

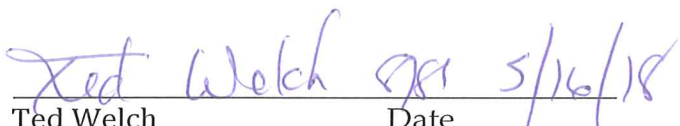


MPGE FOXWOODS ENGINEERING ELECTRICAL SAFETY PROGRAM

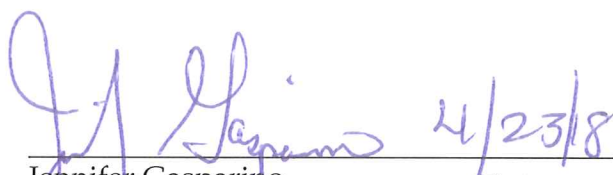
April 20, 2018

This Electrical Safety Program has been developed to satisfy the requirements of NFPA 70E, 2015 edition, "Standard for Electrical Safety in the Workplace".

Anyone that fails to comply with this program shall be subjected to disciplinary action.



Ted Welch Date
Executive Director of Engineering & Projects



Jennifer Gasparino Date
Director of Engineering



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INTRODUCTION

This program establishes minimum standards to prevent hazardous electrical exposures to personnel and ensure compliance with regulatory requirements applicable to electrical systems. Working on equipment in a de-energized state is **required**. This program is designed to help ensure that energized electrical work at all MPGEFOXWOODS ENGINEERING properties is performed safely by Qualified Persons, who are trained and provided with the appropriate safe work procedures, protective equipment and other controls. The program is intended to protect employees and Contractors against electrical shock, burns and other potential electrical safety hazards as well as comply with regulatory requirements.

ELECTRIC HAZARDS

Electricity-related hazards include electric shock and burns, arc-flash burns, arc-blast impacts, and falls.

- **Electric shock and burns:** An electric shock occurs when electric current passes through the body. This can happen when touching an energized part. If the electric current passes across the chest or head, death can result. At high voltages, severe burns can result.
- **Arc-flash burns:** An electric arc flash can occur if a conductive object gets too close to a high-amp current source or by equipment failure (for instance, while opening or closing disconnects). The arc can heat the air to temperatures as high as 35,000° F, and vaporize metal in the equipment. The arc flash can cause severe skin burns by direct heat exposure and by igniting clothing.
- **Arc-blast impacts:** The heating of air and vaporization of metal creates a pressure wave that can damage hearing and cause memory loss (from concussion) and other injuries. Flying metal parts are also a hazard.
- **Falls:** Electric shocks and arc blasts can cause falls, especially from ladders or unguarded scaffolding.

1. PURPOSE

This program has been established in order to:

- Ensure the safety of employees who may work on or near electrical equipment.
- Ensure that employees understand and comply with safety standards related to electrical work.
- Ensure that employees follow uniform practices during the progress of electrical work.
- Comply with TOSHA Standards according to the following six points:
 1. Provide and demonstrate a safety program with defined responsibilities.
 2. Determine the degree of arc flash hazard by qualified personnel.
 3. Affix warning labels on equipment.
 4. Provide Arc Rated personal protective equipment (PPE) for workers.
 5. Provide documented training to workers on Lockout/Tag-out procedures and the hazards of arc flash.
 6. Provide appropriate tools for safe work.

2. SCOPE

This program applies to all MPGE FOXWOODS ENGINEERING properties and work performed by its employees and all Contractors regardless of job site locations.

3. ELECTRIC SAFETY PRINCIPLES-ENERGIZED CONDITION

- **ALWAYS De-energize equipment per NFPA 70E, 2015, Article 120.2.**
- **Plan every job:** The approach and step-by-step procedures to complete the work at hand must be discussed and agreed upon between all involved employees before beginning. Write lockout procedures obtained. Discuss hazards and procedures in a job briefing with Safety Manager, Trade Leads and other Qualified Persons before starting any job. It is the employer's responsibility to have or develop a checklist system for working on live circuits. Foxwoods Engineering will not authorize live work on electrical systems.
- **Identify the hazards:** Conduct a job hazard analysis. Identify steps that could create electric shock or arc-flash hazards.
- **Minimize the hazards:** De-energize any equipment, and insulate, or isolate exposed live parts so contact cannot be made.
- **Anticipate problems:** If it can go wrong, it might. Make sure the proper Arc Rated PPE and tools are immediately available for the worst-case scenario.
- **Obtain training:** Make sure all involved employees are a Qualified Person with appropriate training for the job.

