SECTION 4 - CONDUCTORS

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Topic: Conductors

The following bulletin provides guidance on applying the rules from the 2024 BC Electrical Code. The requirements of local municipal authorities having jurisdiction may vary. Installers should consult with local authorities having jurisdiction, before starting work, to determine their requirements.

Ampacities of underground conductors - General

Rule 4-004, subrule 1) f), and subrule 2) f) are interpreted as follows:
When the ampacity of a conductor is selected in accordance with item f) and subsequently increased in size due to voltage drop requirements to #1/0 and larger, the conductor may be installed in compliance with rule 12-012.

Ampacities of underground conductors – Residential installations.

3 wire 120/240 V and 120/208 V service conductors for single dwellings and feeders supplying single dwelling units of row housing, apartment, and similar buildings and terminating on equipment having a conductor termination temperature of not less than 75 C shall be sized in accordance with Tables 2 or 4.

Service conductors and feeder conductors selected in accordance with this subrule are permitted to be installed in accordance with rule 12-012.

Sizing of neutral conductors

1. Rule 4-018 permits the service neutral to be reduced in size provided it has sufficient ampacity to carry the unbalanced load subject to the requirements of rule 10-210 b) and table 16.

2. Rule 4-018 2) a) i) requires that there be no reduction in size for that portion of the load consisting of electric discharge lighting. Because the third harmonic current that flows in electric discharge lighting circuits feeding ballast or transformers is of considerable size, the neutral conductor will carry a current even when the load has been carefully balanced. This current may be as large as the current in the phase conductors. Electric discharge lighting includes fluorescent, mercury, metal halide, and sodium lighting systems. For this reason, rule 4-018 2) a) does not allow any reduction in size of the neutral conductor for that portion of the load which is made up of electric discharge lighting. Consideration should also be given to other loads which may contribute to third harmonic current.

3. In the application of rule 4-018, it is necessary to subtract the electric discharge lighting load and the balanced portion of the load from the total load, then subtract the 200 amps noted in paragraph 2) b) of rule 4-018 to arrive at a figure to which you may apply the 70% demand. The result must then be added to the sum of, the discharge lighting load and the 200 amps noted in paragraph 2) b) of rule 4-018.

   Example calculation:
   1000 amp service, 400 amps of unbalanced load including 50 amps of discharge lighting.

1000 A – 50 A discharge lighting =	950 A discharge lighting removed
950 A – 600 A balanced portion of load =	350 A unbalanced portion
350A – 200 A from 4-018(2) (b) =	150 A 200 base amount removed
150 A multiplied by 70% derating factor =	105 A

   150 x 70% = 105 A +
   50 A (discharge lighting) +
   200 base amount as per 4-018(2) (b) = 355 A, this is the current the neutral must be able to carry.

4. A three-phase, four-wire circuit feeding electric discharge lighting equipment must be treated as four fully loaded conductors for the purpose of rule 4-004, and be de-rated as required by the rule.

5. For 120/240 V, single-phase services to residential occupancies, sized under the provisions of rules 8-200 or 8-202:

   (a) The reduction should be calculated by subtraction of the “240 V permanently connected loads” (with appropriate demand factors), from the service ampacity. Cord-connected electric dryers and ranges operating at 240 volts are considered to be “240 V permanently connected loads.”

   (b) Paragraphs 1(b) of rules 8-200 and 8-202 are not interpreted to limit the reduction in size of the service neutral.

Refer to the following example.

Calculation of Neutral Conductor Ampacity

Example:
120 m^2 house with:
8 kW of electric heat, at
240 V 1 - 12 kW range
1 - 4 kW water heater

Calculation:

Service size using appropriate demand factors from Rule 8-200

120 m^2 (5kW + 1kW)		= 6000 W
Electrical Heat		= 8000 W
Range		= 6000 W
Water heater		= 1000 W
Total	=	21,000 W

21 kW / 240 V = 87.5 A

Paragraph (1) (b) requires the service size to be 100 amps. The minimum neutral size is calculated by subtracting the 240-volt loads with appropriate demand factors from 100 amperes.

i.e.

Heat	= 8 kW
Water Heater	= 1 kW
Range	= 6 kW
Total	= 15 kW
15 kW / 240 V	= 62.5 A

The calculated size for the neutral: 100 A – 62.5 A = 37.5 amperes

Rule 4-018 3) b) requires that the neutral be sized no smaller than required by table 16.

Minimum size neutral conductor: # 8 AWG copper or # 6 AWG aluminum.

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References:
Safety Standards Act
Electrical Safety Regulation
Safety Standards General Regulation