



Electrical Grounding and Water Service Re-piping

This document is intended to provide guidance in applying certain plumbing and electrical regulations and is for informational use only. It cannot be used as a substitute for the plumbing or electrical codes or for other city codes, such as the construction codes.

The existing electrical service grounding must be identified by the building owner or designee prior to replacement of the water service, to determine the best installation option. When replacing the water service and/or re-piping residential or commercial buildings, the installer must maintain the electrical grounding system per NEC 250.50 and UPC 604.8. (See Notes 1-4).

Option 1: Where the existing water service is metallic pipe and is replaced with metallic pipe, the electrical system ground clamp must be reattached to the new metallic water pipe. When connections are made between dissimilar metals, connect new metallic pipe to existing dissimilar metallic water pipe with six inches of brass pipe or valve. If you install a dielectric union or other type of isolating fitting, it must be bonded around per NEC 250 to ensure the electrical continuity of the metallic water pipe. (See Note 1).

Option 2: Where the existing metallic water service and building metallic water pipes are replaced with plastic pipe, the electrical system ground integrity must be maintained. The method preferred by the City of Bellevue is to install 10 feet of new metallic water pipe on the water supply side from the foundation out. Metallic water pipe must be in contact with earth. The electrical system ground clamp must be reattached to the new metallic water pipe. (See Notes 1-4)

Note 1: NEC 250.52(A)(1) requires bonding around dielectric unions, PRVs, isolation kits, insulating type fittings or pipe to ensure the electrical grounding of the metallic water system. The bonding must be sized per NEC 250.66 and installed per NEC 250.68(B). An electrical permit is required. This should be done by a licensed electrical contractor.

Note 2: For existing metallic water services, where the installer maintains the electrical ground as outlined in Option 1 noted above, the requirement for a supplemental grouping electrode is not required. For new installations, NEC 250.53(D)(2) requires metal underground water pipe to be supplemented by an additional electrode, in the event that the metallic water pipe could be replaced with plastic in the future. Where ground rods are approved to be used per City of Bellevue interpretation, the National Elective Code 250.53 (A)(2) requires two listed 5/8-inch x 8-foot ground rods spaced a minimum of six feet apart. An electrical permit is required. This should be done by a licensed electrical contractor.

Note 3: Where a concrete encased electrode (Ufer) is installed in accordance with NEC 250.52(A)(3), neither the 10 feet of metallic water pipe per Option 2 nor the supplemental grounding rods in Note 2 are required.

Note 4: When plastic materials are used for underground water pipe, a #18 AWG or larger blue insulated tracer wire or other approved conductor shall be installed adjacent to the piping and shall be accessible and/or terminate above ground at each end of the nonmetallic piping. (UPC 604.10 Exception).

UPC 604.10. Approved plastic materials shall be permitted to be used in water service piping, provided that where metal water service piping is used for electrical grounding purposes, replacement piping therefore shall be of like materials.

Exception: Where a grounding system acceptable to the Authority Having Jurisdiction is installed, inspected, and approved, metallic pipe shall be permitted to be replaced with nonmetallic pipe. Plastic materials for water service piping outside underground shall have a blue insulated copper tracer wire or other approved conductor installed adjacent to the piping. Access shall be provided to the tracer wire or the tracer wire shall terminate above ground at each end of the nonmetallic piping. The tracer wire size shall be not less than 18 AWG and insulation type shall be suitable for direct burial.

UPC 312.10 Sleeves. Sleeves shall be provided to protect piping through concrete and masonry walls and concrete floors.

Exception: Sleeves shall not be required where openings are drilled or bored.

UPC 314.4. Trenches shall be backfilled to 12 inches above the top of the piping with clean fill.

UPC 609.1. Building supply piping shall not be less than 12 inches below the local average frost depth.

NEC 250.50 Grounding Electrode System.

All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) through (A)(8) shall be installed and used.

Exception: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.

NEC 250.52 Grounding Electrodes.

(A) Electrodes Permitted for Grounding.

(1) Metal Underground Water Pipe. A metal underground water pipe in direct contact with the earth for 3.0 m (10 feet) or more (including any metal well casing bonded to the pipe) and electrically continuous (or made electrically continuous by bonding around insulating joints or insulating pipe) to the points of connection of the grounding electrode conductor and the bonding conductors. Interior metal water piping located more than 1.52 m (five feet) from the point of entrance to the building shall not be used as a part of the grounding electrode system or as a conductor to interconnect electrodes that are part of the grounding electrode system.

NEC 250.53 (A)(2) Supplemental Electrode Required.

A single electrode consisting of a rod, pipe, or plate that does not have a resistance to ground of 25 ohms or less shall be augmented by one additional electrode of any of the types specified by 250.52(A)(4) through (A)(8). Where multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (six feet) apart. If a ground resistance test is not performed to ensure a resistance to ground of twenty-five ohms or less, two or more electrodes as specified in NEC 250.52 must be installed a minimum of six feet apart.

Exception: A temporary construction service is not required to have more than one rod or pipe electrode.

NEC 250.66 Size of Alternating-Current Grounding Electrode Conductor.

The size of the grounding electrode conductor at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system of a grounded or ungrounded ac system shall not be less than given in Table 250.66, except as permitted in 250.66(A) through (C).

NEC Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors	Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors	Size of Grounding Electrode Conductor (AWG/kcmil)	Size of Grounding Electrode Conductor (AWG/kcmil)
Copper	Aluminum or Copper-Clad	Copper	Aluminum or Copper-Clad
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	3/0	250

Notes: Where multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served. This table also applies to the derived conductors of separately derived AC systems. See installation restrictions in 250.64(A).

NEC 250.68(B) Grounding Electrode Conductor and Bonding Jumper Connection to Grounding Electrodes.

(B) Effective Grounding Path. The connection of a grounding electrode conductor or bonding jumper to a grounding electrode shall be made in a manner that will ensure an effective grounding path. Where necessary to ensure the grounding path for a metal piping system used as a grounding electrode, bonding shall be provided around insulated joints and around any equipment likely to be disconnected for repairs or replacement. Bonding jumpers shall be of sufficient length to permit removal of such equipment while retaining the integrity of the grounding path.