# Electrical Safety Policy

**PURPOSE and SCOPE**

To ensure compliance with the Occupational Health and Safety Administration (OSHA) General Industry Regulations (29 CFR 1910.133 and 1910 Subpart S) and the National Fire Protection Agency Standard for Electrical Safety in the Workplace (2015 NFPA 70E) and the National Fire Protection Agency National Electrical Code (2014 NFPA 70).

To provide a practical safe working area for workers relative to the hazards arising from the use of electricity pertaining to the service provided by Hurt & Proffitt, Inc.; hereafter referred to as "The Company".

**DEFINITIONS**

**Arc Flash Hazard** - A dangerous condition associated with the possible release of energy caused by an electrical arc.
**Arc Flash Hazard Analysis** - A study investigating a worker's potential exposure to arc flash energy, conducted for the purpose of injury prevention and the determination of safe work practices, arc flash boundary, and the appropriate levels of personal protective equipment (PPE).
**Arc Rating** - The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm2 and is derived from the determined value of the Arc Thermal Performance Value (ATPV), or Energy Breakopen Threshold (EBT) (Should a material system exhibit a Breakopen response below the APTV value).
**Barricade** - A physical obstruction such as tape, cones, or A-frame type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.
**Barrier** - A physical obstruction that is intended to prevent contact with equipment or energized electrical conductors and circuit parts or to prevent unauthorized access to a work area.
**Boundary, Arc Flash** - When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur. The arc flash boundary for systems 50 volts and greater shall be the distance at which the incident energy equals 1.2 cal/cm2. A second-degree burn is possible by exposure of unprotected skin to an electric arc flash above the incident energy level of 1.2 cal/cm2.
**Boundary, Electrical Shock** -The three (3) boundaries protecting personnel from exposure to energized parts. The shock protection boundaries identified as (a) limited approach, (b) restricted approach and (c) prohibited approach boundaries shall be applicable where approaching personnel are exposed to energized electrical conductors or circuit parts. 2015 NFPA Table 130.4(C)(a) and Table 130.4(C)(b) shall be used for the associated voltages.

- **Limited Approach Boundary**: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.

- **Restricted Approach Boundary**: An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased risk of shock, due to electrical arc-over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit part.
- **Prohibited Approach Boundary:** An approach limit at a distance from an exposed energized electrical conductor or circuit part within which work is considered the same as making contact with the electrical conductor or circuit part.

**De-Energized** - Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

**Electrical Hazard** - A dangerous condition such as contact or equipment failure that can result in electric shock, arc flash burn, thermal burn or blast.

**Energized** - Electrically connected to, or is, a source of voltage

**Exposed** - Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are NOT suitably guarded, isolated, or insulated.

**Ground-Fault Circuit-Interrupter (GFCI)** - A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds the values established for a Class A device. Class A ground-fault circuit-interrupters trip when the current to ground is 6mA or higher and do not trip when the current to ground is less than 4 mA.

**Ground-Fault Interrupter (GFI)** - A GFI is an equipment protector, unlike the GFCI which is a personnel protector. It is intended to protect the equipment from damaging line-to-ground fault currents by opening all ungrounded conductors of the faulted circuit.

**Ground** - An electrically conducting connection between equipment or an electric circuit and the earth or to another conducting body. A properly designed grounding system provides a reliable conducting path to earth or some other conducting body in place of the earth. This system provides a low impedance path for electric short circuits and faults enabling overload protective devices to open the circuit. The grounding system maintains a common potential for grounded equipment at or near earth's potential level. It also provides a low impedance path for electrical short circuits, permitting large currents to pass through over-load protective devices permitting them to open.

**Qualified Person** - One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.

A qualified person shall be trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method. A person can be considered qualified with respect to certain equipment and methods but still unqualified for others.

**Shock Hazard** - A dangerous condition associated with the possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.
**Working On** - Intentionally coming in contact with energized electrical conductors or circuit parts with hands, feet, or other body parts, with tools, probes or with test equipment, regardless of the personal protective equipment a person is wearing. There are two categories of "working on":

- **Diagnostic (testing):** is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment.
- **Repair:** is any physical alteration of electrical equipment, such as making or tightening connections, removing, or replacing components, etc.

