THE BREHMER AGENCY

Electrical Safety

Ground Fault Circuit Interrupters

"The Little Bean Counters"

GFCIs measure the number of electrons entering a tool or appliance through the hot wire and the number of electrons returning to the wall through the neutral wire. If there is a the slightest difference in the number of electrons that go into the tool and the number that return to the wall, the power to the unit will be disconnected in 1/40th of a second. In the time it has taken you to read this, a GFCI could have shut down power to a tool at least 800 times. Now that is fast… GFCIs offer superior protection for your employees against electrical shock.

This publication is intended to provide an overview of the construction electrical safety standard. It is not implied or intended to provide a guide that ensures 100% compliance with all provisions of the OSHA regulations. To ensure 100% compliance with all OSHA regulations, consult the OSHA construction standard.

(29 CFR 1926)

Working through the "RED" tape of OSHA's Electrical Standard

OSHA has pretty strict requirements for electrical safety in the construction standard. The electrical standard is easy to comply with, but takes some work. Following are the key points to remember when trying to comply with OSHA's Electrical Safety Standard.

OSHA requires either an assured grounding program be in place or 100% Ground Fault Circuit Interrupter (GFCI) use on all construction job sites.

Assured Grounding Program

An assured grounding program is a written program that specifies that all grounded electric power tools and extension cords be tested quarterly to ensure that the ground wire is intact. A ground wire that is not intact could result in serious personal injury and/or death to an employee unfortunate enough to be shocked.

Tools and cords are to be tested with a multi-meter similar to that pictured below:

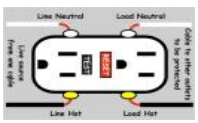
Test procedures will vary slightly depending on what meter is used. The point of the test is to make sure that there is continuity throughout the entire cord and that the ground wire is not broken or damaged in any way. Once the cord and tools are tested, they must be identified in some way to show they have been tested in compliance with OSHA requirements.

OSHA requires that all cords be taped with colored electrical tape to identify them as having been tested. The commonly used tape color scheme is as follows:

December– February (color of snow)	white tape
March– May (color of grass)	green tape
June- August (hot weather)	red tape
September– November (autumn colors)	orange tape

OSHA will issue citations to contractors who are not current with required quarterly testing requirements.

Contractors are able to circumvent all aspects of an assured grounding program simply by mandating 100% GFCI use on all job sites. GFCI protect employees by measuring any fluctuations in electricity. If an employee experiences a shock , the GFCI can detect it and stop the electricity in 1/40th of a second. Ground Fault Circuit Interrupters are often hard-wired, but are also available in a plug-in style as well. Pictured below is a hard wired GFCI as well as an inline GFCI.



To Tape or Not to Tape…. That is the question!

A common problem on construction sites is what to do when an electrical cord is damaged. Should you throw it away, repair it or just use it as is? These questions are not unique to you. These questions face all contractors regardless of trade. The OSHA standard is somewhat vague on this topic, so some "Letters of Interpretation" have been issued by OSHA on the topic. Below is an excerpt from one of them:

Section 1926.416(e)(1) provides that "worn or frayed electrical cords or cables shall not be used." Superficial nicks or abrasions -- those that only slightly penetrate the outer jacket of a flexible cord, and do not permit the cord to bend more in that area than in the rest of the cord -- do not normally render a cord "worn or frayed." Therefore, there is no need to repair or replace such a cord.

Recommendation against taping

While taping these incidental abrasions and cuts does not necessarily violate any OSHA standard, we recommend that employers not tape this type of damage for two reasons. First, Section 1926.403(a) requires that "all electrical conductors and equipment shall be approved." This standard precludes the use of approved electrical conductors and equipment if their characteristics are significantly altered. Applying electrical tape that is too thick or applying too much of it could change the cord's original flexibility and lead to internal damage. Second, the depth of the abrasions and cuts cannot be monitored to see if they get worse without removing the tape.