4. REFERENCES

- NFPA 70-E, "Standard for Electrical Safety in the Workplace", 2015 edition.
 - IEEE Standard 1584-2002, "Guide for Performing Arc Flash Hazard Calculations".
 - **NFPA 70 (National Electrical Code 2014 Ed)** has been adopted by the Mashantucket Building Code. NFPA 70-E and IEE Standard 1584-2002 are both referenced in NFPA 70.
 - OSHA 29 CFR 1910.331 through 1910.335, "Electrical Safety-Related Work Practices".
 - OSHA 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tag-out)".
- The standards and regulations of the Federal OSHA (excluding only the Court jurisdictional provisions of OSHA) have been adopted as the tribal standards and regulations to be enforced through TOSHA pursuant to Title 34 of the Mashantucket Pequot Tribal Laws.

5. RESPONSIBILITIES

Safety Manager must determine each assignment of the following responsibilities based on staff expertise, resources available and specific considerations:

A. Safety Manager

- Evaluate work being performed and determine compliance with this program.
- Provide or assist in the task of specific training for electrical work qualifications.
- Training, recordkeeping.
- Periodically review and update this written program.
- Provide or coordinate general training for work units on the content of this program.
- Evaluate the overall effectiveness of the electrical safety program on a periodic basis.
- Assist work units in the implementation of this program.
- Ensure employees under their supervision receive training appropriate to their assigned electrical tasks and maintain documentation of such training.
- Coordinates Bi-annual testing of all Arc Rated PPE's.

B. Individual Trade Leadsman

- Promote electrical safety awareness to all employees under their supervision.
- Ensure employees under their supervision comply with ALL provisions of the electrical safety program.
- Develop and maintain a listing of all qualified employees under their supervision.
- Ensure employees under their supervision are provided with and trained in the use of appropriate protective equipment.

C. Employees

- Follow the work practices described in this document, including the use of appropriate protective equipment and tools.
- Attend all training required relative to this program.
- Immediately report any concerns related to electrical safety to supervision.
- Maintain all Protective equipment/tools issued in proper working order
- Perform required inspections of equipment/tools issued at the prescribed intervals and document those inspections as needed
- Produce all protective equipment and tools issued to the Safety Manager and/or other designated representatives for independent inspection immediately upon receipt of a request to do so.
- Produce all protective equipment and tools issued for recertification testing of insulation integrity at the prescribed intervals.

6. DEFINITIONS

- **Boundary, Arc Flash Protection.** 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.
- **Boundary, Limited Approach.** An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists.
- **Boundary, Restricted Approach.** 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.
- **Boundary, Prohibited Approach.** 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.
- **Disconnecting (or isolating) switch** -A mechanical switching device used for isolating a circuit or equipment from a source of power.
- **Electrically Safe Work Condition.** A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.
- **Energized.** Electrically connected to, or is, a source of voltage.
- **Energized Electrical Work Permit** -When working on energized electrical conductors or circuit parts that are not placed in an electrically safe work condition (i.e., for the reasons of increased or additional hazards or infeasibility per NFPA 70E, 2012, 130.2B, work to be performed shall be considered energized electrical work and shall be performed by written permit only.
- **Exposed (as applied to energized electrical conductors or circuit parts).** 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 Interrupt (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.
- **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.
- **Service** -The conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.
- **Service Equipment** -The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the entrance of supply conductors to the building and intended to constitute the main control and means of cutoff of the supply.
- **Shock Hazard.** A dangerous condition associated with the possible release of energy caused by contact or approach to energized electrical conductors or circuit parts.
- **Switching Devices** -A device designed to close, open, or both, one or more electric circuits
- **Voltage, Nominal.** A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

7. TRAINING

A. Requirements

Workers near energized, or potentially energized electrical circuitry of fifty (50) volts to ground or greater, shall be trained in energized electrical safe work practices and procedures and retrained as necessary. Safety Manager SHALL coordinate and schedule all required training every three years when the latest NFPA 70E is issued.

B. Qualified Person

Employees must receive training in avoiding the electrical hazards associated with working on or near exposed energized parts prior to performing energized electrical work. Such training will be provided when the employee is initially assigned to the job and refresher training will be provided yearly or when conditions change.

