~~ ~~7) Energy storage systems~~ ~~a) directly mounted to a building surface shall have~~ ~~i) for a single energy storage system, a storage capacity not exceeding 20 kWh; and~~ ~~ii) for multiple energy storage systems, a spacing of not less than 1 m apart and an aggregate storage capacity not exceeding 40 kWh; or~~ ~~b) installed in or on a detached garage, storage building, or free-standing structure, shall have~~ ~~i) for a single energy storage system, a storage capacity not exceeding 20 kWh; and~~ ~~ii) for multiple energy storage systems, a spacing of not less than 1 m from a dwelling unit and an aggregate storage capacity not exceeding 80 kWh.~~ ~~8) Energy storage systems marked with "THIS EQUIPMENT MEETS THE CELL LEVEL PERFORMANCE CRITERIA OF UL 9540A" shall be permitted to exceed the limitations of Subrules 6) and 7).~~ ~~9) The location of energy storage systems shall not impede egress from a building and shall not be located closer than 3 m from~~ ~~a) a path of egress; and~~ ~~b) entrance or exit doors.~~ ~~10) Energy storage systems shall be installed in accordance with Rule 2-328.~~	~~SN4758~~

Delete Rule 64-920: ~~**64-920 Battery installations**~~ ~~1) Batteries installed as part of self-contained energy storage systems shall be installed in accordance with the manufacturer's installation instructions.~~ ~~2) Batteries installed as part of field-assembled energy storage systems shall be installed in accordance with Rules 64-800 to 64-820.~~	SN4758
Renumber Rule 64-922 to read: **64-918~~22~~ Diversion load controllers** A diversion load controller used as the primary means of regulating the stored kinetic energy of an energy storage system shall not use the supply authority system as a diversion load.	SN4758
Revise Rule 64-924 to read: **64-920~~24~~Ampere rating of energy storage system circuits** 1) The ~~maximum~~ current rating for energy storage system circuits shall be ~~determined~~ as follows: a) the rated current indicated on the energy storage system nameplate(s), ~~a~~b) for an inverter output circuit, the inverter continuous output current rating; ~~b~~c) for an inverter input circuit, the continuous inverter input current rating when the inverter is producing rated power at the lowest input voltage; ~~c~~d) for the output of a dc-to-dc converter, the dc-to-dc converter continuous output current rating; and ~~d~~e) for a charge controller, the input current rating while charging; ~~and~~ ~~e) for a self-contained system, the rated current indicated on the energy storage system nameplate(s).~~ 2) Where interconnected with the supply authority system, the current rating referred to in Subrule 1) shall be considered a continuous load for the application of Rule 8-104. 3) Where the output supplies dedicated loads or other power systems, the continuous load shall be determined in accordance with Rule 8-104 3).	SN4758
Revise Rule 64-926 to read: **64-922~~26~~ System charge control** (see Appendix B) 1) Equipment shall be provided to control the charging process of an energy storage system. 2) Adjustable settings for control of the charging process shall be accessible only to qualified personnel. 3) A diversion charge controller installed as part of an energy storage system shall be in accordance with the requirements of Rule 64-820. 4) A self-contained energy storage system shall be deemed to meet the requirements of this Rule.	SN4758

Revise Rule 64-928 to read: **64-9~~28~~24~~28~~Working space and accessibility to energized parts (See Appendix B)** ~~1) Self-contained energy storage systems shall be~~ ~~a) installed in accordance with the manufacturer's installation instructions; and~~ ~~b) permitted to have working space within the energy storage system equipment in accordance with the manufacturer's recommendation.~~ 1) Notwithstanding Rule 2-308, 2-310 and 2-312, working space requirements within energy storage systems complying with Rule 2-024 1) shall be permitted to be in accordance with the manufacturers instructions. 2) ~~Field-assembled e~~Energy storage systems installed in dwelling units shall have no exposed energized parts. ~~3) Energy storage systems shall be installed in accordance with Rules 2-202, 2-308, 2-310, and 2-312.~~	SN4758
Add new Rule 64-926 to read: **64-926 Separation from building exposures and Egress from buildings** (See Appendix B and G) 1) Batteries forming part of an energy storage system located outdoors shall not be located within a) 3 m of a means of egress; and b) 1.5 m of windows, ventilation openings, any other operable openings, or doors other than vehicular access doors. 2) Notwithstanding Subrule 1) energy storage systems evaluated to ANSI/CAN/UL 9540A shall be permitted to be installed in accordance with the manufacturer's installation instructions, including separation distances from means of egress and building openings.	SN4758 SN4835
Add new Subsection to read: **Energy storage systems utilizing batteries (General)** **64-1000 Scope** Rules 64-1002 to 64-1004 apply to the installation of energy storage systems utilizing batteries with a storage capacity exceeding 1 kWh. **64-1002 Installation requirements of energy storage systems** 1) Energy storage systems utilizing batteries shall comply with Rule 2-024 1), and be installed in accordance with the manufacturer's instructions. 2) Except where installed in an electrical equipment vault, energy storage systems utilizing batteries shall not be installed where the floor is a) higher than 23 m above grade; or b) below the lowest level of egress from the occupancy.	SN4758 SN4834

3) Energy storage systems shall be installed in accordance with Rule 2-328 **64-1004 Installation requirements of batteries forming part of an energy storage system** 1) Batteries forming part of an energy storage system shall a) be installed in accordance with the manufacturer's installation instructions where provided; or b) be installed in accordance with Rules 64-800 to 64-820. 2) Notwithstanding Rule 64-804 3), where indicated in the manufacturers installation instructions, batteries forming part of energy storage system installed in a dwelling unit, shall be permitted to be connected to exceed 50 V dc.	
Add new Subsection to read: **Installation of energy storage systems at residential occupancies** **64-1100 Location and separation requirements (See Appendix B)** 1) Except as required by Subrule 2), energy storage systems installed at a dwelling unit or building of residential occupancy shall be suitable for residential use, and be located. a) in an attached garage; b) in or on an associated detached garage, or other free standing structure, c) on the exterior surface of the building; d) in a dedicated room or utility room having a door equipped with a self-closing device and enclosed with a minimum construction of i) ceilings and walls finished with gypsum board; and ii) floors finished with lumber sheathing; or e) in other locations where permitted 2) Where an energy storage system is installed in a building of residential occupancy containing multiple dwelling units, the construction required in Subrule 64-1100 1) d) shall have a fire resistance rating of not less than 1 hour. 3) Notwithstanding Rule 64-1002 2) b), energy storage systems in a dwelling unit or residential occupancy shall be permitted to be installed below the lowest level of egress when located in accordance with Subrule 1) d) or e). 4) Batteries forming part of an energy storage system installed in accordance with Subrule 2) shall not be located directly beneath an exit required by the National Building Code of Canada. 5) Except as required by Subrule 6), energy storage systems installed in accordance with Subrule 1), shall a) have a storage capacity not exceeding 20 kWh for any single energy storage system, or b) where multiple energy storage systems are installed, have an aggregate capacity not exceeding 80 kWh.	SN4758 SN4835

6) Energy storage systems installed in accordance with Subrule 1) d) shall a) have a storage capacity not exceeding 20 kWh for any single energy storage system, or b) where multiple energy storage systems are installed, have an aggregate capacity not exceeding 40 kWh. 7) Notwithstanding Rule 64-926 1), batteries forming part of an energy storage system installed indoors or outdoors shall not be located within 1 m of any window or door, other than a vehicular access door, of a dwelling unit or residential occupancy. 8) Where multiple energy storage systems are installed, batteries forming part of each system shall be spaced not less than 1 m apart from each other. 9) Notwithstanding Subrules 1) through 8), energy storage systems evaluated to ANSI/CAN/UL9540A shall be permitted to be installed in accordance with the manufacturer's installation instructions. 10) Energy storage systems shall not be installed in sleeping areas, or rooms opening directly into sleeping areas. 11) Where an energy storage system is installed in accordance with Subrule 1) d), a smoke alarm or smoke detector shall be installed, a) in the room where the energy storage system is located, and, b) be installed in accordance with Section 32.	

SECTION 66

Revise Rule 66-400 to read: SN4140

66-400 Wiring methods (see Appendix B)

1) Except as permitted in Rules 66-450 to 66-458, wiring methods shall be in accordance with Section 12 and suitable for the condition of use.

2) Cords, cables, conduits, and other electrical equipment shall be protected from physical damage.

3) Cords shall be of the hard-usage type, in good repair, and

a) provided with strain relief where they enter into enclosures and plug-in connectors;

b) if exposed to the weather, be of a type suitable for outdoor use; and

c) where plug-in connections are used,

i) have connectors and receptacles that are rated in amperes and designed so that differently rated devices cannot be connected together;

ii) have the female connector attached to the load end of the cord; ~~and~~

iii) be polarized if an ac multi-conductor connector is used~~.~~; and

iv) be protected by a ground fault circuit interrupter of the Class A type, where utilized outdoors or in damp locations at itinerant midways, carnivals, fairs, and festivals and connected to a receptacle of CSA configuration 5-15R or 5-20R.

4) Notwithstanding Subrule 3) c) ii), for single-conductor cables, the grounded conductor and the bonding conductor shall be permitted to have the female half connected to the supply end of the cord.

5) With the exception of amusement parks, midways, carnivals, home shows, and tent meetings, receptacles rated 15 A, conforming to CSA configuration 5-15R rated 120 V, hospital grade, and protected by a fuse or circuit breaker rated not greater than 20 A, shall be permitted for temporary lighting installations within the Scope of this Section, where the loads are of an intermittent nature.

6) Temporary wiring for portable stage equipment shall be in accordance with Rules 44-350, 44-352, and 44-356.

Revise Rule 66-404 to read: SN4140

66-404 Receptacles

Receptacles having CSA configuration 5-15R or 5-20R installed ~~in~~ for itinerant midways, carnivals, fairs, and festivals and intended to supply loads in outdoor or damp locations shall be protected by ground fault circuit interrupters of the Class A type.	
Revise Rule 66-456 to read: **66-456 Single-conductor cable connections** (see Appendix B) 1) Connections to single-conductor cables shall not be accessible to unqualified persons. 2) Plug-in connectors for single-conductor cables shall a) be of a locking type; b) incorporate a mechanical interlock to prevent wrong connections or be colour-coded in accordance with Subrule 3); ~~and~~ c) be fully engaged when connected; and d ~~c~~) have all connections that are not in use covered with a seal or cap that is acceptable. 3) When colour coding is required by Subrule 2) b) a) bonding connectors shall be identified with green colouring; b) neutral connectors shall be identified with white colouring; c) phase connectors shall be identified with i) red, black, blue colouring; or ii) orange, brown, yellow colouring which shall be permitted only on systems greater than 150 volts to ground: d) circuits shall be identified with i) any phase colour for 2 wire phase to neutral circuits; ii) any two phase colours for single phase circuits on single or 3 phase systems; and iii) any two phase colours for phase to phase individual loads; e) colour coding shall be accomplished by i) manufactured coloured connectors; or ii) connectors that are tape coloured for their entire length except for 30mm from the mating end.	SN4068 SN4180

4) Where single conductor cables utilizing plug-in connectors are connected to circuits with voltages greater than 150 volts to ground the circuit voltage shall be identified with a label that is a) securely attached to each connector or connection point; and b) resistant to damage from the environment in which it is placed. 5 ~~3~~) Single-conductor cables shall not be connected in parallel except as a means of reducing voltage drop, and cables so connected shall have overcurrent protection sized to protect the cable having the smallest ampacity as though it were used alone. 6 ~~4~~) Tapping tees, paralleling tees, or rigid turnarounds shall a) not be directly connected to any single-pin plug or connector rigidly housed or mounted in a multiple-connection device; b) not be directly connected to a panel mount inlet or outlet or to a multiple-connection device with a cable less than 2 m in length; and c) be arranged so that no mechanical strain is imposed on the connection. 7 ~~5~~) In-line single-conductor cable connections forming part of a circuit of more than 150 volts-to-ground shall be mechanically protected by enclosing the connector(s) in a lockable, non-conductive box or similar enclosure. 8 ~~6~~) The lockable enclosure referred to in Subrule 7) ~~5)~~ shall a) be labelled on the outside, in a conspicuous, legible, and permanent manner, identifying the supply voltage of the circuit; and b) be acceptable. ~~7) No more than one tapping or parallel tee per single-conductor cable shall be used at any one point in a power distribution system.~~ ~~8) Any distribution splitting or combining devices requiring more than two load connections per single-conductor cable shall use a single multiple-connection device at that point.~~	

SECTION 68

Revise Rule 68-050 by adding new item and reference to Appendix B to read: SN4816

68-050 Special terminology (see Appendix B)

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Conductive pool shell – a rigid encasing structure that is made of metal, concrete, or other conductive material and that contains the pool water.

“

Revise Rule 68-054 to read: SN4730-68

68-054 Overhead wiring (see Appendix B)

1) No pool shall be placed under or near overhead wiring, and no overhead wiring shall be placed over or near a pool, unless the installation complies with the requirements of this Rule.

2) There shall not be any overhead wiring above the pool and other elevated surfaces associated with the pool, such as a diving structure, slide, swings, observation stand, tower, or platform, or above the adjacent area extending 5.0 m horizontally from the pool edge, except as permitted by Subrules 3) and 4).

3) Communication cables, communication antenna distribution cables, and neutral supported cables not exceeding ~~750~~ 1000 V shall be permitted to be located over a pool and other elevated surfaces associated with the pool, or above the adjacent area extending horizontally from the pool edge, provided that there is a clearance of at least 5.0 m measured from the outer edge of the pool or from other elevated surfaces associated with the pool.

4) Conductors other than the cables covered by Subrule 3) and operating at not more than 50 kV phase-to-phase shall be permitted to be located over a pool and other elevated surfaces associated with the pool, or above the adjacent area extending horizontally from the pool edge, provided that there is a clearance of at least 7.5 m measured from the outer edge of the pool or from other elevated surfaces associated with the pool.

Revise Rule 68-058 to read: SN4816

68-058 Pool Bonding (see Appendix B)

1) The metal parts of the pool and of other non-electrical equipment associated with the pool, such as piping, pool reinforcing steel, ladders, diving board supports, and ~~fences~~ conductive infrastructure within 1.5 m of the pool, shall be bonded together and to non-current-carrying metal parts of electrical equipment such as decorative-type pool luminaires and lighting equipment not located in a forming shell, forming shells, metal screens of shields for underwater speakers, conduit, junction boxes, and the like by a copper bonding conductor.

~~2) Pool reinforcing steel shall be bonded with a minimum of four connections equally spaced around the perimeter.~~

~~3) Notwithstanding Subrule 2), where reinforcing steel is encapsulated with a non-conductive compound, provisions shall be made for an alternative means to eliminate voltage gradients that would otherwise be provided by unencapsulated, bonded reinforcing steel.~~

2) Bonding conductors for pools shall be of copper and not smaller than No. 6 AWG f

3) Pool deck and other perimeter surfaces shall be bonded by means of

a) bonding the unencapsulated, conductive structural reinforcing steel with a minimum of four connections equally spaced around the perimeter;

b) a copper grid constructed

i) of minimum No. 6 AWG bare copper conductors bonded to each other using suitable connectors at all points of crossing;

ii) of conductors in an arranged network of a 300 mm by 300 mm uniformly spaced grid pattern with a tolerance of 100mm; and

iii) such that the grid extends horizontally, 1.5 m from the outside of the pool shell, below grade at a depth of 100 mm to 150 mm to form a continuous 1.5 wide shield around the pool circumference; or

c) for spa or hot tub installations, a copper ring;

i) consisting of a bare copper conductor of a minimum No. 6 AWG; and

ii) constructed such that securement around the pool is made 450 mm to 600 mm from the outer contour of the pool shell at a depth of 100mm to 150 mm below grade.

4) Conductive pool shells are required to be bonded by means of

a) bonding the unencapsulated, conductive structural reinforcing steel with a minimum of four connections equally spaced around the perimeter;

b) a continuous metal pool shell made up of individual panels securely bolted or welded together shall be bonded in at least one location; or

c) a copper grid constructed

i) of minimum No. 6 AWG bare copper conductors bonded to each other at all points of crossing;

ii) of conductors in an arranged network of a 300 mm by 300 mm uniformly spaced grid pattern with a tolerance of 100mm; and

iii) such that securement around and under the pool is made around and under the pool no more than 150 mm from the outer contour of the pool shell.

~~4) Bonding conductors for pools shall be~~

~~a) not smaller than No. 6 AWG for permanently installed pools and for all in-ground pools; or~~
~~b) as required by Table 16 for all other pools.~~

5) Metal sheaths and raceways shall not be relied upon as the bonding medium, and a separate copper bonding conductor shall be used, except that a metal conduit between a forming shell and its associated junction box shall be permitted to be used as the bonding medium, provided that the forming shell and junction box are installed in the same structural section.

6) The bonding conductor ~~from the junction box referred to in Rule 68-060~~ shall be run to the panelboard supplying pool electrical equipment and, if smaller than No. 6 AWG, shall be installed and mechanically protected in the same manner as the insulated circuit conductors or cable.

~~7) The bonding conductor specified in Subrule 4) shall be of copper and not smaller than that required by Table 16 except that the bonding conductor for an in-ground pool shall be not smaller than No. 6 AWG.~~

~~8) A continuous metal pool shell made up of individual panels securely bolted or welded together shall be bonded in at least one location.~~

7) Where none of the bonded parts referred to in Subrule 1) are in direct contact with the pool water a corrosion-resistant conductive surface that exposes not less than 58 cm² of surface area to the pool water at all times shall be installed.

8) The corrosion-resistant conductive surface described in Subrule 7) shall
a) be located where it is not exposed to physical damage or dislodgment during normal pool use; and
b) be connected to any of the pool infrastructure described in Subrule 3) by a No. 6 AWG copper bonding conductor.

Add new rule 68-072 to read:

SN3864

68-072 Disconnecting means for pool pumps, spas, and hot tubs

A disconnecting means rated to interrupt the connected load shall be provided for each permanently connected pool pump, spa, and hot tub, and shall be

a) located not closer than 1.5 m to the inside walls of a pool, spa and hot tub unless behind a permanent barrier that will prevent the occupant of the pool, spa, or hot tub from contacting the device;

b) located outside when the equipment is located outside at a dwelling unit;

c) readily accessible; and

d) lockable when not within sight of the pool pump, spa, and hot tub.

SECTION 86

Revise Rule 86-102 to read:

SN4477

86-102 Voltages in electric vehicle supply equipment installations

~~The nominal ac system voltages used to supply equipment covered in this Section shall not exceed 750 V.~~

1) The nominal ac system voltages used to supply equipment covered in this section shall not exceed 1000 V.

2) The maximum voltage in electric vehicle supply equipment circuits shall not exceed 1060 V dc.

3) The maximum voltage in electric vehicle supply equipment circuits installed in a dwelling unit shall comply with Rule 2-110.

4) Notwithstanding Subrule 2), the maximum voltage in electric vehicle supply equipment circuits shall be permitted to be higher than 1060 V dc but not exceeding 1500 Vdc, provided that

a) the installation is serviced only by qualified persons;

b) the part of the installation exceeding 1060 V dc is inaccessible to the public; and

c) enclosures in which electric vehicle supply equipment and output circuits exceeding 1060 V dc are present are marked with the word “DANGER” followed by the maximum rated electric vehicle supply equipment circuit voltage of the equipment.

5) The installations described in Subrule 4), shall not be required to comply with Section 36.

# Tables	
Revise Title of Table 1 to read: **Table 1** ~~**Allowable**~~ **Ampacities for...** *[no change to remainder of title]*	**SN4628-4**
Revise Table 1, header for temperature columns, to read: ~~**Allowable a**~~**Ampacity †**	**SN4628-4**
Delete mm² column (column 1B) from Table 1	**SN4762**
Revise Title of Table 2 to read: **Table 2** ~~**Allowable**~~ **Ampacities for...** *[no change to remainder of title]*	**SN4628-4**
Revise Table 2, header for temperature columns, to read: ~~**Allowable a**~~**Ampacity †,††**	**SN4628-4**
Delete mm² column (column 1B) from Table 2	**SN4762**
Revise Title of Table 3 to read: **Table 3** ~~**Allowable**~~ **Ampacities for...** *[no change to remainder of title]*	**SN4628-4**
Revise Table 3, header for temperature columns, to read: ~~**Allowable a**~~**Ampacity †**	**SN4628-4**
Delete mm² column (column 1B) from Table 3	**SN4762**
Revise Title of Table 4 to read: **Table 4** ~~**Allowable**~~ **Ampacities for...** *[no change to remainder of title]*	**SN4628-4**

Revise Table 4, header for temperature columns, to read: ~~Allowable a~~Ampacity †§	SN4628-4
Delete mm² column (column 1B) from Table 4	SN4762

Revise Tables 6A through 6K to read:	SN4830

Table 6A

Dimensions of single Class B R90XLPE, RW75XLPE, RW90XLPE, and RPV90 UNJACKETED 600 V insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~R90XLPE, RW75XLPE, RW90XLPE UNJACKETED 600 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~ Dia mm	~~Class B Area mm²~~	1 Area mm²	2 Area mm²	3 Area mm²	4 Area mm²	5 Area mm²	6 Area mm²	7 Area mm²	8 Area mm²	9 Area mm²	10 Area mm²	20 Area mm²	~~30~~ Area mm²	~~40~~ Area mm²	~~50~~ Area mm²	~~60~~ Area mm²	~~70~~ Area mm²	~~80~~ Area mm²	~~90~~ Area mm²	~~100~~ Area mm²
STRANDED CONDUCTORS																				
14	3.36	~~8.87~~	8.87	~~17.73~~ 17.8	26.6	~~35.47~~ 35.5	~~44.33~~ 44.4	53.2	~~62.07~~ 62.1	~~70.93~~ 71.0	79.8	88.67 88.7	~~177.34~~ 178	~~266.0~~	~~354.67~~	~~443.34~~	~~532.01~~	~~620.68~~	~~709.35~~	~~798.01~~	~~886.68~~
12	3.84	~~11.58~~	~~11.58~~ 11.6	~~23.16~~ 23.2	~~34.74~~ 34.8	~~46.32~~ 46.4	~~57.91~~ 58.0	~~69.49~~ 69.5	~~81.07~~ 81.1	~~92.65~~ 92.7	~~104.23~~ 105	~~115.81~~ 116	~~231.62~~ 232	~~347.44~~	~~463.25~~	~~579.06~~	~~694.87~~	~~810.68~~	~~926.49~~	~~1042.31~~	~~1158.12~~
10	4.47	~~15.69~~	~~15.69~~ 15.7	~~31.39~~ 31.4	~~47.08~~ 47.1	~~62.77~~ 62.8	~~78.46~~ 78.5	~~94.16~~ 94.2	~~109.85~~ 110	~~125.54~~ 126	~~141.24~~ 142	~~156.93~~ 157	~~313.86~~ 314	~~470.79~~	~~627.72~~	~~784.65~~	~~941.58~~	~~1098.51~~	~~1255.44~~	~~1412.37~~	~~1569.3~~
8	5.99	~~28.18~~	~~28.18~~ 28.2	~~56.36~~ 56.4	~~84.54~~ 84.6	~~112.72~~ 113	~~140.9~~ 141	~~169.08~~ 170	~~197.26~~ 198	~~225.44~~ 226	~~253.62~~ 254	~~281.8~~ 282	563.6 564	~~845.4~~	~~1127.21~~	~~1409.01~~	~~1690.81~~	~~1972.61~~	~~2254.41~~	~~2536.21~~	~~2818.02~~
6	6.95	~~37.94~~	~~37.94~~ 38.0	~~75.87~~ 75.9	~~113.81~~ 114	~~151.75~~ 152	~~189.68~~ 190	~~227.62~~ 228	~~265.56~~ 266	~~303.49~~ 304	~~341.43~~ 342	~~379.37~~ 380	~~758.73~~ 759	~~1138.1~~	~~1517.47~~	~~1896.83~~	~~2276.2~~	~~2655.57~~	~~3034.94~~	~~3414.3~~	~~3793.67~~
4	8.17	~~52.42~~	~~52.42~~ 52.5	~~104.85~~ 105	~~157.27~~ 158	~~209.7~~ 210	~~262.12~~ 263	~~314.55~~ 315	~~366.97~~ 367	~~419.4~~ 420	~~471.82~~ 472	~~524.24~~ 525	~~1048.49~~ 1049	~~1572.73~~	~~2096.98~~	~~2621.22~~	~~3145.47~~	~~3669.71~~	~~4193.96~~	~~4718.2~~	~~5242.45~~

3	8.88	61.93	61.93 62.0	123.86 124	185.8 186	247.73 248	309.66 310	371.59 372	433.52 434	495.46 496	557.39 558	619.32 620	1238.64 1239	1857.96	2477.28	3096.61	3715.93	4335.25	4954.57	5573.89	6193.21
2	9.7	73.9	73.9	147.8 148	221.69 222	295.59 296	369.49 370	443.39 444	517.29 518	591.18 592	665.08 666	738.98 739	1477.96 1478	2216.94	2955.92	3694.91	4433.89	5172.87	5911.85	6650.83	7389.81
1	11.23	99.05	99.05 99.1	198.1 199	297.15 298	396.2 397	495.24 496	594.29 595	693.34 694	792.39 793	891.44 892	990.49 991	1980.98 1981	2971.47	3961.95	4952.44	5942.93	6933.42	7923.91	8914.4	9904.88
1/0	12.27	118.24	118.24 119	236.49 237	354.73 355	472.98 473	591.22 592	709.46 710	827.71 828	945.95 946	1064.2 1065	1182.44 1183	2364.88 2365	3547.32	4729.76	5912.2	7094.64	8277.08	9459.52	10 641.96	11 824.4
2/0	13.44	141.87	141.87 142	283.74 284	425.61 426	567.48 568	709.35 710	851.22 852	993.09 994	1134.95 1135	1276.82 1277	1418.69 1419	2837.39 2838	4256.08	5674.77	7093.46	8512.16	9930.85	11 349.54	12 768.24	14 186.93
3/0	14.74	170.64	170.64 171	341.28 342	511.92 512	682.57 683	853.21 854	1023.85 1024	1194.49 1195	1365.13 1366	1535.77 1536	1706.42 1707	3412.83 3413	5119.25	6825.66	8532.08	10 238.49	11 944.91	13 651.33	15 357.74	17 064.16
4/0	16.21	206.37	206.37 207	412.75 413	619.12 620	825.5 826	1031.87 1032	1238.25 1239	1444.62 1445	1651.0 1651	1857.37 1858	2063.74 2064	4127.49 4128	6191.23	8254.98	10 318.72	12 382.47	14 446.21	16 509.96	18 573.7	20 637.44
250	17.9	251.65	251.65 252	503.3 504	754.95 755	1006.6 1007	1258.25 1259	1509.9 1510	1761.55 1762	2013.2 2014	2264.84 2265	2516.49 2517	5032.99 5033	7549.48	10 065.98	12 582.47	15 098.97	17 615.46	20 131.95	22 648.45	25 164.94
300	19.3	292.55	292.55 293	585.11 586	877.66 878	1170.21 1171	1462.76 1463	1755.32 1756	2047.87 2048	2340.42 2341	2632.98 2633	2925.53 2926	5851.06 5852	8776.59	11 702.12	14 627.65	17 553.18	20 478.71	23 404.24	26 329.77	29 255.3
350	20.53	331.03	331.03 332	662.06 663	993.09 994	1324.12	1655.15	1986.18	2317.21	2648.24	2979.27	3310.3 3311	6620.61	9930.91	13 241.21	16 551.52	19 861.82	23 172.12	26 482.43	29 792.73	33 103.03

						1325	1656	1987	2318	2649	2980		6621								
400	21.79	372.91	372.91 373	745.82 746	1118.73 1119	1491.64 1492	1864.55 1865	2237.46 2238	2610.37 2611	2983.28 2984	3356.19 3357	3729.1 3730	7458.21 7459	11 187.31	14 916.41	18 645.51	22 374.62	26 103.72	29 832.82	33 561.92	37 291.03
450	22.91	412.23	412.23 413	824.46 825	1236.69 1237	1648.92 1649	2061.15 2062	2473.38 2474	2885.61 2886	3297.84 3298	3710.07 3711	4122.3 4123	8244.61 8245	12 366.91	16 489.22	20 611.52	24 733.83	28 856.13	32 978.44	37 100.74	41 223.04
500	23.95	450.51	450.51 451	901.01 902	1351.52 1352	1802.03 1803	2252.53 2253	2703.04 2704	3153.54 3154	3604.05 3605	4054.56 4055	4505.06 4506	9010.13 9011	13 515.19	18 020.25	22 525.32	27 030.38	31 535.44	36 040.51	40 545.57	45 050.64
600	26.74	561.58	561.58 562	1123.16 1124	1684.74 1685	2246.33 2247	2807.91 2808	3369.49 3370	3931.07 3932	4492.65 4493	5054.23 5055	5615.81 5616	11 231.63 11232	16 847.44	22 463.25	28 079.07	33 694.88	39 310.7	44 926.51	50 542.32	56 158.14
700	28.55	640.18	640.18 641	1280.36 1281	1920.54 1921	2560.72 2561	3200.9 3201	3841.08 3842	4481.26 4482	5121.44 5122	5761.62 5762	6401.8 6402	12 803.6 12804	19 205.4	25 607.2	32 009.0	38 410.8	44 812.6	51 214.4	57 616.2	64 018.0
750	29.41	679.33	679.33 680	1358.66 1359	2037.99 2038	2717.31 2718	3396.64 3397	4075.97 4076	4755.3 4756	5434.63 5435	6113.96 6114	6793.29 6794	13 586.57 13587	20 379.86	27 173.15	33 966.43	40 759.72	47 553.01	54 346.29	61 139.58	67 932.86
800	30.25	718.69	718.69 719	1437.38 1438	2156.07 2157	2874.75 2875	3593.44 3594	4312.13 4313	5030.82 5031	5749.51 5750	6468.2 6469	7186.88 7187	14 373.77 14374	21 560.65	28 747.54	35 934.42	43 121.3	50 308.19	57 495.07	64 681.96	71 868.84
900	31.85	796.73	796.73 797	1593.45 1594	2390.18 2391	3186.9 3187	3983.63 3984	4780.35 4781	5577.08 5578	6373.8 6374	7170.53 7171	7967.26 7968	15 934.51 15935	23 901.77	31 869.02	39 836.28	47 803.53	55 770.79	63 738.05	71 705.3	79 672.56
1000	33.32	871.97	871.97 872	1743.93 1744	2615.9 2616	3487.87 3488	4359.83 4360	5231.8 5232	6103.77 6104	6975.73 6976	7847.7 7848	8719.67 8720	17 439.33 17440	26 159.0	34 878.67	43 598.33	52 318.0	61 037.66	69 757.33	78 477.0	87 196.66

1250	37.56	1108.0	1108.0 1109	2216.01 2217	3324.01 3325	4432.01 4433	5540.02 5541	6648.02 6649	7756.02 7757	8864.03 8865	9972.03 9973	11080.03 11081	22160.07 22161	33240.1	44320.13	55400.16	66480.2	77560.23	88640.26	99720.3	110800.33
1500	40.68	1299.73	1299.73 1300	2599.45 2600	3899.18 3900	5198.9 5199	6498.63 6499	7798.36 7799	9098.08 9099	10397.81 10398	11697.53 11698	12997.26 12998	25994.52 25995	38991.78	51989.04	64986.29	77983.55	90980.81	103978.07	116975.33	129972.59
1750	43.58	1491.64	1491.64 1492	2983.28 2984	4474.92 4475	5966.56 5967	7458.21 7459	8949.85 8950	10441.49 10442	11933.13 11934	13424.77 13425	14916.41 14917	29832.82 29833	44749.23	59665.64	74582.05	89498.46	104414.88	119331.29	134247.7	149164.11
2000	46.27	1681.47	1681.47 1682	3362.94 3363	5044.41 5045	6725.88 6726	8407.35 8408	10088.81 10089	11770.28 11771	13451.75 13452	15133.22 15134	16814.69 16815	33629.38 33630	50444.07	67258.76	84073.45	100888.14	117702.83	134517.52	151332.22	168146.91
SOLID CONDUCTORS																					
14	3.15	7.79	7.79	15.59 15.6	23.38 23.4	31.17 31.2	38.97 39.0	46.76 46.8	54.55 54.6	62.34 62.4	70.14 70.2	77.93 78.0	155.86 156	233.79	311.72	389.66	467.59	545.52	623.45	701.38	779.31
12	3.57	10.01	10.01 10.1	20.02 20.1	30.03 30.1	40.04 40.1	50.05 50.1	60.06 60.1	70.07 70.1	80.08 80.1	90.09 90.1	100.1 101	200.2 201	300.29	400.39	500.49	600.59	700.69	800.79	900.88	1000.98
10	4.11	13.27	13.27 13.3	26.53 26.6	39.8 39.9	53.07 53.1	66.34 66.4	79.6 79.7	92.87 92.9	106.14 107	119.4 120	132.67 133	265.34 266	398.01	530.68	663.35	796.02	928.69	1061.36	1194.03	1326.7

Table 6B

Dimensions of single Class B R90XLPE, RW75XLPE, RW90XLPE and RPV90 UNJACKETED 1000 V insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~R90XLPE, RW75XLPE, RW90XLPE UNJACKETED 1000 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
STRANDED CONDUCTORS																				
14	4.12	~~13.33~~	~~13.33~~ 13.4	~~26.66~~ 26.7	~~39.99~~ 40.0	~~53.33~~ 53.4	~~66.66~~ 66.7	~~79.99~~ 80.0	~~93.32~~ 93.4	~~106.65~~ 107	~~119.98~~ 120	~~133.32~~ 134	~~266.63~~ 267	~~399.95~~	~~533.27~~	~~666.58~~	~~799.9~~	~~933.22~~	~~1066.53~~	~~1199.85~~	~~1333.17~~
12	4.6	~~16.62~~	~~16.62~~ 16.7	~~33.24~~ 33.3	~~49.86~~ 49.9	~~66.48~~ 66.5	~~83.1~~ 83.1	~~99.71~~ 99.8	~~116.33~~ 117	~~132.95~~ 133	~~149.57~~ 150	~~166.19~~ 167	~~332.38~~ 333	~~498.57~~	~~664.76~~	~~830.95~~	~~997.14~~	~~1163.33~~	~~1329.52~~	~~1495.71~~	~~1661.9~~
10	5.23	~~21.48~~	~~21.48~~ 21.5	~~42.97~~ 43.0	~~64.45~~ 64.5	~~85.93~~ 86.0	~~107.41~~ 108	~~128.9~~ 129	~~150.38~~ 151	~~171.86~~ 172	~~193.35~~ 194	~~214.83~~ 215	~~429.66~~ 430	~~644.49~~	~~859.32~~	~~1074.15~~	~~1288.98~~	~~1503.8~~	~~1718.63~~	~~1933.46~~	~~2148.29~~
8	5.99	~~28.18~~	~~28.18~~ 28.2	~~56.36~~ 56.4	~~84.54~~ 84.6	~~112.72~~ 113	~~140.9~~ 141	~~169.08~~ 170	~~197.26~~ 198	~~225.44~~ 226	~~253.62~~ 254	~~281.8~~ 282	~~563.6~~ 564	~~845.4~~	~~1127.21~~	~~1409.01~~	~~1690.81~~	~~1972.61~~	~~2254.41~~	~~2536.21~~	~~2818.02~~
6	7.71	~~46.69~~	~~46.69~~ 46.7	~~93.37~~ 93.4	~~140.06~~ 141	~~186.75~~ 187	~~233.44~~ 234	~~280.12~~ 281	~~326.81~~ 327	~~373.5~~ 374	~~420.19~~ 421	~~466.87~~ 467	~~933.75~~ 934	~~1400.62~~	~~1867.49~~	~~2334.36~~	~~2801.24~~	~~3268.11~~	~~3734.98~~	~~4201.86~~	~~4668.73~~
4	8.93	~~62.63~~	~~62.63~~ 62.7	~~125.26~~ 126	~~187.89~~ 188	~~250.53~~ 251	~~313.16~~ 314	~~375.79~~ 376	~~438.42~~ 439	~~501.05~~ 502	~~563.68~~ 564	~~626.31~~ 627	~~1252.63~~ 1253	~~1878.94~~	~~2505.26~~	~~3131.57~~	~~3757.89~~	~~4384.2~~	~~5010.52~~	~~5636.83~~	~~6263.15~~
3	9.64	~~72.99~~	~~72.99~~ 73.0	~~145.97~~ 146	~~218.9~~ 219	~~291.95~~ 292	~~364.93~~ 365	~~437.92~~ 438	~~510.91~~ 511	~~583.89~~ 584	~~656.88~~ 657	~~729.87~~ 730	~~1459.73~~	~~2189.6~~	~~2919.47~~	~~3649.34~~	~~4379.2~~	~~5109.07~~	~~5838.94~~	~~6568.81~~	~~7298.67~~

													1460							
2	10.46	85.93	85.93 86.0	171.86 172	257.8 258	343.73 344	429.66 430	515.59 516	601.52 602	687.45 688	773.39 774	859.32 860	1718.63 1719	2577.95	3437.27	4296.58	5155.9	6015.22	6874.53	7733.85	8593.17
1	12.49	122.52	122.52 123	245.04 246	367.57 368	490.09 491	612.61 613	735.13 736	857.66 858	980.18 981	1102.7 1103	1225.22 1226	2450.44 2451	3675.67	4900.89	6126.11	7351.33	8576.55	9801.78	11 027.0	12 252.22
1/0	13.53	143.78	143.78 144	287.55 288	431.33 432	575.1 576	718.88 719	862.65 863	1006.43 1007	1150.21 1151	1293.98 1294	1437.76 1438	2875.51 2876	4313.27	5751.03	7188.78	8626.54	10 064.3	11 502.06	12 939.81	14 377.57
2/0	14.7	169.72	169.72 170	339.43 340	509.15 510	678.87 679	848.58 849	1018.3 1019	1188.02 1189	1357.73 1358	1527.45 1528	1697.17 1698	3394.33 3395	5091.5	6788.67	8485.83	10 183.0	11 880.17	13 577.34	15 274.5	16 971.67
3/0	16.0	201.06	201.06 202	402.12 403	603.19 604	804.25 805	1005.31 1006	1206.37 1207	1407.43 1408	1608.5 1609	1809.56 1810	2010.62 2011	4021.24 4022	6031.86	8042.48	10 053.1	12 063.72	14 074.34	16 084.95	18 095.57	20 106.19
4/0	17.47	239.7	239.7 240	479.41 480	719.11 720	958.82 959	1198.52 1199	1438.23 1439	1677.93 1678	1917.63 1918	2157.34 2158	2397.04 2398	4794.08 4795	7191.13	9588.17	11 985.21	14 382.25	16 779.3	19 176.34	21 573.38	23 970.42
250	19.17	288.63	288.63 289	577.25 578	865.88 866	1154.5 1155	1443.13 1444	1731.75 1732	2020.38 2021	2309.0 2310	2597.63 2598	2886.25 2887	5772.5 5773	8658.75	11 545.0	14 431.26	17 317.51	20 203.76	23 090.01	25 976.26	28 862.51
300	20.56	332.0	332.0 332	664.0 664	996.0 996	1327.99 1328	1659.99 1660	1991.99 1992	2323.99 2324	2655.99 2656	2987.99 2988	3319.98 3320	6639.97 6640	9959.95	13 279.94	16 599.92	19 919.91	23 239.89	26 559.88	29 879.86	33 199.85
350	21.79	372.91	372.91 373	745.82 746	1118.73 1119	1491.64 1492	1864.55 1865	2237.46 2238	2610.37 2611	2983.28 2984	3356.19 3357	3729.1 3730	7458.21 7459	11 187.31	14 916.41	18 645.51	22 374.62	26 103.72	29 832.82	33 561.92	37 291.03

400	23.05	417.28	417.28 418	834.57 835	1251.85 1252	1669.14 1670	2086.42 2087	2503.7 2504	2920.99 2921	3338.27 3339	3755.56 3756	4172.84 4173	8345.68 8346	12 518.52	16 691.36	20 864.2	25 037.04	29 209.88	33 382.72	37 555.56	41 728.4
450	24.17	458.82	458.82 459	917.64 918	1376.46 1377	1835.28 1836	2294.1 2295	2752.93 2753	3211.75 3212	3670.57 3671	4129.39 4130	4588.21 4589	9176.42 9177	13 764.63	18 352.84	22 941.04	27 529.25	32 117.46	36 705.67	41 293.88	45 882.09
500	25.21	499.16	499.16 500	998.31 999	1497.47 1498	1996.62 1997	2495.78 2496	2994.93 2995	3494.09 3495	3993.24 3994	4492.4 4493	4991.55 4992	9983.1 9984	14 974.66	19 966.21	24 957.76	29 949.31	34 940.86	39 932.41	44 923.97	49 915.52
600	27.24	582.78	582.78 583	1165.56 1166	1748.34 1749	2331.12 2332	2913.9 2914	3496.68 3497	4079.45 4080	4662.23 4663	5245.0 5245	5827.79 5828	11655.59 11656	17 483.38	23 311.17	29 138.96	34 966.76	40 794.55	46 622.34	52 450.13	58 277.93
700	29.05	662.8	662.8 663	1325.6 1326	1988.4 1989	2651.2 2652	3314.0 3314	3976.8 3977	4639.6 4640	5302.4 5303	5965.2 5966	6627.99 6628	13255.99 13256	19 883.98	26 511.98	33 139.97	39 767.97	46 395.96	53 023.96	59 651.95	66 279.95
750	29.91	702.62	702.62 703	1405.25 1406	2107.87 2108	2810.49 2811	3513.12 3514	4215.74 4216	4918.36 4919	5620.99 5621	6323.61 6324	7026.24 7027	14052.47 14053	21 078.71	28 104.94	35 131.18	42 157.41	49 183.65	56 209.88	63 236.12	70 262.36
800	30.75	742.64	742.64 743	1485.29 1486	2227.93 2228	2970.57 2971	3713.22 3714	4455.86 4456	5198.5 5199	5941.14 5942	6683.79 6684	7426.43 7427	14852.86 14853	22 279.29	29 705.72	37 132.15	44 558.58	51 985.01	59 411.44	66 837.87	74 264.31
900	32.35	821.94	821.94 822	1643.87 1644	2465.81 2466	3287.75 3288	4109.68 4110	4931.62 4932	5753.56 5754	6575.49 6576	7397.43 7398	8219.37 8220	16438.74 16439	24 658.11	32 877.47	41 096.84	49 316.21	57 535.58	65 754.95	73 974.32	82 193.68
1000	33.82	898.33	898.33 899	1796.66 1797	2695.0 2695	3593.33 3594	4491.66 4492	5389.99 5390	6288.33 6289	7186.66 7187	8084.99 8085	8983.32 8984	17966.65 17967	26 949.97	35 933.3	44 916.62	53 899.95	62 883.27	71 866.6	80 849.92	89 833.25
1250	38.32	1153.3	1153.3 1154	2306.59	3459.89	4613.19	5766.48	6919.78	8073.07	9226.37	10379.67	11532.96	23065.93	34 598.89	46 131.85	57 664.81	69 197.78	80 730.74	92 263.7	103 796.66	115 329.63

				2307	3460	4614	5767	6920	8074	9227	10380	11533	23066								
1500	41.44	1348.74	1348.74 1349	2697.49 2698	4046.23 4047	5394.97 5395	6743.72 6744	8092.46 8093	9441.2 9442	10789.95 10790	12138.69 12139	13487.44 13488	26974.87 26975	40 462.31	53 949.74	67 437.18	80 924.61	94 412.05	107 899.48	121 386.92	134 874.35
1750	44.34	1544.12	1544.12 1545	3088.24 3089	4632.36 4633	6176.48 6177	7720.6 7721	9264.72 9265	10808.85 10809	12352.97 12353	13897.09 13898	15441.21 15442	30882.41 30883	46 323.62	61 764.83	77 206.04	92 647.24	108 088.45	123 529.66	138 970.87	154 412.07
2000	47.03	1737.16	1737.16 1738	3474.32 3475	5211.48 5212	6948.64 6949	8685.8 8686	10422.96 10423	12160.12 12161	13897.28 13898	15634.44 15635	17371.6 17372	34743.2 34744	52 114.8	69 486.4	86 858.0	104 229.6	121 601.21	138 972.81	156 344.41	173 716.01
SOLID CONDUCTORS																					
14	3.91	12.01	12.01 12.1	24.01 24.1	36.02 36.1	48.03 48.1	60.04 60.1	72.04 72.1	84.05 84.1	96.06 96.1	108.07 109	120.07 121	240.14 241	360.22	480.29	600.36	720.43	840.51	960.58	1080.65	1200.72
12	4.33	14.73	14.73 14.8	29.45 29.5	44.18 44.2	58.9 58.9	73.63 73.7	88.35 88.4	103.08 104	117.8 118	132.53 133	147.25 148	294.51 295	441.76	589.01	736.27	883.52	1030.77	1178.03	1325.28	1472.54
10	4.87	18.63	18.63 18.7	37.25 37.3	55.88 55.9	74.51 74.6	93.14 93.2	111.76 112	130.39 131	149.02 150	167.64 168	186.27 187	372.54 373	558.82	745.09	931.36	1117.63	1303.9	1490.18	1676.45	1862.72

Table 6C

Dimensions of single Class B R90XLPE, RW75XLPE, R90EP, RW75EP, RW90XLPE, RW90EP and RPV90 JACKETED 600 V insulated conductors and cables for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

R90XLPE, RW75XLPE, R90EP, RW75EP, RW90XLPE, RW90EP JACKETED 600 V

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	Class B		1	2	3	4	5	6	7	8	9	10	20	30	40	50	60	70	80	90	100
	Dia mm	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²
STRANDED CONDUCTORS																					
14	4.12	13.33	13.33 13.4	26.66 26.7	39.99 40.0	53.33 53.4	66.66 66.7	79.99 80.0	93.32 93.4	106.65 107	119.98 120	133.32 134	266.63 267	399.95	533.27	666.58	799.9	933.22	1066.53	1199.85	1333.17
12	4.6	16.62	16.62 16.7	33.24 33.3	49.86 49.9	66.48 66.5	83.1 83.1	99.71 99.8	116.33 117	132.9 133	149.57 150	166.19 167	332.38 333	498.57	664.76	830.95	997.14	1163.33	1329.52	1495.71	1661.9
10	5.23	21.48	21.48 21.5	42.97 43.0	64.45 64.5	85.93 86.0	107.41 108	128.9 129	150.38 151	171.86 172	193.35 194	214.83 215	429.66 430	644.49	859.32	1074.15	1288.98	1503.8	1718.63	1933.46	2148.29
8	6.75	35.78	35.78 35.8	71.57 71.6	107.35 108	143.14 144	178.92 179	214.71 215	250.49 251	286.28 287	322.06 323	357.85 358	715.69 716	1073.54	1431.39	1789.24	2147.08	2504.93	2862.78	3220.62	3578.47
6	8.47	56.35	56.35 56.4	112.69 113	169.04 170	225.38 226	281.73 282	338.07 339	394.42 395	450.76 451	507.11 508	563.45 564	1126.9 1127	1690.36	2253.81	2817.26	3380.71	3944.16	4507.61	5071.07	5634.52
4	9.69	73.75	73.75 73.8	147.49 148	221.24 222	294.98 295	368.73 369	442.47 443	516.22 517	589.97 590	663.71 664	737.46 738	1474.92 1475	2212.37	2949.83	3687.29	4424.75	5162.21	5899.67	6637.12	7374.58
3	10.4	84.95	84.95 85.0	169.9 170	254.85 255	339.79 340	424.74 425	509.69 510	594.64 595	679.59 680	764.54 765	849.49 850	1698.97	2548.46	3397.95	4247.43	5096.92	5946.41	6795.89	7645.38	8494.87

													1699							
2	11.22	98.87	98.9	197.75	296.62	395.49	494.36	593.24	692.11	790.98	889.85	988.73	1977.45 1978	2966.18	3954.9	4943.63	5932.35	6921.08	7909.8	8898.53	9887.25
1	13.51	143.35	144	286.7	430.05	573.4	716.75	860.11	1003.46	1146.81	1290.16	1433.51	2867.02 2868	4300.53	5734.04	7167.55	8601.06	10 034.57	11 468.08	12 901.59	14 335.1
1/0	14.55	166.27	167	332.54	498.81	665.08	831.35	997.62	1163.9	1330.17	1496.44	1662.71	3325.42 3326	4988.12	6650.83	8313.54	9976.25	11 638.95	13 301.66	14 964.37	16 627.08
2/0	15.72	194.09	195	388.17	582.26	776.35	970.43	1164.52 1165	1358.6	1552.69 1553	1746.78	1940.86	3881.73 3882	5822.59	7763.45	9704.32	11 645.18	13 586.04	15 526.91	17 467.77	19 408.63
3/0	17.02	227.51	228	455.03	682.54	910.06	1137.57 1138	1365.09 1366	1592.6	1820.12 1821	2047.63	2275.14	4550.29 4551	6825.43	9100.58	11 375.72	13 650.87	15 926.01	18 201.16	20 476.3	22 751.45
4/0	18.49	268.51	269	537.02	805.54	1074.05 1075	1342.56 1343	1611.07 1612	1879.58 1880	2148.1 2149	2416.61 2417	2685.12 2686	5370.24 5371	8055.36	10 740.48	13 425.6	16 110.72	18 795.84	21 480.96	24 166.08	26 851.2
250	21.21	353.32	354	706.64	1059.97 1060	1413.29 1414	1766.61 1767	2119.93 2120	2473.26 2474	2826.58 2827	3179.9 3180	3533.22 3534	7066.45 7067	10 599.67	14 132.9	17 666.12	21 199.35	24 732.57	28 265.8	31 799.02	35 332.24
300	22.6	401.15	402	802.3	1203.45 1204	1604.6 1605	2005.75 2006	2406.9 2407	2808.05 2809	3209.2 3210	3610.35 3611	4011.5 4012	8023.0 8023	12 034.5	16 046.0	20 057.5	24 069.0	28 080.5	32 092.0	36 103.5	40 115.0
350	23.83	446.0	447	892.01	1338.01 1339	1784.01 1785	2230.02 2231	2676.02 2677	3122.02 3123	3568.03 3569	4014.03 4015	4460.03 4461	8920.06 8921	13 380.1	17 840.13	22 300.16	26 760.19	31 220.22	35 680.26	40 140.29	44 600.32

400	25.09	494.41	494.41 495	988.83 989	1483.24 1484	1977.66 1978	2472.07 2473	2966.49 2967	3460.91 3461	3955.32 3956	4449.73 4450	4944.15 4945	9888.29 9889	14 832.44	19 776.58	24 720.73	29 664.87	34 609.02	39 553.16	44 497.31	49 441.45
450	26.21	539.54	539.54 540	1079.08 1080	1618.62 1619	2158.16 2159	2697.7 2698	3237.24 3238	3776.78 3777	4316.32 4317	4855.86 4856	5395.4 5396	10790.81 10791	16 186.21	21 581.61	26 977.02	32 372.42	37 767.82	43 163.23	48 558.63	53 954.03
500	27.25	583.21	583.21 584	1166.41 1167	1749.62 1750	2332.83 2333	2916.04 2917	3499.24 3500	4082.45 4083	4665.66 4666	5248.87 5249	5832.07 5833	11664.14 11665	17 496.22	23 328.29	29 160.36	34 992.43	40 824.51	46 656.58	52 488.65	58 320.72
600	30.04	708.74	708.74 709	1417.49 1418	2126.23 2127	2834.98 2835	3543.72 3544	4252.47 4253	4961.21 4962	5669.96 5670	6378.7 6379	7087.45 7088	14174.89 14175	21 262.34	28 349.78	35 437.23	42 524.67	49 612.12	56 699.56	63 787.01	70 874.46
700	31.85	796.73	796.73 797	1593.45 1594	2390.18 2391	3186.9 3187	3983.63 3984	4780.35 4781	5577.08 5578	6373.8 6374	7170.53 7171	7967.26 7968	15934.51 15935	23 901.77	31 869.02	39 836.28	47 803.53	55 770.79	63 738.05	71 705.3	79 672.56
750	32.71	840.33	840.33 841	1680.66 1681	2521.0 2521	3361.33 3362	4201.66 4202	5041.99 5042	5882.32 5883	6722.66 6723	7562.99 7563	8403.32 8404	16806.64 16807	25 209.96	33 613.29	42 016.61	50 419.93	58 823.25	67 226.57	75 629.89	84 033.21
800	33.55	884.05	884.05 885	1768.09 1769	2652.14 2653	3536.18 3537	4420.23 4421	5304.28 5305	6188.32 6189	7072.37 7073	7956.42 7957	8840.46 8841	17680.92 17681	26 521.38	35 361.85	44 202.31	53 042.77	61 883.23	70 723.69	79 564.15	88 404.61
900	35.15	970.38	970.38 971	1940.75 1941	2911.13 2912	3881.51 3882	4851.89 4852	5822.26 5823	6792.64 6793	7763.02 7764	8733.39 8734	9703.77 9704	19407.54 19408	29 111.31	38 815.08	48 518.86	58 222.63	67 926.4	77 630.17	87 333.94	97 037.71
1000	36.62	1053.24	1053.24 1054	2106.48 2107	3159.71 3160	4212.95 4213	5266.19 5267	6319.43 6320	7372.67 7373	8425.9 8426	9479.14 9480	10532.38 10533	21064.76 21065	31 597.14	42 129.52	52 661.91	63 194.29	73 726.67	84 259.05	94 791.43	105 323.81
1250	42.38	1410.63	1410.63	2821.25	4231.88	5642.5 5643	7053.13	8463.75	9874.38	11285.01	12695.63	14106.26	28212.51	42 318.77	56 425.03	70 531.28	84 637.54	98 743.8	112 850.05	126 956.31	141 062.57

			1411	2822	4232		7054	8464	9875	11286	12696	14107	28213							
1500	45.5	1625.97 1625.97	1626	3251.94 3252	4877.91 4878	6503.88 6504	8129.85 8130	9755.82 9756	11381.79 11382	13007.76 13008	14633.73 14634	16259.71 16260	32519.41 32520	48 779.12	65 038.82	81 298.53	97 558.23	113 817.94	130 077.64	146 337.35	162 597.05
1750	48.4	1839.84 1839.84	1840	3679.68 3680	5519.53 5520	7359.37 7360	9199.21 9200	11039.05 11040	12878.9 12879	14718.74 14719	16558.58 16559	18398.42 18399	36796.85 36797	55 195.27	73 593.69	91 992.12	110 390.54	128 788.96	147 187.39	165 585.81	183 984.23
2000	51.09	2050.04 2050.04	2051	4100.07 4101	6150.11 6151	8200.15 8201	10250.18 10251	12300.22 12301	14350.26 14351	16400.3 16401	18450.33 18451	20500.37 20501	41000.74 41001	61 501.11	82 001.48	102 501.85	123 002.22	143 502.59	164 002.96	184 503.32	205 003.69
SOLID CONDUCTORS																					
14	3.91	12.01	12.01 12.1	24.01 24.1	36.02 36.1	48.03 48.1	60.04 60.1	72.04 72.1	84.05 84.1	96.06 96.1	108.07 109	120.07 121	240.14 241	360.22	480.29	600.36	720.43	840.51	960.58	1080.65	1200.72
12	4.33	14.73	14.73 14.8	29.45 29.5	44.18 44.2	58.9 58.9	73.63 73.7	88.35 88.4	103.08 104	117.8 118	132.53 133	147.25 148	294.51 295	441.76	589.01	736.27	883.52	1030.77	1178.03	1325.28	1472.54
10	4.87	18.63	18.63 18.7	37.25 37.3	55.88 55.9	74.51 74.6	93.14 93.2	111.76 112	130.39 131	149.02 150	167.64 168	186.27 187	372.54 373	558.82	745.09	931.36	1117.63	1303.9	1490.18	1676.45	1862.72

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Table 6D

Dimensions of single Class B TWU, TWU75, RWU90XLPE UNJACKETED and RPVU90 JACKETED 1000V ~~conductors and~~ cables for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~TWU, TWU75, RWU90XLPE UNJACKETED~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
STRANDED CONDUCTORS																				
14	4.88	~~18.7~~	18.7	~~37.41~~ 37.5	~~56.11~~ 56.2	~~74.82~~ 74.9	~~93.52~~ 93.6	~~112.22~~ 113	~~130.93~~ 131	~~149.63~~ 150	~~168.33~~ 169	~~187.04~~ 188	~~374.08~~ 375	~~561.11~~	~~748.15~~	~~935.19~~	~~1122.23~~	~~1309.27~~	~~1496.3~~	~~1683.34~~	~~1870.38~~
12	5.36	~~22.56~~	~~22.6~~ 22.6	~~45.13~~ 45.2	~~67.69~~ 67.7	~~90.26~~ 90.3	~~112.82~~ 113	~~135.39~~ 136	~~157.95~~ 158	~~180.51~~ 181	~~203.08~~ 204	~~225.64~~ 226	~~451.28~~ 452	~~676.93~~	~~902.57~~	~~1128.21~~	~~1353.85~~	~~1579.49~~	~~1805.13~~	~~2030.78~~	~~2256.42~~
10	5.97	~~27.99~~	~~27.99~~ 28.0	~~55.98~~ 56.0	~~83.98~~ 84.0	~~111.97~~ 112	~~139.96~~ 140	~~167.95~~ 168	~~195.95~~ 196	~~223.94~~ 224	~~251.93~~ 252	~~279.92~~ 280	~~559.85~~ 560	~~839.77~~	~~1119.69~~	~~1399.61~~	~~1679.54~~	~~1959.46~~	~~2239.38~~	~~2519.31~~	~~2799.23~~
8	7.76	~~47.29~~	~~47.29~~ 47.3	~~94.59~~ 94.6	~~141.88~~ 142	~~189.18~~ 190	~~236.47~~ 237	~~283.77~~ 284	~~331.06~~ 332	~~378.36~~ 379	~~425.65~~ 426	~~472.95~~ 473	~~945.9~~ 946	~~1418.84~~	~~1891.79~~	~~2364.74~~	~~2837.69~~	~~3310.64~~	~~3783.58~~	~~4256.53~~	~~4729.48~~
6	8.72	~~59.72~~	~~59.72~~ 59.8	~~119.44~~ 120	~~179.16~~ 180	~~238.88~~ 239	~~298.6~~ 299	~~358.32~~ 359	~~418.04~~ 419	~~477.76~~ 478	~~537.48~~ 538	~~597.2~~ 598	~~1194.1~~ 1195	~~1791.61~~	~~2388.82~~	~~2986.02~~	~~3583.23~~	~~4180.43~~	~~4777.63~~	~~5374.84~~	~~5972.04~~
4	9.95	~~77.76~~	~~77.76~~ 77.8	~~155.51~~ 156	~~233.27~~ 234	~~311.03~~ 312	~~388.78~~ 389	~~466.54~~ 467	~~544.29~~ 545	~~622.05~~ 623	~~699.81~~ 700	~~777.56~~ 778	~~1555.13~~ 1556	~~2332.69~~	~~3110.26~~	~~3887.82~~	~~4665.38~~	~~5442.95~~	~~6220.51~~	~~6998.07~~	~~7775.64~~
3	10.67	~~89.42~~	~~89.42~~ 89.5	~~178.83~~ 179	~~268.25~~ 269	~~357.67~~ 358	~~447.08~~ 448	~~536.5~~ 537	~~625.92~~ 626	~~715.33~~ 716	~~804.75~~ 805	~~894.17~~ 895	~~1788.33~~	~~2682.5~~	~~3576.67~~	~~4470.84~~	~~5365.0~~	~~6259.17~~	~~7153.34~~	~~8047.5~~	~~8941.67~~