**PROCEDURES**

This Compliance Work Instruction is designed to provide guidance and encompass safety-related work practices for qualified workers who work on or near exposed energized electrical conductors or circuit parts and familiarize unqualified persons with electrical safety work practices. It is the role of management to enforce this work instruction, including discipline for non-conformance.

A qualified person shall be familiar with the proper use of the special precautionary techniques, Personal Protective Equipment (PPE), 29 CFR1910.137 (Electrical Protective Equipment), including arc flash suit; insulating and shielding materials; and insulated tools and test equipment. A person may be considered qualified with respect to certain equipment and methods but still unqualified for others.

A worker, who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person and who, during training, has demonstrated an ability to perform specific duties safely at their level of training, and who is under the direct supervision of a qualified person, shall be considered to be a qualified person for the performance of those specific duties.

Workers permitted to work within the limited approach boundary of exposed energized conductors or circuit parts operating at 50 volts or more shall, at a minimum, be additionally trained in all of the following:

- Skills and techniques necessary to distinguish exposed energized electrical conductors or circuit parts from other parts of electrical equipment.
- Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors or circuit parts.

- Approach distances specified in NFPA Table 130.4(C)(a) and Table 130.4(C)(b) and the corresponding voltages to which the qualified person will be exposed.
- Decision-making process necessary to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely.

**Electrical Hazard Analysis**

If the energized electrical conductors or circuit parts operating at 50 volts or more are not placed in an electrically safe work condition, other safety-related work practices shall be used to protect workers who might be exposed to electrical hazards involved. Such work practices shall protect each worker from arc flash and from contact with energized electrical conductors or circuit parts operating at 50 volts or more directly with any part of the body or indirectly through some other conductive object.

Before a worker works within the limited approach boundary or arc flash boundary of exposed energized electrical conductors or circuit parts that are not put into an electrically safe work condition, work, excluding diagnostics, to be performed shall be considered energized electrical work and shall be performed by written permit only.
Work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of energized electrical conductors or circuit parts.
Appropriate safety-related work practices shall be determined before any worker is exposed to the electrical hazards involved by using both shock hazard analysis and arc flash hazard analysis.

**Arc Flash Hazard Analysis**

An arc flash hazard analysis shall determine the arc flash boundary, the incident energy at the working distance, and the PPE that workers within the arc flash boundary shall use.

The arc flash hazard analysis shall be updated when a major modification or renovation takes place. It shall be reviewed periodically, not to exceed five (5) years, to account for changes in the electrical distribution system that could affect the results of the arc flash hazard analysis.

If the analysis is not available or has not been completed, the requirements of 2015 NFPA 70E 130.7(C)(15) and 130.7(C)(16) shall be used in lieu of determining the incident energy at the working distance**.**

**Electrical Hazard Protection Boundaries**

A shock hazard analysis shall determine the voltage to which workers will be exposed, the boundary requirements, and the PPE necessary in order to minimize the possibility of electric shock to workers.

Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit worker access to work areas containing energized electrical conductors or circuit parts. Barricades shall be placed no closer than the limited approach boundary.

If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect workers. An attendant shall remain in the area as long as there is a potential for workers to be exposed to the electrical hazard**.**

**Personal Protective Equipment**

2015 NFPA 70E Table 130.7(C)(16) shall be used to determine the required PPE for the specific task, once the Hazard/Risk Category has been identified from the Arc Flash Hazard Analysis or 2015 NFPA 70E Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b), including associated notes, and requirements of 2015 NFPA 70E 130.7(C)(15).

The PPE requirements of 2015 NFPA 70E are intended to protect a worker from arc flash and shock hazards. While some situations could result in burns to the skin, even with the protection described in 2015 NFPA Table 130.7(C)(16), burn injury should be reduced and survivable.

One of the first lines of defense when it comes to preventing contact with energized electrical components and/or electrical power lines are rubber insulating gloves, commonly known as High Voltage Gloves. High Voltage Gloves must meet the requirements of the current ASTM D120 specifications and NFPA 70E standards. OSHA enforces these requirements as a part of their CFR 1910.137 regulation. These standards dictate manufacturing criteria as well as testing and retesting requirements for Lineman Gloves.