The following items are to be included in the training of Qualified Person:

- Demonstrate a working knowledge of applying NFPA 70E, 2015 safe work practices to their Trade skill level work.
- The Lockout/Tag-out Training Program including safe work practices required to safely de-energize electrical equipment.
- Electrical safety procedures.
- Skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment.
- Perform on-the-job training with a Qualified Person.
- Skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The approach distances specified in NFPA 70E, 2015 and the corresponding voltages to which the Qualified Persons will be exposed.
- Selection and use of proper work practices, personal protective equipment, tools, insulating and shielding materials and equipment for working on or near energized parts.
- Qualified Person must also be trained in recognizing signs and symptoms of electric shock, heart fibrillation, electric burns, and proper first aid protocols for these conditions. They must have the following training:
 - o Basic Cardio Pulmonary Resuscitation (CPR);
 - o Automatic External Defibrillator (AED); and
 - o Contacting emergency personnel and basic first aid.

C. Documentation of Training and Experience

Documentation of training shall be kept by Safety Manager. Experience received by Qualified Person must be maintained for all personnel covered by this program. Documentation is necessary to demonstrate that individuals have met the training and experience requirements for the types of work being performed.

8. PORTABLE ELECTRICAL EQUIPMENT AND EXTENSION CORDS

The following requirements apply to the use of cord-and-plug-connected equipment and flexible cord sets (extension cords):

- Extension cords may only be used to provide temporary power.
- Portable cord-and-plug connected equipment and extension cords must be visually inspected before use on any shift for external defects such as loose parts, deformed and missing pins, or damage to outer jacket or insulation, and for possible internal damage such as pinched or crushed outer jacket. Any defective cord or cord-and-plug-connected equipment must be removed from service and no person may use it until it is repaired and tested to ensure it is safe for use.
- Extension cords must be of the three-wire type. Extension cords and flexible cords must be designed for hard or extra hard usage (for example, types S, ST, and SO). The rating or approval must be visible.
- Job-made extension cords are allowed per the electrical code.
- Personnel performing work on renovation or construction sites using extension cords or where work is performed in damp or wet locations must be provided, and must use, a ground-fault circuit interrupter (GFCI).
- Portable equipment must be handled in a manner that will not cause damage. Flexible electric cords connected to equipment may not be used for raising or lowering the equipment.

- Extension cords must be protected from damage. Sharp corners and projects must be avoided. Flexible cords may not be run through windows or doors unless protected from damage, and then only on a temporary basis. Flexible cords may not be run above ceilings or inside or through walls, ceilings or floors, and may not be fastened with staples or otherwise hung in such a fashion as to damage the outer jacket or insulation.
- Cords must be covered by a cord protector or tape when they extend into a walkway or other path of travel to avoid creating a trip hazard.
- Extension cords used with grounding-type equipment must contain an equipment-grounding conductor (i.e., the cord must accept a three-prong, or grounded, plug).
- Attachment plugs and receptacles may not be connected or altered in any way that would interrupt the continuity of the equipment grounding conductor. Additionally, these devices may not be altered to allow the grounding pole to be inserted into current connector slots. Clipping the grounding prong from an electrical plug is prohibited.
- Flexible cords may only be plugged into grounded receptacles. The continuity of the ground in a two-prong outlet must be verified before use. It is recommended that the receptacle be replaced with a three-prong outlet. Adapters that interrupt the continuity of the equipment grounding connection may not be used.
- All portable electric equipment and flexible cords used in highly conductive work locations, such as those with water or other conductive liquids, or in places where employees are likely to contact water or conductive liquids, must be approved for those locations.
- Employee's hands must be dry when plugging and unplugging flexible cords and cord-and-plug connected equipment if energized equipment is involved.
- If the connection could provide a conducting path to employees hands (for example, if a cord connector is wet from being immersed in water), the energized plug and receptacle connections must be handled only with insulating protective equipment.
- Locking-type connectors must be properly locked into the connector.
- Lamps for general illumination must be protected from breakage, and metal shell sockets must be grounded.
- Temporary lights must not be suspended by their cords unless they have been designed for this purpose.
- Portable lighting used in wet or conductive locations, such as tanks or boilers, must be operated at no more than 120 volts or must be protected by GFCI's.
- Extension cords are considered to be temporary wiring, and must also comply with the section on "Requirements for Temporary Wiring" in this program.