													1789							
2	11.48	103.51	103.51 104	207.02 208	310.52 311	414.03 415	517.54 518	621.05 622	724.56 725	828.06 829	931.57 932	1035.08 1036	2070.16 2071	3105.24	4140.32	5175.4	6210.48	7245.56	8280.64	9315.71	10 350.79
1	13.25	137.89	137.89 138	275.77 276	413.66 414	551.55 552	689.43 690	827.32 828	965.21 966	1103.09 1104	1240.98 1241	1378.86 1379	2757.73 2758	4136.59	5515.46	6894.32	8273.19	9652.05	11 030.92	12 409.78	13 788.65
1/0	14.28	160.16	160.16 161	320.31 321	480.47 481	640.63 641	800.79 801	960.94 961	1121.1 1122	1281.26 1282	1441.41 1442	1601.57 1602	3203.14 3204	4804.71	6406.29	8007.86	9609.43	11 211.0	12 812.57	14 414.14	16 015.71
2/0	15.45	187.48	187.48 188	374.95 375	562.43 563	749.91 750	937.38 938	1124.86 1125	1312.34 1313	1499.81 1500	1687.29 1688	1874.77 1875	3749.53 3750	5624.3	7499.06	9373.83	11 248.59	13 123.36	14 998.12	16 872.89	18 747.65
3/0	16.76	220.62	220.62 221	441.23 442	661.85 662	882.47 883	1103.08 1104	1323.7 1324	1544.32 1545	1764.93 1765	1985.5 1986	2206.6 2207	4412.3 4413	6618.49	8824.66	11 030.82	13 236.99	15 443.15	17 649.32	19 855.48	22 061.65
4/0	18.28	262.45	262.45 263	524.89 525	787.34 788	1049.79 1050	1312.24 1313	1574.68 1575	1837.13 1838	2099.58 2100	2362.3 2363	2624.7 2625	5248.5 5249	7873.42	10 497.9	13 122.37	15 746.84	18 371.32	20 995.79	23 620.27	26 244.74
250	20.2	320.47	320.47 321	640.95 641	961.42 962	1281.9 1282	1602.37 1603	1922.84 1923	2243.32 2244	2563.79 2564	2884.26 2885	3204.74 3205	6409.48 6410	9614.22	12 818.95	16 023.69	19 228.43	22 433.17	25 637.91	28 842.65	32 047.39
300	21.54	364.4	364.4 365	728.8 729	1093.21 1094	1457.61 1458	1822.01 1823	2186.41 2187	2550.82 2551	2915.22 2916	3279.62 3280	3644.02 3645	7288.05 7289	10 932.07	14 576.1	18 220.12	21 864.15	25 508.17	29 152.2	32 796.22	36 440.24
350	22.81	408.64	408.64 409	817.28 818	1225.92 1226	1634.56 1635	2043.2 2044	2451.84 2452	2860.48 2861	3269.12 3270	3677.76 3678	4086.4 4087	8172.79 8173	12 259.19	16 345.58	20 431.98	24 518.38	28 604.77	32 691.17	36 777.56	40 863.96

400	24.07	455.03	455.03 456	910.06 911	1365.13 1366	1820.13 1821	2275.16 2276	2730.19 2731	3185.22 3186	3640.26 3641	4095.29 4096	4550.32 4551	9100.64 9101	13 650.96	18 201.29	22 751.61	27 301.93	31 852.25	36 402.57	40 952.89	45 503.21
450	25.19	498.36	498.36 499	996.73 997	1495.09 1496	1993.45 1994	2491.82 2492	2990.18 2991	3488.54 3489	3986.91 3987	4485.27 4486	4983.63 4984	9967.27 9968	14 950.9	19 934.54	24 918.17	29 901.81	34 885.44	39 869.08	44 852.71	49 836.35
500	26.24	540.78	540.78 541	1081.55 1082	1622.33 1623	2163.1 2164	2703.88 2704	3244.66 3245	3785.43 3786	4326.21 4327	4866.99 4867	5407.76 5408	10815.52 10816	16 223.28	21 631.05	27 038.81	32 446.57	37 854.33	43 262.09	48 669.85	54 077.62
600	29.02	661.43	661.43 662	1322.86 1323	1984.29 1985	2645.72 2646	3307.16 3308	3968.59 3969	4630.02 4631	5291.45 5292	5952.88 5953	6614.31 6615	13 228.62 13229	19 842.94	26 457.25	33 071.56	39 685.87	46 300.19	52 914.5	59 528.81	66 143.12
700	30.82	746.03	746.03 747	1492.06 1493	2238.08 2239	2984.11 2985	3730.14 3731	4476.17 4477	5222.2 5223	5968.22 5969	6714.25 6715	7460.28 7461	14 920.56 14921	22 380.84	29 841.12	37 301.4	44 761.68	52 221.96	59 682.24	67 142.52	74 602.8
750	31.69	788.74	788.74 789	1577.48 1578	2366.22 2367	3154.96 3155	3943.7 3944	4732.45 4733	5521.19 5522	6309.93 6310	7098.67 7099	7887.41 7888	15 774.82 15775	23 662.23	31 549.64	39 437.04	47 324.45	55 211.86	63 099.27	70 986.68	78 874.09
800	32.53	831.11	831.11 832	1662.22 1663	2493.33 2494	3324.44 3325	4155.55 4156	4986.65 4987	5817.76 5818	6648.87 6649	7479.98 7480	8311.09 8312	16 622.18 16623	24 933.27	33 244.36	41 555.45	49 866.54	58 177.63	66 488.72	74 799.81	83 110.9
900	34.13	914.88	914.88 915	1829.75 1830	2744.63 2745	3659.51 3660	4574.38 4575	5489.26 5490	6404.14 6405	7319.01 7320	8233.89 8234	9148.76 9149	18 297.53 18298	27 446.29	36 595.06	45 743.82	54 892.59	64 041.35	73 190.12	82 338.88	91 487.65
1000	35.6	995.38	995.38 996	1990.76 1991	2986.15 2987	3981.53 3982	4976.91 4977	5972.29 5973	6967.68 6968	7963.06 7964	8958.44 8959	9953.82 9954	19 907.64 19908	29 861.47	39 815.29	49 769.11	59 722.93	69 676.76	79 630.58	89 584.4	99 538.22
1250	39.08	1199.5	1199.5 1200	2398.99	3598.49	4797.99	5997.48	7196.98	8396.48	9595.97	10 795.47	11 994.97	23 989.93	35 984.9	47 979.86	59 974.83	71 969.79	83 964.76	95 959.72	107 954.69	119 949.65

				2399	3599	4798	5998	7197	8397	9596	10796	11995	23990								
1500	42.96	1449.5	1449.5 1450	2899.0 2900	4348.5 4349	5798.0 5799	7247.5 7248	8697.0 8698	10 146.5 10147	11 596.01 11597	13 045.51 13046	14 495.01 14496	28 990.01 28991	43 485.02	57 980.03	72 475.03	86 970.04	101 465.05	115 960.06	130 455.06	144 950.07
1750	45.86	1651.8	1651.8 1652	3303.6 3304	4955.41 4956	6607.21 6608	8259.01 8260	9910.81 9911	11 562.61 11563	13 214.42 13215	14 866.22 14867	16 518.02 16519	33 036.04 33037	49 554.06	66 072.08	82 590.1	99 108.12	115 626.14	132 144.16	148 662.18	165 180.2
2000	48.55	1851.26	1851.26 1852	3702.53 3703	5553.79 5554	7405.06 7406	9256.32 9257	11 107.58 11108	12 958.85 12959	14 810.11 14811	16 661.38 16662	18 512.64 18513	37 025.28 37026	55 537.92	74 050.56	92 563.2	111 075.84	129 588.48	148 101.12	166 613.76	185 126.4
SOLID CONDUCTORS																					
14	4.67	17.13	17.13 17.2	34.26 34.3	51.39 51.4	68.51 68.6	85.64 85.7	102.77 103	119.9 120	137.03 138	154.16 155	171.29 172	342.57 343	513.86	685.15	856.43	1027.72	1199.01	1370.29	1541.58	1712.87
12	5.09	20.35	20.35 20.4	40.7	61.04 61.1	81.39 81.4	101.74 102	122.09 123	142.44 143	162.79 163	183.13 184	203.48 204	406.96 407	610.45	813.93	1017.41	1220.89	1424.37	1627.85	1831.34	2034.82
10	5.63	24.89	24.89 24.9	49.79 49.8	74.68 74.7	99.58 99.6	124.47 125	149.37 150	174.26 175	199.16 200	224.05 225	248.95 249	497.89 498	746.84	995.79	1244.73	1493.68	1742.63	1991.57	2240.52	2489.47

Table 6E

Dimensions of single Class B RPVU90 UNJACKETED 1000 V and 2000 V ~~conductors and~~ cables for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~RPVU90 UNJACKETED 1000 V and 2000 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
14	4.89	~~18.78~~	~~18.78~~ 18.8	~~37.56~~ 37.6	~~56.34~~ 56.4	~~75.12~~ 75.2	93.9	~~112.68~~ 113	~~131.46~~ 132	~~150.24~~ 151	~~169.02~~ 170	~~187.81~~ 188	~~375.61~~ 376	~~563.42~~	~~751.22~~	~~939.03~~	~~1126.83~~	~~1314.64~~	~~1502.44~~	~~1690.25~~	~~1878.05~~
12	5.36	~~22.56~~	~~22.56~~ 22.6	~~45.13~~ 45.2	~~67.69~~ 67.7	~~90.26~~ 90.3	~~112.82~~ 113	~~135.39~~ 136	~~157.95~~ 158	~~180.51~~ 181	~~203.08~~ 204	~~225.64~~ 226	~~451.28~~ 452	~~676.93~~	~~902.57~~	~~1128.21~~	~~1353.85~~	~~1579.49~~	~~1805.13~~	~~2030.78~~	~~2256.42~~
10	5.99	~~28.18~~	~~28.18~~ 28.2	~~56.36~~ 56.4	~~84.54~~ 84.6	~~112.72~~ 113	~~140.9~~ 141	~~169.08~~ 170	~~197.26~~ 198	~~225.44~~ 226	~~253.62~~ 254	~~281.8~~ 282	~~563.6~~ 564	~~845.4~~	~~1127.21~~	~~1409.01~~	~~1690.81~~	~~1972.61~~	~~2254.41~~	~~2536.21~~	~~2818.02~~
8	7.77	~~47.42~~	~~47.42~~ 47.5	~~94.83~~ 94.9	~~142.25~~ 143	~~189.67~~ 190	~~237.08~~ 238	~~284.5~~ 285	~~331.92~~ 332	~~379.33~~ 380	~~426.75~~ 427	~~474.17~~ 475	~~948.34~~ 949	~~1422.5~~	~~1896.67~~	~~2370.84~~	~~2845.01~~	~~3319.17~~	~~3793.34~~	~~4267.51~~	~~4741.68~~
6	8.73	~~59.86~~	~~59.86~~ 59.9	~~119.71~~ 120	~~179.57~~ 180	~~239.43~~ 240	~~299.29~~ 300	~~359.14~~ 360	~~419.0~~ 420	~~478.86~~ 479	~~538.72~~ 539	~~598.57~~ 599	~~1197.15~~ 1198	~~1795.72~~	~~2394.3~~	~~2992.87~~	~~3591.45~~	~~4190.02~~	~~4788.6~~	~~5387.17~~	~~5985.75~~
4	9.95	~~77.76~~	~~77.76~~ 77.8	~~155.5~~ 156	~~233.27~~ 234	~~311.03~~ 312	~~388.78~~ 389	~~466.54~~ 467	~~544.29~~ 545	~~622.05~~ 623	~~699.81~~ 700	~~777.56~~ 778	~~1555.13~~ 1556	~~2332.69~~	~~3110.26~~	~~3887.82~~	~~4665.38~~	~~5442.95~~	~~6220.51~~	~~6998.07~~	~~7775.64~~
3	10.66	~~89.25~~	~~89.25~~ 89.3	~~178.5~~ 179	~~267.75~~ 268	~~357.0~~ 357	~~446.25~~ 447	~~535.5~~ 536	~~624.74~~ 625	~~713.99~~ 714	~~803.24~~ 804	~~892.49~~ 893	~~1784.98~~ 1785	~~2677.48~~	~~3569.97~~	~~4462.46~~	~~5354.95~~	~~6247.44~~	~~7139.94~~	~~8032.43~~	~~8924.92~~

2	11.48	103.51	104	208	311	415	518	622	725	829	932	1036	2071	3105.24	4140.32	5175.4	6210.48	7245.56	8280.64	9315.71	10350.79
1	13.25	137.89	138	276	414	552	690	828	966	1104	1241	1379	2758	4136.59	5515.46	6894.32	8273.19	9652.05	11030.92	12409.78	13788.65
1/0	14.27	159.93	160	320	480	640	800	960	1120	1280	1440	1600	3199	4797.99	6397.32	7996.65	9595.97	11195.3	12794.63	14393.96	15993.29
2/0	15.44	187.23	188	375	562	749	937	1124	1311	1498	1686	1873	3745	5617.02	7489.36	9361.69	11234.03	13106.37	14978.71	16851.05	18723.39
3/0	16.76	220.62	221	442	662	883	1104	1324	1545	1765	1986	2207	4413	6618.49	8824.66	11030.82	13236.99	15443.15	17649.32	19855.48	22061.65
4/0	18.23	261.01	262	523	784	1045	1306	1567	1828	2089	2350	2611	5221	7830.41	10440.55	13050.68	15660.82	18270.96	20881.09	23491.23	26101.36
250	20.18	319.84	320	640	960	1280	1600	1920	2239	2559	2879	3199	6397	9595.19	12793.58	15991.98	19190.37	22388.77	25587.17	28785.56	31983.96
300	21.58	365.76	366	732	1098	1464	1829	2195	2561	2927	3292	3658	7316	10972.71	14630.28	18287.85	21945.43	25603.0	29260.57	32918.14	36575.71
350	22.88	411.15	412	823	1234	1645	2056	2467	2879	3290	3701	4112	8224	12334.55	16446.06	20557.58	24669.09	28780.61	32892.12	37003.64	41115.15
400	24.07	455.03	456	911	1366	1820.13	2275.16	2730.19	3185.22	3640.26	4095.29	4550.32	9100.64	13650.96	18201.29	22751.61	27301.93	31852.25	36402.57	40952.89	45503.21

						1821	2276	2731	3186	3641	4096	4551	9101								
450	25.19	498.36	498.36 499	996.73 997	1495.09 1496	1993.45 1994	2491.82 2492	2990.18 2991	3488.54 3489	3986.91 3987	4485.27 4486	4983.63 4984	9967.27 9968	14 950.9	19 934.54	24 918.17	29 901.81	34 885.44	39 869.08	44 852.71	49 836.35
500	26.23	540.36	540.36 541	1080.73 1081	1621.09 1622	2161.46 2162	2701.82 2702	3242.18 3243	3782.55 3783	4322.91 4323	4863.28 4864	5403.64 5404	10807.28 10808	16 210.92	21 614.56	27 018.2	32 421.84	37 825.48	43 229.13	48 632.77	54 036.41
600	29.04	662.34	662.34 663	1324.69 1325	1987.03 1988	2649.37 2650	3311.72 3312	3974.06 3975	4636.4 4637	5298.75 5299	5961.09 5962	6623.43 6624	13246.86 13247	19 870.3	26 493.73	33 117.16	39 740.59	46 364.03	52 987.46	59 610.89	66 234.32
700	30.85	747.48	747.48 748	1494.96 1495	2242.44 2243	2989.92 2990	3737.41 3738	4484.89 4485	5232.37 5233	5979.85 5980	6727.33 6728	7474.81 7475	14949.62 14950	22 424.43	29 899.24	37 374.06	44 848.87	52 323.68	59 798.49	67 273.3	74 748.11
750	31.71	789.74	789.74 790	1579.47 1580	2369.21 2370	3158.95 3159	3948.68 3949	4738.42 4739	5528.16 5529	6317.89 6318	7107.63 7108	7897.37 7898	15794.74 15795	23 692.1	31 589.47	39 486.84	47 384.21	55 281.57	63 178.94	71 076.31	78 973.68
800	32.52	830.6	830.6 831	1661.2 1662	2491.79 2492	3322.39 3323	4152.99 4153	4983.59 4984	5814.19 5815	6644.79 6645	7475.38 7476	8305.98 8306	16611.96 16612	24 917.94	33 223.93	41 529.91	49 835.89	58 141.87	66 447.85	74 753.83	83 059.81
900	34.15	915.95	915.95 916	1831.9 1832	2747.85 2748	3663.8 3664	4579.75 4580	5495.69 5496	6411.64 6412	7327.59 7328	8243.54 8244	9159.49 9160	18318.98 18319	27 478.47	36 637.96	45 797.45	54 956.94	64 116.43	73 275.92	82 435.41	91 594.9
1000	35.62	996.5	996.5 997	1993.0 1993	2989.5 2990	3986.0 3986	4982.5 4983	5979.01 5980	6975.51 6976	7972.01 7973	8968.51 8969	9965.01 9966	19930.02 19931	29 895.03	39 860.04	49 825.05	59 790.06	69 755.07	79 720.08	89 685.08	99 650.09
1250	39.86	1247.86 1248	1247.86 1248	2495.71 2496	3743.57 3744	4991.42 4992	6239.28 6240	7487.14 7488	8734.99 8735	9982.85 9983	11230.7 11231	12478.56 12479	24957.12 24958	37 435.68	49 914.24	62 392.8	74 871.36	87 349.92	99 828.48	112 307.04	124 785.6

1500	42.98	1450.85	1451	2901.75	2902	4352.55	4353	5803.45	5804	7254.25	7255	8705.1	8706	10155.95	10156	11606.81	11607	13057.66	13058	14508.51	14509	29017.01	29018	43525.52	58034.03	72542.53	87051.04	101559.54	116068.05	130576.56	145085.06
1750	45.88	1653.24	1654	3306.49	3307	4959.73	4960	6612.97	6613	8266.22	8267	9919.46	9920	11572.7	11573	13225.94	13226	14879.19	14880	16532.43	16533	33064.86	33065	49597.29	66129.72	82662.15	99194.58	115727.01	132259.44	148791.87	165324.3
2000	48.57	1852.79	1853	3705.58	3706	5558.37	5559	7411.16	7412	9263.95	9264	11116.74	11117	12969.53	12970	14822.32	14823	16675.11	16676	18527.9	18528	37055.79	37056	55583.69	74111.58	92639.48	111167.37	129695.27	148223.16	166751.06	185278.95

Table 6F

Dimensions of single Class B RPVU90 JACKETED 1000 V and 2000 V ~~conductors and~~ cables for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~RPVU90 JACKETED 1000 V and 2000 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
14	5.65	~~25.07~~	~~25.07~~ 25.1	~~50.14~~ 50.2	~~75.22~~ 75.3	~~100.29~~ 101	~~125.36~~ 126	~~150.43~~ 151	~~175.5~~ 176	~~200.57~~ 201	~~225.65~~ 226	~~250.72~~ 251	~~501.44~~ 502	~~752.16~~	~~1002.87~~	~~1253.59~~	~~1504.31~~	~~1755.03~~	~~2005.75~~	~~2256.47~~	~~2507.19~~
12	6.12	~~29.42~~	~~29.42~~ 29.5	~~58.83~~ 58.9	~~88.25~~ 88.3	~~117.67~~ 118	~~147.08~~ 148	~~176.5~~ 177	~~205.92~~ 206	~~235.33~~ 236	~~264.75~~ 265	~~294.17~~ 295	~~588.33~~ 589	~~882.5~~	~~1176.66~~	~~1470.83~~	~~1765.0~~	~~2059.16~~	~~2353.33~~	~~2647.5~~	~~2941.66~~
10	6.75	~~35.78~~	~~35.78~~ 35.8	~~71.57~~ 71.6	~~107.35~~ 108	~~143.14~~ 144	~~178.92~~ 179	~~214.71~~ 215	~~250.49~~ 251	~~286.28~~ 287	~~322.06~~ 323	~~357.85~~ 358	~~715.69~~ 716	~~1073.54~~	~~1431.39~~	~~1789.24~~	~~2147.08~~	~~2504.93~~	~~2862.78~~	~~3220.62~~	~~3578.47~~
8	9.29	~~67.78~~	~~67.78~~ 67.8	~~135.57~~ 136	~~203.35~~ 204	~~271.13~~ 272	~~338.92~~ 339	~~406.7~~ 407	~~474.48~~ 475	~~542.26~~ 543	~~610.05~~ 611	~~677.83~~ 678	~~1355.66~~ 1356	~~2033.49~~	~~2711.32~~	~~3389.15~~	~~4066.98~~	~~4744.82~~	~~5422.65~~	~~6100.48~~	~~6778.31~~
6	10.25	~~82.52~~	~~82.52~~ 82.6	~~165.03~~ 166	~~247.55~~ 248	~~330.06~~ 331	~~412.58~~ 413	~~495.1~~ 496	~~577.61~~ 578	~~660.13~~ 661	~~742.64~~ 743	~~825.16~~ 826	~~1650.32~~ 1651	~~2475.48~~	~~3300.64~~	~~4125.79~~	~~4950.95~~	~~5776.11~~	~~6601.27~~	~~7426.43~~	~~8251.59~~
4	11.47	~~103.33~~	~~103.33~~ 104	~~206.66~~ 207	~~309.98~~ 310	~~413.31~~ 414	~~516.64~~ 517	~~619.97~~ 620	~~723.29~~ 724	~~826.62~~ 827	~~929.95~~ 930	~~1033.28~~ 1034	~~2066.55~~ 2067	~~3099.83~~	~~4133.11~~	~~5166.38~~	~~6199.66~~	~~7232.94~~	~~8266.22~~	~~9299.49~~	~~10332.77~~
3	12.18	~~116.52~~	~~116.52~~ 117	~~233.03~~ 234	~~349.55~~ 350	~~466.06~~ 467	~~582.58~~ 583	~~699.09~~ 700	~~815.61~~ 816	~~932.13~~ 933	~~1048.64~~	~~1165.16~~	~~2330.31~~	~~3495.47~~	~~4660.63~~	~~5825.79~~	~~6990.94~~	~~8156.1~~	~~9321.26~~	~~10486.41~~	~~11651.57~~

											1049	1166	2331							
2	13.76	148.71	148.71 149	297.41 298	446.12 447	594.82 595	743.53 744	892.23 893	1040.9 1041	1189.64 1190	1338.35 1339	1487.05 1488	2974.11 2975	4461.16	5948.22	7435.27	8922.32	10 409.38	11 896.43	13 383.49	14 870.54
1	15.53	189.42	189.42 190	378.85 379	568.27 569	757.69 758	947.12 948	1136.54 1137	1325.96 1326	1515.38 1516	1704.81 1705	1894.23 1895	3788.46 3789	5682.69	7576.92	9471.15	11 365.38	13 259.61	15 153.84	17 048.07	18 942.3
1/0	16.55	215.12	215.12 216	430.25 431	645.37 646	860.49 861	1075.61 1076	1290.74 1291	1505.86 1506	1720.98 1721	1936.1 1937	2151.23 2152	4302.45 4303	6453.68	8604.9	10 756.13	12 907.35	15 058.58	17 209.8	19 361.03	21 512.25
2/0	17.72	246.61	246.61 247	493.23 494	739.84 740	986.46 987	1233.07 1234	1479.68 1480	1726.3 1727	1972.91 1973	2219.52 2220	2466.14 2467	4932.28 4933	7398.41	9864.55	12 330.69	14 796.83	17 262.96	19 729.1	22 195.24	24 661.38
3/0	19.04	284.72	284.72 285	569.45 570	854.17 855	1138.9 1139	1423.62 1424	1708.34 1709	1993.07 1994	2277.79 2278	2562.51 2563	2847.24 2848	5694.48 5695	8541.71	11 388.95	14 236.19	17 083.43	19 930.67	22 777.9	25 625.14	28 472.38
4/0	21.53	364.06	364.06 365	728.13 729	1092.19 1093	1456.26 1457	1820.32 1821	2184.39 2185	2548.45 2549	2912.51 2913	3276.58 3277	3640.64 3641	7281.28 7282	10 921.93	14 562.57	18 203.21	21 843.85	25 484.49	29 125.13	32 765.78	36 406.42
250	23.48	433.0	433.0 433	866.0 866	1298.99 1299	1731.99 1732	2164.99 2165	2597.99 2598	3030.99 3031	3463.99 3464	3896.98 3897	4329.98 4330	8659.96 8660	12 989.95	17 319.93	21 649.91	25 979.89	30 309.87	34 639.85	38 969.84	43 299.82
300	24.88	486.17	486.17 487	972.35 973	1458.52 1459	1944.69 1945	2430.86 2431	2917.04 2918	3403.21 3404	3889.38 3890	4375.55 4376	4861.73 4862	9723.46 9724	14 585.18	19 446.91	24 308.64	29 170.37	34 032.09	38 893.82	43 755.55	48 617.28
350	26.18	538.31	538.31 539	1076.61 1077	1614.92 1615	2153.22 2154	2691.53 2692	3229.84 3230	3768.14 3769	4306.45 4307	4844.75 4845	5383.06 5384	10 766.12 10767	16 149.18	21 532.24	26 915.3	32 298.36	37 681.42	43 064.47	48 447.53	53 830.59

400	27.37	588.36	588.36 589	1176.71 1177	1765.07 1766	2353.42 2354	2941.78 2942	3530.13 3531	4118.49 4119	4706.84 4707	5295.2 5296	5883.55 5884	11767.1 11768	17 650.65	23 534.2	29 417.75	35 301.3	41 184.85	47 068.4	52 951.95	58 835.5
450	28.49	637.49	637.49 638	1274.98 1275	1912.48 1913	2549.97 2550	3187.46 3188	3824.95 3825	4462.44 4463	5099.94 5100	5737.43 5738	6374.92 6375	12749.84 12750	19 124.76	25 499.68	31 874.6	38 249.52	44 624.44	50 999.36	57 374.29	63 749.21
500	29.53	684.88	684.88 685	1369.77 1370	2054.65 2055	2739.53 2740	3424.42 3425	4109.3 4110	4794.19 4795	5479.07 5480	6163.95 6164	6848.84 6849	13697.67 13698	20 546.51	27 395.34	34 244.18	41 093.02	47 941.85	54 790.69	61 639.53	68 488.36
600	32.34	821.43	821.43 822	1642.86 1643	2464.29 2465	3285.72 3286	4107.14 4108	4928.57 4929	5750.0 5751	6571.43 6572	7392.86 7393	8214.29 8215	16428.58 16429	24 642.86	32 857.15	41 071.44	49 285.73	57 500.01	65 714.3	73 928.59	82 142.88
700	34.15	915.95	915.95 916	1831.9 1832	2747.85 2748	3663.8 3664	4579.75 4580	5495.69 5496	6411.64 6412	7327.59 7328	8243.54 8244	9159.49 9160	18318.98 18319	27 478.47	36 637.96	45 797.45	54 956.94	64 116.43	73 275.92	82 435.41	91 594.9
750	35.01	962.66	962.66 963	1925.33 1926	2887.99 2888	3850.65 3851	4813.31 4814	5775.98 5776	6738.64 6739	7701.3 7702	8663.96 8664	9626.63 9627	19253.25 19254	28 879.88	38 506.5	48 133.13	57 759.76	67 386.38	77 013.01	86 639.63	96 266.26
800	35.82	1007.72	1007.72 1008	2015.45 2016	3023.17 3024	4030.89 4031	5038.61 5039	6046.34 6047	7054.06 7055	8061.78 8062	9069.5 9070	10077.23 10078	20154.45 20155	30 231.68	40 308.91	50 386.14	60 463.36	70 540.59	80 617.82	90 695.04	100 772.27
900	37.45	1101.52	1101.52 1102	2203.05 2204	3304.57 3305	4406.09 4407	5507.61 5508	6609.14 6610	7710.66 7711	8812.18 8813	9913.71 9914	11015.23 11016	22030.46 22031	33 045.69	44 060.92	55 076.14	66 091.37	77 106.6	88 121.83	99 137.06	110 152.29
1000	38.92	1189.69	1189.69 1190	2379.39 2380	3569.08 3570	4758.78 4759	5948.47 5949	7138.17 7139	8327.86 8328	9517.56 9518	10707.25 10708	11896.95 11897	23793.89 23794	35 690.84	47 587.79	59 484.74	71 381.68	83 278.63	95 175.58	107 072.53	118 969.47
1250	44.68	1567.89	1567.89	3135.78	4703.68	6271.57	7839.46	9407.35	10 975.25	12 543.14	14 111.03	15 678.92	31 357.84	47 036.77	62 715.69	78 394.61	94 073.53	109 752.46	125 431.38	141 110.3	156 789.22

			1568	3136	4704	6272	7840	9408	10976	12544	14112	15679	31358								
1500	47.8	1794.51	1795	3589.02	3590	5383.53	5384	7178.04	7179	8972.55	8973	10767.05	10768	12561.56	12562	14356.07	14357	16150.58	16151	17945.09	17946	35890.18	35891	53	835.27	71	780.37	89	725.46	107	670.55	125	615.64	143	560.73	161	505.82	179	450.91
1750	50.7	2018.86	2019	4037.72	4038	6056.57	6057	8075.43	8076	10094.29	10095	12113.15	12114	14132.01	14133	16150.87	16151	18169.72	18170	20188.58	20189	40377.16	40378	60	565.74	80	754.33	100	942.91	121	131.49	141	320.07	161	508.65	181	697.23	201	885.81
2000	53.39	2238.77	2239	4477.54	4478	6716.31	6717	8955.09	8956	11193.86	11194	13432.63	13433	15671.4	15672	17910.17	17911	20148.94	20149	22387.71	22388	44775.43	44776	67	163.14	89	550.85	111	938.56	134	326.28	156	713.99	179	101.7	201	489.41	223	877.13

Table 6G

Dimensions of single Class B RPV90 UNJACKETED 2000 V insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~RPV90 UNJACKETED 2000 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
14	4.89	~~18.78~~	~~18.78~~ 18.8	~~37.56~~ 37.6	~~56.34~~ 56.4	~~75.12~~ 75.2	93.9	~~112.68~~ 113	~~131.46~~ 132	~~150.2~~ 151	~~169.02~~ 170	~~187.81~~ 188	~~375.61~~ 376	~~563.42~~	~~751.22~~	~~939.03~~	~~1126.83~~	~~1314.64~~	~~1502.44~~	~~1690.25~~	~~1878.05~~
12	5.36	~~22.56~~	~~22.56~~ 22.6	~~45.13~~ 45.2	~~67.69~~ 67.7	~~90.26~~ 90.3	~~112.82~~ 113	~~135.39~~ 136	~~157.95~~ 158	~~180.51~~ 181	~~203.08~~ 204	~~225.64~~ 226	~~451.28~~ 452	~~676.93~~	~~902.57~~	~~1128.21~~	~~1353.85~~	~~1579.49~~	~~1805.13~~	~~2030.78~~	~~2256.42~~
10	5.99	~~28.18~~	~~28.18~~ 28.2	~~56.36~~ 56.4	~~84.54~~ 84.6	~~112.72~~ 113	~~140.9~~ 141	~~169.08~~ 170	~~197.26~~ 198	~~225.44~~ 226	~~253.62~~ 254	~~281.8~~ 282	~~563.6~~ 564	~~845.4~~	~~1127.21~~	~~1409.01~~	~~1690.81~~	~~1972.61~~	~~2254.41~~	~~2536.21~~	~~2818.02~~
8	7.27	~~41.51~~	~~41.51~~ 41.6	~~83.02~~ 83.1	~~124.53~~ 125	~~166.04~~ 167	~~207.55~~ 208	~~249.06~~ 250	~~290.57~~ 291	~~332.08~~ 333	~~373.6~~ 374	~~415.11~~ 416	~~830.21~~ 831	~~1245.32~~	~~1660.42~~	~~2075.53~~	~~2490.63~~	~~2905.74~~	~~3320.85~~	~~3735.95~~	~~4151.06~~
6	8.23	~~53.2~~	53.2	~~106.39~~ 107	~~159.59~~ 160	~~212.79~~ 213	~~265.99~~ 266	~~319.18~~ 320	~~372.38~~ 373	~~425.58~~ 426	~~478.78~~ 479	~~531.97~~ 532	~~1063.95~~ 1064	~~1595.92~~	~~2127.89~~	~~2659.86~~	~~3191.84~~	~~3723.81~~	~~4255.78~~	~~4787.76~~	~~5319.73~~
4	9.45	~~70.14~~	~~70.14~~ 70.2	~~140.28~~ 141	~~210.41~~ 211	~~280.55~~ 281	~~350.69~~ 351	~~420.83~~ 421	~~490.97~~ 491	~~561.1~~ 562	~~631.24~~ 632	~~701.38~~ 702	~~1402.76~~ 1403	~~2104.14~~	~~2805.52~~	~~3506.9~~	~~4208.28~~	~~4909.66~~	~~5611.04~~	~~6312.42~~	~~7013.8~~
3	10.16	~~81.07~~	~~81.07~~ 81.1	~~162.15~~ 163	~~243.22~~ 244	~~324.29~~ 325	~~405.37~~ 406	~~486.44~~ 487	~~567.51~~ 568	~~648.59~~ 649	~~729.66~~ 730	~~810.73~~ 811	~~1621.46~~ 1622	~~2432.2~~	~~3242.93~~	~~4053.66~~	~~4864.39~~	~~5675.12~~	~~6485.86~~	~~7296.59~~	~~8107.32~~

2	10.98	94.69	94.7	189.38	284.06	378.75	473.44	568.13	662.82	757.5	852.19	946.88	1893.76	2840.64	3787.52	4734.4	5681.28	6628.15	7575.03	8521.91	9468.79
1	13.01	132.94	133	265.87	398.81	531.75	664.68	797.62	930.56	1063.49	1196.43	1329.37	2658.73	3988.1	5317.46	6646.83	7976.19	9305.56	10 634.93	11 964.29	13 293.66
1/0	14.03	154.6	155	309.2	463.8	618.39	772.99	927.59	1082.19	1236.79	1391.39	1545.98	3091.97	4637.95	6183.94	7729.92	9275.91	10 821.89	12 367.88	13 913.86	15 459.85
2/0	15.2	181.46	182	362.92	544.38	725.83	907.29	1088.75	1270.21	1451.67	1633.13	1814.58	3629.17	5443.75	7258.34	9072.92	10 887.5	12 702.09	14 516.67	16 331.26	18 145.84
3/0	16.52	214.34	215	428.69	643.03	857.37	1071.72	1286.06	1500.4	1714.75	1929.09	2143.43	4286.87	6430.3	8573.73	10 717.17	12 860.6	15 004.03	17 147.47	19 290.9	21 434.33
4/0	17.99	254.19	255	508.37	762.56	1016.75	1270.93	1525.12	1779.3	2033.49	2287.68	2541.86	5083.73	7625.59	10 167.45	12 709.32	15 251.18	17 793.04	20 334.91	22 876.77	25 418.63
250	19.94	312.28	313	624.55	936.83	1249.11	1561.39	1873.66	2185.94	2498.22	2810.49	3122.77	6245.54	9368.31	12 491.09	15 613.86	18 736.63	21 859.4	24 982.17	28 104.94	31 227.71
300	21.34	357.67	358	715.33	1073.0	1430.67	1788.33	2146.0	2503.67	2861.33	3219.0	3576.67	7153.34	10 730.01	14 306.67	17 883.34	21 460.01	25 036.68	28 613.35	32 190.02	35 766.69
350	22.64	402.57	403	805.14	1207.71	1610.28	2012.86	2415.43	2818.0	3220.57	3623.14	4025.71	8051.42	12 077.14	16 102.85	20 128.56	24 154.27	28 179.99	32 205.7	36 231.41	40 257.12
400	23.83	446.0	447	892.01	1338.01	1784.01	2230.02	2676.02	3122.02	3568.03	4014.03	4460.03	8920.06	13 380.1	17 840.13	22 300.16	26 760.19	31 220.22	35 680.26	40 140.29	44 600.32

					1339	1785	2231	2677	3123	3569	4015	4461	8921								
450	24.95	488.91	488.91 489	977.82 978	1466.74 1467	1955.65 1956	2444.56 2445	2933.47 2934	3422.39 3423	3911.3 3912	4400.21 4401	4889.12 4890	9778.25 9779	14 667.37	19 556.49	24 445.62	29 334.74	34 223.86	39 112.99	44 002.11	48 891.23
500	25.99	530.52	530.52 531	1061.04 1062	1591.56 1592	2122.08 2123	2652.6 2653	3183.12 3184	3713.65 3714	4244.17 4245	4774.69 4775	5305.21 5306	10 610.42 10611	15 915.62	21 220.83	26 526.04	31 831.25	37 136.46	42 441.67	47 746.87	53 052.08
600	28.78	650.54	650.54 651	1301.07 1302	1951.61 1952	2602.14 2603	3252.68 3253	3903.22 3904	4553.75 4554	5204.29 5205	5854.83 5855	6505.36 6506	13 010.72 13011	19 516.09	26 021.45	32 526.81	39 032.17	45 537.53	52 042.9	58 548.26	65 053.62
700	30.59	734.93	734.93 735	1469.87 1470	2204.8 2205	2939.74 2940	3674.67 3675	4409.61 4410	5144.54 5145	5879.48 5880	6614.41 6615	7349.35 7350	14 698.7 14699	22 048.05	29 397.39	36 746.74	44 096.09	51 445.44	58 794.79	66 144.14	73 493.48
750	31.45	776.84	776.84 777	1553.68 1554	2330.52 2331	3107.36 3108	3884.2 3885	4661.04 4662	5437.88 5438	6214.71 6215	6991.55 6992	7768.39 7769	15 536.79 15537	23 305.18	31 073.57	38 841.96	46 610.36	54 378.75	62 147.14	69 915.54	77 683.93
800	32.26	817.37	817.37 818	1634.74 1635	2452.11 2453	3269.48 3270	4086.85 4087	4904.22 4905	5721.59 5722	6538.96 6539	7356.33 7357	8173.7 8174	16 347.4 16348	24 521.1	32 694.79	40 868.49	49 042.19	57 215.89	65 389.59	73 563.29	81 736.98
900	33.89	902.06	902.06 903	1804.11 1805	2706.17 2707	3608.22 3609	4510.28 4511	5412.33 5413	6314.39 6315	7216.44 7217	8118.5 8119	9020.55 9021	18 041.1 18042	27 061.65	36 082.2	45 102.75	54 123.3	63 143.85	72 164.4	81 184.95	90 205.5
1000	35.36	982.01	982.01 983	1964.01 1965	2946.02 2947	3928.03 3929	4910.03 4911	5892.04 5893	6874.05 6875	7856.05 7857	8838.06 8839	9820.07 9821	19 640.13 19641	29 460.2	39 280.26	49 100.33	58 920.39	68 740.46	78 560.53	88 380.59	98 200.66
1250	39.86	1247.86 1247.86	1247.86 1248	2495.71 2496	3743.57 3744	4991.42 4992	6239.28 6240	7487.14 7488	8734.99 8735	9982.85 9983	11 230.7 11231	12 478.56 12479	24 957.12 24958	37 435.68	49 914.24	62 392.8	74 871.36	87 349.92	99 828.48	112 307.04	124 785.6

1500	42.98	1450.85	1451	2901.75	2902	4352.55	4353	5803.45	5804	7254.25	7255	8705.	8706	10155.95	10156	11606.81	11607	13057.66	13058	14508.51	14509	29017.01	29018	43525.52	58034.03	72542.53	87051.04	101559.54	116068.05	130576.56	145085.06
1750	45.88	1653.24	1654	3306.49	3307	4959.73	4960	6612.97	6613	8266.22	8267	9919.46	9920	11572.7	11573	13225.94	13226	14879.19	14880	16532.43	16533	33064.86	33065	49597.29	66129.72	82662.15	99194.58	115727.01	132259.44	148791.87	165324.3
2000	48.57	1852.79	1853	3705.58	3706	5558.37	5559	7411.16	7412	9263.95	9264	11116.74	11117	12969.53	12970	14822.32	14823	16675.11	16676	18527.9	18528	37055.79	37056	55583.69	74111.58	92639.48	111167.37	129695.27	148223.16	166751.06	185278.95

Table 6H

Dimensions of single Class B RPV90 JACKETED 1000 V insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~RPV90 JACKETED 1000 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
14	4.89	~~18.78~~	~~18.78~~ 18.8	~~37.56~~ 37.6	~~56.34~~ 56.4	~~75.12~~ 75.2	93.9	~~112.68~~ 113	~~131.46~~ 132	~~150.24~~ 151	~~169.02~~ 170	~~187.81~~ 188	~~375.61~~ 376	~~563.42~~	~~751.22~~	~~939.03~~	~~1126.83~~	~~1314.64~~	~~1502.44~~	~~1690.25~~	~~1878.05~~
12	5.36	~~22.56~~	~~22.56~~ 22.6	~~45.13~~ 45.2	~~67.69~~ 67.7	~~90.26~~ 90.3	~~112.82~~ 113	~~135.39~~ 136	~~157.95~~ 158	~~180.51~~ 181	~~203.08~~ 204	~~225.64~~ 226	~~451.28~~ 452	~~676.93~~	~~902.57~~	~~1128.21~~	~~1353.85~~	~~1579.49~~	~~1805.13~~	~~2030.78~~	~~2256.42~~
10	5.99	~~28.18~~	~~28.18~~ 28.2	~~56.36~~ 56.4	~~84.54~~ 84.6	~~112.72~~ 113	~~140.9~~ 141	~~169.08~~ 170	~~197.26~~ 198	~~225.44~~ 226	~~253.62~~ 254	~~281.8~~ 282	~~563.6~~ 564	~~845.4~~	~~1127.21~~	~~1409.01~~	~~1690.81~~	~~1972.61~~	~~2254.41~~	~~2536.21~~	~~2818.02~~
8	7.51	~~44.3~~	44.3	~~88.59~~ 88.6	~~132.89~~ 133	~~177.19~~ 178	~~221.48~~ 222	~~265.78~~ 266	~~310.08~~ 311	~~354.37~~ 355	~~398.67~~ 399	~~442.97~~ 443	~~885.93~~ 886	~~1328.9~~	~~1771.86~~	~~2214.83~~	~~2657.79~~	~~3100.76~~	~~3543.72~~	~~3986.69~~	~~4429.65~~
6	9.23	~~66.91~~	~~66.91~~ 67.0	~~133.82~~ 134	~~200.73~~ 201	~~267.64~~ 268	~~334.55~~ 335	~~401.46~~ 402	~~468.37~~ 469	~~535.28~~ 536	~~602.19~~ 603	~~669.1~~ 670	~~1338.21~~ 1339	~~2007.31~~	~~2676.41~~	~~3345.52~~	~~4014.62~~	~~4683.72~~	~~5352.83~~	~~6021.93~~	~~6691.03~~
4	10.45	~~85.77~~	~~85.77~~ 85.8	~~171.53~~ 172	~~257.3~~ 258	~~343.07~~ 344	~~428.84~~ 429	~~514.6~~ 515	~~600.37~~ 601	~~686.14~~ 687	~~771.91~~ 772	~~857.67~~ 858	~~1715.35~~ 1716	~~2573.02~~	~~3430.7~~	~~4288.37~~	~~5146.05~~	~~6003.72~~	~~6861.4~~	~~7719.07~~	~~8576.74~~
3	11.16	~~97.82~~	~~97.82~~ 97.9	~~195.64~~ 196	~~293.45~~ 294	~~391.27~~ 392	~~489.09~~ 490	~~586.91~~ 587	~~684.73~~ 685	~~782.54~~ 783	~~880.36~~ 881	~~978.18~~ 979	~~1956.36~~ 1957	~~2934.54~~	~~3912.72~~	~~4890.89~~	~~5869.07~~	~~6847.25~~	~~7825.43~~	~~8803.61~~	~~9781.79~~

2	11.98	112.72	112.72 113	225.44 226	338.16 339	450.88 451	563.6 564	676.32 677	789.04 790	901.77 902	1014.49 1015	1127.21 1128	2254.41 2255	3381.62	4508.83	5636.03	6763.24	7890.45	9017.65	10 144.86	11 272.07
1	14.77	171.34	171.34 172	342.67 343	514.01 515	685.35 686	856.68 857	1028.02 1029	1199.36 1200	1370.7 1371	1542.03 1543	1713.37 1714	3426.74 3427	5140.11	6853.48	8566.84	10 280.21	11 993.58	13 706.95	15 420.32	17 133.69
1/0	15.79	195.82	195.82 196	391.64 392	587.46 588	783.27 784	979.09 980	1174.91 1175	1370.73 1371	1566.55 1567	1762.37 1763	1958.19 1959	3916.37 3917	5874.56	7832.75	9790.93	11 749.12	13 707.31	15 665.5	17 623.68	19 581.87
2/0	16.96	225.91	225.91 226	451.83 452	677.74 678	903.65 904	1129.57 1130	1355.48 1356	1581.39 1582	1807.31 1808	2033.22 2034	2259.13 2260	4518.26 4519	6777.4	9036.53	11 295.66	13 554.79	15 813.92	18 073.05	20 332.19	22 591.32
3/0	18.28	262.45	262.45 263	524.89 525	787.34 788	1049.79 1050	1312.24 1313	1574.68 1575	1837.13 1838	2099.58 2100	2362.03 2363	2624.47 2625	5248.95 5249	7873.42	10 497.9	13 122.37	15 746.84	18 371.32	20 995.79	23 620.27	26 244.74
4/0	19.75	306.35	306.35 307	612.71 613	919.06 920	1225.42 1226	1531.77 1532	1838.13 1839	2144.48 2145	2450.83 2451	2757.19 2758	3063.54 3064	6127.09 6128	9190.63	12 254.17	15 317.72	18 381.26	21 444.81	24 508.35	27 571.89	30 635.44
250	22.46	396.2	396.2 397	792.39 793	1188.59 1189	1584.78 1585	1980.98 1981	2377.17 2378	2773.37 2774	3169.56 3170	3565.76 3566	3961.95 3962	7923.91 7924	11 885.86	15 847.81	19 809.77	23 771.72	27 733.68	31 695.63	35 657.58	39 619.54
300	23.86	447.13	447.13 448	894.25 895	1341.38 1342	1788.51 1789	2235.63 2236	2682.76 2683	3129.89 3130	3577.01 3578	4024.14 4025	4471.27 4472	8942.54 8943	13 413.81	17 885.07	22 356.34	26 827.61	31 298.88	35 770.15	40 241.42	44 712.69
350	25.16	497.18	497.18 498	994.35 995	1491.53 1492	1988.71 1989	2485.89 2486	2983.06 2984	3480.24 3481	3977.42 3978	4474.59 4475	4971.77 4972	9943.54 9944	14 915.31	19 887.09	24 858.86	29 830.63	34 802.4	39 774.17	44 745.94	49 717.71

400	26.35	545.32	546	1090.64 1091	1635.96 1636	2181.28 2182	2726.6 2727	3271.92 3272	3817.24 3818	4362.56 4363	4907.88 4908	5453.2 5454	10 906.39 10907	16 359.59	21 812.78	27 265.98	32 719.18	38 172.37	43 625.57	49 078.77	54 531.96
450	27.47	592.66	593	1185.32 1186	1777.99 1778	2370.65 2371	2963.31 2964	3555.97 3556	4148.64 4149	4741.3 4742	5333.96 5334	5926.62 5927	11 853.24 11854	17 779.86	23 706.49	29 633.11	35 559.73	41 486.35	47 412.97	53 339.59	59 266.22
500	28.51	638.39	639	1276.77 1277	1915.16 1916	2553.55 2554	3191.94 3192	3830.32 3831	4468.71 4469	5107.1 5108	5745.49 5746	6383.87 6384	12 767.75 12768	19 151.62	25 535.5	31 919.37	38 303.24	44 687.12	51 070.99	57 454.87	63 838.74
600	30.54	732.53	733	1465.07 1466	2197.6 2198	2930.14 2931	3662.67 3663	4395.21 4396	5127.74 5128	5860.27 5861	6592.81 6593	7325.34 7326	14 650.69 14651	21 976.03	29 301.37	36 626.71	43 952.06	51 277.4	58 602.74	65 928.08	73 253.43
700	32.35	821.94	822	1643.87 1644	2465.81 2466	3287.75 3288	4109.68 4110	4931.62 4932	5753.56 5754	6575.49 6576	7397.43 7398	8219.37 8220	16 438.74 16439	24 658.11	32 877.47	41 096.84	49 316.21	57 535.58	65 754.95	73 974.32	82 193.68
750	33.21	866.22	867	1732.44 1733	2598.66 2599	3464.88 3465	4331.09 4332	5197.31 5198	6063.53 6064	6929.75 6930	7795.97 7796	8662.19 8663	17 324.38 17325	25 986.57	34 648.75	43 310.94	51 973.13	60 635.32	69 297.51	77 959.7	86 621.89
800	34.02	908.99	909	1817.98 1818	2726.97 2727	3635.95 3636	4544.94 4545	5453.93 5454	6362.92 6363	7271.91 7272	8180.9 8181	9089.89 9090	18 179.77 18180	27 269.66	36 359.55	45 449.44	54 539.32	63 629.21	72 719.1	81 808.99	90 898.87
900	35.65	998.18	999	1996.36 1997	2994.54 2995	3992.72 3993	4990.9 4991	5989.08 5990	6987.26 6988	7985.44 7986	8983.62 8984	9981.8 9982	19 963.6 19964	29 945.41	39 927.21	49 909.01	59 890.81	69 872.61	79 854.42	89 836.22	99 818.02
1000	37.12	1082.2	1083	2164.39 2165	3246.59 3247	4328.78 4329	5410.98 5411	6493.17 6494	7575.37 7576	8657.57 8658	9739.76 9740	10 821.96 10822	21 643.91 21644	32 465.87	43 287.83	54 109.79	64 931.74	75 753.7	86 575.66	97 397.62	108 219.57
1250	43.14	1461.67	1461.67	2923.35	4385.02	5846.69	7308.36	8770.04	10 231.71	11 693.38	13 155.06	14 616.73	29 233.46	43 850.18	58 466.91	73 083.64	87 700.37	102 317.1	116 933.82	131 550.55	146 167.28

			1462	2924	4386	5847	7309	8771	10232	11694	13156	14617	29234								
1500	46.26	1680.74	1680.74 1681	3361.48 3362	5042.23 5043	6722.97 6723	8403.71 8404	10084.45 10085	11765.2 11766	13445.94 13446	15126.68 15127	16807.42 16808	33614.85 33615	50422.27	67229.69	84037.12	100844.54	117651.96	134459.39	151266.81	168074.23
1750	49.16	1898.08	1898.08 1899	3796.15 3797	5694.23 5695	7592.3 7593	9490.38 9491	11388.46 11389	13286.53 13287	15184.61 15185	17082.69 17083	18980.76 18981	37961.52 37962	56942.28	75923.05	94903.81	113884.57	132865.33	151846.09	170826.85	189807.61
2000	51.85	2111.48	2111.48 2112	4222.96 4223	6334.45 6335	8445.93 8446	10557.41 10558	12668.89 12669	14780.37 14781	16891.86 16892	19003.34 19004	21114.82 21115	42229.64 42230	63344.46	84459.28	105574.1	126688.93	147803.75	168918.57	190033.39	211148.21

Table 6I

Dimensions of single Class B RPV90 JACKETED 2000 V insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~RPV90 JACKETED 2000 V~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
14	5.65	~~25.07~~	~~25.07~~ 25.1	~~50.14~~ 50.2	~~75.22~~ 75.3	~~100.29~~ 101	~~125.36~~ 126	~~150.43~~ 151	~~175.5~~ 176	~~200.57~~ 201	~~225.65~~ 226	~~250.72~~ 251	~~501.44~~ 502	~~752.16~~	~~1002.87~~	~~1253.59~~	~~1504.31~~	~~1755.03~~	~~2005.75~~	~~2256.47~~	~~2507.19~~
12	6.12	~~29.42~~	~~29.42~~ 29.5	~~58.83~~ 58.9	~~88.25~~ 88.3	~~117.67~~ 118	~~147.08~~ 148	~~176.5~~ 177	~~205.92~~ 206	~~235.33~~ 236	~~264.75~~ 265	~~294.17~~ 295	~~588.33~~ 589	~~882.5~~	~~1176.66~~	~~1470.83~~	~~1765.0~~	~~2059.16~~	~~2353.33~~	~~2647.5~~	~~2941.66~~
10	7.51	~~44.3~~	44.3	~~88.59~~ 88.6	~~132.89~~ 133	~~177.19~~ 178	~~221.48~~ 222	~~265.78~~ 266	~~310.08~~ 311	~~354.37~~ 355	~~398.67~~ 399	~~442.97~~ 443	~~885.93~~ 886	~~1328.9~~	~~1771.86~~	~~2214.83~~	~~2657.79~~	~~3100.76~~	~~3543.72~~	~~3986.69~~	~~4429.65~~
8	8.79	~~60.68~~	~~60.68~~ 60.7	~~121.37~~ 122	~~182.05~~ 183	~~242.73~~ 243	~~303.42~~ 304	~~364.1~~ 365	~~424.78~~ 425	~~485.46~~ 486	~~546.15~~ 547	~~606.83~~ 607	~~1213.66~~ 1214	~~1820.49~~	~~2427.32~~	~~3034.15~~	~~3640.98~~	~~4247.82~~	~~4854.65~~	~~5461.48~~	~~6068.31~~
6	9.75	~~74.66~~	~~74.66~~ 74.7	~~149.32~~ 150	~~223.99~~ 224	~~298.65~~ 299	~~373.31~~ 374	~~447.97~~ 448	~~522.63~~ 523	~~597.3~~ 598	~~671.96~~ 672	~~746.62~~ 747	~~1493.24~~ 1494	~~2239.86~~	~~2986.48~~	~~3733.1~~	~~4479.71~~	~~5226.33~~	~~5972.95~~	~~6719.57~~	~~7466.19~~
4	10.97	~~94.52~~	~~94.52~~ 94.6	~~189.03~~ 190	~~283.55~~ 284	~~378.06~~ 379	~~472.58~~ 473	~~567.09~~ 568	~~661.61~~ 662	~~756.12~~ 757	~~850.64~~ 851	~~945.16~~ 946	~~1890.31~~ 1891	~~2835.47~~	~~3780.62~~	~~4725.78~~	~~5670.93~~	~~6616.09~~	~~7561.24~~	~~8506.4~~	~~9451.55~~
3	11.68	~~107.15~~	~~107.15~~ 108	~~214.29~~ 215	~~321.44~~ 322	~~428.58~~ 429	~~535.73~~ 536	~~642.88~~ 643	~~750.02~~ 751	~~857.17~~ 858	~~964.31~~ 965	~~1071.46~~	~~2142.92~~	~~3214.38~~	~~4285.84~~	~~5357.3~~	~~6428.75~~	~~7500.21~~	~~8571.67~~	~~9643.13~~	~~10714.59~~

												1072	2143								
2	13.26	138.09	138.09 139	276.19 277	414.28 415	552.38 553	690.47 691	828.57 829	966.66 967	1104.76 1105	1242.85 1243	1380.95 1381	2761.89 2762	4142.84	5523.79	6904.73	8285.68	9666.63	11 047.57	12 428.52	13 809.47
1	15.29	183.61	183.61 184	367.23 368	550.84 551	734.45 735	918.07 919	1101.68 1102	1285.3 1286	1468.91 1469	1652.52 1653	1836.14 1837	3672.27 3673	5508.41	7344.54	9180.68	11 016.82	12 852.95	14 689.09	16 525.22	18 361.36
1/0	16.31	208.93	208.93 209	417.86 418	626.79 627	835.71 836	1044.64 1045	1253.57 1254	1462.5 1463	1671.43 1672	1880.36 1881	2089.29 2090	4178.57 4179	6267.86	8357.14	10 446.43	12 535.71	14 625.0	16 714.28	18 803.57	20 892.86
2/0	17.48	239.98	239.98 240	479.96 480	719.94 720	959.91 960	1199.89 1200	1439.87 1440	1679.85 1680	1919.83 1920	2159.81 2160	2399.79 2400	4799.57 4800	7199.36	9599.15	11 998.94	14 398.72	16 798.51	19 198.3	21 598.09	23 997.87
3/0	18.8	277.59	277.59 278	555.18 556	832.77 833	1110.36 1111	1387.96 1388	1665.55 1666	1943.14 1944	2220.73 2221	2498.32 2499	2775.91 2776	5551.8 5552	8327.73	11 103.65	13 879.56	16 655.47	19 431.38	22 207.29	24 983.2	27 759.11
4/0	21.29	355.99	355.99 356	711.99 712	1067.98 1068	1423.97 1424	1779.96 1780	2135.96 2136	2491.95 2492	2847.94 2848	3203.94 3204	3559.93 3560	7119.86 7120	10 679.78	14 239.71	17 799.64	21 359.57	24 919.5	28 479.42	32 039.35	35 599.28
250	23.24	424.19	424.19 425	848.38 849	1272.57 1273	1696.77 1697	2120.96 2121	2545.15 2546	2969.34 2970	3393.53 3394	3817.72 3818	4241.92 4242	8483.83 8484	12 725.75	16 967.67	21 209.58	25 451.5	29 693.42	33 935.33	38 177.25	42 419.17
300	24.64	476.84	476.84 477	953.68 954	1430.52 1431	1907.35 1908	2384.19 2385	2861.03 2862	3337.87 3338	3814.71 3815	4291.55 4292	4768.38 4769	9536.77 9537	14 305.15	19 073.54	23 841.92	28 610.31	33 378.69	38 147.08	42 915.46	47 683.85
350	25.94	528.48	528.48 529	1056.96 1057	1585.44 1586	2113.93 2114	2642.41 2643	3170.89 3171	3699.37 3700	4227.85 4228	4756.33 4757	5284.82 5285	10 569.63 10570	15 854.45	21 139.26	26 424.08	31 708.89	36 993.71	42 278.52	47 563.34	52 848.15

400	27.13	578.08	579	1156.16 1157	1734.25 1735	2312.33 2313	2890.41 2891	3468.49 3469	4046.57 4047	4624.66 6725	5202.74 5203	5780.82 5781	11561.64 11562	17342.46	23123.28	28904.1	34684.92	40465.74	46246.56	52027.38	57808.2
450	28.25	626.8	627	1253.59 1254	1880.39 1881	2507.19 2508	3133.98 3134	3760.78 3761	4387.58 4388	5014.37 5015	5641.17 5642	6267.97 6268	12535.94 12536	18803.9	25071.87	31339.84	37607.81	43875.78	50143.75	56411.71	62679.68
500	29.29	673.8	674	1347.59 1348	2021.39 2022	2695.19 2696	3368.98 3369	4042.78 4043	4716.57 4717	5390.37 5391	6064.17 6065	6737.96 6738	13475.93 13476	20213.89	26951.85	33689.82	40427.78	47165.74	53903.7	60641.67	67379.63
600	32.08	808.27	809	1616.55 1617	2424.82 2425	3233.1 3234	4041.37 4042	4849.64 4850	5657.92 5658	6466.19 6467	7274.47 7275	8082.74 8083	16165.48 16166	24248.22	32330.96	40413.7	48496.44	56579.18	64661.92	72744.66	80827.4
700	33.89	902.06	903	1804.11 1805	2706.17 2707	3608.22 3609	4510.28 4511	5412.33 5413	6314.39 6315	7216.44 7217	8118.5 8119	9020.55 9021	18041.1 18042	27061.65	36082.2	45102.75	54123.3	63143.85	72164.4	81184.95	90205.5
750	34.75	948.42	949	1896.83 1897	2845.25 2846	3793.67 3794	4742.09 4743	5690.5 5691	6638.92 6639	7587.34 7588	8535.76 8536	9484.17 9485	18968.35 18969	28452.52	37936.69	47420.87	56905.04	66389.22	75873.39	85357.56	94841.74
800	35.56	993.15	994	1986.29 1987	2979.44 2980	3972.59 3973	4965.73 4966	5958.88 5959	6952.03 6953	7945.17 7946	8938.32 8939	9931.47 9932	19862.93 19863	29794.4	39725.87	49657.33	59588.8	69520.27	79451.73	89383.2	99314.67
900	37.19	1086.28	1087	2172.56 2173	3258.84 3259	4345.12 4346	5431.41 5432	6517.69 6518	7603.97 7604	8690.25 8691	9776.53 9777	10862.81 10863	21725.62 21726	32588.43	43451.25	54314.06	65176.87	76039.68	86902.49	97765.3	108628.11
1000	38.66	1173.85	1174	2347.71 2348	3521.56 3522	4695.41 4696	5869.26 5870	7043.12 7044	8216.97 8217	9390.82 9391	10564.67 10565	11738.53 11739	23477.05 23478	35215.58	46954.11	58692.63	70431.16	82169.68	93908.21	105646.74	117385.26
1250	44.68	1567.89	1567.89	3135.78	4703.68	6271.57	7839.46	9407.35	10975.25	12543.14	14111.03	15678.92	31357.84	47036.77	62715.69	78394.61	94073.53	109752.46	125431.38	141110.3	156789.22

