# APPENDIX G. ELECTRICAL SAFETY POLICY

**Purpose**
VSC Fire & Security, Inc. (VSC) has established this Policy to provide controls and protection for its employees who are exposed to electrical hazards associated with electrical equipment installation, maintenance, and construction work. This program addresses safe work practices, training requirements, Personal Protection Equipment (PPE) and ground fault protection to ensure the health and safety of VSC employees.

**Regulatory Scope**
This procedure addresses the regulatory requirements under 29 CFR 1910 Subpart S, 29 CFR 1910.331 to 1910.339, 1910.332, 29CFR 1926.400 - 1926.449 and NFPA 70E, *Electrical Safety Requirements for Employee Workplaces*, as applicable.

**This program has been prepared in compliance with the State and Federal OSHA Standard §1926.404 Wiring design and protection. The purpose of this operating procedure is to ensure the protection VSC employees from accidents and/or injury hazards, while working with or around electrical equipment. The following procedures must be followed. No employee shall operate any electrical equipment without training that documents the employee's knowledge of the equipment and its operation, associated safety devices and procedures. Users must perform a daily pre-use inspection of the equipment.**

**Common Hazards**
Safe work practices must be enforced to prevent electric shock or other injuries resulting from either direct or indirect electrical contact when work is performed near or on energized equipment or circuits. The specific safe work practice must be consistent with the nature and extent of the associated electrical hazard(s).

**Hazard Assessment**
**Electric shock is involuntary movement (or freezing) of muscles due to electricity.**
**Electrocution is damage due to "cooking" of flesh as one of the effects of electric current flow is heat.**
The following lists common injuries due to electrical hazards:

- Shocks occur when current flows through parts of the human body. Electrocution is a direct result of an electrical shock.
- Third-, Second-, and First-degree burns.
- Physical injuries caused by atmospheric explosions and/or fire.
- Secondary physical/indirect injuries when the person is forced into or is impaled by stationary objects.

**Authorized Employees**
Only qualified persons may perform testing work on electric circuits or equipment. Qualified persons shall be capable of performing work safely on energized circuits. As stated in OSHA 1910.333(c)(2), qualified persons must be capable of working safely on energized circuits and must be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

**Protection of Employees**
No employee is permitted to work in proximity to any part of an electric power circuit which the employee could contact in the course of the work, unless the employee is protected against electric shock by de-energizing the circuit and grounding it, or by guarding it effectively by insulation or other means.

**Testing on energized equipment 50 volts or greater**

Live parts to which an employee may be exposed, such as fire alarm panels, shall be de-energized before the employee works on or near them, unless it is infeasible due to equipment design or operational limitations. Live parts that operate at less than 50 volts to ground need not be deenergized if there will be no increased exposure to electrical burns or to explosion due to electric arcs. Employees may perform testing on energized parts of equipment, but the equipment may remain energized only as long as necessary to perform the test.

Employees must use insulated tools or handling equipment if the tools or equipment might contact energized parts. In the case of testing equipment, the probes need to be insulated for the voltage.

Employees will use appropriate electrical protective equipment (which includes rubber insulating gloves) when working in areas with potential electrical hazards. If the following conditions are met the use of rubber insulating gloves or other protective equipment is not required:

- The probes are designed so that the employee's hand cannot slip off the end of the insulated handle; and
- There are no other exposed energized parts that the employee's hand might contact during testing.

<u>Conductors and parts of electric equipment that have been de-energized but have not been Locked-out or Tagged-out must be treated as energized parts.</u>

**Arc Flash Hazards**

VSC employees are not authorized to perform any tasks, test or inspections on high voltage equipment requiring the use of arc flash level personal protection equipment.

**Working Near Arc Flash Hazards**

Alarm panels, conduit and fire protection systems are often in the same enclosed area such as mechanical and electrical rooms within proximity to high voltage arc flash hazards. VSC alarm & sprinkler technicians are commonly exposed to these potential hazards. As required by OSHA's standard 29 CFR 1910.269 "Training for non-Electrical Workers" (see attached LOI), technicians must meet the training requirements as described in 1910.269.