- OSHA requires the use of rubber insulated gloves for those workers working on or near energized circuits and/or other electrical sources that are considered either high or low-voltage applications. That means there are many other occupations that need to use rubber insulated gloves as well, such as HVAC Technicians, Automotive Technicians, Electricians, Maintenance Mechanics, Railway Technicians, and even Telecommunications personnel.
- OSHA regulation ***29 CFR 1910.137*** requires that all insulating gloves must be electrically tested before first issue and retested every six months thereafter. OSHA 1910.268 (Tele-com) – Natural rubber insulating gloves must be electrically tested before the first issue, twelve months after the first issue, and every 9 months thereafter. Any unused glove that has not been tested within twelve months must be retested before being used.

Daily Safety Inspections: Rubber insulating gloves should be visually inspected before each day's use and after any situation that may have possibly caused damage to the

gloves. Care and maintenance are critical to ensure an insulated glove retains its protection properties.

Manufacturers suggest gloves be stored out of direct sunlight, in a cool and dry location away from sources of ozone. They should be stored in a glove bag (one pair per bag) and then hung-up versus being laid down on a flat surface. Rubber insulated gloves should never be folded in the storage bag. Creasing insulated gloves may cause cracking which could shorten the useful life of the gloves. 7.4.2 Before use, gloves should be visually inspected for tears, holes, signs of abrasion, ozone damage or possible chemical contact. (ASTM, F1236 standard provides inspection details). In addition, OSHA requires an air-glove inflation test as a part of the inspection process.

**Electrical Hazard Approach Boundaries**

The shock protection boundaries identified as limit approach, restricted approach, and prohibited approach boundaries shall be applicable where approaching workers are exposed to energized electrical conductors or circuit parts. 2015 NFPA 70E Table 130.4(C)(a) and Table 130.4(C)(b) shall be used for the distance associated with system voltages.

In certain instances, the arc flash boundary might be a greater distance from the energized electrical conductor or circuit parts than the limited approach boundary. The shock protection boundaries and the arc flash boundary are independent of each other.

- **Limited Approach Boundary.** When one or more unqualified workers are working at or close to the limited approach boundary, the designated person in charge of the workspace where the electrical hazard exists shall advise the unqualified worker (s) of the electrical hazard and warn them to stay outside of the limited approach boundary.

    - Unless permitted by 2015 NFPA 70E 130.4(D)(2), no unqualified worker shall be permitted to approach nearer than the limited approach boundary of energized electrical conductors or circuit parts.
    - Where there is a need for an unqualified worker(s) to cross the limited approach boundary, a qualified person shall advise them of the possible hazard and continuously escort unqualified worker(s) while inside the limited approach boundary**.**

- **Restricted Approach Boundary.** Under no circumstance shall the escorted unqualified worker(s) be permitted to cross the restricted approach boundary.

- A worker who is undergoing on-the-job training for the purposes of obtaining the skills and knowledge necessary to be considered a qualified person and who, during such training, has demonstrated an ability to perform specific duties safely, and who is under the direct supervision of a qualified person, shall be considered to be a qualified person for the performance of those specific duties.
- No qualified person shall approach or take any conductive object closer to exposed energized electrical conductor or circuit parts operating at 50 volts or more than the restricted approach boundary set forth in 2015 NFPA 70E Table 130.4(C)(a) and Table 130.4(C)(b) unless the requirements are met for the specific listed applications of 2015 NFPA 70E 130.4(C).
- To cross the restricted approach boundary and enter the restricted space, qualified persons must do the following:

    - Have a plan that is documented and approved by authorized foreman or supervisors
    - Use PPE that is appropriate for working near exposed energized conductors or circuit parts and is rated for the voltage and energy level involved
    - Be certain that no part of the body enters the prohibited space
    - Minimize the risk from inadvertent movement by keeping as much of the body out of the restricted space as possible, using only protected body parts in the space necessary to accomplish the work

- **Prohibited Approach Boundary.** Crossing the prohibited approach boundary and entering the prohibited space is considered the same as making contact with exposed energized conductors or circuit parts.

    - To cross the prohibited approach boundary, qualified persons must do the following:

        - Have specified training to work on energized conductors or circuit parts
        - Have a documented plan justifying the need to work close to exposed energized conductors or circuit parts
        - Perform a risk analysis
        - Have the plan and the risk analysis approved by authorized foreman or supervisor

- Use PPE that is appropriate for working near exposed energized conductors or circuit parts and is rated for the voltage and energy level involved

**De-Energized Parts (Electrically Safe Work Condition)**

Energized electrical conductors and circuit parts to which a worker might be exposed shall be put into an electrically safe work condition before a worker performs work.