9. REQUIREMENTS FOR TEMPORARY WIRING

Temporary electrical power and lighting installations 600 volts or less, including flexible cords, cables and extension cords, may only be used during and for renovation, maintenance, repair, or experimental work. The duration for temporary wiring used for decorative lighting for special events and similar purposes may not exceed 90 days. The following additional requirements apply:

- Ground-fault protection (e.g., ground-fault circuit interrupters or GFCI) must be provided on all temporary-wiring circuits, including extension cords, used on construction sites.
- In general, all equipment and tools connected by cord and plug must be grounded. Listed or labeled double insulated tools and appliances need not be grounded.
- Feeders must originate in an approved distribution center, such as a panel board, that is rated for the voltages and currents the system is expected to carry.
- Branch circuits must originate in an approved power outlet or panelboard.
- Neither bare conductors nor earth returns may be used for the wiring of any temporary circuit.
- Receptacles must be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit must contain a separate equipment-grounding conductor, and all receptacles must be electrically connected to the grounding conductor.
- Flexible cords and cables must be of an approved type and suitable for the location and intended use. They may only be used for pendants, wiring of fixtures, connection of portable lamps or appliances, elevators, hoists, connection of stationary equipment where frequently interchanged, prevention of transmission of noise or vibration, data processing cables, or where needed to permit maintenance or repair. They may not be used as a substitute for the fixed wiring, where run through holes in walls, ceilings or floors, where run through doorways, windows or similar openings, where attached to building surfaces, or where concealed behind building walls, ceilings or floors.
- Suitable disconnecting switches or plug connects must be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

- Lamps for general illumination must be protected from accidental contact or damage, either by elevating the fixture or by providing a suitable guard. Hand lamps supplied by flexible cord must be equipped with a handle of molded composition or other approved material and must be equipped with a substantial bulb guard.
- Flexible cords and cables must be protected from accidental damage. Sharp corners and projections are to be avoided. Flexible cords and cables must be protected from damage when they pass through doorways or other pinch points.

10. WET OR DAMP LOCATIONS per NFPA 70 NEC

Work in *wet* or *damp* work locations (i.e., areas surrounded or near water or other liquids) should not be performed unless it is absolutely critical. Electrical work should be postponed until the liquid can be cleaned up. The following special precautions must be incorporated while performing work in *damp* locations:

- Only use electrical cords that have Ground Fault Circuit Interrupters (GFCIs);
- Place a dry barrier over any wet or damp work surface;
- Remove standing water before beginning work. Work is prohibited in areas where there is standing water;
- Do not use electrical extension cords in wet or damp locations; and
- Keep electrical cords away from standing water.

11. WORKING ON DE-ENERGIZED EQUIPMENT

Electrically Safe Work Condition

The most important principle of electrical safety is to **assume all electric circuits are energized unless each involved worker ensures they are not**. Every circuit and conductor must be tested every time work is done on them. Proper Arc Rated PPE must be worn until the equipment is proven to be de-energized.

- Voltage rated gloves and leather protectors must be worn
- Electrically insulated shoes should be worn
- Approved insulating mats
- Safety glasses must be worn
- The required Arc Flash PPE must also be worn

The National Fire Protection Association (NFPA) lists six steps to ensure conditions for electrically safe work.

- Identify all sources of power to the equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
- Remove the load current, and then open the disconnecting devices for each power source.
- Where possible, visually verify that blades of disconnecting devices are fully open or that draw out-type circuit breakers are fully withdrawn.
- Apply lockout/tag-out devices in accordance with a formal, written policy.
- Test each phase conductor or circuit part with an adequately rated voltage detector to verify that the equipment is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Check the voltage detector before and after each test to be sure it is working.
- Properly ground all possible sources of induced voltage and stored electric energy (such as, capacitors) before touching. If conductors or circuit parts that are being de-energized could contact other exposed conductors or circuit parts, apply ground-connecting devices rated for the available fault current.

LIVE.....DEAD.....LIVE

The process of de-energizing is "live" work can result in an arc flash due to equipment failure. When de-energizing, follow the procedures described in "Working On or Near Live Equipment."

