



# **TECHNICAL BULLETIN**

## **PERMIT AND RESOURCE MANAGEMENT DEPARTMENT**

E-8X

2550 Ventura Avenue, Santa Rosa, CA 95403  
(707) 565-1900 FAX (707) 565-1103

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### ***Ufer Ground***

#### **INTRODUCTION**

As stated in Article 250 - Fine Print Note No. 1 of the 1998 California Electrical Code (CEC), "Systems and circuit conductors are grounded to limit voltages due to lightning, line surges, or unintentional contact with higher voltage lines, and to stabilize the voltage to ground during normal operation. Equipment grounding conductors are bonded to the system grounded conductor (*neutral*) to provide a low impedance path for fault current that will facilitate the operation of over current devices under ground-fault conditions."

The Grounding Electrode System is installed to provide surge protection and voltage to ground stabilization. This system is required at each building or structure on the premises. There are numerous methods described in the code. The most common is the Concrete Encased Electrode or UFER and the Driven Rod Electrode. The CEC allows the use of metal underground water pipe. This method requires a supplemental electrode be provided. This requirement is based on the practice of using plastic pipe for replacement when the original water pipe fails.

#### **TECHNICAL DETAILS**

When available the building reinforcing steel (rebar) is the preferred method for providing an electrode. Concrete Encased Electrodes (UFER) can consist of either a minimum of 20' of No. 4 copper wire or two or more No. 4 or larger rebar installed in the foundation with a minimum of 2" of concrete cover. When using rebar, it must be spliced a minimum of 40 bar diameters, ex.  $40bd \times 1/2" = 20"$  min splice length.

When a UFER ground is installed in a pier and grade beam foundation system a number of methods are available:

- I. Use the rebar in the pier if 20' deep or more.
- II. Install 20' of No. 4 copper in the pier if less than 20' deep.
- III. Bond two or more pier rebars together with either copper or rebar connectors if less than 20' deep.
- IV. Grade beams intended to retain a minimum earth contact of 2" or more can be treated as a standard T foundation system and ground accordingly.
- V. Grade beams without a minimum 2" of earth contact should follow items I., II, or III above.

A Driven Rod Electrode must be installed so that at least 8' of its length is in contact with the soil. It can be driven at an oblique angle not greater than 45 degrees from the vertical or buried in a trench at least 30" deep. The most common type is a listed ½" copper rod.

The grounding electrode is connected to the system with a *Grounding Electrode Conductor*. This must be run unbroken to the bonding bus bar at the service disconnect enclosure. It may only be spliced with a listed connector. It must be protected from physical damage and securely fastened in place. When ground clamps are used for terminations they must be listed for the type of materials used and approved for direct burial.

## GLOSSARY

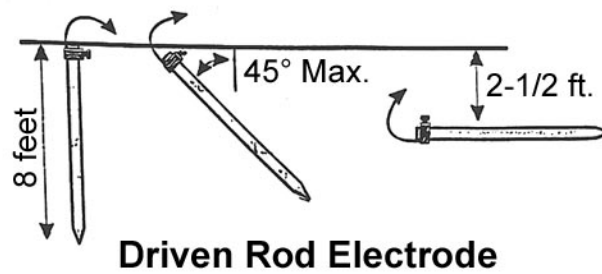
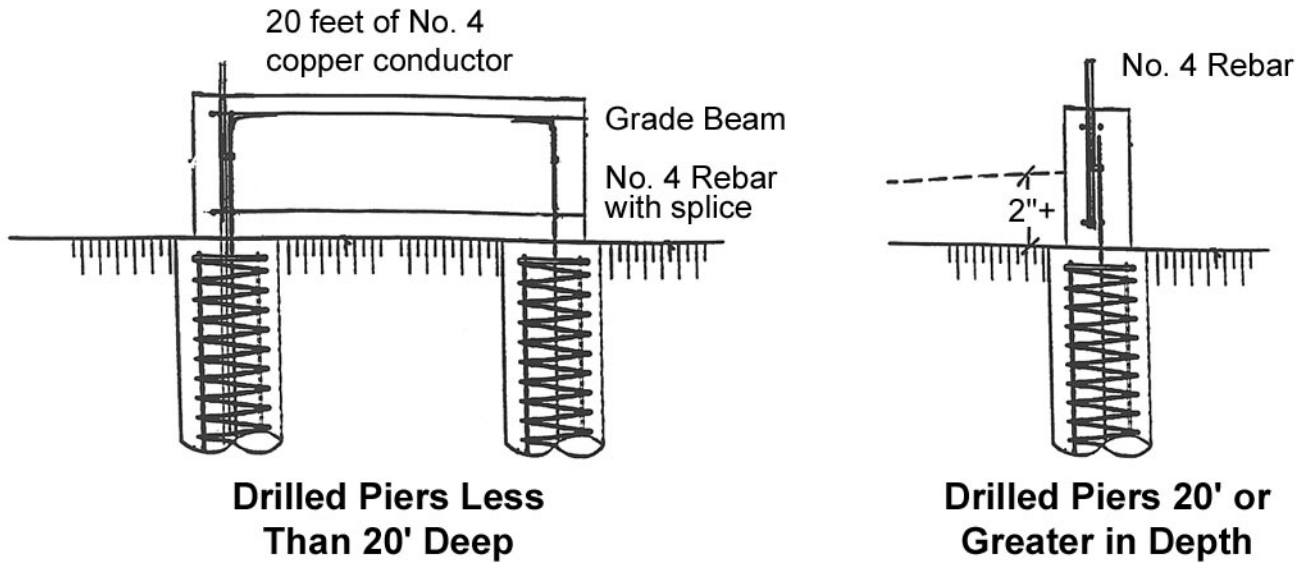
**Grounded:** Connected to the earth or to some conducting body that serves in place of earth.

**Grounded Conductor:** A system or circuit conductor that is intentionally grounded. (neutral)

**Grounding Conductor:** A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode.

**Grounding Conductor, Equipment:** The conductor used to connect the non-current carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor, the grounding electrode conductor, or both at the service equipment or at the source of a separately derived system.

**Grounding Electrode Conductor:** The conductor used to connect the grounding electrode to the equipment grounding conductor, to the grounded conductor, or to both, of the circuit at the service equipment or at the source of a separately derived system.



## REFERENCES

1998 California Electrical Code Article 250-81 through 86  
Sonoma County Residential Construction Handbook Section 17.7

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