**ELECTRICAL SAFETY**

**Policy Statement**

It is the Policy of Piedmont Service Group (PSG) to limit the exposure of all employees to potential electrical and other hazards in the workplace. This program addresses the potential for exposure to electrical hazards whether they arise from the normal course of construction, maintenance or caused by manmade or natural incident. It is also the intention of this policy to clearly state that energized electrical work, at 50V or more is to be avoided, and that any decision to work on an energized system is to be made under strict supervision and only when all the requirements are met. This program and implementation of it will be audited annually or sooner if there is an incident.

**Responsibilities**

*General Responsibilities:*

## The safety related work practices contained in NFPA 70E will be the regulations on which our electrical safety program is based. PSG will provide the safety related work practices, will train the employees, provide the necessary PPE and the employees shall implement them. PSG will also advise the host employer of unique hazards in the workplace presented by the contractor’s work, unanticipated hazards, and any measures taken to correct hazards reported to them by the host employer.

*Supervisor’s Responsibilities:*

* Safety and supervision of all personnel and their activities on site, not just their productive activities, but also the types of activities which may expose them to energized conditions without proper protection and training.
* Use all the documentation tools/paperwork to prepare for the tasks and record results.
* Observation and enforcement of employees’ compliance with protective verification practices and PPE usage requirements.
* Leadership must be demonstrated and compliance requirements must be enforced.

*All Field Employee’s Responsibilities:*

* Never perform any energized work without the appropriate PPE, the knowledge of the Foreman and authorization of responsible supervision.
* Adhere to the PSG self-protective verification process. Test before you touch.
* Possess working Class III or IV voltage meter and understand how they operate.
* All tools and PPE must be tested and inspected prior to use and after any incident.
* Understand the established site specific procedure to control energy through the LOTO Plan.
* Know the meaning of a qualified, unqualified, and authorized person(s).
* Be trained and familiar with any electrical safety related practices necessary for their safety. They must also understand basic system knowledge in order to be familiar with their working environment along with its hazards, restrictions, and limitations.
* Understand that unauthorized employees should not attempt to perform testing and troubleshooting.
* Understand that they are not allowed to make contact with energized parts or work within the limited approach boundary unless they have been authorized and approved to do so.
* Unqualified workers must stay a minimum of 10' away from overhead lines.
* At this time, no workers are qualified or authorized to work closer than 10' to overhead power lines. All vehicles must maintain a minimum of 10' of distance from overhead power lines.
* Report any employee performing an unauthorized task.
* Report immediately any unsafe condition or action.

**Self-Protective Verification**

The Qualified and Authorized person is primarily responsible for implementing the Lock Out/Tag Out Program (LOTO) The Authorized employee(s) shall identify, document, implement, and enforce the lockout tag out procedures for the project in order to safe guard employees from an accidental exposure to electrical hazards.

PSG has implemented the self-protective verification process as a secondary means of protection for all employees. The intention is to ensure that every employee is aware of their working environment.

The Authorized employee is responsible for ensuring that the LOTO program is effectively in place and shall verify the lack of electrical energy. This self protective process is designed to involve all employees in the assurance that power is not present prior to working.

The practice of self-protective verification is **not an option**. No one can afford to make mistakes when working around electricity.

**What is Self-Protective Verification?**

Self-Protective Verification is both an attitude and a habit. When working on circuit parts they must be approached with the attitude and belief that the box, wire, panel, gear or other components are energized, even with Lockout/ Tag out in place. If an employee walks away from any component for a moment, they need to approach it as if it is energized when they return. They need to make a habit of reaching for their tester before they reach for other tools. They need to follow the verification procedures listed below before making contact. These verification procedures require the use of two testers. It may also be required to use the appropriate PPE to determine the status of the equipment.

1. A proximity tester indicates the presence of voltage without actually touching the energized part. It has its limits but must first be used to verify that there is no voltage present so that everyone doesn’t need to have the required PPE with them at all times. If it indicates that there is voltage, they muststop work andobtain assistance from an authorized person to correct and eliminate the hazardous situation before going any further. If the proximity tester indicates that there is no voltage present they should not rely on it. A contact voltage tester must then be used to confirm the lack of voltage.
2. A contact voltage tester requires the actual touching of a potentially energized part with the probe of the instrument in order to indicate voltage.

