

# SERVICE ENTRANCE GROUNDING

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## 2.0 PURPOSE

This standard outlines the general requirements for service entrance grounding. All Local, State and National Electric Codes must be consulted for acceptable methods in specific areas.

## 3.0 GENERAL INFORMATION

3.1 The proper bonding and grounding:

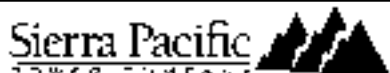
- A. Limits excessive voltages from lightning, line surges, or unintentional contact with higher voltage systems,
- B. Stabilizes the voltage to earth (ground) during normal operations,
- C. Limits voltage to ground on conductive materials enclosing electric conductors or equipment, and
- D. Establishes an effective path for fault current to facilitate the operation of overcurrent devices in the event of insulation failure or ground faults.

3.2 All installations must be in compliance with all the Local, State and National Electric (Article 250) codes and ordinances.

## 4.0 BONDING

4.1 Application:

Bonding must be provided where necessary to assure electrical continuity and the capacity to *safely* conduct any fault current likely to be applied.



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4.2 Requirements:

The following metallic equipment must be bonded and grounded together, by means of threaded fittings or bonding jumpers, to assure the electrical continuity required for a grounding circuit:

- A. Service raceways or service cable armor,
- B. All service equipment enclosures, including meter fittings of boxes, interposed in the service raceway, and
- C. any conduit or armor which forms part of the grounding conductor.

The grounding conductor, bond or bonding jumper must be attached to circuits, conduits, enclosures and the like, which are to be grounded, by means of lugs, connectors or clamps, which are approved for the purpose.

## 5.0 GROUNDING ELECTRODE

5.1 A ***grounding electrode*** is a conductor, normally imbedded in the earth or in concrete (which is in direct contact with the earth), used for maintaining ground potential on conductors connected to it and for dissipating into the earth, current subjected to it.

5.2 Types:

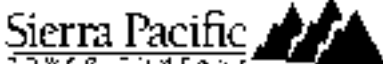
- A. UFER:

Application:

The UFER type ground is the preferred grounding electrode in those areas where it is recognized by local authority having jurisdiction.

Requirements:

The minimum requirements for a UFER ground, as outlined in the NEC, Article 250, is a minimum of 20' of bare copper wire, not smaller than #4, encased by at least 2" of concrete and located near the bottom of a concrete foundation footing that is in direct contact with the earth, as illustrated in Figure 1 on the next page. Local codes should be consulted for additional requirements.



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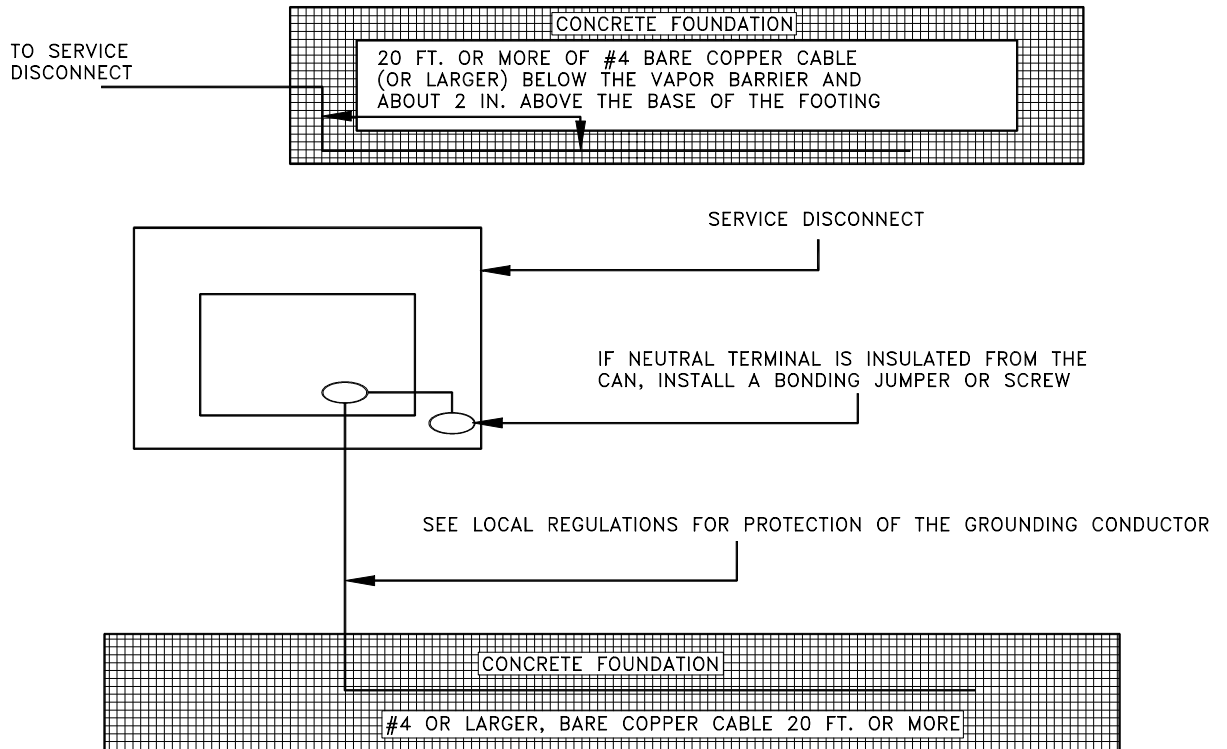
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**Figure 1**  
**UFER Type Ground**



