



STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL HEALTH SECTION
PRIVATE WELL PROGRAM

ELECTRICAL GROUNDS—A Controversial Necessity

Ever since its inception the National Electric Code (NEC) has required that a building's electrical system be grounded to the building's plumbing system to prevent user electrocution or fires caused by stray electrical current or "surges", e.g. lightning strikes. Juxtaposed to this concern is the American Water Works Association's (AWWA) position that the practice of grounding onto water pipes/appurtenances exposes water utility personnel to an unnecessary shock hazard and could have deleterious effects on the water in the home's plumbing system. Typically this manifests itself by corrosion of the copper piping resulting in "blue water." AWWA also feels that is not the responsibility of a water utility to maintain "grounded continuity" for the electric utility. This dilemma continues to exist.

Bonding (not to be confused with grounding) is necessary to assure electrical continuity between the various electrical components of the building and the capacity to safely conduct any fault current along the metal to ground. Grounding is the transmission of any fault current to "ground". The lack of proper bonding and grounding in a building's electrical system can result in severe shock or fire hazards.

The NEC (section 250-81 through 250-83), as adopted by Connecticut, *requires* that the electrical system connected to all of the following, if available for grounding purposes:

- * metal frame of building
- * concrete encased electrode (rod, pipe, plate, braided wire)
- * ground ring and
- * metallic water pipe with 10 lineal feet in contact with earth

The NEC has noted that metal piping will corrode over time and possibly lose its continuity with the soil (i.e. ground) or be replaced by plastic pipe. Accordingly, should this occur, the NEC has mandated the 3 other paths to ground be utilized.

Using the building's domestic water piping for an electrical ground has been a bone of contention between electrical utilities and water utilities since the inception of the NEC. The AWWA in one of its Policy Statements has stated and reaffirmed again and again (the last June 15, 2003) that "AWWA opposes the grounding of electric systems to pipe systems conveying drinking water to a customer's premises". In the policy's final statement "AWWA asserts that a water utility has no direct or indirect responsibility in connection with the installation of water pipe grounding systems or for the maintenance of the integrity of any grounding attachment or connection made to a water pipe system".

It would then certainly follow that grounding of a home's domestic piping, when it is served by a private well, would suffer the same consequences (shock hazard, possible deterioration of water quality) as would a



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homeowner served by a public water system.

This issue once again came to the forefront when the installation of plastic water meters was introduced by the water industry and their subsequent installation interrupted the continuity of the electrical ground. The electric companies met the challenge with the installation of braided brass bonding jumper straps. The water works people cried foul and removed the straps and the electric utilities cried foul. The issue is still unresolved to date.

The purpose of the “grounding” wire is that it is a safety wire that has intentionally been connected to earth. This wire should not carry a continuous electrical current under normal circuit operations. If stray DC current is present it would result in the corrosion on the outside (soil) side of the pipe only. Its sole purpose is to carry electrical current only under short circuit or other conditions (lightning strike) that would be potentially dangerous. Grounding wires serve as an alternate path for the current to flow back to its source (via earth), rather than go through anyone touching a shorted appliance or electrical box. It is important that the house plumbing system have a resistance higher than the grounding rod (<25 ohms) or any other alternative grounds so the aberrant current or electrical surge will go to ground through the path of least resistance.

Grounding rods are usually five-eighths inch copper or steel rods driven into the ground to an 8-foot depth. Should a second rod be installed, it must be at least 6-feet from the first ground rod. The driven rods should be at least 2 feet from the foundation wall. The current carrying capacity of the rod(s) depends largely on the resistivity of the soil surrounding the rod(s).

The water industry has documented evidence that grounded water pipes produce substandard water and when the grounds are eliminated the poor water problems go away, but not always. There have been innumerable studies done and papers written on this electrolysis/corrosion phenomenon and a universally accepted cause has not been found as yet.

What to do if you get a call or complaint?

If you receive a complaint of "blue water" the first thing you do is ask if they have had their well water tested lately. If the test is not recent, the well water should be tested by a state certified laboratory. We recommend at a minimum the following tests: hardness, alkalinity, pH, copper, and chlorides. If the pH is low (<6.0), the hardness low (generally <50-ppm), the alkalinity low (generally <40-ppm,) the water could be considered extremely “soft” and aggressive (corrosive) to the home’s metallic plumbing system. Elevated (>100-ppm) chloride concentrations would only aggravate the problem. Comparing the copper concentrations to previous water tests would be helpful also. The water should be treated to make the water less aggressive by raising the pH, alkalinity or hardness. Please call your local health department or the State Private Well Program at (860) 566-7296 if you have questions about your sample results or suggested treatment.

Should the problem persist and the well water is still blue and it is discovered that the private well’s metal discharge line has an electrical “grounding” clamp, have them contact a licensed electrician to investigate the situation. The electrician would check the main circuit panel for a faulty, missing or improperly secured “neutral” wire. He could also test the plumbing to see if there is any stray AC or DC current. There should not be any current, even in milliamps! If there is current, the improperly functioning or shorted device/appliance should be found and repaired.

He should also check that the house plumbing has a greater resistance (>25 ohms) than the grounding rod(s).

The ground wire to the plumbing system should not be removed as it is mandated in the CT Building Code but it should not be the primary carrier of stray electrical current or voltage surges to “ground”.

CAMJ
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