All electrical circuit conductors and circuit parts shall be considered energized until the source(s) of energy is (are) removed, at which time they shall be considered de-energized. All electrical conductors and circuit parts shall not be considered to be in an electrically safe working condition until all of the applicable requirements of paragraph 10.3 have been met.

Energized electrical conductors or 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.

During the time a worker may be exposed to contact with parts of fixed electrical equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out in accordance with The Company Lockout/Tagout Program.

Conductors and parts of electric equipment that have been de-energized but have not been locked out shall be treated as energized.

Interlocks for electrical equipment shall not be used as a substitute for lockout procedures.

**Work on De-energized Equipment**

The Company shall identify, document, and implement lockout/tagout procedures conforming to 2015 NFPA 70E Article 120 to safeguard workers from exposure to electrical hazards. The lockout/tagout procedure shall be appropriate for the experience and training of the workers and conditions as they exist in the workplace.

Energized electrical conductors or circuit parts to which a worker might be exposed shall be put into an electrically safe work condition before a worker performs work if either of the following conditions exists:

1. The worker is within the limited approach boundary
2. The worker interacts with equipment where conductors or circuit parts are not exposed, but an increased risk of injury from exposure to an arc flash hazard exists

When a qualified person is working within the limited approach boundary or the arc flash boundary that is not placed into an electrically safe work condition, an energized electrical work permit shall be completed.

- Examples of increased or additional hazards 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 may be performed on or near energized circuit parts because of infeasibility due to equipment design or operational limitations include performing diagnostics and testing 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.

Electrical conductors or circuit parts that have been disconnected, but not under lockout; tested; and grounded (where applicable) shall not be considered to be in an electrically safe work condition, and safe work practices appropriate for the circuit voltage and energy level shall be used.

Lockout requirements shall apply to fixed, permanently installed equipment; to temporarily installed equipment; and to portable equipment.

All electrical conductors or circuit parts shall be considered energized until the source(s) of energy is (are) removed, at which time they shall be considered de-energized. All electrical conductors and circuit parts shall not be considered to be in an electrically safe working condition until all of the applicable requirements of 2015 NFPA 70E Article 120.1 have been met.

Establishing an electrically safe working condition:

- Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
- After properly interrupting the load current, open the disconnecting device(s) for each source.
- Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that draw out-type circuit breakers are withdrawn to the fully disconnected position.
- Apply lockout/tagout devices in accordance with The Company’s Lockout/Tagout Program.

- Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the voltage detector is operating satisfactorily.
- Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

Prior to re-energizing circuits or equipment, even temporarily, the following requirements shall be met in the order listed:

- A qualified person shall verify that all tools, electrical jumpers, shorts, grounds, and other similar devices have been removed so the circuits and equipment can be safely energized, including removal of equipment interlock-defeating devices.
- Individuals exposed to the hazards associated with re-energizing the circuit or equipment shall be warned to stay clear of circuits and equipment.
- All lockout equipment shall be removed as specified in the Lockout/Tagout Program.
- A visual check shall be made to ensure all individuals are clear of the circuits and equipment.
- Where appropriate, protective covers, shields, shrouds, and other guarding shall be secured, unless specific maintenance guidance states otherwise.

**Energized Electrical Work Exception**

If the exposed energized parts cannot be de-energized, an equivalent level of safety shall be provided to protect workers who may be exposed to the electrical hazards involved.

Only qualified personnel may work within the Limited Approach Boundary on electrical conductors or circuit parts or equipment that have not been de-energized.

They shall be properly trained regarding working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, PPE, insulating and shielding materials and insulated tools.

Energized electrical conductors or circuit parts are to be de-energized in accordance with established lockout/tagout procedures, unless one of the following conditions applies:

- Energized work shall be permitted where it can be demonstrated that the task to be performed introduces additional hazards or increased risk.

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

- Energized work shall be permitted where it can be demonstrated that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.
- Energized electrical conductors or 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.