12. Lockout/Tag-out Program

- Safety Manager shall establish a written lockout/tag-out program and train employees in the program. The program should cover planning for locating and labeling energy sources, identifying employees at risk, how

and by whom the equipment is de-energized, releasing of stored energy, verifying that the circuit is de-energized and can't be restarted, voltage testing, grounding requirements, shift changes, coordination with other jobs in progress, a procedure for keeping track of all involved personnel, applying and removing lockout/tag-out devices, return to service, and temporary re-energizing for testing/positioning. Lockout/tag-out procedures should be developed for each machine or piece of equipment that will require servicing.

- Lockout/tag-out application. Each person who could be exposed to electric energy must be involved in the lockout/tag-out process.
- After de-energizing, each employee at risk should apply an individual lockout/tag-out device to each source of electric energy. Pushbuttons or selector switches cannot be used as the only way to de-energize. Employee must notify Engineering Dispatch each time a LOTO is applied or removed.
- A lockout device is a key or combination lock with a tag that can be attached to a disconnecting device to prevent the re-energizing of the equipment being worked on without removal of the lock. The lockout device should have a way of identifying whose lock it is. Individual lockout devices with employee's trade color assigned or systems lock from manager's box. That employee must be the only person who has the key or combination for the lockout device they install, and that employee should be the only person to remove the lock after all work has been completed.
- A tag-out device is a tag and a way to attach it that can withstand at least 50 pounds of force. Tag-out devices should be used alone only when it is not possible to install a lockout device.
- The tag used in conjunction with a lockout or tag-out device must have a label prohibiting unauthorized operation of the disconnecting means or unauthorized removal of the device.
- Before beginning work, each involved employee must verify through testing that all energy sources have been de-energized.
- Electric lockout/tag-out procedures should be coordinated with all other site procedures for controlling exposure to electric energy and other types of energy sources.
- Individual qualified-employee control procedure. For minor servicing, maintenance, inspection, and so on, on plug-connected equipment, work may be done without attaching lockout/tag-out devices if the plug is next to where the employee is working, is always easy to see, and the equipment is never left alone while being serviced.
- Complex lockout/tag-out procedures. Special procedures are needed when there is more than one energy source, crew, craft, location, employer, way to disconnect, or lockout/tag-out procedure - or work that lasts beyond one shift. In any of these cases, one qualified person should be in charge of the lockout/tag-out procedure with full responsibility for ensuring all energy sources are under lockout/tag-out and to account for all people on the job. There should be a written plan addressing the specific details and naming the person in charge.
- Removal of lockout/tag-out devices. Lockout and tag-out devices should be removed only per the Engineering Departments LOTO procedures.
- Return to service. Once work is completed and lockout/tag-out devices removed, tests and visual inspection must confirm that all tools, mechanical restraints, electric jumpers, shorts, and grounds have been removed. Only then is it safe to re-energize and return to service. Employees responsible for operating the equipment and needed to safely re-energize it should be out of the danger zone before equipment is re-energized.
- Temporary release. If the job requiring lockout/tag-out is interrupted for testing or positioning equipment, follow the same steps as in return to service (above).

13. WORKING ON OR NEAR ENERGIZED EQUIPMENT

Working on live circuits means actually touching energized parts. Working near live circuits means working close enough to energized parts to pose a risk even though work is on de-energized parts. Common tasks where there may be a need to work on or near live circuits include:

- Taking voltage measurements
- Opening and closing disconnects and breakers
- Racking breakers on and off the bus
- Removing panels and dead fronts
- Opening electric equipment doors for inspection

Facilities should adopt standard written procedures and training for these common tasks. For instance, when opening and closing disconnects, use the **left-hand rule** when possible (stand to the right side of the equipment and operate the disconnect switch with the left hand).

14. Energized Electrical Work Permit for 50 Volts and Higher

- If live parts are not placed in an electrically safe condition, work to be performed shall be considered energized electrical work and shall be performed by written permit only.
- Foxwoods Engineering will not authorize live electrical work.
- Work related to testing, troubleshooting, IR scanning and voltage measuring may be completed on live parts provided appropriate safe work practices and Arc Rated PPE are used.

