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ELETRICAL SAFETY	
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1. POLICY

- 1.1. Work activities involving electrical hazards shall be conducted safely. This policy covers minimum performance standards applicable to all MAPP employees and locations. Local practices requiring more detailed or stringent rules or local, state or other federal requirements regarding this subject can and should be added as an addendum to this procedure as applicable.
- 1.2. A job briefing should be held before starting each job and include all employees involved. The briefing should cover hazards associated with the job, work procedures involved, special precautions, energy source controls, and PPE requirements.
- 1.3. Hazard Analysis should contain event severity, frequency, probability and avoidance to determine the level of safe practices employed.

2. SCOPE

- 2.1. Applies to all MAPP project sites, offices, personnel, and personnel working on MAPP projects.

3. DEFINITIONS

Approved	Acceptable to the authorities
Authorized Person	A person approved or assigned by MAPP to perform a specific duty or duties or to be at a specific location or locations at the jobsite.
Cabinet	An enclosure designed either for surface or flush mounting
Competent Person	One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.
Conductor (bare)	A conductor encased within material of composition and thickness that is recognized as electrical insulation.
Defect	Any characteristic or condition that tends to weaken or reduce the strength of the tool, object, or structure of which it is a part.
Disconnect	A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.
Enclosed	Surrounded by a case, housing, fence or walls which shall prevent persons from accidentally contacting energized parts.
Enclosure	the case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

Exposed(as applied to live parts)	Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated
Guarded	Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach to a point of danger or contact by persons or objects.
Isolated	Not readily accessible to persons unless special means for access are used.
Labeled	Equipment or materials to which has been attached a label, symbol or other identifying mark of a qualified testing laboratory which indicates compliance with appropriate standards or performance in a specified manner.
NEC	Stands for National Electric Code.
Qualified	Persons who are capable of working safely on equipment and are familiar with electrical properties, the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.
Receptacle	A contact device installed at the outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

4. REQUIREMENTS

4.1. General

- 4.1.1. Feasible engineering and administrative controls shall be applied to mitigate or minimize the risk of injury and illness from exposure to electrical hazards. Where such hazards still exist after application of these controls, local controls shall apply and personal protective equipment shall be utilized. Such addenda shall comply with NFPA 70E. (SEE: SEC 19 for further detail on PPE inspection requirements.)
- 4.1.2. When test instruments are used for the testing for the absence of voltage on conductors or circuit parts operating at 50 volts or more, the operation of the test instrument shall be verified before and after an absence of voltage test is performed.
- 4.1.3. Test instruments, equipment, and their accessories shall meet the requirements of ANSI/ISA-61010-1-Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use -Part 1 General Requirements, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 Volts and below.
- 4.1.4. No MAPP employee shall perform work on live electrical circuits. Subcontractors that engage in live work are required to provide applicable safe work procedures, PPE, and equipment to be reviewed and approved by the MAPP Project Team, and client if applicable, prior to any such work. The subcontractors work plan must exceed at minimum MAPP's **Energized Electrical Work Plan Sample (HSE12-002)**, **client specific requirements, OSHA 1910.269, and NFPA 70E.**
- 4.1.5. Unqualified persons shall not be permitted to enter spaces that are required to be accessible to qualified employees only, unless the electric conductors and equipment involved are in an electrically safe work condition
- 4.1.6. In existing installations, no changes in circuit protection shall be made to increase the load in excess of the load rating of the circuit wiring.
- 4.1.7. Worn or frayed electric cords or cables shall be removed from work areas for repair or disposal. Plugs equipped with a grounding prong must have the prong in place. Damaged plugs must be repaired. Repairing cords shall be limited to shortening only by an authorized person, an in compliance with OSHA regulations.
- 4.1.8. Working spaces, walkways, and similar locations must be kept clear of cords to eliminate hazards.
- 4.1.9. Extension cords shall not be fastened with staples or hung with nails.
- 4.1.10. Control equipment, utilization equipment, and busways approved for use in dry

locations only shall be protected against damage from the weather during building construction.

- 4.1.11. Metal raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware shall be of materials appropriate for the environment in which they are to be installed.
- 4.1.12. Electrical switches shall be labeled to indicate the system, equipment, service, or tool they control. This includes switch boxes, cabinets, motor control cabinets, stationary equipment, control panels, and other such switches or disconnects.
- 4.1.13. In work areas where the exact location of underground electric power lines is unknown, employees using jackhammers, bars, or other hand tools that may contact a line shall be provided with insulated protective gloves. Gloves must be rated to (or exceed) the voltage for which they may be exposed. The gloves shall be inspected before use and replaced as per the manufacturer's specifications.
- 4.1.14. Wiring components and equipment in hazardous environments shall be maintained in a condition consistent with NEC requirements (i.e. no loose or missing screws, gaskets, threaded connections, seals, or other impairments to a tight condition).
- 4.1.15. Equipment, wiring methods, and installations of electrical equipment in hazardous (classified) locations must be designated as "intrinsically safe" or be approved for the classification location.
- 4.1.16. MAPP Project Manager shall advise the host employer of:
 - 4.1.16.1. Any unique hazards presented by the contract employer's work,
 - 4.1.16.2. Any unanticipated hazards found during the contract employer's work that the host employer did not mention, and
 - 4.1.16.3. The measures the contractor took to correct any hazards reported by the host employer to prevent such hazards from recurring in the future.