In addition to OSHA training requirements, alarms techs need to follow these general, although not all-inclusive, guidelines:

- Do not enter high voltage area when facility maintenance or other contractors are working on live parts.
- If maintenance or contractor begins work in panel, after you have started work, stop and immediately notify the customer.
- Daily inform the customer you will be working in the space and comply with customers' safety planning and notification requirements, including any LOTO programs.
- If any high voltage panel door is open do not attempt to close it. Immediately leave the area and notify the customer.
- Always maintain a 3-foot clearance from the panel door.
- Do not allow tools, equipment, or material to contact panels.
- Do not operate lift equipment near panels without a spotter.
- Do not climb or lean ladder against panel to access or install alarm conduit.
- If the installation or access to alarm equipment conduit requires working above or in contact with live (active) high voltage equipment, contact the alarms department manager and perform a job hazards analysis before starting any work.
- Contact VSC's Risk-Safety Department (Risk-Safety) for assistance with questions, concerns, hazard analysis and action plans.

**Training**

VSC will provide electrical safety training to all employees whose job requires exposure to electrical hazards. Any employee who does not comply with this training will be subject to discipline, up to and including termination of employment.

VSC will recognize those individuals that are certified by State Board of Contractors, who hold a Journeyman's License, or who

have completed an approved Apprentice Program in electrical safety as “Qualified Employees”.

Employees must be trained in and possess the knowledge for the safety-related work practices required by 1910.331 through 1910.335 that pertain to each job assignment.

Employees who face a risk of electric shock from electrical hazards that are not reduced to a safe level by the electrical installation requirements must be trained in electrical safety-related work practices as required by sections 1910.331 through 1910.335.

Employees are either qualified persons or unqualified persons when working on or near exposed energized parts. Qualified persons have training, whereas unqualified persons have little or no training, in avoiding the electrical hazards of working on or near exposed energized parts.

**Training for Qualified Employees**

A qualified employee is one who is permitted to work on or near exposed energized parts and is trained in the following:

- The knowledge necessary to distinguish exposed live parts from other parts of electrical equipment.
- The knowledge necessary to determine the nominal voltage of exposed live parts.
- The clearance distances to/from the corresponding voltages.
- The proper use of special precautionary techniques, PPE, insulating and shielding materials, and insulated tools.
- General equipment requirements as provided in the national standards.

**Retraining Requirements**

If VSC management has reason to believe that an employee who performs tasks on electrical components or exposed to electrical hazards demonstrates a lack of knowledge and skill required to follow the electrical safe work practices, then the employee will be retrained. Circumstances where retraining is required include, but are not limited to:

- Change in job assignment.
- Change in machines, equipment or processes that present a new hazard.
- Change in the Lockout/Tagout procedure.
- Situations that arise in which retraining appears necessary to ensure electrical safe work practices and/or safe Lockout/Tagout procedures. Recordkeeping:
- Risk-Safety will maintain training records with respect to this Electrical Safety Policy. Records will include: employee name, training topic including course content, date of training, certification (where applicable), and date of future training to maintain certification.
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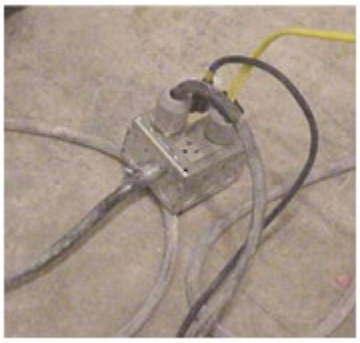
**Electrical Safety on construction sites**