15. Approach to Exposed Live Parts

- **Arc Flash Protection Boundary**
 1. Use Arc Rated PPE appropriate for working near exposed live parts and rated for the voltage and energy level involved.
 2. When working on de-energized parts and inside the flash protection boundary for nearby live exposed parts:
 3. If the parts cannot be de-energized, use barriers such as insulated blankets to protect against accidental contact or wear proper Arc Rated PPE.
- **Limited Approach Boundary**
 2. Shock Hazard Analysis to determine voltage
 3. Arc Flash Analysis to determine boundaries and Arc Rated PPE
 4. Energized Work Permit
 5. LOTO SHALL BE applied
 6. Unqualified Persons SHALL NOT be permitted to enter Qualified Persons spaces
 7. If Unqualified Persons are working nearby Qualified Person shall advise them of possible electrical hazards
- **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. To cross the prohibited approach boundary, the Qualified Person must:
 1. Have specified training to work on exposed live parts.
 2. Have a permit with proper written work procedures and justifying the need to work that close.
 3. Do a risk analysis.
 4. Have (2) and (3) approved by the appropriate manager.
 5. Use PPE appropriate for working near exposed live parts and rated for the voltage and energy level involved.

16. Other Precautions

When working on de-energized parts, but still inside the flash protection boundary for nearby live exposed parts:

- If the parts cannot be de-energized, barriers such as insulated blankets must be used to protect against accidental contact or Arc Rated PPE must be worn.
- Employees shall not reach blindly into areas that might contain exposed live parts.
- Employees shall not enter spaces containing live parts unless illumination is provided that allows the work to be performed safely.
- Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed live parts.
- Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with live parts. Such materials and equipment include, but are not limited to long conductive objects such as ducts, pipes, tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, and chains.
- When an employee works in a confined space or enclosed spaces (such as a manhole or vault) that contains exposed live parts, the employee shall use protective shields, barriers or insulating materials as necessary to avoid contact with these parts. Doors, hinged panels, and the like shall be secured to prevent them from swinging into employees. Refer to the confined space entry program.

ENERGIZED ELECTRICAL EQUIPMENT SAFETY PROGRAM IMPLEMENTATION

17. Equipment Labeling

Article 110.16 of the NEC code **requires** switchboards, panel boards, industrial control panels, and motor control centers **to be field marked** to warn workers of potential electric arc flash hazards.

1. The term Industrial Control Panel covers every enclosure that may contain exposed energized conductors or components.
2. Marking is intended to reduce the occurrence of serious injury or death due to arcing faults to workers working on or near energized electrical equipment.
3. Markings (labels) shall be located so they are visible to the personnel before examination, adjustment, servicing, or maintenance of the equipment.
4. Labels shall meet the standards of NFPA 70E, 2015.
5. The first DANGER label shall be used when information is not presently available. This is the minimum NEC 110.16 requirement.
6. The DANGER label should remind a Qualified Person who intends to open the equipment for analysis or work:
 - a. Electric arc flash hazard exists
 - b. Turn off all power before opening
 - c. Follow all requirements of NFPA 70E, 2015 for safe work practices and wear appropriate personal protective equipment (PPE) for the specific hazard.
7. The second DANGER label shall be used when a Qualified Person or electrical engineer determines the values of the shock and flash protection information.
8. When arc flash and shock data are available for industrial control panels, labels shall include information on flash hazard boundary, the hazard category, required Arc Rated PPE, minimum arc rating, limited approach distances, restricted approach distances and prohibited approach distances.
9. An Unqualified Person must not be near open energized equipment.

A. Implementation Procedures

1. Immediately place danger labels on equipment required to be labeled by NEC 110.16.
2. Until an arc flash hazard analysis can be made, a Qualified Person using **2015 NFPA 70** Table 130.7(C)(15)(a), Hazard/Risk Category Selections, shall for each situation:
 - Determine the hazard/risk category
 - Determine the use of V-rated gloves

- V-rated gloves are gloves rated and tested for the maximum line-to-line voltage upon work will be done.
 - Determine the use of V-rated tools
 - V-rated tools are tools rated and tested for the maximum line-to-line voltage upon work will be done.
3. MPGE FOXWOODS ENGINEERING shall complete an arc flash hazard analysis as required by NFPA 70E, 2015.
- The arc flash hazard analysis shall only be completed by a licensed electrical engineer.
 - The arc flash hazard analysis shall be completed on all major electrical system upgrades or renovations.
 - The arc flash hazard analysis is a responsibility of the MPGE FOXWOODS ENGINEERING.
 - a. The arc flash hazard analysis shall be done for all new electrical system installations.
 - MPGE FOXWOODS ENGINEERING should evaluate the condition of all their electrical equipment and then conduct the arc flash hazard analysis when considered immediately necessary. Reasons for conducting the analysis include the following:
 - b. Some equipment may be old, possibly in poor condition creating a greater potential for flashover.
 - c. Equipment is requiring greater than average maintenance.
 - d. Frequent use of high hazard/risk category personal protective equipment during the conduct of maintenance. Qualified Person are frequently wearing high hazard/risk Arc Rated PPE.
 - e. Proper PM should be performed on all energized equipment to prevent the HRC rating from increasing.