5. WORKING ON OR NEAR ENERGIZED ELECTRICAL PARTS AND SYSTEMS

- 5.1. Every effort shall be made to preclude work on energized electrical parts. When this is not possible, the requirements of this section shall apply.
- 5.2. Potential contact with live energized parts includes work performed on exposed live parts (involving either direct contact or contact by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.
- 5.3. Only qualified persons shall work on electrical equipment that has not been deenergized. **NO MAPP EMPLOYEE SHALL WORK ON ENERGIZED ELECTRICAL SYSTEMS OR PARTS.**

- 5.4. All energized or potentially energized parts shall be Locked and Tagged Out prior to work being performed at all times when possible. For specific lockout tagout requirements, see **HSE28-001 Lockout Tagout Policy**.
- 5.5. Subcontractors that engage in energized electrical work are required to provide applicable safe work procedures, PPE, and equipment to be reviewed and approved by the MAPP Project Team, and client if applicable, prior to any such work. The subcontractors work plan must exceed at minimum MAPP's **Energized Electrical Work Plan Sample (HSE12-002)**, **client specific requirements**, **OSHA 1910.269**, and **NFPA 70E**.
- 5.6. If the exposed live parts are not de-energized (i.e., for reasons of increased or additional hazards or infeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object.
- 5.7. The 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 the exposed electric conductors or circuit parts.
- 5.8. If work is to be performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before work is started. If the lines are to be deenergized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to deenergize and ground them. Verification and test should be performed by the responsible party with observation by the MAPP project team prior to beginning any work.
- 5.9. If protective measures, such as guarding, isolating, or insulating are provided for power lines, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.
- 5.10. Employees shall not enter spaces containing electrical hazards unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees 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.

6. OVERHEAD ELECTRICAL LINES

- 6.1. While conducting site activities near overhead lines, field personnel need to be aware of the location of the lines so as not to use conductive equipment (e.g., metal equipment to include: drill rigs; hand auger extensions; geoprobe units; excavators,

etc.) in close proximity to power lines.

- 6.2. OSHA 29 CFR 1926.550 requires that any vehicle or mechanical equipment (i.e., drill rigs) capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance distance of at least 10 feet is maintained.
- 6.3. Higher voltages require greater clearance distances. Contact the electrical utility company to verify line voltage. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10kV over that voltage.
- 6.4. Under any of the following conditions, OSHA allows the required clearance to be reduced.
 - 6.4.1. If a vehicle is in transit with its structure lowered, the clearance shall be reduced to 4ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in for every 10kV over that voltage.
- 6.5. When an unqualified person is working in an elevated position near overhead lines, or working on the ground in the vicinity of overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the clearance distances indicated in Table 1-1.

Table 1-1	
Voltage	Required Clearance
0-50 kV	10 feet
50-200 kV	15 feet
200-350 kV	20 feet
350-500 kV	25 feet
500-750 kV	35 feet
750-1000 kV	45 feet

- 6.6. For voltages normally encountered with overhead power lines, objects which do not have an insulating rating for the voltage involved shall be considered to be conductive.
- 6.7. When a qualified person is working in the vicinity of overhead lines, the employees companies safety policy shall be enforced.

7. ILLUMINATION

- 7.1. Employees shall not enter spaces containing exposed energized parts, unless illumination is provided that enables the employees to perform the work safely. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform tasks near exposed energized parts. Employees shall not reach blindly into areas which may contain energized parts.

8. PORTABLE LADDERS

- 8.1. Portable ladders shall have nonconductive siderails if they are used where the employee or the ladder could contact exposed energized parts.

9. CONDUCTIVE APPAREL

- 9.1. Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) shall not be worn if they might contact exposed energized parts.

10. HOUSEKEEPING DUTIES

- 10.1. Where live parts present an electrical contact hazard, employees shall not perform housekeeping duties at such close distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided.
- 10.2. Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions) shall not be used in proximity to energized parts unless procedures are followed which will prevent electrical contact.

11. GROUNDING, GFCIS AND ASSURED GROUNDING PROCEDURES

- 11.1. Equipment, tools and cord sets shall be provided and utilized so as to protect employees from electrical shock and to prevent fire.

12. EQUIPMENT AND TOOLS

- 12.1. Note: Portable equipment which is "double insulated" and endorsed by a nationally recognized testing facility need not have a grounding conductor, but is subject to the inspection requirements of this section. Tools and equipment subject to inspection and testing include:

- 12.1.1. Portable Electrical Tools such as grinders, drills and stapling guns

- 12.1.2. Stationary tools such as table saws, drill presses, and jig saws

- 12.1.3. Portable electrical extension cords

- 12.1.4. Portable and Temporary lighting systems and cords

- 12.1.4.1. Receptacles shall be of the grounding type and their contacts shall be grounded by connection to the equipment grounding conductor of the circuit supplying that receptacle in accordance with the NEC.

- 12.2. **Visual inspections** Visual inspection of tools and equipment are required prior to each use and shall include:

12.2.1. General condition

12.2.2. Plugs and caps, and presence of ground prong

12.2.3. Electrical cord sets

12.2.4. External defects, and missing parts

12.3. Defective tools shall be tagged, taken out of service and placed in a secured location until they are repaired or destroyed.

12.4. **Removal from service** Any equipment failing any test shall be taken out of service, shall be tagged with a "Danger, Do Not Use" tag, secured and repaired or destroyed.

13. GROUND FAULT CIRCUIT INTERRUPTERS (GFCI'S)

13.1. Ground Fault Circuit Interrupters (GFCI's) shall be used on receptacles ≥ 15 amps up to and including 30 amps for tool and equipment used in construction applications and potentially wet environments (either indoors or outdoors). Receptacles of temporary wiring systems and portable generators shall be protected with a GFCI.