			1568	3136	4704	6272	7840	9408	10976	12544	14112	15679	31358								
1500	47.8	1794.51	1795	3589.02	3590	5383.53	5384	7178.04	7179	8972.55	8973	10767.05	10768	12561.56	12562	14356.07	14357	16150.58	16151	17945.09	17946	35890.18	35891	53	835.27	71	780.37	89	725.46	107	670.55	125	615.64	143	560.73	161	505.82	179	450.91
1750	50.7	2018.86	2019	4037.72	4038	6056.57	6057	8075.43	8076	10094.29	10095	12113.15	12114	14132.01	14133	16150.87	16151	18169.72	18170	20188.58	20189	40377.16	40378	60	565.74	80	754.33	100	942.91	121	131.49	141	320.07	161	508.65	181	697.23	201	885.81
2000	53.39	2238.77	2239	4477.54	4478	6716.31	6717	8955.09	8956	11193.86	11194	13432.63	13433	15671.4	15672	17910.17	17911	20148.94	20149	22387.71	22388	44775.43	44776	67	163.14	89	550.85	111	938.56	134	326.28	156	713.99	179	101.7	201	489.41	223	877.13

Table 6J

Dimensions of single Class B TW, TW75 insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

TW, TW75

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
STRANDED CONDUCTORS																				
14	3.36	~~8.87~~	8.87	~~17.73~~ 17.8	26.6	~~35.47~~ 35.5	~~44.33~~ 44.4	53.2	~~62.07~~ 62.1	~~70.93~~ 71.0	79.8	~~88.67~~ 88.7	~~177.34~~ 178	~~266.0~~	~~354.67~~	~~443.34~~	~~532.01~~	~~620.68~~	~~709.35~~	~~798.01~~	~~886.68~~
12	3.84	~~11.58~~	~~11.58~~ 11.6	~~23.16~~ 23.2	~~34.74~~ 34.8	~~46.32~~ 46.4	~~57.91~~ 58.0	~~69.49~~ 69.5	~~81.07~~ 81.1	~~92.65~~ 92.7	~~104.23~~ 105	~~115.81~~ 116	~~231.62~~ 232	~~347.44~~	~~463.25~~	~~579.06~~	~~694.87~~	~~810.68~~	~~926.49~~	~~1042.3~~ 1	~~1158.1~~ 2
10	4.47	~~15.69~~	~~15.69~~ 15.7	~~31.39~~ 31.4	~~47.08~~ 47.1	~~62.77~~ 62.8	~~78.46~~ 78.5	~~94.16~~ 94.2	~~109.85~~ 110	~~125.54~~ 126	~~141.24~~ 142	~~156.93~~ 157	~~313.86~~ 314	~~470.79~~	~~627.72~~	~~784.65~~	~~941.58~~	~~1098.5~~ 1	~~1255.4~~ 4	~~1412.3~~ 7	~~1569.3~~
8	5.99	~~28.18~~	~~28.18~~ 28.2	~~56.36~~ 56.4	~~84.54~~ 84.6	~~112.72~~ 113	~~140.9~~ 141	~~169.08~~ 170	~~197.26~~ 198	~~225.44~~ 226	~~253.62~~ 254	~~281.8~~ 282	~~563.6~~ 564	~~845.4~~	~~1127.2~~ 1	~~1409.0~~ 1	~~1690.8~~ 1	~~1972.6~~ 1	~~2254.4~~ 1	~~2536.2~~ 1	~~2818.0~~ 2
6	7.71	~~46.69~~	~~46.69~~ 46.7	~~93.37~~ 93.4	~~140.06~~ 141	~~186.75~~ 187	~~233.44~~ 234	~~280.12~~ 281	~~326.81~~ 327	~~373.5~~ 374	~~420.19~~ 421	~~466.87~~ 467	~~933.75~~ 934	~~1400.62~~	~~1867.49~~	~~2334.36~~	~~2801.24~~	~~3268.11~~	~~3734.98~~	~~4201.86~~	~~4668.73~~
4	8.93	~~62.63~~	~~62.63~~ 62.7	~~125.26~~ 126	~~187.89~~ 188	~~250.53~~ 251	~~313.16~~ 314	~~375.79~~ 376	~~438.42~~ 439	~~501.05~~ 502	~~563.68~~ 564	~~626.31~~ 627	~~1252.63~~ 1253	~~1878.94~~	~~2505.26~~	~~3131.57~~	~~3757.89~~	4384.2	~~5010.52~~	~~5636.83~~	~~6263.15~~
3	9.64	~~72.99~~	~~72.99~~ 73.0	~~145.97~~ 146	~~218.96~~ 219	~~291.95~~ 292	~~364.93~~ 365	~~437.92~~ 438	~~510.91~~ 511	~~583.89~~ 584	~~656.88~~ 657	~~729.87~~ 730	~~1459.73~~1460	~~2189.6~~	~~2919.47~~	~~3649.34~~	~~4379.2~~	~~5109.07~~	~~5838.94~~	~~6568.81~~	~~7298.67~~

2	10.46	85.93	85.93 86.0	171.86 172	257.8 258	343.73 344	429.66 430	515.59 516	601.52 602	687.45 688	773.39 774	859.32 860	1718.63 1719	2577.95	3437.27	4296.58	5155.9	6015.22	6874.53	7733.85	8593.17
1	12.49	122.52	122.52 123	245.04 246	367.57 368	490.09 491	612.61 613	735.13 736	857.66 858	980.18 981	1102.7 1103	1225.22 1226	2450.44 2451	3675.67	4900.89	6126.11	7351.33	8576.55	9801.78	11 027.0	12 252.22
1/0	13.53	143.78	143.78 144	287.55 288	431.33 432	575.1 576	718.88 719	862.65 863	1006.43 1007	1150.21 1151	1293.98 1294	1437.76 1438	2875.51 2876	4313.27	5751.03	7188.78	8626.54	10 064.3	11 502.06	12 939.81	14 377.57
2/0	14.7	169.72	169.72 170	339.43 340	509.15 510	678.87 679	848.58 849	1018.3 1019	1188.02 1189	1357.73 1358	1527.45 1528	1697.17 1698	3394.33 3395	5091.5	6788.67	8485.83	10 183.0	11 880.17	13 577.34	15 274.5	16 971.67
3/0	16.0	201.06	201.06 202	402.12 403	603.19 604	804.25 805	1005.31 1006	1206.37 1207	1407.43 1408	1608.5 1609	1809.56 1810	2010.62 2011	4021.24 4022	6031.86	8042.48	10 053.1	12 063.72	14 074.34	16 084.95	18 095.57	20 106.19
4/0	17.47	239.7	239.7 240	479.41 480	719.11 720	958.82 959	1198.52 1199	1438.23 1439	1677.93 1678	1917.63 1918	2157.34 2158	2397.04 2398	4794.08 4795	7191.13	9588.17	11 985.21	14 382.25	16 779.3	19 176.34	21 573.38	23 970.42
250	19.43	296.51	296.51 297	593.01 594	889.52 890	1186.03 1187	1482.54 1483	1779.04 1780	2075.55 2076	2372.06 2373	2668.57 2669	2965.07 2966	5930.15 5931	8895.22	11 860.29	14 825.37	17 790.44	20 755.52	23 720.59	26 685.66	29 650.74
300	20.82	340.45	340.45 341	680.9 681	1021.35 1022	1361.79 1362	1702.24 1703	2042.69 2043	2383.14 2384	2723.59 2724	3064.04 3065	3404.48 3405	6808.97 6809	10 213.45	13 617.94	17 022.42	20 426.91	23 831.39	27 235.87	30 640.36	34 044.84
350	22.05	381.86	381.86 382	763.73 764	1145.59 1146	1527.45 1528	1909.31 1910	2291.18 2292	2673.04 2674	3054.9 3055	3436.76 3437	3818.63 3819	7637.25 7638	11 455.88	15 274.5	19 093.13	22 911.75	26 730.38	30 549.0	34 367.63	38 186.26
400	23.31	426.75	426.75 427	853.5 854	1280.25	1707.08 1708	2133.75	2560.51	2987.26	3414.01	3840.76	4267.51	8535.02	12 802.53	17 070.04	21 337.54	25 605.05	29 872.56	34 140.07	38 407.58	42 675.09

					1281		2134	2561	2988	3415	3841	4268	8536								
450	24.43	468.75	468.75 469	937.49 938	1406.24 1407	1874.98 1875	2343.73 2344	2812.47 2813	3281.22 3282	3749.96 3750	4218.71 4219	4687.45 4688	9374.9 9375	14 062.36	18 749.81	23 437.26	28 124.71	32 812.16	37 499.61	42 187.07	46 874.52
500	25.47	509.5	509.5 510	1019.01 1020	1528.51 1529	2038.02 2039	2547.52 2548	3057.03 3058	3566.53 3567	4076.03 4077	4585.54 4586	5095.04 5096	10 190.08 10191	15 285.13	20 380.17	25 475.21	30 570.25	35 665.29	40 760.34	45 855.38	50 950.42
600	28.26	627.24	627.24 628	1254.48 1255	1881.72 1882	2508.96 2509	3136.2 3137	3763.44 3764	4390.68 4391	5017.93 5018	5645.17 5646	6272.41 6273	12 544.81 12545	18 817.22	25 089.63	31 362.03	37 634.44	43 906.85	50 179.25	56 451.66	62 724.07
700	30.07	710.16	710.16 711	1420.32 1421	2130.48 2131	2840.64 2841	3550.8 3551	4260.97 4261	4971.13 4972	5681.29 5682	6391.45 6392	7101.61 7102	14 203.22 14204	21 304.83	28 406.43	35 508.04	42 609.65	49 711.26	56 812.87	63 914.48	71 016.09
750	30.93	751.36	751.36 752	1502.73 1503	2254.09 2255	3005.45 3006	3756.81 3757	4508.18 4509	5259.54 5260	6010.9 6011	6762.27 6763	7513.63 7514	15 027.26 15028	22 540.89	30 054.51	37 568.14	45 081.77	52 595.4	60 109.03	67 622.66	75 136.29
800	31.77	792.73	792.73 793	1585.46 1586	2378.18 2379	3170.91 3171	3963.64 3964	4756.37 4757	5549.1 5550	6341.83 6342	7134.55 7135	7927.28 7928	15 854.5 15855	23 781.85	31 709.13	39 636.41	47 563.69	55 490.97	63 418.26	71 345.54	79 272.82
900	33.37	874.59	874.59 875	1749.17 1750	2623.76 2624	3498.34 3499	4372.93 4373	5247.51 5248	6122.1 6123	6996.68 6997	7871.27 7872	8745.86 8746	17 491.71 17492	26 237.57	34 983.42	43 729.28	52 475.13	61 220.99	69 966.84	78 712.7	87 458.55
1000	34.84	953.34	953.34 954	1906.67 1907	2860.01 2861	3813.35 3814	4766.68 4767	5720.02 5721	6673.35 6674	7626.69 7627	8580.03 8581	9533.36 9534	19 066.73 19067	28 600.09	38 133.46	47 666.82	57 200.18	66 733.55	76 266.91	85 800.28	95 333.64
1250	39.08	1199.5	1199.5 1200	2398.99 2399	3598.49 3599	4797.99 4798	5997.48 5998	7196.98 7197	8396.48 8397	9595.97 9596	10 795.47 10796	11 994.97 11995	23 989.93 23990	35 984.9	47 979.86	59 974.83	71 969.79	83 964.76	95 959.72	107 954.69	119 949.65

1500	42.2	~~1398.67~~ 1399	~~2797.34~~ 2798	~~4196.01~~ 4197	~~5594.67~~ 5595	~~6993.34~~ 6994	~~8392.01~~ 8393	~~9790.68~~ 9791	~~11189.35~~ 11190	~~12588.02~~ 12589	~~13986.68~~ 13987	~~27973.37~~ 27974	~~41960.05~~	~~55946.74~~	~~69933.42~~	~~83920.11~~	~~97906.79~~	~~111893.48~~	~~125880.16~~	~~139866.85~~
1750	45.1	~~1597.51~~ 1598	~~3195.02~~ 3196	~~4792.52~~ 4793	~~6390.03~~ 6391	~~7987.54~~ 7988	~~9585.05~~ 9586	~~11182.55~~ 11183	~~12780.06~~ 12781	~~14377.57~~ 14378	~~15975.08~~ 15976	~~31950.15~~ 31951	~~47925.23~~	~~63900.31~~	~~79875.39~~	~~95850.46~~	~~111825.54~~	~~127800.62~~	~~143775.69~~	~~159750.77~~
2000	47.79	~~1793.76~~ 1794	~~3587.52~~ 3588	~~5381.28~~ 5382	~~7175.03~~ 7176	~~8968.79~~ 8969	~~10762.55~~ 10763	~~12556.31~~ 12557	~~14350.07~~ 14351	~~16143.83~~ 16144	~~17937.58~~ 17938	~~35875.17~~ 35876	~~53812.75~~	~~71750.34~~	~~89687.92~~	~~107625.5~~	~~125563.09~~	~~143500.67~~	~~161438.25~~	~~179375.84~~
SOLID CONDUCTORS																				
14	3.15	~~7.79~~	7.79	~~15.59~~ 15.6	~~23.38~~ 23.4	~~31.17~~ 31.2	~~38.97~~ 39.0	~~46.76~~ 46.8	~~54.55~~ 54.6	~~62.34~~ 62.4	~~70.14~~ 70.2	~~77.93~~ 78.0	~~155.86~~ 156	~~233.79~~	~~311.72~~	~~389.66~~	~~467.59~~	~~545.52~~	~~623.45~~	~~701.38~~	~~779.31~~
12	3.57	~~10.01~~	~~10.01~~ 10.1	~~20.02~~ 20.1	~~30.03~~ 30.1	~~40.04~~ 40.1	~~50.05~~ 50.1	~~60.06~~ 60.1	~~70.07~~ 70.1	~~80.08~~ 80.1	~~90.09~~ 90.1	~~100.11~~ 101	~~200.2~~ 201	~~300.29~~	~~400.39~~	~~500.49~~	~~600.59~~	~~700.69~~	~~800.79~~	~~900.88~~	~~1000.98~~
10	4.11	~~13.27~~	13.27 13.3	~~26.53~~ 26.6	~~39.8~~ 39.9	~~53.07~~ 53.1	~~66.34~~ 66.4	79.6	~~92.87~~ 92.9	~~106.14~~ 107	~~119.4~~ 120	~~132.67~~ 133	~~265.34~~ 266	~~398.01~~	~~530.68~~	~~663.35~~	~~796.02~~	~~928.69~~	~~1061.36~~	~~1194.03~~	~~1326.7~~

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Table 6K

Dimensions of single Class C TWN75, T90 NYLON insulated conductors ~~and cables~~ for calculating conduit and tubing fill

(See Rule 12-910 and Appendix B.)

~~TWN75, T90 NYLON~~

CONDUCTOR CHARACTERISTICS			NUMBER OF CONDUCTORS																	
Conductor size, AWG or kcmil	~~Class B~~		1	2	3	4	5	6	7	8	9	10	20	~~30~~	~~40~~	~~50~~	~~60~~	~~70~~	~~80~~	~~90~~	~~100~~
	Dia mm	~~Area mm²~~	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	Area mm²	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~	~~Area mm²~~
STRANDED CONDUCTORS																				
14	2.8	~~6.16~~	6.16	~~12.32~~ 12.4	~~18.47~~ 18.5	~~24.63~~ 24.7	~~30.79~~ 30.8	~~36.95~~ 37.0	43.1	~~49.26~~ 49.3	~~55.42~~ 55.5	~~61.58~~ 61.6	~~123.15~~ 124	~~184.73~~	~~246.3~~	~~307.88~~	~~369.45~~	~~431.03~~	~~492.6~~	~~554.18~~	~~615.75~~
12	3.28	~~8.45~~	8.45	16.9	~~25.35~~ 25.4	33.8	~~42.25~~ 42.3	50.7	~~59.15~~ 59.2	67.6	~~76.05~~ 76.1	84.5	~~168.99~~ 169	~~253.49~~	~~337.99~~	~~422.48~~	~~506.98~~	~~591.47~~	~~675.97~~	~~760.47~~	~~844.96~~
10	4.17	~~13.66~~	~~13.66~~ 13.7	~~27.31~~ 27.4	~~40.97~~ 41.0	~~54.63~~ 54.7	~~68.29~~ 68.3	~~81.94~~ 82.0	95.6	~~109.26~~ 110	~~122.91~~ 123	~~136.57~~ 137	~~273.14~~ 274	~~409.72~~	~~546.29~~	~~682.86~~	~~819.43~~	~~956.0~~	~~1092.58~~	~~1229.15~~	~~1365.72~~
8	5.49	~~23.67~~	~~23.67~~ 23.7	~~47.34~~ 47.4	~~71.02~~ 71.1	~~94.69~~ 94.7	~~118.36~~ 119	~~142.03~~ 143	~~165.7~~ 166	~~189.38~~ 190	~~213.05~~ 214	~~236.72~~ 237	~~473.44~~ 474	~~710.16~~	~~946.88~~	~~1183.6~~	~~1420.32~~	~~1657.04~~	~~1893.76~~	~~2130.48~~	~~2367.2~~
6	6.45	~~32.67~~	~~32.67~~ 32.7	~~65.35~~ 65.4	~~98.02~~ 98.1	~~130.7~~ 131	~~163.37~~ 164	~~196.05~~ 197	~~228.72~~ 229	~~261.4~~ 262	~~294.07~~ 295	~~326.75~~ 327	~~653.49~~ 654	~~980.24~~	~~1306.98~~	~~1633.73~~	~~1960.47~~	~~2287.22~~	~~2613.96~~	~~2940.71~~	~~3267.45~~
4	8.23	~~53.2~~	53.2	~~106.39~~ 107	~~159.59~~ 160	~~212.79~~ 213	~~265.99~~ 266	~~319.18~~ 320	~~372.38~~ 373	~~425.58~~ 426	~~478.78~~ 479	~~531.97~~ 532	~~1063.95~~ 1064	~~1595.92~~	~~2127.89~~	~~2659.86~~	~~3191.84~~	~~3723.81~~	~~4255.78~~	~~4787.76~~	~~5319.73~~
3	8.94	~~62.77~~	~~62.77~~ 62.8	~~125.54~~ 126	~~188.32~~ 189	~~251.09~~ 252	~~313.86~~ 314	~~376.63~~ 377	~~439.4~~ 440	~~502.17~~ 503	~~564.95~~ 565	~~627.72~~ 628	~~1255.44~~ 1256	~~1883.16~~	~~2510.87~~	~~3138.59~~	~~3766.31~~	~~4394.03~~	~~5021.75~~	~~5649.47~~	~~6277.18~~

S2	9.76	~~74.82~~	~~74.82~~ 74.9	~~149.63~~ 150	~~224.45~~ 225	~~299.26~~ 300	~~374.08~~ 375	~~448.89~~ 449	~~523.71~~ 524	~~598.52~~ 599	~~673.34~~ 674	~~748.15~~ 749	~~1496.3~~ 1497	~~2244.45~~	~~2992.61~~	~~3740.76~~	~~4488.91~~	~~5237.06~~	~~5985.21~~	~~6733.36~~	~~7481.51~~
1	11.33	~~100.82~~	~~100.82~~ 101	~~201.64~~ 202	~~302.46~~ 303	~~403.28~~ 404	~~504.1~~ 505	~~604.92~~ 605	~~705.74~~ 706	~~806.57~~ 807	~~907.39~~ 908	~~1008.21~~ 1009	~~2016.41~~ 2017	~~3024.62~~	~~4032.83~~	~~5041.03~~	~~6049.24~~	~~7057.45~~	~~8065.66~~	~~9073.86~~	~~10 082.07~~
1/0	12.37	~~120.18~~	~~120.18~~ 121	~~240.36~~ 241	~~360.54~~ 361	~~480.72~~ 481	~~600.9~~ 601	~~721.08~~ 722	~~841.25~~ 842	~~961.43~~ 962	~~1081.61~~ 1082	~~1201.79~~ 1202	~~2403.58~~ 2404	~~3605.38~~	~~4807.17~~	~~6008.96~~	~~7210.75~~	~~8412.54~~	~~9614.34~~	~~10 816.13~~	~~12 017.92~~
2/0	13.54	~~143.99~~	~~143.99~~ 144	~~287.98~~ 288	~~431.96~~ 432	~~575.95~~ 576	~~719.94~~ 720	~~863.93~~ 864	~~1007.92~~ 1008	~~1151.91~~ 1152	~~1295.89~~ 1296	~~1439.88~~ 1440	~~2879.77~~ 2880	~~4319.65~~	~~5759.53~~	~~7199.42~~	~~8639.3~~	~~10 079.18~~	~~11 519.06~~	~~12 958.95~~	~~14 398.83~~
3/0	14.84	~~172.96~~	~~172.96~~ 173	~~345.93~~ 346	~~518.89~~ 519	~~691.86~~ 692	~~864.82~~ 865	~~1037.79~~ 1038	~~1210.75~~ 1211	~~1383.72~~ 1384	~~1556.68~~ 1557	~~1729.65~~ 1730	~~3459.3~~ 3460	~~5188.94~~	~~6918.59~~	~~8648.24~~	~~10 377.89~~	~~12 107.53~~	~~13 837.18~~	~~15 566.83~~	~~17 296.48~~
4/0	16.31	~~208.93~~	~~208.93~~ 209	~~417.86~~ 418	~~626.79~~ 627	~~835.71~~ 836	~~1044.64~~ 1045	~~1253.57~~ 1254	~~1462.5~~ 1463	~~1671.43~~ 1672	~~1880.36~~ 1881	~~2089.29~~ 2090	~~4178.57~~ ~~4179~~	~~6267.86~~	~~8357.14~~	~~10 446.43~~	~~12 535.71~~	~~14 625.0~~	~~16 714.28~~	~~18 803.57~~	~~20 892.86~~
250	18.04	~~255.6~~	~~255.6~~ ~~256~~ 512	~~511.2~~ 512	~~766.8~~ 767	~~1022.4~~ 1023	~~1278.01~~ 1279	~~1533.61~~ 1534	~~1789.21~~ 1790	~~2044.81~~ 2045	~~2300.41~~ 2301	~~2556.01~~ 2557	~~5112.02~~ 5113	~~7668.0~~	~~10 224.05~~	~~12 780.06~~	~~15 336.07~~	~~17 892.09~~	~~20 448.1~~	~~23 004.11~~	~~25 560.12~~
300	19.44	~~296.81~~	~~296.81~~ 297	~~593.63~~ 594	~~890.44~~ 891	~~1187.25~~ 1188	~~1484.06~~ 1485	~~1780.88~~ 1781	~~2077.69~~ 2078	~~2374.5~~ 2375	~~2671.31~~ 2672	~~2968.13~~ 2969	~~5936.25~~ 5937	~~8904.38~~	~~11 872.51~~	~~14 840.63~~	~~17 808.76~~	~~20 776.89~~	~~23 745.01~~	~~26 713.14~~	~~29 681.26~~
350	20.67	~~335.56~~	~~335.56~~ 336	~~671.12~~ 672	~~1006.68~~ 1007	~~1342.24~~ 1343	~~1677.8~~ 1678	~~2013.36~~ 2014	~~2348.92~~ 2349	~~2684.48~~ 2685	~~3020.04~~ 3021	~~3355.61~~ 3356	~~6711.21~~ 6712	~~10 066.82~~	~~13 422.42~~	~~16 778.03~~	~~20 133.63~~	~~23 489.24~~	~~26 844.84~~	~~30 200.45~~	~~33 556.05~~
400	21.93	~~377.72~~	~~377.72~~	~~755.44~~	~~1133.15~~	~~1510.87~~	~~1888.59~~	~~2266.31~~	~~2644.02~~	~~3021.74~~	~~3399.46~~	~~3777.18~~	~~7554.35~~	~~11 331.53~~	~~15 108.7~~	~~18 885.88~~	~~22 663.05~~	~~26 440.23~~	~~30 217.4~~	~~33 994.58~~	~~37 771.75~~

			378	756	1134	1511	1889	2267	2645	3022	3400	3778	7555							
450	23.05	417.28	417.28 418	834.57 835	1251.85 1252	1669.14 1670	2086.42 2087	2503.7 2504	2920.99 2921	3338.27 3339	3755.56 3756	4172.84 4173	8345.688 8346	12 518.52	16 691.36	20 864.2	25 037.04	29 209.88	33 382.72	37 555.56	41 728.4
500	24.09	455.79	455.79 456	911.58 912	1367.37 1368	1823.15 1824	2278.94 2279	2734.73 2735	3190.52 3191	3646.3 3647	4102.1 4103	4557.89 4558	9115.77 9116	13 673.66	18 231.54	22 789.43	27 347.32	31 905.2	36 463.09	41 020.98	45 578.86
600	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
700	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
750	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
800	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
900	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1000	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1250	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1500	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1750	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2000	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

SOLID CONDUCTORS

14	2.59	5.27	5.27	10.54 10.6	15.81 15.9	21.07 21.1	26.34 26.4	31.61 31.7	36.88 36.9	42.15 42.2	47.42 47.5	52.69 52.7	105.37 106	158.06	210.74	263.43	316.11	368.8	421.48	474.17	526.85
12	3.01	7.12	7.12	14.23 14.3	21.35 21.4	28.46 28.5	35.58 35.6	42.69 42.7	49.81 49.9	56.93 57.0	64.04 64.1	71.16 71.2	142.32 143	213.47	284.63	355.79	426.95	498.11	569.26	640.42	711.58
10	3.81	11.4	11.4	22.8	34.2	45.6	57.0	68.41 68.5	79.81 79.9	91.21 91.3	102.61 103	114.01 115	228.02 229	342.03	456.04	570.05	684.06	798.06	912.07	1026.08	1140.09

Revise Tables 9A, 9C, 9E, and 9G to read:	SN4846

Table 9A

Internal diameter and cross-sectional areas of various trade conduit and tubing

(See Rule *12-910* and Table *8*.)

Nominal trade size	Internal diameter and cross-sectional areas of rigid metal conduit		Internal diameter and cross-sectional areas of flexible metal conduit		Internal diameter and cross-sectional areas of rigid PVC conduit		Internal diameter and cross-sectional areas of rigid Type EB1 PVC conduit and rigid Type DB2/ES2 PVC conduit		Internal diameter and cross-sectional areas of metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of non-metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of electrical metallic tubing		Internal diameter and cross-sectional areas of electrical non-metallic tubing	
		100%		100%		100%		100%		100%		100%		100%		100%
Dia	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²
12	—	—	9.52	71	—	—	—	—	12.29	119	12.07	114	—	—	—	—
16	16.05	202	15.88	198	14.57	167	—	—	15.8	196	15.49	188	15.4	186	14.58	167
21	21.23	354	20.62	334	19.77	307	—	—	20.83	341	20.45	328	20.5	330	19.66	304
27	27.0	573	25.4	507	25.4	507	—	—	26.44	549	25.91	527	26.2	539	25.37	506
35	35.41	985	31.75	792	31.75	792	—	—	35.05	965	34.54	937	34.6	940	33.73	894
41	41.25	1336	38.1	1140	38.1	1140	—	—	40.01	1257	40.01	1257	40.5	1288	39.57	1230
53	52.91	2199	50.8	2027	50.8	2027	50.8	2027	51.31	2068	51.69	2098	52.1	2132	51.18	2057
63	63.22	3139	63.5	3167	61.3	2951	—	—	62.99	3116	—	—	69.4	3783	—	—
78	78.49	4839	76.2	4560	76.2	4560	76.2	4560	77.98	4776	—	—	85.2	5701	—	—
91	90.68	6458	88.9	6207	88.4	6138	88.4	6138	88.9	6207	—	—	97.4	7451	—	—
103	102.87	8311	101.6	8107	100.1	7870	100.1	7870	101.6	8107	—	—	110.0	9503	—	—
129	128.85	13 039	—	—	125.85	12 439	126.35	12 538	—	—	—	—	— 128.9	— 13050	—	—
155	154.76	18 811	—	—	149.75	17 613	149.75	17 613	—	—	—	—	— 154.8	— 18821	—	—
200	—	—	—	—	199.39	31 225	—	—	—	—	—	—	—	—	—	—
275	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
325	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 9C

Internal diameter and maximum conductor cross-sectional areas allowable fill at 53% for various

trade conduit and tubing used for 1 conductor or multi-conductor cable (not lead-sheathed)

(See Rule *12-910* and Table *8*.)

Nominal trade size	Internal diameter and cross-sectional areas of rigid metal conduit		Internal diameter and cross-sectional areas of flexible metal conduit		Internal diameter and cross-sectional areas of rigid PVC conduit		Internal diameter and cross-sectional areas of rigid Type EB1 PVC conduit and rigid Type DB2/ES2 PVC conduit		Internal diameter and cross-sectional areas of metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of non-metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of electrical metallic tubing		Internal diameter and cross-sectional areas of electrical non-metallic tubing	
		53%		53%		53%		53%		53%		53%		53%		53%
Dia	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²
12	—	—	9.52	37.73	—	—	—	—	12.29	62.87	12.07	60.64	—	—	—	—
16	16.05	107.23	15.88	104.97	14.57	88.37	—	—	15.8	103.92	15.49	99.88	15.4	98.72	14.58	88.49
21	21.23	187.61	20.62	176.99	19.77	162.7	—	—	20.83	180.61	20.45	174.08	20.5	174.93	19.66	160.89
27	27.0	303.45	25.4	268.55	25.4	268.55	—	—	26.44	291.0	25.91	279.45	26.2	285.74	25.37	267.92
35	35.41	521.94	31.75	419.62	31.75	419.62	—	—	35.05	511.38	34.54	496.6	34.6	498.33	33.73	473.59
41	41.25	708.29	38.1	604.25	38.1	604.25	—	—	40.01	666.35	40.01	666.35	40.5	682.77	39.57	651.78
53	52.91	1165.31	50.8	1074.22	50.8	1074.22	50.8	1074.22	51.31	1095.9	51.69	1112.19	52.1	1129.9	51.18	1090.35
63	63.22	1663.7	63.5	1678.47	61.3	1564.18	—	—	62.99	1651.62	—	—	69.4	2004.86	—	—
78	78.49	2564.45	76.2	2416.99	76.2	2416.99	76.2	2416.99	77.98	2531.23	—	—	85.2	3021.66	—	—
91	90.68	3422.86	88.9	3289.8	88.4	3252.9	88.4	3252.9	88.9	3289.8	—	—	97.4	3948.97	—	—
103	102.87	4404.97	101.6	4296.88	100.1	4170.94	100.1	4170.94	101.6	4296.88	—	—	110.0	5036.76	—	—
129	128.85	6910.9	—	—	125.85	6592.83	126.35	6645.33	—	—	—	—	128.9	6916	—	—
155	154.76	9969.73	—	—	149.75	9334.68	149.75	9334.68	—	—	—	—	154.8	9975	—	—
200	—	—	—	—	199.39	16549.03	—	—	—	—	—	—	—	—	—	—
275	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
325	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 9E

Internal diameter and maximum conductor cross-sectional areas allowable fill at 31% for various trade conduit and tubing used for 2 conductors or multi-conductor cables (not lead-sheathed)

(See Rule *12-910* and Table *8*.)

Nominal trade size	Internal diameter and cross-sectional areas of rigid metal conduit		Internal diameter and cross-sectional areas of flexible metal conduit		Internal diameter and cross-sectional areas of rigid PVC conduit		Internal diameter and cross-sectional areas of rigid Type EB1 PVC conduit and rigid Type DB2/ES2 PVC conduit		Internal diameter and cross-sectional areas of metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of non-metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of electrical metallic tubing		Internal diameter and cross-sectional areas of electrical non-metallic tubing	
		31%		31%		31%		31%		31%		31%		31%		31%
Dia	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²
12	—	—	9.52	22.07	—	—	—	—	12.29	36.78	12.07	35.47	—	—	—	—
16	16.05	62.72	15.88	61.4	14.57	51.69	—	—	15.8	60.78	15.49	58.42	15.4	57.74	14.58	51.76
21	21.23	109.74	20.62	103.52	19.77	95.16	—	—	20.83	105.64	20.45	101.82	20.5	102.32	19.66	94.11
27	27.0	177.49	25.4	157.08	25.4	157.08	—	—	26.44	170.21	25.91	163.45	26.2	167.13	25.37	156.71
35	35.41	305.28	31.75	245.44	31.75	245.44	—	—	35.05	299.11	34.54	290.47	34.6	291.48	33.73	277.0
41	41.25	414.29	38.1	353.43	38.1	353.43	—	—	40.01	389.75	40.01	389.75	40.5	399.36	39.57	381.23
53	52.91	681.6	50.8	628.32	50.8	628.32	50.8	628.32	51.31	641.0	51.69	650.53	52.1	660.89	51.18	637.75
63	63.22	973.11	63.5	981.75	61.3	914.9	—	—	62.99	966.04	—	—	69.4	1172.66	—	—
78	78.49	1499.96	76.2	1413.71	76.2	1413.71	76.2	1413.71	77.98	1480.53	—	—	85.2	1767.38	—	—
91	90.68	2002.05	88.9	1924.22	88.4	1902.64	88.4	1902.64	88.9	1924.22	—	—	97.4	2309.77	—	—
103	102.87	2576.49	101.6	2513.27	100.1	2439.61	100.1	2439.61	101.6	2513.27	—	—	110.0	2946.03	—	—
129	128.85	4042.22	—	—	125.85	3856.19	126.35	3886.89	—	—	—	—	128.9	4045	—	—
155	154.76	5831.35	—	—	149.75	5459.91	149.75	5459.91	—	—	—	—	154.8	5834	—	—
200	—	—	—	—	199.39	9679.62	—	—	—	—	—	—	—	—	—	—
275	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
325	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 9G

Internal diameter and maximum conductor cross-sectional areas allowable fill at 40% for various trade conduit and tubing used for 3 or more conductors or multi-conductor cables (not lead-sheathed)

(See Rule *12-910* and Table *8*.)

Nominal trade size	Internal diameter and cross-sectional areas of rigid metal conduit		Internal diameter and cross-sectional areas of flexible metal conduit		Internal diameter and cross-sectional areas of rigid PVC conduit		Internal diameter and cross-sectional areas of rigid Type EB1 PVC conduit and rigid Type DB2/ES2 PVC conduit		Internal diameter and cross-sectional areas of metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of non-metallic liquid-tight flexible conduit		Internal diameter and cross-sectional areas of electrical metallic tubing		Internal diameter and cross-sectional areas of electrical non-metallic tubing	
		40%		40%		40%		40%		40%		40%		40%		40%
Dia	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²	ID mm	Area mm²
12	—	—	9.52	28.47	—	—	—	—	12.29	47.45	12.07	45.77	—	—	—	—
16	16.05	80.93	15.88	79.22	14.57	66.69	—	—	15.8	78.43	15.49	75.38	15.4	74.51	14.58	66.78
21	21.23	141.6	20.62	133.58	19.77	122.79	—	—	20.83	136.31	20.45	131.38	20.5	132.03	19.66	121.43
27	27.0	229.02	25.4	202.68	25.4	202.68	—	—	26.44	219.62	25.91	210.9	26.2	215.65	25.37	202.2
35	35.41	393.91	31.75	316.69	31.75	316.69	—	—	35.05	385.95	34.54	374.8	34.6	376.1	33.73	357.42
41	41.25	534.56	38.1	456.04	38.1	456.04	—	—	40.01	502.91	40.01	502.91	40.5	515.3	39.57	491.91
53	52.91	879.48	50.8	810.73	50.8	810.73	50.8	810.73	51.31	827.09	51.69	839.39	52.1	852.76	51.18	822.91
63	63.22	1255.62	63.5	1266.77	61.3	1180.51	—	—	62.99	1246.5	—	—	69.4	1513.1	—	—
78	78.49	1935.43	76.2	1824.15	76.2	1824.15	76.2	1824.15	77.98	1910.36	—	—	85.2	2280.49	—	—
91	90.68	2583.29	88.9	2482.87	88.4	2455.02	88.4	2455.02	88.9	2482.87	—	—	97.4	2980.35	—	—
103	102.87	3324.51	101.6	3242.93	100.1	3147.88	100.1	3147.88	101.6	3242.93	—	—	110.0	3801.33	—	—
129	128.85	5215.77	—	—	125.85	4975.72	126.35	5015.34	—	—	—	—	— 128.9	— 5520	—	—
155	154.76	7524.32	—	—	149.75	7045.04	149.75	7045.04	—	—	—	—	— 154.8	— 7528	—	—
200	—	—	—	—	199.39	12 489.83	—	—	—	—	—	—	—	—	—	—
275	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
325	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Delete Table 10A:

SN4703

Table 10A
Dimensions of stranded insulated conductors for calculating conduit and tubing fill
(See Rule 12-910 and Appendix B.)

Conductor size, AWG or kcmil	R90XLPE*, RW75XLPE*, RW90XLPE 600 V Class B		R90XLPE*, RW75XLPE*, RW90XLPE* 1000 V Class B		R90XLPE†, RW75XLPE†, R90EP†, RW75EP†, RW90XLPE†, RW90EP‡ 600 V Class B		TWN75, T90 NYLON Class C		TW, TW75 Class B		TWU, TWU75, RWU90XLPE* Class B	
	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²
14	3.36	8.89	4.12	13.36	4.12	13.36	2.80	6.18	3.36	8.89	4.88	18.70
12	3.84	11.61	4.60	16.65	4.60	16.75	3.28	8.47	3.84	11.61	5.36	22.56
10	4.47	15.67	5.23	21.45	5.23	21.45	4.17	13.63	4.47	15.67	5.97	27.99
8	5.99	28.17	5.99	28.17	6.75	35.77	5.49	23.66	5.99	28.17	7.76	47.29
6	6.95	37.98	7.71	46.73	8.47	56.39	6.45	32.71	7.71	46.73	8.72	59.72
4	8.17	52.46	8.93	62.67	9.69	73.79	8.23	53.23	8.93	62.67	9.95	77.76
3	8.88	61.99	9.64	73.05	10.40	85.01	8.94	62.83	9.64	73.05	10.67	89.42
2	9.70	73.85	10.46	85.88	11.22	98.82	9.76	74.77	10.46	85.88	11.48	103.5
1	11.23	99.10	12.49	122.6	12.51	143.4	11.33	100.9	12.49	122.6	13.25	137.9
1/0	12.27	118.3	13.53	143.9	14.53	166.4	12.37	120.3	13.53	143.9	14.28	160.2
2/0	13.44	141.9	14.70	169.8	15.72	194.2	13.54	144.0	14.70	169.8	15.45	187.5
3/0	14.74	170.6	16.00	201.0	17.02	227.5	14.84	172.9	16.00	201.0	16.76	220.6
4/0	16.21	206.4	17.47	239.7	18.49	268.5	16.31	209.0	17.47	239.7	18.28	262.4
250	17.90	251.8	19.17	288.5	21.21	353.2	18.04	255.7	19.43	296.4	20.20	320.5
300	19.30	292.6	20.56	332.1	22.60	401.2	19.44	296.9	20.82	340.5	21.54	364.4
350	20.53	331.0	21.79	372.9	23.83	446.0	20.67	335.6	22.05	381.9	22.81	408.6
400	21.79	373.0	23.05	417.3	25.09	494.5	21.93	377.8	23.31	426.8	24.07	455.0

Conductor size, AWG or kcmil	R90XLPE*, RW75XLPE*, RW90XLPE* 600 V Class B		R90XLPE*, RW75XLPE*, RW90XLPE* 1000 V Class B		R90XLPE†, RW75XLPE†, R90EP†, RW75EP†, RW90XLPE†, RW90EP‡ 600 V Class B		TWN75, T90 NYLON Class C		TW, TW75 Class B		TWU, TWU75, RWU90XLPE* Class B	
	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²
450	22.91	412.2	24.17	458.8	26.21	539.5	23.05	417.3	24.49	468.7	25.19	498.4
500	23.95	450.5	25.21	499.2	27.25	583.2	24.09	455.8	25.47	509.5	26.24	540.8
600	26.74	561.7	27.24	582.9	30.04	708.8	—	—	28.26	627.3	29.02	661.4
700	28.55	640.0	29.05	662.6	31.85	796.5	—	—	30.07	710.0	30.82	746.0
750	29.41	679.3	29.91	702.6	32.71	840.3	—	—	30.93	751.9	31.69	788.7
800	30.25	718.7	30.75	742.6	33.55	884.0	—	—	31.77	792.7	32.53	831.1
900	31.85	796.6	32.35	821.8	35.15	970.2	—	—	33.37	874.5	34.13	914.9
1000	33.32	872.0	33.82	898.4	36.62	1053	—	—	34.84	953.4	35.60	995.4
1250	37.50	1108	38.32	1153	42.38	1411	—	—	39.08	1200	39.88	1199
1500	40.68	1300	41.44	1349	45.50	1626	—	—	42.20	1399	42.96	1449
1750	43.58	1492	44.34	1544	48.40	1840	—	—	45.10	1598	45.86	1652
2000	46.27	1681	47.03	1737	51.09	2050	—	—	47.79	1794	48.55	1851

* Unjacketed.
† Jacketed.
‡ Includes EPCV.

Note: *Aluminum conductors might not be available in the same range of sizes as copper conductors.*

Delete Table 10B:

SN4703

Table 10B
Dimensions of photovoltaic insulated conductors and cable for calculating conduit and tubing fill
(See Rule 12-910 and Appendix B.)

Conductor size, AWG or kcmil	RPV*, 600 V		RPV*, 1000 V		RPV*, 2000 V		RPV†, 600 V		RPV†, 1000 V		RPV†, 2000 V		RPVU*, 1000 V and 2000 V		RPVU†, 1000 V and 2000 V	
	Class B		Class B		Class B		Class B		Class B		Class B		Class B		Class B	
	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²
14	3.37	8.92	4.13	13.40	4.89	18.78	4.13	13.40	4.89	18.78	5.65	25.07	4.89	18.78	5.65	25.07
12	3.84	11.58	4.60	16.62	5.36	22.56	4.60	16.62	5.36	22.56	6.12	29.42	5.36	22.56	6.12	29.42
10	4.47	15.69	5.23	21.48	5.99	28.18	5.23	21.48	5.99	28.18	7.51	44.30	5.99	28.18	6.75	35.78
8	5.99	28.18	5.99	28.18	7.27	41.51	7.51	44.30	7.51	44.30	8.79	60.68	7.77	47.42	9.29	67.78
6	6.95	37.94	7.71	46.69	8.23	53.20	8.47	56.35	9.23	66.91	9.75	74.66	8.73	59.86	10.25	82.52
4	8.17	52.42	8.93	62.63	9.45	70.14	9.69	73.75	10.45	85.77	10.97	94.52	9.95	77.76	11.47	103.3
3	8.88	61.93	9.64	72.99	10.16	81.07	10.40	84.95	11.16	97.82	11.68	107.1	10.66	89.25	12.18	116.5
2	9.70	73.90	10.46	85.93	10.98	94.69	11.22	98.87	11.98	112.8	13.26	138.1	11.48	103.5	13.76	148.7
1	11.23	99.05	12.49	122.5	13.01	132.9	13.51	143.4	14.77	171.3	15.29	183.6	13.25	137.9	15.53	189.4
1/0	12.25	117.9	13.51	143.4	14.03	154.6	14.53	165.8	15.79	195.8	16.31	208.9	14.27	159.9	16.55	215.1
2/0	13.42	141.4	14.68	169.3	15.20	181.5	15.70	193.6	16.96	225.9	17.48	240.0	15.44	187.2	17.72	246.6
3/0	14.74	170.6	16.00	201.1	16.52	214.3	17.02	227.5	18.28	262.4	18.80	277.6	16.76	220.6	19.04	284.7
4/0	16.21	206.4	17.47	239.7	17.99	254.2	18.49	268.5	19.75	306.4	21.29	356.0	18.23	261.0	21.53	364.1
250	17.90	251.6	19.16	288.3	19.94	312.3	21.20	353.0	22.46	396.2	23.24	424.2	20.18	319.8	23.48	433.0
300	19.30	292.6	20.56	332.0	21.34	357.7	22.60	401.1	23.86	447.1	24.64	476.8	21.58	365.8	24.88	486.2
350	20.60	333.3	21.86	375.3	22.64	402.6	23.90	448.8	25.16	497.2	25.94	528.5	22.88	411.2	26.18	538.3
400	21.79	372.9	23.05	417.3	23.83	446.0	25.09	494.4	26.35	545.3	27.13	578.1	24.07	455.0	27.37	588.4
450	22.91	412.2	24.17	458.8	24.95	488.9	26.21	539.5	27.47	592.7	28.25	626.8	25.19	498.4	28.49	637.5
500	23.95	450.5	25.21	499.2	25.99	530.5	27.25	583.2	28.51	638.4	29.29	673.8	26.23	540.4	29.53	684.9
600	26.74	561.6	27.24	582.8	28.78	650.5	30.04	708.7	30.54	732.5	32.08	808.3	29.04	662.3	32.34	821.4

Conductor size, AWG or kcmil	RPV*, 600 V		RPV*, 1000 V		RPV*, 2000 V		RPV†, 600 V		RPV†, 1000 V		RPV†, 2000 V		RPVU*, 1000 V and 2000 V		RPVU†, 1000 V and 2000 V	
	Class B		Class B		Class B		Class B		Class B		Class B		Class B		Class B	
	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²
700	28.55	640.2	29.05	662.8	30.59	734.9	31.85	796.7	32.35	821.9	33.89	902.1	30.85	747.5	34.15	915.9
750	29.41	679.3	29.91	702.6	31.45	776.8	32.71	840.3	33.21	866.2	34.75	948.4	31.71	789.7	35.01	962.7
800	30.22	717.3	30.72	741.2	32.26	817.4	33.52	882.5	34.02	909.0	35.56	993.1	32.52	830.6	35.82	1008
900	31.85	796.7	32.35	821.9	33.89	902.1	35.15	970.4	35.65	998.2	37.19	1086	34.15	915.9	37.45	1102
1000	33.32	872.0	33.82	898.3	35.36	982.0	36.62	1053	37.12	1082	38.66	1174	35.62	996.5	38.92	1190
1250	37.56	1108	38.32	1153	39.86	1248	42.38	1411	43.14	1462	44.68	1568	39.86	1247	44.68	1568
1500	41.68	1300	41.44	1349	42.98	1451	45.50	1626	46.26	1681	47.80	1795	42.98	1451	47.80	1795
1750	43.58	1492	44.34	1544	45.88	1653	48.40	1840	49.16	1898	50.70	2019	45.88	1653	50.70	2019
2000	46.27	1681	47.03	1737	48.57	1853	51.09	2050	51.85	2111	53.39	2239	48.57	1853	53.39	2239

* Unjacketed.
† Jacketed.
Note: Aluminum insulated conductors and cables might not be available in the same range of sizes as copper insulated conductors and cables.

Delete Table 10C:

SN4703

Table 10C
Dimensions of solid insulated conductors for calculating conduit and tubing fill
(See Rule 12-910 and Appendix B.)

Conductor size, AWG	R90XLPE*, RW75XLPE*, RW90XLPE*, 600 V		R90XLPE*, RW75XLPE*, RW90XLPE*, 1000 V		R90XLPE†, RW75XLPE†, R90EP†, RW75EP†, RW90XLPE*, RW90EP‡, 600 V		TWN75, T90 NYLON		TW, TW75		TWU, TWU75, RWU90XLPE*	
	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²	Dia, mm	Area, mm²
14	3.15	7.78	3.91	11.99	3.91	11.99	2.59	5.26	3.15	7.78	4.67	17.11
12	3.57	10.02	4.33	14.74	4.33	14.74	3.01	7.13	3.57	10.02	5.09	20.36
10	4.11	13.25	4.87	18.61	4.87	18.61	3.81	11.39	4.11	13.25	5.68	24.88

* Unjacketed.
† Jacketed.
‡ Includes RWU.
Note: Aluminum insulated conductors and cables might not be available in the same range of sizes as copper insulated conductors and cables.

Delete Table 11:

SN4678
SN4826

Table 11
Conditions of use, voltage, and temperature ratings of flexible cords, heater cords, travel cords, equipment wires, Christmas-tree cords, portable power cables, elevator cables, stage lighting, electric vehicle supply equipment cables, and festoon cables
(See Rules 12-010, 12-122, 12-402, and 12-404.)

Location	Use	Kind	CSA type designation	Voltage rating, V	Temperature rating, °C	Reference Notes
Dry locations only	Not for hard usage	Heat-resistant equipment wire	ETF	600	125	4
		Equipment wire	TW, TEW-1	125	60	15
		Indoor Christmas-tree cord	XMT	125	60	—
			SPT	300	105	—
Damp (or dry) locations	Not for hard usage	Flexible cord	SV	600	60, 75, 90	16
			SVO, SVOO	600	60, 75, 90	9
			SVT	600	60, 75, 90, 105	16
			SVTO, SVTOO	600	60, 75, 90, 105	9
			SPT-1, NISPT-1	600	60, 75, 90, 105	7, 16
			SPT-2, NISPT-2	600	60, 75, 90, 105	16
			SPT-3	600	105	16
			SJE, SJEO, SVEO, SPE-3, SPE-2, SPE-1, NISPE-1, NISPE-2	600	90, 105	9
		Heater cord	HPN	300	90, 105	2
	Not for hard usage	Travel cord	TXF	300	60	—
			TST	600	60	—
		Equipment wire	TEW	600	105	1, 3, 4, 11
			SIS	600	90	4, 11
			RFH	600	105	1, 3, 4, 11
			RFH	600	105	1, 3, 4, 8, 11
			SFAF-2	600	150	1, 3, 11
			SFH-1	600	200	1, 3, 11
			SFAF-2	600	150	4, 3, 11
			SFH-2	600	200	4, 3, 11
			TFAN	600	105	1, 3, 11
	For hard usage	Flexible cord	SI	300	60, 75, 90, 105	10
			SJO, SJOO	300	60, 75, 90, 105	3, 10
			ST	300	60, 75, 90, 105	10
			STO, STOO	300	60, 75, 90, 105	3, 10
			SJE, SJEO, SJTOO	300	90, 105	3, 10

Location	Use	Kind	CSA type designation	Voltage rating, V	Temperature rating, °C	Reference Notes
	For hard usage	Heater cord	HSJ, HSJO, HSJOO	300	90, 105	2, 8, 9, 10
	For extra-hard usage	Flexible cord	S	600	60, 75, 90, 105	10
			SO, SOO	600	60, 75, 90, 105	3, 10
			ST	600	60, 75, 90, 105	10
			STO, STOO	600	60, 75, 90, 105	3, 10
			SE, SEO, SEOO	600	90, 105	3, 10
		Dryer and range cable	DRT	300	60	2
	Elevator travelling cable		E	300	60	11
			E	600	90	11
			ETT, ETP	300	90	11
			ETT, ETP	600	90	11
			ED	300	90	3, 11
			ED	600	90	3, 11
Wet (or damp or dry) locations	Not for hard usage	Outdoor Christmas-tree cord	CWT	300	90	—
			CWT	600	90	—
			PWT	600	90	—
			SPT-1W	600	60	7
			SPT-2W	300	105	—
		Outdoor equipment wire	TSJW, TSJW-S	300	90	—
		Heater cord	HPWJ, HSJW	600	90, 105	—
	For hard usage	Outdoor flexible cord	SJOW, SJOOW	300	60, 75, 90, 105	3
			SJTW	300	60, 75, 90, 105	—
			STOW, STOOW	300	60, 75, 90, 105	3
			SJEW, SJEOW, SJTOOW	300	90, 105	3
		Electric vehicle supply equipment cable	EVJ, EVJT	300	60, 75, 90, 105	3, 10
			EVJE	300	90, 105	3, 10
	For extra-hard usage	Outdoor flexible cord	SOOW	600	60, 75, 90, 105	3
			SOW	600	60, 75, 90, 105	3
			STW	600	60, 75, 90, 105	—
			STOW, STOOW	600	60, 75, 90, 105	—
		Electric vehicle supply equipment cable	EV, EVT	600	60, 75, 90, 105	3, 10
			EVJE	600	90, 105	3, 10
			EVJ, EVJT	1000	60, 75, 90, 105	3, 10
			EVJE	1000	90, 105	3, 10

Location	Use	Kind	CSA type designation	Voltage rating, V	Temperature rating, °C	Reference Notes
		Portable power cables	W	2000	90	12, 13
			G	2000	90	12, 13
			G-GC	2000	90	12
			G-BGC	2000	90	12
			SHC-GC	2000	90	12
			SM, SHD, SHD-GC, SHD-BGC	2000, 5000, 8000, 15 000, 25 000, or 35 000	90	12
			DLO	2000	60, 75, 90, 105, 125	—
	For hard usage	Stage lighting	PPC	600	60, 75, 90, 105	13
		Festoon	Festoon	600	60, 105	14
			Festoon-outdoors	600	90, 105	14

Notes:
1) *Types REW, SEW, SEWF, TEW, and TEWF shall be permitted in raceways for Class 1 circuits in accordance with Rule 16-112 2).*
2) *Dryer and range cables are for use in household dryer and range power supply cords only. These cables are not for sale to the public for general use.*
3) *When exposed to oil, the following are limited to 60 °C, regardless of the temperature rating of the product:*
   a) *the temperature rating of the jacket of Types SVO, SVEO, SVTO, HSJO, EO, SJO, SJEO, SJTO, STO, SO, SEO, SEOW, SOW, SJOW, SJTOW, EV, EVE, EVJ, EVJE, EVJT, EVK, EVKT, EVKE and EVT;*
   b) *the insulation and jacket of Types SVOO, SVEOO, SVTOO, SJOO, SJEOO, SJTOO, STOO, SOO, SEOO, SOOW, SEOOW, SJOOW, SJEOOW, SJEOW, and STOOW; and*
   c) *the insulation of Type HPN and HPNW heater cord and TEWN, REW, and TEW equipment wire.*
4) *Types GTF, REW, TEW, TBS, SIS, SEWF-2, and SEW-2 may be used in raceways in accordance with Rule 30-310 2) c) ii).*
5) *Types SEWF-1 and SEWF-2 with an insulated nickel or nickel-coated copper conductor have a temperature rating of 200 °C. Types SEW-1, SEWF-1, SEW-2, and SEWF-2 with an insulated nickel or nickel-coated copper conductor may also have a temperature rating of 250 °C.*
6) *Types having cross-linked PVC insulation are surface marked with the type designation followed by (XLPVC) and types having cross-linked chlorinated polyethylene are surface marked with the type designation followed by (XLCPE).*
7) *Type SPT-1 and SPT-1W No. 20 AWG are for electric clock and decorative lighting use.*
8) *When Type HSJO heater cord is provided with 90 °C polychloroprene insulation (no asbestos insulation), the type designation "HSJO" is surface printed on the cord.*
9) *When Type HSJO heater cord is provided with 90 °C ethylene propylene rubber insulation (no asbestos insulation), the type designation "HSJO" is surface printed on the cord.*
10) *Types HSJO, SJ, SJO, SJOO, SJEO, SJEOW, SJEOO, SJT, SJTO, SJTOO, S, SO, SOO, ST, STO, STOO, EV, EVE, EVJ, EVJE, EVJT, EVK, EVKT, EVKE, and EVT flexible cords are now recognized only as components of equipment.*
11) *Suitable for use in accordance with Rule 38-011 2) when flame-retardant and moisture-resistant.*
12) *Natural rubber jackets are not suitable for use in oily environments.*
13) *Type PPC is single-conductor cable intended for use in temporary installations, such as portable stage lighting and outdoor functions. If multi-conductor cable is needed for the same applications, Type W or 3 shall be permitted to be used if ampacities are higher than those for flexible cords specified in Section 44.*
14) *Festoon cable has a flat configuration incorporating insulated power and/or control conductors and is supported by a messenger. It supplies power and control wiring for cranes and hoists, indoors or outdoors. See Rule 40-004.*
15) *Type TXF is also suitable for indoor Christmas-tree cord.*
16) *The type designation may be followed by a "-B" suffix when a decorative braid is applied over the cord.*

Add new Table 11A:
Note: Table will be set horizontally, similar to Table 19.

SN4826

Table 11A
Conditions of use, voltage, and temperature ratings of flexible cords, heater cords, equipment wire, portable power cables, elevator cables, stage lighting, and festoon cables
(See Rule 12-102.)

Group or Classification (kind)		Equipment Wire								
CSA Type Designation		TEW	TEWN	REW (XLPVC)	REW (CPE)	SEWF-1	SEW-1	SEWF-2	SEW-2	GTF
Voltage ratings, V		300, 600	600	300, 600	300, 600	300	300	600	600	600
Temperature ratings, °C		105, 150, 200	105	105	105	150, 200, or 250	200, or 250	150, 200, 250	200, or 250	125
Temperature ratings when exposed to oil, °C		60	60	60	60	-	-	-	-	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	
	Wet	-	-	-	-	-	-	-	-	-
	Exposed to Oil	✓	✓	✓	✓	-	-	-	-	-
Where Used	Not for hard usage	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For hard usage	-	-	-	-	-	-	-	-	-
	For extra hard usage	-	-	-	-	-	-	-	-	-
When	In a raceway Class 1 circuit (Section 16)	✓	✓	✓	✓	✓	✓	-	-	-
	Exposed to sunlight	-	-	-	-	-	-	-	-	-

Group or Classification (kind)		Outdoor Flexible Cords										Festoon
CSA Type Designation		SJOW, SJOO	SJTW	SJTOW SJTOOW	SJEW	SJEOW	SOOW	SOW	STW	SEOW SEOOW	STOW STOOW	Festoon
Voltage ratings, V		300	300	300	300	300	600	600	600	600	600	600
Temperature ratings, °C		60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	90, or 105	90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	90, or 105	60, 75, 90, or 105	60, 75, 80, 90, or 105
Temperature ratings when exposed to oil, °C		60	-	60	-	60	60	60	-	60	60	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ (when marked W60C or W75C)
	Exposed to Oil	✓	-	✓	-	✓	✓	✓	-	✓	✓	-
Where Used	Not for hard usage	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
	For hard usage	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	For extra hard usage	-	-	-	-	-	✓	✓	-	✓	✓	-
When	In a raceway Class 1 circuit (Section 16)	-	-	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓ (when marked)

Group or Classification (kind)		Heater Cord	
CSA Type Designation		HSJOOW HSJOW	HSJW
Voltage ratings, V		300	300
Temperature ratings, °C		90, or 105	90, or 105
Temperature ratings when exposed to oil, °C		60	60
Location	Dry	✓	✓
	Damp	✓	✓
	Wet	✓	✓
	Exposed to Oil	✓	✓
Where Used	Not for hard usage	✓	✓
	For hard usage	✓	
	For extra hard usage	-	-
When	In a raceway Class 1 circuit (Section 16)	-	-
	Exposed to sunlight	-	-

Group or Classification (kind)		Elevator Travelling Cable			Portable Power Cables						Stage Lighting
CSA Type Designation		E	ETT ETP	EO	W	G	G-GC	G-BGC	SHC-GC	DLO	PPC
Voltage ratings, V		300, or 600	300, or 600	300, or 600	2000	2000	2000	2000	2000	2000	600, 2000
Temperature ratings, °C		60	60	60	90	90	90	90	90	90	60, 75, 90, or 105
Temperature ratings when exposed to oil, °C		-	-	60	-	-	-	-	-	-	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet	-	-	-	✓	✓	✓	✓	✓	✓	✓
	Exposed to Oil	-	-	✓	-	-	-	-	-	-	-
Where Used	Not for hard usage	-	-	-	✓	✓	✓	✓	✓	✓	✓
	For hard usage	-	-	-	✓	✓	✓	✓	✓	✓	✓
	For extra hard usage	-	-	-	✓	✓	✓	✓	✓	✓	-
When	In a raceway Class 1 circuit (Section 16)	-	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	-	-	-	-	-	-	-	-	-	-

Group or Classification (kind)		Portable Power Cables		
CSA Type Designation		SH	SHD, SHD-GC, SHD-BGC	SHD-R
Voltage ratings, V		5000, 8000, 15000, 25000, or 35000	2000, 5000, 8000, 15000, 25000, or 35000	2000
Temperature ratings, °C		90	90	90
Temperature ratings when exposed to oil, °C		-	-	-
Location	Dry	✓	✓	✓
	Damp	✓	✓	✓
	Wet	✓	✓	✓
	Exposed to Oil	-	-	-
Where Used	Not for hard usage	✓	✓	✓
	For hard usage	✓	✓	✓
	For extra hard usage	✓	✓	✓
When	In a raceway Class 1 circuit (Section 16)	-	-	-
	Exposed to sunlight	-	-	-

Add new Table 11B:
Note: Table will be set horizontally, similar to Table 19.