**Temporary electrical power supply on construction sites**

- Temporary electrical panels provided by the general contractor must comply with 29 CFR. 1926 Subpart K, “Wiring Design and Protection Standards”. Dead front and outer panel door must be in place and closed on all temporary breaker panels.
- VSC employees must conduct visual inspection of power supply for proper circuit protection, insulation, and grounding prior to using any temporary or portable power supply. Branch power distribution cables to temporary electrical panels must not be on the floor, ground, or in other locations where employees can be exposed to the branch power cable.
- Ensure portable or temporary electrical panel, outlets, and support structure are in safe condition. Do not use panels with base structure in standing water. Do not connect or disconnect cords in outlets if you are standing in water.
- GFCI's are used on all 120-volt, single phase 15 and 20-ampere temporary wiring on construction sites.
- The use of non-approved shop made extension cords are prohibited such as Portable flex cord or rigid cable with metal outlet boxes as seen here…

Immediately report any damaged or unsafe electrical power sources to the General Contractor and notify other VSC employees not to use the unsafe temporary power sources. DO NOT ATTEMPT TO MAKE ANY REPAIRS OR ALTERATION OF DAMAGED OR UNSAFE PANELS.



**Outdoor Electrical Panels**

- Ensure temporary panels, outlets and connections located outdoors are designed with the correct weather proofing components.
- Ensure panel is not standing in water. Do not connect or disconnect cords from outlets if you are standing in water.
- Do not run extension cords from panel to work zone in area where traffic or heavy equipment can run over them.

When a temporary power outlet exceeds 100 ft in total distance from tools or equipment follow these guidelines:
Outlet exceeds 100 feet:

- relocate power machine, equipment or tool closer to the power source.
- Request GC to establish additional temporary power supply closer to our work zone
- Rent a portable generator as needed.
- Do not plug multiple extension cords together
- Do not use extension cords longer than 100 feet.

**Ground Fault Protection Program**

Employers Responsibility
Out of concern for the safety and health of its employees, VSC will comply with Ground Fault Protection Regulations found at 29 CFR 1926.404 (b)(1)(ii).

All electrical equipment & tools used by VSC employees will be connected to a properly working GFCI. This means that the GFCI must be tested by the foreman prior to use each day. The GFCI must be plugged into an outlet that is in good condition and has the proper cover plate installed. The GFCI must always be located ahead of the extension cord and the power cord of the equipment being used. Therefore, the GFCI must be plugged directly into the wall outlet, not into an extension cord. This method will ensure that both the cord(s) and the equipment are protected from faults and protects the equipment operator from electrical shock.

Insulation and Grounding
*Insulation* and *Grounding* are two recognized means to prevent injury during electrical equipment operation. Conductor insulation may be provided by placing nonconductive material such as plastic around the conductor. Grounding may be achieved through the use of a direct connection to a known ground such as a metal cold water pipe.

Consider, for example, the metal housing or enclosure around a motor or the metal box in which electrical switches, circuit breakers, and controls are placed. Such enclosures protect the equipment from dirt and moisture and prevent accidental contact with exposed wiring.

However, there is a hazard associated with housings and enclosures. A malfunction within the equipment—such as deteriorated insulation— may create an electrical shock hazard. Many metal enclosures are connected to a ground to eliminate the hazard. If a "hot" wire contacts a grounded enclosure, a ground fault results which normally will trip a circuit breaker or blow a fuse. Metal enclosures and containers are usually grounded by connecting them with a wire going to ground. This wire is called an *equipment grounding conductor*. Most portable electric tools and appliances are grounded by this means. There is one disadvantage to grounding: a break in the grounding system may occur without the user's knowledge.