13.2. The minimum requirements relative to the use of Ground Fault Circuit Interrupters are:

13.2.1. Prior to use, and periodically thereafter, verify that the GFCI is in good working order. Periodically re-test the GFCI to ensure continued effectiveness.

13.2.2. Remove from service any GFCI that has insufficient load capacity, is damaged or is ineffective for any reason. Affix a "Danger, Do Not Use" tag and store the GFCI in a secure location until it can be replaced or repaired. Destroy and discard any GFCI that cannot be repaired or reused.

13.2.3. Train employees in the provisions of this section as related to safe use of GFCIs. This training should include:

13.2.3.1. Double insulated tools

13.2.3.2. Defective cords and plugs

13.2.3.3. Heavy moisture, and wet conditions

13.2.3.4. Operation, selection, and use of GFCI's

14. TEMPORARY WIRING

- 14.1. This section applies to temporary electrical power and lighting wiring methods that may be of a class less than would be required for a permanent installation.
- 14.2. Temporary wiring shall be removed immediately upon completion of work and when the purpose for which the wiring was installed no longer applies.
- 14.3. **General requirements for temporary wiring**
 - 14.3.1. Feeders shall originate in a distribution center. The conductors shall be run as multiconductor cord or cable assemblies or within raceways.
 - 14.3.2. Branch circuits shall originate in a power outlet or panel board. Conductors shall be run as multi-conductor cord or cable assemblies or open conductors, or shall be run in raceways. Conductors shall be protected by over current devices at their ampacity.
 - 14.3.3. Receptacles shall be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit shall contain a separate equipment-grounding conductor, and receptacles shall be connected to the grounding system. Receptacles shall not be connected to the same ungrounded conductor of multi-wire circuits that supply temporary lighting.
 - 14.3.4. Disconnecting switches or plug connectors shall be installed to permit the disconnection of ungrounded conductors of each temporary circuit.
 - 14.3.5. Lamps for general illumination shall be protected from accidental contact or breakage. Metal-case sockets shall be grounded.
 - 14.3.6. The temporary wiring cords shall not be used to suspend temporary lights unless cords and lights are designed for this means of suspension. Temporary lighting shall be properly supported.
 - 14.3.7. Portable electric lighting used in wet and/or other conductive locations, as for example, drums, tanks, and vessels, shall be operated at 12 volts or less. However, 120-volt lights may be used if protected by a ground-fault circuit interrupter.
 - 14.3.8. A mounted box (with a cover) shall be used wherever a change is made to a raceway system or a cable system that is metal clad or metal sheathed. Non-metallic wiring system joints below seven foot (7') shall have mounted boxes and be covered. Exposed temporary joints shall have the wire nuts or other mechanical devices taped with black (electrical) tape to prevent them from falling off. Temporary joints including the ground wire shall have a mechanical

connection.

14.3.9. Flexible cords and cables shall be protected from damage. Sharp corners and projections shall be avoided. Flexible cords and cables may pass through doorways or other pinch points, if protection is provided to avoid damage. Cords and temporary wiring passing through walls shall be properly protected (e.g. sleeved).

14.3.10. Extension cord sets used with portable electric tools and appliances shall be of three-wire type and shall be designed for hard or extra-hard usage. Flexible cords used with temporary and portable lights shall be designed for hard or extra-hard usage. See the NEC, ANSI/NFPA 70, in Article 400, Table 400-4 that lists various types of flexible cords, some of which are noted as being designed for hard or extra-hard usage. Note: SEU, SER or other similar cables cannot be laid on the floor despite their rating.

14.3.11. For temporary wiring over 600 volts, nominal, fencing, barriers, or other effective means shall be provided to prevent access of other than authorized and qualified personnel.

15. CLEARANCES IN THE WORK PLACE

15.1. Employees shall not be permitted to work in such proximity to any part of an electric power circuit that the employee could contact the electric power circuit in the course of work, unless the employee is protected against electric shock by deenergizing the circuit and grounding it (if appropriate) or by guarding it effectively by insulation or other means.

15.2. Responsible Subcontractor shall ascertain by inquiry, direct observation, or by instruments, whether any part of an energized electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact with the electric power circuit. The Responsible Subcontractor shall post and maintain proper warning signs where such a circuit exists. The Responsible Subcontractor shall advise employees of the location of such lines, the hazards involved, and the protective measures to be taken.

15.3. Barriers or other means of guarding shall be provided to ensure that workspace for electrical equipment will not be used as a passageway during periods when energized parts of electrical equipment are exposed.

15.4. Only qualified persons complete tasks such as testing, troubleshooting and voltage measuring within the limited approach boundary.

16. FUSES

- 16.1. Installing or removing fuses shall be considered as work with live electrical energy and shall be covered in the hot work policy for the subcontractor.
- 16.2. Persons who perform work on high voltage fuses (over 600 volts) shall wear appropriate head, face, body flash suits, protective footwear and insulated gloves.
- 16.3. Insulating electrical gloves, sleeves, aprons, and other protective electrical clothing shall be tested for leaks and integrity prior to initial use and periodically. These tests shall meet the requirements of OSHA Standard 29 CFR 1910.137.
- 16.4. Protector gloves shall be worn over insulating gloves, except as defined in the above referenced standard.
- 16.5. Only manufacturer-qualified personnel shall inspect and make repairs to electrical insulating protective clothing.