SN4826

Table 11B
Conditions of use in product manufacturing, voltage, and temperature ratings of flexible cords, heater cords, tinsel cords, equipment wires, appliance wiring materials, Christmas-tree cords, wind turbine cables, electric vehicle supply equipment cables, and dryer and range cable
(See Rule 12-102)

Group or Classification (kind)		Flexible Cords										
CSA Type Designation		SV	SVO, SVOO	SVT	SVTO, SVTOO	SPT-1, NISPT-1	SPT-2, NISPT-2 NISP-2	SPT-3	SPT-1W SPT-2W	SVEO, SVEOO	SPE-1 SPE-2 SPE-3,	NISPE-1 NISPE-2
Voltage ratings, V		300	300	300	300	300	300	300	300	300	300	300
Temperature ratings, °C		60, 75, or 90	60, 75, or 90	60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	105	105	90, or 105	90, or 105	90, or 105
Temperature ratings when exposed to oil, °C		-	60	-	60	-	-	-	-	60	-	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet	-	-	-	-	-	-	-	✓	-	-	-
	Exposed to Oil	-	✓	-	✓	-	-	-	-	✓	-	-
Where Used	Not for hard usage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For hard usage	-	-	-	-	-	-	-	-	-	-	-
	For extra hard usage	-	-	-	-	-	-	-	-	-	-	-
When	In a raceway Class 1 circuit (Section 16)	-	-	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	-	-	-	-	-	-	-	✓	-	-	-

Group or Classification (kind)		Equipment Wire		
CSA Type Designation		TXF, TXF-S	TX	SIS
Voltage ratings, V		125	125	600
Temperature ratings, °C		60	60	90
Temperature ratings when exposed to oil, °C		-	-	-
Location	Dry	✓	✓	✓
	Damp	-	-	✓
	Wet	-	-	-
	Exposed to Oil	-	-	-
Where Used	Not for hard usage	✓	✓	✓
	For hard usage	-	-	-
	For extra hard usage	-	-	-
When	In a raceway Class 1 circuit (Section 16)	-	-	-
	Exposed to sunlight	-	-	-

Group or Classification (kind)		Flexible Cords											
CSA Type Designation		SJ	SJO, SJOO	SJT	SJTO, SJTOO	SJE	SJEO SJEOO	S	SO, SOO	ST	STO, STOO	SE	SEO, SEOO
Voltage ratings, V		300	300	300	300	300	300	600	600	600	600	600	600
Temperature ratings, °C		60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	90, or 105	90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	60, 75, 90, or 105	90, or 105	90, or 105
Temperature ratings when exposed to oil, °C		-	60	-	60	-	60	-	60	-	60	-	60
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet	-	-	-	-	-	-	-	-	-	-	-	-
	Exposed to Oil	-	✓	-	✓	-	✓	-	✓	-	✓	-	✓
Where Used	Not for hard usage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For hard usage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For extra hard usage	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓
When	In a raceway Class 1 circuit (Section 16)	-	-	-	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	-	-	-	-	-	-	-	-	-	-	-	-

Group or Classification (kind)		Electric Vehicle Supply Equipment Cable				Outdoor Christmas				
CSA Type Designation		EVJ EVJT	EVJE	EV, EVT	EVE	DPTW	CXWT	PXWT	SPT-1W	SPT-2W
Voltage ratings, V		300	300	600	600	300	300, or 600	300	300	300
Temperature ratings, °C		60, 75, 90, or 105	90, or 105	60, 75, 90, or 105	90, or 105	105	60	60	105	105
Temperature ratings when exposed to oil, °C		60	60	60	60	-	-	-	-	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Exposed to Oil	✓	✓	✓	✓	-	-	-	-	-
Where Used	Not for hard	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For hard usage	✓	✓	✓	✓	-	-	-	-	-
	For extra hard	-	-	✓	✓	-	-	-	-	-
When	In a raceway Class 1 circuit (Section	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	-	-	-	-	✓	✓	✓	✓	✓

Group or Classification (kind)		Indoor Christmas Tree Cord		Tinsel Cords		Heater Cord			Outdoor Equipment Wire	Dryer and Range Cable
CSA Type Designation		PXT	DPT	TST	TPT	HPN	HSJ HSJO HSJOO	HPNW	TXFW TXFW-S	DRT
Voltage ratings, V		125	300	300	300	300	300	300	300	300
Temperature ratings, °C		60	105	60	60	90, or 105	90, or 105	90, or 105	60	60
Temperature ratings when exposed to oil, °C		-	-	-	-	60	60	60	-	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	-	-	✓	✓	✓	✓	✓	✓	✓
	Wet	-	-	-	-	-	-	✓	✓	-
	Exposed to Oil	-	-	-	-	✓	✓	✓	-	-
Where Used	Not for hard usage	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For hard usage	-	-	-	-	-	✓	-	-	✓
	For extra hard usage	-	-	-	-	-	-	-	-	✓
When	In a raceway Class 1 circuit (Section 16)	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	-	-	-	-	-	-	✓	✓	-

Group or Classification (kind)		Wind Turbine Cables	
CSA Type Designation		MV-WT SH-WT	DLO-WT
Voltage ratings, V		5000 to 35000	2000
Temperature ratings, °C		90	90
Temperature ratings when exposed to oil, °C		-	-
Location	Dry	✓	✓
	Damp	✓	✓
	Wet	✓	✓
	Exposed to Oil	-	-
Where Used	Not for hard usage	✓	✓
	For hard usage	✓	✓
	For extra hard usage	✓	✓
When	In a raceway Class 1 circuit (Section 16)	-	-
	Exposed to sunlight	When marked	✓

Group or Classification (kind)		Equipment Wire								
CSA Type Designation		TLW	TR-64	TRSR-64	TR-32	TTR	RR-64 (XLPVC)	RR-64 (CPE)	RR-32 (XLPVC)	RR-32 (CPE
Voltage ratings, V		600	600	600	1400	600	600	600	1400	1400
Temperature ratings, °C		60	90	105	90	90	90	90	90	90
Temperature ratings when exposed to oil, °C		-	-	-	-	-	-	-	-	-
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet	-	-	-	-	-	-	-	-	-
	Exposed to Oil	-	-	-	-	-	-	-	-	-
Where Used	Not for hard usage	✓	✓	✓	✓	✓	✓	✓	✓	✓
	For hard usage	-	-	-	-	-	-	-	-	-
	For extra hard usage	-	-	-	-	-	-	-	-	-
When	In a raceway Class 1 circuit (Section 16)	-	-	-	-	-	-	-	-	-
	Exposed to sunlight	-	-	-	-	-	-	-	-	-

Group or Classification (kind)		Appliance Wiring Material	Appliance Wiring Material
CSA Type Designation		AWM I/II A (with a jacket or overall insulating covering)	AWM I/II B (with a jacket or overall insulating covering)
Voltage ratings, V		30, 90, 125, 150, 300, 600, 1000, 1001-10,000	30, 90, 125, 150, 300, 600, 1000, 1001-10,000
Temperature ratings, °C		60, 75, 80, 90, 105, 125, 150, 180, 200, 250, 350, 450, 550	60, 75, 80, 90, 105, 125, 150, 180, 200, 250, 350, 450, 550
Temperature ratings when exposed to oil, °C		-	-
Location	Dry	✓	✓
	Damp	✓	✓
	Wet	When marked W60C, W75C or W90C	When marked W60C, W75C or W90C
	Exposed to Oil	When marked O or Oil Resistant	When marked O or Oil Resistant
Where Used	Not for hard usage	In accordance with end product standard	-
	For hard usage	-	In accordance with end product standard
	For extra hard usage	-	-
When	In a raceway Class 1 circuit (Section 16)	-	-
	Exposed to sunlight	When marked	When marked

Revise Title of Table 12 to read: **Table 12** ~~Allowable~~ **Ampacity of...** *[no change to remainder of title]*	SN4628-4
Revise Table 12, first column header for temperature columns, to read: ~~Allowable a~~**Ampacity**	SN4628-4
Revise Title of Table 12A to read: ~~Allowable a~~**Ampacities for...** *[no change to remainder of title]*	SN4628-4
Revise Title of Table 12E to read: ~~Allowable a~~**Ampacities for...** *[no change to remainder of title]*	SN4628-4
Revise Table 16, header for column 2, to read: **Table 16** **Minimum size of field-installed system bonding jumpers and bonding conductors** (See Rule 10-616.)	SN4628-10

Ampere rating or setting of overcurrent device protecting conductor (s), equipment, etc.	~~Allowable~~ Ampacity of largest ungrounded conductor or group of conductors	Minimum size of system bonding jumper and bonding conductor			
		Wire		Bus	
Not exceeding		Copper, AWG or kcmil	Aluminum, AWG or kcmil	Copper, mm²	Aluminum, mm²

No change to content of Table 16

Revise Table 18 to read:	**SN4640** **SN4677**

Table 18
Equipment suitable for explosive atmospheres
(See Rules 18-090, 18-100, 18-150, 18-190, 18-200, 18-250, J18-100, J18-150, J18-200, J18-250, J18-300, and J18-350.)

Area classification	Type (Level) of protection	
	Description	Marking
Zone 0	Intrinsic safety (Group II)	ia
	Encapsulation (Group II)	ma
	Flameproof (Group II)	da*
	Equipment assemblies	60079-46, *with EPL Ga***
	Inherently safe optical radiation	op is, *with EPL Ga***
	Optical system with interlock	op sh, *with EPL Ga***
	Intrinsically safe	Intrinsically safe, IS, I.S., Exi, Exia, *for Class I*
	EPL††	Ga
Zone 1	Equipment suitable for use in Zone 0	
	Equipment suitable for use in Class I, Division 1	
	Flameproof (Group II)	d, db
	Intrinsic safety (Group II)	ib
	Increased safety (Group II)	e, eb
	Pressurized enclosure (Group II)	p, px, pxb, py, pyb
	Encapsulation (Group II)	m, mb
	Powder filling (Group II)	q, qb
	Liquid immersion (Group II)	o, ob
	Electrical resistance trace heating	60079-30-1, *with EPL Gb***
	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Gb***
	Equipment Assemblies	60079-46, *with EPL Gb***
	Inherently safe optical radiation	op is, *with EPL Gb***
	Optical system with interlock	op sh, *with EPL Gb***
	Protected optical radiation	op pr, *with EPL Gb***
	EPL††	Gb
Zone 2	Equipment suitable for use in Zone 0	
	Equipment suitable for use in Zone 1	
	Equipment suitable for use in Class I, Division 1	
	Equipment suitable for use in Class I, Division 2	
	Type of Protection “n” (Group II)	nA, nC, nL, nR
	Pressurized enclosure (Group II)	pz, pzc
	Intrinsic safety (Group II)	ic
	Flameproof (Group II)	dc
	Increased safety (Group II)	ec
	Liquid immersion (Group II)	oc
	Encapsulation (Group II)	mc
	Electrical resistance trace heating	60079-30-1, *with EPL Gc***

	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Gc***
	Impedance heating	CSA ~~C22.2 No.~~ 293.3, *with EPL Gc***
	Equipment assemblies	60079-46, *with EPL Gc***
	Inherently safe optical radiation	op is, *with EPL Gc***
	Optical system with interlock	op sh, *with EPL Gc***
	Protected optical radiation	op pr, *with EPL Gc***
	EPL††	Gc
	Other electrical apparatus‡	
	Equipment suitable for use in Class II, Division 1	
Zone 20	Intrinsic safety (Group III)	ia
	Intrinsically safe	Intrinsically safe, IS, I.S., Exi, Exia, *for Class II*
	Protection by enclosure (Group III)	ta
	Encapsulation (Group III)	ma
	Equipment assemblies	60079-46, *with EPL Da***
	Inherently safe optical radiation	op is, *with EPL Da***
	Optical system with interlock	op sh, *with EPL Da***
	EPL††	Da
Group IIIA only	Equipment suitable for use in Class III, Division 1	
	Equipment suitable for use in Zone 20	
	Equipment suitable for use in Class II, Division 1	
Zone 21	Intrinsic safety (Group III)	ib
	Protection by enclosure (Group III)	tb
	Pressurized enclosure (Group III)	p, px, pxb, py, pyb
	Encapsulation (Group III)	mb
	Electrical resistance trace heating	60079-30-1, *with EPL Db***
	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Db***
	Equipment assemblies	60079-46, *with EPL Db***
	Inherently safe optical radiation	op is, *with EPL Db***
	Optical system with interlock	op sh, *with EPL Db***
	Protected optical radiation	op pr, *with EPL Db***
	EPL††	Db
Group IIIA only	Equipment suitable for use in Class III, Division 1	

Zone 22	Equipment suitable for use in Zone 20 Equipment suitable for use in Zone 21 Equipment suitable for use in Class II, Division 1 Equipment suitable for use in Class II, Division 2	
	Intrinsic safety (Group III)	ic
	Protection by enclosure (Group III)	tc
	Pressurized enclosure (Group III)	pz, pzc
	Encapsulation (Group III)	mc
	Electrical resistance trace heating	60079-30-1, *with EPL Dc***
	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Dc***
	Impedance heating	CSA ~~C22.2 No.~~ 293.3, *with EPL Dc***
	Equipment assemblies	60079-46, *with EPL Dc***
	Inherently safe optical radiation	op is, *with EPL Dc***
	Optical system with interlock	op sh, *with EPL Dc***
	Protected optical radiation	op pr, *with EPL Dc***
	EPL††	Dc
	Other electrical apparatus‡	
Group IIIA only	Equipment suitable for use in Class III, Division 2	
Class I, Division 1	Equipment marked for use in Class I, Division 1†	
	Intrinsically safe	Intrinsically safe, IS, I.S., Exi, Exia, *for Class I*
	Purged equipment to NFPA 496	Type X, Type Y, *for Class I*
	~~Purged equipment to NFPA 496~~	~~Type Y, *for Class I*~~
	Equipment suitable for use in Zone 0	
	Intrinsic safety (Group II)	ia
	Encapsulation (Group II)	ma
	Flameproof (Group II)	da*
	Inherently safe optical radiation	op is, *with EPL Ga***
	Optical system with interlock	op sh, *with EPL Ga***
	Equipment assemblies	60079-46, *with EPL Ga***
Class I, Division 2	Equipment suitable for use in Class I, Division 1	
	Equipment marked for use in Class I, Division 2†	
	Purged equipment to NFPA 496	Type Z, *for Class I*
	Equipment suitable for use in Zone 0, Zone 1, or Zone 2	
	Type of Protection “n” (Group II)	nA, nC, nL, nR
	Pressurized enclosure (Group II)	px, pxb, py, pyb, pz, pzc
	Intrinsic safety (Group II)	ia, ib, ic
	Flameproof (Group II)	da, db, dc
	Increased safety (Group II)	eb, ec
	Liquid immersion (Group II)	ob, oc
	Encapsulation (Group II)	ma, mb, mc
	Electrical resistance trace heating	60079-30-1, *with EPL Gb or Gc***

	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Gb or Gc***
	Impedance heating	CSA ~~C22.2 No.~~ 293.3, *with EPL ~~Gb or~~ Gc***
	Inherently safe optical radiation	op is, *with EPL Ga, Gb, or Gc***
	Optical system with interlock	op sh, *with EPL Ga, Gb, or Gc***
	Protected optical radiation	op pr, *with EPL Gb or Gc***
	Equipment assemblies	60079-46, *with EPL Ga, Gb, or Gc***
	Other electrical apparatus‡	
Class II, Division 1	Equipment marked for use in Class II, Division 1†	
	Intrinsically safe	Intrinsically safe, IS, I.S., Exi, Exia, *for Class II*
	Purged equipment to NFPA 496	Type X, Type Y, *for Class II*
	~~Purged equipment to NFPA 496~~	~~Type Y, *for Class II*~~
	Equipment suitable for use in Zone 20§	
	Intrinsic safety (Group III)	ia
	Protection by enclosure (Group III)	ta
	Encapsulation (Group III)	ma
	Inherently safe optical radiation	op is, *with EPL Da***
	Optical system with interlock	op sh, *with EPL Da***
	Equipment assemblies	60079-46, *with EPL Da***
Class II, Division 2	Equipment suitable for use in Class II, Division 1	
	Equipment marked for use in Class II, Division 2†	
	Purged equipment to NFPA 496	Type Z, *for Class II*
	Equipment suitable for use in Zone 20, Zone 21, or Zone 22§	
	Intrinsic safety (Group III)	ia, ib, ic
	Protection by enclosure (Group III)	ta, tb, tc
	Pressurized enclosure (Group III)	px, pxb, py, pyb, pz, pzc
	Encapsulation (Group III)	ma, mb, mc
	Electrical resistance trace heating	60079-30-1, *with EPL Db or Dc***
	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Db or Dc***
	Impedance heating	CSA ~~C22.2 No.~~ 293.3, *with EPL ~~Db or~~ Dc***
	Inherently safe optical radiation	op is, *with EPL Da, Db, or Dc***
	Optical system with interlock	op sh, *with EPL Da, Db, or Dc***
	Protected optical radiation	op pr, *with EPL Db or Dc***
	Equipment assemblies	60079-46, *with EPL Da, Db, or Dc***
	Other electrical apparatus‡	
Class III, Division 1	Equipment suitable for use in Class II, Division 1	
	Equipment marked for use in Class III, Division 1†	
	Intrinsically safe	Intrinsically safe, IS, I.S., Exi, Exia, *for Class II or Class III*
	Enclosure	Type 5‡‡

	Equipment suitable for use in Zone 20 or Zone 21§	
	Intrinsic safety (Group III)	ia, ib
	Protection by enclosure (Group III)	ta, tb
	Encapsulation (Group III)	ma, mb
	Inherently safe optical radiation	op is, *with EPL Da or Db***
	Optical system with interlock	op sh, *with EPL Da or Db***
	Equipment assemblies	60079-46, *with EPL Da or Db***
Class III, Division 2	Equipment suitable for use in Class II, Division 1	
	Equipment suitable for use in Class II, Division 2	
	Equipment suitable for use in Class III, Division 1	
	Equipment marked for use in Class III, Division 2†	
	Equipment suitable for use in Zone 20, Zone 21, or Zone 22§	
	Intrinsic safety (Group III)	ia, ib, ic
	Protection by enclosure (Group III)	ta, tb, tc
	Pressurized enclosure (Group III)	px, pxb, py, pyb, pz, pzc
	Encapsulation (Group III)	ma, mb, mc
	Electrical resistance trace heating	60079-30-1, *with EPL Db or Dc***
	Skin effect trace heating	CSA ~~C22.2 No.~~ 293.1, *with EPL Db or Dc***
	Impedance heating	CSA ~~C22.2 No.~~ 293.3, *with EPL ~~Db or~~ Dc***
	Inherently safe optical radiation	op is, *with EPL Da, Db, or Dc***
	Optical system with interlock	op sh, *with EPL Da, Db, or Dc***
	Protected optical radiation	op pr, *with EPL Db or Dc***
	Equipment assemblies	60079-46, *with EPL Da, Db, or Dc***
	Other electrical apparatus‡	

** "da" is limited to sensors of portable combustible gas detectors.*
†With the exception of intrinsically safe equipment, equipment for use in a Class XX, Division XX location is not required to be marked with a type of protection — only the location where that equipment is permitted to be installed.
‡ "Other electrical apparatus" means electrical apparatus complying with the requirements of a recognized Standard for industrial electrical apparatus that does not in normal service
a) have ignition-capable hot surfaces; or
b) produce incendive arcs or sparks.

See Rules 18-150 2), 18-250 2), J18-150 2) and 3), J18-252, J18-254, and J18-262. "Other electrical apparatus" also makes reference to equipment or systems currently acceptable as alternative means of protection (see Rules 18-066, 18-070, J18-066, and J18-068).

§ For use in Class II and Class III, such (Zone acceptable) equipment is subject to the limitation of
a) Rules J18-054 2) and J18-054 3) for Class II; and
b) Rule J18-054 4) for Class III.

Group IIIA equipment is not suitable for use in Class II locations.
*** Equipment marked with these types of protection is available in multiple levels of protection that are not specifically identified within the Ex marking.*
†† The EPL takes precedence over the type of protection; for example, "Ex ia Gb" is suitable for Zone 1 (not Zone 0), "Ex op is Db" is suitable for Zone 21 (not Zone 20), and "Ex 60079-30-1 Gc is suitable for Zone 2 (not Zone 1). Selection according to the marked EPL is critical to the safe application of this equipment.
‡‡ In Class III, Division 1, switches, controllers, circuit breakers, fuses, control transformers, resistors, utilization equipment (fixed and portable), electric cranes, hoists, and similar equipment may be housed in Enclosure Type 5.
Note: *This Table is structured to show the area classification on the left side and the permitted equipment on the right side. Zone equipment is suitable for use in some Class/Division locations and vice versa. This is indicated by the phrase "Equipment suitable for use in...". For example, in Class I, Division 1 locations, "Equipment suitable for use in Zone 0" means all equipment listed under Zone 0 can be used.*

Revise Table 19 to read:	SN4832

Table 19
Conditions of use for insulated conductors and cables other than flexible cords, portable power cables, and equipment wires
(See Rules 12-100, 12-102, 12-302, 12-406, 12-602, 12-606, 12-902, 12-904, 12-1606, 12-2104, 12-2202, and 22-202, Tables 1, 2, 3, 4, D1, and D3.)

Group or Classification		Thermoset Insulated ~~e~~Conductor				Thermoset Cable			Thermoplastic Insulated Conductor				Thermoplastic Cable	
CSA Type Designation		R90	RW75	RW90	RPV90	RWU75	RWU90	RPVU90	T90 Nylon	TW	TW75	TWN75	TWU	TWU75
Non-metallic jacketed cable (†12-500)														
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		90~~°C~~	75~~°C~~	90~~°C~~	90~~°C~~	75~~°C~~	90~~°C~~	90~~°C~~	90~~°C~~	60~~°C~~	75~~°C~~	75~~°C~~	60~~°C~~	75~~°C~~
Location	**Dry**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Can be used for	**Consumer's services**		✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
	Feeders	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
	Branch circuits	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
	Control and instrumentation circuits	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Class 2 circuits (Section 16)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fire alarm systems	✓ [† 32-100 and 32-102]												
When installed	**Exposed**													
	Concealed													
	In Raceways	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	In Cable trays	✓ [† 12-2202 4)]				✓ [† 12-2202 4)]		✓ [† 64-210]						
	As Direct burial					✓	✓	✓					✓	✓
	Exposed to sunlight		✓ [† 2-136]			✓ [† 2-136]				✓ [† 2-136]			✓ [† 2-136]	
	In Plenums	✓ [† 2-130]												
	Outdoor overhead		✓ [† 12-308]							✓ [† 12-308]				

Group or Classification		Non-Metallic Sheathed Cable		Cables without ~~not having~~ a metal armour or metal sheath										
CSA Type Designation		NMD90	NMWU	CIC	TC	TC ER	DLO TC	DLO TC-ER	NS75	NS90	USEB90	USEI75	USEI90	
Non-metallic jacketed cable (†12-500)						✓		✓						
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		90~~°C~~	60~~°C~~	60, 75, 90, 105,125, 150, 200 250~~°C~~			~~125~~ 90~~°C~~	~~125~~ 90~~°C~~	75~~°C~~	90~~°C~~	90~~°C~~	75~~°C~~	90~~°C~~	
Location	**Dry**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Wet		✓	✓ ~~[marked wet] (90°C)~~ Temperature as marked					✓	✓	✓	✓	✓	
Can be used for	**Consumer's services**				~~✓~~	~~✓~~	✓	✓	✓	✓	✓	✓	✓	
	Feeders	✓	✓		~~✓~~	~~✓~~	✓	✓	✓ [† 10-614]					
	Branch circuits	✓	✓		~~✓~~	~~✓~~	✓	✓	✓ [† 10-614]					
	Control and instrumentation circuits		✓	✓	~~✓~~	~~✓~~	✓	✓	✓	✓	✓	✓	✓	
	Class 2 circuits (Section 16)	✓	✓	✓	~~✓~~	~~✓~~	✓	✓	✓	✓	✓	✓	✓	
	Fire alarm systems	✓ [† 32-100 and 32-102]												
When installed	**Exposed**	✓	✓			✓		✓						
	Concealed	✓	✓			✓		✓						
	In Raceways	✓ [† 12-568 ~~518~~ 2)]		✓	✓ [† 12-2202 ~~2~~3)]						✓	✓	✓	
	In Cable trays				✓	✓	✓	✓						
	As Direct burial		✓	✓when marked [† 12-012]							✓	✓	✓	
	Exposed to sunlight	✓ [† 2-136]												
	In Plenums			✓ [† 2-130]										
	Outdoor overhead								✓ [† 12-308]					

Group or Classification		Cables without ~~not having~~ a metal armour or metal sheath			Extra-low voltage cables without ~~not having~~ a metal armour or metal sheath						
CSA Type Designation		FCC	GTO	Hoistway	GCS	LSS	LVLL	LVT	ELC	ULEC	
Non-metallic jacketed cable (†12-500)					✓	✓		✓			
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		60~~°C~~	60, 90, 105,125, 150, 200, 250 ~~°C~~	60, 90~~°C~~	60~~°C~~	60~~°C~~	60~~°C~~	60~~°C~~	60~~°C~~	60~~°C~~	
Location	**Dry**	✓	✓	✓	✓	✓	✓	✓	✓		
	Damp	✓	✓	✓	✓	✓	✓	✓			
	Wet		✓		✓	✓	✓			✓	
Can be used for	**Consumer's services**										
	Feeders										
	Branch circuits	✓		✓							
	Control and instrumentation circuits	✓	✓	✓	✓	✓ [for extra low voltage Class 2 circuits only]					
	Class 2 circuits (Section 16)			✓	✓	✓ [for extra low voltage Class 2 circuits only]					
	Fire alarm systems										
When installed	**Exposed**		✓ [† 34-402]		✓	✓	✓	✓	✓ [† 16-210]		
	Concealed	✓	✓ [† 34-400]		✓	✓	✓	✓	✓ [† 16-210]		
	In Raceways		✓ [† 34-400]	✓ [† 38-011]	✓	✓	✓	✓	✓		
	In Cable trays				✓ [when marked FT4 ~~and † 12-2202~~]						
	As Direct burial				✓ [† 12-012]					✓	
	Exposed to sunlight		✓ [† 2-136]		✓ [† 2-136]						
	In Plenums			✓ [† 2-130]			✓ [† 2-130]				
	Outdoor overhead										

Group or Classification		Fire alarm and signal cable ~~(Unarmoured~~ without a metal armour or metal sheath~~)~~					Fire alarm and signal cable with ~~(A~~armour~~ed~~ or metal sheath without an overall jacket~~)~~					Fire alarm and signal cable with ~~(A~~armour~~ed~~ or metal sheath with an overall jacket~~)~~				
CSA Type Designation		FAS	FAS90	FAS105	FAS150	FAS200	FAS	FAS90	FAS105	FAS150	FAS200	FAS	FAS90	FAS105	FAS150	FAS200
Non-metallic jacketed cable (†12-500)		✓	✓	✓	✓	✓										
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		60~~°C~~	90~~°C~~	105~~°C~~	150~~°C~~	200~~°C~~	60~~°C~~	90~~°C~~	105~~°C~~	150~~°C~~	200~~°C~~	60~~°C~~	90~~°C~~	105~~°C~~	150~~°C~~	200~~°C~~
Location	**Dry**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓						✓	✓	✓	✓	✓
	Wet	✓ ~~[marked wet]~~ Temperature as marked										✓ ~~[marked wet]~~ Temperature as marked				
Can be used for	**Consumer's services**															
	Feeders															
	Branch circuits															
	Control and instrumentation circuits	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Class 2 circuits (Section	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fire alarm systems	✓ [† 32-100 and 32-102]														
When installed	**Exposed**	✓ [† 32-102]					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Concealed	✓ [† 32-102]					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	In Raceways	✓	✓	✓	✓	✓						✓	✓	✓	✓	✓
	In Cable trays	✓ [when marked FT4 and †32-102 ~~12-2202~~]					✓	✓	✓	✓	✓	✓ [when marked FT4]				
	As Direct burial	✓ [† 12-012]										✓ [† 12-012]				
	Exposed to sunlight	✓ [† 2-136]										✓ [† 2-136]				
	In Plenums	✓ [† 2-130]					✓	✓	✓	✓	✓	✓ [† 2-130]				
	Outdoor overhead	✓ [marked wet]										✓ [marked wet]				

Group or Classification		Armoured Ccables having metal armour							Metal sheathed Ccables having metal armour or metal sheath				
CSA Type Designation		AC90	ACG90	ACGWU90	ACWU90	TECK90	ACIC	SW-ACIC	MI	MI (jacketed)	SSMI (jacketed)	SSMI	LWMI
Non-metallic jacketed cable (†12-500)													
Maximum conductor temperatures, °C (unless otherwise marked)		90°C	90°C	90°C	90°C	90°C	60, 75, 90, 105,125, 150, 200 250°C		250°C	90°C	90°C	250°C	250°C
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp			✓	✓	✓ [with jacket]	✓ [marked wet (°C)]		✓ [see 12-7023)]	✓	✓	✓	✓ [see 12-7023)]
	Wet			✓	✓	✓ [with jacket]	✓ [marked wet (90°C)]		✓ [see 12-7023)]	✓	✓	✓ [see 12-7023)]	
Can be used for	Consumer's services	✓			✓	✓			✓	✓	✓	✓	
	Feeders	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
	Branch circuits	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
	Control and instrumentation circuits	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Class 2 circuits (Section	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fire alarm systems	✓ [† 32-100 and 32-102]											
When installed	Exposed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Concealed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	In Raceways			✓	✓	✓ [with jacket]							
	In Cable trays	✓ [† 12-2202 1)]											
	As Direct burial			✓	✓	✓ [with jacket]				✓	✓	✓	
	Exposed to sunlight			✓ [† 2-136]					✓	✓	✓ [† 2-136]		✓
	In Plenums	✓	✓	✓ [† 2-130]					✓	✓	✓ [† 2-130]		✓
	Outdoor overhead			✓ [† 12-308]		✓ [with a jacket]							

Group or Classification		Metal sheathed ~~C~~cables ~~having metal armour or metal sheath~~							5 kV to 46 kV Shielded Power Cable ~~Unarmoured~~ without a metal armour or metal sheath	5 kV to 46 kV Shielded Power Cable ~~Armoured~~ with a metal armour or metal sheath
CSA Type Designation		LWMI (jacketed)	SSLWMI (jacketed)	SSLWMI	RA90	RC90	RA90 (jacketed)	RC90 (jacketed)	MV68.10	MV68.10
Non-metallic jacketed cable (†12-500)										
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		90~~°C~~	90~~°C~~	250~~°C~~	90~~°C~~	90~~°C~~	90~~°C~~	90~~°C~~	90, 105 ~~°C or as marked~~	90, 105 ~~°C or as marked~~
Location	**Dry**	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓ [see 12-702 3)]			✓	✓	✓	✓ [with jacket]
	Wet	✓	✓	✓ [see 12-702	✓ [see 12-702 3)]		✓	✓	✓	✓ [with jacket]
Can be used for	**Consumer's service**				✓	✓	✓	✓	✓	✓
	Feeders	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Branch circuits	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Control and instrumentation circuits	✓	✓	✓	✓	✓	✓	✓		
	Class 2 circuits (Section	✓	✓	✓	✓	✓	✓	✓		
	Fire alarm systems	✓ [† 32-100 and 32-102]								
When installed	**Exposed**	✓	✓	✓	✓	✓	✓	✓	✓ [† 36-100]	✓
	Concealed	✓	✓	✓	✓	✓	✓	✓	✓ [† 36-100]	✓
	In Raceways								✓ [† 36-100]	✓
	In Cable trays	✓ [† 12-2202]							✓ [† 2-130 and 36-100]	
	As Direct burial	✓	✓	✓		✓	✓	✓	✓	✓ [with jacket]
	Exposed to sunlight	✓ [† 2-136]		✓	✓	✓	✓ [† 2-136]		✓ [† 2-136]	✓ [† 2-136]
	In Plenums	✓ [† 2-130]		✓	✓	✓	✓ [† 2-130]		✓ [† 2-130 and 36-100]	✓ [† 2-130]
	Outdoor overhead								✓ [† 12-308]	✓ [with a jacket]

Group or Classification		Communications Cables							Communications cable with limited power						
CSA Type Designation		CMP	CMR	CMG	CM	CMX	CMH	CMUC	CMP-LP	CMR-LP	CMG-LP	CM-LP	CMX-LP	CMUC-LP	CMH-LP
Non-metallic jacketed cable (†12-500)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		60, 75, 90, 105, 125, 150, 200, 250~~°C~~													
Location	**Dry**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Damp	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wet					✓ [† 2-136]							✓ [† 2-136]		
Can be used for	**Consumer's services**														
	Feeders														
	Branch circuits														
	Control and instrumentation circuits								✓	✓	✓	✓	✓	✓	✓
	Class 2 circuits (Section	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fire alarm systems														
When installed	**Exposed**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Concealed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	In Raceways	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
	In Cable trays	✓ ~~[† 12-2202]~~							✓ ~~[† 12-2202]~~						
	As Direct burial														
	Exposed to sunlight	✓ [† 2-136]							✓ [† 2-136]						
	In Plenums	✓							✓						
	Outdoor overhead					✓ [† 2-136 and 12-308]							✓ [† 2-136 and 12-308]		

Group or Classification		Communications Cables											
CSA Type Designation		OFCP	OFCR	OFCG	OFC	OFNP	OFNR	OFNG	OFN				
Non-metallic jacketed cable (†12-500)		✓	✓	✓	✓	✓	✓	✓	✓				
Maximum conductor temperatures, °C ~~(unless otherwise marked)~~		60, 75, 90, 105, 125, 150~~°C~~											
Location	Dry	✓	✓	✓	✓	✓	✓	✓	✓				
	Damp	✓	✓	✓	✓	✓	✓	✓	✓				
	Wet												
Can be used for	Consumer's services												
	Feeders												
	Branch circuits												
	Control and instrumentation circuits	✓	✓	✓	✓	✓	✓	✓	✓				
	Class 2 circuits (Section 16)												
	Fire alarm systems	✓ [† 32-100 2)]											
When installed	Exposed	✓	✓	✓	✓	✓	✓	✓	✓				
	Concealed	✓	✓	✓	✓	✓	✓	✓	✓				
	In Raceways	✓	✓	✓	✓	✓	✓	✓	✓				
	In Cable trays	✓ ~~[† 12~~	✓	✓	✓	✓	✓	✓	✓				
	As Direct burial												
	Exposed to sunlight	✓ [† 56-104]											
	In Plenums	✓				✓							
	Outdoor overhead	✓ [† 12-308]											

† In addition to the acceptable conditions of use, insulated conductors and cables referenced in these tables shall, where applicable, be installed in accordance with the specific rule(s) identified within their respective column.

Revise Title of Table 36A to read: ~~**Maximum allowable a**~~**A**mpacity for... [no change to remainder of title]	**SN4628-4**
Revise Title of Table 36B to read: ~~**Maximum allowable a**~~**A**mpacity for... [no change to remainder of title]	**SN4628-4**

Delete Table 38: **SN4681**

Table 38
Electric vehicle supply equipment demand factors
(See Rules 8-202 to 8-210.)

Number of automobile spaces or stalls per feeder	Maximum load per space or stall, W	Demand factor, %
1 to 4	2000	100
	4000	100
	6000	100
	8000 or more	100
5 to 8	2000	100
	4000	100
	6000	90
	8000 or more	90
9 to 12	2000	100
	4000	90
	6000	90
	8000 or more	80
13 to 16	2000	100
	4000	90
	6000	80
	8000 or more	80
17 to 24	2000	100
	4000	90
	6000	80
	8000 or more	70
25 and over	2000	100
	4000	90
	6000	70
	8000 or more	70

Revise title of Table 43 to read:

SN4502

Table 43
Minimum conductor size for field-assembled grounding ~~concrete-encased~~ electrodes
(See Rule 10-102.)

Ampacity of largest service conductor or equivalent for multiple conductors, A	Size of bare copper conductor, AWG
165 or less	4
166–200	3
201–260	2
261–355	0
356–475	00
Over 475	000

Revise Table 53 to read:

SN4730-12

Table 53
Minimum cover requirements for direct buried cables or insulated conductors in raceways
(See Rule 12-012.)

Wiring method	Minimum cover, mm			
	Non-vehicular areas		Vehicular areas	
	~~750 V or less~~ Low voltage and extra-low voltage	~~Over 750 V~~ High voltage	~~750 V or less~~ Low voltage and extra-low voltage	~~Over 750 V~~ High voltage
Cable not having a metal sheath or armour	600	750	900	1000
Cable having a metal sheath or armour	450	750	600	1000
Raceway	450	750	600	1000

Note: *Minimum cover means the distance between the top surface of the conductor, cable, or raceway and the finished grade.*

Revise title of Table 57 to read:

SN4628-16

Table 57
~~Allowable a~~Ampacities for insulated copper conductors of Class 2 circuits
(based on an ambient temperature of 30 °C†)
[See Rule 16-210 6) and Table 5A.]

Revise Table 60 to read:

SN4590
SN4594
SN4628-16
SN4608

Table 60
~~Allowable a~~Ampacities for copper, eight-conductor, Class 2 power and data communication circuit cables
(based on an ambient temperature of 30 °C)
(See Rule 16-330 and Table 5A.)

Size, AWG	Allowable ampacity																				
	Number of cables in one cable bundle																				
	~~1~~			~~2-7~~ 1-7			8-19			20-37			38-61			62-91			92-192		
	~~60°C~~	~~75°C~~	~~90°C~~	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	~~1.0~~	~~1.0~~	~~1.0~~	~~1.0~~ 1.00	~~1.0~~ 1.23	~~1.0~~ 1.42	~~0.7~~ 0.71	~~0.8~~ 0.87	~~1.0~~ 1.02	~~0.5~~ 0.55	~~0.6~~ 0.68	~~0.7~~ 0.78	~~0.4~~ 0.46	~~0.5~~ 0.57	~~0.6~~ 0.67	~~0.4~~ 0.45	~~0.5~~ 0.55	~~0.6~~ 0.64			
24	~~2.0~~	~~2.0~~	~~2.0~~	~~1.0~~ 1.19	~~1.4~~ 1.46	~~1.6~~ 1.69	~~0.8~~ 0.81	~~1.0~~ 1.01	~~1.1~~ 1.17	~~0.6~~ 0.63	~~0.7~~ 0.78	~~0.9~~ 0.91	~~0.5~~ 0.55	~~0.6~~ 0.67	~~0.7~~ 0.78	~~0.4~~ 0.46	~~0.5~~ 0.56	~~0.6~~ 0.65	~~0.3~~ 0.40	~~0.4~~ 0.48	~~0.5~~ 0.55
23	~~2.5~~	~~2.5~~	~~2.5~~	~~1.2~~ 1.24	~~1.5~~ 1.53	~~1.7~~ 1.78	~~0.8~~ 0.89	~~1.1~~ 1.11	~~1.2~~ 1.28	~~0.6~~ 0.77	~~0.8~~ 0.95	~~0.9~~ 1.10	~~0.5~~ 0.66	~~0.7~~ 0.80	~~0.8~~ 0.93	~~0.5~~ 0.58	~~0.7~~ 0.71	~~0.8~~ 0.82	~~0.4~~ 0.45	~~0.5~~ 0.55	~~0.6~~ 0.63
22	~~3.0~~	~~3.0~~	~~3.0~~	~~1.4~~ 1.50	~~1.8~~ 1.86	~~2.1~~ 2.16	~~1.0~~ 1.04	~~1.2~~ 1.28	~~1.4~~ 1.49	~~0.7~~ 0.77	~~0.9~~ 0.95	~~1.1~~ 1.11	~~0.6~~ 0.66	~~0.8~~ 0.82	~~0.9~~ 0.96	~~0.6~~ 0.62	~~0.8~~ 0.77	~~0.9~~ 0.89	~~0.5~~ 0.53	~~0.6~~ 0.63	~~0.7~~ 0.72

Notes:
1) *Ampacities shown are for each conductor of the eight-conductor cable.*
2) The per-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in the Table. When cable connectors operate at elevated temperatures near 90°C, their ampacity limitations may render the cable installation inoperable.

SN4430
SN4730-68

Revise Table 61 to read:

Table 61
~~Minimum buried cable h~~Horizontal separations from pools for Direct Buried Underground Cables, and Insulated Conductors in Raceways
(See Rule 68-056.)

Type of installation	Minimum horizontal separation, m	
	Direct buried unjacketed cables with a bare neutral or cables with a semi-conducting jacket	Cables with a non-conducting jacket or insulated conductors in non-conducting raceways
Communication conductors	1.5	1.0
Power cables and insulated conductors		
0–~~750~~ 1000 V	1.5	1.0
~~751~~ 1001 –15 000 V	3.0	1.5
15 001–28 000 V	6.0	2.0

Notes:
1) *Voltages are phase-to-phase.*
2) *This Table is derived from CEA 266 D 991.*
3) *The separation from non-conducting raceways is measured from the nearest edge of the raceway to the inside wall of the pool.*

SN4624
SN4531

Revise Table 65 as shown:
Note: All "x" entries are replaced with "✓".

Table 65
Enclosure type selection table for non-hazardous locations
(See Rules 2-400 and 2-402.)

Provides a degree of protection against the following environmental conditions	Enclosure type															
	Indoor use						Indoor/outdoor use								Submersible	
	1	2	5	12*	12K†	13	3	3X	3R	3RX	3S	3SX	4	4X	6	6P
Accidental contact with live parts	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Falling dirt	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dripping and light splashing of non-corrosive liquids	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Circulating dust, lint, fibres, and flyings	–	–	–	✓	✓	✓	✓	✓	–	–	✓	✓	✓	✓	✓	✓
Settling airborne dust, lint, fibres, and flyings	–	–	✓	✓	✓	✓	✓	✓	–	–	✓	✓	✓	✓	✓	✓
Hosedown and splashing water	–	–	–	–	–	–	–	–	–	–	–	–	✓	✓	✓	✓
~~Corrosion~~ Corrosive agents	–	–	–	–	–	–	–	✓	–	✓	–	✓	–	✓	–	✓
Occasional temporary submersion	–	–	–	–	–	–	–	–	–	–	–	–	–	–	✓	✓
Occasional prolonged submersion	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	✓
Oil and coolant seepage	=	=	=	✓	✓	✓	=	=	=	=	=	=	=	=	=	=
Oil ~~and~~or coolant ~~seepage,~~ spraying and splashing	–	–	–	–	–	✓	–	–	–	–	–	–	–	–	–	–
Rain, snow and sleet, and external formation of ice‡	–	–	–	–	–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rain, snow and sleet and ~~ice~~ external formation of ice§	–	–	–	–	–	–	–	–	–	–	✓	✓	–	–	–	–
Wind-blown dust	–	–	–	–	–	–	✓	✓	–	–	✓	✓	✓	✓	✓	✓

* *Without knockouts.*
† *With knockouts.*
‡ *The external operating mechanism(s) is not required to operate when the enclosure is ice covered.*
§ *The external operating mechanism(s) shall be operable when the enclosure is ice covered.*

SN4731
SN4778

Revise Table 67 to read:

Table 67
Clearance requirements for installed space heating systems
(See Rule 62-200.)

		Clearance Requirements
Heating system type and location	**Minimum Distance ~~clearance~~, mm**	**Clearance details ~~Obstructions and protrusions~~**
All systems, including heating fixtures; trace heater sets; heating panel sets; heating device sets	100	From protruding water pipes and ducts
	200	From electrical outlets to which a luminaire or other heat-producing equipment is liable to be connected. From receptacles* and switches. From other heating devices, unless otherwise rated.
Floor systems above sub-floors, for trace heater sets or heating panel sets	50	From walls, partitions, and permanently fixed Cabinetry.
Floor systems under sub-floors, for trace heating sets or heating panel sets	50	~~Minimum a~~Air gap between bottom of subfloor and heating device sets, unless otherwise rated.
Wall systems for trace heater sets or heating panel sets	0	From the finished wall surface if located not more than 1.2 m above the floor, provided it is marked "mechanically protected" and protected by a Class A GFCI.
	50	~~Minimum air gap behind the wall surface to protect installed heating devices, unless the heating device set is protected by design from mechanical damage.~~ From the top and side surfaces of permanently fixed cabinetry. From the finished wall surface (both sides of wall).
	150	From ceiling, floor, and other wall corners. From partitions, bottom surfaces of permanently fixed cabinetry, doors, and window frames, or other thermal obstructions, unless otherwise rated.
Ceiling systems for trace heater sets or heating panel sets	0	From the finished ceiling surface, provided it is marked "mechanically protected" or protected by a Class A GFCI.
	50	From glass walls and window walls. From the finished ceiling surface.
	150	From corners, partitions, and adjacent surfaces, and not overlapping permanently fixed cabinetry or other thermal obstructions, unless otherwise rated.

* Surface mounted electric heaters such as baseboard heaters, shall have a minimum clearance of 1.2 m below receptacles, however if the heaters are guarded to prevent direct contact with hot surfaces, then only the 200 mm clearance is required.

SN4697

Add new Table 72:

Table 72
Minimum sag for neutral supported cables
(based on a ruling span of 40.0 m*)
(see Rule 12-318 and Appendix B)

		Maximum Span (m)						
Loading	Segment	10.0	15.0	20.0	25.0	30.0	35.0	40.0
		Minimum Sag (m)						
Heavy	Pole to pole	0.2	0.4	0.7	1.0	1.5	2.0	2.6
	Pole to mast	0.3	0.7	1.3	2.0	See Note 1		
Severe	Pole to pole	0.2	0.6	1.0	1.6	2.3	3.1	4.1
	Pole to mast	0.4	0.9	1.7	2.7	See Note 1		

*Ruling span formula:
Ruling span = average span + 2/3 (maximum span- average span)

Notes:
1) For these installations, a calculation for minimum sag is required.

2) This table applies to duplex, triplex, and quadruplex neutral supported cables sized from No. 6 AWG to 336.4 kcmil with or without a bonding conductor, with a full or reduced ACSR neutral, and with or without a PVC jacket on the phase conductors.

3) These minimum sag values are based on a temperature range of -30C to +30C

# Appendix A	
The list of Canadian Standards for electrical equipment developed by CSA Group and other accredited Standards development organizations will be reinstated in Annexes A.1 and A.2. of Appendix A in the published Code. The list will be a snapshot of the online version of Appendix A as at May 11th, 2023.	

Appendix B

Revise Appendix B Note for Object to read: SN4796

Object
The safety provisions of this Code are not intended to limit installation methods to those specifically described by the Rules in this Code. The safety objectives of this Code may be met by utilizing alternative installation methods based on the fundamental safety principles of IEC 60364-1.

Such alternative methods are intended only for industrial and similar installations where objective based installation criteria are addressed under the provisions of safety management systems or equivalent programs developed between users (industrial plants, independent power producers, etc.) and the authorities adopting and enforcing this Code.

~~Chapter 13 of~~ IEC 60364-1 offers the fundamental safety principles. ~~and is included in Appendix K.~~

Add Appendix B Note for definition of Suite to read: SN4569

Suite
Refer to note A-1.4.1.2 (1) in the National Building Code of Canada for additional explanatory material concerning the definition of suite.

Add Appendix B Note for Rule 2-304 to read: SN4459-2

Rule 2-034
The objective of this rule is to ensure that the requirements of CE Code Part I are met only by electrical equipment that is part of an electrical installation covered by the Scope of Part I. For example, electrical equipment located in electrical installations "employed by an electric distribution system utility in the exercise of its function as a utility" cannot be used to meet Part I bonding and grounding, overcurrent or disconnecting means requirements.

Add Appendix B Note for Rule 2-100 1) n) to read: SN4611

Rule 2-100 1) n)
Altitude is an example of other markings that may be necessary on some equipment. Installation of electrical equipment at altitudes exceeding 1000 m may need to have reduced voltage and current ratings. Correction factors or tables are provided by the equipment manufacturer for equipment that may be affected.

Revise Appendix B Note for Rule 2-136 to read: SN4827

Rule 2-136

It is the intent of this Rule to protect totally enclosed non-metallic raceways as well as insulated conductors, and/or the jackets of insulated conductors, and cables against adverse effects caused by direct exposure to rays of the sun. Electrical conductors and non-metallic raceways marked for this application are suitable for installation and use for direct exposure to rays of the sun. Insulated conductors and cables marked “SR”, “Sun Res”, “Sunlight Resistant”, “CMX-Outdoor” (for communications cable), and outdoor cords and equipment wire listed in Table 11A for wet locations, have been found to meet the standard criteria for sunlight resistance. Rigid RTRC conduit marked “RTRC Type AG” and totally enclosed non-metallic raceways marked “SR”, “Sun Res”, “Sunlight Resistant”, or “Outdoor” have been found to meet the standard criteria for sunlight resistance.	
Revise Appendix B Note for Rule 2-306 to read: **Rule 2-306** CSA Z462 provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment to protect against shock and arc flash hazards. ANSI/NEMA Z535.4 provides guidelines for the design of safety signs and labels for application to products. IEEE 1584 provides assistance in determining the arcing fault current, the arc flash ~~hazard distance~~ boundary and the incident energy that workers may be exposed to from electrical equipment. The applicable documentation could include manufacturer’s instructions, schematics and single line drawings. See CSA Z462 *Annex O Safety-related design* for methods of reducing the arcing fault duration.	**SN4623**
Revise Appendix B Note for Rule 2-310 to read: **Rules 2-310 1) and 64-926** Specific requirements pertaining to unobstructed means of egress can be found in Articles 3.3.1.~~23~~24 and 9.9.5.5 of Division B of the National Building Code of Canada. It is intended that doors and gates in the unobstructed means of egress described in this Subrule will open in the direction of exit travel. However, where the room is large relative to the required working space, the National Building Code of Canada may allow doors or gates located more than 7.6 m away from the working space to open in either direction. Articles 3.4.4.4 (7), 3.4.3.3, and 9.9.6.1 of the *National Building Code of Canada* should be consulted as to the limitations that any door swinging out from an electrical room may have to comply with.	**SN4835**
Revise Appendix B Note for Rules 2-328 and 64-918 7) to read:	**SN4505**

Rules 2-328 and ~~64-918 7)~~ 64-1002 3) The clearance distances specified in CSA B149.1 and CSA B149.2 between a source of ignition and a flammable ~~combustible~~ gas relief discharge device or vent are as follows: a) 1 m for natural gas as specified in CSA B149.1; ~~and~~ b) 0.3 m for natural gas if an ANSI Z21.80/CSA 6.22 certified overpressure protection device is used as specified in CSA B149.1; and c) 3 m for propane gas as specified in CSA B149.2. Arc-producing electrical equipment that is considered a source of ignition includes, but is not limited to: receptacles, switches, meter base plug in transfer devices, meter base plug in devices with an internal service disconnecting feature, electric metering equipment with an internal service disconnecting feature, air conditioning units, and related disconnecting means.	SN4712
Revise Appendix B Note for Rule 2-400 to read: **Rule 2-400** Enclosures are not intended to protect against conditions such as condensation, icing, corrosion, or contamination that may occur within the enclosure or enter via the conduit or unsealed openings. ~~Ingress protection (IP) describes the degree of protection an enclosure provides from ingress of water or foreign bodies. [See the ingress protection table in the Note to Rule 18-102 5)]. For further information on the IP designations, refer to CAN/CSA-C22.2 No. 60529. The IP designations are supplemental to the enclosure types specified in Rule 2-400 and Table 65. There is no direct correlation between the IP designations and enclosure types, and CAN/CSA-C22.2 No. 60529 does not cover environmental considerations such as resistance to corrosion or the effects of ultraviolet.~~	SN4531
Add new Appendix B Note for Rule 2-402 to read: **Rule 2-402** It is intended by Subrule 1) to allow the marking of IP Codes on equipment that is not required to be marked with a type designation by Rule 2-400 2). Ingress protection (IP) describes the degree of protection an enclosure provides from ingress of water or foreign bodies. [See the ingress protection table in the Note to Rule 18-102 5)]. For further information on ingress protection designations (IP Codes), refer to CAN/CSA-C22.2 No. 60529. In addition to the enclosure type, an enclosure may be marked with an IP Code that is supplemental to the enclosure types specified in Rule 2-400 and Table 65. There is no direct correlation between IP Codes and enclosure types, and CAN/CSA-C22.2 No. 60529 does not cover environmental considerations such as resistance to corrosion or the effects of ultraviolet.	SN4531

The first number of the IP Code describes the degree of protection against physical contact (i.e., fingers, tools, dust, etc.) with internal parts; the second number designates the degree of protection against water ingress. For example, an IP54 rating requires an enclosure to be dust-protected and protected against water splashing from any direction.

The Table B2-X IP Codes only describe the capability of an enclosure to protect from ingress of solids and water. When selecting an enclosure for a given application, additional environmental and installation considerations must be taken into account separately. This is why IP Codes are not directly comparable to Type ratings, which take into account more than just solids and water ingress. The Type designations of Table 65 take into account additional factors such as the enclosure thickness, knock-out strength, corrosion protection, oil resistance, drainage, mounting means, gaskets, external formation of ice, etc.

Add new Appendix B Table B2-1 to read:

SN4531

Table B2-1
Enclosure selection table using ingress protection designations (IP Codes)

Protection against contact and solid objects *(first digit)*		Protection against water *(second digit)*	
Number	Description	Number	Description
0	No protection	0	No protection
1	Protected against solid foreign objects of 50 mm diameter and greater	1	Vertically falling water drops
2	Protected against solid foreign objects of 12.5 mm diameter and greater	2	Protected against vertically falling water drops when enclosure tilted up to 15°
3	Protected against solid foreign objects of 2.5 mm diameter and greater	3	Spraying water at an angle up to 60°
4	Protected against solid foreign objects of 1.0 mm diameter and greater	4	Splashing water from any direction
5	Dust-protected	5	Low-pressure water jets
6	Dust-tight	6	Powerful water jets
		7	Protected against the effects of temporary immersion in water
		8	Continuous Submersion in water
		9	High pressure and high temperature water jets

Note: As an example, an enclosure rated IP56 provides protection from dust and strong jets of water.

For example, a floor-standing enclosure could be rated IP43 (resistance to entry from slender tools, wires, etc. over 2.5mm; and resistance to water spray up to 60°

from vertical). Enclosures for general outdoor use are often rated IP65 or higher. See also the Appendix B note to Rule 18-102 5).These are examples only, and specific conditions of the installation may require additional enclosure features beyond the IP Code.

Since IP Codes are not a substitute for enclosure Type ratings, a given IP Code is NOT directly comparable to any Type rating from Table 65.

For reference, IP-marked enclosures are assessed for solids and water ingress only, and can be categorized as follows:

a) IP40 or higher for use indoors in ordinary dry locations;
b) IP52 or higher for use indoors where the enclosure may be subject to drops of falling liquid due to condensation or other causes;
c) IP55 or higher for non-metallic enclosures for use in ordinary wet locations;
d) IP56 or higher for use where the enclosure may be subject to direct streams of water; and
e) IP54 or higher for use indoors in dry locations where the atmosphere may contain settling non-hazardous dust.

Add Appendix B Note for Rule 2-404 to read:

SN4599

Rule 2-404

The following examples include but are not limited to designations related to some types of motor enclosure markings:

Open type enclosures

- drip-proof or open drip-proof (DP or ODP);
- splash-proof;
- semi-guarded;
- guarded;
- drip-proof guarded (DPGD) or open drip-proof guarded (ODPG);
- open externally ventilated;
- open pipe-ventilated;
- weather-proof (WP);
- weather-protected (WP-I or WP-II)

Totally enclosed type enclosures

- totally enclosed (TE);
- totally enclosed fan cooled (TEFC);
- totally enclosed non-ventilated (TENV);
- totally enclosed pipe-ventilated (TEPV);
- water-proof;
- totally enclosed fan-cooled guarded;
- totally enclosed water-cooled;
- totally enclosed force-ventilated (TEFV);
- totally enclosed air-over (TEAO):
- totally enclosed air to air cooled (TEAAC); or
- totally enclosed water to air cooled (TEWAC).

See CSA C22.2 No. 100 for additional information on motor enclosure markings.