**PSG requires that all types of Voltage Testers/Meters must be Cat. III or IV.**

**PRIOR TO USE, A TESTER/VOLTAGE METER MUST BE USED ON A KNOWN ENERGIZED SOURCE IN ORDER TO VERIFY THAT IT IS WORKING PROPERLY. LIVE/DEAD/LIVE METHOD.**

**Definitions**

***Working On*:** Intentionally coming in contact with energized electrical conductors or circuit parts with the hands, feet, other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment (PPE) a person is wearing.

There are two categories of “working on”:

***Diagnostic (testing)***is taking readings or measurements of electrical equipment, conductors , or circuit parts with approved test equipment that does not require making any physical change to the equipment, conductors, or circuit parts.

***Repair***is any physical alteration of electrical equipment, conductors, or circuit parts (such as making or tightening connections, re-moving or replacing components, etc.).

**Any form of energized work may only be performed by PSG personnel who:**

1. Have received training where they have demonstrated proficiency
2. Have been deemed qualified and competent
3. Have received authorization

***Unqualified Person:*** A person who is not a qualified person. Not allowed in the restricted shock boundary. Only allowed in the limited shock boundary when accompanied by a Qualified Person.

***Qualified Person***: One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk.

## **•** Only Qualified and Authorized individuals are permitted to perform start up, lockout/tag out, testing and troubleshooting tasks with the Limited and Restricted shock boundaries.

## • If potential hazards in addition to the ones noted on the JHA are observed, work will be stopped. A new JHA will be created and the the controls to mitigate the hazard will be implemented before work proceeds. The hazards will be managed with safety signs and tags, barricades, and attendants to inform employees of potential hazards.

## • All areas that contain exposed energized parts must be properly illuminated. This will be a minimum of 5 foot candles or more depending on the application.

## • So as to mitigate the hazard of exposed live parts, dielectric blankets or shielding shall be used wherever possible.

## • All ladders used around exposed live parts will have fiberglass, non-conductive side rails.

• Conductive apparel will not be worn within the limited or restricted shock boundaries. All tools and meters used within the shock boundaries will be rated at CAT 3 or above or designed for energized work.

**Working in the Limited/Restricted Shock Boundaries**

**Shock Risk Assessment.**

**(A) General.** A shock risk assessment shall be performed:

(1) To identify shock hazards. This is required of anyone who enters or performs work within the Limited or Restricted Shock Boundaries.

(2) To estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health.

(3) To determine if additional protective measures are required, including the use of PPE.

**Additional Protective Measures.** If additional protective measures are required, they shall be selected and implemented according to the hierarchy of risk control identified in 110.1(H). When the additional protective measures include the use of PPE, the following shall be determined:

(1) The voltage to which personnel will be exposed.

(2) The boundary requirements.

(3) The personal and other protective equipment required by this standard to protect against the shock hazard.

**Documentation.** The results of the shock risk assessment shall be documented.

**Δ (D) Shock Protection Boundaries.** The shock protection boundaries identified as limited approach boundary and restricted approach boundary shall be applicable where personnel are approaching exposed energized electrical conductors or circuit parts. Table 130.4(E)(a) shall be used for the distances associated

with various ac system voltages. Table 130.4(E)(b) shall be used for the distances associated with various dc system voltages.

For our work, 480v and under, our **Limited Boundary is 3'-6"** and our **Restricted Boundary is 1'-0"**

**Limited Approach Boundary.**

**Δ (1) Approach by Unqualified Persons.** Unless permitted by 130.4(F)(3), no unqualified person shall be permitted to approach nearer than the limited approach boundary of energized conductors and circuit parts.

**(2) Working at or Close to the Limited Approach Boundary.** Where one or more unqualified persons are working at or close to the limited approach boundary, the designated person in charge of the work space where the electrical hazard exists shall advise the unqualified person(s) of the electrical hazard and warn him or her to stay outside of the limited approach boundary.