17. PPE

- 17.1. All insulating PPE must be inspected before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection.
- 17.2. Such tests include:
 - 17.2.1. Blankets-before first issue/every 12 months thereafter,
 - 17.2.2. Gloves-before first issue and every 6 months,
 - 17.2.3. Sleeves before first issue and every 12 months.
 - 17.2.4. Covers and Line hose shall be testing if insulating value is suspect

18. TRAINING

- 18.1. All potentially exposed employees will be provided awareness training upon hire and annually thereafter of this program in order to be familiar with the potential hazards and proper safe work procedures to follow if exposed to electrical hazards. NO MAPP employee shall work on energized electrical systems under any circumstances, as these tasks should only be performed by a qualified person.
- 18.2. Employees will be instructed on:
 - 18.2.1.1. Distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment,

- 18.2.1.2. Determine the nominal voltage of exposed energized electrical conductors and circuit parts, the approach distances specified in Table 130.2 (Available upon request).
- 18.2.1.3. 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.
- 18.3. Documentation shall be made when the employee demonstrates proficiency, be maintained for the duration of the employee's employment, and contain each employee's name and date of training. Forward all MAPP employee training records to Baton Rouge, LA corporate office for filing.
- 18.4. Re-training
 - 18.4.1. When the employee is not complying with safety-related work practices or when workplace changes necessitate the use of safety-related work practices that are different from those that the employee would normally use?
 - 18.4.2. Intervals not to exceed 3 years

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1.0 PURPOSE AND SCOPE

This HSEP applies where exposure to energized or potentially energized electrical equipment is possible. Following these procedures will help to ensure that electrical work is conducted under the safest conditions possible.

This procedure does not apply to:

- Electrical work from 0-to-50 volts AC or 0-to-100 volts DC or
- Work performed on equipment by authorized service representatives in compliance with procedures approved by the manufacturer of the equipment.

This HSEP applies to all employees and subcontractors engaged in operations covered by the Company HSE Program.

2.0 RESPONSIBILITIES

General responsibilities for HSE Program implementation are stated in Roles and Responsibilities. Additional management, staff, employee, and subcontractor responsibilities that address duties specific to this topic are stated in this procedure.

2.1. Site Superintendent

The Site Manager is responsible for designating and authorizing

- An Electrical Superintendent/Electrical Competent Person and
- One or more on-site Qualified Electricians, as set forth in HSEP 19.3.

The Site Manager or the Electrical Superintendent must review and sign all SPAs for work on energized electrical equipment, prior to the work proceeding.

2.2. Electrical Subcontractor Superintendent

The Electrical Superintendent is responsible for planning, reviewing, and authorizing any work that is to be performed on or near potentially energized equipment of 480 volts or above.

2.3. Qualified Electrician

Workers, who will perform work on energized or potentially energized electrical equipment, shall:

- Possess the experience and education necessary to properly and safely perform the work.
- Successfully complete the company's electrical safety training, including a thorough review of this HSEP.
- Have a history of adhering to site HSE rules and procedures.
- Have been designated as Qualified Electricians and be authorized by the Site Manager to perform electrical work according to the requirements of this HSEP.

3.0 DEFINITIONS

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 Equipment	Wiring, circuits, switches, switch gear, fuses, breakers, distribution systems, and any other equipment or systems capable of containing electrical energy.
Energized	Electrically connected to or having a source of voltage, including "live parts."
Electrical Hazard	A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.
Electrically Safe Work Condition	A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded.
Electrical Superintendent and Electrical Competent Person	An experienced supervisory or management level person, who is capable of identifying existing and potential electrical hazards in the surroundings or working conditions and who has the experience and expertise in electrical work to determine effective corrective measures to mitigate them. (This person may or may not be a company employee.)
Exposure	Where hazards are present or could be created that might result in harm to personnel, equipment, or the environment if not properly controlled.
Exposed To Live Parts	Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.
Flash Protection Boundary	An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur.
Grounded	Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons.
Live Parts	Energized conductive components.
Potentially Energized	Electrical equipment capable of containing electrical energy that has not been locked-out, tagged-out, grounded, and verified as de-energized by proper testing methods.
Qualified Electrician (Qualified Person)	An electrician who has skills and knowledge related to the construction and operation of electrical equipment and installations, and who has received training and been qualified and authorized to perform work on energized or potentially energized electrical equipment. A person can be considered qualified with respect to certain equipment and methods but still be unqualified for others.
Shock Hazard	A dangerous condition associated with the possible release of energy caused by contact or approach to live parts.

Standby Person	A person assigned to support a Qualified Electrician, who is trained in energized electrical procedures, methods of release of victims from contact with energized parts, and response for electrical shock victims.
Working Near Live Parts	A distance from an exposed live part within which a shock hazard exists. Also known as a Limited Approach Boundary.
Working On Live Parts	Coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing.

4.0 PROCEDURE

4.1. Work Practices

Every effort must be made to de-energize the electrical equipment to be worked and other electrical equipment in the area that may affect the work. Prior to conducting work on any energized equipment, approval must be obtained from the Site/Project Manager, Electrical Superintendent, and the company maintenance or construction manager.

Prior to beginning work on or near energized or potentially energized electrical equipment, the Electrical Safety Checklist must be completed. The checklist is designed to ensure appropriate safety measures have been addressed when performing this type of work. The Electrical Safety Checklist will also serve as the authorization form for the performance of energized electrical work. Most facility owners also require an electrical safe work permit for this type of activity. See Sample Permit for Energized Electrical Work.