B. Arc Flash Hazard Analysis

An arc flash hazard analysis includes the following:

- Collect data on the MPGE FOXWOODS ENGINEERING power distribution system.
 - a. Arrangement of components on a one-line drawing with nameplate specifications of every device.
 - b. Lengths and cross-section area of all cables.
- Contact the electric utility for information including the minimum and maximum fault currents that can be expected at the entrance to the facility.
- Conduct a short circuit analysis followed by a coordination study is performed.
- Feed the resultant data into the NFPA 70E-2015 or IEEE Standard 1584-2002 equations.
 - a. These equations produce the necessary **flash protection boundary distances** and **incident energy** to determine the minimum Arc Rated PPE requirement.
 - b. The **flash protection boundary** is the distance at which Arc Rated PPE is needed to prevent incurable burns (2nd degree or worse) if an arc flash occurs. (It is still possible to suffer 1st or 2nd degree burns.)
- For systems of 600 volts and less, the flash protection boundary is 4 feet, based on an available bolted fault current of 50 kA (kilo amps) and a clearing time of 6 cycles (0.1 seconds) for the circuit breaker to act, or any combination of fault currents and clearing times not exceeding 300 kA cycles (5000 ampere seconds).
- For other fault currents and clearing times, see NFPA 70E, 2015.

18. PERSONAL PROTECTIVE EQUIPMENT

A. General Requirements

- Employees working in areas where there are potential electrical hazards must be provided with and use Arc rated personal protective equipment (PPE) that is appropriate for the specific work to be performed. The electrical tools and protective equipment must be specifically approved, rated, and tested for the levels of voltage of which an employee may be exposed.
- MPGE FOXWOODS ENGINEERING shall provide electrical protective equipment (Arc Rated Gear) required by this program. Such equipment shall conform to NFPA 70E, 2015 for rated Arc Rated apparel, eye protection, head protection, hand protection, insulated footwear, and face shields as required.
- **Conductive Articles Being Worn. Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed energized electrical conductors or circuit parts.**
- Employees shall wear nonconductive head protection whenever there is a danger of head injury from electric shock or burns due to contact with live parts or from flying objects resulting from an electrical explosion.

- Employees shall wear protective equipment for the eyes whenever there is a danger of injury from electric arcs, flashes, or from flying objects resulting from an electrical explosion.
- Employees shall wear rubber insulating gloves where there is a danger of hand or arm contact with live parts or possible exposure to arc flash burn.
- Where insulated footwear is used as protection against step and touch potential, dielectric overshoes shall be required. Insulated soles shall not be used as primary electrical protection.
- Face shields without arc rating shall not be used for electrical work. Safety glasses or goggles must always be worn underneath face shields.
- Additional illumination may be needed when using tinted face shields as protection during electrical work.
- Electrical Protective Equipment must be selected to meet the criteria established by the American Society of Testing and Materials (ASTM) and by the American National Standards Institute (ANSI).
- Insulating equipment made of materials other than rubber shall provide electrical and mechanical protection at least equal to that of rubber equipment.
- PPE must be maintained in a safe, reliable condition and be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Must be cleaned per manufacturer's specifications by the employee the equipment is assigned to.
- Employees must use insulated tools and handling equipment that are rated for the voltages to be encountered when working near exposed energized conductors or circuit. Tools and handling equipment should be replaced if the insulating capability is decreased due to damage. Protective gloves must be used when employees are working with exposed electrical parts above fifty (50) volts.
- Fuse handling equipment (insulated for circuit voltage) must be used to remove or install fuses when the fuse terminals are energized. Ropes and hand lines used near exposed energized parts must be non-conductive.
- Protective shields, barriers or insulating materials must be used to protect each employee from shock, burns, or other electrical injuries while that person is working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.