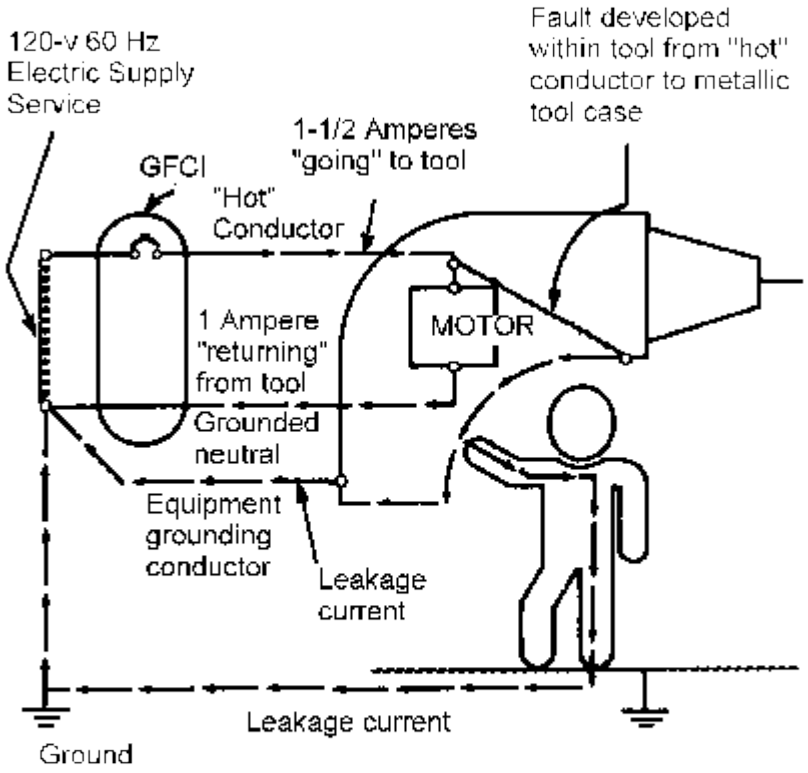
*Insulation* may be damaged by hard usage on the job or simply by aging. If this damage causes the conductors to become exposed, shock, burn, and fire hazards are created. Double insulation may be used as additional protection on the live parts of a tool, but double insulation does not provide protection against defective cords and plugs or against heavy moisture conditions.

The use of a ground-fault circuit interrupter (GFCI) is one method used to overcome grounding and insulation deficiencies.

WHAT IS A GFCI?

The ground-fault circuit interrupter (GFCI) is a fast-acting circuit breaker which senses small imbalances in the circuit caused by current leakage to ground and, in a fraction of a second, shuts off the electricity. The GFCI continually matches the amount of current going to an electrical device, against the amount of current returning from the device, along the electrical path. Whenever the amount "going" differs from the amount "returning" by approximately 5 milliamps, the GFCI interrupts the electric power within as little as 1/40 of a second. (See diagram.)

**Ground-Fault Circuit Interrupter**




GFCI monitors the difference in current flowing into the "hot" and out to the grounded neutral conductors. The difference (1/2 ampere in this case) will flow back through any available path, such as the equipment grounding conductor, and through a person holding the tool, if the person is in contact with a grounded object.

However, the GFCI will not protect the employee from line-to-line contact hazards (such as a person holding two "hot" wires or a hot and a neutral wire in each hand). It does provide protection against the most common form of electrical shock hazard-the ground fault. It also provides protection against fires, overheating, and destruction of insulation on wiring.

WHAT ARE THE HAZARDS?

With the wide use of portable tools on construction sites, the use of flex cords is often necessary. Hazards are created when cords, cord connectors, receptacles, and cord and plug-connected equipment are improperly used and maintained.

Generally, flexible cords are more vulnerable to damage than fixed wiring. Flexible cords must be connected to devices and fittings to prevent tension at joints and terminal screws. Because the cord is exposed, flexible, and unsecured, joints and terminals become

more vulnerable. Flexible cord conductors are finely stranded for flexibility, but the strands of one conductor may loosen from under terminal screws and touch another conductor, especially if the cord is subjected to stress or strain.

A flexible cord may be damaged by activities on the job, by door or window edges, by staples or fastenings, by abrasion from adjacent materials, or simply due to aging. If the electrical conductors become exposed, there is a danger of shock, burns, or fire. A frequent hazard on a construction site is a cord assembly with strained or damaged connections as see here:


Damaged foot pedal connertors.