Additionally, a Safe Plan of Action must be completed. SPAs for work on energized electrical equipment must be reviewed and signed by the site manager or electrical superintendent prior to the work beginning. The Electrical Safety Checklist and SPA must be maintained or posted at the location where the work is being performed.

The following safe practices, when working on or near energized or potentially energized electrical parts, shall be followed:

- All electrical equipment and circuits must be considered energized unless tested and verified to be de-energized.
- No bare-hands work is permitted on exposed energized systems above 50 volts AC or 100 volts DC.
- Only personnel who have been appropriately trained and authorized by the site manager may perform work on electrical equipment.
- Only personnel who have been appropriately trained and authorized by the site manager may enter energized electrical substations and motor control centers. Unauthorized employees must be accompanied by a Qualified Electrician.
- Never assume that an electrical insulation is intact; take the necessary precautions prior to contacting insulated conductors.
- Do not wear jewelry when working on potentially energized equipment.
- Never reach blindly into electrical cabinets or enclosed areas.
- Make sure work areas have good lighting.
- Secure electrical cabinet doors to prevent them from closing unexpectedly.
- Keep the work area clear of non-essential tools and equipment.
- Use only voltage-rated insulated tools.
- Barricades should be used to provide warnings and limit access to work areas.

- Portable ladders shall be made of nonconductive materials, if they are to be used where the worker or ladder could contact exposed live parts or where an electrical hazard exists.
- Ropes or hand lines used near live parts shall be made of non-conductive material.
- Handle conductive objects carefully when in the area of electrical equipment.
- Identify all sources of electricity and take the appropriate safety measures before proceeding with the work.
- Clearly visible identification plates must be provided for electrical equipment. Equipment having auxiliary circuits must have a label, such as "Has Auxiliary Circuit" or "Dual Power Sources."
- When racking or stabbing in/out electrical equipment, stand to one side of the cabinet and turn your face away from the work.
- Only use exact duplicates of the same rating when replacing fuses.
- Wear appropriate level of PPE, as determined by the hazard potential for arc and flash.

4.2. Work On or Near Potentially Energized Electrical Equipment

Energized parts that operate at less than 50 volts to ground shall not be required to be de-energized if there will be no increase in exposure to electrical burns or to explosion due to electrical arcs.

To work on any electrical part rated at or above 50 volts that are not placed in an electrically safe work condition (disconnected, locked and tagged, tested and grounded), safe work practices and personal protective equipment (PPE) must be used that will protect each worker from arc flash and from contacting live parts directly with their body or indirectly with another conductive object.

Both a shock hazard analysis and a flash hazard analysis shall be conducted prior to work on or near potentially energized equipment. Shock and flash hazard analysis data taken from local standards or regulations can be used in conducting this analysis. This analysis shall define what the safe approach distances are and what PPE is required based on the voltage level of the equipment.

Work on energized or potentially energized electrical equipment of 480 volts or above can only be performed by Qualified Electricians and shall not be done unless the following additional conditions are met:

- Prior to the performance of electrical work, confirm that all alternate solutions and scheduling options for de-energizing the system have been considered and are not feasible.

Examples of work that may be performed on or near energized circuit parts because of "infeasibility" due to equipment design or operational limitations, according to OSHA, would include 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 industrial process in a chemical plant that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.
- A designated standby person must be present at all times and equipped with a level of personal protection equal to that of the Qualified Electrician performing the work.
- The supervisor of the Qualified Electrician performing the work must be notified that such work shall be done, the exact location of the work, and when the work will begin. Once the work is complete, the supervisor must also be notified.

4.3. Flash Protection Boundaries for Work on or Near Live Parts

No person shall approach or take a conductive object closer to exposed live parts or to potentially energized parts than the approach boundaries defined below unless they are:

- A Qualified Electrician,
- Using only voltage-rated insulated tools,
- Attended by a stand-by person if the circuit is rated at 480 volts or above,
- Following an approved safe work plan,
- Using an authorized safe work permit, and
- Wearing all required PPE, as defined by the PPE section of this procedure.

<u>Nominal Voltage, Phase to Phase</u>	<u>Flash Protection Boundary (feet)</u>
50 volts to 169 kV	4
230 kV to 242 kV	6
345 kV to 362 kV	9
500 kV to 550 kV	12
765 kV to 800 kV	15

4.4. Lock-out and Tag-out Procedures

Prior to beginning work on electrical equipment, every effort must be made to de-energize the equipment and other electrical equipment in the area that might affect the work.

In order to accomplish this task, the company or site-specific lock-out/tag-out procedures (HSEP 15.1) must be strictly followed.

Before implementing lock-out and tag-out procedures or being allowed to work on electrical equipment, employees must have completed the company's lock-out/tag-out training.

4.5. Qualified Electrician Duties and Functions

Only Qualified Electricians may:

- Operate any circuit switching device 480 volts or above, except motor starters and valve operators from push button stations.
- Test or troubleshoot electrical equipment.
- Repair or alter electrical equipment.
- Remove or install fuses.
- Climb electrical poles.
- Perform work on non-insulated energized circuits and apparatus over 50 volts.
- Perform work within 10 feet of non-insulated energized circuits and apparatus that are not barricaded or covered or otherwise guarded to prevent electrical shock hazards and contact by tools, equipment, or personnel.

Only personnel, who have been appropriately trained and authorized by the site manager, may enter energized electrical substations and motor control centers (see HSEP 19.3). Unauthorized employees must be accompanied by a Qualified Electrician.

4.6. Standby Persons

Designated Standby Persons must be present when work is being performed on energized or potentially energized circuits 480 volts or above.