B. Flame-Resistant Apparel & Under layers

- AR (**Arc Rated**) apparel shall be visually inspected before each use. AR apparel that is contaminated or damaged shall not be used. Protective items that become contaminated with grease, oil flammable liquids, or combustible liquids shall not be used.
- The garment manufacturer's instructions for care and maintenance of AR apparel shall be followed.
- When the apparel is worn to protect an employee, it shall cover all Non-melting, flammable garments (i.e. cotton, wool, rayon, silk, or blends of these materials) clothing and allow for movement and visibility.
- AR apparel must cover potentially exposed areas as completely as possible. AR shirt sleeves must be fastened and AR shirts/jackets must be closed at the neck.
- Non-melting, flammable garments (i.e. cotton, wool, rayon, silk, or blends of these materials) may be used as under layers beneath AR apparel.
- Melt able fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric under layers next to skin. (An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted).
- AR garments worn as outer layers over AR apparel (i.e. jackets or rainwear) must also be made from AR material.
- Employees shall wear nonconductive protective equipment for the face per ANSI Z87.1 2003, neck, and chin whenever there is a danger of injury from exposure to electric arcs or flashes or from flying objects resulting from electrical explosion.
- Arc Rated suits must permit easy and rapid removal by the user.

C. Rubber Insulating Equipment

- Rubber insulating equipment includes protective devices such as gloves, sleeves, blankets, and matting.
- Insulating equipment must be inspected for damage before each day's use and immediately following any incident that could have caused damage.
- An air test must be performed on rubber insulating gloves before each use.
- Insulating equipment found to have defects that might affect its insulating properties must be removed from service until testing indicates that it is acceptable for continued use.
- Where the insulating capability of protective equipment is subject to damage during use, the insulating material shall be protected by an outer covering of leather or other appropriate materials.
- Rubber insulating equipment must be tested according to the schedule supplied by the manufacturer.
- Rubber insulating equipment must be stored in an area protected from light, temperature extremes, excessive humidity, ozone, and other substances and conditions that may cause damage.

- No repairs to rubber insulating equipment shall be attempted without the approval of the safety manager or coordinator.

D. Insulated Tools and Materials

- Only insulated tools and equipment shall be used within the Limited Approach Boundary of exposed energized parts.
- Insulated tools shall be rated for the voltages on which they are used.
- Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.
- Fuse or fuse holder handling equipment, insulated for the circuit voltage, shall be used to removed or install a fuse if the fuse terminals are energized.
- Ropes and hand-lines used near exposed energized parts shall be nonconductive.
- Portable ladders used for electrical work shall have nonconductive side rails.

E. Access Limiting Equipment

- Barricades shall be used in conjunction with safety signs to prevent or limit access to work areas containing live parts. Conductive barricades shall not be used where they might cause an electrical hazard. Barricades shall be placed no closer than the Limited Approach Boundary.
- If signs and barricades do not provide sufficient protection, an attendant will be assigned to warn and protect pedestrians. The primary duty of the attendant shall be to keep an unqualified person out of the work area where an electrical hazard exists. The attendant shall remain in the area as long as there is a potential exposure to electrical hazards.

19. WORKING SPACE ABOUT ELECTRIC EQUIPMENT

Spaces About Electric Equipment.

- Sufficient access and working space shall be provided and maintained about all electric equipment per NFPA 70, NEC to permit ready and safe operating and maintenance of such equipment. Enclosures that house electric apparatus and are controlled by lock and key shall be considered accessible to Qualified Persons.

Access and Entrance to Working Space

- **Unobstructed Exit.** Where the location permits a continuous and unobstructed way of exit travel, a single entrance to the working space shall be permitted.

Illumination

- Illumination shall be provided for all working spaces about service equipment, switchboards, panel boards, or motor control centers installed indoors. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source. In electrical equipment rooms, the illumination shall not be controlled by automatic means only.

20. VENDOR/CONTRACTOR EMPLOYEES

- **Safety programs used by contractors must meet or exceed all applicable guidelines of this Safety Program.**
- **Contractors are required to comply with applicable Safety and Health regulations such as TOSHA, NFPA, and all Tribal Codes.**
- **Contractors SHALL be required to submit copies of their safety program to the MPGE Safety Manager at the start of each project.**