It should also be kept in mind that the heavy duty extension cords commonly used on construction sites are designed to withstand a hostile environment. Damage to an extension cord that is bad enough to consider taping may have caused damage beyond the jacket.

Tape may not be used to repair significant damage to cord jackets

Repair or replacement of a flexible cord (depending on its gauge) is required when the outer jacket is deeply penetrated (enough to cause that part of the cord to bend more than the undamaged part) or penetrated completely, or when the conductors or their insulation inside are damaged. Two provisions of the standard prohibit the repair of the jacket of a worn or frayed flexible cord with electrical tape. Section 1926.403(a) requires that the cord be approved. The original approval of the cord was based on the types of materials and construction used. As noted above, taping the cord can change the flexibility characteristics of the cord, which in turn can affect the amount of stress in the adjacent areas. This is of particular concern with respect to the grounding wire. Also, the jacket is designed both to prevent damage to the conductors and insulators inside, and to further insulate the conductors. Taped repairs usually will not duplicate the cord's original characteristics; in most cases neither the jacket's strength nor flexibility characteristics will be restored. Therefore, tape repairs of the jacket may not be used to bring a worn or frayed flexible cord into compliance.

GROUND WIRE

A Matter Of Life or Death

A good ground on a piece of equipment may be the difference between life and death on a job site. An electrical short occurs when the hot wire in a tool comes into contact with the body of the tool, thus energizing the tool. A proper ground takes the excess energy from the tool body and routes it through the ground wire to the wall receptacle where it will not harm anyone.

If the ground wire is damaged or the ground prong is missing from the cord and an electrical short occurs, whomever is holding the tool at the time becomes the path for the electricity to reach ground. With no ground wire, the employee holding the tool becomes the ground wire.

Electricity always takes the path of least resistance. Copper wire is a far better conductor of electricity than humans are, so if a good ground is provided, the operator will generally receive a tingle indicating there is a problem with the tool. With a bad ground, the employee could receive a severe shock that may cause serious injury or even death. Routinely check your tool grounding circuits and remove from service any tools in need of repair immediately. It really could be a matter of life or death.

LOOK OUT BELOW!!!!

What you don't know can hurt you

Underground utility service damage cost contractors millions of dollars annually. Many of these utility hits came as a result of excavating in an area where utilities have not been properly located and marked. Digging in an area with no locates is also extremely dangerous. Several employees are killed every year due to utility strikes. Most of these fatalities are associated with electrocution or natural gas explosion, but there are instances where striking a water service has led to trench collapse. The bottom line is that there is no good reason to excavate before utilities are properly located.

Contact Diggers Hotline of Wisconsin at 1-800-242-8511 at least three working days before you need to dig. Diggers Hotline will make sure that all utilities services are located and marked for **FREE**. Be aware that Diggers Hotline will only have the utility services located. They are unable to locate privately installed services (those utilities not installed by the electric company, the gas company, water department, etc). For example, they are not able to locate a wire that runs from a personal residence to the detached garage of that residence.

Once utilities are marked, the area 18" on either side of the marks may contain the utility and must remain undisturbed if at all possible. If that area must be excavated, the utility should be exposed either by hand shoveling or by contacting a hydro-excavator (vacuum truck) contactor to pothole all utilities so that their location is known. Be safe and plan ahead.

NFPA 70E– A Basic Overview

NFPA 70E is far too complex to explain in great detail in a publication of this type. In a nutshell however, NFPA 70E was developed to prevent injuries and fatalities associated with arc flash. An arc flash can occur in any live electrical panel.

According to the National Fire Protection Association (NFPA), an arc flash is "a dangerous condition associated with the release of energy caused by an electric arc." An arc flash is an explosion causing severe burns, injuries and/or death depending on severity.