Standby Persons must be trained in energized electrical procedures and emergency rescue and response for electrical shock victims. They must, at a minimum:

- wear high voltage protective gloves,
- remain within line-of-sight of the work at all times while the work is in progress,
- have an effective means for notifying emergency response personnel, and
- know how and who to call for emergency medical response.

If the Standby Person does not have appropriate medical training, emergency medical response may be provided by another appropriately trained designated person, who is either at the site of the work or immediately available, e.g., 3 – 4 minutes maximum response time.

Insulated rescue hooks may also be provided to Standby Persons.

4.7. Overhead Power Lines

Overhead power lines must be considered energized unless disconnected and physically grounded. When working in the vicinity of overhead power lines, Qualified Electricians may not approach or carry conductive objects any closer than outlined in the table below unless:

- The conductive object has an approved insulating handle.
- The person is insulated from the energized part by the appropriate personal protective equipment rated for the expected voltage.
- The energized part is insulated from the person and other conductive objects in the area.
- The person is insulated from all conductive objects in the area.

Approach Distances for Qualified Employees, Alternating Current	
300 volts and less	avoid contact
Over 300 volts, not over 750 volts	1 ft. 0 in
Over 750 volts, not over 2 kvolts	1 ft. 6 in.
Over 2 kvolts, not over 15 kvolts	2 ft. 0 in.
Over 15 kvolts not over 37 kvolts	3 ft. 0 in.
Over 37 kvolts, not over 87.5 kvolts	3 ft. 6 in.
Over 87.5 kvolts, not over 121 kvolts	4 ft. 0 in.
Over 121 kvolts, not over 140 kvolts	4 ft. 6 in.

Source of table: 29 CFR 1910.333(c)(3)(ii)(C), Table S-5

All power lines must be barricaded or flagged when there is danger of contact by mobile equipment.

For procedures related to rigging, lifting, clearance distances, and other mobile crane work, refer to HSEP 17.1.

4.8. Conduit and Cable Dismantling

Before the dismantling of conduit or electrical cable begins, the following procedures must be implemented:

- The electrical circuit(s) to be dismantled must be de-energized and locked out and tagged out by a Qualified Electrician in accordance with the company's lock-out/tag-out procedures.
- All disconnects and the identification and verification of conduits must be performed by a Qualified Electrician.

- All affected conductors must be checked with an appropriate voltage tester by a Qualified Electrician to assure that the conductors to be dismantled have been de-energized and are out of service.
- The voltage tester and all other electrical safety equipment (e.g. gloves, mats, etc.) must have current inspection stickers and be in good condition.
- Immediately before and after each use, the voltage tester shall be tested on a known source to ensure proper operation.
- After determining that all electrical circuits are de-energized and locked out and tagged out, the cables and conductors must be disconnected by a Qualified Electrician at all points of termination (energy source and equipment being served).
- After the cables and conductors have been de-energized and removed from the voltage sources, the conduit and/or cable shall be air-gapped at least 12 inches by a Qualified Electrician at both the source and at the equipment being supplied.
- Conduit and/or cables to be dismantled must be tagged by a Qualified Electrician at each end, each intersection, and at intervals not to exceed fifty feet in any direction along the entire length of the conduit and/or cable. Cable enclosed in an underground duct does not have to be tagged every fifty feet. A unique tag that specifies "demolition" should be used for this purpose.
- Each demolition tag should specify the name of the Qualified Electrician, who performed the work, the date, and the supervisor's name.
- All electrical cable and/or conduit dismantled should be removed in a safe manner and placed where it will not cause a tripping hazard.
- Every effort should be made to ensure that the Qualified Electrician, who began the dismantling work continues with the work until completion. If, for any reason, the electrician performing the work should be absent or unavailable, a second Qualified Electrician may assume the task; however, the status and energy state of the work must be re-verified.

4.9. Test Equipment

- 4.9.1. Only Qualified Electricians may perform tests on energized or potentially energized electrical circuits or equipment of 480 volts and above.

When performing tests, these requirements must be strictly followed:

- The test equipment must be evaluated for proper operation immediately before and after the test on a known voltage source.
- Test instruments, equipment, and all associated test leads, cables, power cords, probes and connectors must be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that could expose someone to injury, the defective or damaged item must be properly tagged out and removed from service. It may not be used again until repairs and tests to assure the equipment is safe to use have been made.
- Test equipment, instruments, and their accessories must be rated for the circuits to which they will be connected and must be designed for the environment in which they will be used.
- No person shall attempt to use any type of test equipment unless they are trained, qualified, and competent and are familiar with the proper use and limitations of the equipment.
- Test equipment that has been exposed to excessive moisture shall be immediately removed from service and may not be returned to service until repairs and tests to assure its safe operation are performed.

- All electrical test equipment must be stored in a clean, dry location, kept clean and in good operating condition.
- Solenoid type testers (also known as “wiggies”) produce a spark during use and may not be used in flammable or explosive environments.
- Voltmeters must be inspected monthly by a designated Competent Person. The inspection results are to be documented and kept on file. Any equipment that is, or is suspected to be defective, shall be tagged and removed from service until proper repairs are made and tests verify that the equipment is accurate and safe to use.
- Proximity testers or “no contact” testers, where approved, may only be used to verify presence of voltage, not the absence of voltage.
- Electrical test equipment that is rated for use on 2,300 volts or higher must be electrically tested and calibrated by an approved testing facility at intervals not to exceed twelve months. If the integrity of such equipment is suspect, it must be taken out of service until it is tested at an approved testing facility and deemed accurate and safe for use. Records of all tests and repairs are to be maintained on file.
- Voltage tester leads shall be kept in a separate pouch (other than tool pouch) to prevent damage by other objects.
- Phasing sticks shall be used when verifying that circuits 1,000 volts or greater are de-energized. Phasing sticks must be tested prior to and after each use.