A motor enclosure in an open machine may require protection that is drip-proof (DP), splash-proof, semi-guarded, guarded, open pipe-ventilated or weather-proof (WP). A motor that is totally enclosed may be totally enclosed fan cooled (TEFC), totally enclosed pipe ventilated (TEPV), (totally enclosed air to air cooled TEAAC), or totally enclosed water to air cooled (TEWAC).	
Revise Appendix B Note for Rule 4-004 to read: **Rule 4-004** The ~~allowable~~ ampacities of Tables 1, 2, 3, and 4 are based on temperature alone and do not take voltage drop into consideration (see Table D3).	**SN4628-4**
Revise Appendix B Note for Rule **Rule 4-006** In accordance with CSA product Standards (e.g., CSA C22.2 No. 4 or CSA C22.2 No. 5), when equipment of 600 V or less is evaluated relative to the appropriate temperature characteristics of the terminations, conductors sized similar to those in the 75 °C column of Table 2 or 4 are used. It is intended by this Rule that the size of conductors terminating on equipment described in Subrules 1), 2), 3), and 4) be not less than the conductor size selected for the ~~maximum~~ insulated conductor ampacity in the corresponding temperature column of Table 1, 2, 3, or 4. This Rule is not intended to address conductor ~~allowable~~ ampacity (see Rule 4-004). Regardless of conductor ~~allowable~~ ampacities determined by other Rules in this Code (for underground conductors, cables, flexible cords, portable power cables, DLO cables, and conductors with higher temperature ratings, etc.), it is intended that the minimum conductor size be based on the requirements of this Rule.	**SN4628-4**
Note: This revision is suspended until Standard ANSI/CAN UL1008M is listed in Appendix A of the CE Code, Part I. *Add Appendix B Note for Rule 6-100 to read:* **Rule 6-100** Meter-mounted transfer switches are covered by ANSI/CAN UL1008M, *Transfer Switch Equipment, Meter Mounted.*	**SN4604**
Note: This revision is suspended until Standard ANSI/CAN UL1008M is listed in Appendix A of the CE Code, Part I. *Add Appendix B Note for Rule 6-200 4) to read:* **Rule 6-200 4)**	**SN4604**

The grounding and bonding requirements for the installation of a meter-mounted transfer switch are covered in Section 10. Subrule 4) requires a caution label located on the meter mounting device or the meter-mounted transfer switch, using the following or equivalent wording: CAUTION: The generator neutral shall not be connected to the generator frame. CSA Standard C22.2 No 100 requires generators without the neutral bonded to the frame are marked as "NEUTRAL FLOATING".	
Add Appendix B Note for Rule 6-402 2)b) to read: **Rule 6-402 2) b)** This Subrule refers to equipment conforming to CSA C22.2 No. 115.	SN4512
Add Appendix B Note for Rule 6-408 1)d) to read: **Rule 6-408 1) d)** It should be noted that in accordance with C22.2 No. 115, meter-mounting devices are tested at temperatures up to 35C.	SN4576
Revise Appendix B Note for Rule 8-002 to read: **Rule 8-002** **Basic load** It is intended by this definition that only ~~a~~ typical lighting loads and those receptacle loads that are connected to receptacles having CSA configuration 5-15R or 5-20R, as described in Rule 8-304, that are within an area bound by the outside dimensions of that area signifies "basic load". Such loads as outside lighting, specialty lighting (i.e., stage, show window lighting, etc.), electric space heating, or air-conditioning loads are not intended to be part of the basic load. Code users should be aware that the value of basic load for each particular building occupancy is different and is dependent on the type of occupancy from Table 14 and on load calculation requirements for residential occupancies.	SN4496
Add Appendix B Note for Rule 8-102 to read: **Rule 8-102** Voltage drop may adversely impact electrical installation as follows: (a) By reducing performance of the electrical system components (of the electrical equipment and appliances), when excessive voltage drop will not allow the equipment or appliances to start and operate as intended by their design; (b) By reducing electrical safety, if the size of the circuit conductors and the bonding conductor does not take into account voltage drop, and the size of a bonding conductor is insufficient to conduct safely any currents liable to be imposed on it (see Appendix B note on Rule 10-616 3) b)).	SN4797
Add Appendix B Note for Rule 8-102 1)b) to read:	SN4797

Rule 8-102 1) b) It is intended by this item that where in addition to the system supplying the consumer's service as described in Rule 10-210, one or more different systems conforming to Rule 10-212 exist at a facility, voltage drop should not exceed 5% between the points of connection and utilization.	
Revise Appendix B Note for Rules 8-104 5)b) and 6)b) to read: **Rules 8-104 5) b) and 6) b)** It is intended that Subrule 5) b) or 6) b) be applied when the ~~allowable~~ ampacity of conductors is obtained from tables such as Table 1, 3, 12E, D8A, D8B, D9A, D9B, D17A, D17B, D17C, D17D, D17I, D17J, or D17M in accordance with Section 4.	SN4628-8
Add Appendix B Note for Rule 8-106 11) to read: **Rule 8-106 11)** It is intended that if the electric vehicle energy management system meets all applicable conditions listed in this Rule, the demand load for the electric vehicle supply equipment controlled by the electric vehicle energy management system in accordance with Rule 8-500, is not required to be considered in the determination of the calculated load.	SN4734-R
Revise Appendix B Note for Rule 10-004, definition for System bonding jumper, to read: **System bonding jumper** This term describes the connection between the point of an electrical system to be solidly grounded and the non-current-carrying conductive parts of the electrical equipment supplied by that system to establish a complete circuit for ground fault currents. The system bonding jumper establishes a solidly grounded system and extends the bonding conductor to the grounded point of the system. See Figure B10-3 showing the point of an electrical system to be solidly grounded.	SN4320
Add legend for Appendix B Figures B10-4 through B10-13	SN4321

The symbols in the legend below apply to Figures B10-4 to B10-13

LEGEND

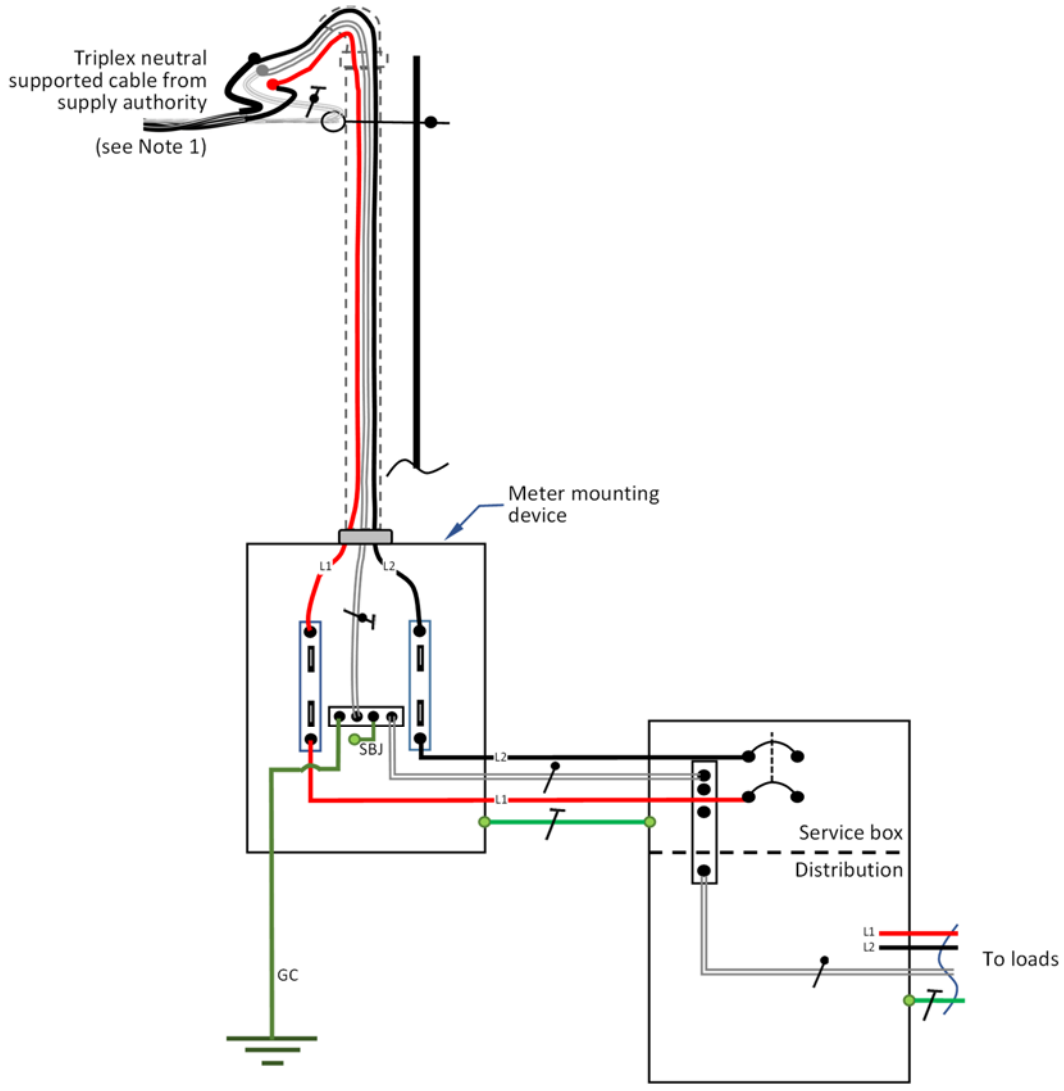
- Bonding conductor
- Termination point to conductive enclosure
- Combined bonding & neutral conductor
- Neutral conductor
SBJ- System bonding jumper *
- Neutral bus
GC- Grounding conductor
- Grounding Electrode

** The system bonding jumper may be field-installed or factory-installed*

SN4321

Delete Appendix B Figure B10-4 and replace with the Figure below:

Figure B10-4
Consumer's service grounded at the meter mounting device



Notes:

1) When the bare neutral of the triplex neutral supported cable is used as a neutral conductor, it is attached to an insulator at the point of support and terminations. It should not be in contact with any grounded surface [see Rule 12-318 e)].

~~2) The neutral bus in the meter mounting device may be isolated from, or solidly connected to, the enclosure, as follows:~~

~~a) when it is isolated from the meter enclosure, either a factory-installed or a field-installed system bonding jumper is acceptable; or~~

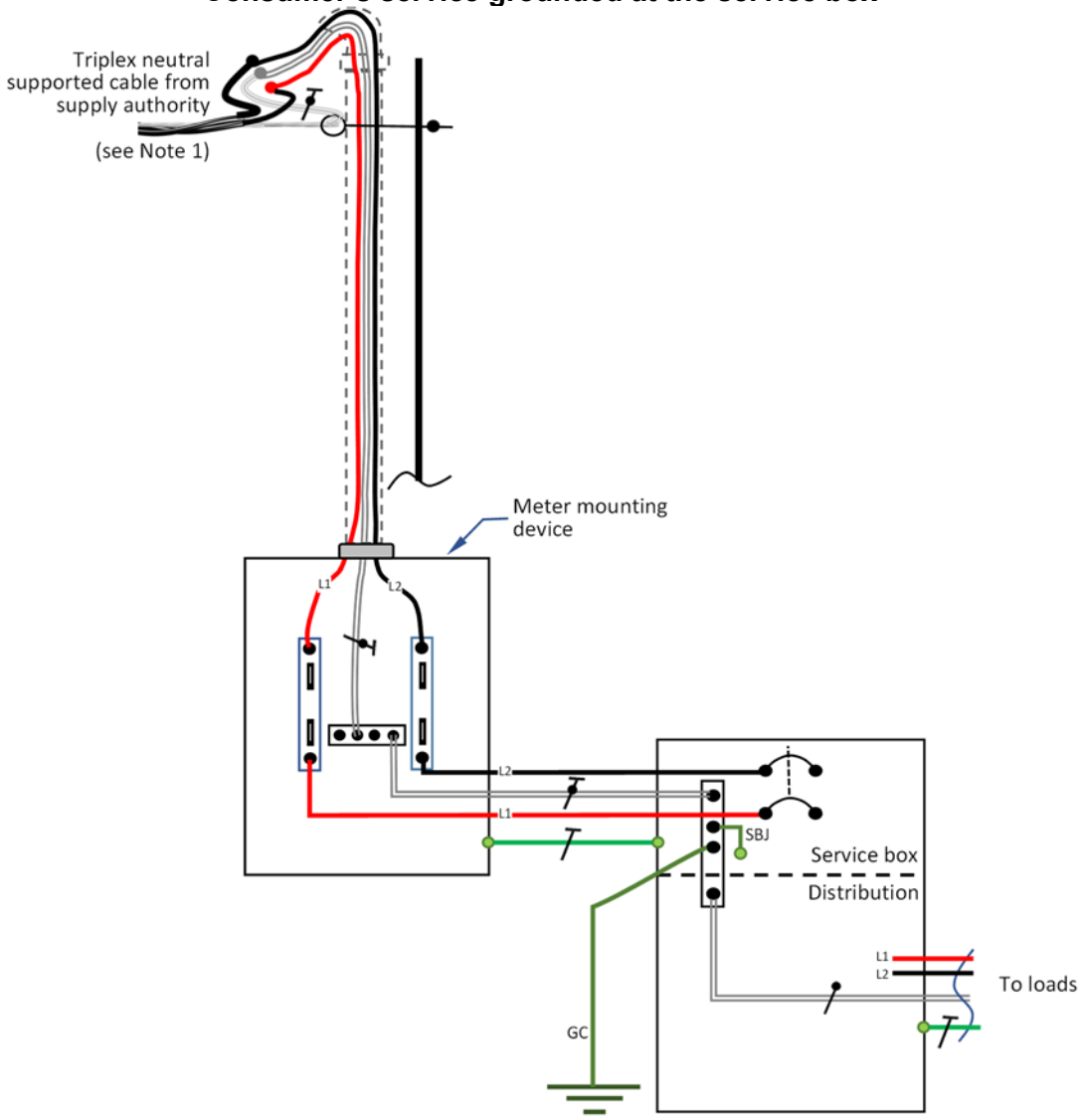
~~b) when it is solidly connected to the meter enclosure, the manufacturer's instructions should be consulted to determine if the solid connection to the meter enclosure is suitable as the system bonding jumper or if a field-installed system bonding jumper is required.~~

~~3) The system bonding jumper may be field-installed (a conductor) or factory-installed (a screw or strap).~~

SN4321

Delete Appendix B Figure B10-5 and replace with the Figure below:

Figure B10-5
Consumer's service grounded at the service box



Notes:

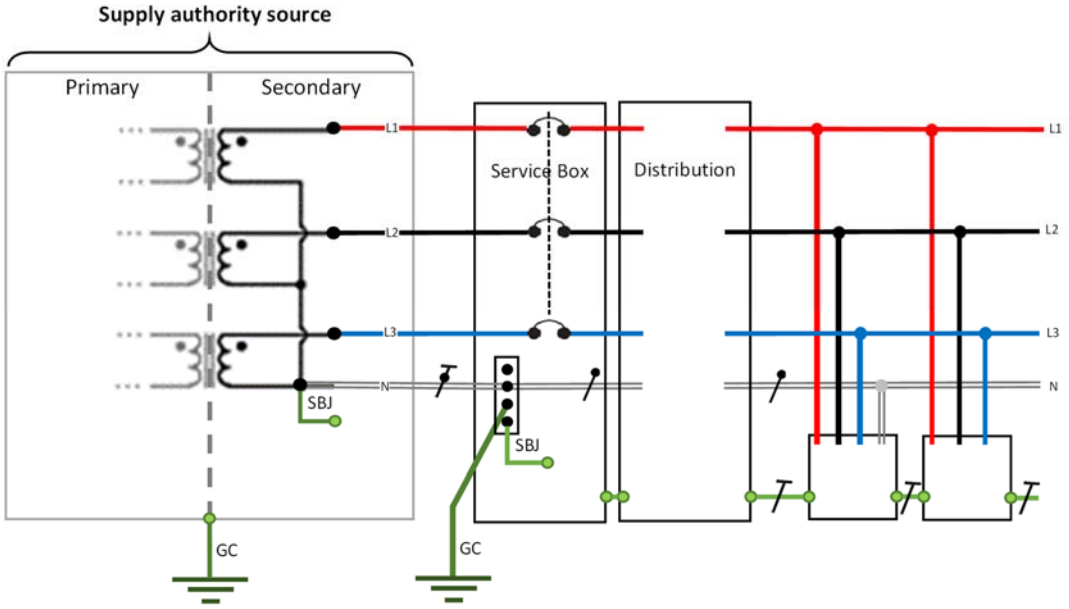
1) When the bare neutral of the triplex neutral supported cable is used as a neutral conductor, it is attached to an insulator at the point of support and terminations. It should not be in contact with any grounded surface [see Rule 12-318 e)].

~~2) The system bonding jumper may be field-installed (a conductor) or factory-installed (a screw or strap).~~

Delete Appendix B Figure B10-6 and replace with the Figure below:

SN4321

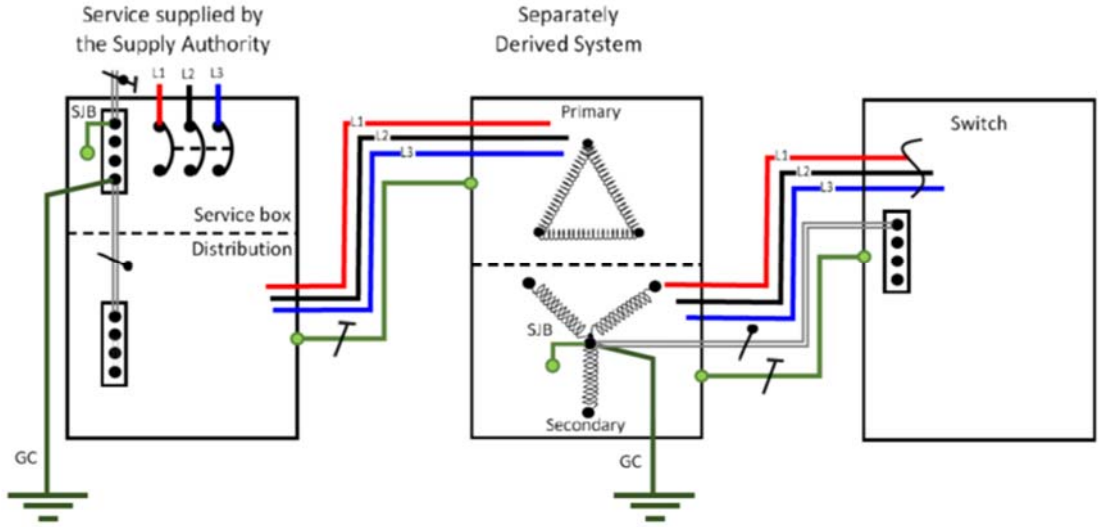
Figure B10-6
Three-phase, 4-wire solidly grounded system, without a bonding conductor, supplied from the supply authority



Delete Appendix B Figure B10-7 and replace with the Figure below:

SN4321

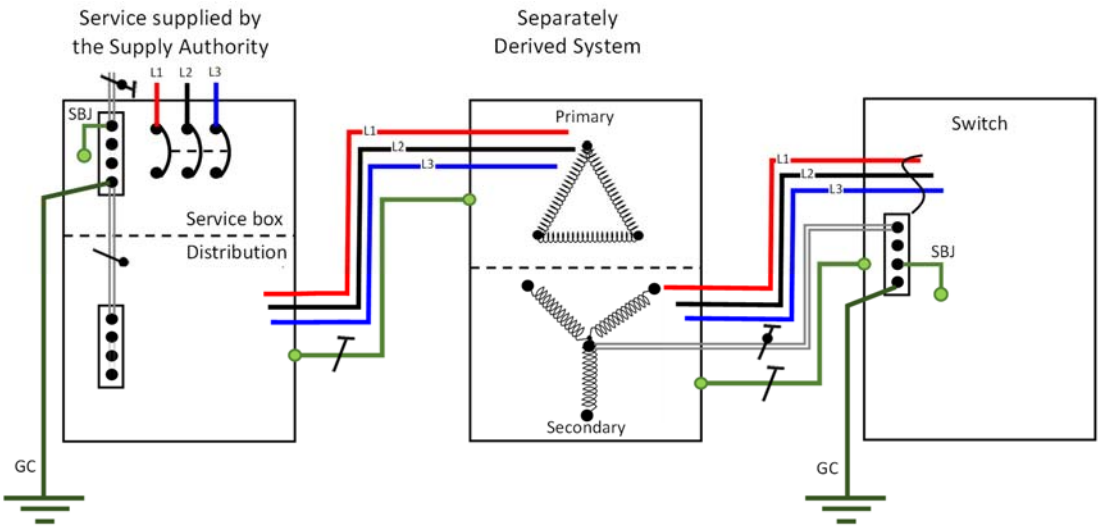
Figure B10-7
Separately derived system grounded at the source



Delete Appendix B Figure B10-8 and replace with the Figure below:

SN4321

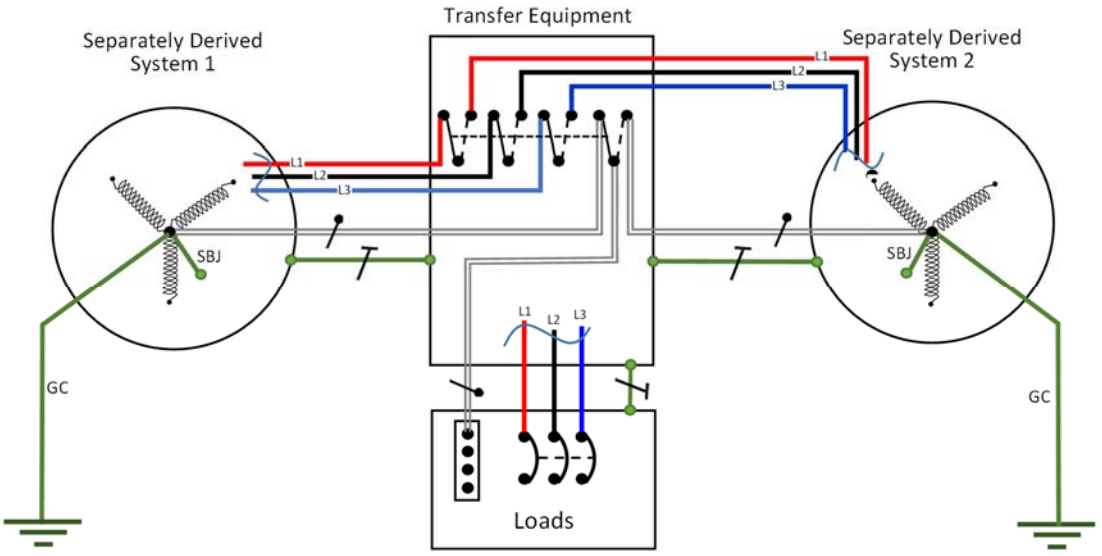
Figure B10-8
Separately derived system grounded at the first switch



Delete Appendix B Figure B10-9 and replace with the Figure below:

SN4321

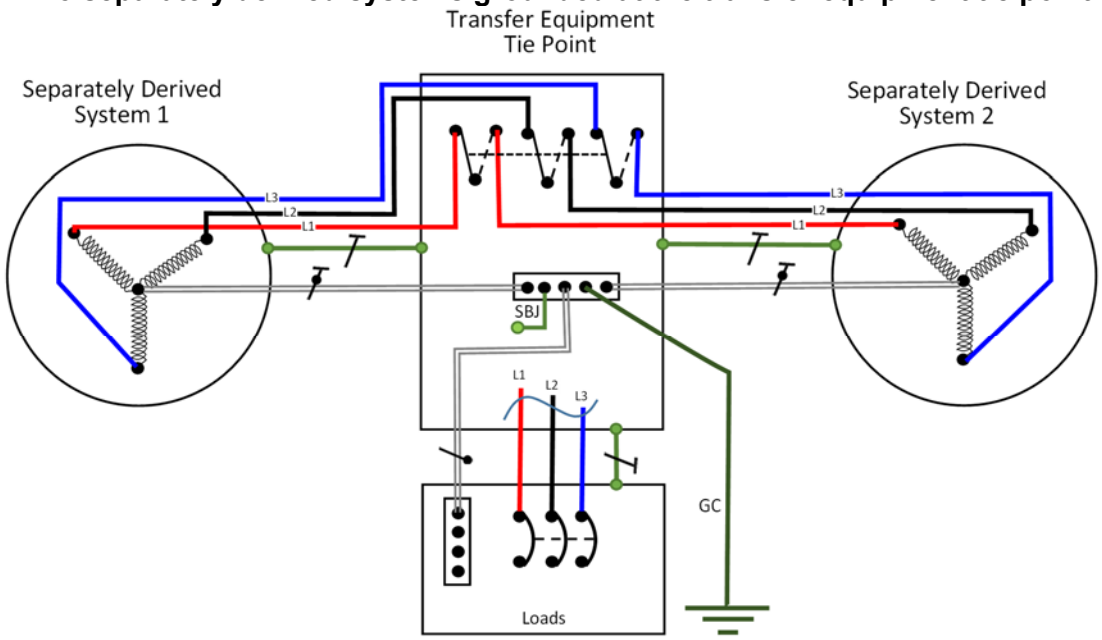
Figure B10-9
Two separately derived systems grounded at each source



Delete Appendix B Figure B10-10 and replace with the Figure below:

SN4321

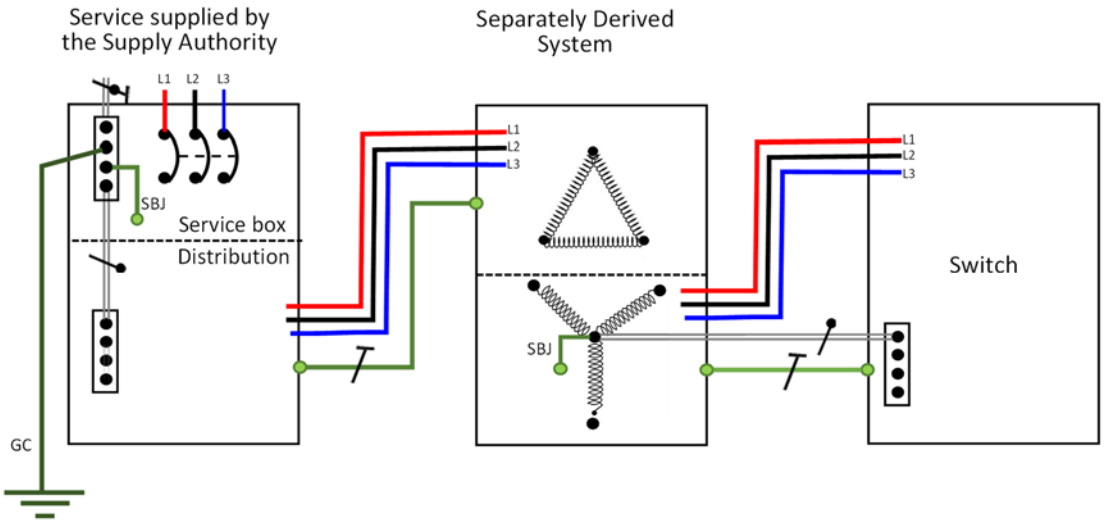
Figure B10-10
Two separately derived systems grounded at the transfer equipment tie point



Delete Appendix B Figure B10-11 and replace with the Figure below:

SN4321

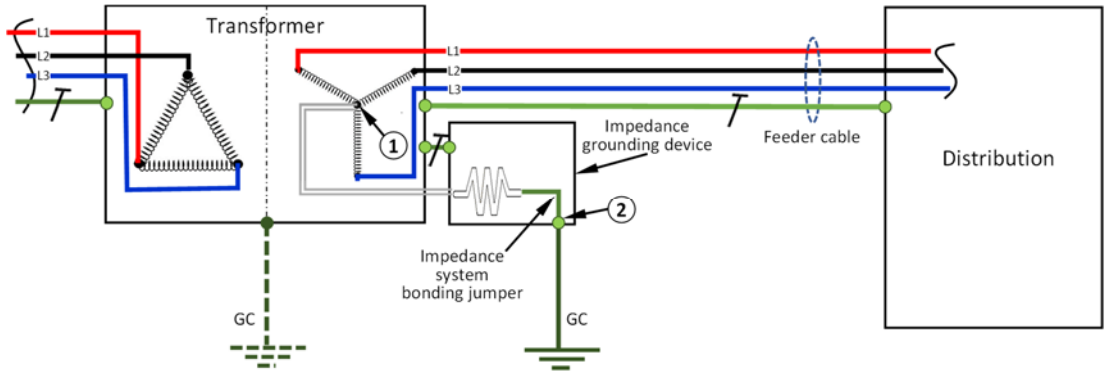
Figure B10-11
Grounding alternative for a separately derived system operating at 750 V or less



Delete Appendix B Figure B10-12 and replace with the Figure below:

SN4321

Figure B10-12
Impedance grounded system



~~Legend:~~ **Notes**

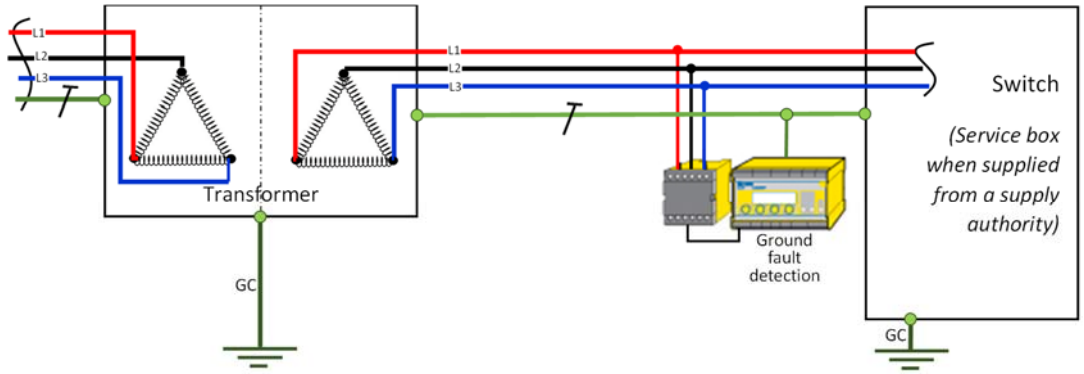
1) ① ② points between which continuity of the impedance grounding circuit is monitored [Rule 10-302 2) ~~c)~~]

2) - - - - - transformer equipment grounded where required (e.g., where high voltage is involved)

Delete Appendix B Figure B10-13 and replace with the Figure below:

SN4321

Figure B10-13
Ungrounded system



Add new Appendix B Note for Rule 10-612 3) to read:

SN4655

Rule 10-612 3)

NEMA WD-AG 1-2019 CAN, titled “Application Guide for Isolated Ground Wiring Devices, Canadian Version” describes the intent and purpose of isolated ground circuits and the proper installation steps of isolated ground receptacles.

The isolated bonding conductor referred to in this Rule is intended to be connected to the isolated ground terminal of these devices.

Revise Appendix B Note for Rule 10-614 3)b) to read: **Rule 10-616 3) b)** When the size of a circuit conductor is increased to compensate for voltage drop due to circuit length, the ampacity of that conductor exceeds that required for the connected load and the rating of the overcurrent protective device. The bonding conductor needs to be increased proportionately to minimize the impedance of the bonding path and facilitate the operation of the overcurrent device. The size of the bonding conductor is based on the circuit ~~conductor allowable~~ ampacity given in Column 2 of Table 16 to compensate for conductor length.	**SN4628-10**
Revise Appendix B Note for Rule 10-700 to read: **Rule 10-700** This Rule applies to equipotential bonding of the conductive surfaces of non-electrical equipment, devices, and structures where the control of voltage rise is required or desired. The equipotential bonding of these conductive pipes and systems is provided to prevent them from carrying a voltage different from the electrical system in order to control potential differences that may cause unwanted circulating currents, galvanic corrosion, or tingle voltages. Continuous water and waste water systems can, under certain circumstances, carry impressed currents from lightning strikes or faults in neighbouring buildings where conductive piping may interconnect the electrical systems of other structures that share the same water supply. Waste water systems constructed of cast iron and rubber couplings are not considered continuous. Metallic waste water systems that used solder joints are considered continuous. The installer should verify that the system is metallic and continuous. In relation to 10-700 c), to provide equipotential bonding to a metal gas piping system, CSA B149.1-2020 Natural Gas and Propane Installation Code defines “gas piping system” as “all components that convey gas or liquids, such as piping, tubing, valves, hoses, and fittings from the point of delivery to the inlet of an appliance.” CSA B149.1 also requires that all metallic gas piping systems are to be made electrically continuous. It should be noted that exterior gas piping systems may be required to be isolated from interior gas piping to prevent the introduction of current as well as to preserve any cathodic protection of the gas piping system. In general, this is accomplished using dielectric fittings at the demarcation between the interior and exterior gas piping system. Any conditions limiting the equipotential bonding of the exterior gas system should be verified with the local gas inspection authority. ~~It should also be noted that the requirement in Rule 10-700 c) to provide equipotential bonding to a metal gas piping system is not intended to apply to metal gas tubing. Attempts to bond metal gas tubing with conventional bonding means can create a hazardous situation where the tubing can be punctured by installation of the bonding means or by arcing between improperly secured bonding means during faults or lightning strikes.~~ When bonding a corrugated stainless steel tubing (CSST) component of a gas piping system, refer to the manufacturer’s instructions. Livestock are particularly sensitive to the effects of step and touch voltages. For this reason, equipotential bonding is prescribed for all conductive metal parts (e.g., metal	**SN4605**

water pipes, stanchions, water bowls or troughs, vacuum lines, and other metal objects that could become energized) accessible by livestock in a building housing livestock. Methods to establish equipotentiality at buildings housing livestock are described in ASABE EP473.2-2001. Low grounding electrode system resistances may reduce potential differences in livestock facilities. Conductive materials used for equipotential bonding need not be wires and can take the form of structural steel, bus, metallic framing and support structures, conductive static mats, or the support structure of a computer room floor. Each of these materials, when adequately interconnected, form an effective equipotential plane. The user should be aware of the effects of galvanic corrosion where dissimilar metals are joined together and ensure that the materials used are compatible or appropriately protected from corrosion at joints and connections.	
Add New Appendix B Note for Rule 10-702 3) to read: **Rule 10-702 3)** An example of an application of this Rule is when gas piping is solidly connected to a fuel burning appliance. The appliance is supplied by a circuit incorporating a bonding conductor and the gas piping is made equipotential by its electrically conductive connection to the electrical equipment.	SN4514
Revise Appendix B Note for Rule 12-012 to read: **Rule 12-012** Wooden planks, when buried in the ground, should be treated with a solution of pentachlorophenol or other suitable material as recommended by a manufacturer of wood preservatives. The use of creosote as a wood preservative in such installations is not recommended because it is known to damage rubber and thermoplastic insulations and acts as a catalyst in the corrosion of lead. In accordance with Table 19, where additional markings on cables, liquid-tight flexible metal and non-metallic conduit are required for direct earth burial, acceptable markings include “DIRECT BURIAL”, “DIR BUR”, “DIRECT BURIAL ONLY” and “DIR BUR ONLY”.	SN4456
Add new Appendix B Note for Subrule 12-012 2) to read: **Rule 12-012 2)** Where the minimum cover requirements of Table 53 for direct buried cables or raceways exceeds the depth specified in Diagrams D8 to D11 referred to in Rule 4-004 1) d) or 2) d), then Rules 4-004 1) e) and 2) e) direct Code users to calculate ampacity using the IEEE 835 calculation method. Where the minimum cover requirements of Table 53 for direct buried cables or raceways exceeds the depth specified in Diagrams D17A to D17L referred to in Rule 4-004 1) g) or 2) g), then the Code directs users to calculate ampacity using the IEEE 835 calculation method.	SN4776

Revise Appendix B Note for Rules 12-100, 12-102 4), 5), and 6), 12-122, 12-402, and 12-406 **Rules 12-100, 12-102 4), 5), and 6), 12-122, 12-402, and 12-406** When a conductor, cable, flexible cord, equipment wire, or portable power cable is being selected, it is important that it be designed for the specific application and conditions of intended use. Rule 2-024 requires conductors, cables, flexible cords, equipment wire, or portable power cables to be approved and installed for use within the design parameters for which they were manufactured and certified. Consult Table 11A or 19 as applicable and the cable manufacturer to ensure that the proper conductor, cable, flexible cord, equipment wire, or portable power cable is selected for the specific application. Limitations on the use of certain product types may be specified in other Rules of this Code. Extra Low Voltage cable types are in CSA C22.2 No. 35, and include the following: Low-energy control cables; Type LVT extra-low-voltage control circuit cables; Type ELC extra-low-voltage control cables; Type GCS golf course; Type LSS lawn sprinkler; Type LVLL low-voltage landscape lighting; and Type ULEC underground low-energy circuit cables.	SN4627 SN4826
Revise Appendix B Note for Rule 12-102 3) to read: **Rule 12-102 3)** Insulated conductors and cables could be marked with multiple CSA Type designations, therefore, when selecting insulated conductors and cables using Table 19 it is important that they are marked with the designations indicating suitability for the particular application and conditions of use. For example: TC/DLO TC-ER/DLO R90/DLO T90 Nylon/TWN75 The examples above are not an exhaustive list of all possibilities and are provided for illustrative purposes only. Note that insulated conductors and cables may be marked with product types and other markings not recognized in this Code. Acceptable insulated conductor and cable markings are associated with the applicable recognized approval prescribed by Rule 2-024. The “Maximum conductor temperature (unless otherwise marked)” row in Table 19 is the maximum operating temperature of the insulated conductor or cable permitted by the manufacturer. The operating temperature of an insulated conductor or cable can be affected by the current of the circuit, the ambient temperature, the proximity of the	SN4702

conductor to other conductors, where the conductor is installed, and how the conductor is installed.

Add Appendix B Note for Rule 12-112 13) to read:

SN4644

Rule 12-112 13)

Grade level in-ground enclosures may be square, rectangular or cylindrical in shape. The intent of this subrule is that these enclosures be used within the manufacturer's specified load design classes as indicated in Table B12-X. Applications listed are for guidance only and may include other applications not indicated, at the discretion of authority having jurisdiction.

Table B12-X

Class (tier)	Typical Application	Design Load - Vertical	
		kN	Lbf
2	Light duty (i.e. pedestrian traffic)	8.9	2000
5	Light duty with a safety factor for occasional, non-deliberate vehicular traffic	22.2	5000
8	Medium duty with a safety factor for non-deliberate vehicular traffic	35.6	8000
15	Medium duty, driveway, parking lot, and off-roadway applications subject to occasional non-deliberate vehicular traffic	66.7	15000
22	Heavy duty, driveway, parking lot, and off-roadway applications subject to non-deliberate heavy vehicular traffic	100.1	22500

Add Appendix B Note for Rule 12-116 5) to read:

SN4665
SN4821

Rules 12-116 5) and 12-406 4)

Ferrules described in these subrules are certified to CSA Standards C22.2 No. 291 and C22.2 No. 342.

Examples of fine strand conductors are Class G, H, M, I, K, and DLO.

Table B12-Y from C22.2 No 65
Stranding for North American class copper conductors

Class	Class AA	Class A	Class B	Class C	Class D	Class G	Class H	Class I	Class K	Class M	DLO Cable	
Application	Power cables					Cords and cables						
	Utility grade wire (Bare conductors)		Building wire		Extra flexible stranding	Portable use	Extreme flexible stranding	Motor leads (24 AWG strands)	(30 AWG strands)	(34 AWG strands)	Diesel electric locomotives, telecom power, oil and gas drilling, mining, etc. (24 AWG strands)	
				More flexible than Class B								
Lay type	Concentric strand					Rope lay concentric strand		Rope lay bunch strand			Locomotive/mining	
Wire gauge, AWG / kcmil	Number of strands										Wire gauge, AWG / kcmil	Number of strands
24-30			Number of strands vary	:					:	:		
24												
22					:	:		:			:	:
20							:		10	26		
18	:	:							16	41		
16									26	65		
14									41	104	14	19
12			7	19					65	168	12	19
10								26	105	259	10	27
8					37	49		41	168	420	8	37
6							133	63	266	665	6	61
4								105	420	1,064	4	105
3	3							133	532	1,323	3	125
2		7						161	625	1,666	2	147
1								210	836	2,090	1	210
1/0			19	37	61	133	259	266	990	2,646	1/0	266
2/0	7							342	1,248	3,325	2/0	323
3/0								418	1,666	4,180	3/0	418
4/0								532	2,055	5,320	222.2	550
250								637	2,499	6,384	262.6	650
300	12	19	37	61	91	259	427	735	2,989	7,581	-	-
350								882	3,450	8,806	313.3	775
400								980	3,990	10,101	373.7	925
500	19							1,225	5,054	12,691	444	1,100
600		37						1,470	5,985	14,945	535.3	1,325
650								1,596	6,517	16,226	646	1,600
700	37		61	91	127	427		1,729	6,916	17,507	-	-
750		61						1,862	7,581	18,788	777	1,925
800								1,995	7,980	20,069	-	-
1000							703	2,527	10,101	25,193	1111	-
1100								2,793				
1200								2,926				
1250			91	127				3,059				
1300								3,192				
1400								3,458				
1500								3,724				
1600								3,990	:	:		
1700								4,256				
1750			127	169			1,159	4,389				
1800								4,522				
1900								4,788				
2000								4,921				

Add Appendix B Note for Rule 12-304 d) to read:

SN4763

Rule 12-304 d)

Examples of mechanical damage that exposed wiring on the exterior of buildings and between building may be subjected to are damage from awnings, swinging signs, shutters, or other movable objects.	
Add Appendix B Note for Rule 12-402 1) to read: **Rule 12-402 1)** The CSA type designation of certain flexible cords may be followed by a "-B" suffix indicating that a decorative braid has been applied over the cord.	SN4656
Add Appendix B Note for Rule 12-406 4) to read: **Rule 12-406 4)** See note to Rule 12-116 5)	SN4665
Add Appendix B Note for Rule 12-500 to read: **Rule 12-500** Many cable types can be described as non-metallic-jacketed cables, in addition to NMD90 and NMWU. Examples of additional non-metallic-jacketed cables include but are not limited to: TC, TC-ER FAS CIC LVT CM, CMP, CMR, CMG, CMX, CMH, CMUC, CMP-LP, CMR-LP, CMG-LP, CM-LP, CMX-LP, CMUC-LP, CMH-LP Although the cables and flexible cords listed in Table 11A do have a non-metallic outer jacketing, they are not considered non-metallic-jacketed cables for the purposes of these rules.	SN4831
Add Appendix B Note for Rule 12-504 to read: **Rule 12-504** Cables must be suitable for the conditions of use, as listed in Table 19. It should be noted that certain cables types such as but not limited to RWU90, TWU75, and TWU may be suitable for use in raceways or direct burial, but would not be considered as suitable for exposed or concealed locations.	SN4831
Revise Appendix B Note for Rule 12-514 to read: **Rules 12-514**, 12-564 A running board is considered a piece of wood installed so that a cable can be secured to the side of the wood to prevent someone from standing on or kneeling on the cable as shown in Figure B12-3.	SN4831

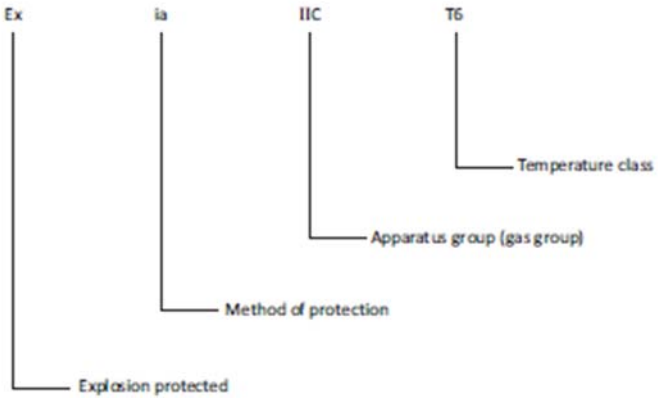
Revise Appendix B Note for Rule 12-516 to read: **Rules 12-516**, 12-566 CSA C22.2 No. 18.3 provides requirements for inserts. CSA C22.2 No. 18.4 provides requirements for protector plates and cylindrical bushings.	SN4831
Revise Appendix B Note for Rule 12-500 to read: **Rule 12-550 ~~500~~** ~~Non-metallic sheath c~~Cable~~s~~ Types NMD90 or NMWU are manufactured with a non-metallic sheath, tested, and marked in accordance with CSA C22.2 No. 48. CSA C22.2 No. 48 refers to the jacket of a NMD90 and NMWU as a sheath within the standard. NMD90, NMW, and NMWU were previously marked NMD-7, NMW-9, and NMW-10, respectively. NMW is no longer available. An acceptable alternative is NMD90 for dry or damp locations, or NMWU for dry, damp, or wet locations.	SN4831
Revise Appendix B Note for Rules 12-510 4), 12-3000 8), and 12-3010 7) to read: **Rules 12-560 ~~510~~ 4), 12-3000 8), and 12-3010 7)** Rules 12-560 ~~510~~ 4), 12-3000 8), and 12-3010 7) are intended to permit the use of a self-contained device in lieu of a device box. A self-contained device is a wiring device with an integral enclosure having brackets that securely fasten the device to walls or ceilings of conventional frame construction, for use with ~~non-metallic-sheathed~~ cable Types NMD90 or NMWU. Self-contained devices used in dry locations are certified to CSA C22.2 No. 111 for switches and CSA C22.2 No. 42 for receptacles and are primarily used in mobile homes, recreational vehicles, manufactured buildings, and on-site frame construction.	SN4831
Add Appendix B Note for Rule 12-608 2) to read: **Rule 12-608 2)** When installing armoured cables between non-metallic enclosures, bonding continuity of the armour is often maintained through the use of bonding bushings. The purpose of this rule is to allow installers to omit the bonding bushing at the final point of termination, if an electrical connection between the armour and the bonding system has been established at the supply end of the cable, maintained throughout the remainder of the run, and the equipment is bonded using the internal bonding conductor of the cable.	SN4782
Revise Appendix B Note for Rule 12-910 to read: **Rule 12-910** The maximum permitted number of insulated conductors and cables in a raceway is based on the actual measured dimensions of the raceways and the insulated conductors and cables. Where calculations of the maximum number of permitted insulated conductors and cables in a given raceway are based on supplied dimensions or product Standards, they should be validated by measuring the products concerned before installation.	SN4783

The Standards for the raceways detailed in Tables 9A to 9H are as follows: • CSA C22.2 No. 45.1 — Rigid metal conduit • CSA C22.2 No. 56 — Flexible metal conduit • CSA C22.2 No. 211.2 — Rigid PVC conduit • CSA C22.2 No. 211.1 — Rigid Type EB1 PVC conduit • CSA C22.2 No. 211.1 — Rigid Type DB2/ES2 PVC conduit • CSA C22.2 No. 211.3 (withdrawn) — Rigid RTRC conduit marked IPS • CSA C22.2 No. 211.3 (withdrawn) — Rigid RTRC conduit marked ID • CSA C22.2 No. 56 — Liquid-tight flexible metal conduit • CSA C22.2 No. 227.2.1 — Liquid-tight flexible non-metallic conduit • CSA C22.2 No. 83 and CSA C22.2 No. 83.1 — Electrical metallic tubing • CSA C22.2 No. 227.1 — Electrical non-metallic tubing • CSA C22.2 No. 327 — HDPE conduit Schedule 40 • CSA C22.2 No. 327 — HDPE conduit Schedule 80 • CSA C22.2 No. 327 — HDPE DR9 conduit • CSA C22.2 No. 327 — HDPE DR11 conduit • CSA C22.2 No. 327 — HDPE DR13.5 conduit • CSA C22.2 No. 327 — HDPE DR15.5 conduit ~~Calculating the maximum permissible number of conductors of the same size in a given raceway provides an alternative basis for determining the maximum number of permitted conductors, provided that the dimensions of such raceways and conductors are derived from Tables 9A to 9H, 10A, and 10B. The maximum numbers of single conductors of one size permitted in a conduit or raceway as determined from Tables 6A to 6K are based on these tables, with no allowance for bare bonding or grounding conductors.~~ ~~Subrule 6) does not permit Tables 6A to 6K to be used to determine the number of insulated conductors of the same size in one HDPE conduit because for each available trade size, HDPE conduit has the smallest internal diameter.~~ Dimensions of bare bonding or grounding conductors, such as bonding conductors that are required for some raceway installations under applicable Code Rules, may be obtained from Table D5. They should be verified by measurement before installation.	
Add Appendix B Note for Rule 12-930 1)b) and c) to read: **Rule 12-930 1) b) and c)** The intent of Items b) and c) is to ensure the integrity of the installation is maintained where raceways are installed in concrete slabs or masonry construction that are in direct contact with the earth. It is not intended that these items apply to raceways installed in concrete and masonry construction that is above grade and not in contact with the earth.	SN4274
Revise Appendix B Note for Rule 12-2252 to read: **Rule 12-2252** CSA C22.2 No. 273 defines Class A and Class B cablebus as follows:	SN4682

Class A cablebus — cablebus that provides protection from contact with [insulated] conductors [or cables] by design and construction of the enclosure. **Class B cablebus** — cablebus that ~~does not~~ provides limited protection from contact with [insulated] conductors [or cables] by design and construction of the enclosure. Cablebus not marked as Class A is considered to be Class B. Cablebus can be made inaccessible to the public by use of barrier (such as fencing) around the area of the cablebus, or by elevation from the ground.	
Add Appendix B note for Rule 12-3030 3) to read: **Rule 12-3030 3)** This Subrule is not intended to be used, when conductors required for the operation of life safety systems are installed between an emergency power supply and life safety systems in conformance with Rule 46-108 4).	SN4761
Revise Appendix B Note for Rule 14-104 to read: **Rule 14-104** When conductors are selected based on a calculated load or a known load, Table 13 is useful in selecting the appropriate rating of overcurrent device based on the installed ampacity of the conductor for the installation. Code users are reminded that the circuit loading requirements of Rule 8-104 apply. It is intended that the ~~conductor~~ ampacity values used in Table 13 can refer to single or multiple conductors. Table 13 is also useful in determining standard overcurrent ratings for Rules such as 14-212 b) or 26-254 3).	SN4628-14
Add an Appendix B Note for Rule 16-330 3)a) to read: **Rule 16-330 3)a)** Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-TSB-184-A and 6.6.8, 6.8.3, and Annex I of ANSI/TIA-568.2-D, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.	SN4593
In Appendix B Note for Rule 18-002, revise entry for Single or dual process seal equipment to read: **Rule 18-002** **Single or dual process seal equipment —** an electrical device can be marked with either designation to indicate that it incorporates into its construction and certification, primary or primary and secondary process seals that will prevent the migration of flammable fluids into the wiring system, as specified in UL 122701 or ~~IEC TS~~ CSA C22.2 No. 60079-40.	SN4749

In Appendix B Note for Rule 18-002, add new entries to read: **Rule 18-002** **Dust-protected enclosure** - Enclosures that would meet or exceed this definition are Types 3, 3X, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, or 13, and those with degrees of protection IP5X or IP6X. Unused entries and openings would be closed off so that dust cannot enter through them. **Uninterrupted (as applied to conduit systems**) – the only devices allowed in an uninterrupted conduit run are NPT conduit couplings. Other devices, such as boxes, unions, tees, NPS couplings, and other fittings would not be acceptable, so as to provide a higher level of conduit system integrity. Conduit that includes straight runs or formed bends are all considered conduit.	SN4749 SN4787 SN4806 SN4823
Revise Appendix B Note for Rule 18-004 2) to read: **Rule 18-004 2)** If a hazard assessment determines that an area is a hazardous location, an area classification is performed. Due to the nature of hazardous locations and the risk of fire and explosions associated with them, involvement by various individuals who understand the relevance and significance of the properties of the hazardous locations identified in Subrule 1), are knowledgeable in the appropriate classification Standards/guidelines, and who are familiar with the process and equipment, is essential to ensure that appropriate measures are taken to mitigate the hazard. For a small or simple facility, this may involve a single discipline, whereas for a large or complex facility, it may involve more than one discipline, such as electrical, mechanical, process, safety, and operations specialists. Documentation is an essential element in area classifications and may include items such as drawings, studies and calculations, reports, and operating descriptions. In addition to the classification of hazardous locations into Zones, it is important that the Group designation and minimum ignition temperature of the flammable or combustible materials handled, be included in the documentation. The minimum ignition temperature should be stated in degrees Celsius. Temperature Codes have often been used in hazardous area classification documentation, however this is not accurate as temperature codes are intended to indicate the maximum surface temperature of electrical equipment. Flammable materials are listed with auto-ignition temperatures (AIT), not temperature codes (T-codes), and the hazardous area classification documentation should list the minimum ignition temperatures rather than T-codes. This documentation should be maintained and updated over the life of the facility. Appendix L contains more details on area classification guidelines.	SN4785
Renumber Appendix B Note for Rule 18-004 3) to read: **Rule 18-004 4)~~3)~~** Hazardous location classification documentation is authenticated by the person taking responsibility for the classification. The person taking responsibility is normally an engineering professional or other individual permitted to practise engineering.	SN4785

Revise Appendix B Note for Rule 18-010 to read: **Rule 18-010** Maintaining electrical installation safety in hazardous locations is dependent on a regimen of regular maintenance that will ensure that the electrical installation continues to provide safety throughout its life. Maintenance personnel are cautioned that modifications to original equipment or substitution of original components may void certification. In addition to the manufacturer's instructions, the following documents may be used to guide owners and operators of hazardous locations in developing appropriate maintenance procedures: a) IEC 60079-17, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance;* b) IEC 60300 series of Standards, *Dependability management;* c) IEEE 902, *IEEE Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems; and* d) NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance.* Most certifications of hazardous location luminaires exclude the use of self-contained (LED, CFL) replacement lamps. The maintenance, repair, or alteration of hazardous location luminaires is intended to be done in a manner that a) does not invalidate the original approval, b) is in accordance with the original manufacturer's instructions, and c) the lamps used are in accordance with those listed on the nameplate. It is not the intent of this Rule to prohibit the use of complete assemblies that have been approved to replace the main body of an existing luminaire which may utilize an existing mounting component. Unused openings of enclosures installed in hazardous locations are suitably closed to maintain the degree of protection and explosion protection intended to be provided by such enclosures.	SN4735 SN4823
Revise third paragraph of Appendix B note for Rules 18-090, 18-100 and 18-150 to read: **Rules 18-090, 18-100, and 18-150** " " In some cases, equipment may be installed on the boundary of Zone 0 and Zone 1 (as provided for by Rule 18-052) and may have two types of protection, with the appropriate type of protection for each side of the boundary identified and connected by a "/". For example, an intrinsic safety device installed on the wall of a flammable liquid storage tank (Zone 0 inside) having a flameproof "d" or flameproof "db" termination compartment on the tank exterior (Zone 1) would be marked Ex ia/db IIB T4 Ga/Gb. Equipment with a "/" marking accompanied by instructions for the user, specifying features and limitations of the separation element between the Ga and Gb equipment sections.	SN4687

“ “	
Revise Appendix B Note for Rules 18-054 and 18-150 to read: **Rules 18-054, and 18-150** Equipment of the heat-producing type is currently required by product Standards to have a temperature code (T-Code) or maximum temperature marking if its temperature exceeds 100 °C. However, for equipment manufactured prior to the T-Code requirement (prior to 1972) and electrical equipment such as motors and generators applied in accordance with Rule 18-150, there may be no such marking. Therefore, the suitability of older hazardous locations equipment of the heat-producing type and motors and generators applied in accordance with Rule 18-150 should be reviewed in the context of Rule 18-054 before such equipment is installed in a hazardous location. For the purpose of Rule 18-150, equipment such as boxes, terminals, fittings, and resistance temperature detectors (RTDs) are not considered to be heat-producing devices.	SN4791
Revise Appendix B Note for Rule 18-052 to read: **Rule 18-052** A typical example of equipment marking is as follows:  The users of this Code are reminded that, in all cases, the identifying mark of an accredited certification organization is required as well as the marking requirements of this Section. Equipment marked for Class I but not marked with a Division is suitable for both Zones 1 and 2. Hazardous location electrical equipment may be marked with a Degree of Protection (IP Code) [see note to Rule 18-102 5) and Table B18-6], a Type rating, or both. However, neither of the foregoing markings is mandatory for hazardous locations equipment. A major difference between Type ratings and IP ratings, is that Type ratings may indicate suitability for a number of other mechanical and environmental factors in addition to solids and water ingress, such as impact, flame, and corrosion resistance. Type ratings are determined in accordance with standards CAN/CSA C22.2 No. 94.1 and 94.2.	SN4530

Revise Appendix B Note for Rule 18-072 to read:

SN4740
SN4749

Rule 18-072
See ~~Figures B18-2 and B18-3~~ Table B18-6A and B18-6B for ~~a flow chart~~ detail~~s~~ing where explosion, flammable fluid migration, ~~or~~ and process seals should be selected for installations using cables and conduits.

UL 122701 and ~~IEC TS~~ CSA C22.2 No. 60079-40 provide construction, performance, and marking requirements for process seals incorporated into process-connected electrical equipment. Equipment containing a primary or a primary and secondary process seal that complies with these Standards is eligible to include either the “Single Seal” or “Dual Seal” designation in the nameplate markings. These markings indicate that the electrical equipment is designed to prevent the migration of flammable fluid through the equipment into the wiring system when the equipment is operated at or lower than its rated pressure. Devices certified as conforming to UL 122701 or ~~IEC TS~~ CSA C22.2 No. 60079-40 and marked either “Single Seal” or “Dual Seal” meet the intent of Subrule 1) a). See Figure B18-1 for typical configurations of process seals.

Where devices containing primary process seals are not marked to indicate conformance with UL 122701 or ~~IEC TS~~ CSA C22.2 No. 60079-40, other means may be used to prevent fluid migration though the wiring system.

“

“

After the 6th paragraph:

….. in case there is a leak under pressure from sources of release within the enclosure.

Where a secondary process seal is employed, the selection of the seal should be such so as to be chemically (corrosion) resistant to the process fluid it would be exposed to if the primary process seal fails.

Downstream of the process seal, any fluids entering the wiring system will be at or near atmospheric pressure. For example, if there is a major release of natural gas into a process building, it is not possible for significant pressure to develop in the building because the walls and windows will burst at a relatively low pressure.

There is no need to seal conduit against significant pressure in Zone 1. However, the conduit itself is required to be ~~in~~ an explosion-proof enclosure; therefore, seals at the boundary of Zone 1 locations are required to be explosion-proof to maintain the explosion-proof rating of the conduit.

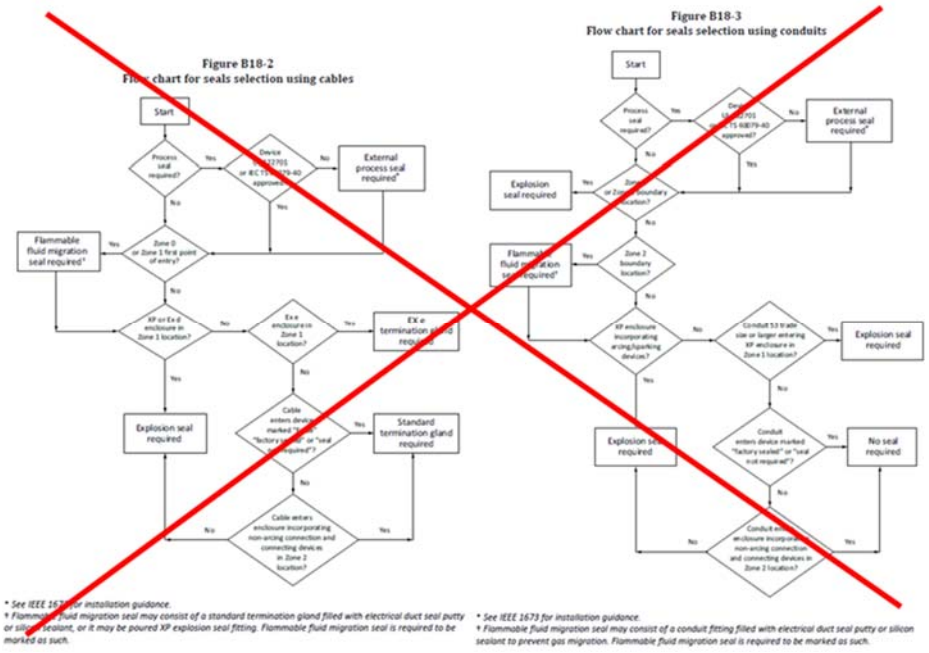
In Zone 2, conduit is not required to be explosion-proof and, therefore, the boundary seals are not required to be explosion-proof. They need only be flammable fluid migration seals, i.e., seals for fluids that are not under pressure. A flammable fluid migration seal can be made using any suitable fitting that has been filled with a material capable of sufficiently preventing the transmission of the flammable fluid at or near atmospheric pressure. The sealing material should be

selected to be compatible with the flammable fluid that can be anticipated to be exposed to the seal. Properly installed explosion seals or increased safety (Ex e) cable glands are ~~one possible~~ a means of providing a flammable fluid migration seal.

Cables with continuous sheaths will admit fluids only at the point where they terminate in hazardous areas. Therefore, except in enclosures containing equipment with fluids under pressure, the probability of flammable fluids entering cables after the process seals is low enough that only a flammable fluid migration seal is required. In many situations, filling the end of the cable connector where the conductors exit the connector (or where the conductors exit the cable when the jacket extends beyond the connector) with silicone or other suitable material will provide an effective flammable fluid migration seal in Zones 0, 1, and 2. Properly installed explosion-proof, flameproof "d", ~~or~~ flameproof "db", or increased safety "e" cable glands are also a ~~possible~~ means of providing a flammable fluid migration seal. As flammable fluid migration seals are often not visible once they are installed, they are required to be identified. This can be done with a label or tag located near the seals, identifying them as a "flammable fluid migration seal" and indicating their location if it is not readily apparent.