Energized Electrical Work Permit: When working within the limited approach boundary or the arc flash boundary of exposed energized electrical conductors or circuit parts that are not placed in an electrically safe work condition, work to be performed shall be considered energized electrical work and shall be performed by written permit only. The intent of the permit is to ensure that all appropriate safety precautions have been taken prior to starting energy-free electrical work.

- Work performed within the limited approach boundary of energized electrical conductors or circuit parts by qualified persons related to tasks such as testing, troubleshooting, and voltage measuring shall be permitted to be performed without an energized electrical work permit, if appropriate safe work practices and PPE are provided and used.

  - If the purpose of crossing the limited approach boundary is only for visual inspection and the restricted approach boundary will not be crossed, then an energized electrical work permit shall not be required.

- The permit must be completed by the worker(s) participating in the work and signed by a foreman or supervisor who has completed the Qualified Person Training within the last twelve (12) months.
- The permit must be posted in the area of the work throughout the duration of the task.
- The completed permit shall be provided to the Safety Coordinator at the completion of the task for retention.

**Overhead Lines**

Work near overhead lines shall be avoided whenever possible. If work near overhead lines must be performed, the lines shall be considered to be energized and the requirements for working near energized equipment shall be followed.

Emergency switches must be located to shut down the grid to overhead lines that workers will be working on or nearby.

When working near an energized overhead line, no part of a vehicle and/or mechanical equipment shall come within 10 feet of the line. This distance shall be increased by 4 inches for every 10 kV over 50kV.

**Lighting**

Where lack of illumination or an obstruction precludes observation of the work to be performed, workers shall not perform any task within the limited approach boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.

A portable light can be used to provide light and should be made of non-conducting material to avoid shortening conductors together. The flexible cord of a portable light should not be pinched, kinked, cracked, or cut, exposing live wires or parts.

An individual shall not reach blindly into areas that may contain energized electrical conductors or circuit parts where an electrical hazard exists.

**Confined or Enclosed Workspaces**

Workers working in a confined or enclosed space that contains exposed energized electrical conductors or circuit parts operating at 50 volts or more, or where an electrical hazard exists, the worker shall use protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts and the effects of the electrical hazard.

> *Example: Individual working inside of a main feed cabinet, the conductors feeding the cabinet must be covered to prevent accidental contact.*

Doors, hinged panels, and the like shall be secured to prevent their swinging into a worker and causing the worker to contact exposed energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists if movement of the door, hinged panel, and the like is likely to create a hazard.

**Conductive Materials and Equipment**

Conductive materials, tools and equipment that are in contact with any part of a worker's body shall be handled in a manner that prevents accidental contact with energized electrical conductors or circuit parts.

Means shall be employed to ensure that conductive materials approach exposed energized conductors and circuit parts no closer than that permitted by 2015 NFPA 70E 130.2.

Conductive Articles of jewelry and clothing (e.g., watch bands, bracelets, rings, key chains, or metal headgear) shall not be worn where they present an electrical contact hazard with exposed energized electrical conductors or circuit parts.

If workers are subject to handle long dimensional conductor objects such as ducts or pipes, The Company shall ensure safe work practices are implemented which includes the use of insultation, guarding, and material handling techniques to minimize the hazard.

**Use of Portable Electric Equipment**

Portable electric equipment such as drills, saws, grinders, and portable lights shall be used in a safe manner and be connected to a circuit protected by GFCI capability if being used in a wet or damp environment (i.e., circuit breaker or separately enclosed, portable GFCI). The following guidelines provide minimum requirements for the use of this type of equipment.

All cord and plug-connected electrical equipment, flexible cord sets (extension cords), and portable electric equipment shall be handled in a manner that will not cause damage.

Multiple outlets shall not be "daisy-chained" to one another.

Use of extension cords in combination with power strips shall not be permitted.

Flexible electrical cords connected to equipment shall not be used for raising or lowering the equipment.

Flexible cords may not be fastened with staples or otherwise hung in a fashion that could damage the outer jacket or insulation.

Portable cord- and plug-connected equipment and extension cords shall be visually inspected for external defects such as loose parts, deformed and missing pins, burns or scorch marks, or damage to the outer jacket or insulation as evidence of possible internal damage such as signs of pinching or crushing before use.

If there is evidence of damage that might expose a worker to injury, the defective or damaged item shall be removed from service and not used until repaired and tested to ensure the equipment is safe.