4.9.2. Use of PPE During Testing

When using a voltage meter to check any energized or potentially energized source that is above 480 volts, and when troubleshooting any energized or potentially energized source that is above 480 volts, the following protective equipment must be worn:

- Approved and tested high voltage rubber gloves of the proper rating, with leather protectors,
- A full-face protective hood,
- Arc flash protective jacket and pants, and
- Dielectric boots of the proper rating.

All personal protective equipment shall be rated and designed to protect the worker from arc and flash potential of the equipment on which they are working. Dielectric switchboard matting between the equipment and worker may also be used to provide additional necessary protection.

4.10. Personal Protective Equipment

Workers shall wear nonconductive PPE when they are within the Flash Protection Boundary or when there is a danger of injury from electric arcs or flashes or burns due to contact with live parts or from flying objects resulting from electrical explosion.

4.10.1. Selection

Appropriate head protection, gloves, eye protection, hearing protection, foot protection, and flame resistant clothing must be worn by personnel who will be working on or near energized electrical equipment.

Selection of PPE must be made by using one of these two methods, either:

- Use the National Fire Protection Association (NFPA) 70 E Table 130.7(C)(9)(a) and Table 130.7(C)(10), or
- Use PPE rated for the level of protection required, as determined by calculations for potential shock and flash hazards of the equipment being worked on or near.

4.10.2. Maintenance of PPE

PPE required by this procedure must be inspected and maintained in compliance with this procedure and the manufacturers' guidelines.

Any defective PPE must be immediately removed from service and properly repaired or replaced.

4.10.3. Body Protection

Personnel shall wear flame retardant (FR) clothing when there is potential exposure to an arc flash above the threshold incident energy level of a second degree burn, 5 J/cm² (1.2 cal/cm²).

FR clothing must be labeled with its arc protection rating, cover all ignitable clothing and other PPE, and shall allow for movement and visibility.

FR clothing must be inspected prior to each use. Clothing contaminated with grease, oil, or flammable or combustible materials shall not be used.

4.10.4. Flash Suits

Flash suits, including the hood's face shield, shall have an arc rating that is suitable for the arc flash exposure. Flash suit design shall permit easy and rapid removal by the wearer.

If exterior air is supplied into the hood, the air hoses and pump housing shall be either covered by flame retardant materials or constructed of non-melting and nonflammable materials.

4.10.5. Face Protection

Face shields shall have an arc rating suitable for the arc flash exposure. Face shields without an arc rating shall not be used. Eye protection (safety glasses or goggles) shall always be worn under face shields or hoods.

Face shields made with energy-absorbing formulations that can provide higher levels of protection from radiant energy are commercially available, but these shields are tinted and can reduce visibility. Additional illumination of the task area might be necessary when these types of face shields are used.

4.10.6. Foot Protection

Where insulated footwear is used as protection against step and touch potential, dielectric overshoes/boots shall be used. Insulated soles shall not be used as primary electrical foot protection.

4.10.7. Hand Protection

Leather or flame retardant gloves shall be worn where required for arc flash protection.

Where insulating rubber gloves are used for shock protection, leather protectors shall be worn over the rubber gloves. Insulating rubber gloves and gloves made from layers of flame-resistant material provide hand protection against the arc flash hazard. The leather protectors worn over insulating rubber gloves provide additional arc flash protection for the hands.

Insulating rubber gloves must be:

- electrically tested by an approved outside testing facility at intervals not to exceed six months. The type, size, class, and latest test date must be clearly marked on each glove. Any glove that fails the electrical test must be immediately removed from service and destroyed.
- stored in a manner to prevent physical damage. Do not store them folded, creased, or compressed. The storage location should be free from chemicals,

solvents, sunlight, heat, moisture, ozone, or any objects that could cause damage.

- inspected by the wearer for defects before each use and at other times if there is cause to suspect damage. They must be inspected over the entire surface and be gently rolled between the hands to expose any defects. If any of the following defects are found, the gloves must be repaired and retested before they are put back into service:
 - Holes, tears, punctures, or cuts
 - Ozone cutting or checking
 - Imbedded foreign objects
 - Texture changes such as softening, hardening, becoming sticky or inelastic
- given an air test before each use and at other times if there is reason to suspect damage. The test is performed by rolling the cuff tightly toward the palm in such a manner that air is trapped inside the glove. Once this is accomplished, look, listen and feel for air leaks throughout the glove. If no leaks are detected, the glove is safe to use. No part of the glove is to be stretched more than 1.25 times its normal size.
- worn with leather protector gloves to prevent damage. If the protectors have been used for any other purpose, they cannot be used to protect insulating gloves. Protectors with holes, tears, cuts, chemical, or oil contamination, holes, or any other defects that diminish their capacity to provide protection must not be used.
- free of any marking, labels, or adhesive tape other than those applied by the manufacturer or testing facility.
- cleaned of any grease, perspiration, etc. after each use. Use only a mild, non-bleaching soap, and rinse with clean water.
- kept and carried in a box, bag, or other container intended exclusively for this purpose. These containers must be kept free of chemicals, dirt, or any other material that could harm the gloves or protectors.