NFPA 70E requires all equipment be de-energized before it is worked on. In cases where this is not feasible, NFPA 70E requires that specific flame-retardant protective equipment be utilized to protect employees from the catastrophic effects of an arc flash were one to occur. Additionally, the standard requires specific perimeters that must be established to protect passersby when live electrical equipment is being maintained.

For more information visit:

WWW.NFPA.ORG

There are head injury hazards all over the place on construction job sites. All employees should wear an approved hard hat at all times when on construction sites. Your head is too valuable to take for granted. Protect Yourself At All Times!!

Aluminum Ladders…… Shockingly Common

This clever maintenance worker is using an electric drill to drill into a ceiling for some reason. He is standing on an aluminum ladder while doing this. The aluminum ladder is standing firmly on the floor of a full swimming pool while he is on the ladder using an electric drill to drill the hole in the ceiling.

Rarely is something this obviously stupid seen on job sites. This is not to say that people do not do unsafe and sometime stupid things. This situation is just far and away more blatantly foolish than most. On occasion though, an electrician will be seen working from an aluminum ladder.

Aluminum like all metals is an excellent conductor of electricity and when positioned properly makes an excellent ground. Under no circumstances should aluminum ladders be used when working with or on anything electrical. Doing so could result in an electric shock to your workers and likely a serious or potentially fatal fall. Use only fiberglass ladders when working with electricity.

Look Up and Live

Contact with energized overhead power lines results in several fatalities every year. In addition to the staggering fatality rates, contact with energized power lines results in tens of thousands of dollars in equipment damage, utility repair cost and electrical service interruption reimbursement.

Power lines are not insulated. They often have a coating of some sort on them, but the coating is for protection of the power line from the weather and elements. It is not intended to prevent electricity from flowing through the coating into any equipment unfortunate enough to make contact with it.

This being the case, efforts should be taken to prevent any contact with overhead power lines. A general rule of thumb is that no piece of equipment should get any closer than 10' from any energized power lines. It is the responsibility of the employer to make sure that this safety distance is utilized 100% of the time.

In cases where it is not feasible to maintain the safety distance of 10', insulating blankets can be installed by the power company or the electricity can be temporarily re-routed. Both of these solutions take some time, so planning ahead is critical.

Finally, wherever there are overhead power lines on a job site, post warning signs like that pictured above to warn equipment operators and vehicle drivers of the power line's presence. When possible, the height of the wire from the ground should also be posted to warn vehicles with high profiles of it's presence.

Daily Equipment Inspection

All electrical equipment should be inspected daily before it is used to make sure that it is not damaged and is in safe working condition.

Items to be looked for include but are not limited to:

- Damaged or missing ground prongs
- Worn or frayed electrical cords
- Cracks or defects in the body of the tool itself that could result in a shock
- Tool functions as intended by the manufacturer

If any problems with the electrical equipment are identified, tool should be tagged as "UNSAFE-DO NOT USE." Tagged tool should be returned to the shop and not returned to the field until it has been repaired by a qualified individual.

Under no circumstances should electrical equipment that is in need of repair be used as it could result in a potentially serious employee injury. Don't take chances….Don't take shortcuts.

Home Sweet Home

All too often people do a great job practicing safety at work only to go home and leave all their safety knowledge in the job box. Electrical safety in the home is very important and often gets overlooked. Here are some things to remember:

- Protect all plug in receptacles with plastic guards if you have infants or toddlers
- Replace traditional plug in receptacles with GFCIs in wet locations such as bathrooms, garages and exterior locations
- Avoid using power strips or other multi-prong plug in adapters that allow several appliances to run off of a single plug in. This could result in an overload of the circuit and is a serious fire hazard
- Always use a grounded extension cord on appliance with a ground plug. Using a ground adapter to plug a three prong plug into a two prong cord is a recipe for disaster that could result in a serious injury or worse.
- Teach your children to respect electricity
- Hire licensed electricians to repair or service your home. They do it for a living and know how to safely work with electricity.