Whenever an attachment plug is to be connected to a receptacle (including extension cords), the plug end and the receptacle shall be checked to ensure they are of proper configurations and the fit is snug.

An extension cord used with grounding-type equipment shall contain an equipment grounding conductor.

Plugs and receptacles may not be connected or altered in a manner that would prevent proper continuity of the equipment grounding conductor at the point where plugs are attached to receptacles. (Do not cut off the ground prong on a plug) Additionally, those devices may not be altered to allow the grounding pole of a plug to be inserted into slots intended for connection to the current-carrying conductors.

- Adapters that do not allow continuity of the equipment grounding connection may not be used.

Portable electric equipment and extension cords used in highly conductive work locations (such as areas with standing water), or in job locations where workers are likely to contact water shall be approved for those locations and GFI protected.

Workers' hands may not be wet when plugging and unplugging flexible cords and cord- and plug-connected equipment if energized equipment is involved.

- Energized plug and receptacle connections may be handled only with insulated gloves if the condition of the connection could provide a conducting path to the worker's hand. For example, a cord connector is wet from being immersed in water.

Locking-type connectors shall be properly secured after connection.

All equipment shall have United Laboratory (U.L.) approval.

Safety inspections in the plant shall include testing and inspection of electrical receptacles, cords and plugs to ensure that all ground circuits, pins, and sockets are properly wired and are in good repair and operating condition. Adapters that permit the ground pin of an electrical plug to be bypassed shall not be used. All electrical cords must not be frayed and must be in good repair.

**Electric Power and Lighting Circuits**

Load rated switched (light switch), electrical disconnects, and circuit breakers specifically designed as a disconnecting means shall be used for the routine opening, reversing, or closing of circuits under load conditions.

Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections may not be used to disconnect a circuit under load except in an emergency.

After a circuit is de-energized by the automatic operation of a circuit protective device, the circuit shall not be manually re-energized until it has been determined that the equipment and circuit can be safely energized.

Repetitive resetting of circuit breakers or re-energizing circuits through replaced fuses is prohibited.

Over current protection of circuits and conductors may not be modified, not even on a temporary basis, beyond that permitted by applicable portions of electrical codes and standards dealing with overcurrent protection.

**Test Instruments and Equipment**

Only qualified persons shall perform tasks such as testing, troubleshooting and voltage measuring within the limited approach boundary of energized electrical conductors or circuit parts operating at 50 volts or more or where an electrical hazard exists.

- Test instruments, equipment, and their accessories shall be rated for the circuits and equipment to which they will be connected. Test instruments and equipment and all associated test leads, cables, power cords, probes and connectors shall be visually inspected for external defects and damage before each use.
- If there is a defect or evidence of damage that might expose a worker to injury, the defective or damaged item shall be removed from service, and no worker shall use it until repairs and tests necessary to render the equipment safe have been made.

**Personal Protective Equipment (PPE)**

Individuals shall be provided with and shall use electrical protective equipment that is appropriate for the type of work to be performed.

Workers shall inspect all Arc Flash PPE prior to use and associated equipment will be maintained and kept in proper working order.

If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected, for example, an outer covering of leather when it is used for the protection of rubber insulating material.

Workers shall wear non-conductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.

Workers shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arches or flashes or from flying objects resulting from electrical explosion.

Workers shall wear protective face and body equipment when working on equipment using chemicals such as battery acid or caustic fluids.

Workers shall wear approved protective equipment when working on equipment with live voltages over 50 volts.

Workers shall wear Arc Rated clothing with sleeves rolled down.

**General Protective Equipment and Tools**

Before a worker works within the limited approach boundary, energized conductors and circuit parts to which a worker might be exposed shall be put into an electrically safe work condition, unless work on energized components can be justified. According to 2015 NFPA 70E Article 130.2(A).

Only qualified people shall be permitted to work on electrical conductors or circuit parts that have not been put into an electrically safe working condition.

Fuse handling equipment, insulated for the circuit voltage, shall be used to remove, or install fuses when the fuse terminals are energized.

Before removing any fuse from a circuit, be sure the switch for the circuit is open or disconnected. When removing fuses, use an approved fuse puller and break contact on the hot side of the circuit first.

- When replacing fuses, install the fuse first into the load side of the fuse clip, then into the line side.