4.10.8. Inspection of PPE and Documentation

All personal protective equipment, including gloves, mats, boots, clothing, faceshields, hoods, etc. must be inspected and maintained in compliance with this HSEP and the manufacturers' guidelines. Any defective personal protective equipment must be immediately removed from service and properly repaired or replaced.

All inspections, repairs, and tests done on protective equipment shall be documented by the Competent Person or approved outside testing facility performing the inspection, repair and/or test. All such documentation is to be maintained on site and available for review.

4.11. Rubber Insulating Blankets

Rubber insulating blankets must be:

- electrically tested by an approved outside testing facility at intervals not to exceed twelve months. Defective or suspect defective blankets cannot be used until they have been tested and approved.
- visually inspected by the user before each use and any time there is reason to suspect any defect or damage. They are to be inspected on both sides over the entire blanket surface for defects and embedded materials. Blankets with any defects must be returned to an approved electrical testing facility for inspection and retesting.

- cleaned as necessary to remove foreign substances or chemicals. They may be cleaned with a mild, non-bleaching detergent and water and then be rinsed thoroughly with clear water to remove all of the detergent. If washed, the blanket should be air-dried. The cleaning agent used must not degrade the insulating or physical properties of the blanket.
- stored in a cool, dark, dry location that is free of chemicals, solvents, ozone, vapors, fumes, electrical discharges and sunlight. They are to be stored in a container, bag, box, or compartment designed for and used exclusively for this purpose. They must not be stored folded, creased, or compressed in any manner that could cause stretching, compression, or abrasion.
- free from any adhesives, tape, labels, or other markings, other than those placed by the manufacturer or testing facility. Tape cannot be used to secure blankets for shipment or storage.
- of the proper class, type, and voltage rating for the task being performed.
- repaired only by an approved facility. Blankets must be retested after any repair. Any rubber insulating blanket not suitable for electrical service must be destroyed.

4.12. Training

4.12.1. Qualified Electricians

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.

Qualified persons shall also be trained in and familiar with the proper use of:

Qualified persons shall also be trained in and familiar with:

- The proper use of
 - any necessary special precautionary techniques,
 - PPE, including arc-flash, insulating, and shielding materials,
 - Insulated tools and test equipment,
- The skills and techniques necessary to distinguish exposed energized parts from other parts of electrical equipment,
- The skills and techniques necessary to determine the nominal voltage of exposed live parts,
- The allowable safe approach distances and the corresponding voltages, and
- The decision-making process necessary to determine the degree and extent of the hazard and the PPE and job planning necessary to perform the task safely.

4.12.2. Electrical Testing Equipment

No person shall attempt to use any type of test equipment unless trained, qualified, and competent to do so and familiar with the equipment, its proper operation, and limitations.

4.12.3. Standby Persons

Standby persons must be trained in energized electrical procedures, methods of release of victims from contact with energized parts, and response for electrical shock victims, including first-aid, CPR, and defibrillation.

4.12.4. Lock-out and Tag-out

Personnel who work on or near energized or potentially energized equipment, shall be trained to understand the lock-out/tag-out procedure and their responsibility in executing

the procedure. New or reassigned workers shall be trained or retrained to understand the lock-out/tag-out procedure as related to their new assignment.

5.0 REFERENCES AND RELATED DOCUMENTS

NFPA 70 E

29 CFR 1910, Subpart S, Electrical

29 CFR 1926, Subpart K, Electrical

HSEP 19.3, Qualified Electrician Program

6.0 FIGURES

[Electrical Safety Checklist](#)

[Sample Permit for Energized Electrical Work](#)

Figure 1 Electrical Safety Checklist

Work Location and Description: _____

Yes	No*	
_____	_____	Electrical Work Order Obtained
_____	_____	Proper Permits Issued
_____	_____	Lockout/Tagout Procedures Properly Implemented
_____	_____	Equipment De-energized**
_____	_____	Safe Plan of Action (SPA) Complete
_____	_____	Task Safety Awareness (TSA) Meeting Conducted
_____	_____	Proper Personal Protective Equipment On Site

*All "No" answers must be explained: _____

Supervisor Signature

**Prior to conducting work on any energized equipment, approval must be obtained from the Site/Project Manager, the Electrical Superintendent, and the Company Maintenance or Construction Manager.

This is to certify that we have reviewed the electrical work as described above and authorize this work to be performed in an energized state. I further certify that all required safety precautions have been taken to safeguard the employees involved.

Site/Project Manager_____
Electrical Superintendent

Figure 2

Sample Plan for Energized Electrical Work

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

Enter details for each step and place check in each box when completed.

☐ Detailed job description procedure to be used in performing the above detailed work: _____

☐ Description of the safe work practices to be employed: _____

☐ Results of the shock hazard analysis: _____

☐ Determination of shock protection boundaries: _____

☐ Results of the flash hazard analysis: _____

☐ Determination of the flash protection boundary: _____

☐ Necessary personal protective equipment to safely perform the assigned task: _____

☐ Means employed to restrict the access of unqualified persons from the work area: _____

☐ Evidence of completion of a job briefing (SPA), including discussion of any job-related hazards: _____

☐ Standby person provided, who has required training, PPE, and emergency communication equipment and capabilities: _____

☐ Do you agree that the work described above can be done safely? ☐ Yes ☐ No (If *no*, return form to requester.)

Qualified Electrician: _____ Date: _____

Qualified Electrician: _____ Date: _____

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

Facility/Equipment Owner: _____ Maint./Engr. Manager: _____

HSE Manager: _____ Electrical Superintendent: _____

Site Manager: _____ Date: _____

Once the work is complete, forward this form to site HSE for review and retention.