ELECTRICAL WIRING PROBLEMS AND CODE VIOLATIONS

Higher magnetic field environments are created by electrical and grounding system problems than by power lines. This is true in both commercial and residential settings.

In commercial buildings, the problem usually results from unbalanced feeders and branch circuits. In residential buildings, both single family homes and apartments, the most common problem is neutral current flow on metallic plumbing and grounding systems.

Improper electrical wiring configurations are a frequent problem in all building types.

For over 100 years, the National Electrical Code has served as the guiding force in the prevention of personal injury and property damage arising from the use of electricity. It has been adopted for mandatory application by most local jurisdictions that exercise control over electrical installations.

The objective of the code is not to avoid the creation of high magnetic fields, but a few provisions, if violated, do result in significantly elevated fields. Since these violations usually create no overt functional deficits in the electrical system, they often escape notice, but they are immediately apparent to someone with the proper equipment. In areas (or entire buildings) where these problems exist, AC magnetic field levels are dramatically higher. Readings of 5-20 mG are not uncommon, and occur whenever the circuits involved are in use. Levels such as this are high enough to cause screen jitter or other display anomalies in computer monitors in the vicinity.

Fortunately, these conditions are fully correctable. They are not, however, always easy to diagnose and correct.

Most of the wiring in homes and commercial buildings consists of cables containing two or more current carrying conductors (or conduits containing multiple conductors). At any point in time, an equal current is flowing in one direction on one wire, and in the opposite direction on another wire. In this case there is no net current on the circuit, and a clamp-on ammeter placed around the cable or conduit will indicate no current. Since these wires are very close together inside the cable jacket or conduit, the magnetic field around one wire is cancelled by the opposite magnetic field around the other wire. The field is negligible a few inches from the wires.

3-Phase Subpanel

Electrical Wiring Box

Problems occur when this balance is destroyed by wiring errors. Examples are cross connected neutrals from separate branch circuits, neutral-ground shorts, incorrect three-way switch wiring, and improperly wired subpanels. A portion of the current is caused to flow over an alternate path, creating a net current on two or more circuits. A clamp-on ammeter placed around the cable or conduit will indicate a substantial current (often 1 to 10 Amps). It is not unusual to find multiple problems in new construction. Inspections conducted by local code enforcement authorities will not detect the great majority of these problems.

Most code violations do not create elevated magnetic fields, but most wiring errors that create high fields are code violations. Thus, there is a solid rationale for correcting (and avoiding) these common problems that extends beyond EMF avoidance. Any survey, residential or commercial, should be designed to detect and document them. We have extensive experience in the correction of electrical wiring errors. All problem resolution services are delivered by an IAEI certified electrical inspector or licensed electrical contractor with over ten years of EMF remediation experience.

PLUMBING CURRENT MAGNETIC FIELDS EMF FROM WATER PIPES

The most common source of elevated magnetic field readings in homes is electrical current on a water pipe. This is more accurately described as neutral current diversion into a metallic plumbing and grounding system, also referred to as plumbing current, or ground current.

Small commercial buildings can also exhibit this condition.

The situation exists when some of the current that would normally return through the electrical service line feeding the building is instead channeled into the grounding system, where it returns to the transformer by way of alternate paths, including water pipes, the public water main, and neighboring residences. This

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Wiring Problems

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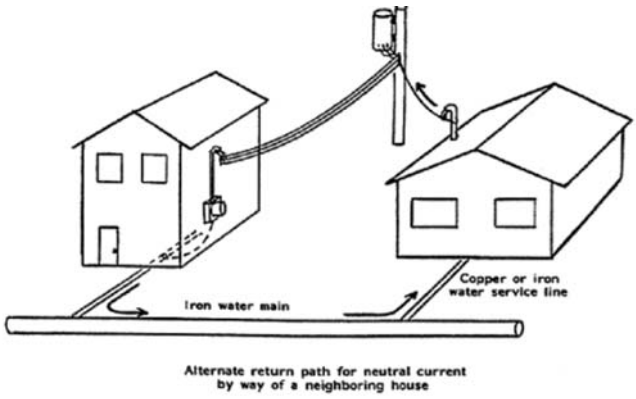
unbalanced current creates a strong magnetic field with a wide spatial extent.

The type of power distribution system used in the U.S., in combination with important National Electrical Code grounding requirements, establish the underlying conditions for this problem to occur. It is more common in communities with moderate to high housing density, especially those served by overhead power distribution lines, but it can occur anywhere.



Drawing by Ed Leeper from Silencing the Fields

This undesired current flow can be blocked very effectively, and in a manner that is code compliant, by the installation of a dielectric coupler, or insulating coupling, in the water supply line to the building. Several strong cautions are necessary before this work is planned.

In some extreme cases, the problem results from a partial failure of the power feed to the building (open neutral), and can represent a potentially serious electrical shock and fire hazard. If intervention is undertaken without an analysis of the nature of the problem, and if the integrity of existing electrical facilities is not verified, extremely hazardous conditions can be created.

In addition, a large sum of money will have been spent on an ineffective solution. We routinely resolve ground current problems, and can coordinate the activities of local service providers at any location through telephone consultation.

Misinformation abounds on the causes and correction of ground current problems. Some sources advise driving additional ground rods (does nothing). Others even tell you to disconnect required grounds from the water pipe in the building (dangerous!). Still others say it cannot be fixed, and suggest suing the electric utility (waste of money). This is not a mysterious issue. It is understandable, explainable, quantifiable, and in almost all cases, fully correctable. For those who wish a further explanation, the following should be helpful:

• Type I ground current is described above. It results from current utilization within the building where the analysis takes place. The magnitude of the problem tracks the changing power load as electrical devices switch on and off. When power to the building is turned off, it goes away. Correctable as described above.

• Type II ground current is also described above. It results from current utilization in another building besides the one under analysis. Power to the building under analysis can be turned off, and the utility meter can even be removed, but the current still flows and the magnetic field is still present. The current magnitude can be seen to vary as electrical devices in another building switch on and off. This problem can occur because of a defective neutral in the service drop to the other building, but this is not always the case. Type I and Type II often exist together in the same building, and can add or subtract. Correctable as described above.

• Type III ground current exists when primary return current (usually from the utility transformer feeding the premises) flows over the secondary portion of the neutral system into the building and crosses over into the plumbing system, usually because of a deficient utility neutral. This is less common and of lower magnitude than Types I and II. Correctable as described here.

RELATED ISSUE

Earth Current refers to the flow of primary return current through the earth back to the serving substation. It is not the type of current discussed on this page, but it is accurately referred to as ground current.

Primary current enters the earth at any point where the electrical system neutral is connected to a grounding electrode. This condition is a consequence of the multi-grounded-neutral (MGN) system that is universally used for power distribution in the United States. This system evolved early in the history of electrical power use because it offered a number of safety advantages.

A fundamental precept of the system is that the earth (which is conductive) functions as a current return pathway to supplement the neutral system, and to handle transitory overvoltages due to lightning or high voltage faults. This is a major route by which primary current returns to the substation.

The utility goes to great length to build and maintain a low resistance ground grid at the substation to handle the current. There may be adverse consequences from earth current flow, such as the establishment of earth surface voltage gradients. This is especially true for the dairy farming industry, where it is one component of the stray voltage issue. It also becomes significant in the design of residential environments for electrically sensitive individuals.

One type of dielectric coupler (union) installed in water line.