Ropes and "fish tapes" used near exposed energized parts shall be non-conductive.

Protective shields, protective barriers or insulating materials shall be used to protect individuals working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur.

Portable ladders used by workers, in areas where the worker or ladder could contact the exposed energized parts, shall have nonconductive side rails, and comply with OSHA 1910.25 and 1910.26.

**Alerting Techniques**

The following techniques shall be used to warn and protect workers from hazards which could cause injury due to electric shock, burns, blasts or failure of electric equipment parts.

- Safety signs, safety symbols, or accident prevention tags shall be used, where necessary, to warn individuals about electrical hazards in their work area. Signs, symbols, and tags shall conform to the requirements of 29 CFR 1910.145, "Specifications for Accident Prevention Signs and Tags."
    - Typical signs warning of electrical hazards includes Red, Danger signage with the words:
        - "Danger - Arc Flash" (To be determined by Arc Flash analysis)
        - “Caution – Arc Flash” (To be determined by Arc Flash analysis)
        - "Danger - High Voltage" (All equipment with voltages exceeding 600 volts)
        - "Danger - High Voltage - Authorized Personnel Only" (Entrances to areas with voltages exceeding 600 volts)
        - "Danger - Electric Shock Hazard, When Door Open" (All panels that have door/interlock)
- Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit worker access to work areas by exposing individuals to non-insulated energized equipment.
- Conductive materials shall not be used for barricades where they might cause an electrical contact hazard.
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- If signs and barricades do not provide sufficient warning and protection from electrical hazards, a safety observer or qualified person shall be stationed to warn and protect individuals from the potential hazard.

**Grounding Clearances**

A minimum of three (3) feet shall be maintained in front of all 0–150-volt electrical panels that may be accessed periodically to perform maintenance on a circuit or to de-energize a circuit in an emergency. A minimum of four (4) feet clear access to the front of all 151-600-volt panels shall be maintained.

Outside of an electrical panel, the workspace may not be less than thirty (30) inches wide in front of the electric panel, and six (6) feet six (6) inches from ground to overhead. Distances will be measured from the front of the enclosure (or opening) of the enclosed live parts. The door must be able to fully open.

Grounding systems are intended to decrease the risk of electric shock to the human body from equipment and wiring.

An Equipment Grounding Conductor (EGC) originating at the service equipment entrance or at the location of a separately derived system shall connect all non-current carrying metal equipment, enclosures, conduits, fittings, and metal outlets. This will provide the necessary electrical continuity required for the over-current devices to trip.

The ground conductor shall be color coded green, green with a tracer color, or bare copper in accordance with the National Electrical Code (NEC).

Grounding conductors must be installed on all electrical equipment, including metal outlets and junction boxes, to comply with NEC and 29 CFR 1910.304 requirements.

The only neutral-to-ground bond shall be at the service entrance and any separately derived source. The neutral and ground should be kept separate at all sub-panel boards and junction boxes. The only two locations where the neutral and ground are bonded together are at the main service entrance and at the secondary side of a separately derived system.

Down line neutral-to-ground bonds result in parallel paths for the load return current where one of the paths becomes the ground circuit. This can cause a malfunction of protective devices and is a direct violation of the NEC.

The Ground Electrode Conductor (GEC) will connect this neutral-to-ground bond to the facilities ground reference.

**Ground-Fault Circuit-Interrupter (GFCI)**

GFCI devices shall be used in wet or damp environments, or any other similar conditions, where the human body could accidentally come into contact with energized wiring or equipment and ground.

All out-of-doors maintenance work must be done with GFCI connections. At a minimum, NEC and local electrical code requirements shall be followed.

It is recommended that GFCI devices be self-tested with the testing indicator on GFCI device before each use to determine at what amperage the circuit trips.

**Ground-Fault Protection**

GFP shall be used when there is a requirement to protect equipment from damaging line-to-ground fault currents by opening all ungrounded conductors of the faulted circuit.

GFI devices shall be used in wet or damp locations. GFP is addressed in the NFPA 70, which requires the installation of all solid-grounded wye electrical services of more than 150 volts to ground, but not exceeding 1000 volts, phase to phase for each service disconnect rated 1000 amperes or more.

