

UNDERSTANDING SINGLE POINT GROUNDING

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The following bulletin provides guidance on the application of rules pertaining to the 2021 BC Electrical Code Regulation. The requirements of local municipal authorities having jurisdiction may vary. Prior to undertaking work, installers should consult with local authorities having jurisdiction to determine their requirements.

Scope:

With adoption of the 24th edition of the CSA C22.1-2018 Canadian Electrical code as the BC Electrical code, there were many changes during the re-write of Section 10. One of the changes was the introduction of single point grounding. These changes remain in the currently adopted edition. This bulletin clarifies the code requirements for establishing an identified conductor (neutral). Rule 10-210 states:

10-210 Grounding connections for solidly grounded ac systems supplied by the supply authority (see Appendix B)

The grounded conductor of a solidly grounded ac system supplied by the supply authority shall

- a) be connected to a grounding conductor at one point only at the consumer's service;*
- b) have a minimum size as specified*
 - i) for a bonding conductor; and*
 - ii) for a neutral conductor when the grounded conductor also serves as a neutral;*
- c) be connected to the equipment bonding terminal by a system bonding jumper; and*
- d) 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.*

In simple terms, the rule is interpreted to mean that the grounded (or neutral, as industry most commonly refers to it) conductor shall be connected to the equipment bonding terminal by a system bonding jumper and a grounding conductor at **one point only** at the consumer's service and shall 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.

This means that the grounded or neutral conductor on the supply side of the consumer's service box is not to be used to bond to ground items such as the meter base, metal service mast, or metal service raceway.

Though not defined in the Code as such, this is the concept of "single point grounding."

There has been some discussion amongst industry over this rule. Non-compliance with Rule 10-210 d) is when there is a clear, point of connection between the grounded (neutral)

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conductor and the non-current carrying parts of the system somewhere on the line or load side of the grounding connection other than the system bonding jumper required by 10-210 c).

Applying the commonly used term 'neutral' in place of 'identified conductor' adds clarity to interpretation of rule 10-210.

10-210 Grounding connections for solidly grounded ac systems supplied by the supply authority (see Appendix B)

The **neutral*** conductor of a solidly grounded AC system supplied by the supply authority shall

- a) be connected to a **grounding conductor** at one point only at the consumer's service;
- b) have a minimum size as specified
 - i) for a bonding conductor; and
 - ii) for a neutral conductor when the grounded conductor also serves as a neutral;
- c) the **neutral*** must be connected to the equipment bonding terminal by a system bonding jumper; and
- d) the **neutral*** must 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.

Rule 10-210 d) does not prohibit a connection between the **neutral** (identified conductor) and the non-current carrying parts of the system by the grounding connection itself. Additional connections beyond the system bonding jumper on the line or load side of the grounding point are prohibited, but the grounding point itself is outside the scope of the literal text of d). The grounding conductor can be connected to any number of bonding conductors or terminals on its way to the neutral termination without violating the requirements of 10-210 d).

Furthermore it is acceptable to have bonding conductors connected directly to the system grounding conductor as outlined in the definition of "Bonding Conductor" in Section 0.

Bonding conductor — a conductor that connects the non-current-carrying parts of electrical equipment, raceways, or enclosures to the service equipment or system grounding conductor.

A bonding conductor is capable of providing equipotentiality and/or a fault path whether it is connected directly to service equipment or the system grounding conductor. The use of the grounding conductor as a circuit bonding conductor does have some complicating factors, including that it may not be large enough to fulfill the requirements of 10-616, and may need to be upsized for the portion where it serves both purposes.

Where the grounding conductor also serves as a bonding conductor, it must achieve the object of Rule 10-002 d) — the interconnection of all non-current carrying parts to the system grounded point with sufficiently low impedance to facilitate the operation of a protective device and to establish equipotentiality.

Frequently asked questions

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Q1. A grounding conductor is run between a plate electrode and a neutral terminal in the service box of a combination panelboard. The panelboard is equipped with a system bonding jumper connecting the neutral to the non-current carrying parts of the system in the service box portion of the panel. In the middle of the run, the grounding conductor is connected to a bonding conductor via a split bolt, and the bonding conductor is run to a bonding clamp installed on some gas piping as an equipotential bonding connection. Is this a compliant installation?

A1. Yes. Rule 10-210 has not been violated, as the grounded conductor is connected to a grounding conductor at one point only (at the neutral terminal in the panelboard) in accordance with Item a). The grounded conductor is properly sized in accordance with Item b). The neutral is connected to a bonding terminal in accordance with item c), and there are no other connections between the neutral and the non-current carrying parts on the line or load side of the grounding connection.

So long as the grounding conductor is still installed in accordance with Rule 10-116 and the bonding conductor from the gas pipe (or metal siding, or other material) to the system grounding conductor is provided and installed in accordance with the 10-700 series of rules, there is no non-compliance that can be called.

Q2. What if the grounding conductor from the first question was uninsulated, and ran through a metallic connector where it entered the panelboard. Doesn't this create a parallel path? Is this a compliant installation?

A2. It does create a parallel path, but this is compliant.
The code argument outlined previously, still holds in this case. The neutral is still:

- connected to a grounding conductor at one point only;
- sized properly;
- connected to an equipment bonding terminal by a system bonding jumper; and
- has no other connection to the non-current carrying parts on the system on the line or load side of the grounding connection.

Q3. A ground plate is installed below a meter base. The grounding conductor is run through the meter base and through a non-metallic consumer's service raceway between the meter base and a combination panelboard, where it terminates on the neutral bus in the service box. Can this grounding conductor also serve as a bonding conductor between the meter base enclosure and the panelboard?

A3. Yes. There is no code rule that prohibits the use of a grounding conductor as a bonding conductor. Rule 10-212 2) expressly permits it for separately derived systems, and it is a common practice in impedance grounded and ungrounded systems.

A grounding conductor is permitted to be run in a raceway with the service conductors under the provisions of Rule 10-116 5).

This installation could be acceptable provided:

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- the grounding conductor is installed in accordance with Rule 10-116 (consider especially 4) and 5));
- the installation complies with Rule 10-210, including having the neutral insulated in the meter base, and terminated on the neutral bus in the panelboard; and
- the grounding conductor is upsized for the portion where it also serves as the bonding conductor where required by Rule 10-614 2) or 3 b).

Q4. What if instead of rigid PVC it had been a piece of ACWU90 or Teck90? Could the bonding conductor in such a cable be used as the grounding conductor?

A4. Yes. If the same requirements were met from the previous question.

Q5. What if it had been a metallic raceway that was permitted to be used as a bonding conductor installed with a bonding bushing at each end, instead of PVC? Could the metallic raceway have served as the grounding conductor as well in that case?

A5. No, unless the ESO chooses to accept it.

Rule 10-112 requires that bonding conductors be of copper, aluminum, or **other acceptable material**. There is useful guidance in the Appendix B note to this rule if other materials are proposed, but in general a steel raceway is not acceptable for use as a grounding conductor.

Provincial Safety Manager – Electrical

References:

Safety Standards Act

Electrical Safety Regulation

Safety Standards General Regulation

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