Delete Appendix B Figures B18-2 and B18-3:

SN4740



Add new Appendix B Table B18-6A:

SN4740

Table B18-6A

Process seal requirements*

(See Rule 18-072.)

Applies to all process systems in hazardous and non-hazardous locations that contain flammable fluids (liquid or gas) and operate above normal atmospheric pressure.	
Equipment certification and marking	Sealing requirement
• Marked “Single seal” or “Dual seal” • Certified to UL 122701 or CSA C22.2 No. 60079-40	None
• Not marked “Single seal” or “Dual seal”; or • Not certified to UL 122701 or CSA C22.2 No. 60079-40	• Stand-alone “Secondary process seal”; or • Engineered solution

**This table does not set the requirements; it only summarizes the requirements in the Rules.*

Add new Appendix B Table B18-6B:	SN4740 SN4806

Table B18-6B

Hazardous location sealing summary* — Not process connected equipment

(see Note 1)

(See Rules 18-072, 18-104, and 18-154.)

<table>
<tr><th>Equipment type</th><th>Zone 0</th><th>Zone 1</th><th>Zone 2</th></tr>
<tr><td colspan="4">Cable</td></tr>
<tr><td colspan="4">Intrinsically safe wiring systems and equipment (IS) (See Note 2)</td></tr>
<tr><td>First point of termination</td><td>FFMS</td><td>FFMS</td><td rowspan="2">No seal</td></tr>
<tr><td>Interconnection of IS equipment within same hazardous area</td><td>No seal</td><td>No seal</td></tr>
<tr><td colspan="4">Explosion-proof enclosures</td></tr>
<tr><td>Contains arcing or heat producing equipment</td><td rowspan="3">Equipment not permitted</td><td rowspan="3">XP seal</td><td>XP seal</td></tr>
<tr><td>Equipment marked “Factory sealed” or “Seals not required”</td><td rowspan="2">No seal</td></tr>
<tr><td>Contains non-ignition capable equipment (such as wiring terminals)</td></tr>
<tr><td colspan="4">Flameproof enclosures (Ex d or Ex db)</td></tr>
<tr><td>Contains arcing or heat producing equipment</td><td rowspan="2">Equipment not permitted</td><td rowspan="2">XP seal</td><td>XP seal</td></tr>
<tr><td>Contains non-ignition capable equipment (such as wiring terminals)</td><td>No seal</td></tr>
</table>

<table>
<tr><td colspan="5">Increased safety enclosures (Ex e or Ex eb)</td></tr>
<tr><td>Contains terminals and/or equipment with an acceptable type of protection (for Zone 1 or Zone 2 as appropriate, see Table 18)</td><td>Equipment not permitted</td><td>Ex e or eb gland</td><td>No seal</td></tr>
<tr><td colspan="5">Increased safety/flameproof enclosures (Ex e d or Ex eb db) (see Note 5)</td></tr>
<tr><td>Factory seal between increased safety (Ex e or eb) termination and flameproof (Ex d or db) sections</td><td>Equipment not permitted</td><td>Ex e or eb gland</td><td>No seal</td></tr>
<tr><td colspan="5">Non-hazardous enclosures (i.e., CSA Type 4, 4X, IP65, or IP66)</td></tr>
<tr><td>Containing equipment with no arcing or heat-producing devices that are acceptable for use in Zone 2 locations</td><td>Equipment not permitted</td><td>Equipment not permitted</td><td>No seal</td></tr>
<tr><td colspan="5">Conduit</td></tr>
<tr><td colspan="5">Intrinsically safe wiring systems and equipment (IS) (see Note 2)</td></tr>
<tr><td>First point of termination</td><td>FFMS</td><td>FFMS</td><td rowspan="2">No seal</td></tr>
<tr><td>Interconnection of IS equipment within same hazardous area</td><td>No seal</td><td>No seal</td></tr>
<tr><td colspan="5">Explosion-proof enclosures</td></tr>
<tr><td>Contains arcing or heat producing equipment</td><td rowspan="4">Equipment not permitted</td><td>XP seal</td><td>XP seal</td></tr>
<tr><td>Equipment marked “Factory sealed” or “Seals not required”</td><td rowspan="2">No seal (see Note 3)</td><td rowspan="3">No seal</td></tr>
<tr><td>Contains non-ignition capable equipment (such as wiring terminals), and the conduit is smaller than 53 trade size (2 in)</td></tr>
<tr><td>Conduit is 53 trade size (2 in) or larger</td><td>XP seal</td></tr>
<tr><td colspan="5">Note: XP seals are to be installed within 450 mm (18 in) or as marked. If conduit entries are “field drilled”, then seals are to be within 50 mm (2 in).</td></tr>
</table>

Flameproof enclosures (Ex d or Ex db)			
Contains arcing or heat-producing equipment	Equipment not permitted	XP seal	XP seal
Contains non-ignition capable equipment (such as wiring terminals)		XP seal	No seal
Note: *XP seals are to be installed within 50 mm (2 in).*			
Increased safety enclosures (Ex e or Ex eb)			
Contains terminals and/or equipment with an acceptable type of protection (for Zone 1 or Zone 2 as appropriate, see Table 18)	Equipment not permitted	(see Note 4)	No seal
Increased safety/Flameproof enclosures (Ex e d or Ex eb db) (see Note 5)			
Factory seal between increased safety (Ex e or eb) termination and flameproof (Ex d or db) sections	Equipment not permitted	(see Note 4)	No seal
Non-hazardous enclosures (i.e., CSA Type 4, 4X, IP65, or IP66)			
Containing equipment with no arcing or heat-producing devices acceptable for use in Zone 2 locations	Equipment not permitted	Equipment not permitted	No seal

Boundary seals

	Connected to	**Sealing requirement**
Zone 0 *(Note: only Intrinsically Safe and Intrinsic Safety Ex ia are permitted)*	**Zone 1, Zone 2, or non-hazardous location**	**FFMS** *(Note: terminations in Zone 1 and Zone 2 locations need to comply with the equipment sealing Rules)*
Zone 1	**Zone 2 or non-hazardous location**	**XP Seal**

		(Note: an uninterrupted conduit run would allow the seal to be at the equipment and not the actual boundary)
Zone 2	**Non-hazardous location**	**FFMS**

Legend

Ex e or eb Gland = Increased safety gland

FFMS = Flammable fluid migration seal (see Note 6)

No Seal = No sealing requirements

XP Seal = Explosion seal

Notes:

1. *This table does not set the requirements; it only summarizes the requirements in the Rules.*

2. *"IS" refers to intrinsically safe or non-incendive wiring and equipment, and intrinsic safety equipment (Ex ia, Ex ib, or Ex ic).*

***3**. While not requiring an explosion seal at the explosion-proof enclosure, where the conduit crosses the Zone 1 boundary, an explosion seal is required by Rule 18-104 5)*

***4**. Where the conduit end opposite the increased safety "e" or "eb" enclosure crosses the Zone 1 boundary or terminates in an explosion-proof enclosure, an explosion seal is required by 18-104 5) and 18-104 6).*

***5**. Can be a single enclosure with two sections or two enclosures having factory seals between the Ex e and Ex d sections.*

***6**. XP Seal and Ex e or eb Gland meets the requirements for a FFMS.*

Add new Appendix B Note for Rule 18-078 to read:

SN4760

Rule 18-078

Explosion-proof or flameproof threaded connections are not required for Zone 20, 21, or 22 locations.

In Zone 2, explosion-proof or flameproof threaded connections are required when entering an enclosure that is required to be explosion-proof or flameproof, and for those installations, the conduit is also considered to be part of the explosion-proof or flameproof system to which it is connected. However, if entries are to an enclosure with non-arcing or non-heat-producing components such as terminals, then explosion-proof or flameproof threaded connections and conduit would not be required, unless part of an "uninterrupted conduit run".

Running threads, which are not allowed for NPT threaded connections where explosion protection is required, are created when a wire entry or length of conduit is threaded beyond the length of the tap resulting in a section of straight threads at the minimum or maximum diameter of the taper. Running threads are not capable of meeting the requirements for explosion protection in hazardous locations.

Where threaded connections are used for explosion protection, the requirement to have 4-1/2 tapered and 5 straight fully engaged threads (i.e., threads done up tight) is critical for the following reasons:

- When the threads are not fully engaged, the flame path is compromised, making it possible for an explosion occurring within the flameproof or explosion-proof system to be transmitted to the surrounding atmosphere. - Because metal conduit forms a bonding path to ground, not making the conduit tight will introduce resistance into the flame path and, if a fault occurs, arcing at the interface may result. While it may not always be possible to install certain fittings without backing off, it is important to ensure that the connection is made tight. Properly made threaded connections are critical to the safety of hazardous location wiring systems. The metric thread tolerances are defined in ISO standard 965-1. Class-of-fit (tolerance) for internal (female) threads is defined by 6H and for external (male) threads by 6g. Better (tighter) tolerances will have lower numbers. Class-of-fit is measured prior to assembly using commercially/readily available screw plug gauges for interior threads and ring gauges for external threads.	

SN4669

Revise Appendix B Note for Rules 18-102, 18-104, 18-152 1) b), 18-192 1) b), 18-202 1) b), and 18-252 1) b) to read:

Rules 18-102, 18-104, 18-152 1) b), 18-192 1) b), 18-202 1) b), and 18-252 1) b)
Cables meeting the requirements of CSA C22.2 No. 174 that are marked "HL" are acceptable for use in all hazardous locations [with some restrictions in 18-092 2) for Zone 0] ~~and are marked "HL"~~.

~~Cables marked for use in hazardous locations are suitable for all locations, but the termination fittings must be suitable for the particular hazardous location. For example, in a Zone 1 or Zone 2 hazardous location, a termination fitting entering an enclosure required to be explosion-proof, flameproof "d", or flameproof "db" must be a sealing-type termination fitting, whereas a termination fitting entering an enclosure not required to be explosion-proof, flameproof "d", or flameproof "db" in a Zone 2 hazardous location is not required to be marked for use in Zone 2 hazardous locations.~~ In Zone 1 hazardous locations, cables marked "HL" are acceptable and all cable glands are required to be suitable for the location and the equipment's Type of Protection that it is connected to. For example, in a Zone 1 hazardous location, cables entering an explosion-proof or flameproof ("d" or "db") enclosure are required to have an explosion seal. Explosion-proof enclosures require a Class I, Division 1 cable gland whereas flameproof ("d" or "db") enclosures require either a Class I, Division 1 or flameproof ("d" or "db") cable gland. Explosion seals are also required to be installed on cables entering enclosures marked as "Factory Sealed" or "Seals not Required" since cables are not tested to determine their ability to contain internal explosions to enclosures. For Increased Safety ("e" or "eb") enclosures, the use of Increased Safety ("e" or "eb") glands is required (see Rule 18-102 5)), which are not the same as explosion seals.

In Zone 2 hazardous locations, there are several cable types identified in Rule 18-152 and other similar constructions, that are acceptable for use, and all cable glands are required to be suitable for the location and the equipment's Type of Protection that it is connected to. For example, in a Zone 2 hazardous location, cables entering an enclosure required to be explosion-proof or flameproof ("d" or "db") are required to follow the same Rules as Zone 1 (see previous paragraph). However, cables entering enclosures marked as "Factory Sealed" or "Seals not Required" do not require an explosion seal. Cables entering an enclosure not required to be explosion-proof or flameproof ("d" or "db") in a Zone 2 location are permitted to use ordinary location cable glands. Cable glands marked Class I, Division 2 are not considered explosion seals.

The requirements for cable glands also apply to cable transit devices.

A Flammable Fluid Migration Seal is required at the first point of termination of a cable in Zone 1 or Zone 0 locations. Since Class I, Division 1, flameproof ("d' or "db") and Increased Safety ("e" or "eb") cable glands also meet the requirements of a flammable fluid migration seal, a separate fitting is not required where those glands are installed.

It is intended that cable glands ~~termination fittings~~ in all hazardous locations be compatible with the degree of protection and the ~~explosion~~ type of protection provided by the enclosure they enter. In general, the minimum requirement will be weatherproof cable glands ~~termination fittings~~.

For the application of Section 18, rigid metal couplings are not considered fittings. The CSA Standard for rigid metal conduit and couplings is CSA C22.2 No. 45.1. This Standard does not require hazardous location markings. Certified rigid metal conduit

and couplings are suitable for hazardous locations without specific area classification marking.	

Delete Appendix B Notes for 18-102 3) a) and 18-152 3) a), and 18-102 3) a) and 18-152 3) b) ~~**Rules 18-102 3) a) and 18-152 3) a)**~~ ~~Where tapered threads are used, the requirement to have 4-1/2 fully engaged threads (i.e., threads done up tight) is critical for the following reasons:~~ ~~a) When the threads are not fully engaged, the flame path is compromised, making it possible for an explosion occurring within the conduit system to be transmitted to the area outside the conduit.~~ ~~b) If there are not 4-1/2 fully engaged threads, the flame path may be too short to cool the gases resulting from an internal explosion to a temperature below that which could ignite gas in the surrounding area.~~ ~~c) Because the conduit forms a bonding path to ground, not making the conduit tight introduces resistance into the flame path and, if a fault occurs, arcing at the interface may result.~~ ~~While it may not always be possible to install certain fittings without backing off, it is important to ensure that the connection is as tight as possible. Properly made conduit connections are critical to the safety of hazardous location wiring systems.~~ ~~**Rules 18-102 3) b) and 18-152 3) b)**~~ ~~Tolerance 6g/6H is defined by ISO 965-1.~~	**SN4760**

Revise Appendix B Note for Rule 18-102 5) to read: **Rule 18-102 5)** The type of protection “increased safety” incorporates protection from ingress of water or foreign bodies. CAN/CSA-C22.2 No. 60079-7 requires that enclosures containing bare conductive parts provide at least degree of protection IP54 (see Table B18-6) and that enclosures containing only insulated conductive parts provide at least degree of protection IP44. It is important that conduit and cable entries maintain ~~at least~~ both the increased safety and the degree of protection provided ~~by the enclosure by the use of devices such as gaskets and sealing lock nuts~~. Increased safety enclosures should restrict easy entry of gases or vapours in order to minimize the entry of gases or vapours from short-term releases. Ingress protection (IP) describes the degree of protection an enclosure provides. The first number of the IP rating ~~designation~~ describes the degree of protection against physical contact and solids (~~i.e.~~ e.g., fingers, tools, dust, etc.) with internal parts; the second number designates the degree of protection ~~IP~~ against ingress of water ~~liquids~~. For example, an IP54 rating requires an enclosure to be dust-protected and protected against water splashing from any direction. While the minimum requirement for an increased safety enclosure is IP44 or IP54 as stated in the previous paragraph, typically most increased safety enclosures meet IP65 or IP66 rating. In Item c), cable glands may be additionally tested to provide an explosion seal function and are identified accordingly. For further information on ~~the IEC~~ IP ratings ~~designations~~, refer to CAN/CSA-C22.2 No. 60529.	SN4530 SN4784

SN4530

Revise Appendix B Table B18-6 to read:

Table B18-6
Ingress protection

Protection against contact and solid objects *(first digit)*		Protection against ~~liquids~~ water *(second digit)*	
Number	Description	Number	Description
0	No protection	0	No protection
1	Protected against solid foreign objects of 50 mm diameter and greater ~~Objects greater than 50 mm~~	1	Vertically falling ~~dripping~~ water drops
2	Protected against solid foreign objects of 12.5 mm diameter and greater ~~Objects greater than 12 mm~~	2	Protected against vertically falling water drops when enclosure ~~Dripping water when~~ tilted up to 15°
3	Protected against solid foreign objects of 2.5 mm diameter and greater ~~Objects greater than 2.5 mm~~	3	Spraying water at an angle up to 60°
4	Protected against solid foreign objects of 1.0 mm diameter and greater ~~Objects greater than 1 mm~~	4	Splashing water from any direction
5	Dust-protected	5	Low-pressure water jets
6	Dust-tight	6	Powerful ~~Strong jets of~~ water jets
		7	Protected against the effects of temporary immersion in water ~~The effects of immersion to a depth of 1 m~~
		8	Continuous Submersion in water
		9	High pressure and high temperature water jets

SN4784

Add new Appendix B Note for Rule 18-102 6) to read:

Rule 18-102 6)
Sealing components (O-rings, sealing washers, or sealing locknuts) are used to maintain the degree of protection where entries to enclosures for cables are through clearance holes. Where gland plates are used, the degree of protection is maintained by the cable gland, plus the threads between the gland plate and gland. Where Ex e conduit hubs are used, the degree of protection is provided by the hub.

Revise Appendix B Note for Rules 18-104 and 18-154 to read: **Rules 18-104 and 18-154** Seals are provided in conduit or cable systems to prevent the passage of gases, vapours, or flames from one portion of the electrical installation to another through the system. Some equipment may include markings such as “FACTORY SEALED” or “SEAL NOT REQUIRED” as permitted by CSA C22.2 No. 30. These terms apply to conduit installations only. The markings “FACTORY SEALED” and “SEAL NOT REQUIRED” are used interchangeably and indicate that the termination enclosure for the equipment is isolated from ignition-capable components by an internal factory seal, or that the equipment incorporates devices that have been assessed as not producing arcs, sparks, or high temperatures. For equipment marked “FACTORY SEALED” or “SEAL NOT REQUIRED”, the following applies: a) In Zone 1 applications: i) For conduit installations, an explosion seal is not required as the conduit system is explosion-proof and will contain an explosion if something were to happen inside the enclosure, such as a wire coming out of a terminal. ii) For cable installations, an explosion seal is required, as the cable cannot contain an explosion in the enclosure if something happened, such as a wire coming off a terminal. Therefore, an explosion seal is needed to contain the explosion to the enclosure. b) In Zone 2 applications, because equipment that is not ignition capable [see Rule 18-150 2) a)] and terminations housed in non-hazardous location enclosures [see Rule 18-150 2) c)] are permitted in Zone 2 locations, an explosion seal for conduit or cable is not required in accordance with Rules 18-154 1). ~~and 4),~~ ~~respectively.~~	SN4749 SN4806
Revise Appendix B Note for Rules 18-104 1) and 18-154 1) to read: **Rules 18-104 ~~1~~ 3) and 18-154 ~~1~~ 2)** Field machining of conduit openings is allowed in enclosures where indicated by the manufacturer’s instructions, provided that they are carried out in accordance with those instructions. The restriction for sealing field-machined entries within 50 mm is to address any variations in the quality of work. Other entries may be acceptable but must be performed by a competent machining facility in accordance with the requirements of CSA C22.2 No. 30.	SN4806

Revise Appendix B Note for Rule 18-104 6) to read: **Rules 18-104 ~~6~~ 4)** Reducers may have one side larger than the trade size of the conduit where the entry to the explosionproof, flameproof "d", or flameproof "db" enclosure is larger than the trade size of the conduit.	SN4806
Revise Appendix B Note for Rules 18-104 6) and 18-154 3) to read: **Rules 18-104 ~~6~~ 4) and 18-154 3)** Conduit fittings, such as unions, reducers, adapters, and elbows, for use in Zone 1 or Zone 2 ~~and similar to the~~ locations and permitted to be installed between the explosion seal and the explosion-proof enclosure are not intended to increase the internal volume more than what the trade size conduit would be. "L", "T", or "Cross" type fittings, although ~~are~~ not usually classed as enclosures when not larger than the trade size of the conduit, will increase the internal volume more than what the trade size conduit would be.	SN4806
Revise Appendix B Note for Rule 18-106 to read: **Rule 18-106** Increased safety motors can only be safely installed and used in Zone 1 hazardous locations when specific protection requirements for their thermal and fault protection are met. This ensures the likelihood of a winding failure resulting in incendive arcing, or that an overload or a fault resulting in high temperatures is unlikely to occur. These protection requirements are outlined in standard IEC 60079-14. IEC 60079-14 contains the requirements for designers and users to apply when Ex eb motors are used in Zone 1. Requirements include the following: a) protection from overload and short-circuits to prevent inadmissible heating; b) application of cage induction motors; c) operation, starting, and automatic reclosing (i.e., restarting after power failure); d) use of winding temperature sensors; e) operation of high-voltage motors ~~machines~~; f) operation of motors from a frequency converter; and g) operation of motors using reduced-voltage (soft) starting.	SN4791
Add new Appendix B Note for Rule 18-150 2)a)ii) to read: **Rule 18-150 2) a) ii)** This subrule is intended to allow for capacitors to be installed in Zone 2 such as are used for partial discharge monitoring, power factor correction, and harmonic reduction.	SN4638
Add new Appendix B Note for Rule 18-150 2)a)iii) to read: **Rule 18-150 2) a) iii)**	SN4638

This type of equipment operates at such extremely low power levels that any operating temperature rise is negligible, and is thereby in compliance with Rule 18-054. All are non-sparking, and do not incorporate inductors, capacitors or other internal components capable of storing or producing significant amounts of electrical energy. For additional information, refer to the description of "simple apparatus" in CSA Standard C22.2 No. 60079-11. RFID tag Readers are not included in this allowance and they would need to be certified for the areas in which they are used.

Revise the Appendix B Note for Rule 18-150 2)e) to read:

SN4522

Rule 18-150 2) e)

Rule 18-150 does not require motors and generators of the open or non-explosion proof type to be certified for Zone 2 locations unless the machines incorporate ignition capable components or heat-producing components that exceed the minimum ignition temperature defined for the hazardous location. This Subrule provides the criteria for applying motors and generators in Zone 2 locations that do not have a certification suitable for Zone 2 or Division 2. Refer to IEEE 1349 for more detailed information on applying these motors and generators in Zone 2 locations.

There is no Class I, Division 2 certification standard for motors and generators ~~rotating electrical machines~~, ~~of the open or non-explosion-proof type do not have a certification Standard for Class I, Division 2;~~ however, there are types of protection that can be used for certifying these machines for use in Zone 2 locations. In addition, these machines can be evaluated for use in Zone 2 locations in accordance with UL1836 "Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations". ~~This Subrule provides the criteria for applying, in Zone 2, rotating electrical machines that do not have a certification suitable for Zone 2 or Division 2. Refer to IEEE 1349 for more detailed information on applying these rotating electrical machines in Zone 2 locations.~~

Revise Appendix B Note for Rule 18-150 4) to read:

SN4688

Rule 18-150 4)

The evaluation process to determine if the sliding contact shaft bonding device is non-incendive is the "motor bearing sparking – discharge energy calculation" found in ~~Annex H of~~ CSA C22.2 No. 60079-0, UL 1836, or IEEE 1349. The potential energy calculation should be retained and available for review. The person taking responsibility for the calculation is normally an engineering professional or other individual permitted to practice engineering.

Revise Table B18-1 as shown:

SN4640
SN4715
SN4822

Table B18-1
Documents applicable to hazardous locations

By function	Publisher	Reference publication

General			
• Design, installation, maintenance	API	RP 14F, *Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Division 1 and Division 2 Locations*	
• Design, installation, maintenance	API	RP 14FZ, *Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1 and Zone 2 Locations*	
• Design, installation, maintenance	IEC/IEEE	60079-30-2, *Explosive atmospheres — Part 30-2: Electrical resistance trace heating — Application guide for design, installation and maintenance*	
• Design, equipment, installation	IEC	60079-14, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*	
~~• Equipment, area classification~~	~~IEC~~	~~60079-20-1, *Explosive atmospheres — Part 20-1: Material characteristics for gas and vapour classification — Test methods and data*~~	
• Material properties	ISA	TR12.13.01, *Flammability Characteristics of Combustible Gases and Vapors*	
• Design, installation	ISA	Book, *Electrical Instruments in Hazardous Locations*~~,~~ ~~4th edition,~~. Author: Ernest Magison	
• ~~Equipment, area classification~~ Material properties	ISO/IEC	~~FDIS~~ 80079-20-1, *Explosive atmospheres — Part 20-1: Material characteristics for gas and vapour classification — Test methods and data*	
• ~~Equipment, area classification~~ Material properties	ISO/IEC	80079-20-2, *Explosive atmospheres — Part 20-2: Material characteristics — Combustible dusts test methods*	
• Design, installation	NFPA	*33, Standard for Spray Application Using Flammable or Combustible Materials*	
• Design, equipment, installation	Butterworth-Heinemann	*Book, Electrical installations in hazardous areas. Author: Allan McMillan*	

• Material properties	Academic Press	Book, *Combustion, Flames and Explosions of Gases.* Author: Bernard Lewis, Guenther von Elbe	
• Design, material properties	Gulf Publishing	Book, *Explosion Hazards in the Process Industries.* Author: Rolf K. Eckhoff	
Design	~~Gulf Publishing~~	~~Book, *Explosion Hazards in the Process Industries.* Author: Rolf K. Eckhoff~~	
	IEC	60079-25, *Explosive atmospheres — Part 25: Intrinsically safe electrical systems*	
	IEC	**TS60079-32-1, *Explosive atmospheres – Electrostatic hazards, guidance***	
	ISA	TR12.2, *Intrinsically Safe System Assessment Using the Entity Concept*	
	ISA	RP12.02.02, *Recommendations for the Preparation, Content, and Organization of Intrinsic Safety Control Drawings*	
	~~NFPA~~	~~51A, *Standard for Acetylene Cylinder Charging Plants* (withdrawn)~~	
	NFPA	Haz 10, *Fire Protection Guide to Hazardous Materials*	
	NFPA	30, *Flammable and Combustible Liquids Code*	
	NFPA	61, *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities*	
	NFPA	68, *Standard on Explosion Protection by Deflagration Venting*	
	NFPA	77, *Recommended Practice on Static Electricity*	
	NFPA	484, *Standard for Combustible Metals*	
	NFPA	654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*	
	NFPA	655, *Standard for the Prevention of Sulfur Fires and Explosions*	

	NFPA	664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*	
	NFPA	91, *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids*	
Area classification*	API	RP 505, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2*	
	API	RP 500, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2*	
	API	PUBL 4615, *Emission Factors for Oil and Gas Production Operations*	
	API	PUBL 4638, *Calculation Workbook for Oil and Gas Production Equipment Fugitive Emissions*	
	API	PUBL 4589, *Fugitive Hydrocarbon Emissions from Oil and Gas Production Operations*	
	Energy Institute	EI 15, *Model code of safe practice Part 15: Area classification code for installations handling flammable fluids*	
	IEC	60079-10-1, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*	
	IEC	60079-10-2, *Explosive atmospheres — Part 10-2: Classification of areas — Explosive dust atmospheres*	
	ISA	12.10, *Area Classification in Hazardous (Classified) Dust Locations*	
	~~ISA~~	~~TR12.13.01, *Flammability Characteristics of Combustible Gases and Vapors*~~	
	NFPA	497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*	

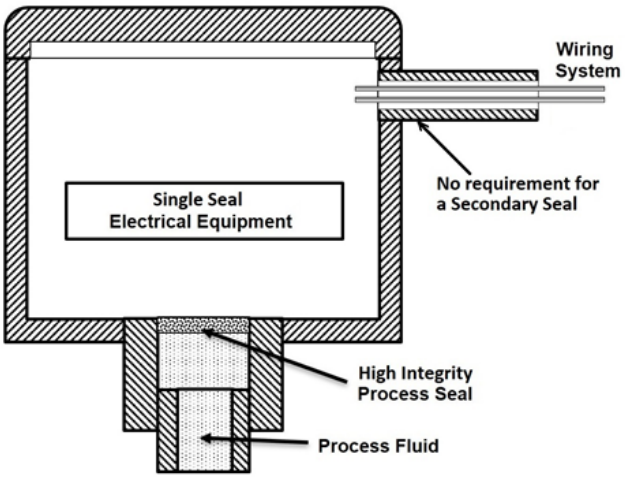
	NFPA	499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*	
Equipment, equipment selection (products)†	CSA	C60079-13, *Explosive atmospheres — Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"*	
	CSA	C80079-36, *Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements*	
	CSA	C80079-37, *Explosive atmospheres – Part 37: Non-electrical equipment for explosive atmospheres – Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"*	
	IEC	60079-29-2, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*	
	IEC	60079-29-3, *Explosive atmospheres — Part 29-3: Gas detectors — Guidance on functional safety of fixed gas detection systems*	
	~~IEC~~	~~TS 60079-40, *Explosive atmospheres — Part 40: Requirements for process sealing between flammable process fluids and electrical systems*~~	
	IEC	*TS 60079-42:2019, Explosive atmospheres - Part 42: Electrical safety devices for the control of potential ignition sources for Ex-Equipment*	
	IEEE	1673, *IEEE Standard for Requirements for Conduit and Cable Seals for Field Connected Wiring to Equipment in Petroleum and Chemical Industry Exposed to Pressures above Atmospheric (1.5 kPa, 0.22 psi)*	

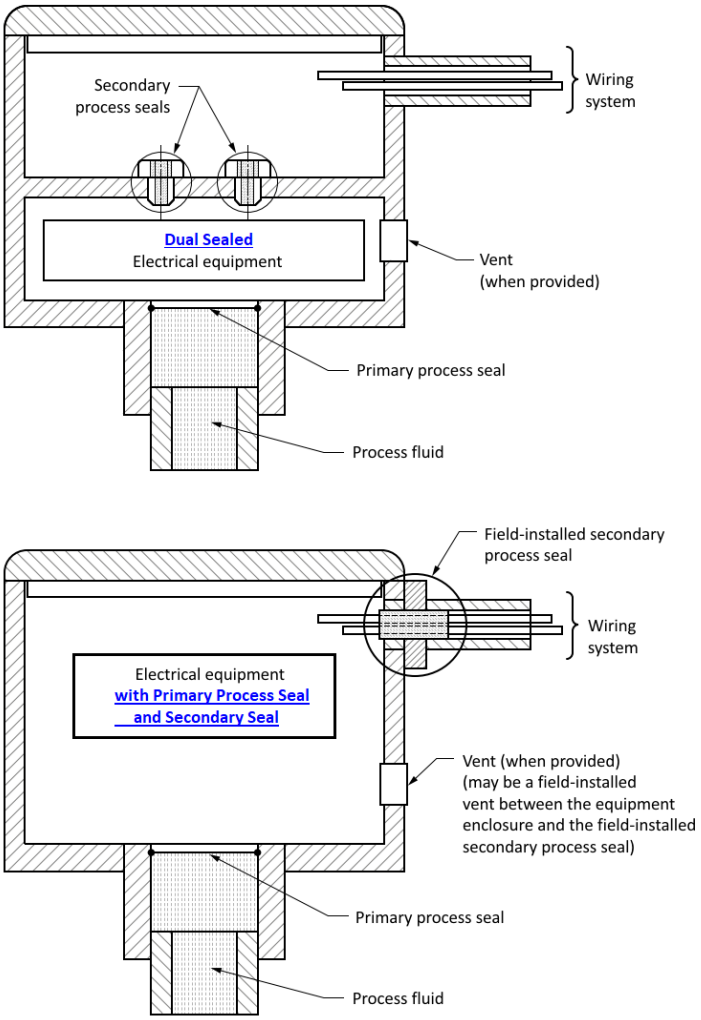
	IEEE	1349, *IEEE Guide for Application of Electric Motors in Class I, Division 2 and Class I, Zone 2 Hazardous (Classified) Locations*	
	~~ISA~~	~~*12.27.01, Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids*~~	
	ISA	TR12.13.03, *Guide for Combustible Gas Detection as a Method of Protection*	
	ISA	TR12.13.04, *Performance Requirements for Open Path Combustible Gas Detectors*	
	ISA	12.20.01, *General Requirements for Electrical Ignition Systems for Internal Combustion Engines in Class I, Division 2 or Zone 2, Hazardous (Classified) Locations*	
	ISA	TR12.21.01, *Use of Fiber Optic Systems in Class I Hazardous (Classified) Locations*	
	ISA	12.01.01, *Definitions and Information Pertaining to Electrical Equipment in Hazardous (Classified) Locations*	
	ISA	12.04.04, *Pressurized Enclosures*	
	ISA	12.12.03, *Standard for Portable Electronic Products Suitable for Use in Class I and II, Division 2, Class I Zone 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations*	
	ISA	12.12.04, *Electrical Equipment in a Class I, Division 2/Zone 2 Hazardous Location*	
	~~ISA~~	~~*Electrical Instruments in Hazardous Locations*, 4th edition, Author: Ernest Magison~~	
	NFPA	496, *Standard for Purged and Pressurized Enclosures for Electrical Equipment*	
	NFPA	505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*	
	UL	122701, *Standard for Requirements for Process Sealing Between Electrical Systems ~~and Systems~~ and Flammable or Combustible Process Fluids*	

	UL	1836, *Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations*	
Erection, verification (installation)	CSA	C22.1, *Canadian Electrical Code, Part I*	
	NFPA	70, *National Electrical Code*	
	IEC	60079-14, *Explosive atmospheres — Part 14: Electrical installations, design, selection and erection*	
	ISA	RP 12.06.01, *Recommended Practice for Wiring Methods for Hazardous (Classified) Locations — Instrumentation — Part 1: Intrinsic Safety*	
Operations, maintenance	IEC	60079-17, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance*	
	IEC	60079-19, *Explosive atmospheres — Part 19: Equipment repair, overhaul and reclamation*	

Add new diagram to Figure B18-1 and modify the two existing diagrams:

SN4715





Add Appendix B Note for Rule 18-152 1) d) to read:

SN4745

Rule 18-152 1) d)

Examples of acceptable armoured and metallic sheathed cables are TECK90, ACWU90, copper-sheathed RC90, aluminum-sheathed RA90, armoured fire alarm and signal (FAS) cable, and armoured control and instrumentation cable (ACIC).

Revise Appendix B Note for Rule 18-154 2) b) to read:

SN4806

Rule 18-154 ~~2~~5) b)

This Item allows the seal at the boundary between an outdoor Zone 2 location and an outdoor non-hazardous location to be located further than 1m ~~300 mm~~ from the boundary of the Zone 2 location, provided that it is located on the conduit prior to ~~its~~ entering an enclosure or a building. Because gas is present in Zone 2 locations only for short periods, it is unlikely that gas or vapour could be released through conduit couplings at sufficiently high rates to form an explosive gas atmosphere in outdoor

areas. However, the seal must be located on the conduit before it enters an enclosure or a building because, depending on the ventilation rate, gas transmitted through the conduit may build up to flammable concentrations.	
Revise Appendix B Note for Rule 18-154 3) to read: **Rule 18-154 3)** See the Note to Rules 18-104 ~~6~~4) and 18-154 3).	SN4806
Add new Appendix B Note for Rule 18-250 to read: **Rule 18-250** In addition to certifying motors and generators with "types of protection", these machines can be evaluated for use in Zone 22 locations in accordance with UL1836 "Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations".	SN4522
Revise Appendix B Note for Rule 20-004 to read: **Rule 20-004** For the purposes of Subrules 6) and 7), buildings such as kiosks, in which electrical equipment such as cash registers and/or self-service console controls are located, are considered to be buildings not suitably cut off. For the purposes of Subrule 11), if the threaded rigid metal conduit emerges in a Zone 1 location, Explosion seals required by section 18 will meet the requirements of a flammable fluid migration seal.	SN4693
Add new Appendix B Note for Rule 24-101 to read: **Rule 24-101** It is intended by this Rule that panelboards supplying circuits in patient care areas, should be located in service rooms or service spaces, readily accessible to authorized personnel only. It is also intended by this Rule to permit the installation of panelboards supplying circuits of the essential electrical system in basic or intermediate care areas, within those care areas, when access by authorized personnel to these patient care areas is allowed by the health care facility administration. The intent of this Rule is also to ensure that when a panelboard is permitted to be located in a critical care area, such panelboard is dedicated to only supplying loads serving the critical care area where it is located, and as such, access by authorized personnel to that particular critical care areas is allowed by the health care facility administration when required.	SN4571

It should be noted that when panelboards are permitted to be installed in patient care areas in accordance with Subrule (2), access to those patient care areas for control of the circuits located outside of the patient care area, may not be granted by the health care facility administration to all maintenance personnel.	
Revise Appendix B Note for Rule 24-108 8) to read: **Rule 24-104 8)** This Subrule is intended to require that all exposed metal parts of non-electrical equipment located within a patient care environment that could become energized during a single fault condition be bonded to ground. ~~Examples of such equipment are metal parts of medical gas equipment, metal parts of support arms or consoles installed in a patient care environment, etc.~~ It is not intended by this Subrule that metal parts of portable non-electrical equipment or metal parts of the building structure and miscellaneous small conductive parts (e.g., metal sinks not provided with line-connected equipment such as electrically operated faucets, metal door frames, window frames, and soap dishes) be bonded to ground.	**SN4606** **SN4634**
Add new Appendix B Note for Rule 24-106 8) to read: **Rule 24-106(8)** It is intended that Subrule 8) supplement the general provisions of Rule 26-706 for tamper-resistant receptacles for those areas in health care facilities covered by the scope of Section 24. Examples of areas designated by the health care facility administration as being intended primarily for the provision of diagnosis, therapy, or care to children would include but are not limited to pediatric units and examination rooms intended for children.	**SN4572**
Revise Appendix B Note for Rule 24-206 to read: **Rule 24-206** It is imperative that the impedance-to-ground of individually isolated branch circuits be tested at regular intervals, and that maintenance procedures be instituted for the system and the equipment connected to it as necessary to limit the total hazard index to 5 ~~2~~ mA.	**SN4708**
Add new Appendix B Note for Rule 26-100 to read: **Rule 26-100** Pullout switches are a type of isolating switch covered by Standard CSA C22.2 No. 335.	**SN4710**
Add new Appendix B Note for Subrule 26-600 1) to read: **Rule 26-600 1)**	**SN4575**

It should be noted that in accordance with C22.2 No. 29, panelboards are tested to operate normally at ambient temperatures up to 40C.	
Revise Appendix B Note for Rule 26-724 a) to read: **Rule 26-724 ~~a)~~** It is intended by this Rule to ensure sufficient availability and ready access to outdoor receptacles. Generally, single dwellings have two or more sides exposed to and accessible from the outdoors. It is intended that by having receptacles installed on opposite sides of a single dwelling, ready access to the outdoor receptacles is maximized. In rare occasions where a single dwelling does not have opposite sides, item 26-724 1) b) provides for alternate means to accommodate the two outdoor receptacles. For smaller single dwellings, having a perimeter of 20m or less, a minimum of one receptacle is deemed sufficient. ~~For single dwellings of the detached, semi-detached, and row housing types, it is recommended that outdoor receptacle be placed at both the front and rear of the house and that these be controlled by a switch located inside the house.~~	SN4602
Revise portions of the Appendix B Section 28 "Example to determine motor insulated conductors and protection" where indicated: **Section 28** **Example to determine motor insulated conductors and protection** The following is an example calculation for determining copper conductor size, ~~and~~ overcurrent rating, and overload protection for one 100 hp, one 30 hp, and two 7 ½ hp motors , 575V, three phase, at full-voltage start. " " " **Overcurrent protection** Branch circuit overcurrent protection for each motor is determined by using Rule 28-200. For the purpose of the motors described, use Rule 28-200 a) and Table 29. Listed below are the actual currents with the standard ~~size of protector~~ rating of overcurrent device shown in brackets. " " "	SN4733

Note that Table D16 may be used to select the ~~size~~ maximum rating of the overcurrent devices in accordance with Rule 28-200, where the full load current rating of the motor is shown in the Table **Feeder over current protection** The maximum allowable feeder overcurrent protection for motors is determined from Rule 28-204. Using Rule 28-204 1) the ratings are as shown below with the standard ~~size~~ rating shown in parentheses:	
Revise Appendix B Note for Rule 28-308 c) to read: **Rule 28-308 c)** The intent of this Item is to allow motors that are designed, constructed, and certified to CSA C22.2 No. 77, ~~and marked as impedance "ZP" and thermally "TP" protected~~ as motors ~~to~~ that can be installed without the overload protection ~~that is~~ required by Rule 28-300. Such motors have inherent overheating protection and are identified with one of the following markings: a) "THERMALLY PROTECTED", or "TP" b) "IMPEDANCE PROTECTED", or "ZP" c) "ELECTRONICALLY PROTECTED", or "EP"	SN4595
Add new Appendix B Note for Rule 30-114 to read: **Rule 30-114** See the note to Rule 8-104.	SN4643
Add new Appendix B Note for Rules 36-404, 36-406, and 36-408 to read: **Rules 36-404, 36-406 and 36-408** High voltage couplers can be field assembled. Torque values for terminations may be marked on the coupler or provided in the manufacturer's installation instructions	SN4154
Add new Appendix B Note for Rule 36-408 to read: **Rule 36-408** The protection functions listed are typically provided by a protective relay or relays which can provide all of the protection, monitoring and control functions described.	SN4154
Revise Appendix B Note for Rule 46-306 1) to read: **Rule 46-306 1)** Where approved unit equipment includes a list of lamps suitable for remote installations, the requirements of CSA C22.2 No. 141 take into account a voltage drop of 5% in the remote lamp's circuit unless the list specifies that certain lamps conform to the requirements with a greater voltage drop.	SN4748-46

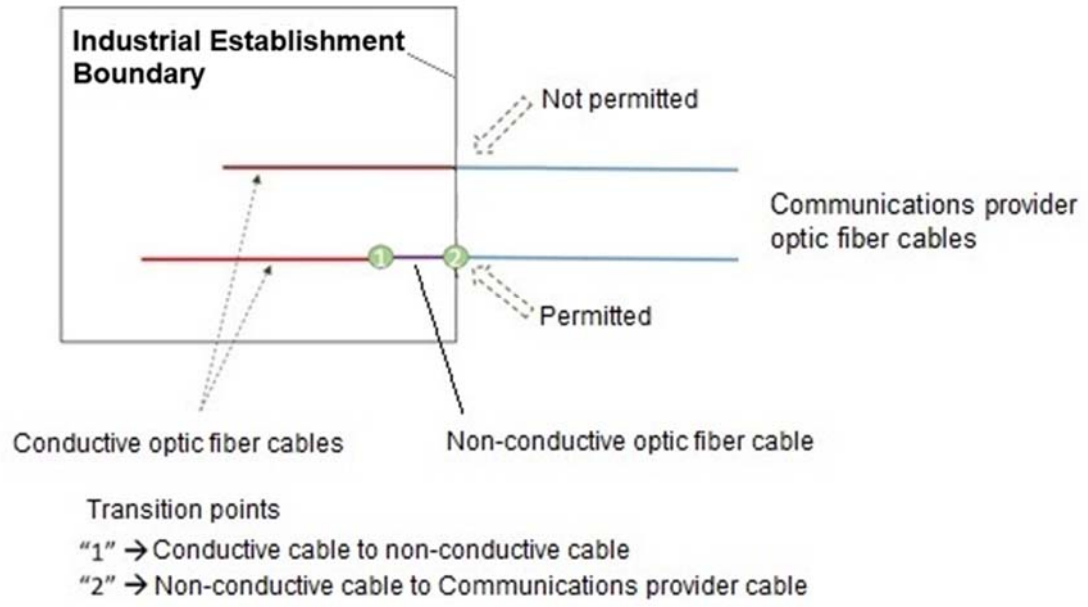
Note 4 of Table ~~D4~~ D3 can be used to determine approximate permissible circuit lengths.

Add new Appendix B Note and Figure for Rule 56-202 to read: SN4271

Rule 56-202 5)

It is intended by this requirement that there is no conductive continuity between the conductive portion of the industrial establishment optical fiber cables, and the communications provider optical fiber cables. The objective of this requirement is to prevent contact by communications provider personnel with any conductive portion of the industrial establishment optical fiber network cables. See Figure B56-1.

Figure B56-1



Revise Appendix B note for Ruler 60-200 2) to read: SN3961-60

Rule 60-200 2)

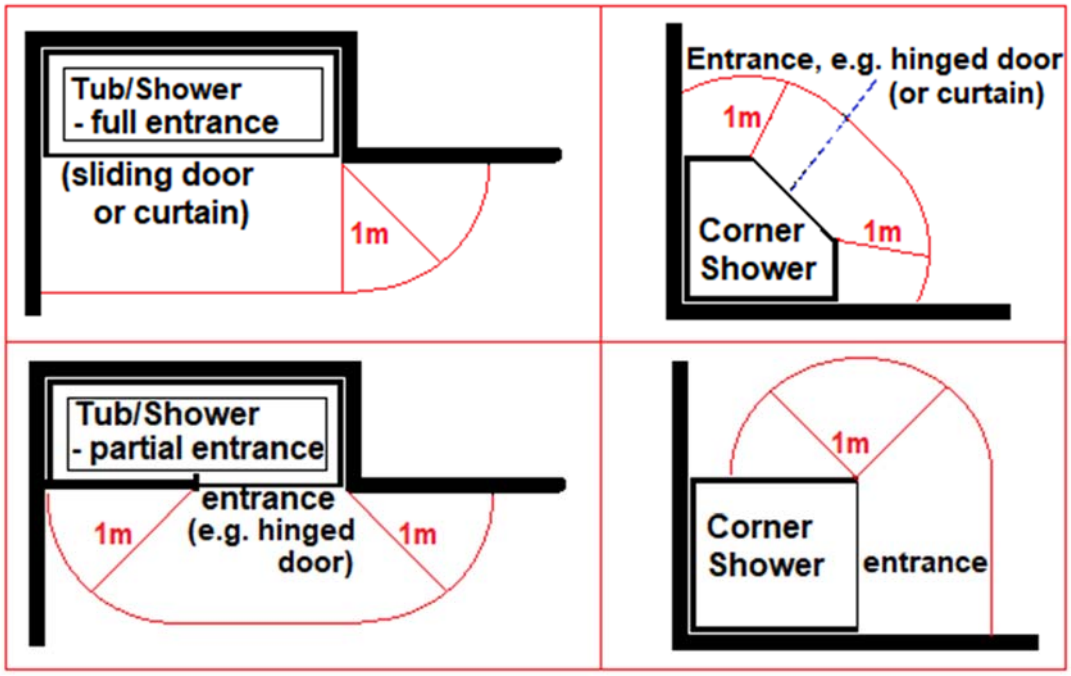
The point at which the exposed ~~conductors~~ cables enter a building is considered to be the point of emergence through an exterior wall, through a concrete floor slab, or from a totally enclosed non-combustible entrance raceway.

Revise Appendix B Note for Rule 62-116 1) to read: SN4773

Rule 62-116 1)

The intent of the "ground fault setting sufficient to allow normal operation of the heater" is that the setting should be as low as practical to allow start-up and running of the heater without nuisance trips, yet still providing ground fault protection for the equipment ~~and insulated supply conductors~~. For many systems, this would be a fixed trip 30 mA ground fault protection device. For higher leakage current circuits, the trip

level for adjustable devices is typically set at 30 mA above any inherent capacitive leakage current. If a fixed trip ground fault protection device is to be used, it should be selected to meet this intent.	
Add new Appendix B Note for Rules 62-124 2) and 3) to read: **Rules 62-124 2) and 3)** This Rule addresses installation requirements for series trace heater sets. Subrule 2) currently addresses the need to maintain the trace heater set and its connection to a non-heating lead within the heating area, typically beneath the thermal insulation. The non-heating lead may then pass through the thermal insulation and be connected within a junction box. Trace heating systems can be designed to allow the trace heater to pass through a heating surface mounted fitting assembly and transition directly into close-coupled power and termination junction boxes. A non-heating lead is not required in this case and the trace heater can be connected directly into the junction box terminal block. Subrule 62-108 3) addresses requirements when temperatures at the point of connection for branch circuit wiring exceeds 60 ºC.	**SN4607**
Add new Appendix B Note for Tule 62-130 to read: **Rule 62-130 2)** Thermostats that have integral Class A GFCI functionality, may only protect the outgoing load conductors. This Rule requires the thermostat itself to have Class A GFCI protection, therefore a separate Class A GFCI would be required to protect the thermostat if the integral Class A GFCI function does not protect it.	**SN4773**
Add new Appendix B Note for Rules 62-130 and 62-132 to read: **Rule 62-130 and 62-132** What is meant by “tub or shower stall entrance” is wherever a person can stand (or sit) and reach from the tub or shower. It does not matter what type of entrance it is, open, curtained, hinged, sliding or similar, the distance would be measured from the entire entrance. Figure B62-1.5 shows a few examples: **Figure B62-1.5**	**SN4567**



Revise Appendix B Note for Rule 62-216 1) to read:

SN4568
SN4803
SN4753

Rule 62-216 ~~1)~~

In Subrule 1), t~~T~~he 13 mm clearance is to prevent mechanical damage of the heating device during installation of the gypsum board and other cementitious material.

Subrule 3) is intended to allow for a trace heater to transition from one ceiling or wall cavity to another by crossing the stud or joist within 150mm of the end, for example in a notch, or through a hole, or around the end of the stud or joist if available.

Subrule 4) is intended to allow for trace heaters and panels to cross over the face of studs or joists without making a notch. For ceiling installations, Class A GFCI or mechanical protection plus ground fault protection would be needed (see Rule 62-116). For wall installations, they are limited to 1.2m above the floor and both Class A GFCI and mechanical protection is needed. The 1.2 m limit is used as there is less likelihood below this height of adding something to the wall, such as mounting a picture or adding shelves.

Subrule 5) is intended to allow for alternative methods of installing trace heaters or panels without gypsum board when mechanical protection is provided.

Mechanical protection referred to in Subrules 4) and 5) can be provided by the requirements of the safety standard for a manufactured product or by field installation. In either case, manufacturer's instructions are provided and need to be followed. One example would be a manufactured panel with the trace heater or heating panel set embedded in it, and integral mechanical protection, which is then attached to the studs or joists. Another example would be the trace heater or heating panel set installed on the face of the studs or joists, with the mechanical protection installed on top of that, and optionally gypsum board installed on top of the mechanical protection, or vice versa, as would be detailed in the manufacturer's instructions.

Standard C22.2 No. 130 contains the details for certifying products for installations requiring mechanical protection.

Revise part of Appendix B Note for Rule 64-002) to read: **Energy storage system** Additional information regarding energy storage systems is located in ANSI/CAN/UL 9540. ~~The Standard does not include other storage systems, such as an~~ This definition is not intended to include an uninterruptible power system (UPS) which is covered by CSA C22.2 No. 107.3. CSA C22.2 No. 107.3 defines an uninterruptible power system as follows: **Uninterruptible power system (UPS)** — combination of converters, switches, and energy storage devices (such as batteries), constituting a power system for maintaining continuity of power to a load in case of input power failure. **Field-assembled energy storage systems** Field-assembled energy storage systems ~~are not approved to UL 9540. These systems~~ involve interconnection of separate ~~components~~ pieces of equipment forming an overall energy storage system. This equipment may include batteries, protection, control, power conversion, charge control, and fire detection. This definition applies to systems approved at a manufacturer's facility prior to field assembly. This definition also applies to field-assembled systems that require approval following assembly. Large energy storage systems may be approved off site, disassembled for shipment, and then reassembled on site based on the manufacturer's installation instructions in which the overall approval of the system is maintained. ~~**Self-contained energy storage systems** Self-contained energy storage systems are approved to UL 9540. These systems may involve populating and interconnection of batteries and associated equipment at the final installation site.~~	SN4758 SN4834
Add new Appendix B Note for Rule 64-104 3) a) to read: **Rule 64-104 3) a)** For application of this item, the combination of a micro-inverter and photovoltaic module is considered to be equivalent to an ac module.	SN4411
Revise Appendix B Note for Rule 64-060 10) to read: **Rule ~~64-060 10)~~ 64-060 1)** It is intended by this Subrule that the following or equivalent wording should be provided on or adjacent to the disconnecting means: WARNING: ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.	SN4689

See Appendix M for a French translation of this marking.	
Add new Appendix B Note for Rule 64-060 1) c) to read: **Rule 64-060 1) c)** DC fault currents are considerably more difficult to interrupt than ac fault-currents. Disconnecting means marked only for ac use should not be used in dc circuits.	SN4689
Add new Appendix B Note for Rule 64-060 1) d) to read: **Rule 64-060 1) d)** Disconnecting means employed in renewable energy systems, energy storage systems and energy production systems may be subject to available fault current from all sources. The intent of this item is to bring awareness that equipment should be rated for the maximum available fault current that is available from any one source.	SN4689
Revise Appendix B Note for Rule 64-060 8) to read: **Rule ~~64-060 8)~~ 64-060 2)** The required disconnecting means is to ensure complete isolation when fuses that could be energized from both sides are being removed.	SN4689
Add new Appendix B Note for Rule 64-060 3) to read: **Rule 64-060 3)** See the Notes for Rule 36-214	SN4689
Revise Appendix B Note for Rule 64-060 12) to read: **Rule ~~64-060 12)~~ 64-221 1)** The intent of this Subrule is to have a disconnecting means for the output circuit of a photovoltaic combiner capable of making and interrupting its full load rating and that may be opened with safety to the operator with a fault on the system.	SN4689
Add new Appendix B Note for Rule 64-061 to read: **Rule 64-061** The isolating means referred to in this rule are not intended to be operated under load, are marked “DO NOT DISCONNECT UNDER LOAD” or “NOT FOR INTERRUPTING CURRENT”, and may not open all conductors of the circuit simultaneously. Examples of isolating means may include but are not limited to attachment plugs and touchsafe fuse holders.	SN4689
Revise Appendix B Note for Rule 64-106 to read:	SN4717

Rule 64-106

~~An inverter or an ac module in an interactive renewable energy system should automatically de-energize its output to the connected electrical production and distribution network upon loss of voltage in that system and should remain in that state until the electrical production and distribution network voltage has been restored.~~

Interconnection requirements:

An inverter or an ac module in an interactive renewable energy system plays a key role in satisfying the interconnection requirements of the supply authority. Those requirements have typically included protection functions, such as abnormal voltage and frequency trip, and anti-islanding. Those requirements are now progressing to include grid-support functions to assist in grid voltage and frequency regulation, fault recovery, ride through, communications, and remote-control requirements. CSA C22.3 No. 9, added many of these requirements in a new version dated 2020. CSA C22.3 No. 9 also provides two levels of grid support features, identified as “basic” and “supplemental” to distinguish between these levels of capability.

An Amendment to the inverter standard CSA C22.2 No. 107.1 refers to inverters that are within the scope of C22.3 No. 9. Other interconnection requirements are allowed to be used for inverters outside that scope of C22.3 No. 9. Markings requirements for inverters and ac modules clearly identify when C22.3 No. 9 has been applied and when it has not.

For products that comply with the amendment to C22.2 No. 107.1, the following markings are required:

a) Interactive inverters or power conversion equipment tested for compliance with the C22.3 No. 9 baseline requirements are marked:

“GRID SUPPORT INTERACTIVE INVERTER - C22.3 NO. 9 - BASIC”

b) Interactive inverters or power conversion equipment tested for compliance with the C22.3 No. 9 supplemental requirements are marked:

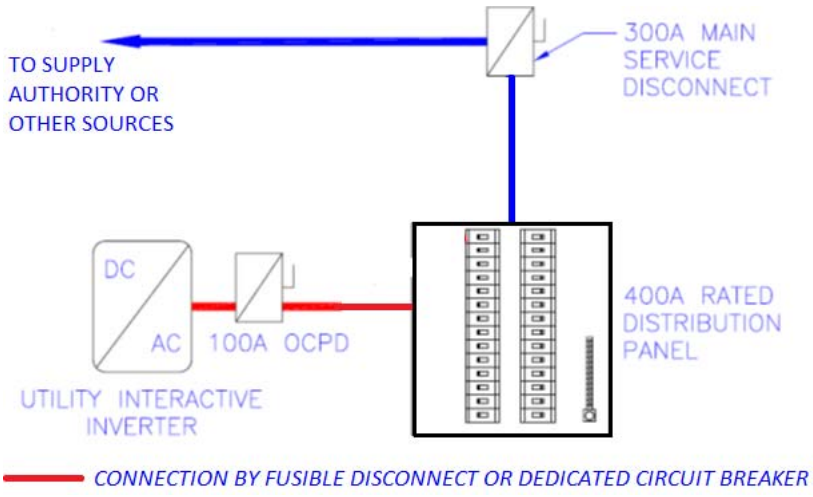
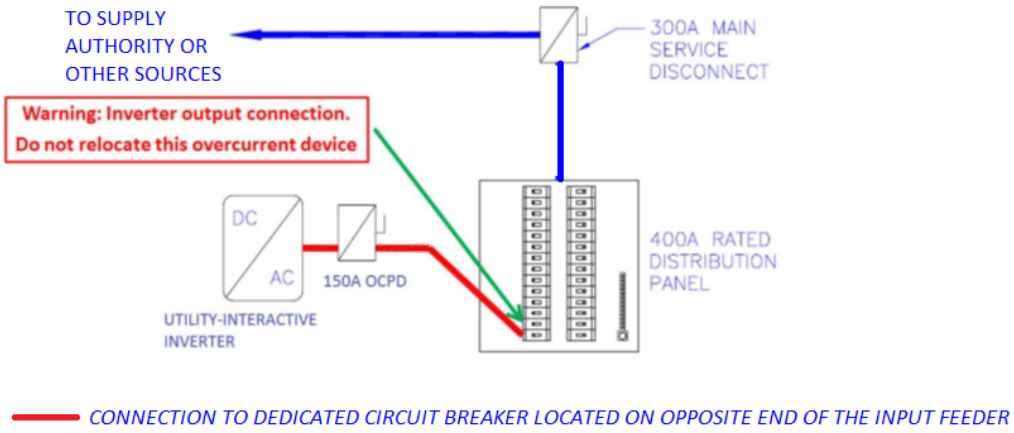
“GRID SUPPORT INTERACTIVE INVERTER - C22.3 NO. 9 - SUPPLEMENTAL”

c) Interactive inverters or power conversion equipment not tested in accordance with C22.3 No. 9 are marked:

“NOT EVALUATED TO C22.3 NO. 9. REFER TO MANUAL. PROVIDED WITH ANTI-ISLANDING PROTECTION.”

The intent of the marking in c) is to make stakeholders in the interconnection process aware that they need to consult the documentation for the inverter or ac module, to determine what interconnection requirements were applied, if any. The marking also points out that anti-islanding protection has been evaluated, regardless of whether or not C22.3 No. 9 was applied. This information is needed during the interconnection assessment to determine if the supply authority’s requirements will be satisfied.

Multi-mode systems:

A renewable energy system that is normally interactive may be permitted to operate as a stand-alone system to supply loads that have been disconnected from an electrical production and distribution network source. ~~Marking requirements for interactive inverters are given in CSA C22.2 No. 107.1 and CAN/CSA-C22.2 No. 62109.~~	
Add new Appendix B Note for Rule 64-112 to read: **Rule 64-112** See Figure B64-8 **Figure B64-8** **Interactive Point of Connection** **(A) Sum of supply sources does not exceed equipment rating**  **(B) Sum of supply sources exceed equipment rating**  	SN4759
Renumber Appendix B Note for Rule 64-112 4) b) iii) to read: **Rule 64-112 4) ~~b) iii)~~ c)**	SN4759

Renumber Appendix B Note for Rule 64-112 e) to read: **Rule 64-112 4) ~~e)~~ g)**	SN4759
Renumber Appendix B Figures B64-8, B64-9 and B64-10 and associated cross references to read: **Figure B64-~~8~~9** **Label for photovoltaic systems that shut down the conductors leaving the array only** **Figure B64-~~9~~10** **Self-contained energy storage** **Figure B64-~~10~~11** **Field-assembled energy storage**	SN4759
Revise Appendix B Note for Rule 64-210 5) to read: **Rule 64-210 5)** The intent of this Subrule is to provide protection against damage from rodents by enclosing the photovoltaic source and output circuit insulated conductors and cables in material such as expanded metal, solid metal, and screening.	SN4587
Add new Appendix B Note for Rule 64-218 4) b) to read: **Rule 64-218 4) b)** The intent of this rule is to ensure rapid shutdown initiation devices are installed in an area that is readily accessible and in a location that provides easy identification to emergency responders who may be required to initiate the rapid shut down process. In certain instances it may not be practicable to locate these devices within 9m or within sight of an array, or there may not be a permanent roof access. Rules 64-218 6) and 64-218 7) provide additional direction for labeling and identifying this equipment at supply authority equipment and on the single line diagram required by Rule 84-030.	SN4561
Add new Appendix B Note for Rule 64-218 5) to read: **Rule 64-218 5)** It is intended by this requirement that activation of a fire alarm system also initiates rapid shutdown of the photovoltaic array. This functionality should be confirmed at the time of installation and during verification of the fire alarm system.	SN4561
Revise Appendix B Note for Rule 64-710 to read: **Rule 64-710** Fuel cells should be considered fuel-burning equipment and be installed in accordance with the National Building Code of Canada. Hydrogen-fuelled systems	SN4610

should be installed in accordance with CAN/BNQ 1784-000. Other considerations for siting and location may be found in NFPA 853.