Damanger connection to power machine.

When a cord connector (plug) is wet, hazardous leakage can occur to the equipment grounding conductor and to humans who pick up that connector if they also provide a path to ground. Such leakage is not limited to the face of the connector but also develops at any wet portion of the connector.

When the leakage current of tools is below 1 ampere, and the grounding conductor has a low resistance, no shock should be (felt or experienced. However, should the resistance of the equipment grounding conductor increase, the current through the body also will increase. Thus, if the resistance of the equipment grounding conductor is significantly greater than 1 ohm (unit of electrical resistance), tools with even small leakages become hazardous.

PREVENTING AND ELIMINATING HAZARDS

GFCIs can be used successfully to reduce electrical hazards on construction sites. Tripping of GFCIs—interruption of current flow—is sometimes caused by wet connectors and tools. It is good practice to limit exposure of connectors and tools to excessive moisture by using watertight or sealable connectors.

Providing more GFCIs or shorter circuits can prevent tripping caused by the cumulative leakage from several tools or by leakages from extremely long circuits.

To prevent and eliminate hazards:

- Electrical tools must be inspected daily before use.
- Damaged electrical tools must be tagged and removed from service immediately.

Generators

Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5kW (kilowatt), where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with GFCI's. VSC will not use generators exceeding 5kW.

**Electrical Equipment Usage and Repair**

All electrical equipment, extension cords, and GFCI's are to be in good condition, with grounding prongs intact, no wiring splices, exterior covering/insulation intact, and all factory installed tool safety devices in place. The following guidelines also apply:

- GFCI, extension cords, and equipment must be inspected (prior to use) daily for damage.
- All extension cords must be #14 gauge or greater.
- No cord will be run through doorways or windows unless the window or door is secured in an open position.
- All extension cords run throughout construction areas will be suspended off the floor using non-metallic ties.
- Splicing extension cords as a means of repair is not permitted.
- Tool/equipment cords can be repaired by replacing the cord or installing the proper male end connection. However, when

this is performed the tool/equipment will not be used until it has been checked by a qualified to ensure the polarity is maintained.

- Strain relief grips should be used when repairing or replacing tool and equipment cords that have been pulled loose from the equipment to avoid future damage of the same type.

Example of an improper repair:

***This male & female connector is unauthorized and a violation. Mechanical compressed non liquid resistant without strain relief connectors as seen here are unauthorized for flex cords.***

***This is the correct authorized replacement connector for flex cords.***

***Electrical tape is not an approved repair method for damaged cords.***

**Electrical repairs**

Employees are not allowed to perform repairs, test, inspections, or replacement of electrical components of equipment or tools requiring the disassembly of the equipment of tools.

Only a qualified electrician or the manufacture can repair, test, or inspect internal electrical components of equipment and tools.

> VSC recognizes that on multiple trade jobsites, equipment is located in close proximity and is sometimes shared by each trade. For safety reasons, VSC employees must not use other trades equipment, and likewise other trades must not be permitted to use VSC equipment.

**Tools, Equipment & PPE**

VSC employees must complete a pre-job Job Hazard Analysis (JHA) to identify electrical hazards and ensure that the necessary equipment is available for employee use. At minimum, it is expected that each employee will adhere to the following:

- Specified PPE must be used when there is potential contact with an exposed electrical source.
- PPE will be properly maintained and inspected for damage before each use.
- VSC issued hard hats have an electrical safety rating and Employees will only wear VSC issued hard hats.
- Employees will wear protective eye/face equipment to protect from the hazards of arcs, flashes, or from flying objects that occur due to electrical explosions.
- Class 00 rubber electrical insulating gloves rated for tasks, testing or inspections with exposure to 50v to 120v electrical hazards.
- Employees will wear heavy duty, composite toed, over the ankle, construction grade work boots. Steel toe safety shoes are not to be worn when working around electrical hazards as the steel toe can act as a conductor which can lead to serious injury or death.
- Protective shields, barriers, or insulating materials will be used to protect against shock, burns, or other electrical related injuries while the employee is working near exposed energized parts.
- Only tools and equipment that are properly insulated and designed for work around electrical hazards are permitted.
- When fuse terminals are energized, fuse-handling equipment will be used to remove or install fuses.
- Damaged electrical safety PPE must be replaced before performing any tasks.
- Any insulating tool or equipment found to be defective or worn to the point that it no longer provides the indicated insulating capability will be returned to VSC management for replacement or repair.
- Portable ladders must have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized parts.
- Employees may not enter spaces containing exposed energized parts unless the area is illuminated brightly enough to allow the employees to perform the work safely.

**Wearing Conductive Articles**
Conductive articles of jewelry and clothing (i.e. watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or unrestrained metal frame glasses, etc.) must not be worn where they present an electrical contact hazard with live parts, unless such articles have been rendered non-conductive by covering, wrapping, or other acceptable insulating means.

**Overhead Lines**
OSHA's preferred method of protecting employees working near overhead power lines is to de-energize and ground the lines when work is to be performed near them. When a worker is working in the vicinity of overhead lines, whether in an elevated position or on the ground, the person must maintain a minimum distance of **20 feet** from the power line. This may include involving other companies in the process.

The purpose of this approach distance is to prevent contact with and/or arcing from energized overhead power lines. The approach distance applies to tools, lifting equipment, scaffolds, ladders and materials (i.e. pipe), which are used by employees, as well as to the employees themselves.

If work is to be performed near overhead lines, a site specific JHA & Safety Plan will be developed with the minimum following requirements: The lines must be de-energized and grounded, or other protective measures must be provided before work is started. If the lines are to be de-energized arrangements must be made with the person or organization that operates or controls the electric circuits involved so they can de-energize and ground them. If protective measures, such as guarding, isolating, or insulating are provided, these precautions must prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

Note: VSC will comply with an Owner or General Contractors electrical safety program as required, as long as the program meets the regulatory requirements referenced in the Regulatory Scope.

**Vehicular and Mechanical Equipment**
All VSC vehicles and mechanical equipment will also maintain a clearance distance of 20 feet from power lines. Employees standing on the ground may not contact the vehicle, or mechanical equipment, or any of its attachments when this clearance is not maintained.

**Alerting Techniques**
VSC will use the following techniques to warn and protect employees from hazards that could cause injury due to electric shock, burns, or failure of electric equipment parts:

- Safety Signs, Tags and Barricades
    - Live electrical equipment will be tagged, covered, shielded, enclosed, or otherwise protected by covers, barriers, or platforms to prevent undue contact by unqualified persons or objects.
    - The minimum clear distances for these signs and barricades are:

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|---|---|---|
| 0 – 150 | Nominal Voltage to Ground | 3 feet |
| 151 – 600 | Nominal Voltage to Ground | 4 feet |
| 601 – 2500 | Nominal Voltage to Ground | 5 feet |
| 2501 – 9000 | Nominal Voltage to Ground | 6 feet |
| 9001 – 25,000 | Nominal Voltage to Ground | 9 feet |
| 25,001 – 75K | Nominal Voltage to Ground | 10 feet |
| Above 75K | Nominal Voltage to Ground | 12 feet |

    - For spaces that do not allow 3 feet or more clearance, the minimum distance from the circuit will be 30 inches.
    - Conductive barricades will not be used where they might cause an electrical contact hazard.
- Attendants
    - If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant will be stationed to warn and protect employees.

**Lockout/Tagout (Electrical Sources)**
VSC employees who are exposed to electric equipment or circuits which have been de-energized will Lockout and Tagout the circuits that energize those parts as described in the "*Lockout/Tagout Safety Policy*", Appendix H. of the VSC Health & Safety Program.


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