**B. Metallic Water Pipe:**

**Application:**

In those areas where the UFER type ground is not recognized or where a concrete foundation is not being poured, such as reconstruction projects or mobile homes, a metallic underground piping system, either local or supplying a community, may be used as a grounding electrode. In any event, the interior piping system should be electrically continuous and bonded to the grounding electrode.

**Requirements:**

The buried metallic portion of the water pipe must be at least 10' in length including any metal well casing effectively bonded to the pipe. Where the metallic portion of the water pipe does not meet this requirement or where it is likely to be isolated by insulated joints/couplings, it must be supplemented by the use of an additional electrode of a type described in Section 5.2 C.

C. Electrodes, other:

Application:

Where electrodes described in A and B above are not available, or where a supplement to water piping is required, the grounding electrode shall consist of (a) driven pipe, (b) driven rod, or (c) buried plate.

Requirements:

- (a). Driven Pipe: Galvanized pipe, 3/4" trade size, minimum x 8', driven to a depth of 8'.
- (b). Driven Rod: Steel or iron rods, 5/8" OD minimum x 8', or copper clad, steel rods, 1/2" OD minimum x 8', driven to a depth of 8'.
- (c). Buried Plate: Iron or steel at least 0.25" thick or of copper at least 0.06" thick, which presents at least 2 square feet of surface area to exterior soil and buried a minimum of 2 1/2' deep.

## 6.0 RESISTANCE

NEC Article 250, limits the resistance between electrodes and grounds to 25 ohms. It also states that where resistance exceeds this limit, two or more electrodes shall be connected in parallel. The additional rods should have a minimum of 6' separation.

## 7.0 GROUNDING ELECTRODE CONDUCTOR

- 7.1 The grounding electrode conductor is the conductor used to connect the grounding electrode to the equipment grounding conductor and to the neutral (grounded conductor) of the circuit at the service.
- 7.2 The grounding electrode conductor shall be installed and protected in accordance with the NEC and applicable local codes and shall be continuous (without bolted splices) from the grounding electrode to the neutral connection. Aluminum or copper-clad aluminum grounding conductors shall not be used where in direct contact with masonry or the earth, or where subject to any corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding conductors shall be installed within 18" of the earth.

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7.3 The grounding electrode conductors shall be sized in accordance with the minimum conductor sizes shown in the NEC 250-66 table.

7.4 Refer to the current issue of the NEC table 250-122 for the minimum size equipment grounding conductors for grounding raceways and equipment.

<b>NEC TABLE 250-66 MINIMUM GROUNDING ELECTRODE CONDUCTOR SIZE FOR A/C SYSTEM</b>			
Size of Largest Service- Entrance Conductor		Size of Grounding Electrode Conductor	
<b>Copper</b>	<b>Aluminum or Copper-clad Aluminum</b>	<b>Copper</b>	<b>Aluminum or Copper-clad Aluminum</b>
#2 or smaller	1/0 or smaller	8	6
1 - 1/0	2/0 - 3/0	6	4
2/0 - 3/0	4/0 - 250 kcm	4	2
Over 3/0 thru 350 kcm	Over 250kcm thru 500 kcm	2	1/0
Over 350 kcm thru 600 kcm	Over 500 kcm thru 900 kcm	1/0	3/0
Over 600 kcm thru 1100 kcm	Over 900 kcm thru 1750 kcm	2/0	4/0
Over 1100 kcm	Over 1750 kcm	3/0	250 kcm

For any notes to this table, please check the current issue of the NEC.

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