Revise Appendix B Note for Rule 64-800 to read: SN4758 SN4834

Rule 64-800

~~The intent of this Rule is to provide direction to Code users when components, such as batteries, inverters, converters, and controls, are interconnected in the field to create an energy storage system and have not been evaluated together as an assembly in accordance with UL 9540.~~

This Rule provides direction to Code users when separate pieces of equipment, such as inverters, converters, and controls, are interconnected with batteries in the field.

Revise Appendix B Note for Rule 64-802 to read: SN4834

Rule 64-802

~~Sufficient ventilation should be provided to prevent the hydrogen gas from building up to a level of 2% by volume in the room air at any time.~~

When lead-acid batteries or other off-gassing batteries are operated in constant-voltage-float service and the float voltage is maintained at appropriate levels, generation of gas is very slight.

However sufficient ventilation should be provided to prevent the hydrogen gas from lead-acid batteries from building up to a level of 2% by volume in the room air at any time.

The rate of ventilation required to maintain the volume of hydrogen gas from lead-acid batteries below the 2% level in a battery room may be calculated in accordance with IEEE 484.

As an example, the volume of hydrogen gas generated daily by a 60 cell, 840 ampere-hour lead calcium grid battery charging at 2.2 V per cell is determined as follows:

Total m3/min of hydrogen gas = number of cells × gas generation rate of battery type in m3/min × float current in amperes × minutes/day.

$$\text{Volume of gas production} = 60 \text{ cells} \times 7.6 \times 10^{-6} \frac{\text{m}^3}{\text{min}} \times \frac{0.006 \text{ A}}{100 \text{ A.H.}} \times 840 \text{ A.H.} \times \frac{60 \text{ min}}{\text{h}} \times \frac{24}{\text{d}}$$

$$= \frac{0.03309 \text{ m}^3 \text{ gas}}{\text{day}}$$

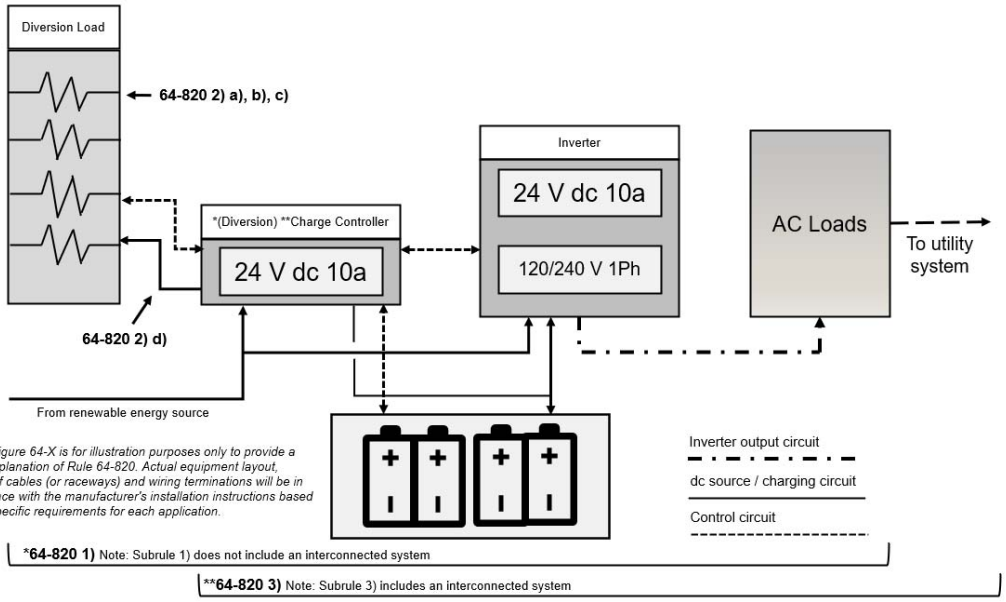
For a room volume of 30 m^3, the total volume of gas that should be allowed to accumulate in this room is 30 m^3 × 2% = 0.6 m^3.

Therefore, to meet this 2% maximum level, one air change is required ~~for each~~ every 18 days

$$\frac{0.6 \text{ m}^3}{0.03309 \text{ m}^3 \frac{\text{gas}}{\text{day}}} = 18 \text{ days}$$

~~However, a minimum of one to four air changes per hour in the battery room is recommended to prevent pockets of hydrogen gas from accumulating and to ensure the comfort of the maintenance personnel~~. Table 9.32.2.3 of the National Building

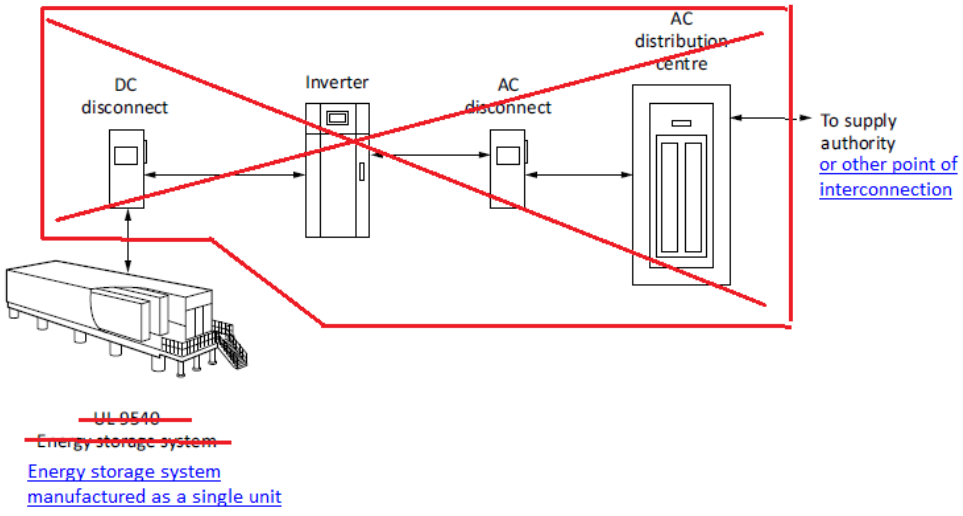
Code of Canada requires 5 L/s minimum ventilation capacity for utility rooms, which meets the minimum requirements of ventilation for rooms in dwelling units where residential battery energy storage systems using lead-acid batteries are stored (e.g. 5L/s required ventilation capacity results in 0.6 Air Changes per Hour for a 30m³ room (3.6m x 3.6m x 2.4m)).	
Revise Appendix B Note for Rule 64-802 2) to read: **Rule 64-802 2)** ~~The freezing point of the electrolyte used in a lead-acid battery is –15 °C for a specific gravity of 1.150, –20 °C for a specific gravity of 1.175, and –27 °C for a specific gravity of 1.200. The freezing point will be higher if the battery is completely discharged. Therefore, batteries should not be located in areas where the temperature is likely to fall below –7 °C.~~ Precautions should be taken to ensure the electrolyte will not be subject to temperatures below it's freezing point when installed in areas that the temperature is likely to fall below this value.–The freezing point of the electrolyte used in a lead-acid battery is –15 °C for a specific gravity of 1.150, –20 °C for a specific gravity of 1.175, and –27 °C for a specific gravity of 1.200. The freezing point will be higher if the battery is completely discharged.	SN4834
Revise Appendix B Note for Rule 64-804 1) to read: **Rule 64-804 1)** The Standard~~s~~ for batteries ~~are~~ is ANSI/CAN/UL 1973 ~~and UL 9540.~~	SN4834
Revise Appendix B Note for Rule 64-820 to read: **Rule 64-820** If any portion of a diversion charge control system fails, the batteries may be overcharged, creating a potentially hazardous condition. A second, independent charge control method minimizes these potential hazards (see Figure B64-XX). ~~problems~~ Figure B64-XX Diversion Charge Control System	SN4834



Revise Appendix B Figure B64-9 to read:

SN4758

Figure B64-9
Self-contained energy storage

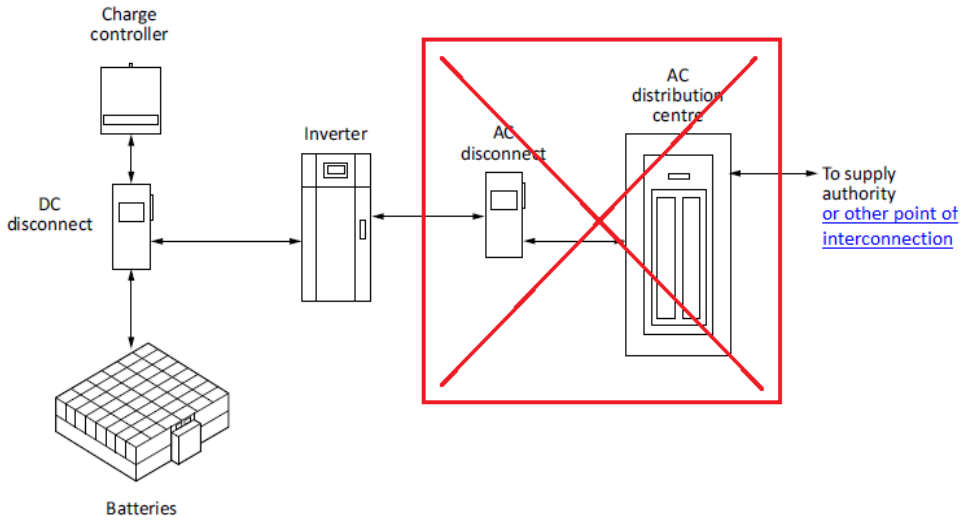


Note: *Self-contained energy storage systems may include such equipment as inverters and disconnects.*

Revise Appendix B Figure B64-10 to read:

SN4758
SN4834

Figure B64-10
Field-assembled energy storage



Note: *Field assembled energy storage systems may be multi-part assemblies that have been evaluated to ANSI/CAN/UL9540, or an assembly of equipment on site that has not been evaluated to ANSI/CAN/UL9540.*

Add new Appendix B Note for Rule 64-9902 1) to read: **Rule 64-902 1)** Placement of signage should be coordinated with the local building, fire, or other appropriate authorities having jurisdiction.	SN4834
Add new Appendix B Note for Rule 64-902 and 64-910 to read: **Rules 64-902 3) and 64-910 1)** Requirements for marking, installation and maintenance of energy storage systems are found in ANSI/CAN//UL 9540.	SN4758 SN4834
Revise Appendix B Note for Rule 64-914 to read: **Rule 64-914** ~~Disconnecting means for self-contained energy storage systems may be provided as part of the energy storage systems or may be required to be installed in accordance with the manufacturer's installation instructions.~~ Disconnecting means for energy storage systems may be provided as part of energy storage systems. When an energy storage system is not supplied with an output circuit disconnecting means, Subrule 3) provides direction on installation requirements for a field installed disconnect.	SN4758 SN4834
Delete Appendix B Note for Rule 64-918 1) ~~**Rule 64-918 1)**~~	SN4758

~~UL 9540 requires energy storage systems intended for dwelling units to be marked "Suitable for Use in Residential Dwelling Units Where Permitted".~~	
Delete Appendix B Note for Rule 64-918 2) ~~**Rule 64-918 2)**~~ ~~Alternative locations may be considered, subject to discussions with the local building, fire, or appropriate authority having jurisdiction.~~	SN4758
Delete Appendix B Note for Rule 64-918 7) ~~**Rule 64-918 7)**~~ ~~See the Note to Rules 2-328 and 64-918 7).~~	SN4758
Delete Appendix B Note for Rule 64-918 8) ~~**Rule 64-918 8)**~~ ~~UL 9540A defines a thermal runaway as "The incident when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion. The thermal runaway progresses when the cell's generation of heat is at a higher rate than the heat it can dissipate. This may lead to fire, explosion and gas evolution".~~	SN4758
Revise Appendix B Note for Rule 64-922 4) to read: **Rule 64-922 4)** ANSI/CAN/UL 9540 requires charge controllers to be part of the energy storage systems.	SN4834
Revise Appendix B Note for Rule 64-926 4) to read: **Rule 64-922~~26~~ 4)** UL 9540 requires charge controllers to be part of the ~~self-contained~~ energy storage systems.	SN4758
Add new Appendix B Note for Rule 64-924 2) to read: **Rule 64-924 2)** The intent of this rule is to acknowledge that the manufacturer's installation instructions may provide minimum working space requirements in or about equipment forming part of an energy storage system that are different than those required by other rules of this Code.	SN4758
Add new Appendix B Note for Rule 64-926 to read: **Rule 64-926**	SN4835

See the Note to Rules 2-310 1) and 64-926. The National Building Code has requirements regarding any object obstructing the minimum required width of an exit in order to not impede egress of occupants from a building in an emergency to a safe location. The National Building Code does not cover the minimum permitted distance between a means of egress and an Energy Storage System and is therefore a requirement in this rule. National Building Code of Canada defines means of egress as follows: “Means of egress means a continuous path of travel provided for the escape of persons from any point in a building or contained open space to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare. Means of egress includes exits and access to exits.	
Add new Appendix B Note for Rule 64-1002 3) to read: **Rule 64-1002 3)** See the Note to Rule 2-328.	SN4758
Add new Appendix B Note for Rule 64-1100 1) to read: **Rule 64-1100 1)** The fire resistance rating of ceilings, floors, and walls constructed for the purposes of this rule should be verified by a qualified individual in accordance with the requirements of the authority having jurisdiction prior to installation. Additional information regarding the Standard Methods of Fire Endurance Tests of Building Construction And Materials is found in CAN/ULC-S101. This standard covers fire endurance tests applicable to walls, partitions, floors, roofs, ceilings, columns, beams, and girders, as well as to some components of these building sub-assemblies. Additional information regarding fire resistance values of generic wall and floor assemblies can be found in Table 9.10.3.1.A and 9.10.3.1.B of the National Building Code of Canada or in Appendix D of the National Building Code of Canada. An example of a wall providing a 1h fire resistance ratings is a construction of 38 mm × 89 mm wood studs spaced 400 mm or 600 mm o.c. without absorptive material in the cavity and with one layer of 15.9 mm Type X gypsum board on each side. An example of a floor/ceiling assembly providing a 1h fire resistance rating is a construction of a typical wooden subfloor (15.5 mm plywood, Oriented Strand Board (OSB) or waferboard, or 17 mm tongue and groove lumber) on wood joists or wood I-joists spaced not more than 400 mm o.c. and 2 layers of 12.7 mm Type X gypsum board on the ceiling side without absorptive material in cavity. Where the spacing of the joists is 600mm, two layers of 15.9 mm Type X gypsum board would be required to achieve the same rating. Alternative locations or wall, ceilings and floor assemblies may be considered, subject to acceptance from the local building, fire, or other appropriate authority having jurisdiction.	SN4758 SN4835
Add new Appendix B Note for Rule 64-1100 3) to read:	SN4835

Rule 64-1100 3) In accordance with the National Building Code of Canada, rooms containing fuel-fired appliances are not permitted to be installed directly under a required exit. Although an energy storage system is not a fuel-burning appliance, similar concerns exist for energy storage systems and are therefore also not permitted to be located directly under a required exit.	
Add new Appendix B Note for Rule 64-1100 8) to read: **Rule 64-1100 8)** The test methodology in the ANSI/CAN/UL9540A standard determines the capability of a battery technology to undergo thermal runaway. Thermal runaway is defined as “The incident when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion. The thermal runaway progresses when the cell’s generation of heat is at a higher rate than the heat it can dissipate. This may lead to fire, explosion and gas evolution”. As part of the energy storage system certification process to ANSI/CAN/UL9540, the testing data generated by ANSI/CAN/UL9540A may be used to determine acceptable installation practices such as but not limited to location of the energy storage system, aggregate capacity limitations, ventilation, and spacing requirements from other energy storage systems. The intent of this rule is to recognize where such systems have undergone this testing that the requirements of Subrules 1) through 7) may not be required. ANSI/CAN/UL 9540 requires energy storage systems intended for installation in the habitable or living space of dwelling units to meet the cell level performance criteria of ANSI/CAN/UL9540A	SN4758 SN4834
Add new Appendix B Note for Rule 66-400 3) c) iv) to read: **Rule 66-400 3) c) iv)** Equipment placed under a temporary structures, such as a tents, should be considered as being used in a damp locations. A portable Class A GFCI device may be used to meet this requirement.	SN4140
Add new Appendix B Note for Rule 66-456 3) e) ii) to read: **Rule 66-456 3) e) ii)** The NEMA single-pole separable ball nose male connector coloured taping needs to begin 30 mm back from the front end to allow expansion of the un-taped portion of the boot/shroud when the male is being mated with the ball nose female connector	SN4180
Add new Appendix B Note for Rule 68-050 to read: **Conductive pool shell**	SN4816

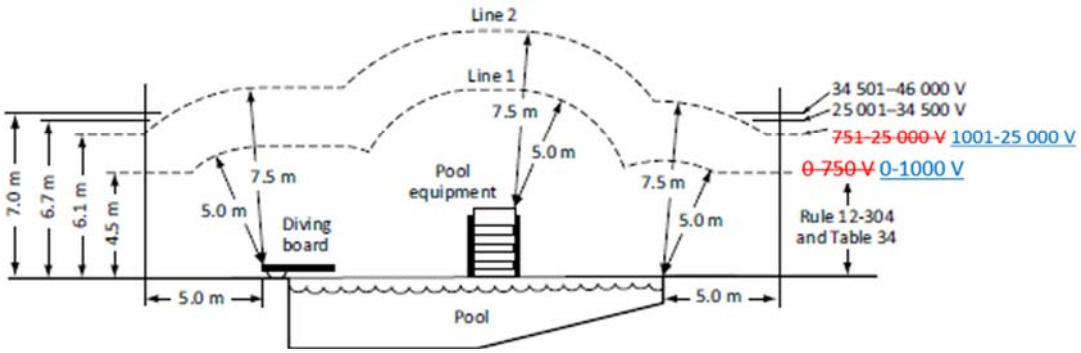
Pool shells which are considered to be non-conductive include vinyl liners and fiberglass composite shells. It is intended that all conductive materials associated with non-conductive pool shells are bonded (such as metal coping tracks for the liner bead, metal liner backings and supports, etc.)

Revise Appendix B Note for Rule 68-054 to read: SN4730-68

Rule 68-054
Figure B68-1 illustrates the minimum clearances for conductors over swimming pools. No conductors are permitted under any circumstances in the area under Line 1. In the area above Line 1, insulated communication conductors and neutral supported cables operating at ~~750 V~~ 1000 V or less may be permitted [see Subrules 2) and 3)]. Any other conductors operating at not more than 50 kV are permitted above the area outlined by Line 2 [see Subrules 2) and 4)].

Revise Appendix B Note Figure B68-1 to read: SN4730-68

Figure B68-1
Minimum clearances for conductors over swimming pools



Add new Appendix B Note for Rule 68-058 3) to read: SN4816

Rule 68-058 3)
To reduce the likelihood of potential differences and shock hazards in existing installations of storable pools, hot tubs and spas it is recommended that a copper ring be installed in accordance with Subrule 68-058 3) c).

Equipotential bonding is not required for nonconductive sections of perimeter surfaces that are separated from the earth or other conductive surfaces or raised on nonconductive supports, and is not required for any conductive perimeter surface that is electrically separated from the pool structure and raised on nonconductive supports above an equipotentially bonded surface.

Some examples of nonconductive materials are wood, plastic, wood-plastic composites, fiberglass, fiberglass composites, etc.

Revise Appendix B Note for Tables 6A to 6K to read: **Tables 6A to 6K** The calculated values in Tables 6A to 6K are based on conventional concentric stranded conductors ~~as detailed in Tables 10A and 10B~~. The calculated values in these Tables are based on raceways selected from Tables 9A to 9H. The diameters of the insulated conductors are calculated based on the nominal diameter of the conductors for a given class and the nominal thickness of the insulation for the conductor or cable type. The applicable product standard for conductors and cables identified in Tables 6A to 6K does not require the stranding class to be marked on the conductor or cable unless the class is other than Class B or Class C. The values in Tables 6A to 6K have been determined using Class B or Class C strand cables and conductors as shown in the tables. Insulated conductors with classes of stranding other than Class B and C (identified in Tables 6A to 6K are permitted in the product standards but may result in a different overall diameter for the same gauge of conductor exceeding allowed raceway fill.	SN4703
Delete Appendix B Note for Tables 10A, 10B, 10C, and 10D: ~~**Tables 10A, 10B, 10C, and 10D**~~ ~~The diameters of the insulated conductors are calculated based on the nominal diameter of the conductors for a given class and the nominal thickness of the insulation for the conductor or cable type.~~ ~~Classes of stranding other than those identified in Tables 10A and 10B are permitted and will result in different diameters for the same gauge of conductor. Use of higher class stranding could result in the acceptable conduit fill being exceeded.~~	SN4703
Add Appendix B Note for Table 72 to read: **Table 72** The minimum sag table has been calculated based on No. 6 AWG quadruplex neutral supported cable with a bonding conductor which was determined to be the worst case for all neutral supported cable constructions for “pole to pole” installations, when subjected to CSA heavy or severe loading conditions. The minimum sag table has been calculated based on 336.4 kcmil quadruplex neutral supported cable with a bonding conductor which was determined to be the worst case for all neutral supported cable constructions for “pole to mast” installations, when subjected to CSA heavy or severe loading conditions. CSA heavy loading conditions are defined in CSA C22.3 No. 1 “Overhead systems”, Table 30 “Deterministic weather loads”, as follows: a) radial thickness of ice of 12.5 mm; b) horizontal wind loading of 400 N/m2; and c) ambient temperature of -20 degrees Celsius. CSA severe loading conditions are defined in CSA C22.3 No. 1 “Overhead systems”, Table 30 “Deterministic weather loads”, as follows:	SN4697

a) radial thickness of ice of 19.5 mm; b) horizontal wind loading of 400 N/m2; and c) ambient temperature of -20 degrees Celsius.	
Add Appendix B Note for Table D3 to read: **Table D3** The K value multiplier of Note 4 is based on a 30 °C ambient with a maximum 10 °C temperature rise. As the operating temperature of a conductor increases so too does its resistance, which increases voltage drop. Conductors loaded to their ampacity will exceed the 40 °C operating temperature assumed by the note, resulting in an underestimation of voltage drop, which has a marked adverse effect on extra-low voltage circuits. To limit the conductor operating temperature of extra-low voltage power circuits to approximately 40 °C, Note 4 restricts load current to no more than two-thirds of the ampacity of copper conductors at 60 °C in Table 2.	SN4748-8

Appendix C

Add new Clauses C5.5.1 to C5.5.5 to read: SN4377

C5.5.1
Where it is intended to make parallel changes to Section 18 and Annex J18, separate companion proposals shall be submitted concurrently

C5.5.2
Where a proposal is intended to change either Section 18 or Annex J18, but not both, the Section 18 subcommittee shall, prior to or in parallel with the deliberations, review the proposal for its suitability as a stand-alone proposal.

C5.5.3
Where, in accordance with Clause C5.5.2, the Subcommittee determines that a companion proposal is required, a concurrent proposal shall be prepared by the submitter or by a Section 18 subcommittee member.

C5.5.4
Where, in accordance with Clause C5.5.2, the Subcommittee determines that a companion proposal is not required, this finding shall be documented by the Subcommittee and included with the recommendation submitted to the Committee on Part I for ballot approval.

C5.5.5
Each proposal shall be processed in accordance with Clause C5.4.

Revise Clause C9.9 to read: SN4625

C9.9
When ~~T~~the Section Subcommittee ~~shall present a~~

a) achieves consensus on an interpretation, the recommended interpretation shall be presented to the Committee on Part I for vote~~. Voting shall be~~ in accordance with Clause C7.1~~.~~; or

b) cannot achieve consensus on an interpretation, the subcommittee shall, in consultation with the submitter and in accordance with Clause C6, create a request for amendment to address the ambiguity of the subject Rule.

Renumber existing Clauses C11.20 to C11.30 as C11.21 to C11.31 and add new Clause C11.20 to read: SN4616

C11.20
The following requirements shall apply to Terms and Definitions, whether in Section 0 or in Special Terminology

a) terms shall appear in alphabetical order and the terms being defined shall be written out completely;

b) each definition shall contain a brief, self-contained description of the term in question and shall not contain any other information such as requirements, elaborative text, or recommendations; and

c) in general, the term should not be used in its own definition.

Revise Annex C to read:

SN4398

Annex C
Guide to Subcommittee chairs for evaluation of proposals submitted in accordance with Clause C5.4.1 and for evaluation of Subcommittee reports required in accordance with Clause C5.4.5

Note: *This Annex contains the suggested criteria for evaluating the feasibility of proposals for Code amendments and of reports provided by the Subcommittee on these proposals.*

1) The following are the basic principles for evaluating the submitted proposals. When a request is made to amend the Code, the following general criteria should be considered:

a) improvements to safety;
b) clarification of the existing wording;
c) correlation with product Standards requirements;
d) technological changes; and
e) ~~correlation with the National Electrical Code, National Building Code of Canada, and other relevant CSA, NFPA, or ULC Standards (CAN/CSA-B72, CSA C22.3 No. 1, CSA C22.3 No. 7, CSA C282, CSA Z32, NFPA 20, CAN/ULC-S524, etc.).~~ correlation with other relevant CSA, NFPA, NRC, IEC, UL, or ULC Codes and Standards

2) The Section Subcommittee that will be deliberating the proposed Code amendment should consider the following measurement points before accepting the submission for deliberation by the Subcommittee:

a) Does the subject have relevance to the Code?
b) Are the reasons and supporting information that are required to be submitted with the proposal deemed sufficient to meet all applied measurement points? (Frivolous proposals should not be accepted.)
c) Does the subject try to do what has already been attempted? It may be necessary to research the topic to find out if it has been dealt with in previous years. If the issue was dealt with at a previous time, it should not be handled again unless there is reason to do so.
d) For a proposed definition, does the term actually appear in the Code? Is a definition really required or is the terminology used in a dictionary sufficient? Is the definition necessary only in one Section of the Code or should it be in Section 0 (General Section)?
e) Is it a safety issue? The CE Code is a safety Standard for installation and maintenance only, so convenience or other issues should not qualify for inclusion.
f) Is the proposal technically sound?

g) Is the proposal dealing with a very prescriptive method that would exclude other methods of achieving the same desired goal?
h) Is it consistent with the language of the Code?
i) Is this Rule enforceable (i.e., it is written in unambiguous language, using indisputable criteria)?
Note: *The Code user must also be able to determine compliance from a visual inspection of the installation on site and without the use of supplementary information or judgment. Rules that, in their wording, require a great deal of judgment on the part of the reader may not be consistently enforced and are a source of conflict and frustration to users of the Code.*
~~j) Is this proposal consistent with the *National Electrical Code*? If it is not, there should be sufficient reasons provided by the submitter.~~
~~k)~~ j) Is the proposal in conflict with other CSA Standards (i.e., the *CE Code, Part II* Standards) or other Canadian safety Standards for electrical equipment?
Note: *The* CE Code, Part I *is not supposed to include* CE Code, Part II *(product design and construction) or other Canadian safety Standards for electrical equipment requirements, unless it is as an interim measure and is substantiated accordingly.*
~~l)~~ k) Is the proposal in conflict with other relevant Codes, such as the *National Building Code of Canada*? Is the proposal in conflict with industry-specific Codes such as NFPA Codes that deal with specific occupancies, hazardous locations, Codes of practice (e.g., API), *CE Code, Part III* Standards, etc.?
~~m)~~ l) If accepted, would this proposal have an impact on already certified products (i.e., would the existing products have to be recertified to meet this new requirement, and is such an approach justifiable)?
~~n)~~ m) Does the subject impact on other Sections, Tables, and Appendices of the Code? If so, have the potential consequences been reviewed?
~~o)~~ n) Does the document style conform with CSA editorial requirements (CSA Guidelines)?
~~p)~~ o) Does the proposal introduce amendments that will require new product Standards or changes to existing product Standards? If so, consideration should be given to including a statement in the proposal that the amendments, if approved, should be suspended until such time that the product requirements are in effect.

3) The following are the basic principles for evaluating the Subcommittee recommendation before reporting it to the Committee on Part I:
a) Is the Subcommittee recommendation understandable and readable?
b) Has the length of the Subcommittee recommendation been reduced to the absolute minimum necessary to convey the intent? It should be noted that the members of the Committee on Part I may not have the time to review long subjects when they come in the form of the Subcommittee recommendation. A suitable one-page summary should be made, especially for lengthy proposals. This would enable members of the Committee on Part I (who are not necessarily technical experts in the specific subject area) to understand the key issues, recommendations, and impacts of the proposal.
c) Has the Subcommittee recommendation expanded to include issues other than that which the original proposal intended to cover? If so, is this expansion of the subject matter justifiable (i.e., it was discussed with the submitter and it is accepted by the submitter) or should it be more appropriately covered by a new subject?
d) Does the Subcommittee recommendation address the issues of the original proposal and satisfy the submitter's intent or does it digress?

Appendix D

Delete Table D3 and replace with new Table:

SN4582
SN4748-8

Table D3
K values* for calculating voltage drop in an installation of 2, 3 or 4 insulated conductors in a cable or raceway based on a conductor operating temperature of 75 °C
(See Appendix B Note to Rule 8-102.)

Size, AWG or kcmil	Copper						Aluminum					
	Cable or Raceway		Cable†		Raceway‡		Cable or Raceway		Cable†		Raceway‡	
	DC	100% pf	90% pf	80% pf	90% pf	80% pf	DC	100% pf	90% pf	80% pf	90% pf	80% pf
14	10.2	10.2	9.92	9.67	10.0	9.67	—	—	—	—	—	—
12	6.38	6.38	6.25	6.10	6.26	6.11	10.5	10.5	10.3	10.0	10.3	9.99
10	4.03	4.03	3.96	3.87	3.96	3.87	6.58	6.58	6.44	6.28	6.45	6.29
8	2.54	2.54	2.50	2.45	2.51	2.45	4.14	4.14	4.07	3.97	4.07	3.98
6	1.59	1.59	1.58	1.55	1.58	1.55	2.62	2.62	2.58	2.52	2.58	2.53
4	1.01	1.01	1.01	0.987	1.01	1.00	1.65	1.65	1.63	1.60	1.64	1.61
3	0.792	0.792	0.797	0.787	0.801	0.792	1.30	1.31	1.30	1.27	1.30	1.28
2	0.626	0.627	0.636	0.629	0.639	0.635	1.04	1.04	1.04	1.02	1.04	1.03
1	0.500	0.500	0.512	0.509	0.516	0.515	0.820	0.820	0.823	0.812	0.827	0.818
1/0	0.395	0.396	0.410	0.409	0.414	0.415	0.651	0.652	0.659	0.652	0.663	0.657
2/0	0.314	0.316	0.331	0.332	0.335	0.338	0.516	0.517	0.526	0.522	0.530	0.528
3/0	0.249	0.251	0.267	0.270	0.271	0.275	0.408	0.409	0.420	0.419	0.424	0.425
4/0	0.197	0.200	0.217	0.221	0.221	0.226	0.326	0.327	0.341	0.341	0.345	0.347
250	0.167	0.171	0.188	0.193	0.192	0.198	0.275	0.277	0.291	0.293	0.295	0.299
300	0.140	0.144	0.162	0.167	0.166	0.172	0.229	0.231	0.247	0.249	0.250	0.255
350	0.120	0.125	0.143	0.148	0.147	0.154	0.196	0.199	0.215	0.218	0.219	0.224
400	0.105	0.111	0.129	0.135	0.133	0.140	0.172	0.175	0.191	0.195	0.195	0.201
500	0.0836	0.0912	0.110	0.116	0.114	0.121	0.138	0.141	0.158	0.163	0.162	0.168
600	0.0697	0.0785	0.0969	0.104	0.101	0.109	0.115	0.119	0.136	0.142	0.140	0.147
750	0.0558	0.0668	0.0850	0.0915	0.0889	0.0970	0.0916	0.0968	0.115	0.121	0.119	0.126
1000	0.0417	0.0558	0.0739	0.0805	0.0778	0.0860	0.0686	0.0758	0.0933	0.0994	0.0973	0.105

* *K* values in this Table are based on IEC 60287-1-1:2006, Electric cables – Calculation of the current rating – Part 1-1: Current rating equations (100 % load factor) and calculation of losses – General, and IEEE 141-1993, Recommended Practice for Electric Power Distribution for Industrial Plants, pp. 69-100.
† Includes manufactured multi-conductor assemblies.
‡ Random single conductors pulled in raceway or laid flat and touching.

Notes:

1) Voltage drop for a known conductor size may be calculated from the Table using the following formula:

$$VD = \frac{K \times f \times I \times L}{1000};$$

When the conductor size is not known, the maximum *K* factor may be calculated using the following formula:

$$K \leq \frac{VD \times 1000}{I \times L \times f};$$

When the conductor size is known, the maximum cable length may be calculated using the following formula:

$$L \leq \frac{VD \times 1000}{I \times K \times f};$$

The percent voltage drop (*VD%*) is:

$$VD\% = \frac{VD}{V} \times 100;$$

Where:

V is the connected load voltage at the source;

VD is the voltage difference between the source and the load expressed in volts;
K is the Table voltage drop factor in Ohms per circuit kilometre;
f is the voltage drop factor based on the electrical system and circuit identified in the Voltage Drop Factor Table;
I is the circuit conductor ampacity in Amperes; and
L is the length of the circuit conductors in metres.

2) The voltage drop factor (*f*) shall be determined from the following table*:

Type of electrical system	Type of circuit for electrical load (number of circuit conductors)	Voltage drop factor (*f*)	Voltage (*V*)
DC	2-wire, positive-to-negative	2	Positive-to-negative
	2-wire, positive-to-grounded conductor	2	Positive-to-grounded conductor
	2-wire, negative-to-grounded conductor	2	Negative-to- grounded conductor
	3-wire, line-to-line with grounded conductor	2	Line-to-line
1-phase AC	2-wire, line-to-grounded conductor	2	Line-to-grounded conductor
	2-wire, line-to-line	2	Line-to-line
	3-wire, line-to-line, with grounded conductor	2	Line-to-line
3-phase AC	2-wire, line-to-grounded conductor	2	Line-to- grounded conductor
	2-wire, line-to-line, no grounded conductor	2	Line-to-line
	3-wire, line-to-line, with grounded conductor	2	Line-to-line
	3-wire, line-to-grounded conductor	2	Line-to-grounded conductor
	3-wire, line-to-line, no grounded conductor	1.73	Line-to-line
	4-wire, line-to-line, with grounded conductor	1.73	Line-to-line

* Note that the grounded conductor referred to in this table is a circuit grounded conductor (neutral or identified conductor).

3) To determine the voltage drop for conductors having 60 °C and 90 °C operating temperatures, multiply the *K* value by 0.95 and 1.05, respectively.

4) Notwithstanding Note 3, to determine the voltage drop for extra-low voltage power circuits in which the load does not exceed two-thirds of the ampacity of copper conductors in the 60 °C column of Table 2, multiply the K value by 0.86.

Delete Table D4:

SN4748-46

Table D4
Copper conductor sizes for 5% drop in voltage on 6 V — Two conductors
[See Appendix B Note to Rule 46-306 1).]

Current, A	One-way distance from power source measured along the conductor, m (calculated for conductor temperature of 20 °C)				
	No. 12 AWG	No. 10 AWG	No. 8 AWG	No. 6 AWG	No. 4 AWG
2-1/2	11.5	18.3	28.5	49.4	72.2
4-1/4	6.8	10.8	16.8	26.7	42.5
7	4.1	6.5	10.2	16.2	25.8
10	2.9	4.6	7.1	11.3	18.0
12	2.4	3.8	5.9	9.5	15.0
15	1.9	3.1	4.8	7.6	12.0
20	1.4	2.3	3.6	5.7	9.0

Note: *Acceptable one-way distance in metres (L) for a selected conductor wire size may be calculated using the following formula where one or all of the actual current (I), the actual voltage (V), and the actual voltage drop permitted (P) differ from Table D4:*

$$L = \frac{V}{6} \times \frac{P}{5} \times \frac{I}{i} \times L_t$$

where

I_t = *current shown in Table D4 closest to the actual current (I)*

L_t = *one-way distance in metres shown in Table D4 corresponding to the conductor size used for the value I_t selected*

Example: System characteristics

V = *12 V*

P = *7%*

I = *3 A*

Wire size = No. 12 AWG

Values of I_t and L_t to be used in the calculation are

I_t = *2.5 A*

L_t = *11.5 m*

$$L = \frac{12}{6} \times \frac{7}{5} \times \frac{2.5}{3} \times 11.5 = 26.8 \text{ m}$$

Delete all occurrences of the word "allowable" in Tables D3, D8A, D8B, D9A, D9B, D10A, D10B, D11A, and D11B.

SN4628-4

Revise heading of Table D16, column 2 to read:

Minimum ~~allowable~~ ampacity of insulated conductor, A

SN4628-28

Revise Item 8 and dagger note in Table D17 as shown:

SN4601

Table D17
Conditions of use for Tables D17A to D17N*††
(See Rule 4-004.)

Item	Characteristic	Condition
"	*No change to items 1 to 7*	
"		
8	Insulated conductor or cable shield, ~~ground~~ bonding and armour bonding†	Both ends of e
"	*No change to items 9 to 18*	
"		

"

"

† *It is assumed that insulated conductor shields, ~~ground~~ bonding conductors, and armou present) are grounded at more than one point. The ampacities in the D17 series of Table been adjusted to take into consideration the heating due to shield, ~~ground~~ bonding cond and armour circulating currents.*

"

"

"

Notes not shown are unchanged

Delete all occurrences of the phrase "maximum insulated conductor" in Table D17. SN4628-4

Delete all occurrences of the word "Allowable" in Tables D17A through D17N. SN4628-4

Add new Table D18: SN4762

Table D18 - Standard conductor sizes (cross-sectional area)
(see Rule 4-002)

AWG or kcmil	circular mil	mm^2	IEC (mm^2)*
14	4110	2.08	
	4934		2.5
12	6530	3.31	
	7894		4
10	10380	5.26	
	11841		6
8	16510	8.37	
	19735		10
6	26240	13.3	
	31576		16
4	41740	21.2	

	49338		25
3	52620	26.7	
2	66360	33.6	
	69073		35
1	83690	42.4	
	98676		50
0	105600	53.5	
00	133100	67.4	
	138146		70
000	167800	85	
	187484		95
0000	211600	107	
	236823		120
250	250000	127	
	296028		150
300	300000	152	
350	350000	177	
	365102		185
400	400000	203	
	473646		240
500	500000	253	
	592057		300
600	600000	304	
700	700000	355	
750	750000	380	
	789410		400
800	800000	405	
900	900000	456	
1000	1000000	507	
	1233453		625
1250	1249241	633	
1500	1499879	760	
	1578820		800
1750	1750516	887	
	1973525		1000
2000	1993260	1010	

* This table illustrates the relationship between standard AWG or kcmil conductor cross sectional areas to standard IEC (mm^2) conductor cross sectional areas as referenced in IEC 60228.

Appendix G

Revise existing and add new Appendix G entries to read:

SN4831
SN4835
Editorial

Section 0	3.1.18.6. ~~3.1.6.6.~~, Automatic emergency generator for emergency air supply in air supported structures
Section 0	3.1.18.7. ~~3.1.6.7.~~, Electrical systems and equipment in tents and air supporting structures
Rule 2-130	3.1.5.21. ~~18.~~(2) and (3), Wires and cables within plenums of noncombustible buildings or wiring and cables that extend from plenums
Rule 2-132	3.1.5.23.(2) ~~3.1.5.21.(3),~~ Combustible raceways within plenums of noncombustible buildings
Rule 2-310	3.3.1.24. ~~3.3.1.23.~~, Obstructions
Rule 12-506 5) and 12-556 5)	3.1.5.12., Combustible interior finishes 9.21.5., Clearance from combustible construction
Rules 12-506 to 12-518 and 12-556 to 12-568	9.23.5., Drilling and notching in plates, studs, trusses, and framing members
Section 20 and Annex	6.3.1.3. ~~6.3.1.4~~., Ventilation requirement for storage garages
Rule 26-600	9.34.1.1., Electrical facilities — general
Rule 32-200	3.2.4.20. and 9.10.19.4., Smoke alarms
Section 32	3.2.4.10.(3), Sprinklers used in lieu of fire alarm system heat detectors
Section 32	3.2.4.16., Manual ~~pull~~ stations
Section 32	3.2.4.19., Visible ~~Visual~~ signal devices in a fire alarm system
Section 32	3.2.4.23. One way voice communication system
Section 32	3.2.4.9. ~~10.~~(2), Standpipe valve supervision
Section 32	3.2.6.2.(5) and (6), and 3.2.6.6.(1), Control of air-moving fans in high buildings (smoke control and smoke venting)
Sections 32 and 38	3.2.6.5. Elevator for Use by Firefighters
Sections 32, 38, and 46	3.2.7.10., Protection of electrical conductors against exposure to fire
Sections 32 and 46	3.4.6.16.(4), (5) and (6~~5~~), Release of electromagnetic locks on exit doors
Section 32	3.2.4.8.(2)(e)., Reference to NFPA 96 for commercial cooking ventilation equipment (interconnection with fire alarm system, etc.)
Section 32	9.10.8.2., Electrical ~~S~~supervision of sprinklers used in lieu of roof fire-resistance rating

Section 32	6.9.2.2., Requirement for duct type smoke detectors in circulating air handling systems
Section 32	9.10.9.17. ~~9.10.9.15~~.(2) and (3), Supervision of sprinklers used in lieu of public corridor fire separation
Section 32	9.10.18.8., Fire alarm system in open air storage garages
Section 38	3.3.1.7.(1), Protection of elevator conductors against exposure to fire for elevator used in barrier-free floor area
Section 38	3.2.4.14.(3), Alternate floor recall for elevators
Section 38	3.5.1.1., Vertical transportation facilities installed in a building, including elevators, escalators and dumbwaiters
Rule 46-400	3.4.5.1. and 3.4.5.2., Exit signs
Section 46	3.2.7.5., Emergency power supply installation in conformance with C282, general
Section 46	3.2.7.9., Emergency power supply for building services by an emergency generator (elevators, fire pumps, fans, etc.)
Section 46	3.3.1.25~~4~~., Exit signs in service spaces
Section 46	3.4.6.16.(4), (5) and (6~~5~~), Installation of electromagnetic locks
Rule 46-202 3)	3.6.2.8., Emergency power installations provided by emergency generators
Section 46	9.34.3.1, ~~Emergency lighting~~ Criteria for Emergency Lighting
Sections 32 and 46	3.2.9.1. and 9.10.1.2., Testing of Integrated fire protection and life safety systems
Rule 64-926	9.9.5.4., Obstructions in exits 9.9.5.5., Obstructions in means of egress
Rule 64-1100	9.10.3.1. Fire-Resistance and Fire-Protection Ratings Appendix D Fire-Performance Ratings

# Appendix I	
Delete all existing entries in Appendix I	
Add the following entry to Appendix I: **Rule 4-004 7)b)iii)** **Question:** Does the requirement of paragraph 4-004 7)b)iii) apply to 4 conductors described in Subrule 4-004 3)? **Answer:** No	SN4713
Add the following entry to Appendix I: **Rule 8-106 11)** **Question:** Do conditions listed in Subrule 8-106 11), allow to disregard electrical vehicle supply equipment loads connected to the distribution system panelboards, including the consumer's service, if an electric vehicle energy management system, described in Subrule 10) performs the functions of (a) monitoring the consumer's service, feeders, and branch circuits; and (b) controlling these electric vehicle supply equipment loads in accordance with Rule 8-500? **Answer:** Yes	SN4734
Add the following entry to Appendix I: **Rule 8-200 1) a) vii)** **Question:** Is calculation of an electric storage tank water heater load included in Rule 8-200(1)(a)(vii) of the CE Code? **Answer:** Yes	SN4767
Add the following entry to Appendix I: **Rule 8-202 1) a) viii)** **Question:** Is calculation of an electric storage tank water heater load included in Rule 8-202(1)(a)(viii) of the CE Code? **Answer:** Yes	SN4768
Add the following entry to Appendix I:	SN4727

Rule 10-118 **Question**: Where the consumer service conductors incorporate a bonding conductor, and the supply authority has made provision for termination of this bonding conductor, is a grounding conductor connection, to the grounded conductor supplied by the supply authority, as described in Rule 10-210 required? **Answer:** Yes	
Add the following entry to Appendix I: **Rule 10-210** **Question**: Based on the definition of consumers service in Section 0, is it permissible to connect the grounding conductor required by Rule 10-210 a) at the point where connection is made between the supply service and consumer service? **Answer**: Yes	SN4726
Add the following entry to Appendix I: **Rule 10-210 c)** **Question:** Is it permissible to connect the grounded conductor of a solidly grounded ac system supplied by the supply authority, to the grounding conductor required by Rule 10-210 a) within the transition box that is permissible by Rule 6-310 a)? **Answer:** Yes	SN4721
Add the following entry to Appendix I: **Rule 10-708 2)** **Question:** With regards to Rule 10-708 2), can a person run a #10AWG equipotential bonding conductor in the walls where it is concealed and has mechanical protection provided by location? **Answer:** Yes	SN4676
Add the following entry to Appendix I: **Rule 14-114** **Question:** Can the supplementary overcurrent protection in a portable generator as specified under C22.2 No. 100 be used as a substitute for branch circuit overcurrent devices prohibited by CE Code Rule 14-114? **Answer:** No	SN4240

Add the following entry to Appendix I: **Rule 62-102** **Question:** Is a storage-tank water heater considered a heating device? **Answer:** Yes	SN4691
Add the following entry to Appendix I: **Rule 68-058** **Question:** Does the rebar for a small pad on which a moveable Hot Tub is intended to be set and connected require bonding in accordance with Rule 68-058? **Answer:** No	SN4614A
Add the following entry to Appendix I: **Rule 68-058** **Question:** Does the rebar for a large pad/patio on which a moveable Hot Tub is intended to be set and connected require bonding in accordance with Rule 68-058? **Answer:** No	SN4614B
Add the following entry to Appendix I: **Rule 68-058** **Question:** Does the rebar for a patio from which people access a moveable Hot Tub located on the adjacent earth require bonding in accordance with Rule 68-058? **Answer:** No	SN4614C

Appendix J, Annex J18

Add new entries to Rule J18-002 to read:

SN4565-J18
SN4749-J18
SN4787-J18
SN4806-J18

J18-002 Special terminology (see Annex JB)
In this Section, the following definitions shall apply:

Dust-protected enclosure – an enclosure where the ingress of dust is not totally excluded, but where dust is unlikely to enter in sufficient quantity to interfere with the safe operation of the equipment and does not accumulate within the enclosure where it is liable to cause an ignition hazard.

Non-incendive circuit — a circuit in which any spark or thermal effect that may occur under normal operating conditions or due to opening, shorting, or grounding of field wiring is incapable of causing an ignition of the prescribed flammable gas or vapour.

Uninterrupted –

As applied to conduit - that portion of a rigid metal conduit system that includes only couplings with NPT threads.

As applied to cable – that portion of a cable system having a continuous sheath, either metal or non-metal.

Revise Rule J18-010 to read:

SN4735-J18
SN4823-J18

J18-010 Maintenance (see Annex JB)
Special precautions shall be observed as follows:
a) unauthorized repairs or alterations shall not be made to ~~live~~ equipment; ~~and~~
b) electrical equipment shall be maintained in its original safe and operable condition~~.~~; and
c) unused enclosure openings shall be suitably closed.

Revise Rule J18-072 to read:

SN4791-J18

J18-072 Bonding in hazardous locations
1) Exposed non-current-carrying metal parts of electrical equipment, including the frames or metal exteriors of motors and generators, fixed or portable luminaires or other utilization equipment, luminaires, cabinets, cases, and conduit, shall be bonded to ground using
   a) bonding conductors sized in accordance with Rule 10-616; or
   b) rigid metal conduit with threaded couplings and threaded bosses on enclosures with joints made up tight.
2) Notwithstanding Subrule 1), where raceways or cables incorporate an internal bonding conductor, box connectors with standard locknuts shall be permitted to bond the metallic armour or raceway.

Add new Rule J18-076 to read: **J18-076 Threaded joints** (see Annex JB) 1) Threaded joints that are required to be explosion-proof, flameproof "d", or flameproof "db" shall be permitted to be either tapered or straight and shall comply with the following: a) tapered threads shall have at least 4-1/2 fully engaged threads, and running threads shall not be used; and b) metric straight threads shall have a class-of-fit 6g/6H or better and at least 5 fully engaged threads. 2) Where thread forms differ between the equipment and the wiring system, suitable adapters shall be used.	SN4760-J18
Revise Rule J18-106 to read: **J18-106 Wiring methods, Class I, Division 1** (see Annex JB) 1) The wiring method shall be a) threaded rigid metal conduit with explosion-proof fittings; or b) hazardous location cables with associated cable glands suitable for the application. 2) Explosion-proof boxes, fittings, and joints shall be threaded for connection to conduit and cable glands. ~~3) Threaded joints shall have at least 5 fully engaged threads, and running threads shall not be used.~~ 3)~~4)~~ Cables shall be installed and supported so as to avoid tensile stress at the cable glands. 4)~~5)~~ Where it is necessary to use flexible connections at motor and generator terminals and similar places, flexible fittings of the explosion-proof type shall be used. 5)~~6)~~ Notwithstanding Subrules 1) to 5), intrinsically safe equipment and associated circuits designed and installed as intrinsically safe "i" or "ia" shall be permitted as specified in Rule J18-066.	SN4760-J18 SN4791-J18
Revise Rule J18-108 to read: **J18-108 Sealing, Class I, Division 1** (see Annex JB) ~~1) Explosion seals shall be provided in conduit systems where the conduit~~ ~~a) enters an explosion-proof enclosure that contains devices which produce ignition-capable arcs or temperatures; or~~ ~~b) is 53 trade size or larger.~~ ~~2) Where conduit explosion seals are required for an enclosure, they shall be located as close as practicable to the enclosure, or as marked on the enclosure, but not farther than~~ ~~a) 450 mm from the enclosure; and~~ ~~b) 50 mm from the enclosure for field-drilled entries.~~ ~~3) Where a conduit run crosses a Class I, Division 1 boundary and terminates in the Division 1 area,~~ ~~a) an explosion seal shall be installed in the conduit run~~ ~~i) within the Division 1 location; or~~ ~~ii) no more than 1 m external to the Division 1 boundary; and~~	SN4749-J18 SN4806-J18

~~b) the conduit run shall be uninterrupted between the explosion seal and the point~~
~~i) of termination within the Division 1 location; and~~
~~ii) at which the conduit crosses the Division 1 boundary.~~
~~4) Where a conduit run passes through a Class I, Division 1 area without termination, it shall not require an explosion seal, provided that~~
~~a) the conduit run is uninterrupted within the Division 1 area; and~~
~~b) the termination points of the conduit are in a non-hazardous location.~~
~~5) In Subrules 3) and 4), an uninterrupted conduit run is that portion of a conduit run which~~
~~a) except as provided for in Item b), shall not have any equipment, box, fitting, union, tee, or similar device installed; and~~
~~b) shall be permitted to have conduit couplings installed.~~
~~6) Only explosion-proof unions, reducers, and elbows that are not larger than the trade size of the conduit shall be permitted between the explosion seal and an explosion-proof enclosure.~~
~~7) A flammable fluid migration seal shall be provided where a cable first terminates after entering the Division 1 area.~~
~~8) Explosion seals shall be provided in a cable system where the cable enters an enclosure that is required to be explosion-proof.~~
~~9) Runs of cables, each having a continuous sheath, either metal or non-metal, shall be permitted to pass through a Class I, Division 1 location without seals.~~

1) Except as permitted in Subrule 2), an explosion seal shall be provided where a wiring system (conduit or cable) enters an explosion-proof enclosure.

2) An explosion seal shall not be required
   a) for a wiring system (conduit or cable) passing through a Division 1 area uninterrupted, and the termination points are in a Division 2 or non-hazardous location; or
   b) in conduit systems where the conduit enters an explosion-proof enclosure if
      i) the enclosure does not contain devices which produce ignition-capable arcs or temperatures, or the enclosure is marked “Factory Sealed” or “Seal Not Required”; and
      ii) the conduit is smaller than 53 trade size.

3) Explosion seals shall be located as close as practicable to the enclosure or as marked on the enclosure, and for conduit systems no farther than
   a) 450 mm from the enclosure; and
   b) 50 mm from the enclosure for field-drilled entries.

4) Only explosion-proof unions, reducers, adapters, and elbows that are not larger than the trade size of the conduit shall be permitted between an explosion seal and an explosion-proof enclosure.

5) Except as permitted by Rule 18-066 5), where a conduit system crosses a Division 1 boundary and terminates in the Division 1 area,
   a) an explosion seal shall be installed in the conduit
      i) within the Division 1 location; or
      ii) no more than 1 m external to the Division 1 boundary; and
   b) the conduit system shall be uninterrupted between the explosion seal and
      i) the point of termination within the Division 1 location; and
      ii) the point at which the conduit crosses the Division 1 boundary.

6) A flammable fluid migration seal shall be provided where a cable first terminates after entering the Division 1 area.	
Revise Rule J18-114 to read: **J18-114 Motors and generators, Class I, Division 1** Motors and~~,~~ generators~~, and other rotating electrical machines~~ shall comply with the requirements of Rule J18-100.	SN4791-J18
Revise Subrules J18-150 1) and 2) to read: **J18-150 Equipment in Class I, Division 2 locations** (see Annex JB) 1) Electrical ~~E~~equipment installed in a Class I, Division 2 location shall be in accordance with Table 18. 2) Notwithstanding Subrule 1) and Rule J18-052, the following shall be permitted: a) ~~transformers, solenoids, coils, and similar electromagnetic devices~~ equipment that complies ~~comply~~ with the requirements of Rule J18-054 and is any of the following: i) inductive devices, including transformers, solenoids, coils and similar equipment; ii) capacitors that do not have integral fuses; or iii) devices used for instrumentation and measurement purposes, including thermocouples, resistance temperature detectors (RTDs), piezoelectric pressure transducers and accelerometers, resistive strain gauges, passive RFID (radio frequency identification) tags and similar equipment; b) conduit and cables as specified in Rule J18-152 1); c) equipment that is installed in a Type 4 or 4X enclosure, or an IP65 or higher enclosure, and is i) non-sparking in normal operation; ii) not used for heating purposes; and iii) not otherwise provided for in Subrule 2); d) fuses, where they are used for i) the protection of equipment subject to overload during normal operation and are A) of the current-limiting, non-indicating, filled type; or B) of the current-limiting, indicating, filled type constructed in a manner such that the blown fuse indication does not cause the fuse body to be penetrated; or ii) short-circuit protection only; or e) motors~~,~~ and generators~~, and other rotating electrical machines~~ of the open or non-explosion-proof type that i) except as permitted by Subrule 3) or 4), do not incorporate arcing, sparking, or heat producing components; or ii) incorporate arcing, sparking, or heat-producing components that comply with the requirements of Rule J18-100.	SN4638-J18 SN4791-J18
Revise Subrule J18-152 to read: **J18-152 Wiring methods, Class I, Division 2** (see Annex JB)	SN4745-J18 SN4760-J18

1) The wiring method shall be

a) threaded rigid metal conduit;

b) hazardous location cables;

c) Tray cables in accordance with Rule 12-102 3); ~~Type TC cable, installed in cable tray in accordance with Rule 12-2202;~~

d) armoured and metallic sheathed cables with an overall jacket in accordance with Rule 12-102 3);~~armoured cable with overall non-metallic jacket, such as TECK90, ACWU90, copper-sheathed RC90, or aluminum sheath RA90;~~

~~e) armoured fire alarm and signal cable, such as FAS, FAS90, FAS105, FAS150, and FAS200;~~

e) Non-armoured control and instrumentation cable (CIC), and non-armoured fire alarm and signal cables (FAS), provided that
i) the installation is in cable tray in accordance with Rule 12-2202 3);
ii) the voltage rating of the cable is not less than 300 V;
iii) the circuit voltage is 150 V or less; and
iv) the circuit current is 5 A or less;

~~f) control and instrumentation cables with an interlocking metallic armour and a continuous jacket in control circuits (Type ACIC);~~

~~g) Type CIC cable (non-armoured control and instrumentation cable) installed in cable tray in accordance with the installation requirements of Rule 12-2202 2), where~~
~~i) the voltage rating of the cable is not less than 300 V;~~
~~ii) the circuit voltage is 150 V or less; and~~
~~iii) the circuit current is 5 A or less;~~

f)~~h)~~ rigid RTRC conduit Type XW, provided that
i) associated boxes, fittings, and joints are marked with the suffix "–XW"; and
ii) installation is performed in industrial establishments that are not accessible to the public and where only qualified persons service the installation;

g)~~i)~~ intrinsically safe or non-incendive wiring circuits installed in accordance with Rule J18-066; or

h)~~j)~~ liquid-tight flexible metal conduit and connectors, marked for heavy duty.

2) Explosion-proof, flameproof "d", or flameproof "db" boxes, fittings, and joints shall be threaded for connection to conduit and cable glands.

~~3) Threaded joints that are required to be explosion-proof, flameproof "d", or flameproof "db" shall be permitted to be either tapered or straight and shall comply with the following:~~
~~a) tapered threads shall have at least 5 fully engaged threads, and running threads shall not be used;~~
~~b) where straight threads are used in Groups IIA and IIB atmospheres, they shall have at least 5 fully engaged threads; and~~

~~c) where straight threads are used in Group IIC atmospheres, they shall have at least 8 fully engaged threads.~~

~~4) Where thread forms differ between the equipment and the wiring system, adapters in accordance with Rule J18-150 shall be used.~~

3)~~5)~~ Cables shall be installed and supported so as to avoid tensile stress at the cable glands.

4)~~6)~~ Boxes, fittings, and joints need not be explosion-proof, flameproof "d", or flameproof "db", except as required by the Rules in this Section.

5)~~7)~~ Cable glands shall be compatible with the degree of ingress protection and explosion protection provided by the enclosure that the cable enters, where the area classification and environmental conditions require these degrees of protection.