**Δ (3) Entering the Limited Approach Boundary.** Where there is a need for an unqualified person(s) to cross the limited approach boundary, a qualified person shall advise the unqualified person(s) of the possible hazards and continuously escort the unqualified person(s) while inside the limited approach boundary. Under no circumstance shall unqualified person(s) be permitted to cross the restricted approach boundary.

**Restricted Approach Boundary.**

No qualified person shall approach or take any conductive object closer to exposed energized electrical conductors or circuit parts than the restricted approach boundary set forth in Table 130.4(E)(a) and Table

130.4(E)(b), unless one of the following conditions applies:

(1) The qualified person is insulated or guarded from energized electrical conductors or circuit parts operating at 50 volts or more. **Insulating gloves** and sleeves are considered insulation only with regard to the energized parts upon which work is performed.

(2) The energized electrical conductors or circuit parts are insulated from the qualified person and from any other conductive object at a different potential.

**Arc Flash Risk Assessment.**

An arc flash risk assessment shall be performed:

(1) To identify arc flash hazards. This will be performed and documented before anyone crosses the Arc Flash Boundary.

(2) To estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health

(3) To determine if additional protective measures are required, including the use of PPE

**Energized Work-Hot Work Permit**

***Non-Permit Type Work:*** Work that is performed within the limited approach boundary of energized conductors or circuit parts, by qualified and authorized persons, wearing the required PPE related to tasks such as visual inspections, testing and troubleshooting while using equipment such as multi-meters, clamp-on meters, phase rotation meters, thermal imaging cameras, oscilloscopes, power quality meters or other testing equipment. The purpose of these tasks is defining the presence of, and the characteristics of voltage, current, power, and the general condition of the equipment using it.

***Permit Type Work:*** Modifications and repairs when working within the limited approach boundary, or the arc flash boundary of exposed energized conductors or circuit parts, other than that which is clearly defined as exempt non-permit work will require a permit. Energized work shall be permitted where it can be demonstrated that de-energizing cannot be accomplished due to one of the following:

Energized work shall be permitted where the employer can demonstrate that de-energizing introduces additional hazards or increased risk.

 1**. Additional Hazards or Increased Risk.** Energized work shall be permitted where the employer can demonstrate that de-energizing introduces additional hazards or increased risk.

1. **Infeasibility.** Energized work shall be permitted where the employer can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment de-sign or operational limitations.
2. **Less Than 50 Volts.** Energized electrical conductors and circuit parts that operate at less than 50 volts shall not be required to be de-energized where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.

Examples of additional hazards or increased risk include, but are not limited to, interruption of life-support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment.

Examples of work that might be performed within the limited approach boundary of exposed energized electrical conductors or circuit parts because of infeasibility due to equipment design or operational limitations include performing diagnostics and testing (for example, start-up or troubleshooting) of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

**Energized work requires a permit which is located in the appendix.**

**Training Requirements**

All personnel who face a risk of electrical hazard that is not reduced to an acceptable level by the applicable electrical installation requirements shall be trained to understand specific hazards associated with electrical energy. They shall be trained in safety related work practices and procedural requirements as necessary to provide protection from the electrical hazards associated with their respective job or task assignments.

Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury. Employees must also be able to demonstrate that they know the limitations of their testing equipment and be able to demonstrate how to properly operate their testing equipment. Retraining shall be performed at intervals not to exceed (3) years and shall be documented. (NFPA 70E)

**To be qualified, each employee who is, or might be, exposed to an elevated risk of injury by exposure to an electrical hazard must be trained to understand the specific hazards to which he or she might be exposed to and demonstrate the following:**

1. What electrical hazards are present in the workplace.
2. How each electrical hazard affects body tissues.
3. How to determine the degree of each hazard.
4. How to avoid exposure of each hazard.
5. What PPE is needed for the employee to execute his or her work assignment.
6. How to select and inspect PPE.
7. What employer-provided procedures, including specific work practices, the employee must implement.
8. How increased duration of exposure to an electrical hazard results in higher frequency of injuries.
9. How to perform a hazard identification and risk assessment analysis.
10. How to determine, limited, restricted, and approach boundaries and recognize that these boundaries are related to protection from exposure to electrical shock and electrocution.

##  11. How to interpret the information on equipment labels/Arc Flash labels and select the appropriate PPE when working within the arc flash boundary.