**Training**

Training applies to all workers who face a risk of electrical shock or injury when they are working on or near exposed energized parts, or parts that may become energized. Initial training shall be given upon assignment to a position requiring an individual to work with or in close proximity to electrical parts, equipment, or conductors as a regular part of his/her job. Refresher training shall be given if there is a significant change in this procedure or work practices.

- Workers shall, at a minimum, be trained in, possess the knowledge of, and/or be familiar with the following to become **"Qualified"** ***personnel:***

    - The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment. Understanding the specific hazards associated with electrical energy, to include the results of the Arc Flash Hazard Assessments.
    - The skills and techniques necessary to determine the nominal voltage of exposed live parts.
    - The clearance distances specified in 29 CFR 1910.33, NFPA 70E Table 130.2(C)(a) and Table 130.4(C)(b) and the corresponding voltages to which the "Qualified Person" will be exposed.
    - Safety related work practices required by 29 CFR 1910.331-335 that pertain to his/her respective job assignments.

- The requirements specified in this Work Instruction.
- Proper Lockout and Energy control procedures for the equipment they are working on.
- To identify and understand the relationship between electrical hazards and possible injury.
- Instructions on how to read and interpret the Arc Flash warning labels.
- The PPE required for each Hazard Risk Category. How to use and care for the PPE properly.
- First Aid training dealing specifically with victims of electrical accidents.

- **"Unqualified" workers** must have awareness level training that includes:

  - Warning signs indicating electrical hazards.
  - The safe use of portable equipment.
  - Emergency notification procedures.
  - Any electrical safety-related practices necessary for their safety.

**Host and Contract Employers Responsibilities**

The Company shall inform contractors performing work on or near exposed energized electrical conductors or circuit parts of the hazards and safe related work practices as outlined in this document. All approved contractors participate in annual training and a copy of this work instruction is provided on the company web site.

Contractors are instructed to advise The Company of the following:

- Any unique hazards presented by the contract employer's work
- Hazards identified during the course of work by the contract employer that were not communicated by the host employer.
- The measures the contractor took to correct any violations reported by the host employer to prevent them from recurring.
- New conditions related to contracted work

Contractors are also required to complete a documented Pre-Job Meeting (documented)

- Exchange of electrical safety programs
- Means/methods for reporting violations
- Requirement for energized work permit:

- **When working within the limited approach boundary or the arc flash boundary of exposed energized electrical conductors or circuit parts that are not placed in an electrically safe work condition, work to be performed shall be considered energized electrical work and shall be performed by written permit only.**
- The intent of the permit is to ensure that all appropriate safety precautions have been taken prior to starting energized electrical work.

- Required additional PPE

**ENERGIZED ELECTRICAL WORK PERMIT**

**Part I: TO BE COMPLETED BY THE REQUESTER:** Job/Work Order Number_____

(**1**) Description of circuit/equipment/job location:

_____
_____
_____

(**2**) Description of work to be done:

_____
_____
_____

(**3**) Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage:

_____
_____
_____

_____ _____
Requester/Title Date

**Part II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS *DOING* THE WORK:**

(**1**) Description of the Safe Work Practices to be employed:

_____
__

(**2**) **Shock Hazard Analysis:** Voltage Level Phase to Phase _____

Approach Boundaries: Limited _____ Restricted _____ Prohibited _____

(**3**) **Results of Flash Hazard Analysis:**

Flash Protection Boundary: _____ (Assumed or Calculated)

Hazard/Risk Category _____ **OR** Calculated Flash Hazard at 18" _____

(**4**) Necessary personal protective equipment to safely perform the assigned task:

_____
__

(**5**) Means employed to restrict the access of unqualified persons from the work area:
_____
__

(**6**) Evidence of completion of a Job Briefing including discussion of any job-related hazards:
_____
__

(**7**) Do you agree the above-described work can be done safely? **YES** / **NO** (circle)

_____ _____ _____
_____
Electrically Qualified Person(s) Date Electrically Qualified Person(s)
Date

**Part III: APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:**

_____ _____
Approving Supervisor Date

**Part IV: DOCUMENATATION OF ELECTRICALLY ENERGIZED WORK:**

I understand that the above Energized Work was completed on the following date:
_____
Administrative Supervisor

**NOTE:** Once work is complete, forward a copy of this form to NAME OF DESIGNATED PERSON.