Revise Subrule J18-154 to read:

SN4749-J18
SN4806-J18

J18-154 Sealing, Class I, Division 2 (see Annex JB)

~~1) Explosion seals shall be provided in conduit systems where the conduit enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db", and the seals shall be located as close as practicable to the enclosure, or as marked on the enclosure, but not farther than~~
~~a) 450 mm from the enclosure; and~~
~~b) 50 mm from the enclosure for field-drilled entries.~~
~~2) Flammable fluid migration seals for conduit shall be installed where~~
~~a) the conduit leaves the Class I, Division 2 location with no box, coupling, or fitting in the conduit run between the seal and the point at which the conduit leaves the location, except that a rigid unbroken conduit that passes completely through a Class I, Division 2 area, with no fittings less than 300 mm beyond each boundary, need not be sealed, provided that the termination points of the unbroken conduit are in non-hazardous areas; or~~
~~b) the conduit leaves a Class I, Division 2 location outdoors, in which case the seal shall be permitted to be located more than 300 mm beyond the Class I, Division 2 boundary, provided that it is located on the conduit before the conduit enters an enclosure or building.~~
~~3) Only explosion-proof unions, couplings, reducers, and elbows that are not larger than the trade size of the conduit shall be permitted between the sealing fitting and an explosion-proof or flameproof enclosure.~~
~~4) An explosion seal shall be provided in a cable system where the cable enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db".~~
~~5) Where a run of conduit enters an enclosure that is required to be explosion-proof, flameproof "d", or flameproof "db", every part of the conduit from the explosion seal to that enclosure shall comply with Rule J18-106.~~
~~6) Runs of cables, each having a continuous sheath, either metal or non-metal, shall be permitted to pass through a Class I, Division 2 location without seals.~~

1) An explosion seal shall be provided in a wiring system (cable or conduit) that enters an enclosure which
a) is explosion-proof, flameproof "d", or flameproof "db";

b) contains devices which produce ignition-capable arcs or temperatures in normal operation; and c) is not marked “Factory Sealed” or “Seal Not Required”. 2) Explosion seals shall be located as close as practicable to the enclosure or as marked on the enclosure, and for conduit systems no farther than a) 450 mm from an explosion-proof enclosure; b) 50 mm from an explosion-proof enclosure for field-drilled entries; and c) 50 mm from a flameproof “d” or flameproof “db” enclosure. 3) Only explosion-proof, flameproof “d”, or flameproof “db” unions, reducers, adapters, and elbows that are not larger than the trade size of the conduit shall be permitted between an explosion seal and an explosion-proof enclosure. 4) Where an explosion seal is installed in a conduit system to provide explosion protection, the wiring method between the seal and the enclosure shall be compatible with the degree of protection provided by the enclosure in accordance with Rule 18-102. 5) Except as permitted in Subrule 6), flammable fluid migration seals for conduit shall be installed where a) the conduit leaves the Division 2 location uninterrupted between the seal and the point at which the conduit leaves the location, up to 1 m beyond each boundary, provided that all termination points of the conduit are in non-hazardous areas; or b) the conduit leaves a Division 2 location outdoors, in which case the seal shall be permitted to be located more than 1 m beyond the Division 2 boundary, provided that i) the seal and conduit are located outdoors; and ii) the conduit is uninterrupted. 6) Seals shall not be required for a wiring system (conduit or cable) passing through a Division 2 area uninterrupted, and the termination points are in a non-hazardous location.	
Delete Rule J18-208: **~~J18-208 Switches, controllers, circuit breakers and fuses, Class II, Division 1~~** ~~Switches, controllers, circuit breakers, and fuses, including pushbuttons, relays, and similar devices, shall be provided with a dust tight enclosure marked for use in Class II locations.~~	SN4788-J18
Delete Rule J18-210: **~~J18-210 Control transformers and resistors, Class II, Division 1~~** ~~Transformers, impedance coils, and resistors used as or or in conjunction with control equipment for motors, generators, or electric appliances, and the overcurrent~~	SN4788-J18

~~devices or switching mechanisms, if any, associated with them, shall be provided in dust-tight enclosures marked for use in Class II locations.~~	
Delete Rule J18-212: **~~J18-212 Motors and generators, Class II, Division 1 (see Annex JB)~~** ~~Motors, generators, and other rotating electrical machines shall be marked for use in Class II locations.~~	SN4788-J18 SN4791-J18
Revise Rule J18-214 to read: **J18-214 Ventilating pipes, Class II, Division 1** (see Annex JB) 1) Every vent pipe for a motor and~~,~~ generator~~, or other rotating electrical machine~~ or for enclosures for electrical apparatus or equipment shall a) be of metal not less than 0.52 mm (No. 24 MSG) thick or of an equally substantial non-combustible material; b) lead directly to a source of clean air outside a building; c) be screened at the outer end to prevent the entrance of small animals or birds; and d) be protected against mechanical damage and corrosion. 2) Every vent pipe and its connection to a motor, generator or to an ~~dust-tight~~ enclosure for other equipment or apparatus shall be ~~dust-tight~~ dust tight throughout its entire length. ~~3) The seams and joints of every metal vent pipe shall be~~ ~~a) riveted and soldered;~~ ~~b) bolted and soldered;~~ ~~c) welded; or~~ ~~d) rendered dust-tight by some other equally effective means.~~ 3~~4~~) No exhaust pipe shall discharge inside a building.	SN4788-J18 SN4791-J18
Delete Rule J18-216: **~~J18-216 Utilization equipment, fixed and portable, Class II, Division 1~~** ~~Utilization equipment, fixed and portable, including electrically heated and motor-driven equipment shall be marked for use in Class II locations.~~	SN4788-J18
Revise Rule J18-218 to read: **J18-218 Luminaires, Class II, Division 1** ~~1) Luminaires and portable lighting shall be complete assemblies marked for use in Class II locations and shall be clearly marked to indicate the maximum wattage of lamps for which they are approved~~. ~~2) Luminaires intended for portable use shall be complete assemblies for that purpose.~~ ~~3) Each luminaire shall be protected against physical damage by a suitable guard or by location~~	SN4786-J18

15) Luminaires shall be supported by boxes, box assemblies, and fittings that are intended for the purpose and for Class II locations. 24) Pendant luminaires shall be a) suspended by a threaded rigid conduit stem or chains with approved suitable fittings or by other approved means that do not include a flexible cord as the support medium, and threaded joints shall be provided with set screws or effective a means to prevent loosening; b) where suspended by threaded rigid conduit stems longer than 300mm, provided with i) permanent and effective bracing against lateral displacement at a level not more than 300mm from the point of attachment to the supporting box or fitting; or ii) flexibility in the form of a fitting or flexible connector suitable for the purpose and for the location not more than 300 mm from the point of attachment to the supporting box or fitting; and c) where wiring between an outlet box or fitting and the luminaire is not enclosed in conduit, provided with a flexible cord approved for extra-hard usage and suitable seals where the cord enters the luminaire and the outlet box or fitting.	
Delete Rule J18-222: **J18-222 Receptacle and attachment plugs, Class II, Division 1** Receptacles and attachment plugs shall be approved for Class II locations.	SN4788-J18
Delete Rule J18-224: **J18-224 Signal, alarm, remote control, and communication systems, meters, instruments and relays, Class II Division 1** Signal, alarm, remote control, and communication systems, meters, instruments, and relays shall conform to the following: a) All apparatus and equipment shall be provided with enclosures marked for use in Class II locations, except that i. Devices that carry or interrupt only a voice current shall not be required to be provided with such enclosures; and ii. Current-breaking contacts that are immersed in oil or enclosed in a chamber sealed against the entrance of dust shall be permitted to be provided with a general-purpose enclosure if the prevailing dust is electrically non-conductive; and b) All wiring shall comply with Rules J18-204 and J18-206	SN4788-J18
Revise Rule J18-250 to read: **J18-250 Equipment in Class II, Division 2 hazardous locations** 1) Equipment installed in a Class II, Division 2 location shall be in accordance with Table 18. 2) Notwithstanding Subrule 1, where installed in dust-protected enclosures, the following equipment shall be permitted: a) Switches, motor controllers, circuit breakers, fuses, meters, instruments, relays, transformers, impedance coils, resistors; and	SN4787-J18

b) Signal, alarm, remote control, and communications systems.	
Revise Item J18-252 3) b) to read: 3) Dry-core transformers installed in Class II, Division 2 locations shall a) be installed in electrical equipment vaults in accordance with Rules 26-350 to 26-356; or b) have their windings and terminal connections enclosed in tight housings without ventilating or other openings and operate at not more than ~~750~~ 1000 V.	SN4730-J18
Revise Rule J18-254 to read: **J18-254 Wiring methods, Class II, Division 2** (see Annex JB) 1) The wiring method shall be a) threaded rigid metal conduit; b) hazardous location cables; c) Tray cables in accordance with Rule 12-102 3); ~~Type TC cable installed in cable tray in accordance with Rule 12-2202 and enclosed in rigid conduit or another acceptable wiring method wherever it leaves the cable tray;~~ d) armoured and metallic sheathed cables with an overall jacket in accordance with Rule 12-102 3); ~~armoured cable with overall non-metallic jacket, such as TECK90, ACWU90, copper-sheathed RC90, or aluminum-sheathed RA90;~~ ~~e) armoured fire alarm and signal cable, such as FAS, FAS90, FAS105, FAS150, and FAS200;~~ e) Non-armoured control and instrumentation cable (CIC), and non-armoured fire alarm and signal cables (FAS), provided that i) the installation is in cable tray in accordance with 12-2202 3); ii) the voltage rating of the cable is not less than 300 V; iii) the circuit voltage is 150 V or less; and iv) the circuit current is 5 A or less; ~~f) control and instrumentation cables with an interlocking metallic armour and a continuous jacket in control circuits (Type ACIC);~~ ~~g) Type CIC cable (non-armoured control and instrumentation cable) installed in cable tray in accordance with the installation requirements of Rule 12-2202 2), where~~ ~~i) the voltage rating of the cable is not less than 300 V;~~ ~~ii) the circuit voltage is 150 V or less; and~~ ~~iii) the circuit current is 5 A or less;~~ f)~~h)~~ rigid RTRC conduit Type XW, provided that i) associated boxes, fittings, and joints are marked with the suffix "–XW"; and	SN4745-J18 SN4760-J18 SN4787-J18

ii) installation is performed in industrial establishments that are not accessible to the public and where only qualified persons service the installation; or g)~~i)~~ liquid-tight flexible metal conduit and connectors, marked for heavy duty. 2) Boxes and fittings in which taps, joints, or terminal connections are made shall be dust-protected. ~~either an Enclosure Type 4 or 5, or~~ ~~a) be provided with telescoping or close-fitting covers or with other effective means to prevent the escape of sparks or burning material; and~~ ~~b) have no openings, such as holes for attachment screws, through which, after installation, sparks or burning material might escape, or through which exterior accumulations of dust or adjacent combustible material might be ignited.~~ 3) Cables shall be installed and supported so as to avoid tensile stress at the cable glands. 4) Where it is necessary to use flexible connections, the provisions of Rule J18-204 4) a) and c) and 5) shall apply.	
Delete Rule J18-258: **~~J18-258 Switches, controllers, circuit breakers, and fuses, Class II, Division 2~~** ~~Enclosures for switches, motor controllers, circuit breakers, and fuses, including push buttons, relays, and similar devices, shall be either an Enclosure Type 4 or 5, or~~ ~~a) be provided with telescoping or close-fitting covers or with other effective means to prevent the escape of sparks or burning material; and~~ ~~b) have no openings, such as holes for attachment screws, through which, after installation, sparks or burning material might escape, or through which exterior accumulations of dust or adjacent combustible material might be ignited.~~	SN4787-J18 SN4788-J18
Delete Rule J18-260: **~~J18-260 Control transformers and resistors, Class II, Division 2~~** ~~1) Switching mechanisms, including overcurrent devices, used in conjunction with control transformers, impedance coils, and resistors shall be provided with enclosures conforming to Rule J18-258.~~ ~~2) Where not located in the same enclosure with switching mechanisms, control transformers and impedance coils shall be provided with tight housings without ventilating openings.~~ ~~3) Resistors and resistance devices shall have dust-tight enclosures marked for use in Class II locations, except that where the maximum normal operating temperature of the resistor will not exceed 120 °C, non-adjustable resistors and resistors that are part of an automatically timed starting sequence may have enclosures conforming to Subrule 2).~~	SN4787-J18 SN4788-J18

Revise Rule J18-262 to read: **J18-262 Motors and generators, Class II, Division 2** (see Annex JB) 1) Except as provided for in Subrule 2), motors and~~,~~ generators~~, and other rotating electrical machinery~~ shall be a) marked for use in Class II or Class II, Division 2 locations; or b) ordinary totally enclosed pipe-ventilated or totally enclosed fan-cooled, subject to the following: i) equipped with integral overheating protection in accordance with Rule 28-314; and ii) if drain holes or other openings are provided, they shall be closed with threaded plugs. 2) Where accumulations of non-conductive, non-abrasive combustible dust are or will be moderate and if machines can be easily reached for routine cleaning and maintenance, the following shall be permitted to be installed: a) standard open-type motors and generators without sliding contacts, centrifugal or other types of switching mechanisms (including motor overcurrent, overload, and overtemperature devices), or integral resistance devices; b) standard open-type machines with such contacts, switching mechanisms, or resistance devices enclosed within dust-tight housings without ventilating or other openings; and c) self-cleaning textile motors of the squirrel-cage type.	SN4791-J18
Revise Rule J18-264 to read: **J18-264 Ventilation pipes, Class II, Division 2** (see Annex JB) 1) Vent pipes for motors and~~,~~ generators~~, or other rotating electrical machinery~~, or for enclosures for electrical apparatus or equipment, shall conform to Rule J18-214 1). 2) Vent pipes and their connections shall be sufficiently tight to prevent the entrance of appreciable quantities of dust into the ventilated equipment or enclosure, and to prevent the escape of sparks, flame, or burning material that might ignite accumulations of dust or combustible material in the vicinity. 3) Where metal vent pipes are used, lock seams and riveted or welded joints shall be permitted to be used and, where some flexibility is necessary, for example at connections to motors, tight-fitting slip joints shall be permitted to be used.	SN4791-J18
Delete Rule J18-266: ~~**J18-266 Utilization equipment, fixed and portable, Class II, Division 2**~~ ~~1) Electrically heated utilization equipment, whether fixed or portable, shall be marked for use in Class II locations~~. ~~2) Motors of motor-driven utilization equipment shall conform to Rule J18-262.~~ ~~3) The enclosure for switches, circuit breakers, and fuses shall conform to Rule J18-258.~~ ~~4) Transformers, impedance coils, and resistors forming part of or used in connection with utilization equipment shall conform to Rule J18-260 2) and 3).~~	SN4788-J18

Revise Rule J18-268 to read: **J18-268 Luminaires, Class II, Division 2** 1) Luminaires shall be installed in accordance with Rule J18-218. ~~1) Lighting equipment shall conform to the following:~~ ~~a) portable lamps shall be complete assemblies marked for use in Class II locations and shall be clearly marked to indicate the maximum wattage of lamps with which they are permitted to be used; and~~ ~~b) luminaires shall~~ ~~i) be protected from physical damage by suitable guards or by location;~~ ~~ii) provide enclosures for lamps and lampholders that shall be designed to minimize the deposit of dust on lamps and to prevent the escape of sparks, burning material, or hot metal; and~~ ~~iii) be clearly marked to indicate the maximum wattage of lamps for which they are permitted to be used without exceeding the marked maximum surface temperature or temperature code.~~ ~~2) Pendant luminaires shall be~~ ~~a) Suspended by a threaded rigid conduit stem or chains with approved fittings or by other approved means that do not include a flexible cord as the support medium, and threaded joints shall be provided with set screws or effective means to prevent loosening.~~ ~~b) Where suspended by threaded rigid conduit stems longer than 300mm, provided with~~ ~~i. Permanent and effective bracing against lateral displacement at a level not more than 300mm from the point of attachment to the supporting box or fitting~~ ~~ii. Flexibility in the form of a fitting or flexible connector suitable for the purpose and for the location not more than 300 mm from the point of attachment to the supporting box or fitting; and~~ ~~c) where wiring between an outlet box or fitting and the luminaire is not enclosed in conduit, provided with an extra-hard-usage flexible cord.~~ ~~3) Luminaires shall be supported by boxes, box assemblies, and fittings that are intended for the purpose.~~ 2~~4~~) Starting and control equipment for mercury vapour and fluorescent lamps shall ~~conform to~~ comply with Rule J18-260.	SN4786-J18
Delete Rule J18-274: ~~**J18-274 Signal, alarm, remote control, and communication systems, meters, instruments, and relays, Class II, Division 2**~~ ~~Signal, alarm, remote control, and communications systems, meters, instruments, and relays shall conform to the following:~~ ~~a) contacts that interrupt other than voice currents shall be enclosed in conformity with Rule J18-258;~~ ~~b) the windings and terminal connections of transformers and choke coils that may carry other than voice currents shall be provided with tight enclosures without ventilating openings; and~~ ~~c) resistors, resistance devices, thermionic tubes, and rectifiers that may carry other than voice currents shall be provided with Class II dust-tight enclosures, except that where the maximum normal operating temperature of thermionic tubes, non-adjustable resistors, or rectifiers will not exceed 120 °C, such devices shall be permitted to have tight enclosures without ventilating openings.~~	SN4787-J18 SN4788-J18

Revise Rule J18-300 to read: **J18-300 Equipment in Class III, Division 1 hazardous locations** 1) Equipment installed in a Class III, Division 1 location shall be in accordance with Table 18. 2) Notwithstanding Subrule 1), where installed in dust-protected enclosures, the following equipment shall be permitted: a) Switches, motor controllers, circuit breakers, fuses, meters, instruments, relays, transformers, impedance coils, resistors; and b) Signal, alarm, remote control, and communications systems.	SN4787-J18
Revise Subrule J18-304 1) to read: **J18-304 Wiring methods, Class III, Division 1** (see Annex JB) 1) The wiring method shall be a) threaded rigid metal conduit; b) hazardous location cables; c) electrical metallic tubing; d) armoured and metallic sheathed cables with an overall jacket in accordance with Rule 12-102 3); or ~~d) armoured cable with overall non-metallic jacket, such as TECK90, ACWU90, copper-sheathed RC90, or aluminum-sheathed RA90;~~ ~~e) armoured fire alarm and signal cable, such as FAS, FAS90, FAS105, FAS150, and FAS200;~~ ~~f) control and instrumentation cables with an interlocking metallic armour and a continuous jacket in control circuits (Type ACIC); or~~ e)~~g)~~ liquid-tight flexible metal conduit and connectors, marked for heavy duty. 2) Boxes and fittings in which taps, joints, or terminal connections are made shall be dust-protected. ~~either an Enclosure Type 5 or shall~~ ~~a) be provided with telescoping or close-fitting covers or with other effective means to prevent the escape of sparks or burning material; and~~ ~~b) have no openings, such as holes for attachment screws, through which, after installation, sparks or burning material might escape, or through which adjacent combustible material might be ignited.~~ 3) Cables shall be installed and supported so as to avoid tensile stress at the cable glands. 4) Where it is necessary to use flexible connections, the provisions of Rule J18-204 4) a) and c) and 5) shall apply.	SN4745-J18 SN4787-J18

Delete Rule J18-306: ~~**J18-306 Switches, controllers, circuit breakers, and fuses, Class III, Division 1**~~ ~~Enclosures for switches, motor controllers, circuit breakers, and fuses, including push buttons, relays, and similar devices, shall be either an Enclosure Type 5 or shall be tight enclosures designed to minimize entrance of fibres and flyings, and shall~~ ~~a) be provided with telescoping or close-fitting covers or with other effective means to prevent the escape of sparks or burning material; and~~ ~~b) have no openings, such as holes for attachment screws, through which, after installation, sparks or burning material might escape, or through which exterior accumulations of fibres or flyings or adjacent combustible material might be ignited.~~	SN4787-J18 SN4788-J18
Delete Rule J18-308: ~~**J18-308 Control transformers and resistors, Class III, Division 1**~~ ~~Transformers, impedance coils, and resistors used as or in conjunction with control equipment for motors, generators, and appliances shall conform to Rule J18-260, with the exception that, when these devices are in the same enclosure with switching devices of such control equipment and are used only for starting or short-time duty, the enclosure shall conform to the requirements of Rule J18-306.~~	SN4787-J18 SN4788-J18
Revise Rule J18-310 to read: **J18-310 Motors and generators, Class III, Division 1** 1) Except as provided for in Subrule 2), motors~~,~~ and generators~~, and other rotating electrical machinery~~ shall be a) totally enclosed non-ventilated; b) totally enclosed pipe-ventilated; or c) totally enclosed fan-cooled. 2) Where only moderate accumulations of lint and flyings are likely to collect on, or in the vicinity of, a rotating electrical machine and the machine is readily accessible for routine cleaning and maintenance, it shall be permissible to install the following in the location: a) standard open-type machines without sliding contacts or centrifugal or other types of switching mechanisms, including motor overload devices; b) standard open-type machines that have contacts, switching mechanisms, or resistance devices enclosed within tight housings without ventilating or other openings; or c) self-cleaning textile motors of the squirrel-cage type. 3) Motors and~~,~~ generators~~, or other rotating electrical machinery~~ of the partially enclosed or splash-proof type shall not be installed in Class III locations.	SN4791-J18
Revise Subrule J18-312 1) to read: **J18-312 Ventilating pipes, Class III, Division 1** (see Annex JB) 1) Vent pipes for motors and~~,~~ generators~~, or other rotating electrical machinesry~~ or for enclosures for electrical apparatus or equipment shall conform to Rule J18-214 1).	SN4791-J18

Delete Rule J18-314: ~~**J18-314 Utilization equipment, fixed and portable, Class III, Division 1**~~ ~~1) Electrically heated utilization equipment, whether fixed or portable, shall be marked for use in Class III locations.~~ ~~2) Motors of motor-driven utilization equipment shall conform to Rule J18-310.~~ ~~3) The enclosures for switches, motor controllers, circuit breakers, and fuses shall conform to Rule J18-306.~~	SN4787-J18 SN4788-J18
Revise Rule J18-316 to read: **J18-316 Luminaires, Class III, Division 1** 1) Luminaires shall be installed in accordance with Rule J18-218. ~~1) Lighting equipment shall conform to the following:~~ ~~i) Portable lamps shall~~ ~~i. Be eequipped with handles;~~ ~~ii. Be protected with substantial guards~~ ~~iii. Have lampholders of the unswitched type with no exposed metal parts and without provisions for receiving attachment plugs; and~~ ~~iv. In all other aspects comply with item b); and~~ ~~b) Luminaires shall~~ ~~i. Provide enclosures for lamps and lampholders that shall be designed to minimize the entrance of fibres and flyings and to prevent the escape of sparks, burning material, or hot metal; and~~ ~~ii. Be clearly marked to indicate the maximum wattage lamp that is permitted to be used without exceeding a maximum exposed surface temperature of 165C under normal conditions of use.~~ ~~2) Luminaires that may be exposed to physical damage shall be proteted by a suitable guard.~~ ~~3) Pendent luminaires shall comply with Rule J18-262 2).~~ ~~4) Luminaires shall be supported by boxes, box assemblies, or fittings designed for the purpose.~~ 2~~5~~) Starting and control equipment for mercury vapour and fluorescent lamps shall comply with Rule J18-308.	SN4786-J18
Delete Rule J18-322: ~~**J18-322 Signal, alarm, remote control, and communication systems, Class III, Division 1**~~ ~~Signal, alarm, remote control, and communication systems shall comply with Rule J18-274.~~	SN4787-J18
Delete Item J18-324 d) to read: **J18-324 Electric cranes, hoists, and similar equipment, Class III, Division 1** Where installed for operation over combustible fibres or accumulations of flyings, travelling cranes and hoists for material handling, travelling cleaners for textile machinery, and similar equipment shall conform to the following:	SN4787-J18 SN4788-J18

a) the power supply to contact conductors shall be isolated from all other systems, ungrounded, and equipped with i) recording ground detection that will give an alarm and will automatically de-energize the contact conductors in case of a fault to ground; or ii) ground fault detection that will give a visual and audible alarm and maintain the alarm as long as power is supplied to the system and the ground fault remains; b) contact conductors shall be located or guarded so as to be inaccessible to other than authorized persons and shall be protected against accidental contact with foreign objects; and c) current collectors shall conform to the following: i) they shall be arranged or guarded to confine normal sparking and to prevent escape of sparks or hot particles; ii) to reduce sparking, two or more separate surfaces of contact shall be provided for each contact conductor; and iii) reliable means shall be provided to keep contact conductors and current collectors free of accumulations of lint or flyings.~~; and~~ ~~d) control equipment shall comply with Rules J18-306 and J18-308.~~	
Revise Rule J18-350 to read: **J18-350 Equipment in Class III, Division 2 hazardous locations** 1) Electrical equipment installed in a Class III, Division 2 location shall be in accordance with Table 18. 2) Notwithstanding Subrule 1), where installed in dust-protected enclosures, the following equipment shall be permitted: a) Switches, motor controllers, circuit breakers, fuses, meters, instruments, relays, transformers, impedance coils, resistors; and b) Signal, alarm, remote control, and communications systems.	SN4787-J18
Revise Rule J18-354 to read: **J18-354 Wiring method, Class III, Division 2** (see Annex JB) The wiring method shall be a) threaded rigid metal conduit; b) hazardous location cables; c) electrical metallic tubing; ~~d) armoured cable with overall non-metallic jacket, such as TECK90, ACWU90, copper-sheathed RC90, or aluminum-sheathed RA90;~~ ~~e) armoured fire alarm and signal cable, such as FAS, FAS90, FAS105, FAS150, and FAS200;~~ d) armoured and metallic sheathed cables with an overall jacket in accordance with Rule 12-102 3); e) Tray cables in accordance with Rule 12-102 3);	SN4745-J18

f) Non-armoured control and instrumentation cable (CIC), and non-armoured fire alarm and signal cables (FAS), provided that i) the installation is in cable tray in accordance with Rule 12-2202 3); ii) the voltage rating of the cable is not less than 300 V; iii) the circuit voltage is 150 V or less; and iv) the circuit current is 5 A or less; or ~~f) control and instrumentation cables with an interlocking metallic armour and a continuous jacket in control circuits (Type ACIC);~~ ~~g) Type TC cable installed in cable tray in accordance with Rule 12-2202;~~ ~~h) Type CIC cable (non-armoured control and instrumentation cable) installed in cable tray in accordance with the installation requirements of Rule 12-2202 2), where~~ ~~i) the voltage rating of the cable is not less than 300 V;~~ ~~ii) the circuit voltage is 150 V or less; and~~ ~~iii) the circuit current is 5 A or less; or~~ g)~~i)~~ liquid-tight flexible metal conduit and connectors, marked for heavy duty.	
Delete Rule J18-356 to read: ~~J18-356 Switches, controllers, circuit breakers, and fuses, Class III, Division 2~~ ~~Enclosures for switches, motor controllers, circuit breakers, and fuses shall conform to Rule J18-306.~~	SN4787-J18 SN4788-J18
Delete Rule J18-358 to read: ~~J18-358 Control transformers and resistors, Class III, Division 2~~ ~~Transformers, impedance coils, and resistors used as or in conjunction with control equipment for motors, generators, and appliances shall conform to Rule J18-308.~~	SN4787-J18 SN4788-J18
Revise Rule J18-360 to read: **J18-360 Motors and generators, Class III, Division 2** (see Annex JB) Motors and~~,~~ generators~~, or other rotating electrical machinery~~ shall conform to Rule J18-310.	SN4791-J18
Delete Rule J18-364 to read: ~~J18-364 Utilization equipment, fixed and portable, Class III, Division 2~~ ~~Fixed or portable utilization equipment shall conform to Rule J18-314.~~	SN4787-J18 SN4788-J18
Delete Rule J18-372 to read: ~~J18-372 Signal, alarm, remote control, and communication systems, Class III, Division 2~~	SN4787-J18 SN4788-J18

~~Signal, alarm, remote control, and communication systems shall conform to Rule J18-274.~~	

Appendix J, Annex J20

Revise Subrule J20-000 1) to read: **J20-000 Scope** (see Appendix G) 1) This Section constitutes an Annex to this Code and supplements or amends the general requirements of this Code and Annex J18 and applies to installations as follows: a) gasoline dispensing and service stations — Rules J20-002 to J20-014; b) propane dispensing, container filling, and storage — Rules J20-030 to J20-042; c) compressed natural gas refuelling stations, compressors, and storage facilities — Rules J20-060 to J20-070; d) commercial repair garages — Rules J20-100 to J20-112; e) bulk storage plants — Rules J20-200 to J20-212; f) finishing processes — Rules J20-300 to J20-314; and g) aircraft hangars — Rules J20-400 to J20-422.	SN4790-J20

Appendix J, Annex JB

Add new entries to Annex JB Note for Rule J18-002 to read: **Dust-protected enclosure** - Enclosures that would meet or exceed this definition are Types 3, 3X, 3S, 3SX, 4, 4X, 5, 6, 6P, 12, 12K, or 13, and those with degrees of protection IP5X or IP6X. Unused entries and openings would be closed off so that dust cannot enter through them. **Uninterrupted (as applied to conduit systems) –** the only devices allowed in an uninterrupted conduit run are NPT conduit couplings. Other devices, such as boxes, unions, tees, NPS couplings, and other fittings would not be acceptable, so as to	SN4749-J18 SN4787-J18 SN4806-J18 SN4823-J18

provide a higher level of conduit system integrity. Conduit that includes straight runs or formed bends are all considered conduit.	
Revise Annex JB Note for Rule J18-002, entry for Single or dual process seal equipment, to read: **Single or dual process seal equipment —** an electrical device can be marked with either designation to indicate that it incorporates into its construction and certification, primary or primary and secondary process seals that will prevent the migration of flammable fluids into the wiring system, as specified in UL 122701 or ~~IEC TS~~ CSA C22.2 No. 60079-40.	SN4749-J18
Revise Annex JB Note for Rule J18-010 to read: **Rule J18-010** Maintaining electrical installation safety in hazardous locations is dependent on a regimen of regular maintenance that will ensure that the electrical installation continues to provide safety throughout its life. Maintenance personnel are cautioned that modifications to original equipment or substitution of original components may void certification. In addition to the manufacturer's instructions, the following documents may be used to guide owners and operators of hazardous locations in developing appropriate maintenance procedures: a) IEC 60079-17, *Explosive atmospheres — Part 17: Electrical installations inspection and maintenance*; b) IEC 60300 series of Standards, *Dependability management*; c) IEEE 902, *IEEE Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems*; and d) NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*. Most certifications of hazardous location luminaires exclude the use of self-contained (LED, CFL) replacement lamps. The maintenance, repair, or alteration of hazardous location luminaires is intended to be done in a manner that a) does not invalidate the original approval, b)is in accordance with the original manufacturer's instructions, and c)the lamps used are in accordance with those listed on the nameplate. It is not the intent of this Rule to prohibit the use of complete assemblies that have been approved to replace the main body of an existing luminaire which may utilize an existing mounting component. Unused openings of enclosures installed in hazardous locations are suitably closed to maintain the degree of protection and explosion protection intended to be provided by such enclosures.	SN4735-J18 SN4823-J18
Add a new paragraph to the end of the Annex JB Note for Rule J18-052 to read: **Rule J18-052**	SN4530-J18

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Hazardous location electrical equipment may be marked with a Degree of Protection (IP Code) [see note to Rule 18-102 5) and Table B18-6], a Type rating, or both. However, neither of the foregoing markings is mandatory for hazardous locations equipment. A major difference between Type ratings and IP ratings, is that Type ratings may indicate suitability for a number of other mechanical and environmental factors in addition to solids and water ingress, such as impact, flame, and corrosion resistance. Type ratings are determined in accordance with standards CAN/CSA C22.2 No. 94.1 and 94.2.

Revise Annex JB Note for Rules J18-054 and J18-150 to read:

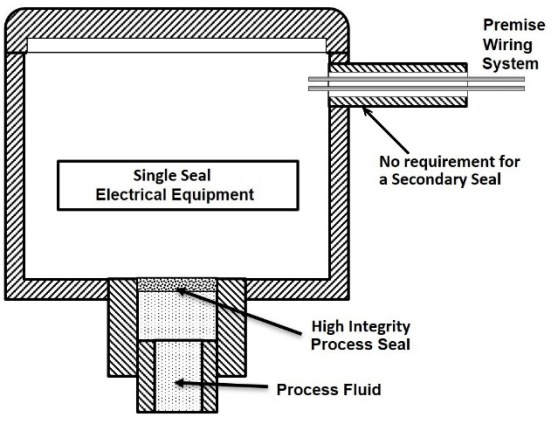
SN4791-J18

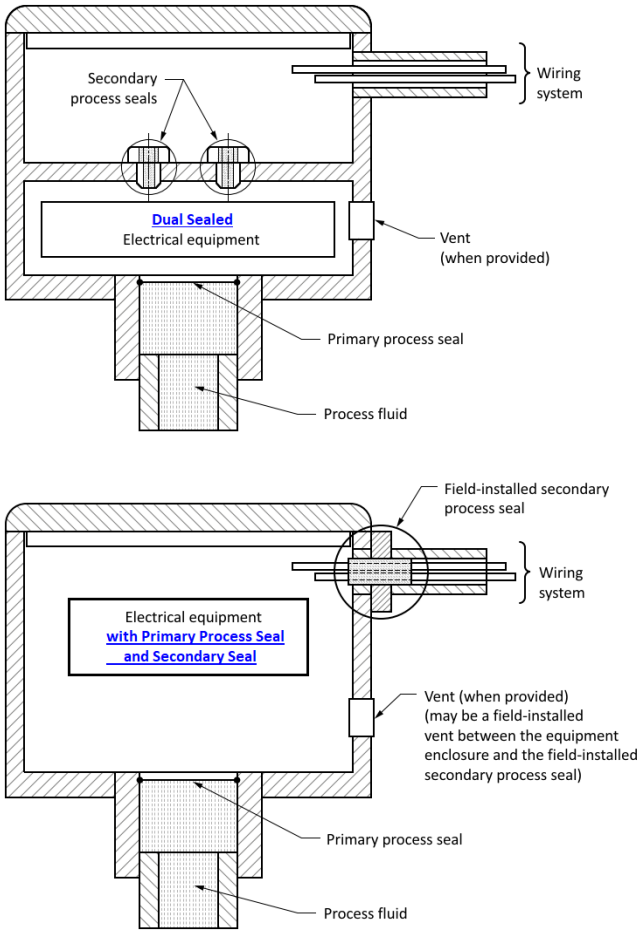
Rules J18-054 and J18-150

Equipment of the heat-producing type is currently required by product Standards to have a temperature code (T-Code) marking if its temperature exceeds 100 °C. However, for equipment manufactured prior to the T-Code requirement and motors and generators applied in accordance with Rule J18-150, there may be no such marking. Therefore, the suitability of older hazardous locations equipment of the heat-producing type and motors and generators applied in accordance with Rule J18-150 should be reviewed prior to being installed in a hazardous location to ensure compliance with Rule J18-054. For the purpose of these Rules, equipment such as boxes, terminals, fittings, and resistance temperature detectors (RTDs) are not considered to be heat-producing devices.

Revise Figure JB18-1 to read:

SN4715-J18





Revise Annex JB Note for Rule J18-070 to read:

SN4740-J18
SN4749-J18

Rule J18-070

See ~~Figures JB18-2 and JB18-3~~ Table JB18-4A and JB18-4B for ~~a flow chart~~ detail~~s~~~~ing~~ where explosion, flammable fluid migration, ~~or~~ and process seals should be selected for installations using cables and conduits.

UL 122701 and ~~IEC TS~~ CSA C22.2 No. 60079-40 provide construction, performance, and marking requirements for process seals incorporated into process-connected electrical equipment. Equipment containing a primary or a primary and secondary process seal that complies with these Standards is eligible to include either the “Single Seal” or “Dual Seal” designation in the nameplate markings. These markings indicate that the electrical equipment is designed to prevent the migration of flammable fluid through the equipment into the wiring system when the equipment is operated at or lower than its rated pressure. Devices certified as conforming to UL 122701 or ~~IEC TS~~ CSA C22.2 No. 60079-40 and marked either “Single Seal” or “Dual Seal” meet the intent of Subrule 1) a). See Figure B18-1 for typical configurations of process seals.

Where devices containing primary process seals are not marked to indicate conformance with UL 122701 or ~~IEC TS~~ CSA C22.2 No. 60079-40, other means may

be used to prevent fluid migration though the wiring system. *[no change to remainder of paragraph]*

After the 6th paragraph:
..... in case there is a leak under pressure from sources of release within the enclosure.

Where a secondary process seal is employed, the selection of the seal should be such so as to be chemically (corrosion) resistant to the process fluid it would be exposed to if the primary process seal fails.

Downstream of the process seal, any fluids entering the wiring system will be at or near atmospheric pressure. For example, if there is a major release of natural gas into a process building, it is not possible for significant pressure to develop in the building because the walls and windows will burst at a relatively low pressure.

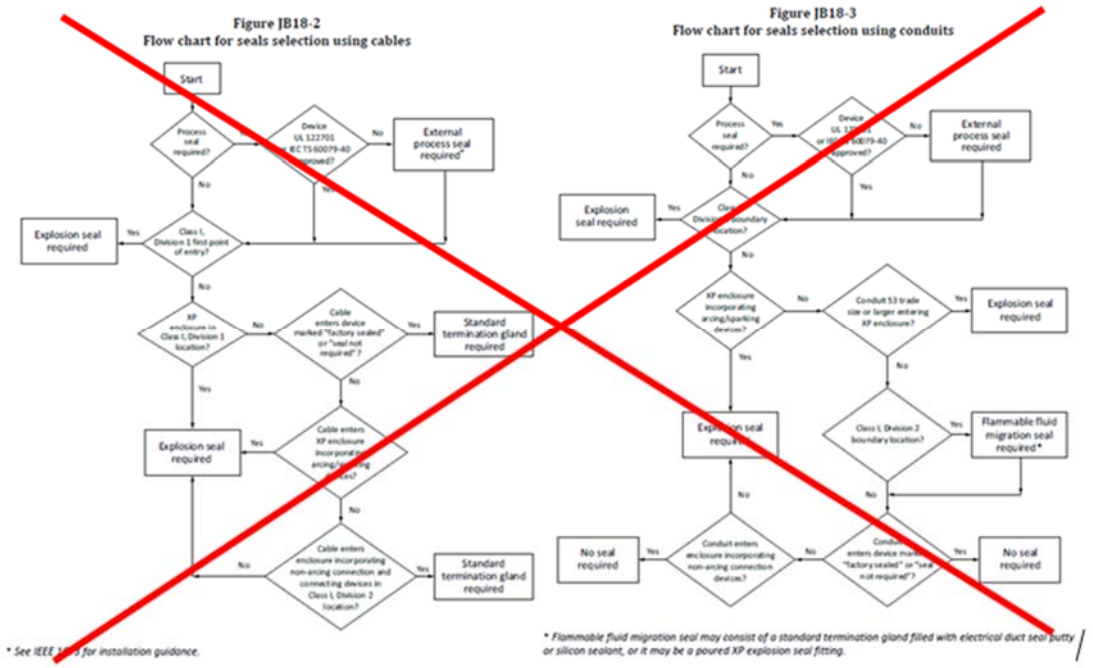
There is no need to seal conduit against significant pressure in Class I, Division 1. However, the conduit itself is required to be ~~in~~ an explosion-proof enclosure; therefore, seals at the boundary of Class I, Division 1 locations are required to be explosion-proof to maintain the explosion-proof rating of the conduit.

In Class I, Division 2, conduit is not required to be explosion-proof and, therefore, the boundary seals are not required to be explosion-proof. They need only be flammable fluid migration seals, i.e., seals for fluids that are not under pressure. A flammable fluid migration seal can be made using any suitable fitting that has been filled with a material capable of sufficiently preventing the transmission of the flammable fluid at or near atmospheric pressure. The sealing material should be selected to be compatible with the flammable fluid that can be anticipated to be exposed to the seal. Properly installed explosion seals or increased safety (Ex e) cable glands are ~~one possible~~ a means of providing a flammable fluid migration seal.

Cables with continuous sheaths will admit fluids only at the point where they terminate in hazardous areas. Therefore, except in enclosures containing equipment with fluids under pressure, the probability of flammable fluids entering cables after the process seals is low enough that only a flammable fluid migration seal is required. In many situations, filling the end of the cable connector where the conductors exit the connector (or where the conductors exit the cable when the jacket extends beyond the connector) with silicone or other suitable material will provide an effective flammable fluid migration seal in Class I, Division 1 and Class I, Division 2. Properly installed explosion-proof, flameproof "d", ~~or~~ flameproof "db", or increased safety "e" cable glands are also a ~~possible~~ means of providing a flammable fluid migration seal. As flammable fluid migration seals are often not visible once they are installed, they are required to be identified. This can be done with a label or tag located near the seals, identifying them as a "flammable fluid migration seal" and indicating their location if it is not readily apparent.

Delete Figures JB18-2 and JB18-3:

SN4740-J18



Add new Annex JB Table JB18-4A to read:

SN4740-J18

Table JB18-4A

Process seal requirements *

(See Rule J18-070.)

Applies to all process systems in hazardous and non-hazardous locations that contain flammable fluids (liquid or gas) and operate above normal atmospheric pressure.

Equipment certification and marking	Sealing requirement
• Marked “Single Seal” or “Dual Seal” • Certified to UL 122701 or CSA C22.2 No. 60079-40	None
• Not Marked “Single Seal” or “Dual Seal” or • Not certified to UL 122701 or CSA C22.2 No. 60079-40	“Primary Process Seal” plus • Stand-alone “Secondary Process Seal” or • Engineered solution

**This Table does not set the requirements; it only summarizes the requirements in the Code Rules.*

Add new Annex JB Table JB18-4B to read:

SN4740-J18
SN4806-J18

Table JB18-4B
Hazardous Location Sealing Summary — Not Process Connected Equipment
(see Note 1)
(See Rules J18-070, J18-108, and J18-154.)

Equipment type	Class I, Div. 1	Class I, Div. 2
Cable		
Intrinsically safe wiring systems and equipment (IS) (see Note 2)		
First point of termination	FFMS	No seal
Interconnection of IS equipment within same hazardous area	No seal	
Explosion-proof enclosures		
Contains arcing or heat producing equipment	XP seal	XP seal
Equipment marked "Factory Sealed" or "Seals not Required"		No seal
Contains non-ignition capable equipment (such as wiring terminals)		
Flameproof enclosures (Ex d or Ex db)		
Contains arcing or heat producing equipment	Equipment not permitted	XP seal
Contains non-ignition capable equipment (such as wiring terminals)		No seal
Increased safety enclosures (Ex e or Ex eb)		
Contains terminals and/or equipment with an acceptable type of protection (See Table 18 for Class I, Div. 2)	Equipment not permitted	No seal

Increased safety/Flameproof enclosures (Ex e d or Ex eb db) (see Note 4)		
Factory seal between Increased Safety (Ex e or eb) termination and Flameproof (Ex d or db) sections	Equipment not permitted	No seal
Non-hazardous enclosures (i.e., CSA Type 4, 4X, IP65, or IP66)		
Containing equipment with no arcing or heat-producing devices that are acceptable for use in Class I, Div. 2 locations	Equipment not permitted	No seal
Conduit		
Intrinsically safe wiring systems and equipment (IS) (see Note 2)		
First point of termination	FFMS	No seal
Interconnection of IS equipment within same hazardous area	No seal	
Explosion-proof enclosures		
Contains arcing or heat producing equipment	XP seal	XP seal
Equipment marked "Factory Sealed" or "Seals not Required"	No seal (see Note 3)	No seal
Contains wiring terminals or non-ignition capable equipment (such as wiring terminals)		
Conduit is 53 trade size (2 in) or larger	XP seal	
Note: *XP seals are to be installed within 450 mm (18 in) or as marked. If conduit entries are "field drilled", then seals are to be within 50 mm (2 in).*		

Flameproof enclosures (Ex d or Ex db)		
Contains arcing or heat-producing equipment	Equipment not permitted	XP seal
Contains non-ignition capable equipment (such as wiring terminals)		No seal
Note: *XP seals are to be installed within 50 mm (2 in).*		
Increased safety enclosures (Ex e or Ex eb)		
Contains terminals and/or equipment with an acceptable type of protection (See Table 18 for Class I, Div. 2)	Equipment not permitted	No seal
Increased safety/Flameproof enclosures (Ex e d or Ex eb db) (see Note 4)		
Factory seal between Increased Safety (Ex e or eb) termination and Flameproof (Ex d or db) sections	Equipment not permitted	No seal
Non-hazardous enclosures (i.e., CSA Type 4, 4X, IP65, or IP66)		
Containing equipment with no arcing or heat-producing devices acceptable for use in Class I, Division 2 locations	Equipment not permitted	No seal

Boundary seals requirements		
	Connected to	**Sealing requirement**
Class I, Division 1	**Class I, Division 2 or non-hazardous location**	XP seal (Note: An uninterrupted conduit run would allow the seal to be at the equipment and not the actual boundary.)
Class I, Division 1 *Where only intrinsically safe or intrinsic safety Ex ia is used*	**Class I, Division 2 or non-hazardous location**	FFMS (Note: Terminations in Class I, Division 2 locations need to comply with the equipment sealing Rules.)
Class I, Division 2	**Non-hazardous location**	FFMS

Legend

Ex e or eb Gland =
Increased safety gland
FFMS =
Flammable fluid migration seal (see Note 5)
No seal =
No sealing requirements
XP seal =
Explosion seal

Notes:

1. *This table does not set the requirements; it only summarizes the requirements in the Rules.*
2. *"IS" refers to intrinsically safe or non-incendive wiring and equipment, and intrinsic safety equipment (Ex ia, Ex ib, or Ex ic).*
3. *While not requiring an explosion seal at the explosion-proof enclosure, where the conduit crosses the Division 1 boundary, an explosion seal is required by Rule J18-108 5).*
4. *Can be a single enclosure with two sections or two enclosures having factory seals between the Ex e and Ex d sections.*
5. *XP Seal and Ex e or eb Gland meets the requirements for a FFMS.*

Add Annex JB Noted for Rule J18-076 to read:

SN4760-J18

Rule J18-076
Explosion-proof or flameproof threaded connections are not required for Class II or Class III locations.

In Class I, Division 2 locations, explosion-proof or flameproof threaded connections are required when entering an enclosure that is required to be explosion-proof or flameproof, and for those installations, the conduit is also considered to be part of the explosion-proof or flameproof system to which it is connected. However, if entries are to an enclosure with non-arcing or non-heat-producing components such as terminals, then explosion-proof or flameproof threaded connections and conduit are not required, unless part of an "uninterrupted conduit run". Running threads, which are not allowed for NPT threaded connections where explosion protection is required, are created when a wire entry or length of conduit is threaded beyond the length of the tap resulting in a section of straight threads at the minimum or maximum diameter of the taper. Running threads are not capable of meeting the requirements for explosion protection in hazardous locations. Where threaded connections are used for explosion protection, the requirement to have 4-1/2 tapered and 5 straight fully engaged threads (i.e., threads done up tight) is critical for the following reasons: When the threads are not fully engaged, the flame path is compromised, making it possible for an explosion occurring within the flameproof or explosion-proof system to be transmitted to the surrounding atmosphere. Because metal conduit forms a bonding path to ground, not making the conduit tight will introduce resistance into the flame path and, if a fault occurs, arcing at the interface may result. While it may not always be possible to install certain fittings without backing off, it is important to ensure that the connection is made tight. Properly made threaded connections are critical to the safety of hazardous location wiring systems. The metric thread tolerances are defined in ISO standard 965-1. Class-of-fit (tolerance) for internal threads is defined by 6g and for external threads by 6H. Better (tighter) tolerances will have lower numbers. Class-of-fit is measured prior to assembly using commercially available screw plug gauges for interior threads and ring gauges for external threads.	
Delete Annex JB Note for Rule J18-106 3) ~~**Rule J18-106 3)**~~ ~~Where tapered threads are used, the requirement to have 5 fully engaged threads (i.e., threads done up tight) is critical for the following reasons:~~ ~~a) When the threads are not fully engaged, the flame path is compromised, making it possible for an explosion occurring within the conduit system to be transmitted to the area outside the conduit.~~ ~~b) If there are not 5 fully engaged threads, the flame path may be too short to cool the gases resulting from an internal explosion to a temperature below that which could ignite gas in the surrounding area.~~ ~~c) Because the conduit forms a bonding path to ground, not making the conduit tight will introduce resistance into the flame path and, if a fault occurs, arcing at the interface may result.~~ ~~While it may not always be possible to install certain fittings without backing off, it is important to ensure that the connection is as tight as possible. Properly made conduit connections are critical to the safety of hazardous location wiring systems.~~	~~SN4760-J18~~

SN4669-J18

Revise Annex JB Note for Rules J18-106, J18-108, J18-152, J18-204 1) b), J18-254 1) b), J18-304, and J18-354 to read:

Rules J18-106, J18-108, J18-152, J18-204 1) b), J18-254 1) b), J18-304, and J18-354

Cables meeting the requirements of CSA C22.2 No. 174 that are marked "HL" are acceptable for use in all hazardous locations ~~and are marked "HL"~~.

~~Cables marked for use in hazardous locations are suitable for all locations, but the termination fittings must be suitable for the particular hazardous location. For example, in a Zone 1 or Zone 2 hazardous location, a termination fitting entering an enclosure required to be explosion-proof, flameproof "d", or flameproof "db" must be a sealing-type termination fitting, whereas a termination fitting entering an enclosure not required to be explosion-proof, flameproof "d", or flameproof "db" in a Zone 2 hazardous location is not required to be marked for use in Zone 2 hazardous locations.~~ In Class I, Division 1 hazardous locations, explosion-proof enclosures require a Class I, Division 1 cable gland, which is an explosion seal. These seals are also required to be installed on cables entering enclosures marked as "Factory Sealed" or "Seals not Required" since cables are not tested to determine their ability to contain internal explosions to enclosures. Flameproof ("d" or "db") glands are not acceptable for use with explosion-proof enclosures.

In Class I, Division 2 hazardous locations, several cable types identified in Rule J18-152, and other similar constructions, are acceptable for use. Cable glands are required to be suitable for the equipment's Type of Protection. For example, in a Class I, Division 2 hazardous location, cables entering an enclosure required to be explosion-proof are required to use Class I, Division 1 cable glands whereas cables entering a flameproof ("d" or "db") enclosure, may use either Class I, Division 1 or flameproof ("d" or "db") cable glands. However, cables entering enclosures marked as "Factory Sealed" or "Seals not Required" do not require an explosion seal. Cables entering an enclosure not required to be explosion-proof or flameproof ("d" or "db") in a Division 2 location are permitted to use ordinary location cable glands.

C22.2 No. 174 no longer permits Cable Glands to be marked with Class I Division 2. Cable Glands certified to earlier editions of CSA C22.2 No. 174 and marked Class I Division 2 do not meet the requirements for explosion seals.

A Flammable Fluid Migration Seal is required at the first point of termination of a cable in Class I, Division 1 locations. Since Class I, Division 1 cable glands also meet the requirements of a flammable fluid migration seal, a separate fitting is not required where those glands are installed.

It is intended that cable glands ~~termination fittings~~ in all hazardous locations be compatible with the degree of protection and the type of ~~explosion~~ protection provided by the enclosure they enter. In general, the minimum requirement will be weatherproof cable glands ~~termination fittings~~.

For the application of Annex J18, rigid metal couplings are not considered fittings. The CSA Standard for rigid metal conduit and couplings is CSA C22.2 No. 45.1. This Standard does not require hazardous location markings. Certified rigid metal conduit and couplings are suitable for hazardous locations without specific area classification marking.

Revise Annex JB Note for Rules J18-108 and J18-154 to read: **Rules J18-108 and J18-154** Seals are provided in conduit or cable systems to prevent the passage of gases, vapours, or flames from one portion of the electrical installation to another through the system. Some equipment may include markings such as “FACTORY SEALED” or “SEAL NOT REQUIRED” as permitted by CSA C22.2 No. 30. These terms apply to conduit installations only. The markings “FACTORY SEALED” and “SEAL NOT REQUIRED” are used interchangeably and indicate that the termination enclosure for the equipment is isolated from ignition-capable components by an internal factory seal, or that the equipment incorporates device s that have been assessed as not producing arcs, sparks, or high temperatures. For equipment marked “FACTORY SEALED” or “SEAL NOT REQUIRED”, the following applies: a) In Class I, Division 1 applications: i) For conduit installations, an explosion seal is not required as the conduit system is explosion-proof and will contain an explosion if something were to happen inside the enclosure, such as a wire coming out of a terminal. ii) For cable installations, an explosion seal is required, as the cable cannot contain an explosion in the enclosure if something happened, such as a wire coming off a terminal. Therefore, an explosion seal is needed to contain the explosion to the enclosure. b) In Class I, Division 2 applications, because equipment that is not ignition capable [see Rule J18-150 2) a)] and terminations housed in non-hazardous location enclosures [see Rule J18-150 2) c)] are permitted in Zone 2 locations, an explosion seal for conduit or cable is not required in accordance with Rules J18-154 1) ~~and 4), respectively~~. *[remainder of note unchanged]*	SN4749-J18 SN4806-J18
Revise Annex JB Note for Rules J18-108 1) and J18-154 1) to read: **Rules J18-108 ~~1~~3) and J18-154 ~~1~~2)** Field machining of conduit openings is allowed in enclosures where indicated by the manufacturer’s instructions, provided that they are carried out in accordance with those instructions. The restriction for sealing field-machined entries within 50 mm is to address any variations in the quality of work. Other entries may be acceptable but must be performed by a competent machining facility in accordance with the requirements of CSA C22.2 No. 30.	SN4806-J18
Revise Annex JB Note for Rules J18-108 6) and J18-154 3) to read: **Rules J18-108 ~~6~~4) and J18-154 3)** Conduit fittings, such as unions, reducers, adapters, and elbows, for use in Zone 1 or Zone 2 ~~and similar to the~~ locations and permitted to be installed between the	SN4806-J18

explosion seal and the explosion-proof enclosure are not intended to increase the internal volume more than what the trade size conduit would be. "L", "T", or "Cross" type fittings, although ~~are~~ not usually classed as enclosures when not larger than the trade size of the conduit, will increase the internal volume more than what the trade size conduit would be.	
Revise Annex JB Note for Rules J18-108 8) and J18-154 4) to read: **Rules J18-108 ~~8~~1) and J18-154 ~~4~~1)** Cables and flexible cords are not tested to determine their ability to resist internal explosions. Therefore, regardless of size, each cable must be sealed at the point of entry into any enclosure that is required to be explosion-proof. Some designs of cable glands incorporate an integral seal and these are marked "SL" to indicate that the seal is provided by the cable gland. Cable glands of this type are identified with the class designation. Designs requiring a field- or factory-installed sealing fitting have the group designation marked on this component. Because the appropriate sealing characteristics may be achieved by different means, the manufacturer's instructions should be followed.	SN4806-J18
Add new Annex JB Note for Rule J18-150 2)a)ii) to read: **Rule J18-150 2) a) ii)** This subrule is intended to allow for capacitors to be installed in Division 2 such as are used for partial discharge monitoring, power factor correction, and harmonic reduction.	SN4638-J18
Add new Annex JB Note for Rule J18-150 2)a)iii) to read: **Rule J18-150 2) a) iii)** This type of equipment operates at such extremely low power levels that any operating temperature rise is negligible, and is thereby in compliance with Rule J18-054. All are non-sparking, and do not incorporate inductors, capacitors or other internal components capable of storing or producing significant amounts of electrical energy. For additional information, refer to the description of "simple apparatus" in CSA Standard C22.2 No. 60079-11. RFID tag Readers are not included in this allowance and they would need to be certified for the areas in which they are used.	SN4638-J18
Revise Annex JB Note for Rule J18-150 2)e) to read: **Rule J18-150 2) e)** See the Note to Rules J18-114 and J18-150. Rule J18-150 does not require motors and generators of the open or non-explosion proof type to be certified for Class I, Division 2 locations unless the machines incorporate ignition capable components or heat-producing components that exceed the minimum ignition temperature defined for the hazardous location. ~~Rotating electrical machines of the open or non-explosion-proof type do not have a certification Standard for Class I, Division 2.~~ This Subrule provides the criteria for	SN4522-J18

applying, in Division 2, motors and generators ~~rotating electrical machines~~ that do not have a certification suitable for Division 2. Refer to IEEE 1349 for more detailed information on applying these motors and generators ~~rotating electrical machines~~ in Class I, Division 2 locations. Motors and generators do not have a certification Standard for Class I, Division 2. However, these machines can be evaluated for use in Class I, Division 2 locations in accordance with UL1836 “Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations”.	
Revise Annex JB Note for Rule J18-150 4) to read: **Rule J18-150 4)** The evaluation process to determine if the sliding contact shaft bonding device is non-incendive is the “motor bearing sparking – discharge energy calculation” found in ~~Appendix A of~~ CSA C22.2 No. 60079-0, UL 1836, or IEEE 1349. The potential energy calculation should be retained and available for review. The person taking responsibility for the calculation is normally an engineering professional or other individual permitted to practice engineering.	SN4688-J18
Add new Annex JB Note for Rules J18-152 1) d), J18-254 1) d), J18-304 1) d), and J18-354 1) d) to read: **Rules J18-152 1) d), J18-254 1) d), J18-304 1) d), and J18-354 1) d)** Examples of acceptable armoured and metallic sheathed cables are TECK90, ACWU90, copper-sheathed RC90, aluminum-sheathed RA90, armoured fire alarm and signal (FAS) cable, and armoured control and instrumentation cable (ACIC).	SN4745-J18
Revise 4th paragraph of Annex JB Note for Rule 18-152 7) to read: **Rule J18-152 7)** “ “ Where equipment is specifically designed for use in Division 2 locations, ordinary location cable glands that maintain the degree of protection of the enclosure may be used. One means of achieving equivalent protection is the use of a cable gland with the same or better IP (ingress protection) rating as the enclosure (see Table B18-6). If the gland does not have an IP rating, other ratings, such as weatherproof, may be matched to the enclosure rating.	SN4530-J18
Revise Annex JB Note for Rule J18-154 2) b) to read: **Rule J18-154 ~~2~~5) b)** This Subrule allows the seal at the boundary between an outdoor Class I, Division 2 location and an outdoor non-hazardous location to be located farther than 1 m ~~300 mm~~ from the boundary of the Class I, Division 2 location, provided that it is located on the conduit prior to ~~it~~ entering an enclosure or a building. Because gas is present	SN4806-J18

in Class I, Division 2 locations only for short periods, it is unlikely that gas or vapour could be released through conduit couplings at sufficiently high rates to form an explosive gas atmosphere in outdoor areas. However, the seal must be located on the conduit before it enters an enclosure or a building because, depending on the ventilation rate, gas transmitted through the conduit may build up to flammable concentrations.	
Revise Annex JB Note for Rule J18-154 3) to read: **Rule J18-154 3)** See the Note to Rules J18-108 ~~6~~4) and J18-154 3).	SN4806-J18
Add new Annex JB Note for Rule J18-250 to read: **Rule J18-250** Motors and generators can be evaluated for use in Class II, Division 2 locations in accordance with UL1836 “Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2, Class I, Zone 2, Class II, Division 2 and Zone 22 Hazardous (Classified) Locations”.	SN4522-J18

# Appendix K	
Delete contents of Appendix K and revise heading to read: **Appendix K** **Note:** *This Appendix has been deleted*	SN4796

Subjects incorporated into this Memorandum of Revisions							
MOR 25-1		MOR 25-2		MOR 25-3		MOR 25-4	
4148-12	4624	3864	4705	3961-60	4785	4240	4755
4323-0	4627	4274	4712	4308	4787	4271	4757
4323-10	4628-4	4319	4713	4321	4787-J18	4531	4761
4353	4628-8	4320	4715	4411	4788-J18	3948-60	4762
4356	4628-10	4398	4715-J18	4496	4791	4643	4763
4377	4628-12	4430	4723	4514	4791-J18	4561	4765
4494	4628-14	4477	4729	4563		4703	4766
4502	4628-16	4512	4732	4592		4708	4774
4505	4628-26	4569	4733	4604		4706	4775
4509	4628-28	4572	4734	4655		3961-52	4776
4519	4628-62	4576		4665		4068	4778
4522	4628-64	4587		4681		4140	4781
4522-J18	4630	4591		4690		4154	4783
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4565-0	4637	4625		4717		4530	4790
4565-18	4638	4626		4721		4530-J18	4790-J20
4565-J18	4638-J18	4628-42		4725		4599	4795
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4595		4669-J18		4748-46		4730-16	4823
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4608		4687		4759		4734-R	4831
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4614A		4688-J18		4760-J18		4735-J18	4834
4614B		4691-R		4767		4741	4835
4614C		4691		4768		4746	4842
4620-8		4693		4773		4750	4846
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