

# Electrical Hazards

*Electrical hazards can be found in nearly every roofing work site. Whether the hazard is posed by worn or damaged power tools or cords, improperly grounded tools or equipment, or the presence of standing water, it is the responsibility of the contractor to make sure the tools and equipment employees use are in safe working order and safeguards are in place to protect employees from electrical energy sources. This chapter will describe the requirements set forth by the Occupational Safety and Health Administration (OSHA) as they pertain to electrical safety. It will not address overhead or underground electrical hazards; they are addressed in other chapters of this manual.*

## **Power Tools**

*When selecting electrical hand tools, it is important to select those that are double-insulated. This generally means the tool is encased in plastic, which will prevent the user from electrocution if the tool develops a short circuit. Double-insulated tools are identified with a square-within-a-square logo or the words “double-insulated” on the label. These tools will have a two-prong plug with no ground pin and one prong will be wider than the other. The wider pin is the neutral conductor while the thinner pin is the hot. This is important because if plugged into a properly wired circuit, the tool’s switch will control the hot conductor and the internal wiring of the tool cannot become energized. If a circuit is wired incorrectly so that the hot conductor connects to the neutral pin of the tool, the switch will still shut the tool off and on but in the off position the internal wiring of the tool may be energized causing a potential for the user to be exposed to electric current.*

*Some tools that have three prongs (hot, neutral and ground) may have the grounding pin missing. This is an extremely hazardous situation because if a short develops in the tool, the user may become the ground in the system and electricity will travel through him or her.*

*Power tools should be inspected before each use. If there are any defects, such as insulation missing from the cord or a piece of the protective shell broken, the tool must be taken out of service until repaired.*

## **Extension Cords**

*When extension cords are needed for a roofing job, it is important that only extension cords in good working order be used. Because construction work can be tough on extension cords, OSHA requires three-wire cords designed for hard or extra-hard usage. The National Electrical Code (NEC) has different designations for extension cords (Table 400.4). Hard-service cords*

are marked with letters such as S, SE, SO, ST; junior hard service cords are marked with letters such as SJ, SJE, SJO, SJT or SJTO. Other letters may be included after these that indicate the nature of the insulation or outer covering. Flat-wire cords are prohibited from use on construction sites because they do not provide the protection that double-insulated cords do. Wire gauge (diameter) is not set out in the OSHA standard, but the size of the wire in an extension cord set must be sufficient to handle the amperage that will be drawn by tools connected to the cord. For example, a contractor may find a hard service cord made of 18-gauge wire that is rated to carry a maximum of 7 amps. That would be insufficient to power a drill that draws 11 amps. The proper cord set in that instance would be one made of 12-gauge wire that has an ampacity of 20.

Because OSHA requires three-wire extension cords be used on construction sites, a cord's plug must have three prongs at one end. Sometimes during use, the third prong, or the grounding pin, may become loose or fall out. No one should be allowed to bypass the grounding pin by bending it out of the way or removing it completely. If the grounding pin is missing, the cord must be removed from use, repaired and tested before it is put back into service. Testing procedures will be discussed later.

## **Ground-fault Circuit Interrupters**

Ground-fault circuit interrupters (GFCIs) must be used on all projects for 120-volt, single-phase 15- and 20-ampere services when the circuit is not a part of the permanent wiring of a building or structure. Most modern generators are equipped with GFCIs, and they must be checked to ensure they are working properly.

If the generator or electrical source is not equipped with a GFCI, a portable unit must be used. To ensure proper ground-fault protection, the portable GFCI should be plugged into the generator or power source, and then extension cord(s) should be plugged into the GFCI.

## **Assured Grounding Program**

Instead of using GFCIs, a roofing contractor can develop and implement an assured grounding program for equipment used on a project. The objective is to prevent electrocution by ensuring grounding wire is electrically continuous from the power tool to the power source.

The assured grounding program consists of a written program, daily visual inspections and a method to detect a faulty grounding wire in an extension cord or hand tool. A sample program is included at the end of this chapter. In addition to hand tools and extension cords, receptacles also must be tested.

*The written program should describe the procedures for equipment testing and must be implemented by a competent person. Testing should be conducted on each piece of equipment every three months, as well as before first use or return to service after repair.*

*In order to ensure a grounding wire is electrically continuous throughout the extension cord or power tool, a continuity test must be conducted. There are several different types of continuity testers on the market, but they pretty much work in the same manner. On one end of the tester, there is typically an alligator clip that attaches to the grounding pin of a tool that is not double-insulated or the extension cord. The other end of the tester has a metal probe that plugs into the extension cord or is touched to a metal part of the power tool. If the light on the tester illuminates, the ground is continuous, thus passing the continuity test. If the light does not illuminate, the power tool or extension cord must be removed from service until it is repaired. Circuit testers are simple plug-in devices that light up different bulb sequences to indicate if a circuit is wired properly. This is critical because it allows a user to test if the hot wire is connected to the hot terminal of an outlet; the neutral wire is connected to the neutral terminal; and the ground is continuous.*

*OSHA requires test results to be recorded. Two record-keeping systems common to construction trades and often used together are a log and color-coding with tape. The log keeps track of the date each piece of equipment is tested and its service and maintenance history. The tape indicates the status of the equipment—for example, whether a piece of equipment or an extension cord needs repair or has passed its most recent test.*

*Equipment generally is tested every three months, and when a piece passes its test, it can be tagged with a tape color that “matches” the season: white for winter, green for spring, red for summer and orange for fall. This helps a user readily identify that a piece has been tested and when. Brown tape can be used to identify any equipment that needs repair, and it then can be replaced once the piece has been fixed and passed its test. Any color scheme is fine, as long as it is consistent and easily understood by the equipment users.*