**Emergency Procedures**

1. Employees exposed to shock hazards, and those employees responsible for taking action in case of emergency, shall be trained in methods of release of victims from contact with exposed energized electrical conductors or circuit parts.
2. Shall be regularly instructed in methods of first aid and emergency procedures, such as approved methods of resuscitation, including CPR /AED use, and shall be certified by the employer annually.
3. Employees who are or might be exposed to shock/electrocution must be trained to respond to emergency conditions.
4. Must be trained to know that the first action in responding to an electrical contact incident must be to remove the source of electricity and the second is to request emergency assistance.

**Summary**

**Whenever you use a voltage meter-you need Shock and Arc Flash protection!!**

For our work, 480v and under, our **Shock** **Limited Boundary is 3'-6"** and our **Restricted Boundary is 1'-0"**

For our work 400A, 25 KA and under, when downstream from a molded case circuit breaker,

Our **Arc Flash Boundary is 17".**

For this scenario, see the PPE below. **If over 400a, 25 KA, 12 cal PPE kit is required**

We require at a minimum the following PPE:

Dielectric gloves 500v/Class 00

Leather gloves-Arc Flash

All skin covered in non-melting clothing/Arc flash sleeves

Safety Glasses

**References**

For Shock Boundaries & PPE required: NFPA 70e 2021, Table 130.4 (E) (a) & 130.4 (G) (1)

For Arc Flash & PPE required: NFPA 70e 2021, Tables 130.5(C), 130.7(C)(15)(a), 130.7(C)(15)(b) and Annex D.4.1 (IEEE 1584-2018), NFPA 70e 2018 Annex D Table D.4.7

**Assured Grounding Program, GFCI Requirements and Temporary Power**

PSG expects all employees to adhere to its Assured Equipment Grounding Conductor Program, which follows current NEC requirements under Temporary Wiring, Art. 590.6, OSHA and EM385-1-1 requirements (as applicable if on a NAVFAC or USACE project). The program requires coding and testing to be conducted by the Foreman or designated Qualified **and Authorized** person on the job site, and the diligence of every employee to visually inspect cords, plugs, and receptacles, for external defects. Hand tools do not need to be tested within the Assured Grounding Program requirements as long as ground-fault circuit interrupters are being utilized, as required. Tests shall be performed as follows:

* Visual inspections of any and all tools or equipment must be performed prior to each use.
* When there is evidence of damage
* Before equipment is returned to service following any repairs
* At intervals not exceeding (3) months

Ground-fault circuit interrupter receptacles or circuit breakers will be used on all 120-volt, AC, single phase, 15, 20 and 30 ampere receptacle outlets used on construction sites, which are not part of the permanent wiring of the building or structure. If a receptacle(s) is installed, or exists as part of the permanent wiring of the building or structure, and is used for temporary electric power, ground-fault circuit interrupter protection for personnel shall be provided. Cord sets or devices incorporating listed ground-fault circuit interrupter protection for personnel identified for portable use shall be permitted. If subject to the requirements of EM385-1-1, all temporary power circuits (those listed above and also including 30 and 50A 125/250 V receptacles and cords) will be protected by GFCI devices.

Receptacles, cord sets, and cord-and-plug connected equipment that have been tested shall be identified by the following color code, unless the project requirements specify a different code:

Orange: January through March

Blue: April through June

Red: July through September

Yellow: October through December

Foremen are required to maintain documentation of compliance with this program. Safety shutdowns will follow the PSG procedure. Contact your Foreman if you have any questions regarding these procedures.

All electrical equipment and systems shall be treated as energized until tested or otherwise proven to be de-energized.

Electrical equipment, or systems, will be worked upon only after being de-energized. The PSG Lock Out/Tag Out Procedures shall be followed when deactivating such equipment or systems.

All electrical cords shall be routed in an effort to minimize potential damage. When routing within a building avoid pinch points, such as where doors are installed, or running across sharp metal objects, such as bottom track. Pay attention to placement so that the cords do not suffer damage from other trades placing materials or tools on top of them. Protect cords and boxes from vehicle and construction equipment traffic damage. Use nonmetallic methods to support cords.