*An assured equipment grounding program requires compliance with a strict inspection and administrative process to document the condition of power tools and extension cords. It can be easy to miss a step and increase a chance for an injury or an OSHA citation. The better practice may be to use portable GFCIs to protect all tools present on the job site.*

# List of Safe Work Practices

## Electrical Safe Work Practices

*[Company name] recognizes that electricity can kill or injure employees. It has decided to implement the following work practices in the company to minimize the potential dangers associated with electricity. This section will not include lockout/tagout procedures or power tool usage. These topics are discussed elsewhere in the safety program.*

### **General**

- Each circuit encountered will be considered live until proven otherwise.*
- Only proper tools will be used to test circuits.*
- No wire will be touched until the circuit is determined to be dead.*
- Improper connections to HVAC or other rooftop power sources must be avoided.*

### **Extension Cords**

- All extension cords used on any project will be three-pronged.*
- All extension cords will be in good working order.*
- Each extension cord ground will be tested for continuity on at least a quarterly basis and marked to indicate when the inspection occurred.*
- Each extension cord will be visually inspected before each use.*
- If any extension cord is found in disrepair or fails the continuity test, it will be tagged and taken out of service and retested before it goes back into service.*
- Any extension cord that does not have the grounding pin will be taken out of service and not used.*
- Extension cords will not be used in place of fixed wiring.*
- Extension cords will not be run through holes in walls, ceilings or floors.*
- Extension cords will not be attached to the surface of any building.*

- *Extension cords will carry hard or extra-hard NEC designations, such as: S, ST, SO, STO, SJ, SJO, SJT, SJTO.*
- *No extension cord will be of the “flat wire” type. Every extension cord will have each individual wire insulated and further protected by an outside cover.*

### **Power Tools/Plug and Cord Sets**

- *Any cord that is cut in a way that exposes insulation will be removed from service and repaired.*
- *All tools and plug and cord sets will be tested for continuity.*
- *If grounding pins are missing, the plug and cord will be removed from service until repaired.*
- *Any tool or plug and cord set failing the continuity test will be removed from service until repaired.*
- *All power tools will have three-pronged plugs unless double insulated.*

### **Ground-fault Circuit Interrupters (GFCIs)**

- *Each 120-volt electrical wall receptacle providing power to the job site will be protected by a portable GFCI.*
- *Each GFCI will be tested quarterly and marked with markings similar to those of the assured grounding program.*
- *Each 120-volt, single-phase, 15- and 20-ampere receptacle outlet, including those on generators, will have an approved GFCI.*
- *GFCIs will be located in line as close to the piece of equipment as possible.*

## **Assured Grounding Program**

### **Policy**

*[Company name] has developed and adopted this assured grounding program to provide protection for employees.*

### **Scope**

*This program will apply to all extension cords or plug and cord sets. It also will apply to three-pronged tools and all electrical receptacles of 110 volt 15- and 20-ampere ratings.*

## **Procedure**

*All extension cords used on projects must be three-pronged and carry one of the designations required by the Occupational Safety and Health Administration (OSHA) and the National Electric Code (NEC). Each extension cord, power tool and receptacle, as defined earlier, shall be tested for grounding continuity.*

*Any cord, receptacle or tool that has not passed the continuity test shall be tagged and may not be used until it is repaired and retested.*

*This program will be implemented and monitored by the safety director, serving as the competent person. A “competent person” is one who can identify existing and potential hazards in a job site’s surroundings or working conditions that are hazardous or dangerous to employees and has the authority to take prompt corrective measures.*

## **Testing Frequency**

*Each tool, receptacle and extension cord shall be tested:*

- *Before the equipment is first used*
- *Before it is returned to service following any repairs*
- *Before the equipment is used after any incident that can reasonably be suspected to have caused damage to the tool, such as a vehicle running over the cord*
- *At intervals not to exceed three months for tools and cords and six months for receptacles*

## **Color-coding**

*[Company name] has chosen to rely on a system of colored tape to indicate that a piece of equipment has passed the continuity test. Colored tape will be placed on each piece of equipment according to the chart below. Routine testing will be completed on the first working day of the new quarter. Monthly testing will be conducted on the first day of the month. The following chart shows testing frequency and colored tape selections.*

## **Program Review**

*This program will be reviewed annually.*

<i>Month/ Quarter</i>	<i>Quarterly Colors</i>	<i>Monthly Colors</i>
<i>January</i>	<i>White</i>	<i>White</i>
<i>February</i>	<i>White</i>	<i>White and Yellow</i>
<i>March</i>	<i>White</i>	<i>White and Blue</i>
<i>April</i>	<i>Green</i>	<i>Green</i>
<i>May</i>	<i>Green</i>	<i>Green and Yellow</i>
<i>June</i>	<i>Green</i>	<i>Green and Blue</i>
<i>July</i>	<i>Red</i>	<i>Red</i>
<i>August</i>	<i>Red</i>	<i>Red and Yellow</i>
<i>September</i>	<i>Red</i>	<i>Red and Blue</i>
<i>October</i>	<i>Orange</i>	<i>Orange</i>
<i>November</i>	<i>Orange</i>	<i>Orange and Yellow</i>
<i>December</i>	<i>Orange</i>	<i>Orange and Blue</i>
<i>Repair/Damaged</i>	<i>Brown</i>	<i>Brown</i>